SELF ASSESSMENT REPORT

submitted to

NATIONAL BOARD OF ACCREDITATION

for the accreditation of

Bachelor of Chemical Engineering

[2nd CYCLE ACCREDITATION (TIER-I)]

Department of Chemical Engineering
Institute of Chemical Technology
Deemed University under Section 3 of UGC Act 1956
Elite Status and Centre of Excellence – Govt. of Maharashtra
Nathalal Parekh Marg, Matunga (E), Mumbai 400 019, India

NOVEMBER, 2022

SAR Contents

PART A: Institutional Information

1. Name and Address of the Institution:

Institute of Chemical Technology, Mumbai
University under section 3 of UGC Act 1956 Estd.1933,
Elite Status and Centre of Excellence-Govt. of Maharashtra
ICT, Nathalal Parekh Marg, Matunga, Mumbai – 400019
Tel: +91-22-33612312, Fax: +91-22-33611020
Website: www.ictmumbai.edu.in

2. Name and Address of the Affiliating University, if applicable:

3. Year of establishment of the Institution: 1933

4. Type of the Institution:

- [ ] Institute of National Importance
- [ ] University
- [x] Deemed University
- [ ] Autonomous
- [ ] Affiliated Institution
- [ ] Any other (Please specify)

5. Ownership Status:

- [ ] Central Government
- [x] State Government
- [ ] Government Aided
- [ ] Self-financing
- [ ] Trust
- [ ] Society
- [ ] Section 25 Company
- [ ] Any Other (Please specify)

6. Other Academic Institutions of the Trust/Society/Company etc., if any:

Name of the Institution(s)	Year of Establishment	Programs of Study	Location

Table A.6

7. Details of all the programs offered by the institution:

Sr. No.	Program Name	Name of the Department	Year of Start	Intake	Increase/ Decrease in intake, if any	Year of Increase/ Decrease	AICTE Approval	Accreditation Status*
1.	B. Chemical Engineering	Chemical Engineering	1933	60	15	1995	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	27/12/2016 to 30/06/2022
2.	B.Tech - Dyestuff Technology	Dyestuff Technology	1944	16	2	1995	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	27/12/2016 to 30/06/2022
3.	B.Tech- Food Engineering and Technology	Food Engineering and Technology	1943	16	N.A.	N.A.	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	27/12/2016 to 30/06/2022
4.	B.Tech- Fibres and Textile Processing Technology	Fibres and Textile Processing Technology	1933	34	N.A.	N.A.	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	27/12/2016 to 30/06/2022
5.	B.Tech- Oils, Oleochemicals and Sufactant Technology	Oils, Oleochemicals and Sufactant Technology	1943	16	N.A.	N.A.	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	27/12/2016 to 30/06/2022
6.	B.Tech- Pharmaceuticals Chemistry and Technology	Pharmaceutical Sciences and Technology	1943	18	N.A.	N.A.	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	14/01/2017 to 30/06/2020
7.	B.Tech Polymer Engineering and Technology	Polymer and Surface Engineering	1946	08	08	1995	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	27/12/2016 to 30/06/2022
8.	B.Tech Surface Engineering & Technology	Polymer and Surface Engineering	1946	08	16	1995	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	27/12/2016 to 30/06/2022
9.	B. Pharmacy	Pharmaceutical Sciences and Technology	1959	18	30	1995	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	22/09/2016 to 30/06/2021

Sr. No.	Program Name	Name of the Department	Year of Start	Intake	Increase/ Decrease in intake, if any	Year of Increase/ Decrease	AICTE Approval	Accreditation Status*
1.	M. Chemical Engineering	Chemical Engineering	1958	30	N.A.	N.A.	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	28/09/2016 to 30/06/2021
2.	M.Tech- Dyestuff Technology	Dyestuff Technology	1961	4	14	2019	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	01/07/2015 to 30/06/2020
3.	M.Tech.-Food Engineering &Technology	Food Engineering and Technology	1945	8	N.A.	N.A.	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	03/03/2020 to 30/06/2026
4.	M.Tech- Fibres and Textile Processing Technology	Fibres and Textile Processing Technology	1961	18	N.A.	N.A.	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	01/07/2015 to 30/06/2020
5.	M.Tech- Oils, Oleochemicals and Sufactant Technology	Oils, Oleochemicals and Sufactant Technology	1966	18	N.A.	N.A.	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	03/03/2020 to 30/06/2023
6.	M.Tech- Pharmaceuticals Sciences and Technology	Pharmaceutical Sciences and Technology	1961	18	N.A.	N.A.	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	03/03/2020 to 30/06/2026
7.	M.Tech- Polymer Engineering and Technology	Polymer and Surface Engineering	1966	18	N.A.	N.A.	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	01/07/2015 to 30/06/2020
8.	M.Tech- Surface Engineering & Technology	Polymer and Surface Engineering	1966	18	N.A.	N.A.	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	01/07/2015 to 30/06/2020
9.	M.Tech- Food Biotechnology	Food Engineering and Technology	2008	2	8	2009	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	28/09/2016 to 30/06/2021
10.	M.Tech- Bioprocess Technology	DBT-ICT Center of Biosciences	1994	30	N.A	N.A.	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	03/03/2020 to 30/06/2023
11.	M.Tech- Perfumery and Flavor Technology	Dyestuff Technology	1992	5	13	2017	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	01/07/2015 to 30/06/2020

12.	M.Tech. Green Technology	Green Technology	2010	30	N.A.	N.A.	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	28/09/2016 to 30/06/2021
13.	M. Tech. Pharmaceutical Biotechnology	Pharmaceutical Sciences and Technology	2017	15	N.A.	N.A.	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	N.A.
14.	M.E. (Plastic Engineering)	General Engineering	1972	18	N.A.	N.A.	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	03/03/2020 to 30/06/2023
15.	M.Sc. (Chemistry)	Chemistry	2010	20	N.A.	N.A.	N.A.	N.A.
16.	M.Sc. (Textile Chemistry)	Fibres and Textile Processing Technology	2010	20	N.A.	N.A.	N.A.	N.A.
17.	M.Sc. (Engineering Mathematics)	Mathematics	2012	20	N.A.	N.A.	N.A.	N.A.
18.	M.Sc. (Physics)	Physics	2014	20	N.A.	N.A.	N.A.	N.A.
19.	M. Pharmacy	Pharmaceutical Sciences and Technology	1965	18	N.A.	N.A.	AICTE Approved (F.No. Western/1-9318340850/2021/EOA)	01/07/2014 to 30/06/2017

Table: A.8.1

**** Write applicable one:***

- Applying first time
- Granted provisional accreditation for two/three years for the period (specify period)
- Granted accreditation for 5/6 years for the period (specify period)
- Not accredited (specify visit dates, year)
- Withdrawn (specify visit dates, year)
- Not eligible for accreditation
- Eligible but not applied

Note: 1. Add rows as needed. 2. Separate tables for UG and PG Programs to be prepared.

8. Programs to be considered for Accreditation vide this application

S. No.	Program Name	Current Year Sanctioned Intake	Current Year Admission (in Nos.)
1.	Bachelor of Chemical Engineering	75	87

9. Total number of Engineering Students:

Bachelor of Chemical Engineering			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	68	66	66
Total no. of girls	19	22	21
Total no. of students	87	88	87
B.Tech (Dyestuff Technology)			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	11	14	15
Total no. of girls	5	5	6
Total no. of students	16	19	21
B.Tech (Pharma)			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	13	16	11
Total no. of girls	10	7	10
Total no. of students	23	23	21
B.Tech (Oils)			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	11	15	13
Total no. of girls	6	3	6
Total no. of students	17	18	19
B.Tech (Surface Coating)			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	11	14	14
Total no. of girls	3	5	5
Total no. of students	14	19	19
B.Tech (Food engineering)			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	13	13	10
Total no. of girls	7	7	10
Total no. of students	20	20	20
B.Tech (Polymer)			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	16	17	14
Total no. of girls	3	2	5
Total no. of students	19	19	19
B.Tech (Fibres)			
Items	**2021-2022**	**2020-2021**	**2019-2020**

Total no. of boys	19	23	17
Total no. of girls	4	14	16
Total no. of students	23	37	33

Master of Chemical Engineering			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	21	24	23
Total no. of girls	5	5	7
Total no. of students	26	29	30
ME Plastic Engineering			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	8	5	9
Total no. of girls	3	6	1
Total no. of students	11	11	10
M.Tech (Dyestuff Technology)			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	4	1	7
Total no. of girls	4	5	8
Total no. of students	8	6	15
M.Tech (Textile)			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	12	11	9
Total no. of girls	3	5	6
Total no. of students	15	16	15
M.Tech (Polymer)			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	14	14	14
Total no. of girls	2	4	4
Total no. of students	16	18	18
M.Tech (Food Engg & Tech)			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	8	10	12
Total no. of girls	9	8	5
Total no. of students	17	18	17
M.Tech (Green Tech)			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	10	8	16
Total no. of girls	13	20	10
Total no. of students	23	28	26
M.Tech (Oils)			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	12	12	8
Total no. of girls	6	5	10
Total no. of students	18	17	18
M.Tech (Perfumery)			

Items	2021-2022	2020-2021	2019-2020
Total no. of boys	8	6	9
Total no. of girls	8	12	9
Total no. of students	16	18	18
M.Tech (Surface-coating)			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	10	11	15
Total no. of girls	7	7	3
Total no. of students	17	18	18
M.Tech (Parma Tech)			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	9	11	5
Total no. of girls	8	7	13
Total no. of students	17	18	18
M.Tech (Bioprocess Tech)			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	18	12	14
Total no. of girls	10	17	16
Total no. of students	28	29	30
M.Tech (Food Biotech)			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	3	1	5
Total no. of girls	7	8	5
Total no. of students	10	9	10
M.Tech (Pharma-biotech)			
Items	**2021-2022**	**2020-2021**	**2019-2020**
Total no. of boys	3	5	3
Total no. of girls	4	5	7
Total no. of students	7	10	10

10. Vision of the Institution:

We shall perennially strive to be a vibrant institute with continuously evolving curricula to brighten the future of the chemical, biological, materials and energy industries of the nation, and rank amongst the very best in the world through active participation and scholarship of our faculty, students and alumni. We shall be creators of sprouting knowledge and design cutting-edge technologies that will have the greatest impact on society and benefit mankind at large.

11. Mission of the Institution:

We shall generate and sustain an atmosphere conducive to germinating new knowledge at every available opportunity. The education we shall impart will enable our students to devise new solutions to meet the needs of all segments of society with regard to material and energy, while protecting the environment and conserving the natural resources. Our endeavours, while extending well beyond the confines of the classroom, will aim to enhance public welfare and our attempts to disseminate knowledge will spread to a greater multi- and cross-disciplinary platform to conduct research, discovery, technology development, service to industry and entrepreneurship, in consonance with India's aspirations to be a welfare state. We will team scientists and engineers with professionals in other disciplines to arrive at better solutions. We will provide all our students with a strong foundation to encourage them to be our ambassadors in the professional activities that they choose to undertake in service of society at national and international levels. Through our vision, we will serve the profession and society and strive to reach the summit as a team, and ultimately serve as role models to the younger generation.

12. Contact Information of the Head of the Institution and NBA coordinator, if designated:

i. Name: Prof. A. B. Pandit
Designation: Vice-Chancellor
Mobile No: 9820408037
Email id: vc@ictmumbai.edu.in

ii. NBA co-coordinator
Name: Dr. Ashwin Mohan
Designation: Associate Dean, Internal Quality Assurance
Contact No. 022-33611019
Mobile No: 9869506632/9920084964
Email id: associatedean.iqa@ictmumbai.edu.in

PART B: Criteria Summary

Name of the program: <u>Bachelor of Chemical Engineering</u>

Criteria No.	Criteria	Mark/Weightage
Program Level Criteria		
1.	Course Outcomes and Program Outcomes	100/100
2.	Program Curriculum and Teaching –Learning Processes	75/75
3.	Students' Performance	71.30/75
4.	Faculty Information and Contributions	98.8/100
5.	Resources	75/75
6.	Continuous Improvement	75/75
	Total	**495.1/500**

PART B: Program Level Criteria

CRITERION 1	Course Outcomes and Program Outcomes	100/100

1.1. State the Vision, Mission of the Department and Institute and Program Educational Objectives (5) **(Institute Marks 5)**

VISION OF INSTITUTE

We shall perennially strive to be a vibrant institute with continuously evolving curricula to brighten the future of the chemical, biological, materials and energy industries of the nation, and rank amongst the very best in the world through active participation and scholarship of our faculty, students and alumni. We shall be creators of sprouting knowledge and design cutting-edge technologies that will have the greatest impact on society and benefit mankind at large.

MISSION OF INSTITUTE

We shall generate and sustain an atmosphere conducive to germinating new knowledge at every available opportunity. The education we shall impart will enable our students to devise new solutions to meet the needs of all segments of society with regard to material and energy, while protecting the environment and conserving the natural resources. Our endeavors, while extending well beyond the confines of the classroom, will aim to enhance public welfare and our attempts to disseminate knowledge will spread to a greater multi- and cross-disciplinary platform to conduct research, discovery, technology development, service to industry and entrepreneurship, in consonance with India's aspirations to be a welfare state. We will team scientists and engineers with professionals in other disciplines to arrive at better solutions. We will provide all our students with a strong foundation to encourage them to be our ambassadors in the professional activities that they choose to undertake in service of society at national and international levels. Through our vision, we will serve the profession and society and strive to reach the summit as a team, and ultimately serve as role models to the younger generation.

VISION OF DEPARTMENT

We will strive to be a vibrant department, with continuously evolving curricula and program that will charter the future of chemical, biological, materials and energy industries of the nation and be on par with the very best in the world through the participation and scholarship of our faculty, and students who will be torch bearers in education and research and have great impact in solving societal needs for the benefit of mankind at large.

MISSION OF DEPARTMENT

The mission of the department are listed below:

M1) We will create an atmosphere conductive to generate new knowledge at every opportunity for our students at large. Our education will enable new chemical engineering solutions to meet the need of all segments of society with regard to material and energy, while protecting the environment and conserving the natural resources.

M2) Our endeavors will enhance the public welfare. Our activities will not be limited to class-rooms but will extend to a greater multi and cross disciplinary platform to conduct research, discovery, technology development, service to industry and entrepreneurship in consonance with India's aspiration to be a welfare state.

M3) We will team chemical engineers with professionals in other disciplines to arrive at better solutions. We will provide all students with a strong foundation in chemical engineering and applied sciences to encourage them to be our ambassadors at national and international level, in whatever professional activity they undertake to serve the society.

M4) Through our vision, we will sever the chemical engineering profession and society and strive to reach the summit as a team and stake-holders and as role models to the younger generation.

Program Education Objectives (PEOs)

PEO 1) Our graduates are expected to think critically, creatively and apply the fundamentals of Chemical Engineering to chemical and allied industries for the benefit of country in general, economy, society and environment in particular.

PEO 2) Our graduates are expected to adopt to evolving technologies and stay in tune with current needs of the country and society.

PEO 3) Our graduates are expected to undertake fundamental and applied research for development and implementation of new technologies for the benefit of mankind in general, economy, society and environment in particular.

PEO 4) Our graduates are expected to be innovative and have good entrepreneurship and project management skills.

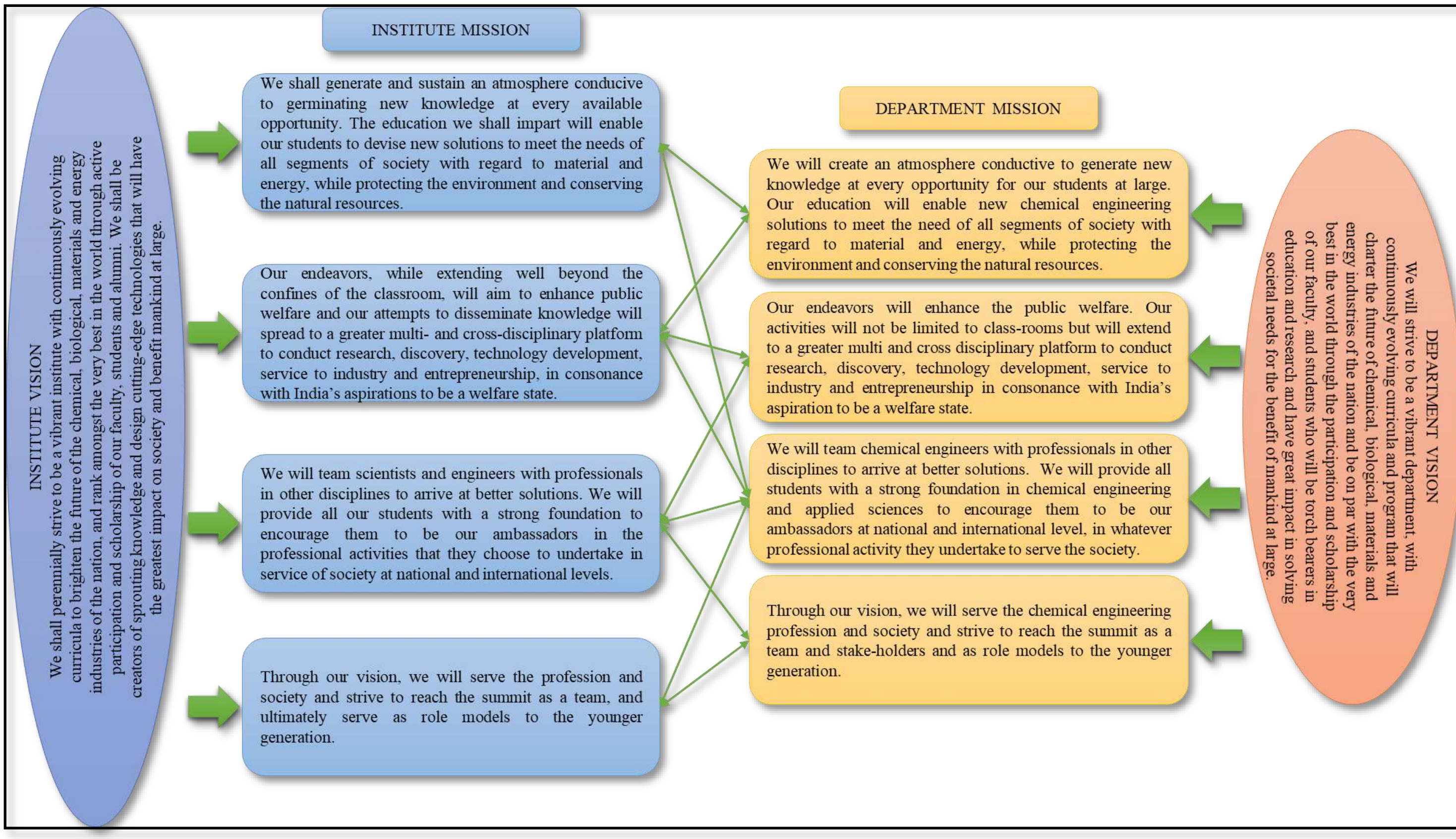


Figure 1.1: Consistency of Department Vision & Mission with Institute Vision & Mission

1.2. Indicate where the Vision, Mission and PEOs are published and disseminated among stakeholders (5) (Institute Marks 5)

The Vision and Mission are published and disseminated in the following:

Published:

1. In ICT's Handbook
2. In the Annual Report
3. In Department's Profile
4. On ICT's website:

(https://www.ictmumbai.edu.in/Deptindex.aspx?page=a&ItemID=cc&nDeptID=c)

Publicized:

1. On walls of the Department's Premises, such as labs, corridors, classrooms, etc.
2. On the Head of the Department office
3. On plaques inside the faculty and staff cabins/rooms
4. In the student diary
5. Discussed with students in the classroom

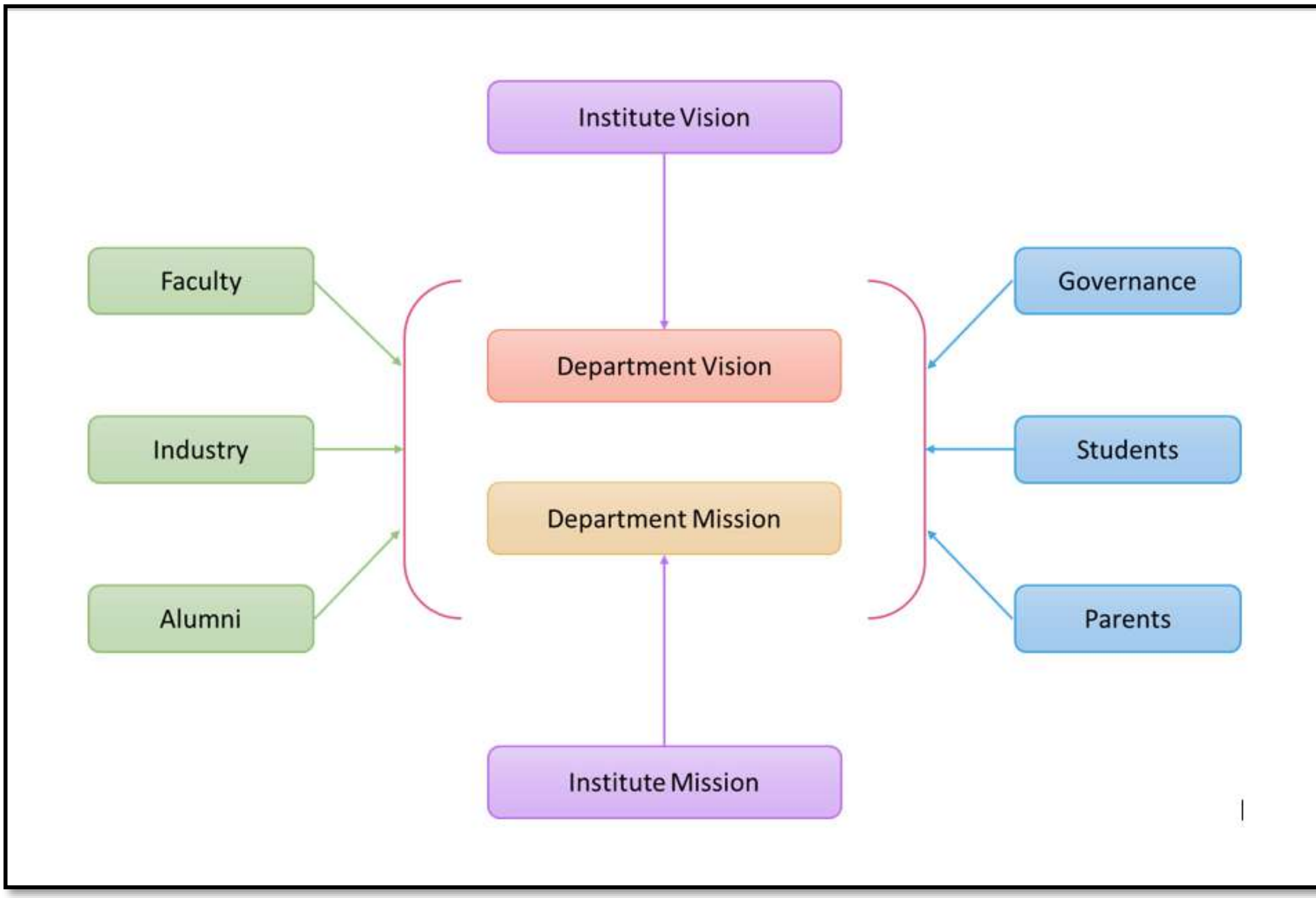


Figure 1.2: Process for defining Vision and Mission of the Department

Stakeholders are the students, teaching staff, support staff, Industry that employs the graduates, Parents, Government, Society

- Students are the direct beneficiaries of the educational program.
- The teachers are responsible for the quality of the student output and hence an extremely important part of the activity.
- The support staff is responsible for the smooth conduct of administrative processes, laboratory activities, cleanliness, and maintenance. This activity plays a crucial role in influencing the ambiance and motivation levels to stimulate a progressive environment.
- Government is a contributor through financial support for the program.
- The industry is always looking for the best manpower available and the institute commits to delivering such manpower.
- Trained manpower in this health-related area who would contribute to bringing benefits to society.

1.3. Establish consistency of PEOs with Mission of the Department (5) (Institute Marks 5)

The Program Educational Objectives are established through a consultation process involving the core constituents such as Students, Alumni, Industry, Faculty, and Employers.

Table 1.1: Consistency of mission and PEO statements

PEO's	Mission			
	M1	M2	M3	M4
PEO1: Our graduates are expected to think critically, creatively and apply the fundamentals of Chemical Engineering to chemical and	3	3	3	1

allied industries for the benefit of country in general, economy, society and environment in particular.				
PEO2: Our graduates are expected to adopt to evolving technologies and stay in tune with current needs of the country and society	2	3	2	2
PEO3: Program Assessment Committee summarizes the collected views and expresses its opinion on the views and forwards the same to Department Advisory Board.	3	3	2	1
PEO4: Our graduates are expected to be innovative and have good entrepreneurship and project management skills.	1	2	3	3

Where, 3 2 1 refers to strong, medium and weak correlations, respectively.

1.4. Establish the correlation between the courses and the Program Outcomes (POs) & Program Specific Outcomes (PSOs) (10) (Institute Marks 10)

Table 1.2: Course Outcomes for major core courses

CET1301	Chemical Engineering Thermodynamics I
1) Students, at the end of the course will be able to comprehend the fundamental concepts of enthalpy, entropy, internal energy and free energy.(K3) 2) Students, at the end of the course will be able to describe non-ideal gas behavior through volumetric equations of state.(K3) 3) Students, at the end of the course will be able to use volumetric equations of state to estimate saturation pressure of pure components.(K4) 4) Students, at the end of the course will be able to describe and relate property changes with volumetric properties.(K3) 5) Students, at the end of the course will be able to use the concept of ideal mixtures and binary vapor-liquid equilibrium including bubble point, flash calculations.(K4) 6) Students, at the end of the course will be able to use the concept of thermodynamic consistency of vapor-liquid equilibrium data through Gibbs-Duhem equation and test consistency of data.(K4)	
CET1101	Momentum and Mass Transfer
1) Calculate velocity profiles, forces, pressure drops for simple 1 –D laminar flow situations.(K3) 2) Calculate pressure drop in pipelines and equipment for different situations such as single and two phase flow, fixed and fluidized beds.(K3) 3) Calculate forces on particles and terminal velocities of particles.(K3) 4) Calculate mass transfer rates for simple multiphase processes.(K3) 5) Design pumps and piping systems for simple situations.(K5) 6) Design mass transfer equipment for simple mass transfer processes.(K5)	
CET1102	Heat Transfer
1) select the controlling modes of heat transfer and calculate the heat transfer rates.(K1) 2) select proper insulation to avoid heat losses and determine thickness of insulations.(K3) 3) select a suitable heat exchanger as well as determine the performance of available heat exchanger.(K3) 4) design double pipe heat exchangers, shell and tube heat exchangers, plate heat exchangers.(K3) 5) solve problems in various heat transfer heat equipment such as evaporators, furnace.(K3) 6) determine time required for heating and cooling in batch reactor.(K3)	
CET1201	Chemical Reaction Engineering
1) Solve energy and material balance equations and analyze the performance of various multi-phase reactors.(K1) 2) Develop rate laws and determine kinetics of several homogenous and heterogeneous reactions.(K2) 3) Gain knowledge to design and interpret data of reactors for catalytic and non-catalytic reactions.(K3) 4) Solve integrated and differential rate equations for series and parallel reactions in a system.(K4) 5) Perform, evaluate and optimize the design and operation of catalyzed and non-catalyzed chemical reactors.(K5)	
CET1504	Chemical Project Engineering & Economics
1) Describe the basic terminologies used in chemical project engineering and economics.(K5)	

2) Identify various parameters for the evaluation of product and services for a variety of industries.(K4) 3) Evaluate project and product cost.(K2) 4) Compare various project financing options.(K3) 5) Predict project profitability, legality and feasibility.(K2) 6) Evaluate quantitative and qualitative project execution methods.(K2)	
CET1501	Material and Energy Balance Computations
1) Covert units of various quantities and equations.(K3) 2) Calculate quantities, compositions, temperatures of different process streams from the given data for processes involving single / multiple units.(K3) 3) Students would be able to examine the effects of variation in inputs to their effects on outputs from processes involving single / multiple units.(K4) 4) Students would be able to design and develop various options for carrying out processes involving single / multiple units.(K5) 5) Students would be able to judge the process units from various angles such as: society, environment, sustainability, etc.(K6)	
CET1302	Chemical Engineering Thermodynamics II
1) Students, at the end of the course will be able to describe the concept of non-ideal behavior of mixtures, activity coefficients.(K3) 2) Students, at the end of the course will be able to use models for liquid phase non-ideality of mixtures with multiple levels of complexity and capability including predictive models.(K4) 3) Students, at the end of the course will be able to describe phase equilibria such as gas-liquid, liquid-liquid, solid-liquid with thermodynamic framework and correlate data and estimate properties.(K4) 4) Students, at the end of the course will be able to use the concept of chemical reaction equilibrium in ideal gas reactions in thermodynamic terms.(K4) 5) Students, at the end of the course will be able to describe nonideal gas, liquid, solid and multiphase chemical reaction equilibria and predict equilibrium conversions.(K4)	
CET1401	Chemical Engineering Operations
1) Estimate no of stages and reflux rate for given separation using distillation (K3) 2)Size plate and packed column for distillation and absorption operations (K4) 3)Select, Size dryers and decide the operating conditions (K4) 4)Design single stage and multistage evaporators (K3) 5) Design filtration equipment for given solid-liquid separation (K4)	
CET1203	Multiphase Reaction Engineering
1) Understand the interplay between mass transfer and chemical reaction in determining reactor performance including concepts of rate-controlling steps and kinetic regimes.(K3) 2) Be aware of various types of reactor configurations and the reactions they are optimal for and the standard modes they are operated under.(K2) 3) Understand the relationship between power input and reactor performance of a variety of standard reactor configurations.(K4) 4) Be able to design/size standard reactor configurations for a given production rate.(K5)	
CET1703	Instrumentation and Process Control
1) Gain Knowledge relating to the design and working of various control systems used in industries.(K1) 2) Measure and calculate system parameters and evaluate the response.(K2) 3) Identify, analyse and control multi-variable systems by using several sophisticated techniques.(K3) 4) Gain knowledge regarding designing multi-loop and cascade control systems and their applications.(K4) 5) Identify, Design and Control various system variables and parameters for industrial processes and reactors.(K5)	
MAT1106	Design and Analysis of Experiments
1)Understand the process of designing and analyzing experiments using several mathematical and statistical techniques. (K1) 2)Understand the role of experimentation and validation in chemical process development and improvement. (K2) 3)Formulate and interpret experimental data by using hypothesis testing and variance analysis. (K3) 4)Solve optimization problems in process systems engineering with help of different techniques (K4)	

5)Design, choose and conduct experiments efficiently through systematic and scientific experimental strategy, statistical analysis of data and interpretation of results. (K5)	
CEP1701	Chemical Engineering Lab -I
1) To be able to perform experiments based on fluid mechanics such as Flow through pipes, coils and fittings.(K3) 2) Flow through packed beds and two phase flow. (K4) 3) Experiments based on mixing. (K2) 4) Heat transfer in shell and tube, and plate heat exchangers.(K3)	
CEP1702	Process Simulation Lab -I
1) Several Examples from Chemical Engineering fields to be solved using self-developed programmes. (K5) 2) Stagewise calculations for unit operations, dynamics of linear and non-linear systems, simulation of heat transfer equipment, optimisation of equipment, process and plant.(K4) 3) Use of design softwares such as ASPEN(K2)	
CEP1704	Chemical Engineering Lab -II
1) Experiments related to mass transfer such as diffusion, absorption in a packed column(K5). 2) Adsorption isotherms. Drying characteristics. Differential and steam distillation. Homogeneous kinetics.(K3) 3) Properties of liquid fuels. Proximate analysis of coal. Study of spray nozzles, impellers, tower packings, dryers, filters, evaporators. (K2)	
CEP1705	Process Simulation Lab -II
1) simulation of reactors with multiple reactions (heat and material balances),(K5) 2) conduction / diffusion, stagewise calculations for unit operations, dynamics of linear and non-linear systems, (K4) 3) Computational fluid dynamics.(K4)	
CEP1706	Chemical Engineering Lab -III
1) Performing experiments on absorption with and without chemical reactions in packed, plate and bubble columns.(K3) 2) Solid dissolution with or without chemical reaction; Sublimation of solids. Analogy between momentum, heat and mass transfer. (K2) 3) Dynamics of feedback control systems. Level and pH control.(K5)	
CEP1707	Process Simulation Lab -III
1) simulation of reactors with multiple reactions (heat and material balances), (K2) 2) conduction / diffusion, stage wise calculations for unit operations, dynamics of linear and non-linear systems,(K1) 3) Computational fluid dynamics (CFD).(K5)	

Table 1.3: Correlation between the core courses and the POs & PSOs

CET1301															
	CO	**Statements**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
	CO1	1) Comprehen	3	2	1	1	1	1	1	1	1	1	1	1	3	3
	CO2	2) Describe no	3	3	3	1	1	1	1	1	1	1	1	1	2	2
	CO3	3) Use volume	2	3	2	2	1	1	1	1	1	1	1	1	2	1
	CO4	4) Describe an	3	3	3	2	1	1	1	1	1	1	1	2	2	1
	CO5	5) Use the con	3	3	3	3	1	1	1	1	1	1	1	1	3	3
	CO6	6) Use the con	3	3	3	3	1	1	1	1	1	1	1	1	3	3

CET1101																
	CO	**Statements**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
	CO1	1) Calculate ve	3	3	2	2	1	1	1	2	1	1	1	2	3	1
	CO2	2) Calculate pr	3	3	2	2	2	1	1	2	2	1	1	1	3	1
	CO3	3) Calculate fo	3	3	2	2	2	1	2	2	1	1	2	2	3	1
	CO4	4) Calculate m	3	3	2	2	1	2	1	2	1	2	1	1	3	1
	CO5	5) Design pum	3	2	3	2	3	1	1	2	1	1	1	2	3	1
	CO6	6) Design mass	3	2	3	2	3	1	1	2	1	1	1	1	3	1

CET1102																
	CO	Statements	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	1) select the co	3	3	3	2	2	1	1	1	1	1	1	1	2	2
	CO2	2) select prope	3	3	3	3	1	1	1	1	2	1	1	1	2	2
	CO3	3) select a suit	3	3	2	3	1	1	1	1	2	1	1	1	2	2
	CO4	4) design doub	3	3	2	2	3	1	1	1	2	1	1	1	2	2
	CO5	5) solve proble	3	2	3	3	3	1	1	1	2	1	1	1	2	2
	CO6	6) determine ti	3	2	3	3	3	1	1	1	2	1	1	1	2	2

CET1201																
	CO	Statements	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	1) Solve energy	3	3	3	2	2	1	1	1	2	1	2	1	2	2
	CO2	2) Develop rate	2	3	3	3	2	1	1	1	2	1	1	1	2	2
	CO3	3) Gain knowle	2	3	3	3	3	1	2	1	2	2	2	1	2	2
	CO4	4) Solve integra	3	3	3	2	3	1	1	1	2	1	1	1	2	2
	CO5	5) Perform, eva	2	3	3	3	3	2	2	2	3	2	3	2	3	3

CEP1702																
	CO	Statements	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	1) Several Exar	3	3	2	1	1	3	1	3	1	2	1	1	3	3
	CO2	2) Stagewise ca	3	3	2	1	1	3	1	3	1	2	1	1	2	2
	CO3	3) Use of desig	3	3	2	2	1	3	1	3	1	2	1	2	2	2

CEP1704																
	CO	Statements	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	1) Experiments	1	1	1	1	1	1	1	1	1	1	1	1	3	3
	CO2	2) Adsorption i	3	2	1	1	1	1	1	1	1	1	1	1	2	2
	CO3	3) Properties o	3	3	2	2	2	1	1	1	1	1	1	1	2	2

CET1504																
	CO	Statements	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	1) Describe the	3	3	2	3	3	1	1	1	1	1	3	3	3	3
	CO2	2) Identify vari	3	3	3	3	3	1	1	1	1	1	3	1	3	3
	CO3	3) Evaluate pro	3	3	3	3	3	1	1	1	1	1	3	1	2	2
	CO4	4) Compare va	3	3	3	3	3	1	1	1	1	1	3	1	3	3
	CO5	5) Predict proje	3	3	3	3	3	1	1	1	1	1	3	1	3	3
	CO6	6) Evaluate qua	3	3	3	3	3	1	1	1	1	1	3	1	3	3

CET1501																
	CO	Statements	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
	CO1	1) Covert units	3	3	3	3	1	2	2	1	1	1	1	1	3	1
	CO2	2) Calculate qu	3	3	3	3	1	2	2	1	1	1	1	1	3	1
	CO3	3) Students wo	3	3	3	3	1	2	2	1	1	1	1	1	3	1
	CO4	4) Students wo	3	3	3	3	2	3	3	1	1	1	1	1	3	1
	CO5	5) Students wo	3	3	3	3	2	3	3	1	1	1	1	1	3	1

CEP1701																
	CO	Statements	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	1) To be able t	3	3	3	2	2	1	1	1	2	1	2	2	2	3
	CO2	2) Flow throug	2	3	3	3	2	1	1	1	2	1	1	1	3	3
	CO3	3) Experiments	2	3	3	3	3	1	2	1	2	2	2	2	3	3
	CO4	4) Heat transfe	3	3	3	2	3	1	1	1	2	1	1	1	3	3

CET1302																
	CO	Statements	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	1) Describe the	3	3	2	2	1	1	1	1	1	1	1	1	1	2
	CO2	2) Use models	3	3	3	2	1	1	1	1	1	1	1	1	2	2
	CO3	3) Describe pha	3	3	3	1	1	1	1	1	1	1	1	1	2	2
	CO4	4) Use the con	3	3	3	1	1	1	1	1	1	1	1	1	2	2
	CO5	5) Describe no	3	3	3	1	1	1	1	1	1	1	1	1	2	2

CET1401																
	CO	Statements	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	1) Estimate no	3	3	3	2	2	1	1	1	2	1	1	2	2	3
	CO2	2)Size plate an	2	3	3	3	2	1	1	1	2	1	1	1	3	3
	CO3	3)Select, Size d	2	3	3	3	3	1	2	1	2	2	1	2	3	3
	CO4	4)Design single	3	3	3	2	3	1	1	1	2	1	1	1	2	3
	CO5	5) Design filtra	2	3	3	3	3	2	2	2	3	2	2	3	2	3

CET1601																
	CO	Statements	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	1) Correlate st	3	3	2	1	1	3	1	3	1	2	1	1	2	2
	CO2	2) Structure pr	3	3	2	1	1	3	1	3	1	2	1	1	2	2
	CO3	3) Understand	3	3	2	2	1	3	1	3	1	2	2	1	2	2
	CO4	4) Industrial tr	3	3	2	3	1	3	1	3	1	2	2	1	2	2
	CO5	5) Different ty	3	3	2	2	1	3	3	3	1	2	1	1	3	3
	CO6	6) Corrosion m	3	3	2	3	1	3	3	3	1	2	2	1	3	3

CEP1706																
	CO	Statements	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	1) Performing	3	3	3	3	1	1	2	1	1	1	1	1	2	2
	CO2	2) Solid dissolu	3	3	3	3	1	1	1	1	1	2	1	1	2	2
	CO3	3) Dynamics of	3	3	3	3	1	1	1	1	1	1	1	1	3	3

CEP1705																
	CO	Statements	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	1) simulation o	3	3	3	2	2	1	1	1	1	1	1	1	3	3
	CO2	2) conduction ,	3	3	3	3	1	1	1	1	2	1	1	1	2	2
	CO3	3) Computatio	3	3	2	3	1	1	1	1	2	1	1	1	2	2

CET1203																
	CO	Statements	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	1) Understand	3	3	2	1	1	1	1	1	1	1	1	1	2	2
	CO2	2) Be aware of	3	3	3	2	1	1	1	1	1	1	1	1	2	2
	CO3	3) Understand	3	3	3	2	1	1	1	1	1	1	1	1	2	2
	CO4	4) Be able to d	3	3	3	3	1	1	1	1	1	1	1	1	3	3

CET1703																
	CO	Statements	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	1) Gain Knowle	2	3	3	2	1	1	1	1	1	3	1	1	2	2
	CO2	2) Measure an	3	2	3	2	1	1	1	1	1	3	1	1	2	2
	CO3	3) Identify, ana	3	2	3	2	1	1	1	1	1	3	1	1	2	2
	CO4	4) Gain knowle	3	3	3	2	1	1	1	1	1	3	1	1	2	2
	CO5	5) Identify, Des	3	3	3	2	2	1	1	1	1	1	2	3	3	3

MAT1106															
	CO	**Statements**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
	CO1	1) Understand	3	3	3	3	3	1	1	1	1	2	1	2	2	3
	CO2	2) Understand	2	3	3	3	3	2	1	2	1	1	1	2	2	3
	CO3	3) Formulate a	2	3	3	3	3	1	1	2	1	1	1	1	3	2
	CO4	4) Solve optimi	3	3	3	3	3	1	1	2	1	1	1	1	3	3
	CO5	5) Design, choc	3	3	3	3	3	1	1	1	2	1	3	2	2	1

Table B.1.4a

Table 1.4: Program Articulation Matrix

CourseCode	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CHT1131	3	2	1	1	1	2	2	1	2	1	1	1	1	1
MAT1101	3	3	3	3	3	2	1	2	2	2	2	3	2	2
PYT1101	3	3	1	1	1	1	1	1	1	1	1	2	1	1
MAT1103	3	3	3	3	3	2	1	2	2	2	2	3	2	2
CHT1211	3	3	3	3	3	2	1	1	2	2	2	3	2	1
CET1501	3	3	3	3	3	3	3	1	2	2	2	3	3	3
PYT1103	3	3	1	1	1	1	1	1	1	1	1	2	1	1
CHT1231	3	2	1	1	1	2	2	1	2	1	1	1	1	1
PYT1201	3	3	1	1	1	1	1	1	1	1	1	2	1	1
GET1303	3	3	2	3	1	1	1	1	1	1	1	1	1	2
CET1301	3	3	3	2	2	1	2	1	1	1	1	3	2	2
BST1102	3	3	3	3	2	2	2	1	3	1	1	3	1	2
GET1102	3	3	3	1	1	1	1	1	1	1	1	1	1	1
CET1101	3	3	3	3	2	2	2	3	2	1	1	1	3	3
CHT1403	3	3	3	3	3	2	1	2	2	2	2	3	2	1
CHT1341	3	3	3	3	3	2	1	1	2	2	2	3	1	1
GET1109	2	3	1	1	1	1	1	1	1	1	1	1	1	1
CET1302	3	3	3	3	2	1	1	1	1	1	1	2	2	2
GET1107	3	3	3	1	1	1	1	1	1	1	1	1	1	2
CET1401	3	3	3	3	3	2	2	2	3	2	3	2	2	3
CET1502	3	3	3	3	1	3	2	3	2	3	2	2	2	2
CET1102	3	3	3	3	3	2	2	2	3	1	1	3	3	3
CET1201	3	3	3	3	3	2	2	2	3	2	3	2	3	3
CET1402	3	3	3	3	2	2	2	1	2	1	1	2	2	3
CET1202	3	3	3	3	2	1	2	1	2	2	1	2	2	3
CET1601	3	3	3	3	1	3	2	3	2	3	2	2	2	2
CET1203	3	3	3	3	1	1	1	1	1	1	1	3	3	3
CET1503	3	3	3	3	3	3	3	2	2	1	1	2	2	2
CET1703	3	3	3	3	2	1	1	2	1	3	2	2	2	3
CET1510	3	3	3	3	3	2	2	2	2	3	3	2	2	2
CET1408	3	3	3	3	3	2	1	2	2	2	2	3	2	2
CET1504	3	3	3	3	3	2	1	2	2	2	3	2	3	3
CET1505	3	3	3	3	3	2	1	2	2	2	2	3	2	2
HUT1102	3	3	3	3	3	3	3	3	3	2	1	2	3	2
CET1511	3	3	3	3	3	2	1	2	2	2	2	3	2	2
HUT1108	2	3	1	3	1	3	3	3	3	3	3	3	1	2
HUT1105	2	3	1	3	1	3	3	3	3	3	3	3	1	2
MAT1106	3	3	3	3	3	2	1	1	2	1	3	1	3	1
HUT1109	2	3	1	3	1	3	3	3	3	3	3	3	1	2
CET1607	3	3	3	3	3	3	2	2	3	1	1	3	1	1
CEP1701	3	3	3	3	2	1	2	1	2	2	1	3	3	3
CEP1702	3	3	3	3	1	3	2	3	2	3	2	1	3	1
CEP1704	3	3	3	3	2	1	2	1	2	2	1	3	3	3
CEP1705	3	3	3	3	3	2	2	2	3	1	1	1	3	1
CEP1706	3	3	3	3	2	1	2	1	2	2	1	3	3	3

Table B.1.4b

Note: *Correlation levels 1, 2 or 3 as defined below:*

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)*

1.5. Attainment of Course Outcomes (25) **(Institute Marks 25)**

1.5.1. Describe the assessment tools and processes used to gather the data upon which the evaluation of Course Outcome is based (5) **(Institute Marks 5)**

The assessment of the students is carried out through the following methods:

- Classroom/online teaching
- Assignments
- MCQ tests
- Quiz
- Student projects & presentations
- Group discussion
- Case studies
- Experimental laboratory work

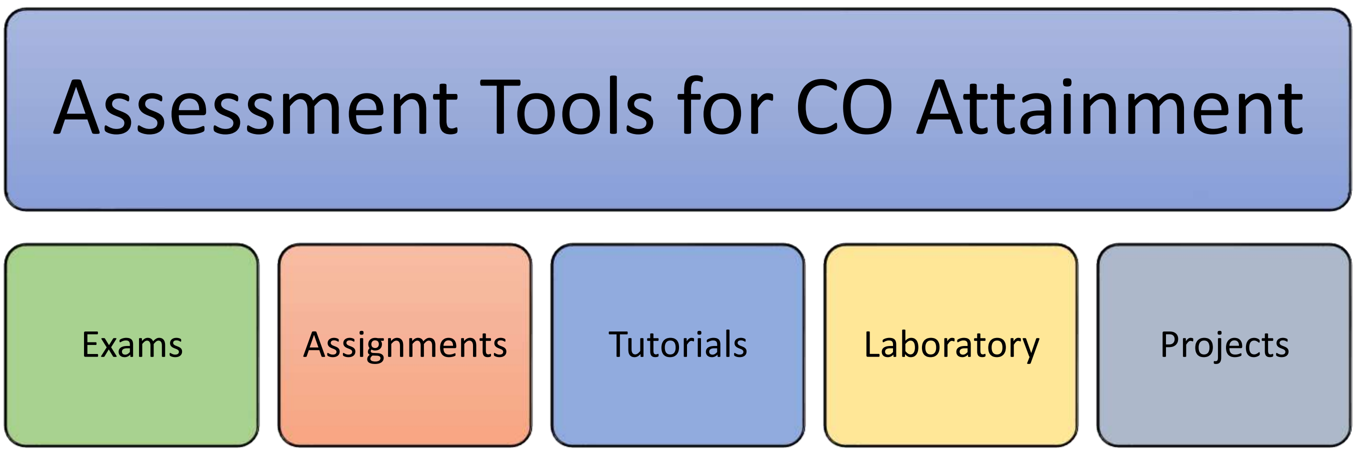


Figure 1.3: Assessment tools for CO attainment

Calculation Methodology with Sample Calculation

We will illustrate the calculation methodology with sample calculation using the example of the course CET1201 for the academic year 2020-2021.

A. Sample calculation for CO attainment:

1. First a matrix is created which maps the COs with the various assessment exams. The same table also maps the COs with the POs, where 3, 2, and 1 denote strong, medium, and weak correlations, respectively. The matrix is shown in Table 1.5.

Table 1.5: Mapping of CO with assessment exams.

CO	CA	MidSem	EndSem	CO Statement
Marks	**20**	**30**	**50**	
CO1	5	25	10	Solve energy and material balance equations and analyze the performance of various multi-phase reactors. (K1)
CO2	30	25	15	Develop rate laws and determine kinetics of several homogenous and heterogeneous reactions. (K2)
CO3	30	25	15	Gain knowledge to design and interpret data of reactors for catalytic and non-catalytic reactions. (K3)
CO4	30	0	30	Solve integrated and differential rate equations for series and parallel reactions in a system. (K4)
CO5	5	25	30	Perform, evaluate and optimize the design and operation of catalyzed and non-catalyzed chemical reactors. (K5)

2. As can be seen from Table 1.5, each assessment exam (CA – continuous assessment, MidSem – mid-semester exam, EndSem – end-semester exam) is associated with a distribution of COs – the distribution summing up to 100%. Marks scored in that exam are automatically distributed amongst the COs in proportion to the distribution allocated to the COs in that exam.

Hence, the maximum attainment for CO1 in the semester is 5×20+25×30+10×50=1350.

Now, we turn to the results of the assessment for each student on the student roll. Table 1.6 shows a partial table of the scores in each assessment by the students. Taking the example of the first student i.e. 17CHE103, we have the student's attainment in CO1 as 5×19+25×23+10×28=950.

Table 1.6: Results of the direct assessment

Sr. No.	Roll No	CA	MidSem	EndSem
1	17CHE103	19	23	28
2	18CHE151	20	18	18
3	19CHE101	19	18	28
4	19CHE102	19	18	23
5	19CHE103	20	17	42
6	19CHE104	20	24	37
7	19CHE105	19	24	40
8	19CHE106	20	24	35
9	19CHE107	20	24	35
10	19CHE108	19	18	27
11	19CHE110	17	24	33
12	19CHE111	19	30	17

3. We also defined the initial target attainment for a classroom course as 0.8. Hence the CO1 attainment of the student 17CHE103 is $\frac{950}{1350} \times \frac{100}{0.8} = 87.96$. For a number greater than 100, we set it as 100. We calculate the attainments of each student in the class for each CO as shown in Table 1.7.

Table 1.7: COs calculated as a result of direct assessment for CET1201 for the academic year 2020-2021.

Sr. No.	Roll No	CA	MidSem	EndSem	CO1	CO2	CO3	CO4	CO5
1	17CHE103	19	23	28	87.96	93.15	93.15	83.93	80.32
2	18CHE151	20	18	18	67.59	78.57	78.57	67.86	57.98
3	19CHE101	19	18	28	76.39	85.71	85.71	83.93	73.67
4	19CHE102	19	18	23	71.76	81.25	81.25	75	65.69
5	19CHE103	20	17	42	87.5	98.51	98.51	100	94.95
6	19CHE104	20	24	37	99.07	100	100	100	96.28
7	19CHE105	19	24	40	100	100	100	100	100
8	19CHE106	20	24	35	97.22	100	100	98.21	93.09
9	19CHE107	20	24	35	97.22	100	100	98.21	93.09
10	19CHE108	19	18	27	75.46	84.82	84.82	82.14	72.07
11	19CHE110	17	24	33	93.98	95.54	95.54	89.29	89.1
12	19CHE111	19	30	17	93.98	93.75	93.75	64.29	72.07

4. We then calculated overall % CO attainment by taking an average of each CO column. We thus obtained a percent CO attainment for each subject as shown in Table 1.8 for CET1201 for the academic year 2020-2021.

Table 1.8: %CO attainment for CET1201 for the academic year 2020-2021.

CO	CA	MidSem	EndSem	% CO Attainment
Marks	**20**	**30**	**50**	**100**
CO1	5	25	10	83.53
CO2	30	25	15	90.09
CO3	30	25	15	90.09
CO4	30	0	30	87.4
CO5	5	25	30	80.9

1.5.2. Record the attainment of Course Outcomes of courses with respect to set attainment levels(20)

(Institute Marks 20)

Table 1.9: %CO attainment major subjects for the academic year 2018-2019, 2019-2020, 2020-2021.

CourseCode	CO	CO Attainment			Target	Comments
		2018-2019	**2019-2020**	**2020-2021**		
BST1102	CO1	91.64	91.93	94.15	80-85	CO Attainment is satisfactory.
	CO2	87.4	87.11	96.63	80-85	
	CO3	88.06	89.17	95.13	80-85	
	CO4	83.24	81.43	98.23	80-85	
	CO5	89.74	87.2	98.23	80-85	
	CO6	87.55	84.51	96.23	80-85	
CEP1701	CO1	95.55	73.7	99.29	80-85	CO Attainment is not satisfactory in 2019-2020. This is a laboratory course. The CO Attainment in the year 2019-2020 was impacted by the COVID-19 pandemic. The laboratory courses were taken online in 2019-2020. The attainment is again back to better than expected in 2020-2021.
	CO2	95.63	77.23	98.84	80-85	
	CO3	95.55	82.16	99.34	80-85	
	CO4	95.39	77.23	99.12	80-85	
CEP1702	CO1	96.58	96.23	88.6	90-95	CO Attainment is satisfactory.
	CO2	97.12	96.46	90.38	90-95	
	CO3	97.12	96.46	90.38	90-95	
CEP1704	CO1	99.27	98.61	91.49	80-85	CO Attainment is satisfactory.
	CO2	99.55	98.6	89.69	80-85	
	CO3	99.55	98.6	89.69	80-85	
CEP1705	CO1	82.64	63.73	97.27	80-85	CO Attainment is not satisfactory in 2019-2020. This is a laboratory course. The CO attainment in the year 2019-2020 was impacted by the COVID-19 pandemic. The laboratory courses were taken online in 2019-2020. The attainment is again back to better than expected in 2020-2021.
	CO2	81.32	60.73	97.47	80-85	
	CO3	77.01	50.92	98.03	80-85	
CEP1706	CO1	94.47	62.75	95.91	80-85	CO Attainment is not satisfactory in 2019-2020. This is a laboratory course. The CO attainment in the year 2019-2020 was impacted by the COVID-19 pandemic. The laboratory courses were taken online in 2019-2020. The attainment is again back to better than expected in 2020-2021.
	CO2	95.71	70.17	96.63	80-85	
	CO3	96.03	72.45	96.81	80-85	

CEP1715	CO1	88.99	86.25	89.33	80-85	CO Attainment is satisfactory.
	CO2	93.1	86.25	93.17	80-85	
	CO3	87.26	85.27	89.33	80-85	
	CO4	88.36	86.25	88.78	80-85	
	CO5	89.68	86.83	89.33	80-85	
CEP1717	CO1	91.54	99.35	99.23	90-95	CO Attainment is satisfactory.
	CO2	96.08	98.19	99.06	90-95	
CET1101	CO1	73.69	64.29	65.22	60-65	CO Attainment is satisfactory. Based on the rigorous evaluation and expected outcomes from the students this CO attainment is set low.
	CO2	69.19	64.62	67.06	60-65	
	CO3	68.06	65.42	62.82	60-65	
	CO4	78.21	64.8	64.89	60-65	
	CO5	73.61	63.66	63.98	60-65	
	CO6	78.74	63.64	63.06	60-65	
CET1102	CO1	77.4	70.82	76.07	70-75	CO Attainment is not satisfactory. More numericals were included to understand the concepts and troubleshooting of various heat transfer equipment. Extra lectures were also organized for modern design software such as HTRI.
	CO2	74.13	66.54	67.57	70-75	
	CO3	74.23	67.03	67.79	70-75	
	CO4	72.63	64.83	63.69	70-75	
	CO5	74.13	66.54	67.57	70-75	
	CO6	71.47	62.11	60.92	70-75	
CET1201	CO1	80.95	93.61	83.53	80-85	CO Attainment is not satisfactory in 2018-2019. More emphasis was given to understanding the problem statement, problem-solving and thought-provoking problems resulted in better CO attainment in subsequent years.
	CO2	72.41	92.07	90.09	80-85	
	CO3	72.41	92.07	90.09	80-85	
	CO4	57.33	92.07	87.4	80-85	
	CO5	80.95	81.06	80.9	80-85	
CET1202	CO1	87.05	86.81	88.21	80-85	CO Attainment is satisfactory.
	CO2	87.91	84.25	86.9	80-85	
	CO3	93.43	80.34	86.76	80-85	
CET1203	CO1	74.32	76.55	79.3	75-80	CO Attainment is not satisfactory in 2018-2019. Industry problems were added to understand the design concepts. Lectures by eminent professors contributed to better CO attainment in subsequent years.
	CO2	73.82	76.56	76.2	75-80	
	CO3	74.15	76.07	78.94	75-80	
	CO4	73.93	76.56	76.82	75-80	
CET1301	CO1	78.13	69.56	78.13	75-80	CO Attainment is not satisfactory in 2019-2020. More emphasis put on understanding the problem at hand rather than directly jumping on solving the problem resulted in better CO attainment in the subsequent year.
	CO2	78.13	69.56	78.13	75-80	
	CO3	78.97	69.39	78.97	75-80	
	CO4	76.71	69.13	76.71	75-80	
	CO5	75.85	68.99	75.85	75-80	
	CO6	74.04	67.6	74.04	75-80	
CET1302	CO1	74.91	76.54	67.92	75-80	CO Attainment is not satisfactory in 2020-2021. Encouraged students for lateral thinking and group exercises for the various problems should result in better CO attainment in the next year.
	CO2	74.14	78.17	69.41	75-80	
	CO3	73.27	79.35	70.68	75-80	
	CO4	73.3	77.36	69.51	75-80	
	CO5	70.3	76.9	70.71	75-80	
CET1401	CO1	83.04	79.57	96.85	75-80	CO Attainment is satisfactory.
	CO2	83.76	81.65	97.16	75-80	
	CO3	85.11	80.52	96.85	75-80	
	CO4	88.5	87	94.61	75-80	
	CO5	86.79	86.62	93.07	75-80	
CET1402	CO1	84.23	97.76	89.59	80-85	CO Attainment is satisfactory.
	CO2	84.23	97.76	89.59	80-85	
	CO3	84.32	97.9	89.73	80-85	

	CO4	84.32	97.9	89.73	80-85	
	CO5	84.63	98.35	90.19	80-85	
	CO6	84.63	98.35	90.19	80-85	
CET1501	CO1	66.6	76.38	64.49	60-65	CO Attainment is satisfactory. Based on the rigorous evaluation and expected outcomes from the students this CO attainment is set low.
	CO2	66.9	71.42	63.58	60-65	
	CO3	67.83	68.73	63.04	60-65	
	CO4	67.98	73.8	63.14	60-65	
	CO5	67.58	75.2	65.38	60-65	
CET1502	CO1	74.68	74.31	80.05	75-80	CO Attainment is not satisfactory in 2018-2019 and 2019-2020. The students were given case studies to analyze the problems and find the appropriate solutions in the manufacturing sector resulting in better CO attainment in 2020-2021.
	CO2	70	73.17	78.59	75-80	
	CO3	72.27	72.11	81.13	75-80	
	CO4	70.76	68.52	87.32	75-80	
	CO5	73.62	71.07	84.21	75-80	
	CO6	71.94	68.52	87.47	75-80	
CET1503	CO1	83.97	79.74	98.36	75-80	CO Attainment is satisfactory.
	CO2	80.58	78.64	97.59	75-80	
	CO3	81.38	77.84	97.83	75-80	
	CO4	79.44	77.61	97.3	75-80	
	CO5	80.58	78.64	97.59	75-80	
	CO6	75.73	79.94	95.43	75-80	
CET1504	CO1	85.54	87.27	90.46	80-85	CO Attainment is satisfactory.
	CO2	84.89	87.56	90.2	80-85	
	CO3	85.15	87.11	91.04	80-85	
	CO4	85.22	87.63	91.04	80-85	
	CO5	84.67	87.11	89.26	80-85	
	CO6	85.28	88.71	91.98	80-85	
CET1505	CO1	92.19	61.1	97.64	80-85	CO Attainment is not satisfactory in 2019-2020. More emphasis was given to understanding the problem statement, practice problems, and the use of e-teaching platforms and flipped classrooms resulted in better CO attainment in the subsequent year.
	CO2	93.4	60.11	97.32	80-85	
	CO3	96.13	64.47	97.08	80-85	
	CO4	95.12	65.06	96.51	80-85	
	CO5	93.04	50.74	97.34	80-85	
	CO6	88.92	56.05	97.34	80-85	
CET1509	CO1	82.98	89.61	86.05	80-85	CO Attainment is satisfactory.
	CO2	82.28	90.68	81.4	80-85	
	CO3	85.02	90.6	81	80-85	
	CO4	84.88	90.96	82.42	80-85	
CET1515	CO1	87.86	88.52	81.69	80-85	CO Attainment is satisfactory.
	CO2	87.43	87.8	80.63	80-85	
	CO3	87.23	90.57	81.99	80-85	
CET1601	CO1	62.13	82.19	64.59	70-75	CO Attainment is not satisfactory in 2018-2019 and 2020-2021. Emphasis is given to the material failure analysis and mechanical failure of chemical process equipment to understand the root cause analysis. This should contribute positively to CO attainment in subsequent years.
	CO2	56.68	80.19	67.87	70-75	
	CO3	59.74	80.21	64.69	70-75	
	CO4	62.11	81.31	63.5	70-75	
	CO5	43.94	77.06	77.16	70-75	
	CO6	43.94	77.06	77.16	70-75	
CET1608	CO1	83.52	93.56	95.8	80-85	CO Attainment is satisfactory.
	CO2	84.86	95.66	97.57	80-85	
	CO3	84.88	95.98	98.23	80-85	
	CO4	87.75	97.75	99.06	80-85	
CET1703	CO1	72.36	70.95	82.86	75-80	CO Attainment is not satisfactory in 2018-2019 and 2019-2020. More real-world problems and assignments were given to the students on the
	CO2	60.22	60.01	76.1	75-80	
	CO3	57.71	56.57	73.49	75-80	

	CO4	64.47	61.03	75.87	75-80	design of multivariable control systems resulting in better CO attainment in 2020-2021.
	CO5	62	60.77	76.34	75-80	
CET1716	CO1	92.49	99	99.21	90-95	CO Attainment is satisfactory.
	CO2	91.21	98.92	99.13	90-95	
	CO3	91.56	99.29	96.47	90-95	
GEP1101	CO1	85.2	92.43	83.92	80-85	CO Attainment is satisfactory.
	CO2	85.2	92.43	81.67	80-85	
	CO3	85.83	92.97	81.07	80-85	
	CO4	85.83	92.97	87.59	80-85	
GEP1103	CO1	95.32	91.33	98.11	80-85	CO Attainment is satisfactory.
	CO2	94.81	91.3	98.22	80-85	
	CO3	95.32	91.33	98.11	80-85	
	CO4	95.25	91.28	97.8	80-85	
GEP1108	CO1	94.38	97.5	94.32	80-85	CO Attainment is satisfactory.
	CO2	87.05	97.5	93.3	80-85	
	CO3	91.29	97.5	84.33	80-85	
	CO4	91.29	97.5	92.03	80-85	
GEP1112	CO1	99.91	99.97	100	80-85	CO Attainment is satisfactory.
	CO2	99.77	100	100	80-85	
	CO3	99.88	100	100	80-85	
GET1102	CO1	81.75	78.39	95.91	75-80	CO Attainment is satisfactory.
	CO2	82.56	79.44	95.02	75-80	
	CO3	79.35	79.3	95	75-80	
	CO4	82.56	79.17	94.25	75-80	
	CO5	77.78	78.18	94.25	75-80	
	CO6	75.7	80	93.13	75-80	
GET1107	CO1	82.43	87.64	93.55	80-85	CO Attainment is satisfactory.
	CO2	83.13	86.76	92.72	80-85	
	CO3	79.83	88.3	96.11	80-85	
	CO4	83.36	88.02	94.68	80-85	
	CO5	81.54	87.04	92.73	80-85	
	CO6	79.4	100	96.28	80-85	
HUT1102	CO1	88.88	93.09	99.41	80-85	CO Attainment is satisfactory.
	CO2	87.91	94.8	99.33	80-85	
	CO3	88.88	95.13	99.68	80-85	
	CO4	88.88	95.13	99.68	80-85	
	CO5	90.24	95.36	99.28	80-85	
	CO6	87.2	95.61	99.19	80-85	
MAT1106	CO1	93.25	64.98	99.17	80-85	CO Attainment is not satisfactory in 2019-2020. More emphasis was given to understanding the design of the experiments, hands-on problem solving and assignments resulted in better CO attainment in the subsequent year.
	CO2	93.25	64.98	99.17	80-85	
	CO3	85.93	90.16	98.53	80-85	
	CO4	85.93	90.16	98.64	80-85	
	CO5	85.82	95.56	98.1	80-85	

1.6. Attainment of Program Outcomes and Program Specific Outcomes (25) **(Institute Marks 25)**

1.6.1. Describe assessment tools and processes used for measuring the attainment of each Program Outcome and Program Specific Outcomes (5) **(Institute Marks 5)**

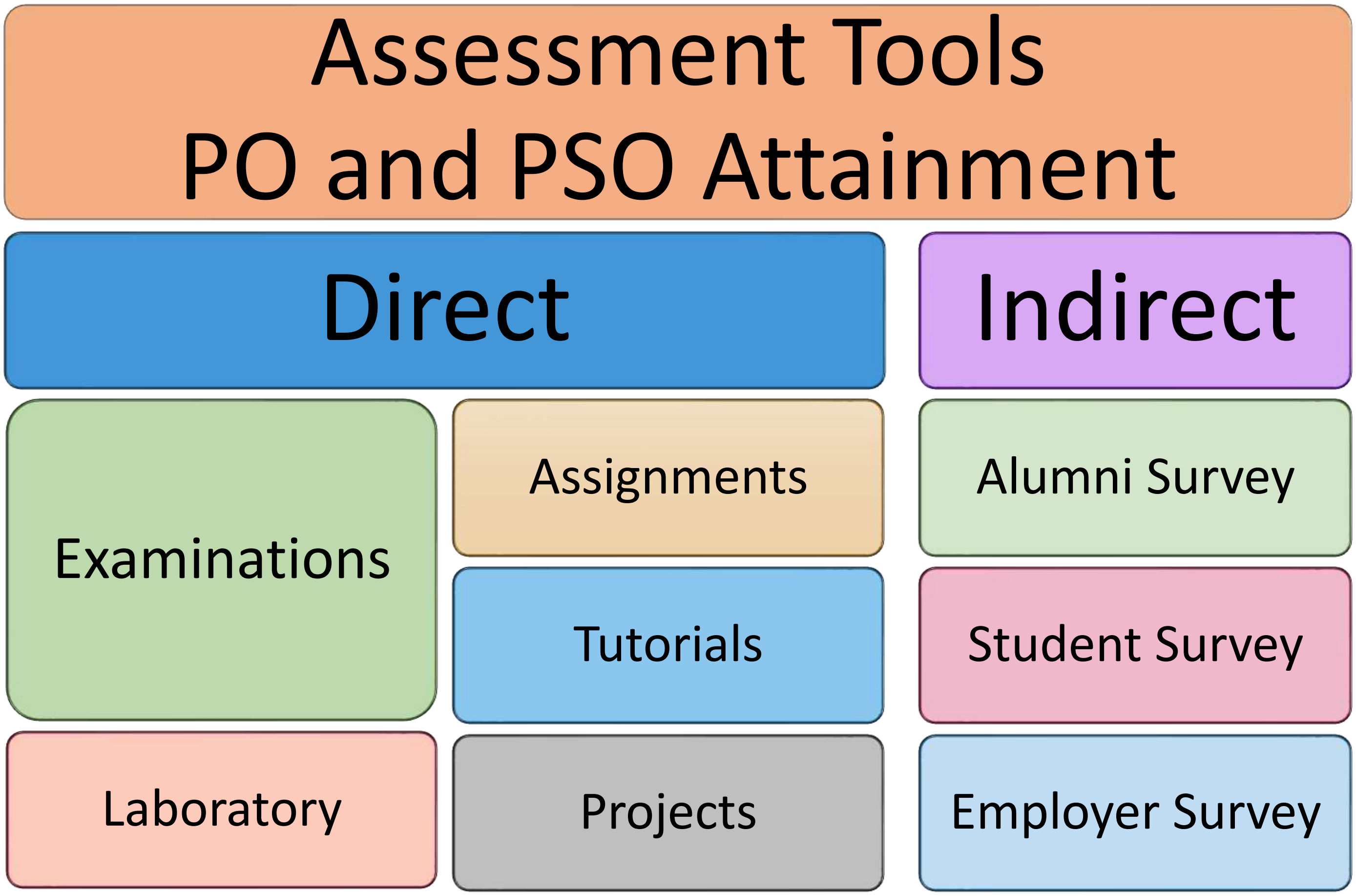


Figure 1.4: Assessment tools for PO attainment

B. Sample calculation for PO and PSO attainment (Direct Assessment)

1. First a matrix is created which maps the COs, POs, and PSOs with the various assessment exams. The matrix is as shown in Table 1.10, where 3, 2, and 1 denote strong, medium, and weak correlation, respectively. Table 1.10 is fundamentally an extension of Table 1.5.

Table 1.10: Mapping of CO with assessment exams and with POs and PSOs

CO	CA	MidSem	EndSem	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Marks	**20**	**30**	**50**														
CO1	5	25	10	3	3	3	2	2	1	1	1	2	1	2	1	2	2
CO2	30	25	15	2	3	3	3	2	1	1	1	2	1	1	1	2	2
CO3	30	25	15	2	3	3	3	3	1	2	1	2	2	2	1	2	2
CO4	30	0	30	3	3	3	2	3	1	1	1	2	1	1	1	2	2
CO5	5	25	30	2	3	3	3	3	2	2	2	3	2	3	2	3	3

2. Using % CO attainment information from Table 1.8, we calculated the PO attainment for each subject using the matrix defined in Table 1.10. Therefore, the contribution of each CO to each PO is calculated. An example of PO1 calculation for CET1201 for the academic year 2020-2021 is given by $\frac{(83.53\times3+90.09\times2+90.09\times2+87.4\times3+80.9\times2)}{3+2+2+3+2} = 86.25\%$.

3. Table 1.11 reflects all the percent POs and PSOs calculated corresponding to each CO percentage for CET1201. Likewise, we calculated the PO and PSO Attainment levels of all the subjects. Table 1.12 represents % of direct PO attainment for each subject in the academic year 2020-21.

Table 1.11: % PO and % PSO attainment for CET1201 for the academic year 2020-2021.

CO	% CO Attainment	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Marks	**100**														
CO1	83.53	3	3	3	2	2	1	1	1	2	1	2	1	2	2
CO2	90.09	2	3	3	3	2	1	1	1	2	1	1	1	2	2
CO3	90.09	2	3	3	3	3	1	2	1	2	2	2	1	2	2
CO4	87.4	3	3	3	2	3	1	1	1	2	1	1	1	2	2
CO5	80.9	2	3	3	3	3	2	2	2	3	2	3	2	3	3
% PO Attainment		86.25	86.4	86.4	86.55	86.34	85.49	86.14	85.49	85.9	86.14	85.27	85.49	85.9	85.9

Table 1.12. Direct %PO and %PSO attainment for each course in the academic year 2020-2021.

CourseCode	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
BST1102	96.55	96.27	96.44	96.74	96.63	96.41	96.11	96.43	96.81	96.43	96.43	96.55	96.27	96.55
CEP1701	99.16	99.15	99.15	99.14	99.16	99.15	99.19	99.15	99.15	99.19	99.21	99.21	99.14	99.15
CEP1702	89.78	89.78	89.78	89.93	89.78	89.78	89.78	89.78	89.78	89.78	89.78	89.93	89.61	89.61
CEP1704	89.95	89.99	90.14	90.14	90.14	90.29	90.29	90.29	90.29	90.29	90.29	90.29	90.46	90.46
CEP1705	97.59	97.59	97.54	97.63	97.51	97.59	97.59	97.59	97.66	97.59	97.59	97.59	97.55	97.55
CEP1706	96.45	96.45	96.45	96.45	96.45	96.45	96.32	96.45	96.45	96.5	96.45	96.45	96.5	96.5
CEP1715	89.53	89.88	89.83	89.88	89.99	89.99	89.99	90.15	89.99	90.55	89.99	89.83	90.04	89.99
CEP1717	99.14	99.14	99.14	99.14	99.17	99.14	99.14	99.14	99.11	99.11	99.11	99.14	99.14	99.14
CET1101	64.5	64.63	64.36	64.5	64.25	64.56	64.26	64.5	64.87	64.56	64.26	64.34	64.5	64.5
CET1102	67.27	67.65	67.46	66.94	66.47	67.27	67.27	67.27	66.47	67.27	67.27	67.27	67.27	67.27
CET1201	86.25	86.4	86.4	86.55	86.34	85.49	86.14	85.49	85.9	86.14	85.27	85.49	85.9	85.9
CET1202	87.29	87.29	87.29	87.29	87.29	87.29	87.52	87.29	87.29	87.19	87.29	87.29	87.29	87.29
CET1203	77.81	77.81	77.68	77.51	77.81	77.81	77.81	77.81	77.81	77.81	77.81	77.81	77.7	77.7
CET1302	69.65	69.65	69.77	69.37	69.65	69.65	69.65	69.65	69.65	69.65	69.65	69.65	69.84	69.65
CET1401	95.71	95.71	95.71	95.7	95.51	95.27	95.49	95.27	95.47	95.49	95.27	95.37	95.92	95.71
CET1402	89.87	89.89	89.92	89.9	89.85	89.89	89.84	89.84	89.93	89.84	89.84	89.84	89.89	89.89
CET1408	95.12	95.02	95.49	95.17	95.26	95.12	95.12	95.12	95.12	95.12	95.23	95.3	95.12	95.22
CET1501	63.93	63.93	63.93	63.93	64.02	63.98	63.98	63.93	63.93	63.93	63.93	63.93	63.93	63.93
CET1502	83.05	83.77	84.22	82.91	84.46	83.13	83.01	83.57	83.13	83.73	83.89	84.2	83.46	83.61
CET1503	97.35	97.22	97.33	97.34	97.27	97.35	97.59	97.35	97.08	97.35	96.87	97.35	97.28	97.28
CET1504	90.67	90.67	90.68	90.67	90.67	90.67	90.67	90.67	90.67	90.67	90.67	90.61	90.64	90.64
CET1505	97.2	97.21	97.17	97.21	97.21	97.23	97.19	97.21	97.21	97.21	97.15	97.21	97.18	97.17
CET1509	95.2	95.2	95.19	95.19	95.2	95.2	95.2	95.2	95.2	95.2	95.2	95.2	95.2	95.2
CET1510	97.35	97.34	97.47	97.35	97.47	97.47	97.22	97.47	97.47	97.81	97.67	97.48	97.34	97.34
CET1515	81.44	81.44	81.44	81.32	81.54	81.44	81.44	81.44	81.44	81.44	81.6	81.26	81.44	81.37
CET1601	69.16	69.16	69.16	69.84	69.16	69.16	72.36	69.16	69.16	69.16	68.92	69.16	70.3	70.3
CET1607	97.58	97.39	97.38	97.36	97.28	97.3	97.5	97.47	97.48	97.5	97.4	97.48	97.45	97.54
CET1608	97.66	98.04	97.46	97.46	97.04	97.21	97.04	97.46	97.04	97.62	97.12	97.37	97.67	97.61
CET1703	76.51	77.26	76.93	76.93	76.83	76.93	76.93	76.93	76.93	77.02	76.83	76.76	76.88	76.88
CET1716	98.27	98.27	98.27	98.27	98.27	98.27	98.51	98.27	98.27	98.49	98.27	98.27	98.16	98.16
CHP1132	100	100	100	100	100	100	100	100	100	100	100	100	100	100

CHP1342	84.84	84.84	84.87	84.87	84.79	84.84	84.84	84.8	84.84	84.84	84.84	84.81	84.87	84.84
CHT1131	75.1	74.92	75.12	75.17	75.12	75.04	75.03	74.92	74.87	74.97	75.02	75.03	75.03	74.97
CHT1211	86.04	86.04	86.04	86.04	86.1	86.04	86.04	86.04	86.04	86.04	86.04	85.91	86.05	86.04
CHT1231	93.09	93.25	93.09	93.09	93.09	93.09	93.09	93.09	93.09	93.09	93.09	93.09	93.09	93.09
CHT1341	75.22	75.22	75.33	75	75.09	75.39	75.29	75.44	75.17	75.22	75.22	75.29	75.14	75.29
CHT1403	97.52	97.52	97.52	97.52	97.52	97.52	97.52	97.52	97.52	97.52	97.57	97.48	97.52	97.52
GEP1101	83.56	83.56	83.56	83.56	83.56	83.31	83.92	83.18	83.41	83.63	83.51	83.56	83.79	83.79
GEP1103	98.06	98.06	98.06	98.06	98.06	98.06	98.06	98.06	98.06	98.06	98.06	98.06	98.06	98.06
GEP1108	90.99	90.99	90.99	91.25	90.99	90.99	90.99	90.99	91.43	90.99	90.44	90.43	91.6	90.99
GEP1111	78.04	78.4	78.4	78.4	78.4	79.02	78.4	78.4	76.37	78.4	77.81	78.4	77.69	77.69
GEP1112	100	100	100	100	100	100	100	100	100	100	100	100	100	100
GET1102	94.59	94.59	94.59	94.59	94.59	94.59	94.59	94.59	94.59	94.59	94.59	94.59	94.73	94.73
GET1107	94.31	94.22	94.07	93.94	94.35	94.35	94.35	94.35	94.35	94.35	94.35	93.98	94.22	94.35
GET1109	88.25	88.32	88.25	88.25	88.25	88.25	88.25	88.25	88.25	88.25	88.25	88.25	88.25	88.25
HUT1102	99.43	99.46	99.4	99.43	99.42	99.42	99.42	99.43	99.42	99.4	99.39	99.36	99.43	99.42
HUT1105	97.44	97.44	97.51	97.44	97.44	97.51	97.44	97.44	97.44	97.44	97.44	97.44	97.44	97.44
HUT1108	99.91	99.91	99.91	99.91	99.91	99.91	99.91	99.91	99.92	99.91	99.91	99.91	99.91	99.91
HUT1109	99.82	99.87	99.86	99.87	99.86	99.83	99.85	99.85	99.83	99.85	99.85	99.86	99.86	99.85
MAT1101	85.8	85.8	85.91	85.8	85.91	85.8	85.98	85.38	85.98	85.8	85.98	85.8	85.8	85.8
MAT1103	89.11	88.66	88.13	88.73	88.67	87.43	89.11	89.11	89.11	89.11	89.11	89.17	87.94	88.1
MAT1106	98.7	98.72	98.72	98.72	98.72	98.8	98.72	98.74	98.62	98.8	98.54	98.76	98.7	98.84
OLT1120	99.08	99.11	99.11	99.14	99.14	99.19	99.17	99.19	99.15	99.17	99.17	99.19	99.15	99.15
PYP1102	96.71	96.68	96.71	96.71	96.74	96.68	96.74	96.71	96.73	96.71	96.71	96.71	96.71	96.71
PYT1101	88.14	88.23	88.14	88.14	88.14	88.14	88.14	88.14	88.14	88.14	88.14	88.14	88.14	88.14
PYT1103	86.48	86.57	86.48	86.48	86.48	86.48	86.48	86.48	86.48	86.48	86.48	86.48	86.49	86.48
Average	**89.59**	**89.64**	**89.62**	**89.61**	**89.61**	**89.57**	**89.67**	**89.6**	**89.56**	**89.65**	**89.57**	**89.6**	**89.62**	**89.62**

C. Sample calculation for PO and PSO attainment (Indirect Assessment)

1. We carried out surveys from the students, alumni, and employers for the indirect assessment (sample feedback forms in Figures 1.5, 1.6, and 1.7). The survey questions were asked on a scale of 5 and then connected to POs and PSOs for the calculation of PO and PSO attainment.

Current Student Feedback for Accreditation of Chemical Engineering Courses

Dear Students,

Greetings from the Institute of Chemical Technology, Mumbai. We are currently in the process of applying for accreditation for our Chemical Engineering Programmes. As a requirement we have to collect and produce the student/alumni feedback to National Board of Accreditation (NBA) committee. The accreditation process is Outcome Based Education (OBE). The delivery of the programme needs to focus on the future needs of students and train them accordingly. The achievements of the objectives set for the programme needs to be evaluated by considering the data of current students. At present the information is required from current students. The feedback form is designed in such a way that it will not take more than 2 minutes to complete the information. It is a sincere request to fill this form so that the education objectives can be evaluated and appropriate action plan can be prepared".

Regards,
Accreditation Committee
Department of Chemical Engineering
Email: chemeng@staff.ictmumbai.edu.in / chemeng.acred@faculty.ictmumbai.edu.in

* Required

1. Please specify the year of joining the programme. e.g. 2016 *

2. Present Academic year *

Mark only one oval.

- Second Year *Skip to question 20*
- Third Year *Skip to question 19*
- Fourth Year *Skip to question 18*

3. How do you rate the programme you studying at ICT to the level of meeting your expectations in terms of technical/engineering knowledge? *

Mark only one oval.

	1	2	3	4	5	
Lowest						Highest

4. How do you rate the programme you studying at ICT in terms of Problem analysis skills *

Mark only one oval.

	1	2	3	4	5	
Lowest						Highest

5. How do you rate the programme you studying at ICT in terms of Designing and development of Solutions to engineering Problems? *

Mark only one oval.

	1	2	3	4	5	
Lowest						Highest

Figure 1.5: Sample student feedback form

Alumni Feedback for Accreditation of Chemical Engineering Courses

Dear Alumni,

Greetings from the Institute of Chemical Technology, Mumbai. We are currently in the process of applying for accreditation for our Chemical Engineering Programmes. As a requirement we have to collect and produce the student/alumni feedback to National Board of Accreditation (NBA) committee. The accreditation process is Outcome Based Education (OBE). The delivery of the programme needs to focus on the future needs of students and train them accordingly. The achievements of the objectives set for the programme needs to be evaluated by considering the data of Alumni. At present the information is required from students who have passed out between 2016 to 2021. The feedback form is designed in such a way that it will not take more than 2 minutes to complete the information. It is a sincere request to fill this form so that the education objectives can be evaluated and appropriate action plan can be prepared".

Regards,
Accreditation Committee
Department of Chemical Engineering
Email: chemeng@staff.ictmumbai.edu.in / chemeng.acred@faculty.ictmumbai.edu.in

* Required

1. Please specify the year of joining the programme. e.g. 2016 *

2. Please specify the year of completion of programme. e.g. 2020 *

3. Please specify the name of your current employer/organization. *

4. Please select the type role in your current organization. *

   Mark only one oval.

   - Research & Development
   - Management
   - Industry
   - Academic
   - Entrepreneur
   - Higher Studies
   - Techno-commercial/Marketing
   - Others

5. What was the annual remuneration/salary/fellowship (INR in lakhs) you were offered during the campus placement at ICT? *

   Mark only one oval.

   - < 4
   - 4-6
   - 6-8
   - 8-10
   - 10-12
   - > 12
   - Opted for entrepreneurship
   - Opted for Higher Education
   - No Campus Placement

Figure 1.6: Sample alumni feedback form

Employer Feedback

Dear Employer,

Greetings from the Institute of Chemical Technology, Mumbai (Formerly known as UDCT, Mumbai). We are currently in the process of applying for accreditation for our Bachelors of Chemical Engineering Programme. As a requirement we have to collect and produce the employer feedback to National Board of Accreditation (NBA) committee. As you have recruited/mentored our Bachelors of Chemical Engineering students in recent past, hence we request you to provide your valuable feedback based on your experiences with the candidate.

Regards,
Accreditation Committee
Department of Chemical Engineering
Email: chemeng@staff.ictmumbai.edu.in / chemeng.acred@faculty.ictmumbai.edu.in

* Required

1. Please specify your designation. *

2. Evaluation parameter (from most relevant to least relevant) *

Check all that apply.

	5	4	3	2	1
Technical/Engineering Knowledge	☐	☐	☐	☐	☐
Problem Analysis (problem understanding, literature review, suggesting solutions)	☐	☐	☐	☐	☐
Design/development of solutions	☐	☐	☐	☐	☐
Conducting Investigation of complex problems	☐	☐	☐	☐	☐
Modern engineering software/tool usage	☐	☐	☐	☐	☐
Responsibility towards the society	☐	☐	☐	☐	☐
Responsibility towards the environment	☐	☐	☐	☐	☐
Ethics	☐	☐	☐	☐	☐
Team work skills	☐	☐	☐	☐	☐
Communicational skills	☐	☐	☐	☐	☐
Project Management skills	☐	☐	☐	☐	☐
Life-long Learning	☐	☐	☐	☐	☐
Innovative ideas	☐	☐	☐	☐	☐
Motivation for higher studies/research	☐	☐	☐	☐	☐
Desire to serve industry	☐	☐	☐	☐	☐

Figure 1.7: Sample employer feedback form

2. Table 1.13 shows the calculation of PO attainment from alumni feedback. We took the average of the scores obtained from the number of students for each PO on a scale of 5 and then converted the value on a scale of 100 to obtain % attainment. For example, PO1 attainment is calculated as $(3+4+5+5+4+5+5+5+5+4+3+5+3+4+4+5+4+4+5+4)/20 = 4.30$. The average PO1 is then converted to % attainment as $\frac{4.30}{5} \times 100 = 86.00\%$. The PO1 attainment on a scale of 3 is calculated as $\frac{4.30}{5} \times 3 = 2.58\%$

3. The same procedure we followed for the indirect assessment through the student and employer feedback and is tabulated in Table 1.14 and 1.15, respectively. Refer to Figures 1.8, 1.9, and 1.10 for satisfaction survey analysis in Section 1.6.2.

Table 1.13: Indirect PO and PSO attainment through alumni feedback

	Alumni Feedback Analysis (2016-2020)													
Sr No	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
A1	3	3	3	3	3	5	4	3	3	4	5	4	2	3
A2	4	3	3	3	3	3	3	5	4	4	4	4	4	3
A3	5	5	5	5	4	5	5	4	5	4	4	5	5	3
A4	5	5	5	4	3	5	5	5	5	5	5	5	5	3
A5	4	4	3	3	4	2	3	4	3	4	2	3	4	3
A6	5	5	5	5	5	4	4	3	2	2	5	5	5	1
A7	5	5	5	5	5	5	5	5	5	5	5	5	4	5
A8	5	5	5	5	5	5	5	5	5	5	5	5	5	3
A9	5	5	5	5	5	5	5	5	5	5	5	5	4	4
A10	4	4	4	4	2	2	4	4	4	5	4	4	4	1
A11	3	4	4	4	3	4	3	4	4	3	4	3	3	3
A12	5	5	5	5	5	5	5	5	5	5	5	5	5	5
A13	3	4	3	4	4	5	4	4	5	4	4	5	3	5
A14	4	4	4	4	4	4	4	4	4	4	4	4	4	4
A15	4	3	3	3	2	3	4	4	4	4	4	4	4	4
A16	5	5	5	5	4	4	4	5	4	3	4	5	5	3
A17	4	4	5	4	3	4	4	4	4	3	4	4	5	3
A18	4	4	5	5	5	5	5	5	5	4	4	5	3	3
A19	5	5	5	5	5	5	5	5	5	5	5	5	5	4
A20	4	5	4	5	5	5	5	5	5	5	5	5	5	5
Average	**4.30**	**4.35**	**4.30**	**4.30**	**3.95**	**4.25**	**4.30**	**4.40**	**4.30**	**4.15**	**4.35**	**4.50**	**4.20**	**3.40**
PO Att	**2.58**	**2.61**	**2.58**	**2.58**	**2.37**	**2.55**	**2.58**	**2.64**	**2.58**	**2.49**	**2.61**	**2.70**	**2.52**	**2.04**
%PO Att	**86.00**	**87.00**	**86.00**	**86.00**	**79.00**	**85.00**	**86.00**	**88.00**	**86.00**	**83.00**	**87.00**	**90.00**	**84.00**	**68.00**

Table 1.14: Indirect PO attainment through student feedback

	Student Feedback Analysis (2020 -2021)													
Sr No	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
S1	5	5	5	5	5	5	5	5	5	5	5	5	5	5
S2	5	5	5	4	3	4	5	4	4	5	4	5	5	3
S3	5	5	5	4	3	5	5	5	5	5	5	4	5	4
S4	3	3	4	4	4	3	4	4	4	2	2	3	2	4
S5	5	5	5	5	4	5	5	5	5	5	5	5	5	5
S6	3	3	3	3	3	4	3	3	3	3	3	3	4	3
S7	5	5	5	5	5	5	5	5	5	5	5	5	5	5
S8	5	5	5	5	4	4	4	5	3	3	4	4	4	3
S9	3	3	3	3	3	3	3	3	3	3	3	3	4	3
S10	4	4	4	4	4	4	4	4	4	4	4	4	4	4
S11	4	4	4	3	3	3	4	4	3	3	4	4	2	5
S12	4	3	3	3	3	4	3	3	3	3	4	3	3	3
S13	5	4	4	5	5	4	3	4	4	5	4	4	5	4
S14	5	4	5	4	5	4	4	4	5	5	4	4	3	4
S15	4	4	4	4	4	3	4	3	3	3	4	3	4	4
S16	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S17	5	5	5	5	5	5	5	5	5	5	5	5	5	5
S18	4	4	4	4	4	4	4	4	4	4	4	4	4	5
S19	5	4	4	4	4	3	5	4	3	4	3	4	2	4
S20	4	4	4	4	4	4	4	4	4	3	3	3	4	3

S21	3	4	3	3	3	3	3	3	3	3	3	3	3	3
S22	4	4	4	4	4	4	4	4	4	4	4	4	4	4
S23	4	4	5	4	3	2	4	3	4	3	3	3	4	4
S24	3	3	3	3	3	2	3	3	3	3	3	3	3	3
S25	4	4	4	3	3	5	3	3	4	4	3	4	4	2
S26	4	4	4	4	4	4	5	5	4	4	3	5	5	4
S27	4	4	4	4	4	4	4	4	5	4	4	4	4	4
S28	5	5	5	5	5	5	5	5	5	5	5	5	3	5
S29	4	4	3	3	3	3	4	4	3	4	3	4	4	3
S30	4	3	4	4	4	4	4	4	4	4	4	4	4	4
S31	5	4	3	4	2	4	5	5	4	4	5	5	4	3
S32	4	3	3	4	4	3	4	4	4	3	4	4	4	5
S33	4	4	4	4	3	3	3	4	4	4	3	4	4	3
S34	3	3	3	3	3	3	3	3	3	3	3	3	3	3
S35	5	5	4	4	4	4	4	4	4	4	4	4	4	4
S36	5	4	5	4	5	4	4	4	5	5	3	4	3	4
S37	5	4	4	4	4	4	4	4	4	4	4	4	4	5
S38	4	3	4	5	4	4	4	4	4	5	5	4	5	5
S39	4	4	4	4	4	4	4	4	3	4	4	4	4	4
S40	4	4	4	4	4	4	4	4	4	4	4	4	4	4
S41	3	3	3	3	4	2	3	3	3	3	3	3	3	3
S42	4	3	4	4	3	4	3	3	3	3	3	3	3	4
S43	3	2	2	3	3	3	2	3	3	3	3	3	3	3
S44	5	5	5	4	4	4	4	4	4	4	4	4	4	4
S45	5	5	5	4	4	4	4	4	5	5	5	5	5	4
S46	4	4	4	4	5	5	5	5	4	5	4	5	4	5
Average	**4.13**	**3.89**	**3.96**	**3.87**	**3.74**	**3.74**	**3.89**	**3.89**	**3.83**	**3.85**	**3.74**	**3.87**	**3.80**	**3.83**
PO Att	**2.48**	**2.33**	**2.37**	**2.32**	**2.24**	**2.24**	**2.33**	**2.33**	**2.30**	**2.31**	**2.24**	**2.32**	**2.28**	**2.30**
%PO Att	**82.61**	**77.83**	**79.13**	**77.39**	**74.78**	**74.78**	**77.83**	**77.83**	**76.52**	**76.96**	**74.78**	**77.39**	**76.09**	**76.52**

Table 1.15: Indirect PO attainment through employer feedback

	Employer Feedback Analysis													
Sr No	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
E1	5	5	5	5	5	5	5	5	5	5	5	5	5	5
E2	4	4	4	4	3	3	3	4	3	3	3	3	5	5
E3	4	4	3	3	3	4	4	4	4	4	3	3	4	5
E4	5	5	5	5	5	5	5	5	5	5	5	5	5	5
E5	5	5	5	5	3	5	5	5	3	3	4	5	4	5
E6	5	5	5	5	4	4	4	5	4	4	5	4	3	3
E7	5	5	4	4	5	5	5	5	5	4	4	5	5	5
E8	4	4	3	4	5	4	4	3	3	4	4	4	5	3
E9	4	4	5	4	4	4	5	3	4	4	5	4	5	5
E10	5	4	5	5	5	4	4	5	5	5	4	4	5	5
E11	4	4	4	5	5	4	5	5	5	4	4	4	5	5
E12	5	5	5	5	5	5	5	5	5	5	4	5	5	5
E13	5	5	5	5	4	4	5	4	5	5	5	5	3	5
E14	4	5	5	4	5	4	5	5	4	5	5	5	5	4
E15	5	4	5	5	4	5	4	4	4	5	5	5	4	4
E16	5	4	5	5	4	4	4	5	5	5	5	5	5	5
E17	4	3	3	4	4	4	4	4	5	5	4	5	4	4
Average	**4.59**	**4.41**	**4.47**	**4.53**	**4.29**	**4.29**	**4.47**	**4.47**	**4.35**	**4.41**	**4.35**	**4.47**	**4.53**	**4.59**
PO Att	**2.75**	**2.65**	**2.68**	**2.72**	**2.58**	**2.58**	**2.68**	**2.68**	**2.61**	**2.65**	**2.61**	**2.68**	**2.72**	**2.75**
%PO Att	**91.76**	**88.24**	**89.41**	**90.59**	**85.88**	**85.88**	**89.41**	**89.41**	**87.06**	**88.24**	**87.06**	**89.41**	**90.59**	**91.76**

1.6.2. Provide results of evaluation of each PO & PSO (20) **(Institute Marks 20)**

D. Sample calculations for overall PO and PSO attainment

1. For overall PO and PSO calculations, we converted all the (Direct) % attainment values to a scale of 3 for each subject. Table 1.16 depicts the PO attainment for each subject in the academic year 2020-2021. This table is another representation of Table 1.12.

2. We also included the values of Indirect attainment (Alumni, Student, and Employer feedback forms) from Tables 1.13, 1.14, and 1.15 (converted to the scale of 3) in Table 1.16.

3. The overall PO and PSO attainment are then calculated as 0.8 × Average of Direct attainment + 0.2 × Average of Indirect attainment. For example, PO1 is calculated as 0.8×2.69+0.2×2.6=2.67.

Table 1.16: PO and PSO attainment (on the scale of 3) for each course in the academic year 2020-2021.

CourseCode	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
BST1102	2.9	2.89	2.89	2.9	2.9	2.89	2.88	2.89	2.9	2.89	2.89	2.9	2.89	2.9
CEP1701	2.97	2.97	2.97	2.97	2.97	2.97	2.98	2.97	2.97	2.98	2.98	2.98	2.97	2.97
CEP1702	2.69	2.69	2.69	2.7	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.7	2.69	2.69
CEP1704	2.7	2.7	2.7	2.7	2.7	2.71	2.71	2.71	2.71	2.71	2.71	2.71	2.71	2.71
CEP1705	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93
CEP1706	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.9	2.9
CEP1715	2.69	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.72	2.7	2.7	2.7	2.7
CEP1717	2.97	2.97	2.97	2.97	2.98	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97
CET1101	1.94	1.94	1.93	1.94	1.93	1.94	1.93	1.94	1.95	1.94	1.93	1.93	1.94	1.94
CET1102	2.02	2.03	2.02	2.01	1.99	2.02	2.02	2.02	1.99	2.02	2.02	2.02	2.02	2.02
CET1201	2.59	2.59	2.59	2.6	2.59	2.56	2.58	2.56	2.58	2.58	2.56	2.56	2.58	2.58
CET1202	2.62	2.62	2.62	2.62	2.62	2.62	2.63	2.62	2.62	2.62	2.62	2.62	2.62	2.62
CET1203	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33
CET1302	2.09	2.09	2.09	2.08	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.1	2.09
CET1401	2.87	2.87	2.87	2.87	2.87	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.88	2.87
CET1402	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
CET1408	2.85	2.85	2.86	2.86	2.86	2.85	2.85	2.85	2.85	2.85	2.86	2.86	2.85	2.86
CET1501	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92
CET1502	2.49	2.51	2.53	2.49	2.53	2.49	2.49	2.51	2.49	2.51	2.52	2.53	2.5	2.51
CET1503	2.92	2.92	2.92	2.92	2.92	2.92	2.93	2.92	2.91	2.92	2.91	2.92	2.92	2.92
CET1504	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72
CET1505	2.92	2.92	2.91	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.91	2.92	2.92	2.92
CET1509	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86
CET1510	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.93	2.93	2.92	2.92	2.92
CET1515	2.44	2.44	2.44	2.44	2.45	2.44	2.44	2.44	2.44	2.44	2.45	2.44	2.44	2.44
CET1601	2.07	2.07	2.07	2.1	2.07	2.07	2.17	2.07	2.07	2.07	2.07	2.07	2.11	2.11
CET1607	2.93	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.93
CET1608	2.93	2.94	2.92	2.92	2.91	2.92	2.91	2.92	2.91	2.93	2.91	2.92	2.93	2.93
CET1703	2.3	2.32	2.31	2.31	2.3	2.31	2.31	2.31	2.31	2.31	2.3	2.3	2.31	2.31
CET1716	2.95	2.95	2.95	2.95	2.95	2.95	2.96	2.95	2.95	2.95	2.95	2.95	2.94	2.94
CHP1132	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CHP1342	2.55	2.55	2.55	2.55	2.54	2.55	2.55	2.54	2.55	2.55	2.55	2.54	2.55	2.55
CHT1131	2.25	2.25	2.25	2.26	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25

CHT1211	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58
CHT1231	2.79	2.8	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79
CHT1341	2.26	2.26	2.26	2.25	2.25	2.26	2.26	2.26	2.26	2.26	2.26	2.26	2.25	2.26
CHT1403	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.92	2.93	2.93
GEP1101	2.51	2.51	2.51	2.51	2.51	2.5	2.52	2.5	2.5	2.51	2.51	2.51	2.51	2.51
GEP1103	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94
GEP1108	2.73	2.73	2.73	2.74	2.73	2.73	2.73	2.73	2.74	2.73	2.71	2.71	2.75	2.73
GEP1111	2.34	2.35	2.35	2.35	2.35	2.37	2.35	2.35	2.29	2.35	2.33	2.35	2.33	2.33
GEP1112	3	3	3	3	3	3	3	3	3	3	3	3	3	3
GET1102	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84
GET1107	2.83	2.83	2.82	2.82	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.82	2.83	2.83
GET1109	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65
HUT1102	2.98	2.98	2.98	2.98	2.98	2.98	2.98	2.98	2.98	2.98	2.98	2.98	2.98	2.98
HUT1105	2.92	2.92	2.93	2.92	2.92	2.93	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92
HUT1108	3	3	3	3	3	3	3	3	3	3	3	3	3	3
HUT1109	2.99	3	3	3	3	2.99	3	3	3	3	3	3	3	3
MAT1101	2.57	2.57	2.58	2.57	2.58	2.57	2.58	2.56	2.58	2.57	2.58	2.57	2.57	2.57
MAT1103	2.67	2.66	2.64	2.66	2.66	2.62	2.67	2.67	2.67	2.67	2.67	2.67	2.64	2.64
MAT1106	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.97
OLT1120	2.97	2.97	2.97	2.97	2.97	2.98	2.98	2.98	2.97	2.98	2.98	2.98	2.97	2.97
PYP1102	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
PYT1101	2.64	2.65	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64
PYT1103	2.59	2.6	2.59	2.59	2.59	2.59	2.59	2.59	2.59	2.59	2.59	2.59	2.59	2.59
Direct Average	**2.69**	**2.69**	**2.69**	**2.69**	**2.69**	**2.69**	**2.69**	**2.69**	**2.69**	**2.69**	**2.69**	**2.69**	**2.69**	**2.69**
Student Survey	2.48	2.33	2.37	2.32	2.24	2.24	2.33	2.33	2.3	2.31	2.24	2.32	2.28	2.3
Alumni Survey	2.58	2.61	2.58	2.58	2.37	2.55	2.58	2.64	2.58	2.49	2.61	2.7	2.52	2.04
Employer Survey	2.75	2.65	2.68	2.72	2.58	2.58	2.68	2.68	2.61	2.65	2.61	2.68	2.72	2.75
Indirect Average	**2.6**	**2.53**	**2.55**	**2.54**	**2.4**	**2.46**	**2.53**	**2.55**	**2.5**	**2.48**	**2.49**	**2.57**	**2.51**	**2.36**
Overall Attainment	**2.67**	**2.66**	**2.66**	**2.66**	**2.63**	**2.64**	**2.66**	**2.66**	**2.65**	**2.65**	**2.65**	**2.66**	**2.65**	**2.62**

Table B.1.6.2a & B.1.6.2b

4. Likewise, following the above-mentioned methodology in sections A, B, C, and D (Section 1.5 and 1.6 of this document), we calculated the overall average PO attainment for the academic years 2021-22, 2020-2021, 2019-2020, and 2018-19 which is presented in Table 1.16, 1.16a, 1.17 and 1.18, respectively (Figure 1.11).

Table 1.16a: PO and PSO attainment (on a scale of 3) for each course in the academic year 2021-2022.

CourseCode	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
BST1102	2.39	2.41	2.38	2.39	2.42	2.41	2.46	2.42	2.38	2.42	2.42	2.39	2.41	2.39
CEP1701	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64
CEP1702	2.69	2.69	2.69	2.7	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.7	2.69	2.69
CEP1704	2.7	2.7	2.7	2.7	2.7	2.71	2.71	2.71	2.71	2.71	2.71	2.71	2.71	2.71
CEP1705	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87
CEP1706	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
CEP1715	2.5	2.52	2.51	2.52	2.52	2.52	2.52	2.52	2.52	2.54	2.52	2.52	2.52	2.52
CEP1717	2.91	2.91	2.91	2.91	2.92	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91
CET1101	2.05	2.06	2.05	2.05	2.06	2.04	2.07	2.05	2.08	2.04	2.07	2.07	2.05	2.05

CET1102	2.02	2.03	2.02	2.01	1.99	2.02	2.02	2.02	1.99	2.02	2.02	2.02	2.02	2.02
CET1201	2.58	2.58	2.58	2.58	2.59	2.55	2.57	2.55	2.56	2.57	2.53	2.55	2.56	2.56
CET1202	2.62	2.62	2.62	2.62	2.62	2.62	2.63	2.62	2.62	2.62	2.62	2.62	2.62	2.62
CET1203	1.79	1.79	1.78	1.77	1.79	1.79	1.79	1.79	1.79	1.79	1.79	1.79	1.78	1.78
CET1301	2.06	2.06	2.05	2.03	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.04	2.03
CET1302	1.97	1.97	1.97	1.98	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97
CET1401	2.18	2.18	2.18	2.18	2.2	2.2	2.2	2.2	2.19	2.2	2.2	2.19	2.17	2.18
CET1402	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
CET1501	1.88	1.88	1.88	1.88	1.89	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.88
CET1502	2.07	2.06	2.05	2.08	2.04	2.07	2.08	2.05	2.07	2.05	2.06	2.05	2.06	2.06
CET1503	1.95	1.93	1.93	1.95	1.94	1.95	1.96	1.95	1.95	1.95	1.94	1.95	1.96	1.96
CET1504	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.52	2.54	2.54
CET1505	2.27	2.28	2.3	2.28	2.28	2.32	2.27	2.28	2.28	2.28	2.28	2.29	2.28	2.29
CET1515	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.51	2.52	2.52
CET1601	1.59	1.59	1.59	1.56	1.59	1.59	1.47	1.59	1.59	1.59	1.59	1.59	1.54	1.54
CET1604	2.87	2.86	2.86	2.85	2.85	2.82	2.83	2.82	2.84	2.83	2.82	2.82	2.84	2.84
CET1703	1.75	1.81	1.78	1.78	1.77	1.78	1.78	1.78	1.78	1.79	1.77	1.76	1.77	1.77
CET1716	2.95	2.95	2.95	2.95	2.95	2.95	2.96	2.95	2.95	2.95	2.95	2.95	2.94	2.94
CHP1132	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95
CHP1342	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78
CHT1131	2.69	2.67	2.7	2.7	2.7	2.68	2.68	2.67	2.66	2.67	2.68	2.68	2.68	2.67
CHT1211	2.71	2.71	2.71	2.71	2.71	2.71	2.71	2.71	2.71	2.71	2.71	2.71	2.71	2.71
CHT1231	2.4	2.42	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
CHT1343	2.47	2.47	2.47	2.46	2.46	2.48	2.48	2.48	2.46	2.47	2.47	2.48	2.47	2.48
CHT1403	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.54	2.5	2.52	2.52
GEP1101	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49
GEP1103	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76
GEP1108	2.68	2.68	2.68	2.67	2.68	2.68	2.68	2.68	2.7	2.68	2.71	2.69	2.68	2.68
GEP1110	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89
GEP1111	2.21	2.22	2.22	2.22	2.22	2.24	2.22	2.22	2.15	2.22	2.2	2.22	2.19	2.19
GEP1112	3	3	3	3	3	3	3	3	3	3	3	3	3	3
GET1102	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.67	2.66
GET1107	2.1	2.09	2.13	2.05	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.16	2.09	2.06
GET1109	2.79	2.78	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79
HUT1102	2.63	2.64	2.62	2.63	2.63	2.63	2.63	2.63	2.63	2.61	2.61	2.63	2.63	2.62
HUT1105	2.68	2.68	2.69	2.68	2.68	2.69	2.68	2.68	2.68	2.68	2.68	2.68	2.68	2.68
HUT1108	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.75	2.73	2.73	2.73	2.73	2.73
HUT1109	2.75	2.7	2.71	2.7	2.71	2.74	2.72	2.72	2.74	2.72	2.72	2.72	2.71	2.72
MAT1101	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
MAT1102	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75
MAT1106	2.31	2.33	2.33	2.33	2.33	2.43	2.33	2.3	2.26	2.43	2.21	2.43	2.26	2.43
OLT1120	2.76	2.77	2.77	2.78	2.78	2.8	2.79	2.8	2.79	2.79	2.8	2.8	2.78	2.78
PET1712	2.63	2.61	2.61	2.6	2.61	2.58	2.6	2.58	2.59	2.6	2.57	2.58	2.61	2.61
PHT1093	2.87	2.87	2.87	2.87	2.87	2.87	2.89	2.86	2.87	2.87	2.88	2.86	2.87	2.87
PHT1095	2.54	2.54	2.51	2.54	2.53	2.54	2.54	2.54	2.54	2.54	2.52	2.53	2.53	2.53
PHT1097	2.87	2.87	2.87	2.86	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87
PYP1102	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48
PYT1101	2.49	2.48	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49

PYT1103	2.62	2.63	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.64	2.63
Direct Average	**2.51**	**2.52**	**2.51**	**2.51**	**2.51**	**2.52**	**2.51**	**2.51**	**2.51**	**2.52**	**2.51**	**2.52**	**2.51**	**2.51**
Student Survey	2.48	2.33	2.37	2.32	2.24	2.24	2.33	2.33	2.3	2.31	2.24	2.32	2.28	2.3
Alumni Survey	2.58	2.61	2.58	2.58	2.37	2.55	2.58	2.64	2.58	2.49	2.61	2.7	2.52	2.04
Employer Survey	2.75	2.65	2.68	2.72	2.58	2.58	2.68	2.68	2.61	2.65	2.61	2.68	2.72	2.75
Indirect Average	**2.6**	**2.53**	**2.55**	**2.54**	**2.4**	**2.46**	**2.53**	**2.55**	**2.5**	**2.48**	**2.49**	**2.57**	**2.51**	**2.36**
Overall Attainment	**2.53**	**2.52**	**2.52**	**2.52**	**2.49**	**2.51**	**2.52**	**2.52**	**2.51**	**2.51**	**2.51**	**2.53**	**2.51**	**2.48**

Table 1.17: PO and PSO attainment (on a scale of 3) for each course in the academic year 2019-2020.

CourseCode	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
BST1102	2.59	2.6	2.58	2.59	2.6	2.6	2.63	2.61	2.58	2.61	2.61	2.59	2.6	2.59
CEP1701	2.31	2.33	2.33	2.34	2.34	2.33	2.35	2.33	2.33	2.35	2.33	2.33	2.34	2.33
CEP1702	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89
CEP1704	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96
CEP1705	1.75	1.75	1.78	1.73	1.79	1.75	1.75	1.75	1.72	1.75	1.75	1.75	1.78	1.78
CEP1706	2.05	2.05	2.05	2.05	2.05	2.05	2.01	2.05	2.05	2.07	2.05	2.05	2.07	2.07
CEP1715	2.59	2.59	2.58	2.59	2.59	2.59	2.59	2.58	2.59	2.58	2.59	2.59	2.58	2.59
CEP1717	2.96	2.96	2.96	2.96	2.97	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96
CET1101	1.93	1.94	1.93	1.93	1.93	1.93	1.94	1.93	1.93	1.93	1.94	1.93	1.93	1.93
CET1102	1.99	2	1.99	1.98	1.97	1.99	1.99	1.99	1.98	1.99	1.99	1.99	1.99	1.99
CET1201	2.72	2.71	2.71	2.69	2.69	2.66	2.67	2.66	2.68	2.67	2.66	2.66	2.68	2.68
CET1202	2.51	2.51	2.51	2.51	2.51	2.51	2.54	2.51	2.51	2.52	2.51	2.51	2.51	2.51
CET1203	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29
CET1301	2.07	2.07	2.07	2.06	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07
CET1302	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33
CET1401	2.49	2.49	2.49	2.49	2.5	2.51	2.5	2.51	2.5	2.5	2.51	2.5	2.48	2.49
CET1402	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94
CET1501	2.19	2.19	2.19	2.19	2.21	2.2	2.2	2.19	2.19	2.19	2.19	2.19	2.19	2.19
CET1502	2.14	2.13	2.12	2.14	2.11	2.14	2.14	2.13	2.14	2.13	2.12	2.12	2.13	2.13
CET1503	2.36	2.36	2.36	2.36	2.36	2.36	2.36	2.36	2.37	2.36	2.37	2.36	2.37	2.37
CET1504	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.62	2.63	2.63
CET1505	1.8	1.78	1.78	1.78	1.78	1.77	1.81	1.79	1.79	1.79	1.8	1.81	1.81	1.8
CET1509R	2.51	2.51	2.51	2.51	2.51	2.51	2.5	2.51	2.51	2.51	2.51	2.51	2.51	2.52
CET1509	2.48	2.48	2.47	2.47	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48
CET1511	2.08	2.08	2.07	2.07	2.08	2.1	2.08	2.08	2.1	2.1	2.08	2.09	2.06	2.07
CET1515	2.67	2.67	2.67	2.66	2.67	2.67	2.67	2.67	2.67	2.67	2.68	2.67	2.67	2.66
CET1601	2.39	2.39	2.39	2.38	2.39	2.39	2.36	2.39	2.39	2.39	2.39	2.39	2.38	2.38
CET1608	2.87	2.89	2.86	2.86	2.85	2.85	2.85	2.86	2.85	2.87	2.85	2.86	2.87	2.87
CET1703	1.84	1.87	1.86	1.86	1.85	1.86	1.86	1.86	1.86	1.86	1.85	1.85	1.85	1.85
CET1716	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97
CHP1132	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.74	2.75	2.75	2.75
CHP1342	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93
CHT1131	2.39	2.34	2.38	2.39	2.38	2.38	2.37	2.34	2.33	2.35	2.37	2.37	2.37	2.35
CHT1211	2.81	2.81	2.81	2.81	2.81	2.81	2.81	2.81	2.81	2.81	2.81	2.81	2.82	2.81
CHT1231	2.68	2.72	2.68	2.68	2.68	2.68	2.68	2.68	2.68	2.68	2.68	2.68	2.68	2.68

CHT1403	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.54	2.53	2.53	2.53
GEP1101	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78
GEP1103	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74
GEP1108	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93
GEP1110	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84
GEP1111	1.51	1.54	1.54	1.54	1.54	1.6	1.54	1.54	1.36	1.54	1.49	1.54	1.48	1.48
GEP1112	3	3	3	3	3	3	3	3	3	3	3	3	3	3
GET1102	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.38	2.38
GET1107	2.68	2.68	2.66	2.67	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.66	2.68	2.69
GET1109	1.96	1.97	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
GET1303	2.6	2.61	2.59	2.61	2.58	2.6	2.6	2.58	2.6	2.6	2.6	2.6	2.59	2.58
HUT1102	2.85	2.85	2.84	2.84	2.83	2.83	2.83	2.84	2.83	2.84	2.84	2.85	2.85	2.85
HUT1105	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83
HUT1108	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.85	2.86	2.86	2.86	2.86	2.86
HUT1109	2.42	2.64	2.63	2.64	2.71	2.52	2.59	2.59	2.45	2.59	2.59	2.57	2.69	2.59
MAT1101	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
MAT1103	2.55	2.55	2.55	2.55	2.55	2.54	2.55	2.55	2.55	2.55	2.55	2.56	2.55	2.55
MAT1106	2.45	2.44	2.44	2.44	2.44	2.35	2.44	2.44	2.51	2.35	2.56	2.37	2.48	2.34
PHT1095	2.53	2.53	2.51	2.52	2.52	2.53	2.53	2.53	2.53	2.53	2.52	2.53	2.52	2.52
PHT1097	2.49	2.49	2.46	2.44	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.48	2.48
PYP1102	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
PYT1101	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19
PYT1103	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.76	2.75
PYT1201	2.51	2.52	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.54	2.48
Direct Average	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**
Student Survey	2.43	2.37	2.3	2.29	2.22	2.23	2.37	2.37	2.32	2.28	2.24	2.36	2.33	2.37
Alumni Survey	2.61	2.52	2.52	2.43	2.01	2.37	2.52	2.61	2.52	2.49	2.46	2.43	2.31	2.34
Employer Survey	2.75	2.65	2.68	2.72	2.58	2.58	2.68	2.68	2.61	2.65	2.61	2.68	2.72	2.75
Indirect Average	**2.6**	**2.51**	**2.5**	**2.48**	**2.27**	**2.39**	**2.52**	**2.55**	**2.48**	**2.47**	**2.44**	**2.49**	**2.45**	**2.49**
Overall Attainment	**2.52**	**2.51**	**2.5**	**2.5**	**2.46**	**2.48**	**2.51**	**2.51**	**2.49**	**2.5**	**2.49**	**2.5**	**2.49**	**2.5**

Table B.1.6.2a & B.1.6.2b

Table 1.18: PO and PSO attainment (on a scale of 3) for each course in the academic year 2018-2019.

CourseCode	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
BST1102	2.63	2.63	2.62	2.63	2.64	2.64	2.65	2.64	2.63	2.64	2.64	2.63	2.63	2.63
CEP1701	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87
CEP1702	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91
CEP1704	2.99	2.99	2.98	2.98	2.98	2.98	2.98	2.98	2.98	2.98	2.98	2.98	2.98	2.98
CEP1705	2.41	2.41	2.42	2.4	2.43	2.41	2.41	2.41	2.4	2.41	2.41	2.41	2.42	2.42
CEP1706	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86
CEP1715	2.67	2.68	2.68	2.68	2.68	2.68	2.68	2.69	2.68	2.69	2.68	2.68	2.69	2.68
CEP1717	2.81	2.81	2.81	2.81	2.79	2.81	2.81	2.81	2.84	2.84	2.84	2.81	2.81	2.81
CET1101	2.21	2.2	2.22	2.21	2.21	2.23	2.18	2.21	2.19	2.23	2.18	2.19	2.21	2.21
CET1102	2.22	2.22	2.22	2.22	2.21	2.22	2.22	2.22	2.21	2.22	2.22	2.22	2.22	2.22
CET1201	2.17	2.18	2.18	2.2	2.17	2.23	2.22	2.23	2.21	2.22	2.26	2.23	2.21	2.21
CET1202	2.68	2.68	2.68	2.68	2.68	2.68	2.67	2.68	2.68	2.67	2.68	2.68	2.68	2.68

CET1203	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22
CET1301	2.31	2.31	2.3	2.29	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.3	2.3
CET1302	2.2	2.2	2.19	2.21	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.19	2.2
CET1401	2.56	2.56	2.56	2.56	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.56	2.56	2.56
CET1402	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53
CET1501	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02
CET1502	2.16	2.17	2.17	2.17	2.16	2.17	2.17	2.15	2.17	2.16	2.17	2.17	2.17	2.17
CET1503	2.41	2.39	2.4	2.41	2.4	2.41	2.43	2.41	2.39	2.41	2.37	2.41	2.41	2.41
CET1504	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.56	2.55	2.55
CET1505	2.8	2.8	2.8	2.8	2.8	2.78	2.81	2.79	2.79	2.79	2.8	2.8	2.79	2.8
CET1509	2.72	2.71	2.71	2.71	2.71	2.71	2.72	2.71	2.71	2.71	2.72	2.71	2.71	2.71
CET1510	2.63	2.63	2.62	2.63	2.62	2.62	2.64	2.62	2.62	2.58	2.59	2.62	2.63	2.63
CET1511	1.89	1.89	1.91	1.9	1.9	1.9	1.89	1.89	1.9	1.9	1.89	1.9	1.89	1.89
CET1515	2.63	2.63	2.63	2.62	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.62	2.63	2.63
CET1601	1.64	1.64	1.64	1.61	1.64	1.64	1.51	1.64	1.64	1.64	1.65	1.64	1.6	1.6
CET1603	2.52	2.54	2.52	2.51	2.5	2.52	2.52	2.52	2.51	2.52	2.52	2.52	2.5	2.5
CET1604	2.53	2.54	2.54	2.55	2.55	2.58	2.56	2.58	2.56	2.56	2.58	2.58	2.56	2.56
CET1608	2.56	2.57	2.55	2.55	2.54	2.54	2.54	2.55	2.54	2.56	2.54	2.55	2.56	2.56
CET1703	1.88	1.92	1.9	1.9	1.89	1.9	1.9	1.9	1.9	1.91	1.89	1.89	1.9	1.9
CET1716	2.75	2.75	2.75	2.75	2.75	2.75	2.76	2.75	2.75	2.75	2.75	2.75	2.75	2.75
CHP1132	2.4	2.41	2.4	2.41	2.4	2.42	2.42	2.4	2.41	2.41	2.43	2.4	2.41	2.41
CHP1342	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
CHT1131	2.16	2.13	2.17	2.18	2.17	2.15	2.15	2.13	2.12	2.14	2.15	2.15	2.15	2.14
CHT1211	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.46	2.47	2.47
CHT1231	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06
GEP1101	2.57	2.57	2.57	2.57	2.57	2.56	2.56	2.56	2.56	2.56	2.57	2.57	2.56	2.56
GEP1103	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86
GEP1108	2.73	2.73	2.73	2.72	2.73	2.73	2.73	2.73	2.74	2.73	2.75	2.73	2.73	2.73
GEP1110	2.87	2.85	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87	2.87
GEP1111	2.23	2.23	2.23	2.23	2.23	2.25	2.23	2.23	2.19	2.23	2.22	2.23	2.22	2.22
GEP1112	3	3	3	2.99	2.99	3	3	3	2.99	3	3	3	3	3
GET1102	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.41	2.4
GET1107	2.45	2.45	2.46	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.46	2.45	2.45
GET1109	2.3	2.29	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
GET1303	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.69
HUT1102	2.66	2.66	2.66	2.66	2.66	2.66	2.66	2.66	2.66	2.66	2.66	2.66	2.66	2.66
HUT1105	2.66	2.66	2.66	2.66	2.66	2.66	2.66	2.66	2.66	2.66	2.66	2.66	2.66	2.66
HUT1108	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.39	2.38	2.38	2.38	2.38	2.38
HUT1109	2.92	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.92	2.93	2.93	2.93	2.93	2.93
MAT1101	2.51	2.51	2.51	2.51	2.51	2.51	2.51	2.5	2.51	2.51	2.51	2.51	2.51	2.51
MAT1103	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.62	2.63
MAT1106	2.66	2.67	2.67	2.67	2.67	2.69	2.67	2.66	2.65	2.69	2.64	2.69	2.65	2.69
PHT1095	2.39	2.39	2.35	2.38	2.37	2.39	2.39	2.39	2.39	2.39	2.37	2.38	2.38	2.38
PYP1102	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
PYT1101	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18
PYT1103	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58
PYT1201	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.59	2.57

TXT1501	2.54	2.54	2.54	2.55	2.54	2.54	2.55	2.54	2.54	2.54	2.54	2.53	2.54	2.54
Direct Average	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.51**	**2.5**	**2.5**	**2.5**	**2.51**	**2.51**	**2.51**	**2.5**	**2.5**
Student Survey	2.59	2.57	2.48	2.48	2.14	2.36	2.4	2.36	2.36	2.36	2.42	2.55	2.59	2.63
Alumni Survey	2.57	2.4	2.57	2.06	2.06	2.23	2.4	2.06	2.49	2.31	2.23	2.49	2.06	2.06
Employer Survey	2.75	2.65	2.68	2.72	2.58	2.58	2.68	2.68	2.61	2.65	2.61	2.68	2.72	2.75
Indirect Average	**2.64**	**2.54**	**2.58**	**2.42**	**2.26**	**2.39**	**2.49**	**2.37**	**2.49**	**2.44**	**2.42**	**2.57**	**2.45**	**2.48**
Overall Attainment	**2.53**	**2.51**	**2.52**	**2.49**	**2.45**	**2.48**	**2.5**	**2.48**	**2.5**	**2.49**	**2.49**	**2.52**	**2.49**	**2.5**

Table B.1.6.2a & B.1.6.2b

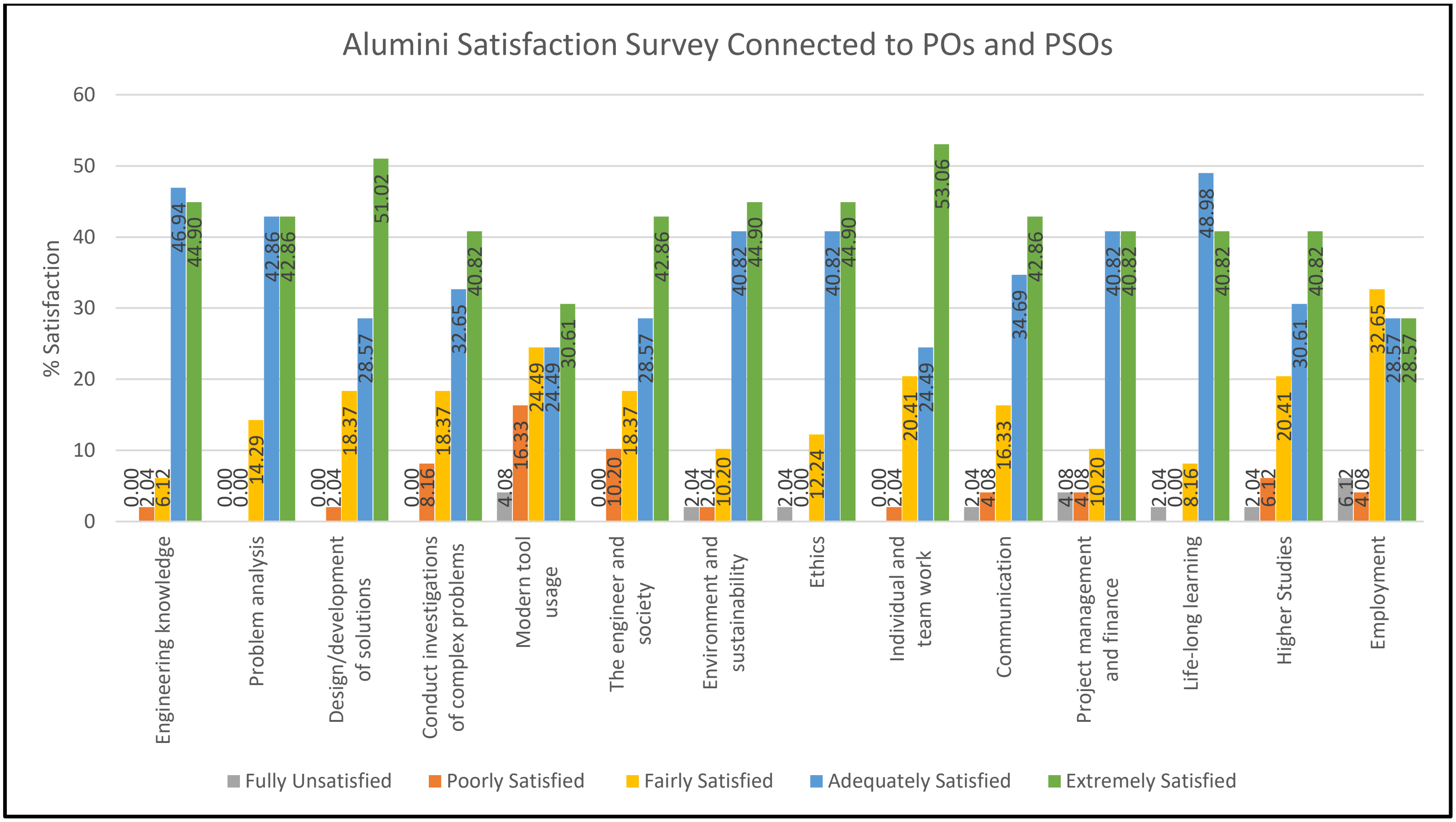


Figure 1.8: Alumni Satisfaction Survey Connected to POs and PSOs

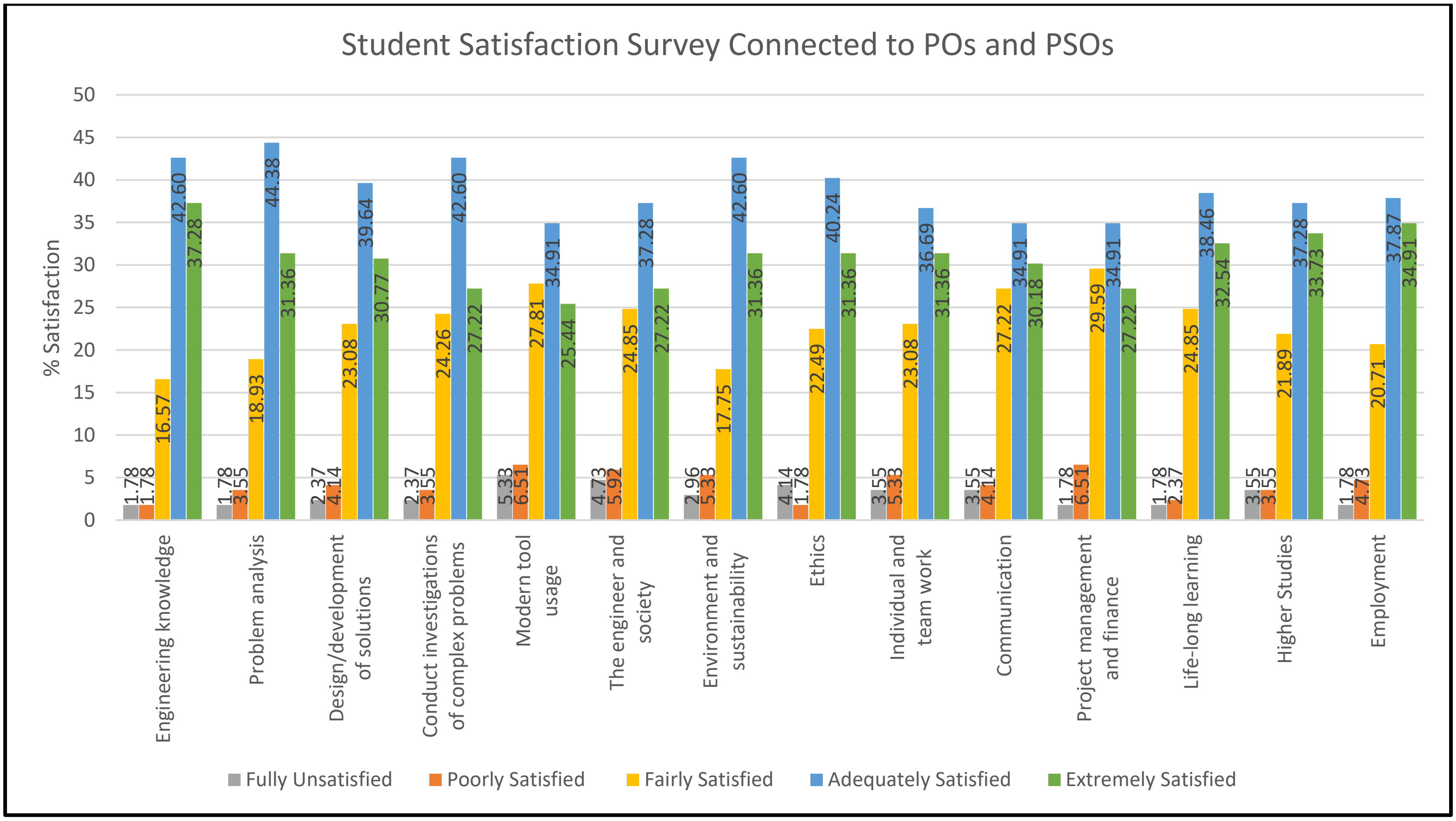


Figure 1.9: Student Satisfaction Survey Connected to POs and PSOs

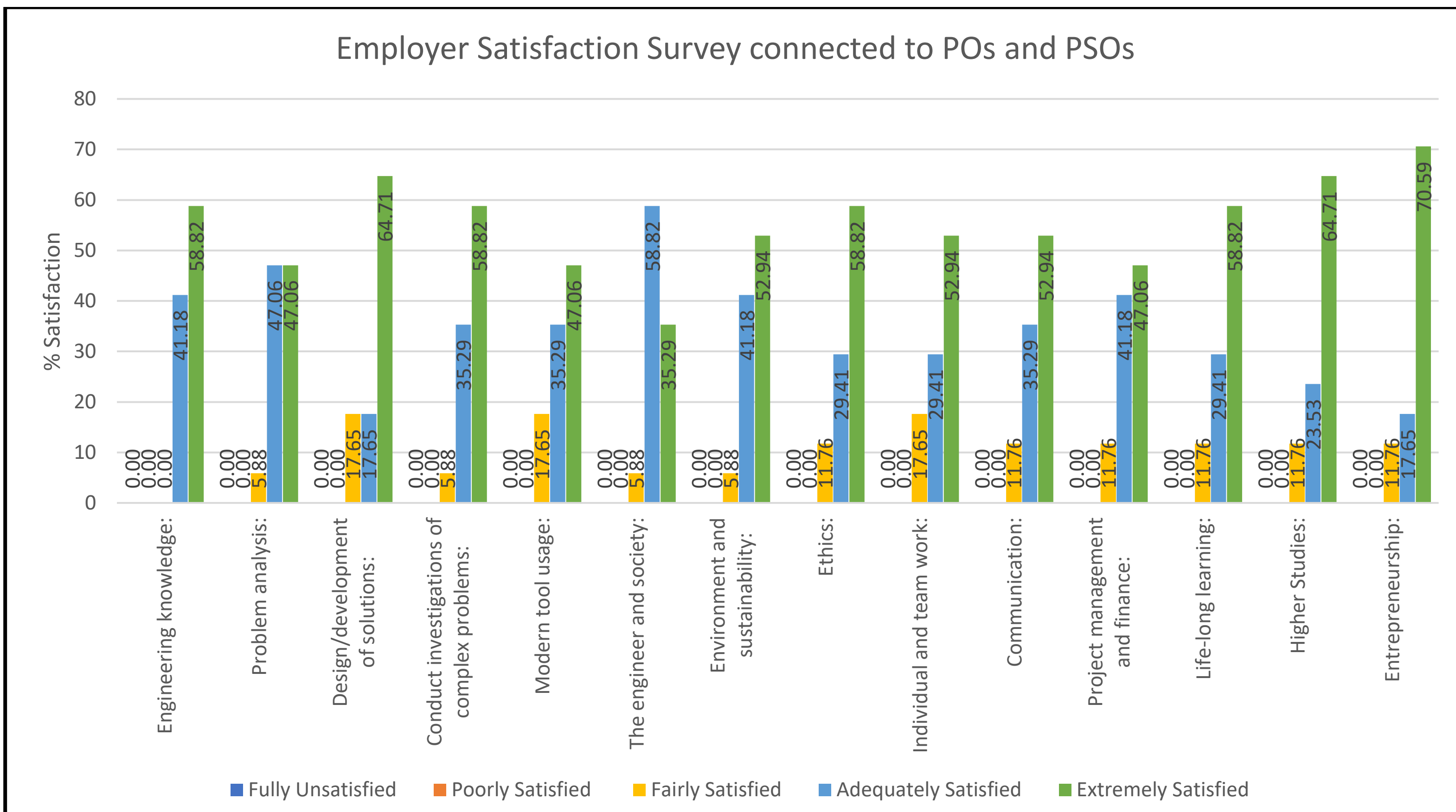


Figure 1.10: Employer Satisfaction Survey Connected to POs and PSOs

Figure 1.11: Yearwise PO and PSO attainment levels

1.7. Evidence of solving complex engineering Problems (25) (Institute Marks 25)

The students are assessed through mini projects (Seminar), major projects (Home Paper), independent studies (Laboratory), and industrial exposure (In-plant Training) throughout the course duration which involves solving complex engineering problems.

Table 1.19: List of laboratory experiments: S. Y. B. Chem. Engg. Sem IV

No	Name of the experiment	Subject
1	Flow through Rough & Smooth pipes, Static mixers	Momentum Transfer
2	Flow of Non-Newtonian Fluid through Pipes	Momentum Transfer
3	Characteristics of Flow through Coil	Momentum Transfer
4	Orifice and Venturi Meter	Momentum Transfer
5	Pressure Drop across Pipe Fittings	Momentum Transfer
6	Liquid Solid Fluidization	Momentum Transfer
7	Two-Phase Flow in Pipes	Momentum Transfer
8	Sedimentation Characteristics	Momentum Transfer
9	Batch Sedimentation	Momentum Transfer
10	Capillary Viscometer	Momentum Transfer
11	Flow Characteristics of Control Valves	Momentum Transfer
12	Characteristics of a Centrifugal Pump	Momentum Transfer
13	Diffusivity of Benzoic Acid	Mass Transfer
14	Diffusivity of Acetone in Air	Mass Transfer
15	Ion exchange Isotherm	Thermodynamics
16	Thermodynamic properties of liquid mixtures	Thermodynamics
17	Estimation of Mass Transfer Coefficient Camphor balls	Chem Engg Operations
18	Differential Distillation of Acetic acid water	Chem Engg Operations
19	Steam Distillation	Chem Engg Operations
20	Distillation of toluene-xylene in Packed & Plate column	Chem Engg Operations
21	Spinning Band Distillation Column Acetic acid water	Chem Engg Operations
22	Filtration Characteristics of Sparkler Filter and ANF	Chem Engg Operations
23	Hydrodynamics of Gas – Liquid Packed Columns	Chem Engg Operations

Table 1.20: List of laboratory experiments: T. Y. B. Chem. Engg. SEM V

No	Name of the experiment	Subject
1	Characterization of Gas-Solid Fluidization	Momentum Transfer
2	Double Pipe Heat Exchanger and Gas fired hot water generator	Heat Transfer
3	Shell and tube heat exchanger	Heat Transfer
4	Plate Heat Exchanger	Heat Transfer
5	Unsteady state heat transfer	Heat Transfer
6	Heat transfer by Natural Circulation (thermosiphon)	Heat Transfer
7	Fin Efficiency	Heat Transfer
8	Finned tube heat exchanger	Heat Transfer
9	Heat transfer by natural convection	Heat Transfer
10	Kinetics of PFR and CSTR	Chemical Rection Engineering
11	Dye degradation by Photocatalysis	Chemical Rection Engineering
12	Kinetics of Condensation Polymerization	Chemical Rection Engineering
13	Vapor Liquid Equilibrium	Thermodynamics
14	LLE: AcOH-Water-Xylene or cyclohexane, tie lines	Thermodynamics
15	L-L Mutual solubility and upper consolute temperature	Thermodynamics
16	Kinetics of Drug Dissolution	Chem Engg Operations
17	Mass Transfer in Packed Column	Chem Engg Operations
18	Vacuum drying	Chem Engg Operations
19	Ion-Exchange breakthrough and Isotherm	Chem Engg Operations
20	Liquid holdup and axial dispersion in packed column	Chem Engg Operations
21	Hydrodynamics and Mass transfer Spray Extraction	Chem Engg Operations
22	Hydrodynamics of Packed Extraction Column	Chem Engg Operations
23	Analysis of Cooling tower (small / big)	Chem Engg Operations

Table 1.21: List of laboratory experiments: T. Y. B. Chem. Engg. Sem VI

No	Name of the experiment	Subject
1	Kinetics of dehydration of tert-Butanol	Chemical Rection Engineering
2	Kinetics of Phenol degradation	Chemical Rection Engineering
3	Residence time distribution in PFR & CSTR	Chemical Rection Engineering
4	Chiller characterization	Thermodynamics
5	Solid suspension in MAC use different impellers	Multiphase Reactors
6	Gas liquid dispersion in MAC use different of impellers	Multiphase Reactors
7	Mixing time in MAC in presence & absence of gas	Multiphase Reactors
8	Hydrodynamics of bubble column (water, CMC, NaCl)	Multiphase Reactors
9	Mixing time bubble column & sectionalized bubble column	Multiphase Reactors
10	Jet Loop Ejector	Multiphase Reactors
11	Hydrodynamics of Gas induced impeller	Multiphase Reactors
12	Reactive Gas absorption in packed column	Multiphase Reactions
13	Reactive Gas absorption in MAC	Multiphase Reactions
14	Reactive Gas absorption in bubble Column	Multiphase Reactions
15	Copper disc dissolution	Multiphase Reactions
16	Solid dissolution with instantaneous reaction	Multiphase Reactions
17	Dynamics of first order systems (tank, Thermometer)	Dynamics and Control
18	Linearization of dynamics of tapering tank	Dynamics and Control
19	Dynamics of Interacting tanks	Dynamics and Control
20	Dynamics of non-interacting	Dynamics and Control
21	Dynamics of overdamped and underdamped systems	Dynamics and Control
22	Yokogawa Process Control Module 1 Level and Flow	Dynamics and Control
23	Yokogawa Process Control Module 2 Temperature and Pressure	Dynamics and Control

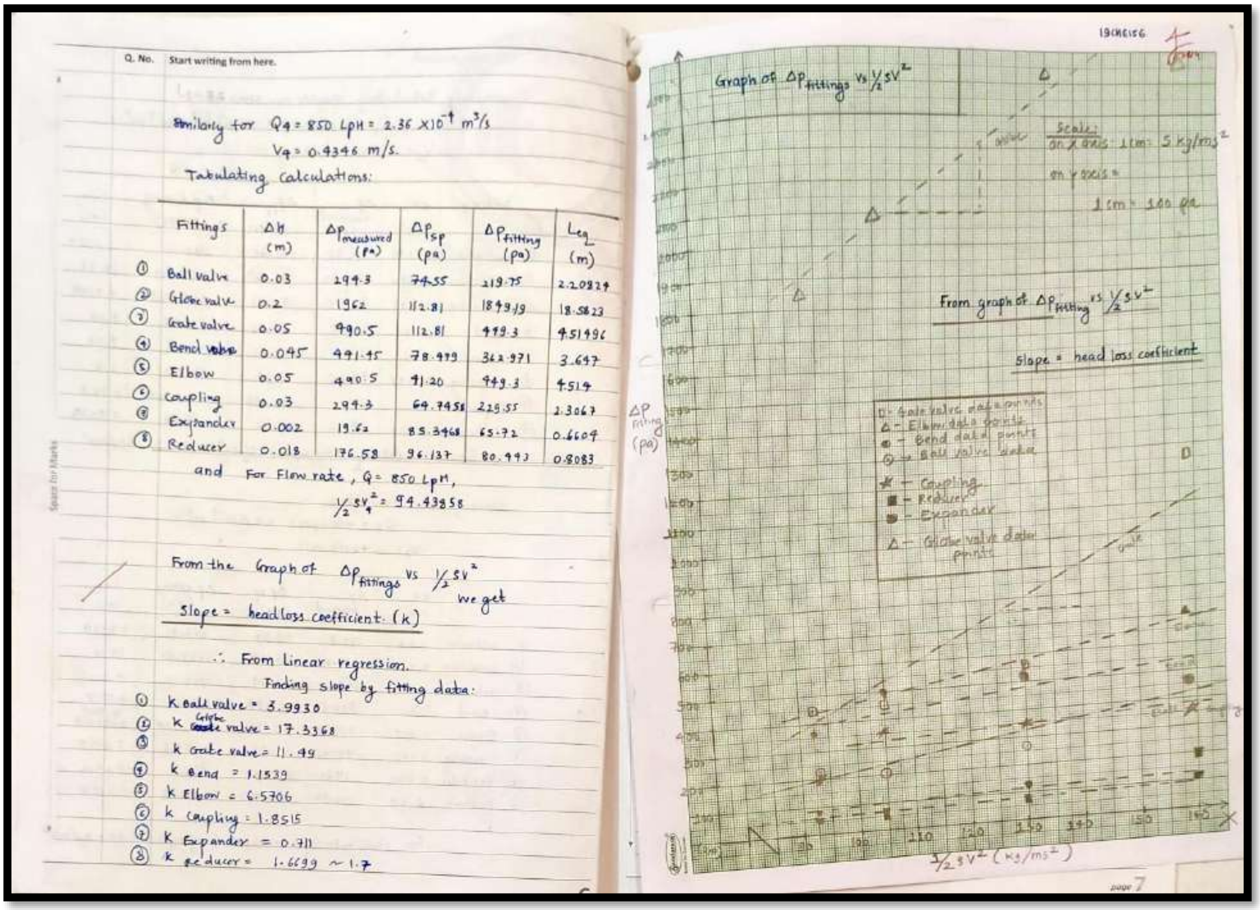


Figure 1.12: Evidence of solving complex problems - Laboratory examination answerbook sample

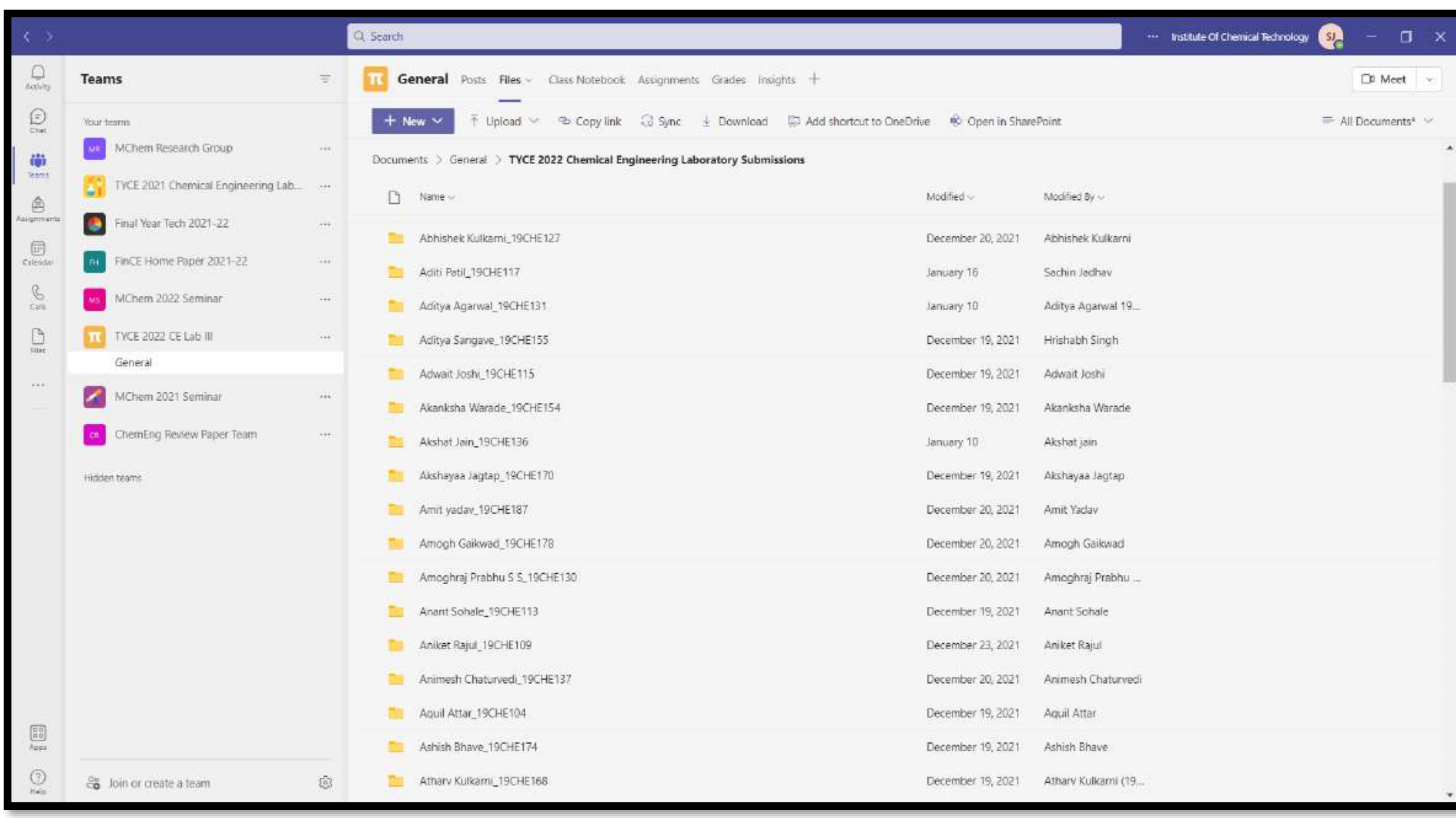


Figure 1.13a: Sample chemical engineering laboratory journal submission (Online I)

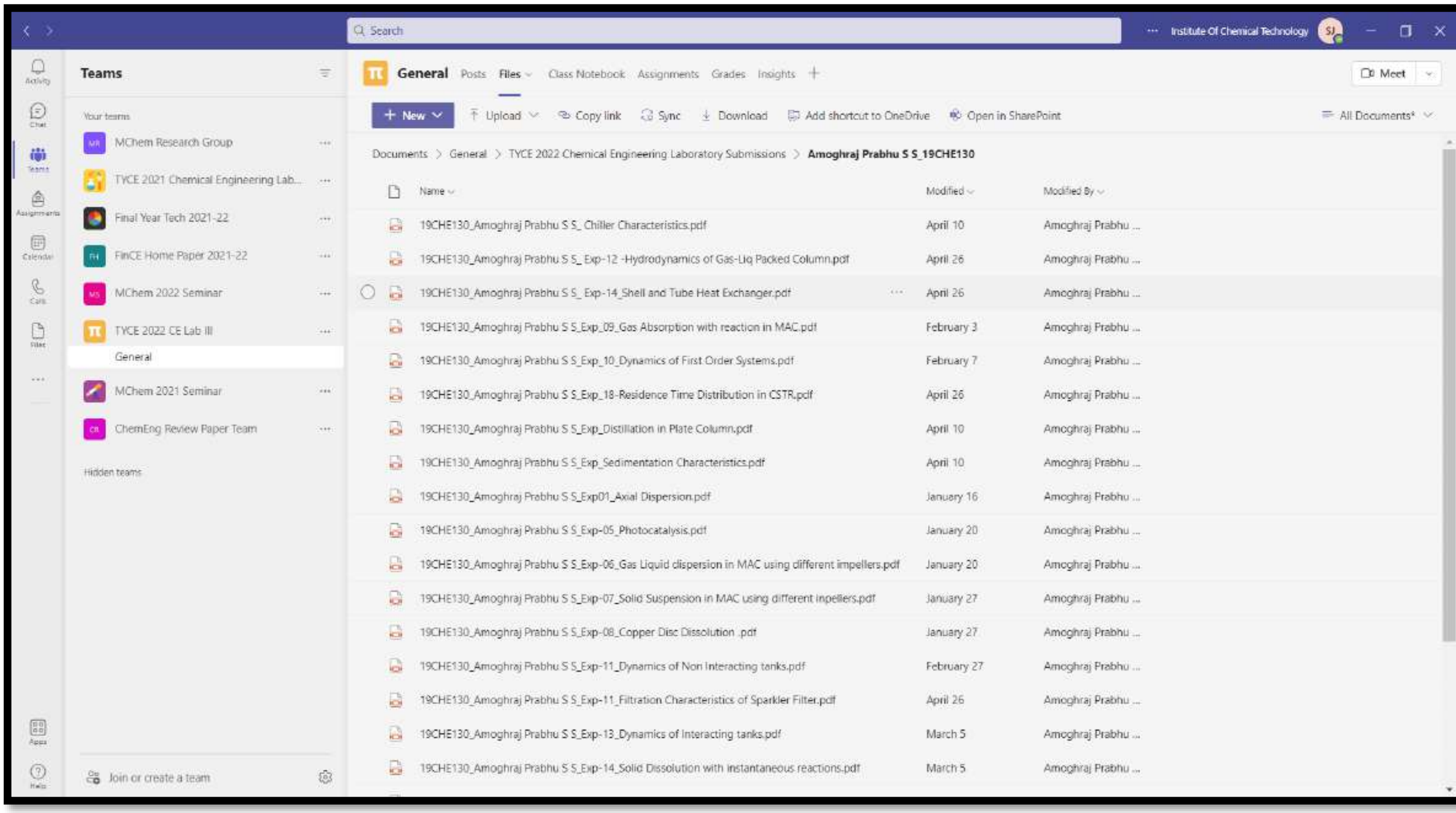


Figure 1.13b: Sample chemical engineering laboratory journal submission (Online II)

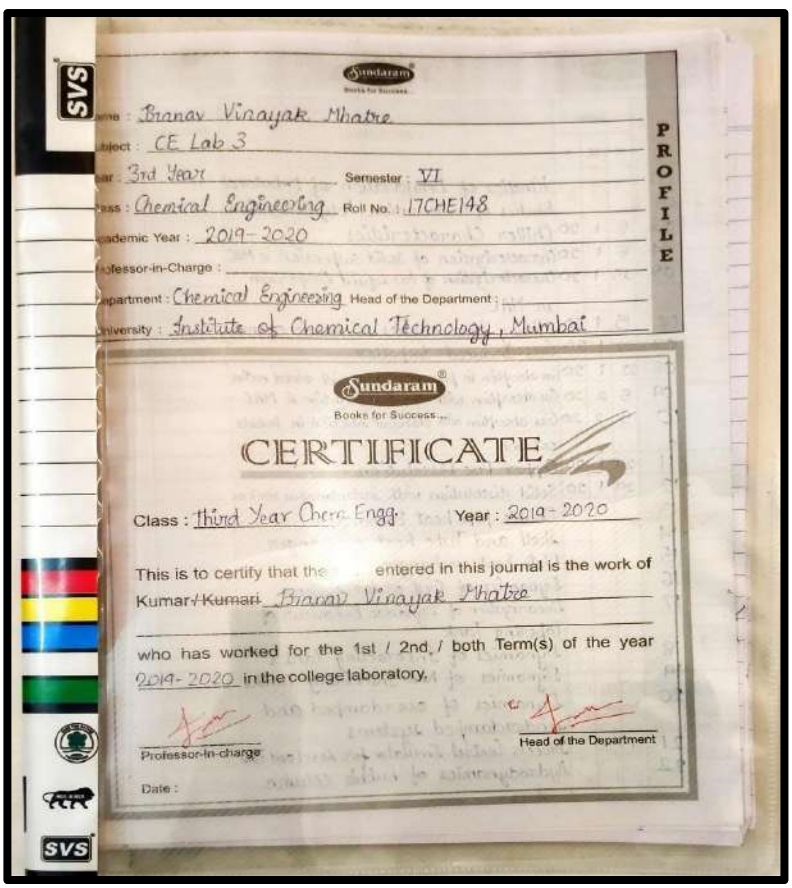


Figure 1.14: Sample chemical engineering laboratory journal submission front page (Physical)

Table 1.22: List of B. Chem. Engg. Home Paper (Major Projects) 2019-20

Roll No.	Student Name	Topic
16CHE107	Akash Sanjay Nogaja	Design a plant to manufacture 10 TPD of Isopropyl Acetate
16CHE142	Naman Anil Joshi	Design a plant to manufacture 5 TPD Lanolin Alcohol
16CHE150	Raunak Shiocharan Balkote	Design a plant for solar Electricity Based H_2 generation through water electrolysis
14CHE1062	Rohan Rajesh Parlikar	Design a plant to manufacture 10TPD of Mango Butter
16CHE164	Shriram Rajendra Chavan	Design a plant to manufacture 10 TPD of Refused derived Fuel(RDF)
16CHE105	Aditi Anil Sawant	Design a plant to manufacture 10 TPD of L-menthol
16CHE125	Chinmay Vidyadhar Mhatre	Design a plant for separation and purification of methane and carbon dioxide from 100,000 m^3/ day biogas obtained from anaerobic digestion.
16CHE126	Darshana Uttam Malusare	Design a plant to manufactre 100 TPD of acrylic acid
16CHE128	Dishit Pankaj Ghumra	Design a plant for gasification of 100 TPD of used & waste oils and hydrogen production
16CHE168	Siddhesh Dilip Sarda	Design a plant to manufacture 20 TPD of alpha pinene
16CHE134	Kalash Rajendra Pai	Design a plant to manufacture lubricants from epoxidised vegetable oil.
16CHE141	Monik Sanjay Magiya	Design a plant to manufacture methylene diphenyl isocyanate.
16CHE151	Razeen Ramzan Shaikh	Design a plant to manufacture iron gluconate.
16CHE166	Shubham Gangaram Ravan	Design a plant to manufacture L-ascorbic acid.
16CHE111	Amol Bharat Khatke	Design a plant to manufacture 5 TPD trimellitic anhydride
16CHE120	Asmee Maruti Prabhu	Design a plant to manufacture 500 TPA of Carbon Fiber
16CHE124	Kaustubh Chaitanya Rane	Design a plant to recover Uranium from 100 TPD phosphoric acid plant
16CHE145	Ninad Chandrakant Khelukar	Design a plant to manufacture 50000 tpa polylactic acid
16CHE149	Pujit Sunil Juneja	Design a plant to Manufacture 10 TPD of tetrabutyl ammonium hydroxide
16CHE113	Aniket Jayendra Murumkar	Design a plant to produce 5 TPA of 3,4-ethylenedioxy aniline
16CHE118	Ashin Antony Sunny	Design a plant to produce 100000 MTPA of phenol
16CHE131	Gaurav Vasudevan Mampally	Design a plant to produce 100 TPA of crotamiton

16CHE140	Mihir Mahendra Kulkarni	Design a plant to produce 5000 MTPA of aluminium fluoride
16CHE157	Sai Mukund Nazare	Design a plant to produce 100 MTPA of ortho nitrotoluene
16CHE115	Anirudh Venkatesh - -	Design a plant for the manufacture of 10,000 TPA 4-methoxy propiophenone using a green method
16CHE116	Ankit Sanjay Gaikwad	Design a plant for 50,000 TPA of m-phenylene diamine
16CHE154	Saaksshi Chandrashekhar Tenpe	Design a plant for 25,000 TPA of m-phenoxy benzyl alcohol.
16CHE179	Vidit Vivek Shah	Design a plant for the manufacture of 5,000 TPA diphenyl carbonate
16CHE106	Aditya Dilip Phad	Design a plant to manufacture potassium dichromate
16CHE133	Harshada Gangaram Gabhale	Design a plant to manufacture saccharin
16CHE135	Kaushal Sanjayrao Kaloo	Design a plant to manufacture salicylic acid
16CHE153	Saagar Shaival Gandhi	Design a plant to manufacture poly vinyl chloride
16CHE165	Shubham Ashokrao Shinde	Design a plant to manufacture hydrogen peroxide
16CHE110	Amogh Sandip Nagarkar	Design a plant to manufacture p-methoxy acetophenone.
16CHE117	Anu Sanjay Deshmukh	Design a plant to manuactre p-methyl acetophenone
16CHE161	Shivani Uday Kulkarni	Design a plant to manufacture Benzophenone
16CHE104	Abhinav Vivek Handu	Design a plant to manufacture 1000 TPA of Polyoxymethylene dimethyl ethers
16CHE108	Akshay Suhas Patil	Design a plant to manufacture 100 TPA of (Z)-5- (4-hydroxybenzylidene)thiazolidine-2,4-dione
16CHE147	Ojaswi Sandeep Rathi	Design a plant to manufacture 1000 TPA of n- butyl acrylate
16CHE159	Shalaka Sunil Dhande	Design a plant to manufacture 1000 TPA of 1,1- Diethoxybutane
16CHE163	Shreekant Sudheer Gokhale	Design a plant to manufacture 2,6-naphthalenedicarboxylic acid (1000 tpa)
16CHE119	Ashish Shyam Tangade	Design a plant to manufacture 10 TPD iodized salt

16CHE127	Dhiraj Manoj Jain	Design a plant to manufacture 10 TPD Fe + I Double Fortified Salt
16CHE146	Nishant Narendra Pardeshi	Design a plant to manufacture 10 TPD bioethanol from mixed feed of lignocellulosic biomass
16CHE160	Shital Vikas Suryavanshi	Design a plant to manufacture Spray/Freeze-dried re-dispersible powder from 1 TPD sugarcane juice
16CHE171	Surabh Santhosh K t	Design a plant to manufacture 10 TPD sodium chlorite, an important water treatment chemical
16CHE130	Eashaan Girish Godbole	Design a plant to produce alachlor at a capacity suitable for Indian context
16CHE139	Malhar Satish Mankar	Design a plant to produce Isoborneol at a capacity suitable for Indian context
16CHE143	Namita Nitin Jadhav	Design a plant to produce methyl tert-butyl phenol at a capacity suitable for Indian context
16CHE148	Prathamesh Milind Bolaj	Design a plant to produce 1-3 Cyclohexanedione at a capacity suitable for Indian context
16CHE162	Shivani Krishna kumar Bisen	Design a plant to produce p-toluene sulfonic acid at a capacity suitable for Indian context
16CHE101	Aadesh Satish Bhakkad	Design a plant to manufacture lauryl glycine at a suitable scale
16CHE121	Avinash Suresh Nayak	Design a plant to manufacture coco fatty acid chloride at a suitable scale.
16CHE152	Rounak Vinod Naryani	Design a plant to manufacture hydroxylamine solution at a suitable scale.
16CHE167	Shubham Pradip Adarkar	Design a plant to manufacture benzyl chloride at a suitable scale.
16CHE181	Vishal kumar -- Binay	Design a plant to manufacture 2,6-dichloro phenol at a suitable scale.
16CHE122	Bharthi -- Ponrathnam	Design a plant to manufacturing of methyl bromide
16CHE123	Bosco Johny --	Design a plant to manufacturing of xanthan gum
16CHE177	Vartul Jain	Design a plant to Manufacture of Chloropicrin
16CHE182	Yash Manoj Budhe	Design a plant to Manufacture of para nitrophenol
16CHE114	Aniket Sonba Pote	Design a plant to manufacture 50 TPD of dihydrofuran
16CHE136	Keith Anthony Dsouza	Design of a Plant to manufacture 50 TPD of 7- ethyl tryptophol
16CHE144	Nayantara Rajendra Pradhan	Design of a plant to manufacture 2,3-butanediol by biotechnological route
16CHE155	Sahil Vasantrao Ghormare	Design a plant to manufacture 100 TPD of furan dicarbolylic acid from sugar (5% solution)
16CHE170	Sreejith Thampan Nair	Design a plant to manufacture 1 TPD of cyclophosphamide

16CHE102	Aagamkumar Kirtikumar Khandor	Design a plant to manufacture 10 TPD of polycarboxy ether for use as concrete viscosity modifier
16CHE129	Dnyanesh Deepak Sarawate	Design a plant to manufacture 10 TPDof Isoindoline pigment
16CHE132	Gautami Rajendra Kelkar	Design a plant to manufacture 25 TPD of 2 phenylethanol
16CHE156	Sahil Surendra Khatavkar	Design a plant to dry 50 TPD of grapes to make raisins using solar concentrator
16CHE175	Suyog Girish Shaha	Design a plant to generate compressed biogas suitable for transportation purposes from 100 tons per day of agricultural waste
16CHE109	Amitej Nageswara Neti	Design a plant to manufacture 10 TPD Camphorsulfonic acid
16CHE112	Amrut Deepak Bagdi	Design a plant to manufacture 10 TPD of Metformin HCL
16CHE169	Snehal Sanjay Patil	Design a plant to produce 1 CMD of Jamun seed extract concentrate
16CHE176	Vaishnavi Girish Honavar	Design a plant to manufacture 1 TPD of Boreneol

Table 1.23: List of B. Chem. Engg. Home Paper (Major Projects) 2020-2021

Roll No	Student Name	Topics
17CHE105	Abhishek - Bhardwaj	Design a Plant to manufacture 10 to 50TPD of Choline Chloride
17CHE113	Anosh Mehernosh Dumasia	Design a plant for 5 TPD of Sodium Meta – bisulphite.
17CHE123	Chirag Mandar Mule	Design a plant to manufacture 50 TPD of Lithium Hydroxide.
17CHE124	Chirag Sanjay Jain	Design a plant to manufacture 2 TPD of Lithium Silicate.
17CHE148	Pranav Vinayak Mhatre	Design a plant to manufacture 10 TPD of Ammonium Citrate.
17CHE125	Dev Pramod Malu	Design a plant to manufacture of L- alpha-glyceryl phosphoryl choline.
17CHE139	Mayur Surendra Pimpalkar	Design a plant to manufacture Juglone.
17CHE180	Riddhesh Nitin Kumtakar	Design a plant to manufacture Carbomer 940 (polyacrylic acid).
17CHE169	Sukhada Sanjeev Gharat	Design a plant to manufacture Lawsone.
16CHE174	Sushmita Shekhar Khole	Design a plant to manufacture Propofol.
17CHE118	Atharva Vijay Suryavanshi	Design a plant to manufacture 1 TPD TODGA
17CHE136	Madhur Ramesh Khadke	Design a plant to manufacture 10000 TPA beta picoline
17CHE163	Shruti Unnikannan	Design a plant to manufacture 5 TPD TOPO
17CHE166	Siddhant Sanjay Mehta	Design a plant to generate 10 Nm^3/hr Hydrogen from LOHC: di benzyl toluene

17CHE172	Tushar Pyarelal Chaudhari	Design a plant to recover 1 TPD bromine form sea water
17CHE134	Kunal Pralhad Magare	Design a plant to manufacture 500 TPA of n-nonyl phenol ethoxylate
17CHE157	Salil Sandeep Narvekar	Design a plant to manufacture 5000 TPA of benzene using toluene
17CHE160	Saurabh Sukhadeo Bagal	Design a plant manufacture 200 TPA of Diclofenac Sodium
17CHE164	Shubham Gangaram Wanje	Design a plant to manufacture 5000 TPA of 4-anisaldehyde
17CHE178	Siddharth Gautam Vaishnav	Design a plant to manufacture 1000 TPA of bromobenzene
17CHE112	Ankit Balkrishna Kolpe	Design a plant to manufacture 5 TPD of Stearyl amine using a greener and safer process
17CHE131	Jay Dinesh Sankhe	Design a plant to manufacture 15 TPD of diphenyl amine using a catalytic process
16CHE137	Kovi Rishya Shrung	Design a plant to manufacture 25 TPD of 4-tert-butylcatechol
17CHE154	Rajarshi - Samajdar	Design a plant to manufacture 10 TPD of styrene carbonate using a green process
17CHE168	Sriram Pramod Tendulkar	Design a plant to manufacture 5 TPD of caffeine
17CHE106	Aditya Hemant Jain	Design a plant to manufacture liquid oxygen.
17CHE110	Amitkumar Harigovind Chauhan	Design a plant to manufacture di iso Nonylpthalate (DINP)
17CHE130	Hritik Rakesh Jain	Design a plant to manufacture calcium stearate.
17CHE170	Sumant Yogesh Salphale	Design a plant to manufacture methyl tert butyl ether (MTBE)
17CHE173	Uma Gopinath Kulkarni	Design a plant to manufacture epoxy resin
17CHE104	Abhishek Kundu	Design a Plant to Manufacture 2- Chloropyridine
17CHE116	Ashlesha Girish Tiple	Design a plant to Manufacture Favipiravir
17CHE153	R Ramya Ragunathan	Design a plant to Manufacture Remdesivir
17CHE179	Samiksha Jugalkishore Asawa	Design a Plant to manufacture tributyl amine
17CHE126	Gautam Manoj Borkar	Design a plant to manufacture 1 TPD of Coumarin.
17CHE101	Junaid Gul Naikoo	Design a plant to manufacture 5 TPD of Benzyl salicylate.
17CHE133	Kshitija Dipak Waikar	Design a plant to manufacture 2 TPD of Metanilic acid.
17CHE138	Makarand Ravindra Jagtap	Design a plant to manufacture 2 TPD of Cyclamen aldehyde.
17CHE174	Vedant Kiran Wankhede	Design a plant to manufacture 3 TPD of Styrallyl acetate.
17CHE129	Hrishikesh Girish Mane	Design a plant for the production of methane from carbon dioxide
17CHE132	Joel Biju	Design a plant to manufacture taurine
17CHE142	Neha Rajendra Gadekar	Design a plant to manufacture light olefins from crop residue
17CHE144	Nirmit Shantilal Solanki	Design a plant to manufacture Camphorane
17CHE171	Tanmay Nagesh Salvi	Design a plant to manufacture L- Arabitol
17CHE140	Merul Ritesh Shah	Design of brine preparation unit for 2000 TPD soda ash manufacture using seawater as water source.

17CHE182	Sarvesh Subhash Pandey	Design of dilute molasses preparation unit for 1000 TPD ethanol production using spent wash as water source.
17CHE161	Shantanu Sanjay Shembade	Design of 1 MLD heavy brine preparation unit (for offshore oil drilling) using seawater as water source.
17CHE167	Siddhi Santosh Kotnis	Design of 15 m3 reject water (generated from brackish water RO plants) Dewatering unit with co-production of dissolved fertilizer for fertigation.
17CHE165	Srushti Sanjeev Kumar Sindagi	Design of 1 MW solar PV unit integrated with pre-heating assembly for solar thermal energy storage
17CHE119	Burhanuddin Husain	Design a plant to manufacture camphor at a capacity suitable for Indian context
17CHE128	Himanshu Prashant Sail	Design a plant to manufacture cyclohexanol at a capacity suitable for Indian context
17CHE145	Nitin Ramchandra Karande	Design a plant to manufacture Nitrofurantoin at a capacity suitable for Indian context
17CHE150	Prateek Shriram Badgujar	Design a plant to manufacture ethylenediamine at a capacity suitable for Indian context
17CHE151	Priyanka Subhash Humane	Design a plant to manufacture Ondansetron hydrochloride dihydrate at a capacity suitable for Indian context
17CHE107	Aishwarya Suhas Khandekar	Design a plant to manufacture anthraquinone at a suitable scale.
17CHE114	Apurva Ajay Pawar	Design a plant to manufacture 2- hydroxy-3-naphthoic acid and its anilide from 2-naphthol at a suitable scale.
17CHE122	Chinmayee Pradeep Sarode	Design a plant to manufacture 2-methyl resorcinol solution at a suitable scale.
17CHE135	Lakshay - Vashist	Design a plant to manufacture propranalol from 1-naphthol at a suitable scale.
17CHE156	Rushikesh Gorakhnath Rathod	Design a plant to manufacture naphthalene-2,6-dicarboxylic acid at a suitable scale
17CHE108	Akshaykumar Dundappa Bhangari	Design a plant to manufacture polystyrene at a suitable capacity
17CHE115	Arya Kirti Pavani	Design a plant to manufacture resistant starch at a suitable capacity
17CHE121	Chinmay Prasad Deshpande	Design a plant to manufacture titanium dioxide at a suitable capacity
17CHE181	Meenal Shyam Rathi	Design a plant to manufacture ammonium polyphosphate at a suitable capacity
17CHE155	Rasik Gurunath Wathare	Design a plant to manufacture cellulose acetate at a suitable capacity
17CHE120	Burhanuddin Esmail Samiwala	Design a plant to manufacture 5 TPD of Ciprofloaxcin
17CHE137	Mahesh Subhash Patil	Design a plant to manufacture 5 TPD of Norfloxacin
17CHE143	Niraj Devdas Bhavar	Design a plant to manufacture 1 TPD of butyl-glucoside
17CHE149	Prasanna Prasad Khare	Design a plant to manufacture 5 TPD of Levofloaxcin
17CHE175	Vipul Moreshwar Karekar	Design a plant to manufacture 5 TPD of Tinidazole
17CHE111	Aniket Rajay Surwade	Design a plant to produce 500 kw of electricity on a 24 hour basis using (do not use any fossil fuels).
17CHE117	Ashutosh Arvind Kulkarni	Design a plant to produce 10 TPD of diphenyl amine
17CHE127	Harsh Prakash Solanki	Design a plant to treat 10,000 litres per hour of 30,000 ppm COD liquid waste using microalgal photobioreactors.

17CHE176	Yash Ghanashyam Barhate	Design a plant to process 10 TPD of Agricultural Residue using Catalytic Thermal Liquefaction
17CHE177	Yashraj Sanjay Jagtap	Design a plant to produce 30 kl/day of absolute ethanol from sugarcane juice
17CHE109	Alankrita Shreekant Patil	Design a plant to Manufacture 10 TPA acetyl acetone
17CHE146	Omkar Narayan Korke	Design a plant to manufacture 10000 TPA sulphuric acid
17CHE147	Palkit Vinod Shahdadpuri	Design a plant to Manufacture Isobornyl cyclohexanol
17CHE152	Purva Harshad Paranjape	Design a plant to manufacture γ- pipradrol
17CHE158	Sanil Govind Yadav	Design a plant to Manufacture 10 TPA of ethyl butyrate via green route

Table 1.24: List of B. Chem. Engg. Home Paper (Major Projects) 2021-2022

Roll No	**Student Name**	**Topic**
18CHE114	Tanay Ashish Jawdekar	Design a plant to manufacture of Benzyl sulphonyl chloride
18CHE116	Neha Madhukar Sangle	Design a plant to manufacture 10 TPD of sophorolipids
18CHE121	Prajwal Shilkumar Shambharkar	Design a plant to manufacture D-Fartanic acid
18CHE176	Aniruddha Rajesh Jain	Design a plant to manufacture of Para-chloro troiphenol
R18CHE135	Diksha Sunil Raut	Design a plant to manufacture Tetra Hydro Furan
18CHE122	Advay Naval Shirrwalkar	Design a plant to manufacture of selected alkyl lithiums
18CHE145	Bharat Prasad	Design a plant to manufacture Methylene blue
18CHE152	Aryan Razdan	Design a plant to manufacture epichlorohydrin
18CHE166	Bhavya Jain	Design a plant to manufacture Lopinavir
18CHE181	Varun Inamdar	Design a plant to manufacture avocado oil
18CHE102	Shikhar Dinesh Singh	Design a plant to manufacture 50 TPD ethyl vaniline
18CHE123	Krishnakant Pandey	Design a plant to manufacture 30 TPD p-anisyl alcohol
18CHE127	Yash Subhash Butale	Design a plant to manufacture 10 TPD 4-hydroxy phenyl acetic acid
18CHE146	Vyankatesh Nagesh Puri	Design a plant to manufacture 10 IPD 4-nitro orthoxylene
18CHE162	Yash Anil Bartakke	Design a plant to manufacture 5 TPD of gallic acid
18CHE134	Durvesh Eknath Parab	Design a plant to manufacture of 25 ton/month of ethyl bromoacetate
18CHE139	Neil Graig Dias	Design a plant to manufacture of 25 ton/month of ethyl bromoacetate
18CHE153	Amey Amol Suryavanshi	Design a plant to manufacture of 100 ton/month of phenoxy ethanol
18CHE155	Harshali Valmik Shardul	Design a plant to manufacture of 100 ton/annum of methoxyamino chlorobenzene
18CHE157	Ramakrishna S	Design a plant to manufacture of 500 ton/annum of methyl ethyl ketone
18CHE112	Aditya Mahaveer Patil	Design a plant to manufacture 5 TPD of 4-(4- hydroxyphenyl) sulfonylphenol by a green

		process
18CHE137	Abhishek Devendra Avhad	Design a plant to manufacture 10 TPD of difenoconazole technical using latest process
18CHE147	Harikrishnan R Namboothiri	Design a plant to manufacture 1500 TPA of 4-methyl-3-nitroaniline using modern reactor and separation technologies
18CHE150	Sonti Siddharth	Design a plant to manufacture 300 TPD of carbon dioxide from a fermenter into methanol using latest technologies
18CHE180	Atharva Shailesh Sonavane	Design a plant to manufacture 5000 TPA of 1,2,4- triazinone with an environment friendly process
18CHE103	Tanmay Nitin Kothawade	Design a plant to manufacture Copper Sulfate
18CHE106	Vaishnavi Rajendra Bhalekar	Design a plant to manufacture Sodium hydroxide
18CHE129	Tanvi Mahendra Apte	Design a plant to manufacture Zinc sulphate
18CHE136	Shruti Sarjerao Kadam	Design a plant to manufacture aluminium chloride
18CHE149	Krishna Gopal Jakhotiya	Design a plant to manufacture nickel flouride
18CHE105	Shekhar Ganapati Shinde	Design a plant to manufacture xylitol from xylose
18CHE109	Aniruddha Dhondiram Pinjari	Design a plant to manufacture Sorbitol from Glucose
18CHE133	Aakanksha Gubbala	Design a plant to manufacture 1,2-pentane diol
18CHE164	Omkar Sambhaji Thube	Design a plant to manufacture Alanine from lactic acid
17CHE159	Sanket Bhojraj Dadmal	Design a plant to manufacture Cephalexin
18CHE124	Geet Arun Chheda	Design a plant to manufacture Cefixime Trihydate
18CHE144	Dhaval Divakar Dhande	Design a plant to manufacture Sodium Nitrotetrazolate
18CHE154	Abhinav Umesh Patil	Design a plant to manufacture Tipifarnib
18CHE165	Anmol Ajay Rathi	Design a plant to manufacture Lofexidine Hydrochloride
18CHE140	Aniket Rajendra Mali	Design a plant to manufacture dinitronapthalene
18CHE159	Akshayu Pramod Ambatkar	Design a plant to manufacture solketal
18CHE161	Akash Dilip Pawar	Design a plant to manufacture ethylene glycol diacetate
18CHE168	Aditya Namdeo Naik	Design a plant to manufacture 2-methyl-1,4-napthoquinone
18CHE171	Aditya Rajkumar Ratnapagol	Design a plant to manufacture p-methyl cyclohexylamine
17CHE162	Shrushti Anand Chaudhari	Design a plant for production of Forward Osmosis membrane module from dialysis membrane module (coating of 100 m2 membrane area per day)
18CHE117	Siddharth Mangesh Petare	Deigan a plant to manufacture 10,000 TPA of cyanoguanidine (intermediate of metformin) starting from limestone
18CHE141		Design a 10 TPD plant for production of vacuum evaporated salt (sodium chloride) from solar-

	Shrinivas Anand Acharya	concentrated (24 oBe') sea or sub-soil brine, forward integrated to iodized salt production
18CHE148	Shantanu Uttam Kadam	Design a plant to manufacture 50 TPD anhydrous HF plant integrated with fluoride separation from fertilizer grade phosphoric acid
18CHE163	Atharv Hemendra Tiwari	Design a plant for production of 300 TPA plant of D2EHPA-TOPO solvent composition (required for uranium recovery from phosphoric acid) from basic chemicals
18CHE119	Shubhalaxmi Dillip Swain	Design a plant to manufacture acetamiprid
18CHE138	Rushad Mehernosh Dumasia	Design a plant to manufacture indoxacarb
18CHE143	Kushagra Manoj Dwivedi	Design a plant to manufacture acephate
18CHE160	Rajas Milind Mehendale	Design a plant to manufacture pendimethalin
R16CHE178	Varun Satish Kumar Raina	Design a plant to manufacture para tert butyl phenol
18CHE110	Akanksha Sanjay Chougule	Design a plant to manufacture ethyl acetate from acetic acid and ethylene
18CHE111	Saloni Surendra Varunkar	Design a plant to manufacture 3-methoxy butanol via crotonaldehyde
18CHE113	Anuj Pundalik Farakate	Design a plant to manufacture adiponitrile
18CHE132	Durgeshnandini Rajendra Shinde	Design a plant to manufacture tetralin
18CHE178	Amey Santosh Murudkar	Design a plant to manufacture acetaldehyde by ethylene oxidation
16CHE138	Kshitij Narendra Thaware	Design a plant to manufacture methylene diphenyl diisocyanate
18CHE125	Mihir Shrinivas Dakappagari	Design a plant to manufacture whey protein
18CHE142	Naresh Khushalchand Dhanwani	Design a plant to manufacture cyanoacrylate
18CHE158	Jayesh Chander Saraogi	Design a plant to manufacture phosphorus trichloride
18CHE167	Tejas Sriniwas Abhyankar	Design a plant to manufacture potassium permanganate
18CHE175	Meenal Rawlani	Design a plant to manufacture acetylsalicylic acid
16CHE172	Suraj Bhagwat Shinde	Design a plant to manufacture 5 TPD of ,2,4-Trimethyl-1,2-dihydroquinoline
18CHE115	Monil Manish Shah	Design a plant to manufacture 5 TPD of 4.2 - Mercapto-benzimidazole
18CHE128	Anushka Manoj Khodake	Design a plant to manufacture 5 TPD of Diaryl-p-phenylenediamine
18CHE170	Nagashravan Hemadri	Design a plant to manufacture 5 TPD of N-Isopropyl-N'-phenyl-p-phenylenediamine
18CHE169	Shubham Maruti Mali	Design a plant to manufacture 5 TPD of 5.Octyl-diphenylamine
18CHE101	Arun Sadotra	Design a plant to manufacture 1 GW worth of solar grade silicon ingots per year
18CHE107	Aditya Rajesh Gedam	Design a plant to manufacture 100 tons per day of methanol from CO2 and water

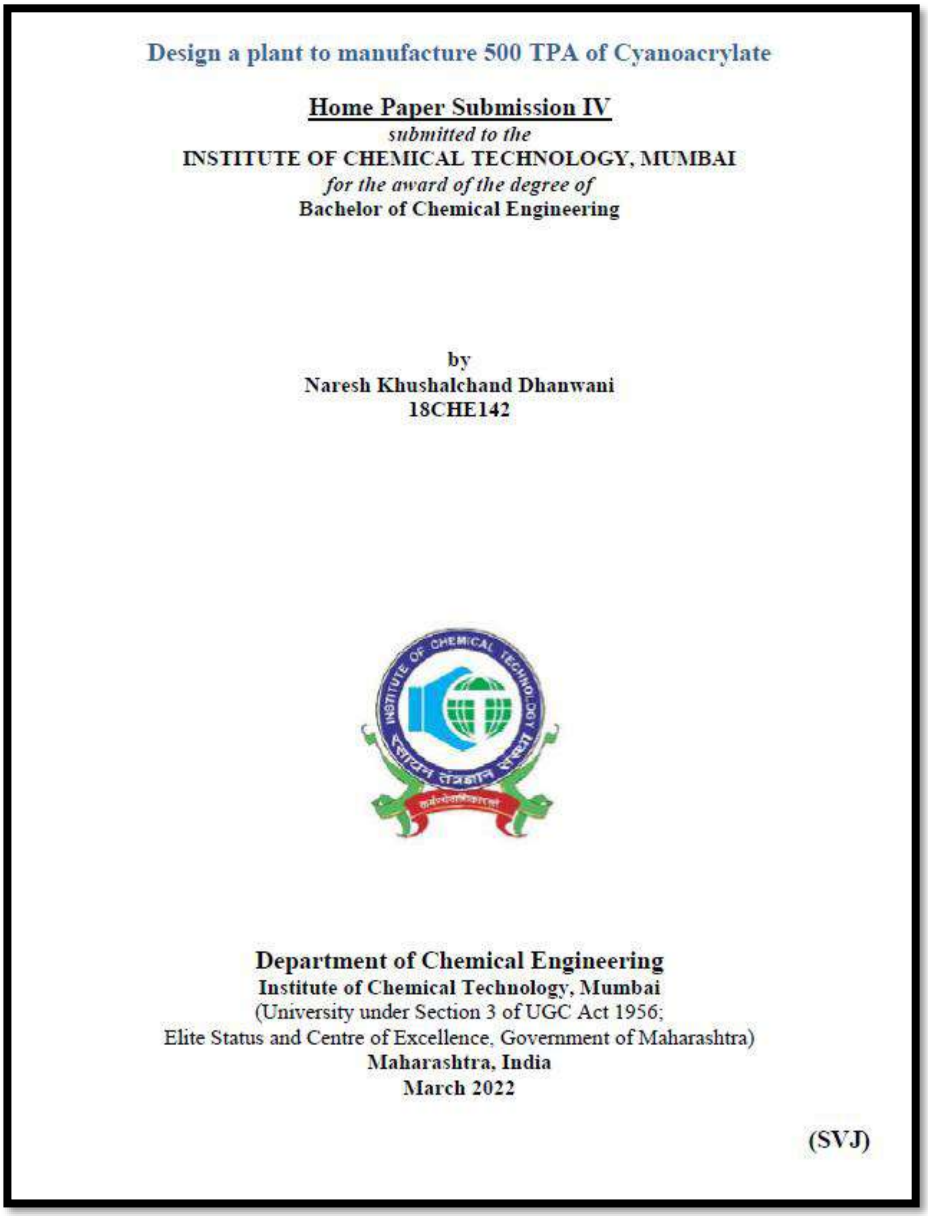
18CHE156	Mayank Mukesh Kumrawat	Design a plant to manufacture 10 m3 per day of compressed biogas suitable for transportation fuel from agricultural waste
18CHE172	Dharam Dilip Parwani	Design a plant to manufacture to reform enough ethanol to Hydrogen to drive a 50 kW hydrogen fuel cell
18CHE173	Bhalekar Snehal Sakharam	Design a plant to manufacture 100 tons per day of ethanol from agricultural waste
18CHE104	Vrushal Rajendra Varude	Design a plant to manufacture p-hydroxy acetophenone
18CHE108	Tanvi Swapnil Varadkar	Design a plant to manufacture nicotinic acid
18CHE120	Mayur Devendra Kulmethe	Design a plant to manufacture hydrochloric acid
18CHE130	Sayalee Chandrasing Pawara	Design a plant to manufacture 1,3 Difluro benzene
18CHE131	Saad Jamal	Design a plant to manufacture acetyl acetone

Table 1.25: List of B. Chem. Engg. Seminar (Mini Projects) 2021-22

Roll No	Student Name	Topic
18CHE101	Arun Sadotra	Bioreactors for COVID vaccine manufacturing
18CHE102	Shikhar Dinesh Singh	Hydrogen peroxide free from metals and organics
18CHE103	Tanmay Nitin Kothawade	Recent advances in membranes for organic solvent nanofiltration
18CHE104	Vrushali Rajendra Varude	Electrochemical CO2 Reduction
18CHE105	Shekhar Ganapati Shinde	Design aspects of Impinging Jet Crystallizers
18CHE106	Vaishnavi Rajendra Bhalekar	Techno-economic evaluation of alternatives for drying of organic solvents
18CHE107	Aditya Rajesh Gedam	Recent advances in Graphitic Carbon Nitride based photocatalytic materials
18CHE108	Tanvi Swapnil Varadkar	Recent advances in spray drying for pharmaceuticals
18CHE109	Aniruddha Dhondiram Pinjari	Land fill Bio-reactor Management
18CHE110	Akanksha Sanjay Chougule	Recent trends in hydrogenation of vegetable oils with focus on catalyst and reactor types
18CHE111	Saloni Surendra Varunkar	Henry reaction using heterogeneous catalysts
18CHE112	Aditya Mahaveer Patil	Recent advances in continuous crystallization of pharmaceutical products
18CHE113	Anuj Pundalik Farakate	Recent developments in Zeolite membrane based gas separation
18CHE114	Tanay Ashish Jawdekar	Hydrodeoxygenation of bio-oil: Catalysis and modeling
18CHE115	Monil Manish Shah	N-Oxidation of tertiary amines using heterogeneous catalysts
18CHE116	Neha Madhukar Sangle	Role of HAZOP analysis in Chemical Industry
18CHE117	Siddharth Mangesh Petare	Developments in process plant failure detection techniques
18CHE118	Mihir Madhav Gokhale	Critical review of electrolytic hydrogen production
18CHE119	Shubhalaxmi Dillip Swain	Opportunities for energy recovery in zero liquid discharge systems
18CHE120	Mayur Devendra Kulmethe	The Concept of Waste Refinery and its Potential
18CHE121	Prajwal Shilkumar Shambharkar	Recent advances in dye-sensitised solar cells
18CHE122	Advay Shirwalkar	Photo-reforming of methanol for production of hydrogen
18CHE123	Krishnakant Pandey	Advances in heteropoly acid based ionic liquids and their applications

18CHE124	Geet Arun Chheda	Recent developments in biosensors in continuous manufacturing
18CHE125	Mihir Shrinivas Dakappagari	Circular Economy: Concept and Utility
18CHE126	Gayatri Chikarmane	Review of processes for uranium separation from phosphoric acid and isolation of recovered uranium in pure form
18CHE127	Yash Subhash Butale	Recent Advances in Power-to-X Technology for the Production of Fuels and Chemicals
18CHE128	Anushka Manoj Khodake	Trends and future scope in fabric lamination adhesives
18CHE129	Tanvi Mahendra Apte	Environmental Applications of Fungal and Plan Systems
18CHE130	Sayalee Chandrasing Pawara	Catalysis in direct oxidation of methane to methanol
18CHE131	Saad Jamal	Applications of heat pumps for heating
18CHE132	Durgeshnandini Rajendra Shinde	Solar Desalination
18CHE133	Aakanksha Gubbala	Recent advances in smart membrane materials and systems for separation
18CHE134	Durvesh Eknath Parab	Applications of Nanotechnology in Oil and Gas Industry
18CHE135	Diksha Sunil Raut	Modeling of gas liquid flows using VOF-DBM
18CHE136	Shruti Sarjerao Kadam	Land fill mining
18CHE137	Abhishek Devendra Avhad	The Problem of Line Tension
18CHE138	Rushad Mehernosh Dumasia	Creep deformations in fibre reinforced composites
18CHE139	Neil Graig Dias	Nano-Sorbents based on Polysaccharide in Water Remediation
18CHE140	Aniket Rajendra Mali	Critical review on recent advances on graphene oxide/cement-based composites
18CHE141	Shrinivas Anand Acharya	Industrial applications of meso scale reactors in continuous flow chemistry
18CHE142	Naresh Khushalchand Dhanwani	Design aspects of Co-axial mixers
18CHE143	Kushagra Manoj Dwivedi	Wittig reaction using heterogeneous catalysts
18CHE144	Dhaval Divakar Dhande	Recent trends in desulfurization of turpentine as feed stock for perfumery chemicals
18CHE145	Bharat Prasad	Current Status of Residual Sugarcane Bagasse Conversion in India
18CHE146	Vyankatesh Nagesh Puri	Critical review of chemistry aspects of hydrogenation/reduction in the manufacture of pharmaceutical intermediates
18CHE147	Harikrishnan R Namboothiri	Application of Biotechnology for odour control
18CHE148	Shantanu Uttam Kadam	Recent advances on process based on Perfusion bioreactors for mAb production
18CHE149	Krishna Gopal Jakhotiya	Recent developments in cooling tower design and operation
18CHE150	Sonti Siddharth	Comparative assessment of the Birkeland-Eyde process vis-à-vis the Haber process in the context of future sustainability
18CHE152	Aryan Razdan	Deep Reinforcement Learning
18CHE153	Amey Amol Suryavanshi	MSW Segregation techniques and scaling them
18CHE154	Abhinav Umesh Patil	Zwitterionic silicone materials derived from amino functional PDMS with acrylic acid
18CHE155	Harshali Valmik Shardul	Non-Intrusive in-line Rheometery
18CHE156	Mayank Mukesh Kumrawat	Recent advances in the manufacturing process development of mass spectrometry grade trypsin
18CHE157	Ramakrishna S	Recent advances in membranes for organic pervaporation/membrane distillation
18CHE158	Jayesh Chander Saraogi	Dry vacuum pumps: applications, selection and operating guidelines

18CHE159	Akshayu Pramod Ambatkar	Oil Spill Treatment using Oil eating Microbes
18CHE160	Rajas Milind Mehendale	Data –Driven models in Chemical Engineering Research and applications
18CHE161	Akash Dilip Pawar	Design considerations for a cold storage unit
18CHE162	Yash Anil Bartakke	Industrial processes for extraction of natural products
18CHE163	Atharv Hemendra Tiwari	high temperature degradation in power plants and refineries
18CHE164	Omkar Sambhaji Thube	Recent developments in reboiler design
18CHE165	Anmol Ajay Rathi	Recent advances in the manufacturing process development of PNGaseF (recombinant)
18CHE166	Bhavya Jain	Design of spiral plate heat exchanger
18CHE167	Tejas Sriniwas Abhyankar	Wadsworth -Emmons reaction using heterogeneous catalysts
18CHE168	Aditya Namdeo Naik	Developments in application and modification of niobium oxides as catalysts in industrially important reactions
18CHE169	Shubham Maruti Mali	Developments in eco-pesticides
18CHE170	Nagashravan Hemadri	Recent advances in the purification process development of pepsin
18CHE171	Aditya Rajkumar Ratnapagol	Green Hydrogen Production
18CHE172	Dharam Dilip Parwani	Review of technology options for small-scale and large-scale seawater desalination
18CHE173	Bhalekar Snehal Sakharam	Ultrasound applications for water treatment and recycle
18CHE175	Meenal Rawlani	Effect of cold working on creep rupture strength
18CHE176	Aniruddha Rajesh Jain	The Role of Carbon Capture and Storage in the Energy Transition
18CHE177	Nikhil Manjunath Devadiga	Intensified biogas production based on use of cavitation
18CHE178	Amey Santosh Murudkar	Recombinant DNA Technology in synthesis of Insulin
18CHE180	Atharva Shailesh Sonavane	Icy ball design for small refrigerated storage
18CHE181	Varun Inamdar	Taurine surfactants
16CHE138	Kshitij Narendra Thaware	VOC emissions and mitigation techniques in manufacturing industries
16CHE172	Suraj Bhagwat Shinde	Review of use of natural products in paints, ink and adhesives
16CHE178	Varun Satish Kumar Raina	Recent advances in the manufacturing process development of mass spectrometry grade chymotrypsin
17CHE159	Sanket Bhojraj Dadmal	Development of non-invasive sensors for medical applications
17CHE162	Shrushti Anand Chaudhari	Recent trends in treatment of effluent containin antibiotics



Design a plant to manufacture 500 TPA of Cyanoacrylate

Home Paper Submission IV
submitted to the
INSTITUTE OF CHEMICAL TECHNOLOGY, MUMBAI
for the award of the degree of
Bachelor of Chemical Engineering

by
Naresh Khushalchand Dhanwani
18CHE142

Department of Chemical Engineering
Institute of Chemical Technology, Mumbai
(University under Section 3 of UGC Act 1956;
Elite Status and Centre of Excellence, Government of Maharashtra)
Maharashtra, India
March 2022

(SVJ)

Figure 1.15: Sample home paper (major project) submission front page

Table 1.26: List of students completing industrial training 2021-22

Sr. No.	Name of the student	Roll Number	Company
1	Aayush Bhat	19CHE101	Lanxess
2	Shivani Manhas	19CHE102	RCF ltd
3	Sagar Vivek Mudaliar	19CHE103	Reliance Industries Ltd
4	Aquil Abdulhamid Attar	19CHE104	Reliance
5	Parth Thakkar	19CHE105	BASF
6	Pranay Shah	19CHE106	BASF
7	Parth Patel	19CHE108	AMI Lifesciences Ltd
8	Sahil Birwatkar	19CHE111	Aarti Industries
9	Tanish Agrawal	19CHE112	Jubilant Ingrevia
10	Anant Prasanna Sohale	19CHE113	Eternis
11	Prithvi Dake	19CHE114	Tridiagonal Solutions Ltd
12	Adwait Joshi	19CHE115	Tridiagonal Solutions Ltd
13	Jay Piyushbhai Thakkar	19CHE116	Kiri Industries ltd

14	Aditi Sachin Patil	19CHE117	RCF ltd
15	Dhruv Gohil	19CHE118	Fairmate
16	Sudarshan Shreenivas	19CHE119	Jayant Agro
17	Shaikh Mohd Shoeb Sher Ali	19CHE120	Reliance
18	Hrishabh Singh	19CHE121	Deccan Fine Chemicals Ltd.
19	Nimish Vaidya	19CHE122	Beetachem Industries
20	Harsh Upadhyay	19CHE123	Thyssenkrupp Industrial Solutions
21	Pankti Paresh Savla	19CHE124	Jayant Agro
22	Gargee Yadav	19CHE125	Akry Organics
23	Vivin Sibi	19CHE126	Piramal - Ennore
24	Abhishek Shashikant Kulkarni	19CHE127	Tridiagonal Solutions Ltd
25	Uma Rajesh Tulsiani	19CHE128	Rubamin Pvt Ltd
26	Shrivatsa Korde	19CHE129	Tridiagonal Solutions Ltd
27	Amoghraj Prabhu S S	19CHE130	Gmm Pfaudler
28	Aditya Agarwal	19CHE131	Sudarshan Chemicals
29	Darshil Jain	19CHE132	Aarti Inds
30	Saloni Vaidya	19CHE133	Atul Ltd
31	Siddharth Nitin Shah	19CHE134	Jayant Agro
32	Vyankatesh Shyam Tarkase	19CHE135	Gharda Chemicals
33	Akshat Jain	19CHE136	Lanxess
34	Animesh Chaturvedi	19CHE137	Gharda Chemicals (Absent)
35	Vikram Vinayak Shanbhag	19CHE138	Tridiagonal Solutions
36	Prathamesh Patil	19CHE139	Atul ltd
37	Sahil Unmesh Patil	19CHE140	Harman Finochem ltd
38	Makrand Tanaji Barge	19CHE141	Piramal Thane
39	Ria Gada	19CHE142	JB Pharmaceuticals Pvt Ltd
40	Vignesh Krishnan	19CHE143	Solara
41	Sanskar Shridhar Tanvidkar	19CHE144	Excel
42	Parikshit Subhash Kadu	19CHE145	Lanxess
43	Vinod Mamraj Rathod	19CHE146	Lanxess
44	Utkarsh Pravin Patil	19CHE147	Reliance
45	Abhijeet Agatrao Tarange	19CHE148	Laxmi Organics
46	Gouresh Vinay Gargate	19CHE149	Piramal Thane
47	Snehal Bhosale	19CHE150	Vanita Agrochem pvt ltd
48	Vaibhav Khapekar	19CHE151	Eternis
49	Umesh Jaiswal	19CHE152	Shell
50	Vashishth Purohit	19CHE153	Jubilant ingrevia
51	Akanksha Warade	19CHE154	Biocon
52	Aditya Sangave	19CHE155	Eternis
53	Sanmesh Pravin Kharade	19CHE156	Jubilant ingrevia
54	Priyanshu Singh	19CHE157	Deccan Fine Chemicals Ltd.
55	Prehas Madke	19CHE158	Eternis
56	Falguni Akulwar	19CHE159	Jubilant ingrevia
57	Shivraj Chandrakant Gove	19CHE160	Lanxess
58	Vaidehi Padamwar	19CHE161	Jubilant ingrevia
59	Bhushan Murjani	19CHE162	Piramal Thane
60	Suraj Kekane	19CHE163	Solara
61	Shyam Gandhi	19CHE164	Reliance

62	Dhaval Chaudhari	19CHE165	UPL
63	Nikita Mohta	19CHE166	Akry Organics
64	Soham Mamidwar	19CHE167	Aarti inds
65	Atharv Prasad Kulkarni	19CHE168	Tridiagonal Solutions Ltd
66	Rutuja Pingale	19CHE169	Gharda Chemicals, Lote
67	Akshayaa Jagtap	19CHE170	Exxon Mobil
68	Priya Katkar	19CHE171	Gharda Chemicals, Lote
69	Harsh Mohane	19CHE172	Aarti Inds
70	Ashish Bhave	19CHE174	Tridiagonal Solutions Ltd
71	Sahil Sabne	19CHE175	Deepak Nitrite - Baroda
72	Manasi Bansod	19CHE176	Biocon
73	Amogh Subhash Gaikwad	19CHE178	Gharda Chemicals Dombivli(
74	Janhavi Sunil Waghachoude	19CHE179	Aarti Industries, Vapi
75	Ruchita Baban Laswante	19CHE180	Aarti Industries, Vapi
76	Rakhi Narnaware	19CHE181	Gharda Chemicals, lote
77	Sushant Hemant Moule	19CHE182	Aarti inds
78	Onkar Rajendra Salavi	19CHE185	Excel
79	Vinay Sharma	19CHE186	Deepak Nitrite - Baroda
80	Amit Dinesh Yadav	19CHE187	UPL
81	Yashvir Koul	19CHE188	Aarti Industries
82	Sakshi Pandit Patil	19CHE189	Gharda Chemicals, Lote
83	Prasanna Gangawane	19CHE190	Harman Finochem Ltd
84	Abhigyan Ray	17CHE103	Piramal Thane
85	Siddhesh Borole	18CHE151	Laxmi Organics
86	Kalyan Hanumant Mali	18CHE179	UPL

CRITERION 2	Program Curriculum and Teaching - Learning Processes	75/75

2.1. Program Curriculum (15) (Institute Marks 15)

2.1.1. State the Structure and Component of the Curriculum (5) (Institute Marks 5)

The Departmental Academic Committee looks at the curriculum of leading universities such as MIT, Purdue, Waterloo, NUS (International) and IITB, IITD, and IITKGP (Indian). The committee formulates the draft curriculum plan which is sent to (a) Alumni (b) external examiners (3) Visiting faculty (4) Subject experts from IIT, NCL, other eminent institutes (5) Industry experts (6) recently graduated students (7) Subject experts from foreign universities. Based on their suggestions, the final draft is prepared and proposed to UGPC for final implementation.

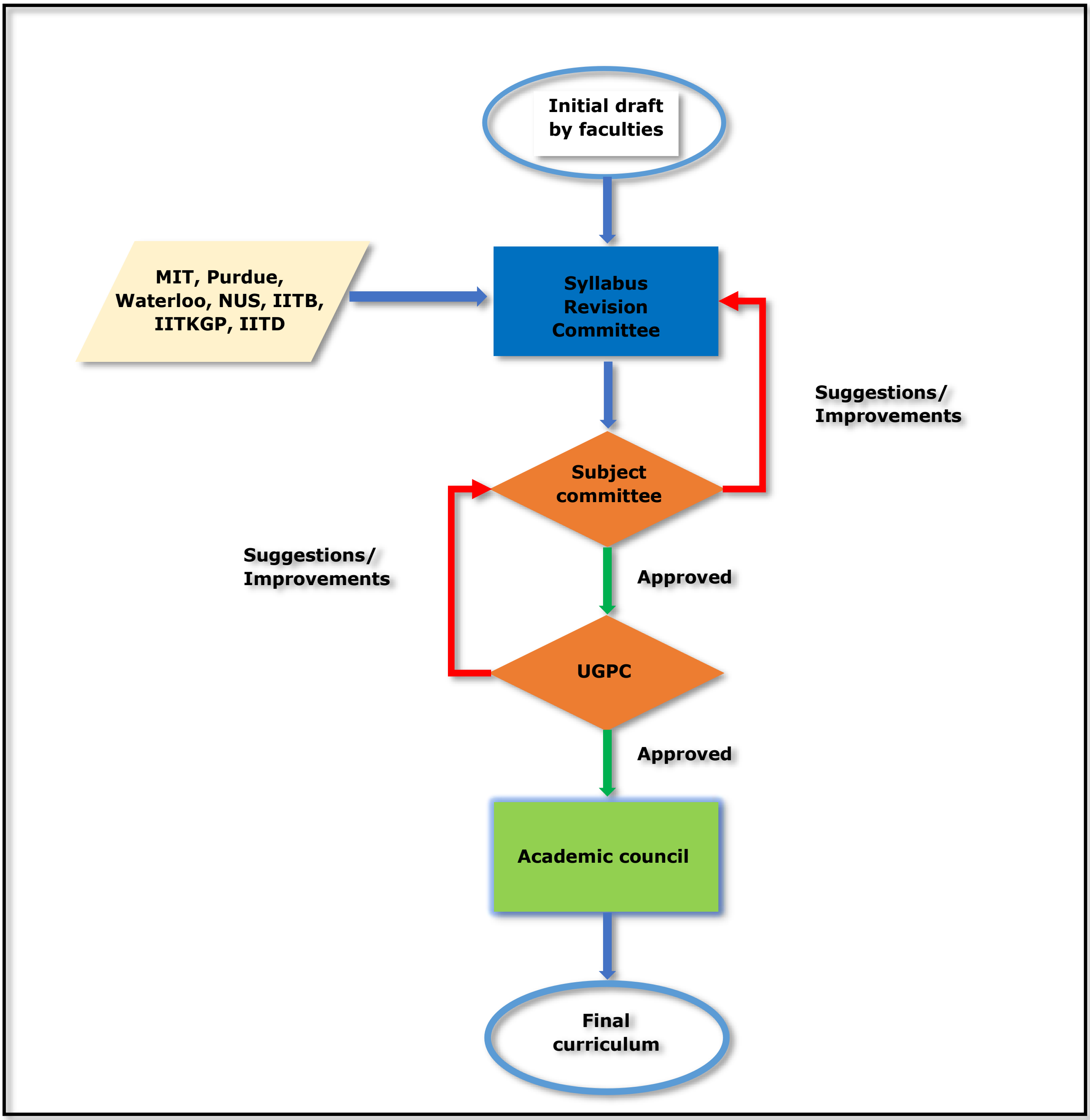


Figure 2.1: Process of defining the curriculum

Table 2.1: Structure and Components of the Curriculum

CourseCode	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	Credits
Semester I						
CHT1131	Organic Chemistry-I	45	15	0	60	4
CHT1341	Physical Chemistry	30	15	0	45	3
MAT1101	Applied Mathematics-I	45	15	0	60	4
PYT1101	Applied Physics – I	45	15	0	60	4
GEP1101	Engineering Graphics-I	30	0	60	90	4
PYP1102	Physics Laboratory	0	0	60	60	2
CHP1132	Organic Chemistry Laboratory	0	0	60	60	2
Semester II						
CHT1231	Organic Chemistry-II	45	15	0	60	4
CHT1211	Analytical Chemistry	30	15	0	45	4
CET1501	Material & Energy Balance Calculations	45	15	0	60	4
MAT1103	Applied Mathematics-II	45	15	0	60	4
PYT1103	Applied Physics – II	30	15	0	45	2
CHP1342	Physical & Analytical Chemistry Lab.	0	0	60	60	2
HUP1101	Communication Skills	0	0	60	60	2
Semester III						
CET1301	Chem. Eng. Thermodynamics-I	45	15	0	60	4
CET1101	Momentum and Mass Transfer	45	15	0	60	4
GET1102	Structural Mechanics	30	15	0	45	3
GET 1109	Electrical Engineering and Electronics	30	15	0	45	3
CET 1502	Industrial & Engineering Chemistry	45	15	0	60	4
GEP1103	Structural Mechanics Lab.	0	0	60	60	2
GEP1110	Electrical Engg and Electronics Laboratory	0	0	60	60	2
CEP1715	Engineering Applications of Computers	0	0	60	60	2
Semester IV						
GET1107	Energy Engineering	45	15	0	60	4
BST1102	Introduction to Biological Sci. & Bioengineering	45	15	0	60	4
CET 1401	Chemical Engineering Operations	30	30	0	60	4
CET 1302	Chem. Eng. Thermodynamics-II	45	15	0	60	4
GET/CHT/ PYT/MAT	Elective 1 (Outside Department)	30	15	0	45	3
GEP1108	Engineering Graphics -II	0	0	60	60	2
CEP 1701	Chemical Engineering Laboratory-I	0	0	90	90	3
Semester V						
CET1716	Mathematical Methods in Chem. Engg.	45	15	0	60	4
CET1102	Heat Transfer	30	30	0	60	4
CET1201	Chemical Reaction Engineering I	30	30	0	60	4
CET1402	Separation Processes	30	30	0	60	4
CET1202	Biochemical Engineering	30	15	0	45	3
CEP1704	Chemical Engineering Laboratory-II	0	0	90	90	3
CEP1702	Process Simulation Lab – I	0	0	60	60	2
Semester VI						
CET1601	Material Science and Engineering	30	15	0	45	3

CET1203	Multiphase Reaction Engineering	30	15	0	45	3
CET1503	Environmental Engg & Process Safety	30	30	0	60	4
CET1703	Chemical Process Control	45	15	0	60	4
CET	Department Elective 1	30	15	0	45	3
CEP1706	Chem. Eng. Laboratory-III	0	0	90	90	3
CEP1705	Process Simulation Lab – II	0	0	60	60	2
GET1111	Equipment Design and Drawing-I	30	0	60	90	2
CEP 1710	Internship	0	0	120	0	6
			Semester VII			
CET1504	Chemical Project Engineering & Economics	30	10	0	40	3
CET1505	Process Development and Engineering	40	20	0	60	4
HUT1102	Perspectives of Society, Sci. & Tech.	30	10	0	40	3
CET	Department Elective 2	30	20	0	50	3
CET1511	Optimization of Chem. Engg. Systems	20	0	40	60	2
CEP1708	Project 1: Seminar	0	0	40	40	2
CEP1709	Project 2: Home Paper – I	0	0	40	40	2
			Semester VIII			
HUT 1103	Ind. Psychology & H. R. Management	30	15	0	45	3
HUT1108	Industrial Management – I	30	15	0	45	3
HUT1105	Industrial Management – II	30	15	0	45	3
MAT1106	Design & Analysis of Experiments	30	15	0	45	3
CET	Department Elective 3	30	15	0	45	3
GEP1112	Equipment Design and Drawing -II	30	0	60	90	2
CEP1711	Project 3: Home Paper – II	0	0	90	90	3
TOTAL		**1470**	**645**	**1380**	**3375**	**186**

Table B.2.1.1a

Table 2.2: Program curriculum grouping based on course components

Course Component	**Curriculum Content (% of the total number of credits of the program)**	**Total Number of Contact hours**	**Total Credits**
Basic Sciences	21%	675	39
Engineering Sciences	13%	600	24
Humanities and Social Sciences	6%	175	12
Program Core	45%	1510	84
Program Electives	3%	90	6
Open Electives	3%	95	6
Project(s)	3%	130	5
Internships/Seminars	4%	160	8
Employment Enhancement Courses/Skill Based Courses	1%	60	2
Total number of Credits			**186**

Table B.2.1.1b

2.1.2. State the process used to identify the extent of compliance of the curriculum for attaining the Program Outcomes and Program Specific Outcomes as mentioned in Annexure I (10)
(Institute Marks 10)

The process used to identify the extent of compliance with the curriculum: The curriculum for B. Chem. Engg. Program maintains a balance among various categories of courses from Science, Mathematics, Engineering, Humanities and Management, Projects, and Internship components. The syllabus for each course has been designed to meet compliance with the curriculum for attaining PO's and PSO's defined for the program. All the courses in the program are very closely related to the Program Outcomes and Program Specific Outcomes. At the end of each semester, the attainment of course outcomes is estimated and is related to program outcome attainment. A similar analysis of compliance of curriculum for attaining the PO and PSO is carried out by taking student, alumni, and employer feedback. Institute also has a process to collect student feedback at the end of each semester. The feedback helps in evaluating the POs and PSOs. The curriculum design and component-wise distribution are in accordance with leading universities.

1. Courses are offered in a sequence of order in a logical manner to make the students aware of how to arrive at the solution for a particular problem
2. Laboratory experiments are designed to characterize the material and lab-scale behavior of the relevant materials for real field applications
3. The performance of students is appraised through direct and indirect assessments.
4. Assignments are provided to the students to verify the theory and solve the practical problems
5. State-of-the-art technologies are adopted for real-time practice to solve the problems in the field of civil engineering
6. Internships, technical field visits, and seminars are made part of the curriculum to make the students aware of industry practices and presentation of the work completed
7. Projects are assigned to the students related to field problems
8. Minor and Major projects are reviewed by the faculty of the department for the betterment of the project results
9. Special attention is given to weak students by conducting lecture sessions

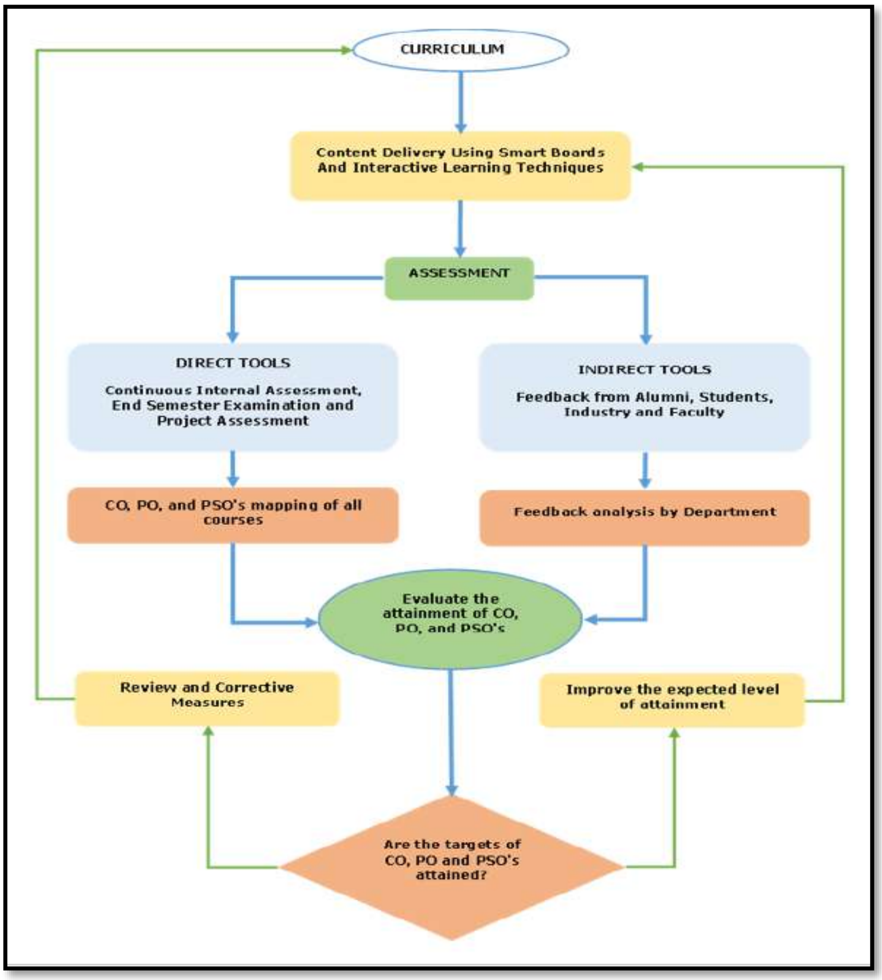


Figure 2.2: Compliance of curriculum with CO, PO and PSO

2.2. Teaching-Learning Processes (60)

2.2.1. Describe Processes followed to improve the quality of Teaching & Learning (15)

(Institute Marks 15)

The following steps are taken throughout the academic year to improve the quality of teaching and learning:

- The academic calendar is strictly followed so far as classes and examinations are concerned
- Based on the credits, the number of contact hours has been allotted in the academic timetable and is strictly followed by the faculty
- Course feedback is evaluated by the concerned faculty to improve the quality of teaching
- Real field problems are addressed in the assignments or the lectures.
- Giving demonstrations of key components through PowerPoint presentations, and academic videos and recommending case studies
- Laboratory experiments are designed to make the student aware of the real-world scenario. Demonstration experiments are planned every year to visually explain the different governing principles. These experiments are conducted by the research students and also some experiments are catered to explain the novel concepts and recent trends in Chemical Engineering
- The industry or field internship reports assessing the learning outcomes of the student (s) are examined
- Bright students are encouraged to participate in conferences and technical fests
- The weaker students based on their class performance are identified and accordingly, some extra classes are conducted to improve their performance for their benefits
- Students are encouraged to apply for R&D projects under various schemes.
- We have a state-of-art library facility with an e-journals facility. Students are encouraged for learning beyond the syllabus.
- Technical events, fests, seminars, workshops, and short term courses corresponding to different specializations are regularly conducted

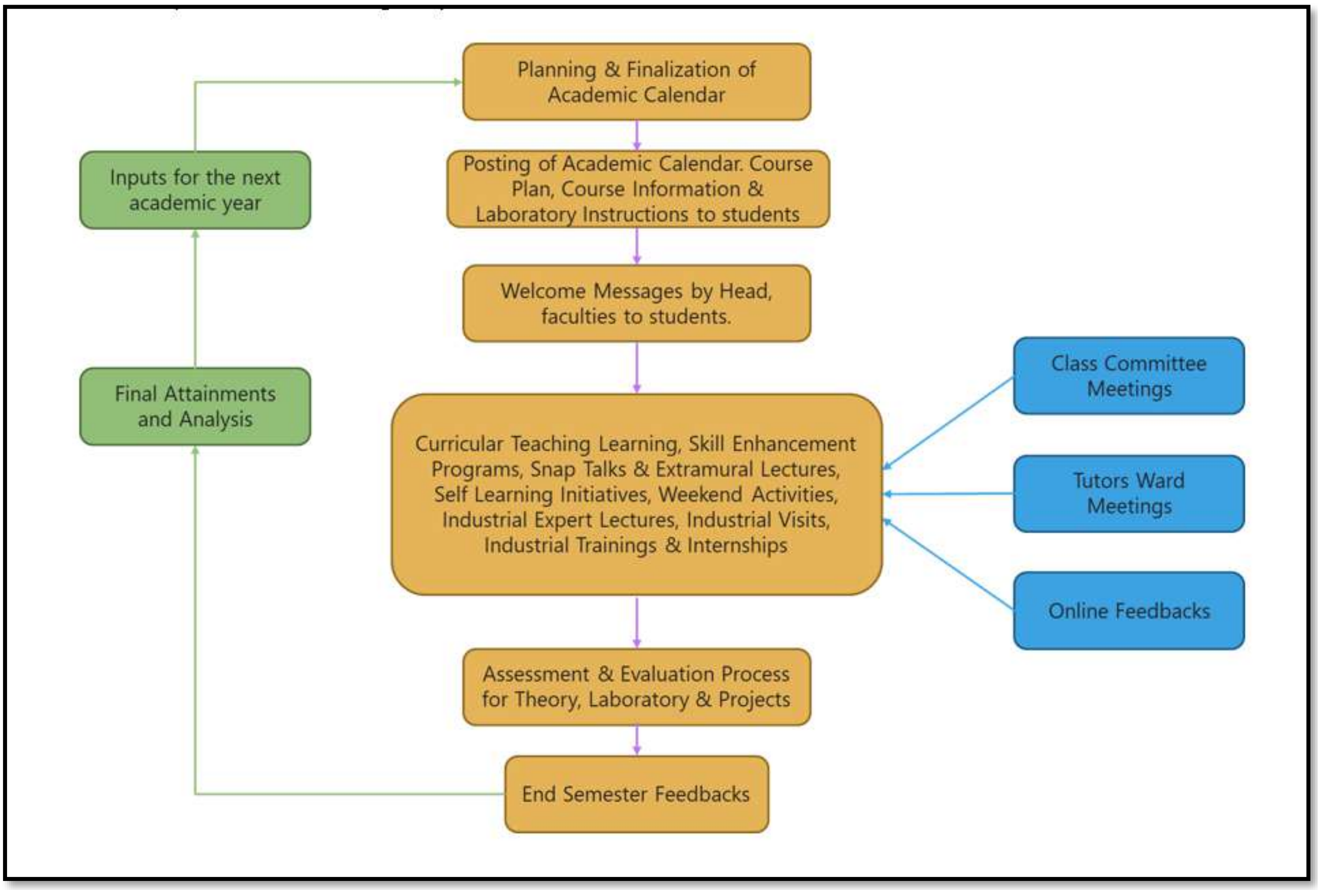


Figure 2.3: Processes followed to improve the quality of Teaching & Learning

Adherence to Academic calendar:

Department prepares its action plan in alignment with to academic calendar before the commencement of the semester. The action plan includes major routine tasks for the timely execution of the teaching/learning and other academic activities.

Academic calendars are given below:

ACADEMIC CALENDER 2019-2020

The following shall be the Academic Calendar :

(A) DIVISION OF SEMESTERS FOR ALL COURSES

Odd Semester

First Year and Final Year (UG & PG) : August 08, 2019 (Thu.) to December 31, 2019 (Tue.)
Second (UG & PG) & Third Year (UG) : July 01, 2019 (Mon.) to November 30, 2019 (Sat.)
Ganpati Vacation (UG and PG) : September 02 2019 (Mon.) to September 07, 2019 (Sat.)
Diwali Vacation (UG and PG) : October 28, 2019 (Mon.) to November 05, 2019 (Tue.)
Even Semester : December 16, 2019 (Mon.) to May 16, 2020 (Sat.)
First Year and Final Year (UG & PG) : January 01, 2020 (Wed.) to May 16, 2020 (Sat.)
Second (UG & PG) & Third Year (UG) : December 16, 2019 (Mon.) to May 16, 2020 (Sat.)
Summer Vacation : May 17, 2020 (Sat.) to June 30, 2020 (Tue.)

(B) EXAMINATION SCHEDULE FOR ALL COURSES

Mid Semester Examination

Odd Semester

First Year and Final Year (UG & PG) : October 19, 2019 (Sat.) to October 25, 2019 (Fri.)
Second (UG & PG) & Third Year (UG) : August 23, 2019 (Fri.) to August 30, 2019 (Fri.)
Even Semester (UG and PG) : February 07, 2020 (Fri.) to February 14, 2020 (Fri.)

(C) SEMESTER EXAMINATIONS FOR ALL COURSES

Odd Semester

a) Theory

First Year and Final Year (UG & PG) : December 16, 2019 (Mon.) to December 23, 2019 (Mon.)
Second (UG & PG) & Third Year (UG) : November 11, 2019 (Mon.) to November 19, 2019 (Tue.)

b) Practical

First Year and Final Year (UG & PG) : December 24, 2019 (Tue.) to December 31, 2019 (Tue.)
Second (UG & PG) & Third Year (UG) : November 20, 2019 (Fri.) to November 30, 2019 (Mon.)

c) Evaluation & Declaration of Results : Within 45 days after examinations

Even Semester

a) Theory

First, Second and Final Year (UG) : April 24, 2020 (Fri.) to May 04, 2020 (Mon.)
Third Year (UG) : April 15, 2020 (Wed.) to April 22, 2020 (Wed.)
First and Second Year (PG) : May 08, 2020 (Fri.) to May 16, 2020 (Sat.)

b) Practical

First, Second and Final Year (UG) : May 05, 2020 (Tue.) to May 16, 2020 (Sat.)
Third Year (UG) : April 23, 2020 (Thu.) to April 30, 2020 (Thu.)
First and Second Year (PG) : April 24, 2020 (Fri.) to May 07, 2020 (Thu.)

c) Evaluation & Declaration of Results : Within 45 days after examinations

Students Activities:-

- Orientation programme for new students : Three weeks of academic session
- Psychometric analysis :-
  1) Final year of under graduate, second year of Master and Ph. D. students – March
  2) S.Y., T.Y. UG and F.Y. of P. G. students – during PG orientation programme
  3) First year under graduate students – during UG orientation programme
- Sharing and physical data analysis : -
  1) First year of under graduate and first year of Master students – November
  2) Final year of under graduate and second year of Master students – April

Technological Association festivals :-

Festival	2019-20	2020-21
Funtech	Jan 3-14, 2019 (14th January non-instructional day)	Jan 3-14, 2020 (14th January non-instructional day)
Manzar (Intercollegiate Cultural Festival)	Jan 31 to February 03, 2019 (31st Jan & 1st Feb non-instructional days)	Jan 31 to Feb 03, 2020 (31st Jan & 3rd Feb non-instructional days)
Sportsaga (Intercollegiate Sports Festival)	March 14-24, 2019	March 14-24, 2020
Vortex (Intercollegiate Technical Festival)	Sept 30 to October 03, 2019 (30th Sept & 03rd Oct non-instructional days)	

Dean (Academic Programmes)

32

Figure 2.4a: Academic Calendar 2019-2020

INSTITUTE OF CHEMICAL TECHNOLOGY
ACADEMIC CALENDER 2020-21

The following shall be the academic calendar:

A) ODD SEMESTER

First Year (UG) : As per GoM directive
First Year (PG) : Nov 3, 2020 (Tue) to Feb 27, 2021 (Sat)
Final Year (PG) : Oct 01, 2020 (Thu) to Dec 31, 2020 (Thu)
Second, Third & Final Year (UG) : Aug 01, 2020 (Sat) to Dec 31, 2020 (Thu)

Diwali Vacation (UG and PG) : No Diwali vacation

MIDSEMESTER EXAMINATIONS

Second, Third & Final Year (UG) : Oct 01, 2020 (Thu) to Oct 07, 2020 (Wed)
First Year (PG) : Dec 28, 2020 (Mon) to Jan 2, 2021 (Sat)
First Year (UG) : As per GoM directive

END SEMESTER EXAMINATIONS

a) <u>Theory</u>

Second, Third & Final Year (UG) : Dec 15, 2020 (Tue) to Dec 23, 2020 (Wed)
First Year (PG) : Feb 22, 2021 (Mon) to Feb 27, 2021 (Sat)

b) <u>Practical</u>

All practical examinations timetable will be dealt separately as per prevailing situation.

c) Evaluation & Results : Within 45 days after examinations

B) EVEN SEMESTER

First Year (PG) : Mar 01, 2021 (Mon) to Jun 26, 2021 (Sat)
First Year (UG) : As per GoM directive
Final Year (UG & PG) : Jan 01, 2021 (Fri) to May 15, 2021 (Sat)
Second Year (UG & PG) : Jan 01, 2021 (Fri) to May 15, 2021 (Sat)
Third Year (UG) : Jan 01, 2021 (Fri) to May 15, 2021 (Sat)

MIDSEMESTER EXAMINATIONS

Second, Third, Final Year (UG) : Feb 19, 2021 (Fri) to Feb 26, 2021 (Fri)
First Year (UG) : As per GoM directive
Final Year (PG) : Feb 19, 2021 (Fri) to Feb 26, 2021 (Fri)
First Year (PG) Apr 26, 2021 (Mon) to May 3, 2021 (Mon)

END SEMESTER EXAMINATIONS

a) <u>Theory</u>

First Year (UG) : As per GoM directive
Second and Final Year (UG) : April 26, 2021 (Mon) to May 4, 2021 (Tue)
Third Year (UG) : April 16, 2021 (Fri) to April 23, 2021 (Fri)
Final Year (PG) : May 07, 2021 (Fri) to May 15, 2021 (Sat)
First Year (PG) Jun 24, 2021 (Thu) to Jun 30, 2021 (Wed)

b) <u>Practical</u>

First Year (UG) : As per GoM directive
Second and Final Year (UG) : May 05, 2021 (Wed) to May 10, 2021
Third Year (UG) : (Mon)
Final Year PG : April 26, 2021 (Mon) to April 30, 2021 (Fri)
First Year (PG) Apr 26, 2021 (Mon) to Apr 30, 2021 (Fri)
Jun 21, 2021 (Mon) to Jun 23, 2021 (Wed)

c) Evaluation & Results : Within 45 days after examinations

C) Summer Vacation : No summer vacation in 2021

Students Activities: No student activities till further notice.

Registrar

Figure 2.4b: Academic Calendar 2020-2021

Classroom discussion:

- Lecture notes are distributed as per the lesson plan
- Special attention is given to the students who are lagging behind
- Possibilities of computer-aided learning are always explored to assist students' learning
- Asking questions that engage students in innovative thinking or application of basic principles is encouraged

Use of Various instructional methods and pedagogical initiatives:

- The faculty is now oriented toward outcome-based education and are actively utilizing the OBE to cater to the learning need of students by innovative methods.
- The faculty of the department adopts various innovative Teaching & Learning methodologies to create the best learning environment for students. These methodologies include traditional blackboard teaching, presentations, video lecturing, collaborative learning methods, etc.
- Students' projects and seminar presentations, various modes of continuous assessment such as MCQ tests, Quiz, group discussion, skits, poster making, and ppt preparations on case studies, industrial visits, etc. help students to develop interpersonal skills, subject knowledge, team work, and peer learning or cooperative learning, problem-solving approach, etc.

Extramural Lectures:

Extramural lectures are presented by the students to help them to improve their presentation and public speaking skills. The student themselves select the topic, prepare slides and deliver the presentation to faculty and students.

ICT based learning:

The institute is equipped with a sufficient number of computers, LCD projectors, internet facility, application software, and system software which are effectively used for teaching and learning.

Self-Learning Courses:

The registration and participation of students in MOOC Courses like NPTEL, Coursera, and Edx are evidence of their self-learning capabilities

Project-based learning

The project-Based Learning is significantly more effective than traditional instruction to train competent and skilled practitioners and it promotes long-term retention of knowledge and skills. It is an innovative practice that is used to implement Outcome Based Education. The students are encouraged to carry out research projects in the final year. The faculty mentor and the students collectively identify the Projects based on societal needs and issues. At the end of the semester, projects are evaluated by industry personnel and external faculty members.

Collaborative learning

Through collaborative learning, students are exposed to learn various topics and hands-on experience in different laboratories, related to the program curriculum.

Assignments based problem solving:

Assignments are given to students on problems and they solve them by themselves. Assignments are based on COs which helps to achieve Program Outcomes.

Student feedback on the teaching-learning process and actions taken

- After the End-semester exams, all the students are required to undergo filling the online feedback form to apprise the faculty on a scale of 1 (low) to 5 (high).
- Based on the students' feedback, the HOD of the Department and senior Professors give valuable suggestions to improve the quality of teaching-learning wherever essential.
- Faculty development programs are conducted by professional experts to enhance the teaching skills of faculty.

Impact Analysis:

- Improvement in the communication skills of the students.
- Active involvement of weaker students in coaching classes is observed.
- More students have undergoing internships in industries at national and international levels.
- More students publications in national, and international conferences and journals.
- Improvement in students analytical capability, and soft skills in their placements.

2.2.2. Quality of end semester examination, internal semester question papers, assignments and evaluation (15) (Institute Marks 15)

The examinations are done at three levels: that is at least two class tests per course and one mid semester and one end semester exam are conducted. Though Mid and End semester examinations are purely written and practical examinations are based on experimentation followed by viva-voce, internal exams may include, seminar or topic presentations, skits, poster presentations, quizzes, etc. The questions set to the students are at three levels, knowledge and information level, justification and explanation level and last is comprehension and application for problem-solving. The whole syllabus till the last lecture becomes the syllabus for the test at a given time.

- The quality and the difficulty level of the question papers are adjusted based on the analysis of the performance of the students
- Each course typically has continuous assessment evaluations (typically 3 to 4) based on the short tests, quizzes, presentations, etc
- The question paper typically has distribution catered to test the basic understanding, problem-solving abilities as well as thinking capacity
- For some courses, group assignments are also given such that a team-building ability is developed. The presentations for the group are planned in such a way to test the understanding of all the team members
- After each midterm examination, the course instructor explains the model answers to the students and also tells the expectations for ideal solutions
- An audit committee comprising COEs from other universities/Institutes is constituted to oversee the exam quality.

End-Semester examination:

The semester-end examination covers the full syllabus of the course and is conducted as per the Institutional timetable at the end of each semester.

For end–semester examinations in theory papers, the duration of the examination are 1 hour for 3 credit courses and 2 hours for 4 credit courses

For the end semester evaluation of seminar/home paper, students are expected to submit a written report and also make a presentation. The evaluation is based on the quality of the written report and presentation.

The impact of the delivery of the course and course content is assessed in two ways:

1. Examination/evaluation conducted by the course teacher.
2. Students feedback about teacher and course.

Table 2.3: Weightages of different modes of assessments

	In Semester Evaluation		End Semester Exam	Components of Continuous Mode
	Continuous mode	Mid semester Exam		
Theory	20%	30%	50%	Quizzes, class tests (open or closed book), home assignments, group assignments, viva-voce, assignments, discussions.

Practical	50%	-	50%	Attendance, viva -voce, journal, assignments, project, experiments, tests

In-Semester Evaluation:

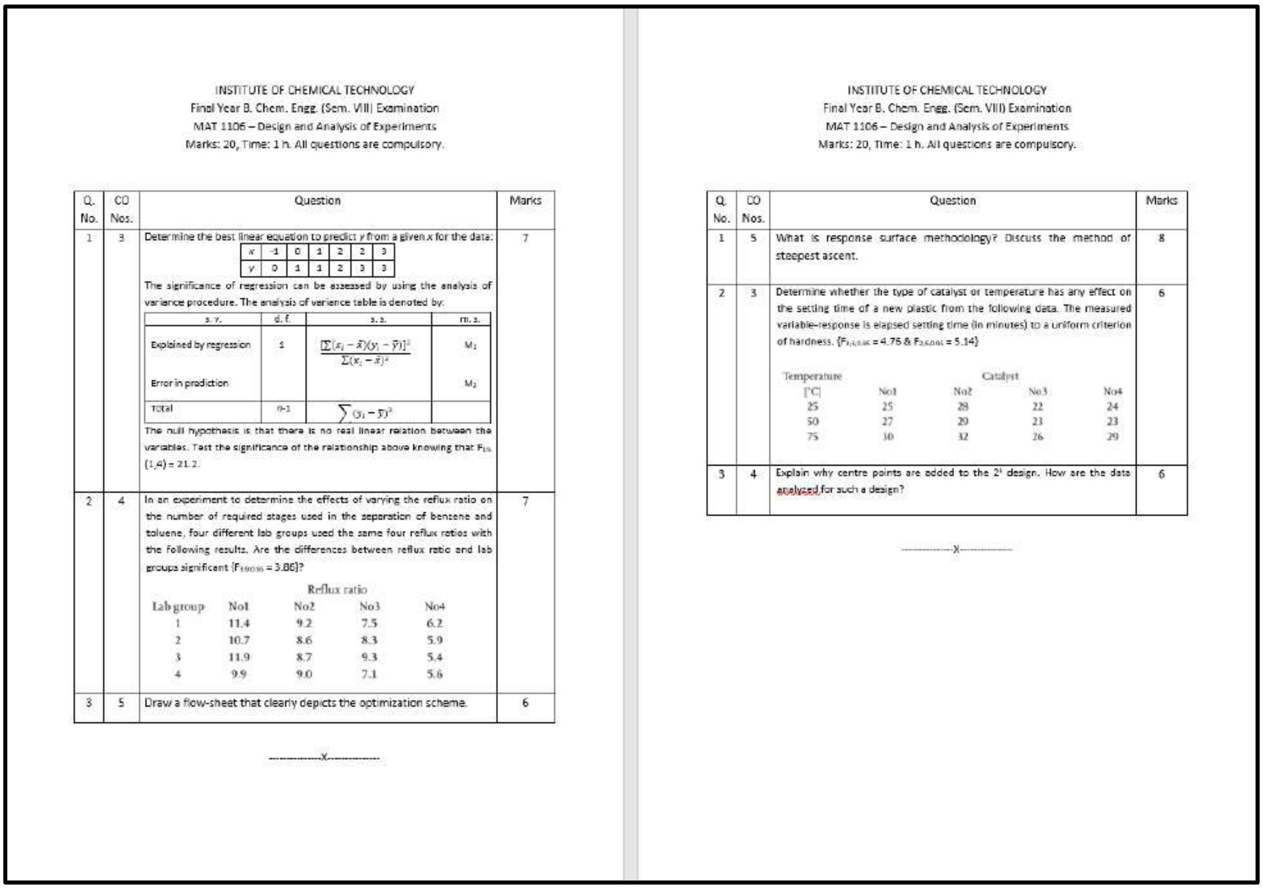
a) It is expected that the teacher would conduct at least two assessments under the continuous mode in a Semester.

b) The teacher announces at the beginning of the respective course the method of conducting the tests under the continuous mode and the assignment of marks.

c) In-semester performance of all students is displayed and sent to the academic office by the teacher at least 15 days before the end-semester examination.

d) For the theory courses, there is one mid-semester test for each course to be held as per the schedule fixed in the Academic Calendar.

e) For mid-semester examinations in theory papers, the duration of the examination is 1 hour for 3 credit courses and 2 hours for 4 credit courses



INSTITUTE OF CHEMICAL TECHNOLOGY
Final Year B. Chem. Engg. (Sem. VIII) Examination
MAT 1106 – Design and Analysis of Experiments
Marks: 20, Time: 1 h. All questions are compulsory.

Q. No.	CO Nos.	Question	Marks
1	3	Determine the best linear equation to predict y from a given x for the data: x: -1, 0, 1, 2, 2, 3 y: 0, 1, 1, 2, 3, 3 The significance of regression can be assessed by using the analysis of variance procedure. The analysis of variance table is denoted by: s.v. / d.f. / s.s. / m.s. Explained by regression / 1 / $\frac{[\sum(x_i-\bar{x})(y_i-\bar{y})]^2}{\sum(x_i-\bar{x})^2}$ / M_1 Error in prediction / / / M_2 Total / n-1 / $\sum(y_i-\bar{y})^2$ / The null hypothesis is that there is no real linear relation between the variables. Test the significance of the relationship above knowing that $F_{1\%}(1,4) = 21.2$.	7
2	4	In an experiment to determine the effects of varying the reflux ratio on the number of required stages used in the separation of benzene and toluene, four different lab groups used the same four reflux ratios with the following results. Are the differences between reflux ratio and lab groups significant ($F_{3,9,0.95} = 3.86$)? Reflux ratio Lab group / No1 / No2 / No3 / No4 1 / 11.4 / 9.2 / 7.5 / 6.2 2 / 10.7 / 8.6 / 8.3 / 5.9 3 / 11.9 / 8.7 / 9.3 / 5.4 4 / 9.9 / 9.0 / 7.1 / 5.6	7
3	5	Draw a flow-sheet that clearly depicts the optimization scheme.	6

--------------X--------------

INSTITUTE OF CHEMICAL TECHNOLOGY
Final Year B. Chem. Engg. (Sem. VIII) Examination
MAT 1106 – Design and Analysis of Experiments
Marks: 20, Time: 1 h. All questions are compulsory.

Q. No.	CO Nos.	Question	Marks
1	5	What is response surface methodology? Discuss the method of steepest ascent.	8
2	3	Determine whether the type of catalyst or temperature has any effect on the setting time of a new plastic from the following data. The measured variable-response is elapsed setting time (in minutes) to a uniform criterion of hardness. {$F_{3,6,0.05} = 4.76$ & $F_{2,6,0.05} = 5.14$} Temperature [°C] / Catalyst No1 / No2 / No3 / No4 25 / 25 / 28 / 22 / 24 50 / 27 / 29 / 23 / 23 75 / 30 / 32 / 26 / 29	6
3	4	Explain why centre points are added to the 2^k design. How are the data analyzed for such a design?	6

--------------X--------------

Figure 2.5: Sample End Semester Examination Question Paper

CET1402 – Separation Processes – Mid-Semester Examination
Marks: 30, Date: 1st Sep'2021, Time: 11 am – 1.15 pm.

Attempt any three questions.

Q1 a. Discuss mass transfer considerations and breakthrough curves in adsorption [6 m].

Q1 b. The following data were collected at T=25 ^{0}C for batch ultrafiltration of 2% BSA (mol. wt.=69,000 dalton) using a membrane of 10,000 dalton MWCO. The applied pressure difference was maintained constant at 27.1 kPa. *Calculate the membrane resistance and the cake resistance.* Assume complete rejection. The viscosity of water is 0.9 cP [4 m].

Time, s	11	19	31	42	52	61	72	83
$100\times J_W$ L/m^2-h	6.63	5.14	4.49	3.86	3.55	3.21	3.17	2.96

Q2 a. Differentiate between temperature swing adsorption and pressure swing adsorption [4 m].

Q2 b. It is desired to decolorize an oil sample (1.5 tonnes) using a new type of clay. The density of oil is 945 kg/m^3. The initial colour concentration of 59 units in the oil is to be reduced to 7 units. A series of lab-scale trials was performed to obtain adsorption equilibrium data. If Y and X^* denote the number of colour units per kg oil and the number of colour units per kg clay in equilibrium, a Henry's law type relation holds $Y = 3.3\times10^{-4} X^*$. The specific surface area of the solid adsorbent is 39 m^2/kg and the surface mass transfer coefficient is 4.6×10^{-3} mm/s (on the basis of the solid-phase concentration). *Find the minimum amount of the adsorbent required. Also, find the required contact time if 1.5 times the minimum amount of adsorbent is used* [6 m].

Q3 a. Differentiate between different general types of ion exchange resins [4 m].

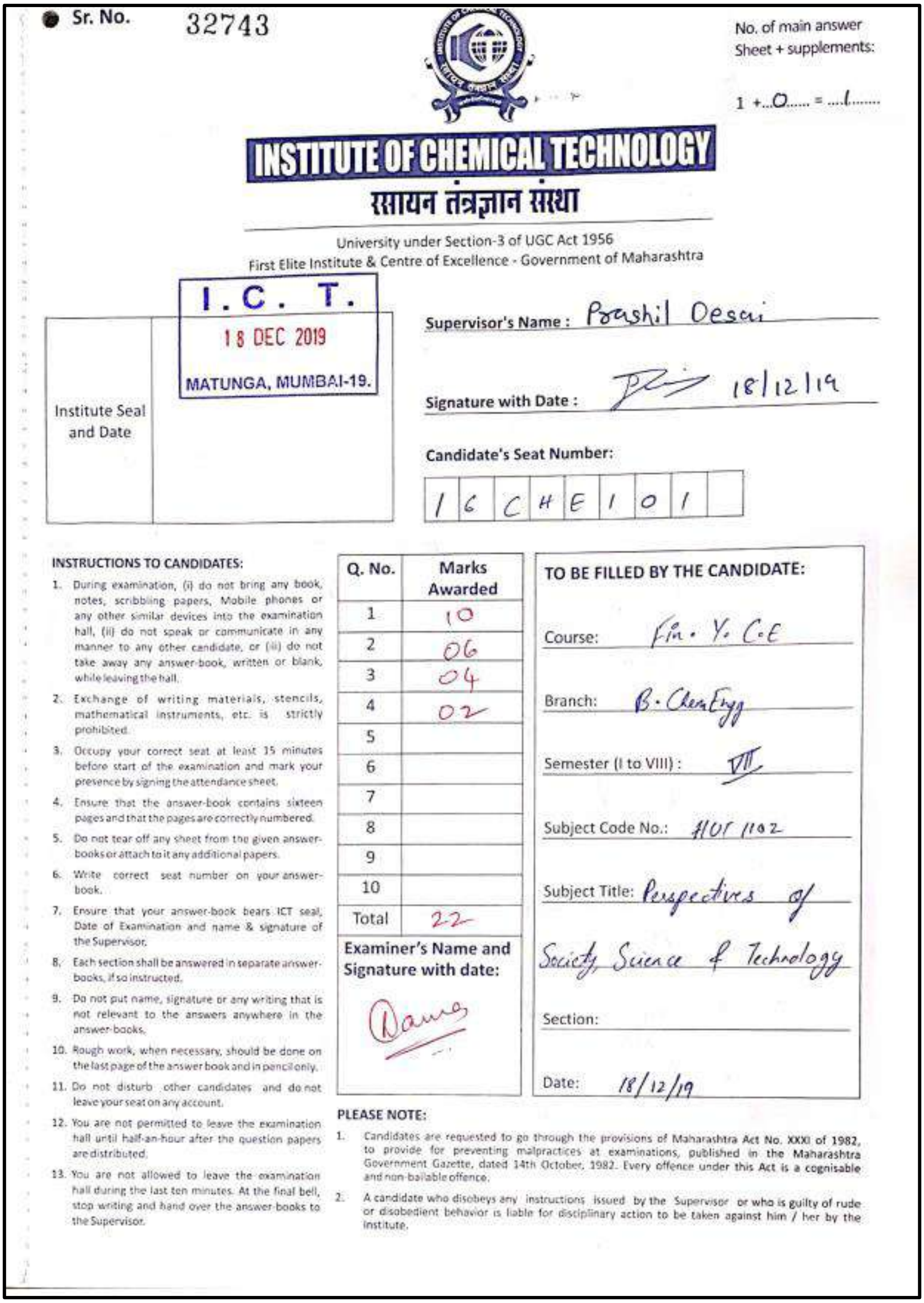
Q3 b. A solute-solid pair is to be tested in a pilot trial. The solid has a bulk density of 613 kg/m^3. A liquid (density = 976 kg/m^3) with 0.13% solute is to flow at 96 m^3/day. A superficial velocity of 1.8 mm/s and sorption capacity of 0.3 g-solute/g-solid are suitable. It is desired to have 51 h of time-on-stream before regeneration is necessary. Find the diameter of column and height of packing [6 m].

Q4 a. Using a suitable example, discuss how membranes can be applied for process intensification [4 m].

Q4 b. A macromolecular solution (mol. wt. = 6500; concentration = 1.2 mass%) is passed through a tubular ceramic UF membrane of 0.9 cm internal diameter and 1.1 m length at 27 ^{o}C. The membrane has a pure water permeability of 1.3 m^3/m^2-day-atm. Find the flow velocity to be maintained in the tube to prevent the formation of a gel layer on the membrane surface. Rejection coefficient R' = 0.99; applied pressure difference, ΔP = 1.6 bar; diffusivity of the solute, $D = 8.4\times10^{-7}$ cm^2/s; viscosity of the solution = 3.2 cP; density of the solution = 990 kg/m^3; concentration at which the solute forms a gel, C_g = 11%. Pore leakage and fouling may be ignored [6 m].

---------------X--------------

Figure 2.6: Sample Mid Semester Examination Question Paper



Sr. No. 32743

No. of main answer Sheet + supplements:

1 + 0 = 1

INSTITUTE OF CHEMICAL TECHNOLOGY

रसायन तंत्रज्ञान संस्था

University under Section-3 of UGC Act 1956

First Elite Institute & Centre of Excellence - Government of Maharashtra

I. C. T.

18 DEC 2019

MATUNGA, MUMBAI-19.

Institute Seal and Date

Supervisor's Name : Prashil Desai

Signature with Date : 18/12/19

Candidate's Seat Number:

1	6	C	H	E	1	0	1	

INSTRUCTIONS TO CANDIDATES:

1. During examination, (i) do not bring any book, notes, scribbling papers, Mobile phones or any other similar devices into the examination hall, (ii) do not speak or communicate in any manner to any other candidate, or (iii) do not take away any answer-book, written or blank, while leaving the hall.
2. Exchange of writing materials, stencils, mathematical instruments, etc. is strictly prohibited.
3. Occupy your correct seat at least 15 minutes before start of the examination and mark your presence by signing the attendance sheet.
4. Ensure that the answer-book contains sixteen pages and that the pages are correctly numbered.
5. Do not tear off any sheet from the given answer-books or attach to it any additional papers.
6. Write correct seat number on your answer-book.
7. Ensure that your answer-book bears ICT seal, Date of Examination and name & signature of the Supervisor.
8. Each section shall be answered in separate answer-books, if so instructed.
9. Do not put name, signature or any writing that is not relevant to the answers anywhere in the answer-books.
10. Rough work, when necessary, should be done on the last page of the answer book and in pencil only.
11. Do not disturb other candidates and do not leave your seat on any account.
12. You are not permitted to leave the examination hall until half-an-hour after the question papers are distributed.
13. You are not allowed to leave the examination hall during the last ten minutes. At the final bell, stop writing and hand over the answer-books to the Supervisor.

Q. No.	Marks Awarded
1	10
2	06
3	04
4	02
5	
6	
7	
8	
9	
10	
Total	22

Examiner's Name and Signature with date:

Dama

TO BE FILLED BY THE CANDIDATE:

Course: Fin. Y. C.E

Branch: B. Chem Engg

Semester (I to VIII) : VII

Subject Code No.: HUC 1102

Subject Title: Perspectives of Society Science & Technology

Section:

Date: 18/12/19

PLEASE NOTE:

1. Candidates are requested to go through the provisions of Maharashtra Act No. XXXI of 1982, to provide for preventing malpractices at examinations, published in the Maharashtra Government Gazette, dated 14th October, 1982. Every offence under this Act is a cognisable and non-bailable offence.
2. A candidate who disobeys any instructions issued by the Supervisor or who is guilty of rude or disobedient behavior is liable for disciplinary action to be taken against him / her by the Institute.

Figure 2.7: Sample answer booklet

2.2.3. Quality of student projects (15) **(Institute Marks 15)**

- All the student projects are relevant to the needs of Chemical Engineering.
- Students are encouraged to bring new dimensions to the project considering the latest trends.
- Periodic meetings are planned by each professor to check the progress of the project. The periodic evaluation helps the students to adjust the progress of the project and also ensure its correctness.
- Students are encouraged to the search the available e-resources to get the required information on Process design and economic analysis
- Students are also required to present a brief summary of the complete project and justify the feasibility of the project
- Project 1: Seminar ((Semester VII, CEP 1708, 2 Credits, 4 hours/week, 50 Marks) include the Literature Survey, Planning, and Cost estimation of the given topic.
- Project 2: Home Paper- I ((Semester VII, CEP 1709, 2 Credits, 4 hours/week, 50 Marks) includes the Literature Survey, Process & site selection block diagram, Kinetics & thermodynamic feasibility, Material & Energy Balance, Report Submission and Viva Voce.
- Project 3: Home Paper-II ((Semester VIII, CEP 1711, 3 Credits, 6 hours/week 50 Marks) includes the Sizing of all the equipment, Detailed mechanical design, one equipment fabrication, P & ID diagram, controls, safety costing, references, waste management system, Report Submission and Viva Voce.
- A typical Project Report consists of sections viz. Introduction, Literature Review, Process & site selection, block diagram, Kinetics & thermodynamic feasibility, material and energy balance, Sizing of all equipment, detailed mechanical design, P & ID diagram, controls, safety, waste management system, Cost Estimation, Summary, and Conclusion.
- The Final report is evaluated by one External and one Internal Examiner and the students defend their Project work in front of batch mates and faculty.

Table 2.4: Rubrics for evaluation of Seminar (Project I)

Item	Assessment criterion	Marks
Report	Technical content and completeness of report	/15
	Bibliography, illustration of table/ figures	/10
	Summary/ Conclusions	/05
Presentation (Average of both faculty)	Clarity of presentation	/10
	Presentation skill	/05
	Question and Answer	/05
	Total	**/50**

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Bachelor of Chemical Engineering

Evaluation of Project- I (seminar) by the Internal and External Examiner

Date of Presentation:	**Dec 23,2021**
Name of the student:	Geet Arun Chheda
Name of the Research Supervisor:	Dr. Sachin Vijay Jadhav
Degree:	Bachelor of Chemical Engineering
Title of the Project:	-
Department:	Department of Chemical Engineering

Sr No.	Assessment Criterion	Marks (Total 50)
1	Technical Content and Completeness of report	15/15
2	Bibliography, illustration of table/Figures	9/10
3	Summary/conclusions	5/5
4	Clarity of presentation	9/10
5	Presentation skill	5/5
6	Question and Answer	5/5
	Total marks (out of 50) :	**48/50**
Outstanding: 100%-90%; Excellent: 89.99%-80%; Very Good: 79.99%-70%; : 69.99%-60%; Reasonable: 59.99%-50% (these are only guidelines)		

Recommendation (please choose ONE):

The report submitted (Project- I (seminar)) by the candidate is:

1. Acceptable, and may be regarded as final in the present form.
2. Acceptable with minor revisions. The revisions have been indicated to the student during the presentation.

Figure 2.8: Sample evaluation of Seminar (Project I)

Table 2.5: Rubrics for evaluation of Home Paper I (Project II)

Sr. No.	Item	Marks
1	Compound overview	/5
2	Literature, process and site selection	/10
3	Material and Energy balance	/10
4	Report writing as per instruction	/5
5	Presentation (Average of two examiners)	/20
	Total	/50

Table 2.6: Rubrics for evaluation of Home Paper II (Project II)

Sr. No.	Item	Marks
1	Design Protocol and its correctness	/10
2	Process control and waste management	/8
3	Safety analysis and cost estimation	/7
4	Report writing as per instruction	/5
5	Presentation (Average of two examiners)	/20
	Total	/50

INSTITUTE OF CHEMICAL TECHNOLOGY

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Ph: +91-22-33611111/2222, Fax: +91-22-33611020, www.ictmumbai.edu.in

Bachelor of Chemical Engineering

Evaluation of Home Paper Submission 2 by the Internal and External Examiner

Date of Presentation:	**Dec 03,2020**
Name of the student:	Akshaykumar Dundappa Bhangari
Name of the Research Supervisor:	Sachin Vijay Jadhav
Degree:	Bachelor of Chemical Engineering
Title of the Project:	-
Department:	Department of Chemical Engineering

Sr No.	Assessment Criterion	Marks (Total 50)
1	Compound overview	5/5
2	Literature, process and site selection	9/10
3	Material and energy balance	9/10
4	Report writing as per instructions	4/5
5	Presentation (Average of two examiners)	17/20
	Total marks (out of 50) :	**44/50**
Outstanding: 100%-90%; Excellent: 89.99%-80%; Very Good: 79.99%-70%; : 69.99%-60%; Reasonable: 59.99%-50% (these are only guidelines)		

Recommendation (please choose ONE):

The report submitted (Home Paper Submission 2) by the candidate is:

1. Acceptable, and may be regarded as final in the present form.
2. Acceptable with minor revisions. The revisions have been indicated to the student during the presentation.

Figure 2.9: Sample evaluation of Home Paper submission I (Project II)

INSTITUTE OF CHEMICAL TECHNOLOGY

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Ph: +91-22-33611111/2222, Fax: +91-22-33611020, www.ictmumbai.edu.in

Bachelor of Chemical Engineering

Evaluation of Project Iv : Home Paper - Iv by the Internal and External Examiner

Date of Presentation:	**Apr 04,2022**
Name of the student:	Naresh Khushalchand Dhanwani
Name of the Research Supervisor:	Dr. Sachin Vijay Jadhav
Degree:	Bachelor of Chemical Engineering
Title of the Project:	-
Department:	Department of Chemical Engineering

Sr No.	Assessment Criterion	Marks (Total 50)
1	Design Protocol and its correctness	10/10
2	Process Control and Waste management	8/8
3	Safety analysis and cost estimation	6/7
4	Report writing as per instructions	4/5
5	Presentation (Average of two examiners)	18/20
	Total marks (out of 50) :	46/50
Outstanding: 100%-90%; Excellent: 89.99%-80%; Very Good: 79.99%-70%; Good: 69.99%-60%; Reasonable: 59.99%-50% (these are only guidelines)		

Recommendation (please choose ONE):

The report submitted (Project Iv : Home Paper - Iv) by the candidate is:

1. Acceptable, and may be regarded as final in the present form.
2. Acceptable with minor revisions. The revisions have been indicated to the student during the presentation.

Figure 2.10: Sample evaluation of Home Paper submission II (Project II)

Table 2.7: Rubrics for evaluation of Home Paper I (Final Submission)

Sr. No.	Name of student	Report						Viva (50)	Total (100)	Examiner
		Literature, process and site selection (10)	Material & energy balance (10)	Design of equipment (10)	Process flow diagram and Instrumentation (05)	Project cost estimation & environment analysis (10)	Overall Impression (5)			
1										**Internal**
										External
2										
3										

Title of the Home Paper

Home Paper submitted to the

INSTITUTE OF CHEMICAL TECHNOLOGY, MUMBAI

for the award of the degree of

Bachelor of Chemical Engineering

by

NAME OF STUDENT

Department of Chemical Engineering

Institute of Chemical Technology, Mumbai

(University under Section 3 of UGC Act 1956;
Elite Status and Centre of Excellence, Government of Maharashtra)

Maharashtra, India

June 2020

Initial of supervisor (VKR)

Figure 2.10: Sample Home Paper submission front page

Institute of Chemical Technolgy, Matunga, Mumbai

B.Chem. Engg. Sem. VIII Exam. April/May 2022

Home paper Viva Voce Examination

Day & Date: **Saturday, 30 April 2022**

Time	Gr. 1	Gr. 2	Gr. 3	Gr. 4	Gr. 5	Gr. 6	Gr. 7	Gr. 8	Gr. 9	Gr. 10	Gr. 11	Gr. 12	Gr. 13	Gr. 14
Venue	CE Office	AVP Office	AWP Office	GDY Office	KVM Office	Process control	PRG Office	CE Office	PKG Office	SSB Office	Process Control	VGG Office	CE Office	Visiting Faculty 1
Examiners	ABP/KS	AVP/MT	AWP/MK	GDY/VS	KVM/JP	MDY/AS	PRG/MB	PDV/RD	PKG/SM	SSB/KR	SVJ/OG	VGG/PG	VKR/MP	VHD/VM
9.30 to 10.30	S. Swain T. Apte	S. G. Shinde H. Naboothiri	S. Jamal V. Inamdar	A. Pinjari A. Naik	V. Varude A. Khodke	P. Sambharkar A Sadotra	N. Dias A. Ratnagopal	S. Pawara A Farkate	A. Patil T. Abhyankar	D. Dhande T Kothawade	A. Suryavashi S Mali	T. Waradkar D. Raut	R. Mehendale N Hemadri	A. Rathi R. Dumasia
Break														
Examiners	ABP/VM	AVP/KS	AWP/MT	GDY/MK	KVM/VS	MDY/JP	PRG/AS	PDV/MB	PKG/RD	SSB/SM	SVJ/KR	VGG/OG	VKR/PG	VHD/MP
11.00 to 12.00	G. Cheeda K Jakhotiya	S. Dadmal A. Tiwari	H. Shardul M Shrinivas	A. Gubbala S Acharya	A. Sonavane A. Gedam	B. Prasad M Kumrawat	O. Tubhe S Kadam	K. Pandey S Petare	M. Kulmathe A. Pawar	A. Razdan S Chaudhari	A. Avhad S. Varunkar	T. Javdekar A Murudkar	S. Sonti A. Ambatkar	A. Mali J. Saraogi
Break														
Examiners	ABP/MP	AVP/VM	AWP/KS	GDY/MT	KVM/MK	MDY/VS	PRG/JP	PDV/AS	PKG/MB	SSB/RD	SVJ/SM	VGG/KR	VKR/OG	VHD/PG
12.15 to 1.15	B. Jain Y. Butale	A. U. Patil M Shah	K. Dwivedi M Rawlani	A. Shirwalkar	G. Chikarmane S. Shinde	S. Ramkrishna	D. Parab N Dhanwani	A. Jain V Puri	A. Chaugule	V. Raina D. Parvani	Y. Bartakke D. shinde	V. Bhalekar S. Singh	N. Sangle S. Bhalekar	S U Kadam
Lunch														

ABP - A. B. Pandit	PDV - P. D. Vaidya	KS - K Sahasranaman	RD - R. M. Desai
AVP - A. V. Patwardhan	PKG - P. K. Ghosh	MT - Milind Talathi	SM - Sanjay Mande
AWP - A. W. Patwardhan	SSB - S. S. Bhagwat	MK - Manoj Kharkar	OG - O. P. Goyal
GDY - G. D. Yadav	SVJ - S. V. Jadhav	VS - V Subramanian	KR - K. Ravi
KVM - K. V. Marathe	VGG - V. G. Gaikar	JP - Janki Patwardhan	PG - Pradnya Gune
MDY - M. D. Yadav	VKR - V. K. Rathod	AS - Anirudh Shenvi	MP - M. Palekar
PRG - P. R. Gogate	VHD - V. H. Dalvi	MB - Manish Bhole	VM - Vinayak Marathe

Figure 2.11: Sample Home Paper Viva Voce Examination with externals (2022)

Table 2.8a: List of B. Chem. Engg. Seminar 2019-2020

Sr. No.	Student Name	Topic	Guide
16CHE101	Aadesh Satish Bhakkad	Process intensification of biogas generation from municipal solid waste	Prof. V. G. Gaikar
16CHE102	Aagamkumar Kirtikumar Khandor	Regeneration of Activated Carbon	Dr. V. H. Dalvi
16CHE104	Abhinav Vivek Handu	Mineralisation of salicylic acid by catalytic ozonation	Prof. K. V. Marathe
16CHE105	Aditi Anil Sawant	Review of applications of reaction calorimetry in chemical engineering and process safety	Prof. P. K. Ghosh
16CHE106	Aditya Dilip Phad	Valorisation methods of surplus activated sludge	Dr. S. V. Jadhav
16CHE107	Akash Sanjay Nogaja	Life cycle analysis: A tool for sustainability	Prof. K. V. Marathe
16CHE108	Akshay Suhas Patil	Soil Fertility Evaluation techniques/Analysis	Prof. A. B. Pandit
16CHE109	Amitej Nageswara Neti	Design guidelines of rising film evaporators	Dr. C. S. Mathpati
16CHE110	Amogh Sandip Nagarkar	Concrete Admixtures	Dr. S. V. Jadhav
16CHE111	Amol Bharat Khatke	Mathematical models to predict stability of probiotics	Dr. R. D. Jain
16CHE112	Amrut Deepak Bagdi	Solid Fuel Based boilers: Comparison between Coal and Biomass Pellets	Prof. A. B. Pandit
16CHE113	Aniket Jayendra Murumkar	Improvements in photocatalytic reactions	Prof. P. R. Gogate

16CHE114	Aniket Sonba Pote	Sustainable production of zeolites	Prof. P. D. Vaidya
16CHE115	Anirudh Venkatesh	Metal organic framework for separation of compounds	Prof. V. K. Rathod
16CHE116	Ankit Sanjay Gaikwad	Recent Advances in living radical polymerization	Prof. A. W. Patwardhan
16CHE117	Anu Sanjay Deshmukh	Review of emerging applications of graphene	Prof. P. K. Ghosh
16CHE118	Ashin Antony Sunny	Review of Biomass-to-Liquid Technologies	Prof. A. M. Lali
16CHE119	Ashish Shyam Tangade	Two Stage Anaerobic Digestion	Dr. V. H. Dalvi
16CHE120	Asmee Maruti Prabhu	Recovery of organic acids from dilute aqueous streams	Dr. C. S. Mathpati
16CHE121	Avinash Suresh Nayak	Critical review of green solvent-free synthesis of active pharmaceutical ingredients (API).	Prof. A. V. Patwardhan
16CHE122	Bharthi Ponrathnam	Deep Shaft Aerators for Wastewater Secondary Treatment	Dr. V. H. Dalvi
16CHE123	Bosco Johny	Dry anerobic digestion	Prof. S. S. Bhagwat
16CHE124	Kaustubh Chaitanya Rane	Ultra-fine grain steel	Prof. K. V. Marathe
16CHE125	Chinmay Vidyadhar Mhatre	Direct air carbon capture technologies	Dr. S. V. Jadhav
16CHE126	Darshana Uttam Malusare	Bioreactor process parameters and its impact on mAb production	Dr. R. D. Jain
16CHE127	Dhiraj Manoj Jain	Silane based surfactants	Prof. S. S. Bhagwat
16CHE128	Dishit Pankaj Ghumra	Recent advances in effluent treatment options in	Prof. P. R. Gogate
16CHE129	Dnyanesh Deepak Sarawate	Recent advances in hydro-desulfurization catalysts	Prof. P. D. Vaidya
16CHE130	Eashaan Girish Godbole	Climate change mitigation potential of carbon capture and utilization in the chemical industry	Prof. P. K. Ghosh
16CHE131	Gaurav Vasudevan Mampally	Foam synthesis from bio-based polyols	Prof. S. S. Bhagwat
16CHE132	Gautami Rajendra Kelkar	Al-beta zeolites for important acid and redox catalysed reactions.	Prof. G.D. Yadav
16CHE133	Harshada Gangaram Gabhale	Turing Structures	Dr. V. H. Dalvi
16CHE134	Kalash Rajendra Pai	Techno Economic evaluation of Biomass valorisation option	Prof. A. B. Pandit
16CHE135	Kaushal Sanjayrao Kaloo	CFD Modeling of spiral membrane modules	Prof. A. W. Patwardhan
16CHE136	Keith Anthony Dsouza	Advances in Covalent organic frameworks (COF)	Prof. G.D. Yadav
16CHE139	Malhar Satish Mankar	Application of AI in structural product design	Prof. V. G. Gaikar
16CHE140	Mihir Mahendra Kulkarni	Recent development in synthesis of m-aminophenol	Prof. L. K. Mannepalli
16CHE141	Monik Sanjay Magiya	Cracking of waste polyethylene	Prof. A. M. Lali
16CHE142	Naman Anil Joshi	3D Printing of pharmaceutical products	Dr. R. D. Jain
16CHE143	Namita Nitin Jadhav	Flurinated surfactants - properties and substitutes	Prof. S. S. Bhagwat

16CHE144	Nayantara Rajendra Pradhan	Surfactants for rare earth separations	Prof. S. S. Bhagwat
16CHE145	Ninad Chandrakant Khelukar	Why and How of Protein Engineering	Prof. A. M. Lali
16CHE146	Nishant Narendra Pardeshi	Moving bed reactors: Challenges and progress	Prof. P. D. Vaidya
16CHE147	Ojaswi Sandeep Rathi	Measurement and prediction of flow patterns in packed beds	Prof. A. W. Patwardhan
16CHE148	Prathamesh Milind Bolaj	Merits of single site gold catalysts	Prof. G.D. Yadav
16CHE149	Pujit Sunil Juneja	Recent technologies for process intensification of reversible reactions	Dr. C. S. Mathpati
16CHE150	Raunak Shiocharan Balkote	Process intensification in production of p-hydroxy acetphenone	Prof. L. K. Mannepalli
16CHE151	Razeen Ramzan Shaikh	Solid-liquid separation in continuous hydrogenation processes	Dr. C. S. Mathpati
16CHE152	Rounak Vinod Naryani	Challenges and opportunities for bio-oil refining	Prof. P. D. Vaidya
16CHE153	Saagar Shaival Gandhi	Process for synthesis of 1,2-pentanediol	Prof. L. K. Mannepalli
16CHE154	Saaksshi Chandrashekhar Tenpe	Metal Erosion by Hydrodynamic Cavitation	Prof. A. B. Pandit
16CHE155	Sahil Vasantrao Ghormare	Mass transfer aspects of super/sub critical extraction of natural products	Prof. V. K. Rathod
16CHE156	Sahil Surendra Khatavkar	Critical review of Grignard chemistry in process development of active pharmaceutical ingredients (API).	Prof. A. V. Patwardhan
16CHE157	Sai Mukund Nazare	Smart bio manufacturing and plug and play manufacturing plants	Dr. R. D. Jain
16CHE159	Shalaka Sunil Dhande	Numerical studies in tidal turbine designs	Dr. C. S. Mathpati
16CHE160	Shital Vikas Suryavanshi	Selective hydrogenation of carboxylic acid derivatives using novel catalysts	Prof. G.D. Yadav
16CHE161	Shivani Uday Kulkarni	Recent advances in synthesis of biodiesel based	Prof. P. R. Gogate
16CHE162	Shivani Krishna kumar Bisen	Rectors for Enzyme catalysed reactions	Prof. V. K. Rathod
16CHE163	Shreekant Sudheer Gokhale	Critical review of hydride reductants alternative to lithium aluminium hydride.	Prof. A. V. Patwardhan
16CHE164	Shriram Rajendra Chavan	CRISPR-Cas Technology: An Overview	Prof. A. M. Lali
16CHE165	Shubham Ashokrao Shinde	Recent advances in synthesis processes for micr	Prof. P. R. Gogate
16CHE166	Shubham Gangaram Ravan	Advance ceramic fibres	Prof. K. V. Marathe
16CHE167	Shubham Pradip Adarkar	Kinetics of polymerization of Acrylonitrile	Prof. A. W. Patwardhan
16CHE168	Siddhesh Dilip Sarda	Recent developments in Energy storage in solar power	Prof. V. G. Gaikar
16CHE169	Snehal Sanjay Patil	Recent advances in treatment of frac water	Prof. P. R. Gogate
16CHE170	Sreejith Thampan Nair	Determination of Hydrophobicity of Immersed Surfaces	Dr. V. H. Dalvi

16CHE171	Surabh Santhosh K	Artificial intelligence in chemical synthesis	Prof. V. G. Gaikar
16CHE175	Suyog Girish Shaha	Bolaform surfactants - synthesis, properties and applications	Prof. S. S. Bhagwat
16CHE176	Vaishnavi Girish Honavar	Alternative to Protein A chromatography for mAb purification	Dr. R. D. Jain
16CHE177	Vartul Jain	Synthesis and purification of anticancer drugs	Prof. V. G. Gaikar
16CHE179	Vidit Vivek Shah	Critical review of enantio-selective achiral ketones to corresponding chiral non-racemic alcohols.	Prof. A. V. Patwardhan
16CHE181	Vishal kumar Binay	Design aspects of fire heaters	Prof. V. K. Rathod
16CHE182	Yash Manoj Budhe	Overview of the TRIZ methodology and its application in inventive problem solving	Prof. P. K. Ghosh
14CHE1062	Rohan Rajesh Parlikar	Role of surfactants in polyurethanes	Prof. S. S. Bhagwat
15CHE1087	Rupanshi Anand	Removal of fluoride form ground water by adsorption	Prof. K. V. Marathe

Table 2.8b: List of B. Chem. Engg. Seminar 2020-2021

Roll No	**Student Name**	**Topics**	**Guide**
17CHE101	Junaid Gul Naikoo	Root cause of pitting and its prevention.	Prof. K. V. Marathe
17CHE104	Abhishek Kundu	Process design and optimization of vibratory fluidized bed dryer	Dr. C. S. Mathpati
17CHE105	Abhishek Bhardwaj	Photocatalysis by graphite carbon nitride	Prof. G. D. Yadav
17CHE106	Aditya Hemant Jain	One dimensional modelling of blood flow in the cardiovascular system	Dr. C. S. Mathpati
17CHE107	Aishwarya Suhas Khandekar	C-C coupling by homogenous catalysis	Prof. L. K. Mannepalli
17CHE108	Akshaykumar Dundappa Bhangari	Corrosion and its prevention in high pressure, high temperature reactor.	Prof. K. V. Marathe
17CHE109	Alankrita Shreekant Patil	Transitions in petroleum product utilization	Prof. S. S. Bhagwat
17CHE110	Amitkumar Harigovind Chauhan	Kinetics and thermodynamics aspects of enzyme catalysed reactions	Prof. V. K. Rathod
17CHE111	Aniket Rajay Surwade	Risk management in supply chain	Prof. V. G. Gaikar
17CHE112	Ankit Balkrishna Kolpe	Combustible dust and safety measures	Prof. V. G. Gaikar
17CHE113	Anosh Mehernosh Dumasia	Critical Review on C-N Coupling reactions	Prof. L. K. Mannepalli
17CHE114	Apurva Ajay Pawar	Industrial Reactor safety	Prof. V. K. Rathod
17CHE115	Arya Kirti Pavani	Chiral synthesis of API	Prof. A. B. Pandit
17CHE116	Ashlesha Girish Tiple	Regime map for liquid-liquid two phase flow in micro channels	Prof. A. W. Patwardhan
17CHE117	Ashutosh Arvind Kulkarni	Review of face mask technology and	Prof. P. K. Ghosh

17CHE118	Atharva Vijay Suryavanshi	Selective halogenation of aromatic compounds	Prof. S. S. Bhagwat
17CHE119	Burhanuddin Husain	Recent advances in venturi scrubbing for dust collection	Dr. C. S. Mathpati
17CHE120	Burhanuddin Esmail Samiwala	Recent advancement in Heterogenous Catalysis	Prof. L. K. Mannepalli
17CHE121	Chinmay Prasad Deshpande	Mathematical modelling and simulation of bag filters	Dr. C. S. Mathpati
17CHE122	Chinmayee Pradeep Sarode	Improved Synthesis of microspheres for food technology applications	Prof. P.R. Gogate
17CHE123	Chirag Mandar Mule	Compressed Biogas	Dr. V.H. Dalvi
17CHE124	Chirag Sanjay Jain	monoterpenoid based perfumery compounds	Prof. A. V. Patwardhan
17CHE125	Dev Pramod Malu	Contact angle and line tension	Dr. V.H. Dalvi
17CHE126	Gautam Manoj Borkar	Advances in dry reforming	Dr. S. V. Jadhav
17CHE127	Harsh Prakash Solanki	Machine learning for catalyst design and discovery	Dr. M. D. Yadav
17CHE128	Himanshu Prashant Sail	Rain - Water Harvesting Options: Quantitative Analysis	Prof. A. B. Pandit
17CHE129	Hrishikesh Girish Mane	Augmented reality in Chemical process safety	Prof. V. G. Gaikar
17CHE130	Hritik Rakesh Jain	Critical review of chemistry aspects of hydrogenation/reduction in vitamin manufacture	Prof. A. V. Patwardhan
17CHE131	Jay Dinesh Sankhe	Li-ion battery recycling: key issues and challenges	Dr. M. D. Yadav
17CHE132	Joel Biju	Synthesis of transparent superhydrophobic coatings and their	Prof. G. D. Yadav
17CHE133	Kshitija Dipak Waikar	Overview of TRIZ methodology and its application in chemical industry	Prof. P. K. Ghosh
17CHE134	Kunal Pralhad Magare	Kinetics and thermodynamics aspects of adsorbents for natural gas for vehicular application	Prof. A. W. Patwardhan
17CHE135	Lakshay Vashist	Digital reliability for process optimization and safety	Prof. V. G. Gaikar
17CHE136	Madhur Ramesh Khadke	Technics for separation of hydroquinone and catechol	Prof. V. K. Rathod
17CHE137	Mahesh Subhash Patil	Advances in Lyophilization process for bio molecules	Dr. R. D. Jain
17CHE138	Makarand Ravindra Jagtap	Improvement in delignification process	Prof. P.R. Gogate
17CHE139	Mayur Surendra Pimpalkar	Biohydrogen Production from Organic Waste	Prof. P.D. Vaidya
17CHE140	Merul Ritesh Shah	Mathematical modelling of aerosol transport: coughing and sneezing	Dr. C. S. Mathpati
17CHE142	Neha Rajendra Gadekar	Combined power and cooling cycles	Prof. S. S. Bhagwat
17CHE143	Niraj Devdas Bhavar	Sonochemistry in Biotechnology	Prof. P.R. Gogate
17CHE144	Nirmit Shantilal Solanki	Hard surface, foods and human skin decontamination formulations for SARS- CoV-2	Prof. S. S. Bhagwat
17CHE145	Nitin Ramchandra Karande	Technoeconomic feasibility of hydrogen storage method	Prof. A. W. Patwardhan

17CHE146	Omkar Narayan Korke	Biochemical Conversion of Microalgae Biomass into Biofuel	Prof. P.D. Vaidya
17CHE147	Palkit Vinod Shahdadpuri	Corrosion prevention methods in underground pipes for gasoline.	Prof. K. V. Marathe
17CHE148	Pranav Vinayak Mhatre	Production of Chemicals from Chemical Looping Conversion of Gaseous and Liquid Fuels	Prof. P.D. Vaidya
17CHE149	Prasanna Prasad Khare	Types and prevention of corrosion in cooling water systems.	Prof. K. V. Marathe
17CHE150	Prateek Shriram Badgujar	Recent Development on C-H Coupling by Heterogenous catalysis	Prof. L. K. Mannepalli
17CHE151	Priyanka Subhash Humane	Recent development in precision farming	Dr. S. V. Jadhav
17CHE152	Purva Harshad Paranjape	Recovery of rare earths and precious metals from E-waste	Dr. M. D. Yadav
17CHE153	R Ramya Ragunathan	Critical review of membrane applications in pharma industry, including the effluent treatment	Prof. A. V. Patwardhan
17CHE154	Rajarshi - Samajdar	Review of advances in industrial wastewater treatment and recycle	Prof. P. K. Ghosh
17CHE155	Rasik Gurunath Wathare	Recent advances in catalytic oxidation process of p-xylene	Dr. M. D. Yadav
17CHE156	Rushikesh Gorakhnath Rathod	Cellulase Enzymes: Production and Application	Dr. V.H. Dalvi
17CHE157	Salil Sandeep Narvekar	Review of innovations in the use of edible containers and cutlery advances in face mask sterilization and reuse	Prof. P. K. Ghosh
17CHE158	Sanil Govind Yadav	Noble metal-free electrocatalysts for water splitting applications	Prof. G. D. Yadav
17CHE160	Saurabh Sukhadeo Bagal	Progress toward Applications of Perovskite Solar Cells	Prof. P.D. Vaidya
17CHE161	Shantanu Sanjay Shembade	Corrosion in oil wells.	Prof. K. V. Marathe
17CHE163	Shruti Unnikannan	Hyper-branched lignin derivatives: Synthesis and applications	Prof. G. D. Yadav
17CHE164	Shubham Gangaram Wanje	Design of Domestic Air purifiers	Prof. A. B. Pandit
17CHE165	Srushti Sanjeev Kumar Sindagi	Economics of biopharmaceutical production	Dr. R. D. Jain
17CHE166	Siddhant Sanjay Mehta	Critical review of case studies in crystallization and polymorphism in active pharmaceutical ingredients	Prof. A. V. Patwardhan
17CHE167	Siddhi Santosh Kotnis	Use of artificial intelligence in plant maintenance	Dr. S. V. Jadhav
17CHE168	Sriram Pramod Tendulkar	Biomass Pre-treatment for Anaerobic Digestion	Dr. V.H. Dalvi
17CHE169	Sukhada Sanjeev Gharat	Composite phase change materials for thermal energy utilization	Prof. G. D. Yadav
17CHE170	Sumant Yogesh Salphale	Co-pyrolysis of Plastic and Biomass	Prof. A. B. Pandit
17CHE171	Tanmay Nagesh Salvi	Non-classical crystal growth of organic materials	Dr. M. D. Yadav
17CHE172	Tushar Pyarelal Chaudhari	Biojet and Biogasoline Fuel Production from Castor Oil	Prof. P.D. Vaidya

17CHE173	Uma Gopinath Kulkarni	Recent development in separation of heat sensitive biomaterials	Prof. V. K. Rathod
17CHE174	Vedant Kiran Wankhede	Machine Learning for drug discovery	Dr. R. D. Jain
17CHE175	Vipul Moreshwar Karekar	Recent development in fire retardants	Dr. S. V. Jadhav
17CHE176	Yash Ghanashyam Barhate	IoT in biomanufacturing and smart biofactory	Dr. R. D. Jain
17CHE177	Yashraj Sanjay Jagtap	Ultrasound application in Medicine	Prof. P.R. Gogate
17CHE178	Siddharth Gautam Vaishnav	Critical review of Chemistry aspects of Emu oil and similar other oils, and their applications	Prof. A. V. Patwardhan
17CHE179	Samiksha Jugalkishore Asawa	Fluidized Bed Pyrolysis of Biomass	Prof. A. B. Pandit
17CHE180	Riddhesh Nitin Kumtakar	Microbial Fuel Cell	Dr. V.H. Dalvi
17CHE181	Meenal Shyam Rathi	Boiling in microchannels	Prof. A. W. Patwardhan
17CHE182	Sarvesh Subhash Pandey	Role of Microwaves in Heterogenous reaction	Prof. V. K. Rathod
16CHE137	Kovi Rishya Shrung	Exergetic comparison of various types of thermal power plants	Prof. S. S. Bhagwat
16CHE174	Sushmita Shekhar Khole	Ethylene ethane separation by membranes - Recent Advancement	Prof. A. W. Patwardhan

Table 2.8c: List of B. Chem. Engg. Seminar 2021-2022

Roll No	**Student Name**	**Topic**	**Guide**
18CHE101	Arun Sadotra	Bioreactors for COVID vaccine manufacturing	Prof. V. G. Gaikar
18CHE102	Shikhar Dinesh Singh	Hydrogen peroxide free from metals and organics	Prof. S. S. Bhagwat
18CHE103	Tanmay Nitin Kothawade	Recent advances in membranes for organic solvent nanofiltration	Prof. A. V. Patwardhan
18CHE104	Vrushali Rajendra Varude	Electrochemical CO2 Reduction	Dr. V.H. Dalvi
18CHE105	Shekhar Ganapati Shinde	Design aspects of Impinging Jet Crystallizers	Prof. A. W. Patwardhan
18CHE106	Vaishnavi Rajendra Bhalekar	Techno-economic evaluation of alternatives for drying of organic solvents	Prof. A. W. Patwardhan
18CHE107	Aditya Rajesh Gedam	Recent advances in Graphitic Carbon Nitride based photocatalytic materials	Dr. M. D. Yadav
18CHE108	Tanvi Swapnil Varadkar	Recent advances in spray drying for pharmaceuticals	Dr. M. D. Yadav
18CHE109	Aniruddha Dhondiram Pinjari	Land fill Bio-reactor Management	Prof. A. B. Pandit
18CHE110	Akanksha Sanjay Chougule	Recent trends in hydrogenation of vegetable oils with focus on catalyst and reactor types	Prof. P.R. Gogate
18CHE111	Saloni Surendra Varunkar	Henry reaction using heterogeneous catalysts	Prof. L. K. Mannepalli
18CHE112	Aditya Mahaveer Patil	Recent advances in continuous crystallization of pharmaceutical products	Dr. M. D. Yadav

18CHE113	Anuj Pundalik Farakate	Recent developments in Zeolite membrane based gas separation	Dr. M. D. Yadav
18CHE114	Tanay Ashish Jawdekar	Hydrodeoxygenation of bio-oil: Catalysis and modeling	Prof. G. D. Yadav
18CHE115	Monil Manish Shah	N-Oxidation of tertiary amines using heterogeneous catalysts	Prof. L. K. Mannepalli
18CHE116	Neha Madhukar Sangle	Role of HAZOP analysis in Chemical Industry	Prof. V. K. Rathod
18CHE117	Siddharth Mangesh Petare	Developments in process plant failure detection techniques	Dr. S. V. Jadhav
18CHE118	Mihir Madhav Gokhale	Critical review of electrolytic hydrogen production	Prof. P. K. Ghosh
18CHE119	Shubhalaxmi Dillip Swain	Opportunities for energy recovery in zero liquid discharge systems	Dr. C. S. Mathpati
18CHE120	Mayur Devendra Kulmethe	The Concept of Waste Refinery and its Potential	Prof. P.D. Vaidya
18CHE121	Prajwal Shilkumar Shambharkar	Recent advances in dye-sensitised solar cells	Prof. A. V. Patwardhan
18CHE122	Advay Shirwalkar	Photo-reforming of methanol for production of hydrogen	Prof. G. D. Yadav
18CHE123	Krishnakant Pandey	Advances in heteropoly acid based ionic liquids and their applications	Prof. G. D. Yadav
18CHE124	Geet Arun Chheda	Recent developments in biosensors in continuous manufacturing	Dr. S. V. Jadhav
18CHE125	Mihir Shrinivas Dakappagari	Circular Economy: Concept and Utility	Prof. A. B. Pandit
18CHE126	Gayatri Chikarmane	Review of processes for uranium separation from phosphoric acid and isolation of recovered uranium in pure form	Prof. P. K. Ghosh
18CHE127	Yash Subhash Butale	Recent Advances in Power-to-X Technology for the Production of Fuels and Chemicals	Prof. P.D. Vaidya
18CHE128	Anushka Manoj Khodake	Trends and future scope in fabric lamination adhesives	Dr. S. V. Jadhav
18CHE129	Tanvi Mahendra Apte	Environmental Applications of Fungal and Plan Systems	Prof. V. K. Rathod
18CHE130	Sayalee Chandrasing Pawara	Catalysis in direct oxidation of methane to methanol	Prof. G. D. Yadav
18CHE131	Saad Jamal	Applications of heat pumps for heating	Prof. S. S. Bhagwat
18CHE132	Durgeshnandini Rajendra Shinde	Solar Desalination	Dr. V.H. Dalvi
18CHE133	Aakanksha Gubbala	Recent advances in smart membrane materials and systems for separation	Prof. A. V. Patwardhan
18CHE134	Durvesh Eknath Parab	Applications of Nanotechnology in Oil and Gas Industry	Prof. P.D. Vaidya
18CHE135	Diksha Sunil Raut	Modeling of gas liquid flows using VOF-DBM	Prof. A. W. Patwardhan
18CHE136	Shruti Sarjerao Kadam	Land fill mining	Prof. A. B. Pandit
18CHE137	Abhishek Devendra Avhad	The Problem of Line Tension	Dr. V.H. Dalvi
18CHE138	Rushad Mehernosh Dumasia	Creep deformations in fibre reinforced composites	Prof. K. V. Marathe

18CHE139	Neil Graig Dias	Nano-Sorbents based on Polysaccharide in Water Remediation	Prof. V. K. Rathod
18CHE140	Aniket Rajendra Mali	Critical review on recent advances on graphene oxide/cement-based composites	Dr. M. D. Yadav
18CHE141	Shrinivas Anand Acharya	Industrial applications of meso scale reactors in continuous flow chemistry	Dr. C. S. Mathpati
18CHE142	Naresh Khushalchand Dhanwani	Design aspects of Co-axial mixers	Prof. A. W. Patwardhan
18CHE143	Kushagra Manoj Dwivedi	Wittig reaction using heterogeneous catalysts	Prof. L. K. Mannepalli
18CHE144	Dhaval Divakar Dhande	Recent trends in desulfurization of turpentine as feed stock for perfumery chemicals	Prof. P.R. Gogate
18CHE145	Bharat Prasad	Current Status of Residual Sugarcane Bagasse Conversion in India	Prof. P.D. Vaidya
18CHE146	Vyankatesh Nagesh Puri	Critical review of chemistry aspects of hydrogenation/reduction in the manufacture of pharmaceutical intermediates	Prof. A. V. Patwardhan
18CHE147	Harikrishnan R Namboothiri	Application of Biotechnology for odour control	Prof. V. G. Gaikar
18CHE148	Shantanu Uttam Kadam	Recent advances on process based on Perfusion bioreactors for mAb production	Dr. R. D. Jain
18CHE149	Krishna Gopal Jakhotiya	Recent developments in cooling tower design and operation	Dr. C. S. Mathpati
18CHE150	Sonti Siddharth	Comparative assessment of the Birkeland-Eyde process vis-à-vis the Haber process in the context of future sustainability	Prof. P. K. Ghosh
18CHE152	Aryan Razdan	Deep Reinforcement Learning	Dr. V.H. Dalvi
18CHE153	Amey Amol Suryavanshi	MSW Segregation techniques and scaling them	Prof. A. B. Pandit
18CHE154	Abhinav Umesh Patil	Zwitterionic silicone materials derived from amino functional PDMS with acrylic acid	Prof. K. V. Marathe
18CHE155	Harshali Valmik Shardul	Non-Intrusive in-line Rheometery	Prof. A. W. Patwardhan
18CHE156	Mayank Mukesh Kumrawat	Recent advances in the manufacturing process development of mass spectrometry grade trypsin	Dr. R. D. Jain
18CHE157	Ramakrishna S	Recent advances in membranes for organic pervaporation/membrane distillation	Prof. A. V. Patwardhan
18CHE158	Jayesh Chander Saraogi	Dry vacuum pumps: applications, selection and operating guidelines	Dr. C. S. Mathpati
18CHE159	Akshayu Pramod Ambatkar	Oil Spill Treatment using Oil eating Microbes	Prof. V. G. Gaikar
18CHE160	Rajas Milind Mehendale	Data –Driven models in Chemical Engineering Research and applications	Prof. A. B. Pandit
18CHE161	Akash Dilip Pawar	Design considerations for a cold storage unit	Prof. S. S. Bhagwat
18CHE162	Yash Anil Bartakke	Industrial processes for extraction of natural products	Prof. V. K. Rathod
18CHE163	Atharv Hemendra Tiwari	high temperature degradation in power plants and refineries	Prof. K. V. Marathe
18CHE164	Omkar Sambhaji Thube	Recent developments in reboiler design	Dr. C. S. Mathpati
18CHE165	Anmol Ajay Rathi	Recent advances in the manufacturing process development of PNGaseF (recombinant)	Dr. R. D. Jain

18CHE166	Bhavya Jain	Design of spiral plate heat exchanger	Prof. V. K. Rathod
18CHE167	Tejas Sriniwas Abhyankar	Wadsworth -Emmons reaction using heterogeneous catalysts	Prof. L. K. Mannepalli
18CHE168	Aditya Namdeo Naik	Developments in application and modification of niobium oxides as catalysts in industrially important reactions	Prof. G. D. Yadav
18CHE169	Shubham Maruti Mali	Developments in eco-pesticides	Dr. S. V. Jadhav
18CHE170	Nagashravan Hemadri	Recent advances in the purification process development of pepsin	Dr. R. D. Jain
18CHE171	Aditya Rajkumar Ratnapagol	Green Hydrogen Production	Dr. V.H. Dalvi
18CHE172	Dharam Dilip Parwani	Review of technology options for small-scale and large-scale seawater desalination	Prof. P. K. Ghosh
18CHE173	Bhalekar Snehal Sakharam	Ultrasound applications for water treatment and recycle	Prof. P.R. Gogate
18CHE175	Meenal Rawlani	Effect of cold working on creep rupture strength	Prof. K. V. Marathe
18CHE176	Aniruddha Rajesh Jain	The Role of Carbon Capture and Storage in the Energy Transition	Prof. P.D. Vaidya
18CHE177	Nikhil Manjunath Devadiga	Intensified biogas production based on use of cavitation	Prof. P.R. Gogate
18CHE178	Amey Santosh Murudkar	Recombinant DNA Technology in synthesis of Insulin	Prof. V. G. Gaikar
18CHE180	Atharva Shailesh Sonavane	Icy ball design for small refrigerated storage	Prof. S. S. Bhagwat
18CHE181	Varun Inamdar	Taurine surfactants	Prof. S. S. Bhagwat
16CHE138	Kshitij Narendra Thaware	VOC emissions and mitigation techniques in manufacturing industries	Dr. S. V. Jadhav
16CHE172	Suraj Bhagwat Shinde	Review of use of natural products in paints, ink and adhesives	Prof. P. K. Ghosh
16CHE178	Varun Satish Kumar Raina	Recent advances in the manufacturing process development of mass spectrometry grade chymotrypsin	Dr. R. D. Jain
17CHE159	Sanket Bhojraj Dadmal	Development of non-invasive sensors for medical applications	Prof. V. G. Gaikar
17CHE162	Shrushti Anand Chaudhari	Recent trends in treatment of effluent containin antibiotics	Prof. P.R. Gogate

Table 2.9a: List of B. Chem. Engg. Home paper 2019-2020

Roll No.	**Student Name**	**Topic**	**Guide**
16CHE107	Akash Sanjay Nogaja	Design a plant to manufacture 10 TPD of Isopropyl Acetate	Prof. A. B. Pandit
16CHE142	Naman Anil Joshi	Design a plant to manufacture 5 TPD Lanolin Alcohol	
16CHE150	Raunak Shiocharan Balkote	Design a plant for solar Electricity Based H_2 generation through water electrolysis	
14CHE1062	Rohan Rajesh Parlikar	Design a plant to manufacture 10TPD of Mango Butter	

16CHE164	Shriram Rajendra Chavan	Design a plant to manufacture 10 TPD of Refused derived Fuel (RDF)	
16CHE105	Aditi Anil Sawant	Design a plant to manufacture 10 TPD of L-menthol	Prof. A.M.Lali
16CHE125	Chinmay Vidyadhar Mhatre	Design a plant for separation and purification of methane and carbon dioxide from 100,000 m^3/ daybiogas obtained from anaerobic digestion.	
16CHE126	Darshana Uttam Malusare	Design a plant to manufactre 100 TPD of acrylic acid	
16CHE128	Dishit Pankaj Ghumra	Design a plant for gasification of 100 TPD of used & waste oils and hydrogen production	
16CHE168	Siddhesh Dilip Sarda	Design a plant to manufacture 20 TPD of alpha pinene	
16CHE134	Kalash Rajendra Pai	Design a plant to manufacture lubricants from epoxidised vegetable oil.	Prof. A. V. Patwardhan
16CHE141	Monik Sanjay Magiya	Design a plant to manufacture methylene diphenyl isocyanate.	
16CHE151	Razeen Ramzan Shaikh	Design a plant to manufacture iron gluconate.	
16CHE166	Shubham Gangaram Ravan	Design a plant to manufacture L-ascorbic acid.	
16CHE111	Amol Bharat Khatke	Design a plant to manufacture 5 TPD trimellitic anhydride	Prof. A. W. Patwardhan
16CHE120	Asmee Maruti Prabhu	Design a plant to manufacture 500 TPA of Carbon Fiber	
16CHE124	Kaustubh Chaitanya Rane	Design a plant to recover Uranium from 100 TPD phosphoric acid plant	
16CHE145	Ninad Chandrakant Khelukar	Design a plant to manufacture 50000 tpa polylactic acid	
16CHE149	Pujit Sunil Juneja	Design a plant to Manufacture 10 TPD of tetrabutyl ammonium hydroxide	
16CHE113	Aniket Jayendra Murumkar	Design a plant to produce 5 TPA of 3,4-ethylenedioxy aniline	Dr. C. S. Mathpati
16CHE118	Ashin Antony Sunny	Design a plant to produce 100000 MTPA of phenol	
16CHE131	Gaurav Vasudevan Mampally	Design a plant to produce 100 TPA of crotamiton	
16CHE140	Mihir Mahendra Kulkarni	Design a plant to produce 5000 MTPA of aluminium fluoride	
16CHE157	Sai Mukund Nazare	Design a plant to produce 100 MTPA of ortho nitrotoluene	
16CHE115	Anirudh Venkatesh --	Design a plant for the manufacture of 10,000 TPA 4-methoxy propiophenone using a green method	Prof. G. D. Yadav
16CHE116	Ankit Sanjay Gaikwad	Design a plant for 50,000 TPA of m-phenylene diamine	

16CHE154	Saaksshi Chandrashekhar Tenpe	Design a plant for 25,000 TPA of m-phenoxy benzyl alcohol.	
16CHE179	Vidit Vivek Shah	Design a plant for the manufacture of 5,000 TPA diphenyl carbonate	
16CHE106	Aditya Dilip Phad	Design a plant to manufacture potassium dichromate	Prof. K. V. Marathe
16CHE133	Harshada Gangaram Gabhale	Design a plant to manufacture saccharin	
16CHE135	Kaushal Sanjayrao Kaloo	Design a plant to manufacture salicylic acid	
16CHE153	Saagar Shaival Gandhi	Design a plant to manufacture poly vinyl chloride	
16CHE165	Shubham Ashokrao Shinde	Design a plant to manufacture hydrogen peroxide	
16CHE110	Amogh Sandip Nagarkar	Design a plant to manufacture p-methoxy acetophenone.	Prof. L. K. Mannepalli
16CHE117	Anu Sanjay Deshmukh	Design a plant to manuactre p-methyl acetophenone	
16CHE161	Shivani Uday Kulkarni	Design a plant to manufacture Benzophenone	
16CHE104	Abhinav Vivek Handu	Design a plant to manufacture 1000 TPA of Polyoxymethylene dimethyl ethers	Prof. P.D. Vaidya
16CHE108	Akshay Suhas Patil	Design a plant to manufacture 100 TPA of (Z)-5- (4-hydroxybenzylidene)thiazolidine-2,4-dione	
16CHE147	Ojaswi Sandeep Rathi	Design a plant to manufacture 1000 TPA of n-butyl acrylate	
16CHE159	Shalaka Sunil Dhande	Design a plant to manufacture 1000 TPA of 1,1-Diethoxybutane	
16CHE163	Shreekant Sudheer Gokhale	Design a plant to manufacture 2,6-naphthalenedicarboxylic acid (1000 tpa)	
16CHE119	Ashish Shyam Tangade	Design a plant to manufacture 10 TPD iodized salt	Prof. P. K. Ghosh
16CHE127	Dhiraj Manoj Jain	Design a plant to manufacture 10 TPD Fe + I Double Fortified Salt	
16CHE146	Nishant Narendra Pardeshi	Design a plant to manufacture 10 TPD bioethanol from mixed feed of lignocellulosic biomass	
16CHE160	Shital Vikas Suryavanshi	Design a plant to manufacture Spray/Freeze-dried re-dispersible powder from 1 TPD sugarcane juice	
16CHE171	Surabh Santhosh K t	Design a plant to manufacture 10 TPD sodium chlorite, an important water treatment chemical	
16CHE130	Eashaan Girish Godbole	Design a plant to produce alachlor at a capacity suitable for Indian context	Prof. P.R.

16CHE139	Malhar Satish Mankar	Design a plant to produce Isoborneol at a capacity suitable for Indian context	Gogate
16CHE143	Namita Nitin Jadhav	Design a plant to produce methyl tert-butyl phenol at a capacity suitable for Indian context	
16CHE148	Prathamesh Milind Bolaj	Design a plant to produce 1-3 Cyclohexanedione at a capacity suitable for Indian context	
16CHE162	Shivani Krishna kumar Bisen	Design a plant to produce p-toluene sulfonic acid at a capacity suitable for Indian context	
16CHE101	Aadesh Satish Bhakkad	Design a plant to manufacture lauryl glycine at a suitable scale	Prof. S. S. Bhagwat
16CHE121	Avinash Suresh Nayak	Design a plant to manufacture coco fatty acid chloride at a suitable scale.	
16CHE152	Rounak Vinod Naryani	Design a plant to manufacture hydroxylamine solution at a suitable scale.	
16CHE167	Shubham Pradip Adarkar	Design a plant to manufacture benzyl chloride at a suitable scale.	
16CHE181	Vishal kumar -- Binay	Design a plant to manufacture 2,6-dichloro phenol at a suitable scale.	
16CHE122	Bharthi -- Ponrathnam	Design a plant to manufacturing of methyl bromide	Dr. S. V. Jadhav
16CHE123	Bosco Johny --	Design a plant to manufacturing of xanthan gum	
16CHE177	Vartul Jain	Design a plant to Manufacture of Chloropicrin	
16CHE182	Yash Manoj Budhe	Design a plant to Manufacture of para nitrophenol	
16CHE114	Aniket Sonba Pote	Design a plant to manufacture 50 TPD of dihydrofuran	Prof. V. G. Gaikar
16CHE136	Keith Anthony Dsouza	Design of a Plant to manufacture 50 TPD of 7-ethyl tryptophol	
16CHE144	Nayantara Rajendra Pradhan	Design of a plant to manufacture 2,3-butanediol by biotechnological route	
16CHE155	Sahil Vasantrao Ghormare	Design a plant to manufacture 100 TPD of furan dicarbolylic acid from sugar (5% solution)	
16CHE170	Sreejith Thampan Nair	Design a plant to manufacture 1 TPD of cyclophosphamide	
16CHE102	Aagamkumar Kirtikumar Khandor	Design a plant to manufacture 10 TPD of polycarboxy ether for use as concrete viscosity modifier	Dr. V.H. Dalvi
16CHE129	Dnyanesh Deepak Sarawate	Design a plant to manufacture 10 TPDof Isoindoline pigment	
16CHE132	Gautami Rajendra Kelkar	Design a plant to manufacture 25 TPD of 2 phenylethanol	
16CHE156	Sahil Surendra Khatavkar	Design a plant to dry 50 TPD of grapes to make raisins using solar concentrator	

16CHE175	Suyog Girish Shaha	Design a plant to generate compressed biogas suitable for transportation purposes from 100 tons per day of agricultural waste	
16CHE109	Amitej Nageswara Neti	Design a plant to manufacture 10 TPD Camphorsulfonic acid	Prof. V. K. Rathod
16CHE112	Amrut Deepak Bagdi	Design a plant to manufacture 10 TPD of Metformin HCL	
16CHE169	Snehal Sanjay Patil	Design a plant to produce 1 CMD of Jamun seed extract concentrate	
16CHE176	Vaishnavi Girish Honavar	Design a plant to manufacture 1 TPD of Boreneol	

Table 2.9b: List of B. Chem. Engg. Home paper 2020-2021

Roll No	Student Name	Topics	Guide
17CHE105	Abhishek Bhardwaj	Design a Plant to manufacture 10 to50TPD of Choline Chloride	Prof. A. B. Pandit
17CHE113	Anosh Mehernosh Dumasia	Design a plant for 5 TPD of SodiumMeta – bisulphite.	
17CHE123	Chirag Mandar Mule	Design a plant to manufacture 50 TPDof Lithium Hydroxide.	
17CHE124	Chirag Sanjay Jain	Design a plant to manufacture 2 TPD ofLithium Silicate.	
17CHE148	Pranav VinayakMhatre	Design a plant to manufacture 10 TPDof Ammonium Citrate.	
17CHE125	Dev Pramod Malu	Design a plant to manufacture of L-alpha-glyceryl phosphoryl choline.	Prof. A. V. Patwardhan
17CHE139	Mayur Surendra Pimpalkar	Design a plant to manufacture Juglone.	
17CHE180	Riddhesh Nitin Kumtakar	Design a plant to manufacture Carbomer 940 (polyacrylic acid).	
17CHE169	Sukhada Sanjeev Gharat	Design a plant to manufacture Lawsone.	
16CHE174	Sushmita Shekhar Khole	Design a plant to manufacture Propofol.	
17CHE118	Atharva Vijay Suryavanshi	Design a plant to manufacture 1 TPDTODGA	Prof. A. W. Patwardhan
17CHE136	Madhur Ramesh Khadke	Design a plant to manufacture 10000TPA beta picoline	
17CHE163	Shruti Unnikannan	Design a plant to manufacture 5 TPDTOPO	
17CHE166	Siddhant Sanjay Mehta	Design a plant to generate 10 Nm^3/hrHydrogen from LOHC: di benzyl toluene	
17CHE172	Tushar Pyarelal Chaudhari	Design a plant to recover 1 TPDbromine form sea water	
17CHE134	Kunal Pralhad Magare	Design a plant to manufacture 500 TPAof n-nonyl phenol ethoxylate	Dr. C. S. Mathpati
17CHE157	Salil Sandeep Narvekar	Design a plant to manufacture 5000 TPAof benzene using toluene	
17CHE160	Saurabh Sukhadeo	Design a plant manufacture 200 TPA ofDiclofenac	

	Bagal	Sodium	
17CHE164	Shubham Gangaram Wanje	Design a plant to manufacture 5000 TPAof 4-anisaldehyde	
17CHE178	Siddharth Gautam Vaishnav	Design a plant to manufacture 1000 TPAof bromobenzene	
17CHE112	Ankit Balkrishna Kolpe	Design a plant to manufacture 5 TPD of Stearyl amine using a greener and safer process	Prof. G. D. Yadav
17CHE131	Jay Dinesh Sankhe	Design a plant to manufacture 15 TPD of diphenyl amine using a catalytic process	
16CHE137	Kovi Rishya Shrung	Design a plant to manufacture 25 TPD of 4-tert-butylcatechol	
17CHE154	Rajarshi - Samajdar	Design a plant to manufacture 10 TPD of styrene carbonate using a green process	
17CHE168	Sriram Pramod Tendulkar	Design a plant to manufacture 5 TPD of caffeine	
17CHE106	Aditya Hemant Jain	Design a plant to manufacture liquid oxygen.	Prof. K. V. Marathe
17CHE110	Amitkumar Harigovind Chauhan	Design a plant to manufacture di iso Nonylpthalate (DINP)	
17CHE130	Hritik Rakesh Jain	Design a plant to manufacture calcium stearate.	
17CHE170	Sumant Yogesh Salphale	Design a plant to manufacture methyl tert butyl ether (MTBE)	
17CHE173	Uma Gopinath Kulkarni	Design a plant to manufacture epoxy resin	
17CHE104	Abhishek Kundu	Design a Plant to Manufacture 2- Chloropyridine	Prof. L. K. Mannepalli
17CHE116	Ashlesha Girish Tiple	Design a plant to Manufacture Favipiravir	
17CHE153	R Ramya Ragunathan	Design a plant to Manufacture Remdesivir	
17CHE179	Samiksha Jugalkishore Asawa	Design a Plant to manufacture tributyl amine	
17CHE126	Gautam Manoj Borkar	Design a plant to manufacture 1 TPD of Coumarin.	Dr. M.D. Yadav
17CHE101	Junaid Gul Naikoo	Design a plant to manufacture 5 TPD of Benzyl salicylate.	
17CHE133	Kshitija Dipak Waikar	Design a plant to manufacture 2 TPD of Metanilic acid.	
17CHE138	Makarand Ravindra Jagtap	Design a plant to manufacture 2 TPD of Cyclamen aldehyde.	
17CHE174	Vedant Kiran Wankhede	Design a plant to manufacture 3 TPD of Styrallyl acetate.	
17CHE129	Hrishikesh Girish Mane	Design a plant for the production of methane from carbon dioxide	Prof. P.D. Vaidya
17CHE132	Joel Biju	Design a plant to manufacture taurine	
17CHE142	Neha Rajendra Gadekar	Design a plant to manufacture light olefins from crop residue	
17CHE144	Nirmit Shantilal Solanki	Design a plant to manufacture Camphorane	
17CHE171	Tanmay Nagesh Salvi	Design a plant to manufacture L- Arabitol	

17CHE140	Merul Ritesh Shah	Design of brine preparation unit for 2000 TPD soda ash manufacture using seawater as water source.	Prof. P. K. Ghosh
17CHE182	Sarvesh Subhash Pandey	Design of dilute molasses preparation unit for 1000 TPD ethanol production using spent wash as water source.	
17CHE161	Shantanu Sanjay Shembade	Design of 1 MLD heavy brine preparation unit (for offshore oil drilling) using seawater as water source.	
17CHE167	Siddhi Santosh Kotnis	Design of 15 m3 reject water (generated from brackish water RO plants) Dewatering unit with co-production of dissolved fertilizer for fertigation.	
17CHE165	Srushti Sanjeev Kumar Sindagi	Design of 1 MW solar PV unit integrated with pre-heating assembly for solar thermal energy storage	
17CHE119	Burhanuddin Husain	Design a plant to manufacture camphor at a capacity suitable for Indian context	Prof. P.R. Gogate
17CHE128	Himanshu Prashant Sail	Design a plant to manufacture cyclohexanol at a capacity suitable for Indian context	
17CHE145	Nitin Ramchandra Karande	Design a plant to manufacture Nitrofurantoin at a capacity suitable for Indian context	
17CHE150	Prateek Shriram Badgujar	Design a plant to manufacture ethylenediamine at a capacity suitable for Indian context	
17CHE151	Priyanka Subhash Humane	Design a plant to manufacture Ondansetron hydrochloride dihydrate at a capacity suitable for Indian context	
17CHE107	Aishwarya Suhas Khandekar	Design a plant to manufacture anthraquinone at a suitable scale.	Prof. S. S. Bhagwat
17CHE114	Apurva Ajay Pawar	Design a plant to manufacture 2- hydroxy-3-naphthoic acid and its anilide from 2-naphthol at a suitable scale.	
17CHE122	Chinmayee Pradeep Sarode	Design a plant to manufacture 2-methyl resorcinol solution at a suitable scale.	
17CHE135	Lakshay - Vashist	Design a plant to manufacture propranalol from 1-naphthol at a suitable scale.	
17CHE156	Rushikesh Gorakhnath Rathod	Design a plant to manufacture naphthalene-2,6-dicarboxylic acid at a suitable scale	
17CHE108	Akshaykumar Dundappa Bhangari	Design a plant to manufacture polystyrene at a suitable capacity	Dr. S. V. Jadhav
17CHE115	Arya Kirti Pavani	Design a plant to manufacture resistant starch at a suitable capacity	
17CHE121	Chinmay Prasad Deshpande	Design a plant to manufacture titanium dioxide at a suitable capacity	
17CHE181	Meenal Shyam Rathi	Design a plant to manufacture ammonium polyphosphate at a suitable capacity	
17CHE155	Rasik Gurunath Wathare	Design a plant to manufacture cellulose acetate at a suitable capacity	
17CHE120	Burhanuddin Esmail Samiwala	Design a plant to manufacture 5 TPD of Ciprofloaxcin	Prof. V. G.

17CHE137	Mahesh Subhash Patil	Design a plant to manufacture 5 TPD of Norfloxacin	Gaikar
17CHE143	Niraj Devdas Bhavar	Design a plant to manufacture 1 TPD of butyl-glucoside	
17CHE149	Prasanna Prasad Khare	Design a plant to manufacture 5 TPD of Levofloaxcin	
17CHE175	Vipul Moreshwar Karekar	Design a plant to manufacture 5 TPD of Tinidazole	
17CHE111	Aniket Rajay Surwade	Design a plant to produce 500 kw of electricity on 24 hour basis using (do not use any fossil fuels).	Dr. V.H. Dalvi
17CHE117	Ashutosh Arvind Kulkarni	Design a plant to produce 10 TPD of diphenyl amine	
17CHE127	Harsh Prakash Solanki	Design a plant to treat 10,000 litres per hour of 30,000 ppm COD liquid waste using microalgal photobioreactors.	
17CHE176	Yash Ghanashyam Barhate	Design a plant to process 10 TPD of Agricultural Residue using Catalytic Thermal Liquefaction	
17CHE177	Yashraj Sanjay Jagtap	Design a plant to produce 30 kl/day of absolute ethanol from sugarcane juice	
17CHE109	Alankrita Shreekant Patil	Design a plant to Manufacture 10 TPA acetyl acetone	Prof. V. K. Rathod
17CHE146	Omkar Narayan Korke	Design a plant to manufacture 10000 TPA sulphuric acid	
17CHE147	Palkit Vinod Shahdadpuri	Design a plant to Manufacture Isobornyl cyclohexanol	
17CHE152	Purva Harshad Paranjape	Design a plant to manufacture γ- pipradrol	
17CHE158	Sanil Govind Yadav	Design a plant to Manufacture 10 TPA of ethyl butyrate via green route	

Table 2.9c: List of B. Chem. Engg. Home paper 2021-2022

Roll No	Student Name	Topic	Guide
18CHE114	Tanay Ashish Jawdekar	Design a plant to manufacture of Benzyl sulphonyl chloride	Prof. A. B. Pandit
18CHE116	Neha Madhukar Sangle	Design a plant to manufacture 10 TPD of sophorolipids	
18CHE121	Prajwal Shilkumar Shambharkar	Design a plant to manufacture D-Fartanic acid	
18CHE176	Aniruddha Rajesh Jain	Design a plant to manufacture of Para-chloro troiphenol	
R18CHE135	Diksha Sunil Raut	Design a plant to manufacture Tetra Hydro Furan	
18CHE122	Advay Naval Shirrwalkar	Design a plant to manufacture of selected alkyl lithiums	Prof. A. V. Patwardhan
18CHE145	Bharat Prasad	Design a plant to manufacture Methylene blue	
18CHE152	Aryan Razdan	Design a plant to manufacture epichlorohydrin	
18CHE166	Bhavya Jain	Design a plant to manufacture Lopinavir	
18CHE181	Varun Inamdar	Design a plant to manufacture avocado oil	

18CHE102	Shikhar Dinesh Singh	Design a plant to manufacture 50 TPD ethyl vaniline	Prof. A. W. Patwardhan
18CHE123	Krishnakant Pandey	Design a plant to manufacture 30 TPD p-anisyl alcohol	
18CHE127	Yash Subhash Butale	Design a plant to manufacture 10 TPD 4-hydroxy phenyl acetic acid	
18CHE146	Vyankatesh Nagesh Puri	Design a plant to manufacture 10 IPD 4-nitro orthoxylene	
18CHE162	Yash Anil Bartakke	Design a plant to manufacture 5 TPD of gallic acid	
18CHE134	Durvesh Eknath Parab	Design a plant to manufacture of 25 ton/month of ethyl bromoacetate	Dr. C. S. Mathpati
18CHE139	Neil Graig Dias	Design a plant to manufacture of 25 ton/month of ethyl bromoacetate	
18CHE153	Amey Amol Suryavanshi	Design a plant to manufacture of 100 ton/month of phenoxy ethanol	
18CHE155	Harshali Valmik Shardul	Design a plant to manufacture of 100 ton/annum of methoxyamino chlorobenzene	
18CHE157	Ramakrishna S	Design a plant to manufacture of 500 ton/annum of methyl ethyl ketone	
18CHE112	Aditya Mahaveer Patil	Design a plant to manufacture 5 TPD of 4-(4-hydroxyphenyl)sulfonylphenol by a green process	Prof. G. D. Yadav
18CHE137	Abhishek Devendra Avhad	Design a plant to manufacture 10 TPD of difenoconazole technical using latest process	
18CHE147	Harikrishnan R Namboothiri	Design a plant to manufacture 1500 TPA of 4-methyl-3-nitroaniline using modern reactor and separation technologies	
18CHE150	Sonti Siddharth	Design a plant to manufacture 300 TPD of carbon dioxide from a fermenter into methanol using latest technologies	
18CHE180	Atharva Shailesh Sonavane	Design a plant to manufacture 5000 TPA of 1,2,4- triazinone with an environment friendly process	
18CHE103	Tanmay Nitin Kothawade	Design a plant to manufacture Copper Sulfate	Prof. K. V. Marathe
18CHE106	Vaishnavi Rajendra Bhalekar	Design a plant to manufacture Sodium hydroxide	
18CHE129	Tanvi Mahendra Apte	Design a plant to manufacture Zinc sulphate	
18CHE136	Shruti Sarjerao	Design a plant to manufacture aluminium chloride	

	Kadam		
18CHE149	Krishna Gopal Jakhotiya	Design a plant to manufacture nickel flouride	
18CHE105	Shekhar Ganapati Shinde	Design a plant to manufacture xylitol from xylose	Prof. L. K. Mannepalli
18CHE109	Aniruddha Dhondiram Pinjari	Design a plant to manufacture Sorbitol from Glucose	
18CHE133	Aakanksha Gubbala	Design a plant to manufacture 1,2-pentane diol	
18CHE164	Omkar Sambhaji Thube	Design a plant to manufacture Alanine from lactic acid	
17CHE159	Sanket Bhojraj Dadmal	Design a plant to manufacture Cephalexin	Dr. M.D. Yadav
18CHE124	Geet Arun Chheda	Design a plant to manufacture Cefixime Trihydate	
18CHE144	Dhaval Divakar Dhande	Design a plant to manufacture Sodium Nitrotetrazolate	
18CHE154	Abhinav Umesh Patil	Design a plant to manufacture Tipifarnib	
18CHE165	Anmol Ajay Rathi	Design a plant to manufacture Lofexidine Hydrochloride	
18CHE140	Aniket Rajendra Mali	Design a plant to manufacture dinitronapthalene	Prof. P.D. Vaidya
18CHE159	Akshayu Pramod Ambatkar	Design a plant to manufacture solketal	
18CHE161	Akash Dilip Pawar	Design a plant to manufacture ethylene glycol diacetate	
18CHE168	Aditya Namdeo Naik	Design a plant to manufacture 2-methyl-1,4-napthoquinone	
18CHE171	Aditya Rajkumar Ratnapagol	Design a plant to manufacture p-methyl cyclohexylamine	
17CHE162	Shrushti Anand Chaudhari	Design a plant for production of Forward Osmosis membrane module from dialysis membrane module (coating of 100 m2 membrane area per day)	Prof. P. K. Ghosh
18CHE117	Siddharth Mangesh Petare	Deigan a plant to manufacture 10,000 TPA of cyanoguanidine (intermediate of metformin) starting from limestone	
18CHE141	Shrinivas Anand Acharya	Design a 10 TPD plant for production of vacuum evaporated salt (sodium chloride) from solar- concentrated (24 oBe') sea or sub-soil brine, forward integrated to iodized salt production	
18CHE148	Shantanu Uttam Kadam	Design a plant to manufacture 50 TPD anhydrous HF plant integrated with fluoride separation from fertilizer grade phosphoric acid	

18CHE163	Atharv Hemendra Tiwari	Design a plant for production of 300 TPA plant of D2EHPA-TOPO solvent composition (required for uranium recovery from phosphoric acid) from basic chemicals	
18CHE119	Shubhalaxmi Dillip Swain	Design a plant to manufacture acetamiprid	Prof. P.R. Gogate
18CHE138	Rushad Mehernosh Dumasia	Design a plant to manufacture indoxacarb	
18CHE143	Kushagra Manoj Dwivedi	Design a plant to manufacture acephate	
18CHE160	Rajas Milind Mehendale	Design a plant to manufacture pendimethalin	
R16CHE178	Varun Satish Kumar Raina	Design a plant to manufacture para tert butyl phenol	
18CHE110	Akanksha Sanjay Chougule	Design a plant to manufacture ethyl acetate from acetic acid and ethylene	Prof. S. S. Bhagwat
18CHE111	Saloni Surendra Varunkar	Design a plant to manufacture 3-methoxy butanol via crotonaldehyde	
18CHE113	Anuj Pundalik Farakate	Design a plant to manufacture adiponitrile	
18CHE132	Durgeshnandini Rajendra Shinde	Design a plant to manufacture tetralin	
18CHE178	Amey Santosh Murudkar	Design a plant to manufacture acetaldehyde by ethylene oxidation	
16CHE138	Kshitij Narendra Thaware	Design a plant to manufacture methylene diphenyl diisocyanate	Dr. S. V. Jadhav
18CHE125	Mihir Shrinivas Dakappagari	Design a plant to manufacture whey protein	
18CHE142	Naresh Khushalchand Dhanwani	Design a plant to manufacture cyanoacrylate	
18CHE158	Jayesh Chander Saraogi	Design a plant to manufacture phosphorus trichloride	
18CHE167	Tejas Sriniwas Abhyankar	Design a plant to manufacture potassium permanganate	
18CHE175	Meenal Rawlani	Design a plant to manufacture acetylsalicylic acid	
16CHE172	Suraj Bhagwat Shinde	Design a plant to manufacture 5 TPD of ,2,4-Trimethyl-1,2-dihydroquinoline	Prof. V. G. Gaikar
18CHE115	Monil Manish Shah	Design a plant to manufacture 5 TPD of 4.2 - Mercapto-benzimidazole	
18CHE128	Anushka Manoj Khodake	Design a plant to manufacture 5 TPD of Diaryl-p-phenylenediamine	

18CHE170	Nagashravan Hemadri	Design a plant to manufacture 5 TPD of N-Isopropyl-N'-phenyl-p-phenylenediamine	
18CHE169	Shubham Maruti Mali	Design a plant to manufacture 5 TPD of 5.Octyl-diphenylamine	
18CHE101	Arun Sadotra	Design a plant to manufacture 1 GW worth of solar grade silicon ingots per year	Dr. V.H. Dalvi
18CHE107	Aditya Rajesh Gedam	Design a plant to manufacture 100 tons per day of methanol from CO2 and water	
18CHE156	Mayank Mukesh Kumrawat	Design a plant to manufacture 10 m3 per day of compressed biogas suitable for transportation fuel from agricultural waste	
18CHE172	Dharam Dilip Parwani	Design a plant to manufacture to reform enough ethanol to Hydrogen to drive a 50 kW hydrogen fuel cell	
18CHE173	Bhalekar Snehal Sakharam	Design a plant to manufacture 100 tons per day of ethanol from agricultural waste	
18CHE104	Vrushal Rajendra Varude	Design a plant to manufacture p-hydroxy acetophenone	Prof. V. K. Rathod
18CHE108	Tanvi Swapnil Varadkar	Design a plant to manufacture nicotinic acid	
18CHE120	Mayur Devendra Kulmethe	Design a plant to manufacture hydrochloric acid	
18CHE130	Sayalee Chandrasing Pawara	Design a plant to manufacture 1,3 Difluro benzene	
18CHE131	Saad Jamal	Design a plant to manufacture acetyl acetone	

2.2.4. Initiatives related to industry interaction, industry internship/summer training (10)

(Institute Marks 10)

To know the challenges and present-day practices of the industry, the department invites the industry professionals to deliver, guide, and discuss/update the students with the current technological advancements. This gives a platform for the students to interact and learn from industry experts with respect to the industrial practices. It also mutually benefits the industry, as students get job-ready to be employed in the industry. The technology gap between the Institutes and Industry is thus narrowed down and employability of the students shoots up because of such exposure.

Table 2.10: Industry supported laboratories

Laboratory	Industry Sponsor	Year
Chemical Engineering Laboratory	1968 Bachelor of Chemical Engineering Batch	2018-19
Process Control Laboratory Section – Chemical Engineering Laboratory	1968 Bachelor of Chemical Engineering Batch	2018-19
Heat Lab Section – Chemical Engineering Laboratory	1968 Bachelor of Chemical Engineering Batch	2019-20

Analytical Instrumentation Laboratory	Sanjay Gaikwad, 1987 Bachelor of Chemical Engineering Batch	2020
UGC – Networking Resource Centre (DST-FIST & UGC-CAS Supported)	Surendra Gupta, 1964 Bachelor of Chemical Engineering Batch Vijay Kelkar, Former Chairman, Finance Commission	2011

Table 2.11: Industry involvement in the program design and curriculum

The Syllabus Revision Committee plays a vital role in the designing of the program curriculum. This committee is constituted under the supervision of HoD, and there are 3-4 mandatory members from industries. Following is the list of industry experts who were involved in the program design and curriculum:

Sr No	**Expert**	**Industry**
1	Dr. Sanjay Tiwari	Biocon
2	Dr. Sandeep Gharat	Godrej Industries Limited
3	Mr. Ramesh Bakshi	Independent Consultant
4	Ravi Raghavan	Chemical Weekly
5	Dr. Sanjay Jain	GEIST Research Private Limited
6	D K Deshpande	HPCL
7	Dr. Shamel Merchant	Exxon Mobil

Table 2.12: Industry involvement in partial delivery of regular courses

SN	**Course Code**	**Title**	**Visiting Faculty**	**Affiliation**
1	CET 1604	Basic course in Entrepreneurship	Mr. Vikrant S. Potnis	Founder at FundEnable, Director at Fortemagna Advisors, Founder at Indian Academy of Venture Capital (IAVC)
2	CET 1401	Chemical Engineering Operations	Mr. Aniruddha Shenvi	Freelance Technical Consultant
3	HUT 1102	Persp. of Society, Sci. & Tech.	Dr. Rama Iyer	Former Chairman & CEO of Aker Kvaerner
4	CET1509	Refinery Science & Engineering	Mr. Ravindra Kubade	Dy. General Manager (DGM) Process Technology BPCL-Mumbai Refinery (MR)
5	CET1509	Refinery Science & Engineering	Mr. Sunil Balwant	DGM OPERATIONS (ARU, ISOM, CCR, CCU, FCCU, GTU) BPCL-Mumbai Refinery (MR)
6	CET1509	Refinery Science & Engineering	Mr. Nilesh Kandalkar	DGM Technical Services (Energy & Environment) BPCL-Mumbai Refinery (MR)
7	CET1503	Environmental Engg. & Process Safety	K. Sahasranaman	Independent consultant in areas of Process Engineering and Design, Energy, Utilities and Safety for Chemical Process Industry.
8	CET1509	Refinery Science & Engineering	O.P. Goyal	Freelance Technical Consultant
9	HUT1103	Industrial Psychology and Human Resource	Dr. Rama Iyer	Former Chairman & CEO of Aker Kvaerner
10	HUP1101	Communication Skills	Yogesh Anvekar	Head, Department of English, G.N. Khalasa College, Mumbai.
11	CET1511	Plant Utilities	K. Sahasranaman	Independent consultant in areas of Process Engineering and Design, Energy, Utilities and Safety for Chemical Process Industry.

12	HUT1105	Industrial Management (II)	O.P. Goyal	Freelance Technical Consultant
13	HUT1104	Industrial Management (I)	Dr. Rama Iyer	Former Chairman & CEO of Aker Kvaerner

Table 2.13: In-plant training

Due to COVID-19 pandemic and lockdown restrictions many students could not complete their industrial training during 2019-2020 and 2020-2021. As of now, due to relaxation in the restriction following are the details of the In-plant training cum internship:

Students completing industrial training in 2021-22:

Sr. No.	Full name of the student	Roll Number	Company
1	Aayush Bhat	19CHE101	Lanxess
2	Shivani Manhas	19CHE102	RCF ltd
3	Sagar Vivek Mudaliar	19CHE103	Reliance Industries Ltd
4	Aquil Abdulhamid Attar	19CHE104	Reliance
5	Parth Thakkar	19CHE105	BASF
6	Pranay Shah	19CHE106	BASF
7	Parth Patel	19CHE108	AMI Lifesciences Ltd
8	Sahil Birwatkar	19CHE111	Aarti Industries
9	Tanish Agrawal	19CHE112	Jubilant Ingrevia
10	Anant Prasanna Sohale	19CHE113	Eternis
11	Prithvi Dake	19CHE114	Tridiagonal Solutions Ltd
12	Adwait Joshi	19CHE115	Tridiagonal Solutions Ltd
13	Jay Piyushbhai Thakkar	19CHE116	Kiri Industries ltd
14	Aditi Sachin Patil	19CHE117	RCF ltd
15	Dhruv Gohil	19CHE118	Fairmate
16	Sudarshan Shreenivas	19CHE119	Jayant Agro
17	Shaikh Mohd Shoeb Sher Ali	19CHE120	Reliance
18	Hrishabh Singh	19CHE121	Deccan Fine Chemicals Ltd.
19	Nimish Vaidya	19CHE122	Beetachem Industries
20	Harsh Upadhyay	19CHE123	Thyssenkrupp Industrial Solutions
21	Pankti Paresh Savla	19CHE124	Jayant Agro
22	Gargee Yadav	19CHE125	Akry Organics
23	Vivin Sibi	19CHE126	Piramal - Ennore
24	Abhishek Shashikant Kulkarni	19CHE127	Tridiagonal Solutions Ltd
25	Uma Rajesh Tulsiani	19CHE128	Rubamin Pvt Ltd
26	Shrivatsa Korde	19CHE129	Tridiagonal Solutions Ltd
27	Amoghraj Prabhu S S	19CHE130	Gmm Pfaudler
28	Aditya Agarwal	19CHE131	Sudarshan Chemicals
29	Darshil Jain	19CHE132	Aarti Inds
30	Saloni Vaidya	19CHE133	Atul Ltd
31	Siddharth Nitin Shah	19CHE134	Jayant Agro
32	Vyankatesh Shyam Tarkase	19CHE135	Gharda Chemicals
33	Akshat Jain	19CHE136	Lanxess
34	Animesh Chaturvedi	19CHE137	Gharda Chemicals (Absent)
35	Vikram Vinayak Shanbhag	19CHE138	Tridiagonal Solutions
36	Prathamesh Patil	19CHE139	Atul ltd
37	Sahil Unmesh Patil	19CHE140	Harman Finochem ltd

38	Makrand Tanaji Barge	19CHE141	Piramal Thane
39	Ria Gada	19CHE142	JB Pharmaceuticals Pvt Ltd
40	Vignesh Krishnan	19CHE143	Solara
41	Sanskar Shridhar Tanvidkar	19CHE144	Excel
42	Parikshit Subhash Kadu	19CHE145	Lanxess
43	Vinod Mamraj Rathod	19CHE146	Lanxess
44	Utkarsh Pravin Patil	19CHE147	Reliance
45	Abhijeet Agatrao Tarange	19CHE148	Laxmi Organics
46	Gouresh Vinay Gargate	19CHE149	Piramal Thane
47	Snehal Bhosale	19CHE150	Vanita Agrochem pvt ltd
48	Vaibhav Khapekar	19CHE151	Eternis
49	Umesh Jaiswal	19CHE152	Shell
50	Vashishth Purohit	19CHE153	Jubilant ingrevia
51	Akanksha Warade	19CHE154	Biocon
52	Aditya Sangave	19CHE155	Eternis
53	Sanmesh Pravin Kharade	19CHE156	Jubilant ingrevia
54	Priyanshu Singh	19CHE157	Deccan Fine Chemicals Ltd.
55	Prehas Madke	19CHE158	Eternis
56	Falguni Akulwar	19CHE159	Jubilant ingrevia
57	Shivraj Chandrakant Gove	19CHE160	Lanxess
58	Vaidehi Padamwar	19CHE161	Jubilant ingrevia
59	Bhushan Murjani	19CHE162	Piramal Thane
60	Suraj Kekane	19CHE163	Solara
61	Shyam Gandhi	19CHE164	Reliance
62	Dhaval Chaudhari	19CHE165	UPL
63	Nikita Mohta	19CHE166	Akry Organics
64	Soham Mamidwar	19CHE167	Aarti inds
65	Atharv Prasad Kulkarni	19CHE168	Tridiagonal Solutions Ltd
66	Rutuja Pingale	19CHE169	Gharda Chemicals, Lote
67	Akshayaa Jagtap	19CHE170	Exxon Mobil
68	Priya Katkar	19CHE171	Gharda Chemicals, Lote
69	Harsh Mohane	19CHE172	Aarti Inds
70	Ashish Bhave	19CHE174	Tridiagonal Solutions Ltd
71	Sahil Sabne	19CHE175	Deepak Nitrite - Baroda
72	Manasi Bansod	19CHE176	Biocon
73	Amogh Subhash Gaikwad	19CHE178	Gharda Chemicals Dombivli(
74	Janhavi Sunil Waghachoude	19CHE179	Aarti Industries, Vapi
75	Ruchita Baban Laswante	19CHE180	Aarti Industries, Vapi
76	Rakhi Narnaware	19CHE181	Gharda Chemicals, lote
77	Sushant Hemant Moule	19CHE182	Aarti inds
78	Onkar Rajendra Salavi	19CHE185	Excel
79	Vinay Sharma	19CHE186	Deepak Nitrite - Baroda
80	Amit Dinesh Yadav	19CHE187	UPL
81	Yashvir Koul	19CHE188	Aarti Industries
82	Sakshi Pandit Patil	19CHE189	Gharda Chemicals, Lote
83	Prasanna Gangawane	19CHE190	Harman Finochem Ltd
84	Abhigyan Ray	17CHE103	Piramal Thane

85	Siddhesh Borole	18CHE151	Laxmi Organics
86	Kalyan Hanumant Mali	18CHE179	UPL

GMMPfaudler
Defining the standard

23rd August 2021

Subject: **Internship Completion Certificate**

We are pleased to inform you that Mr. Aryan Razdan from Institute of Chemical Technology (ICT) Mumbai, has successfully completed his internship with GMM Pfaudler Limited from 24th May 2021 to 23rd August 2021.

We appreciate his dedicated efforts to deliver the internship project on time. We admire his ingenuity in delivering an outstanding outcome. We were impressed with the way he kept himself motivated and focused throughout the internship period.

We thank Aryan for giving this company his best. May he enjoy this type of success in all his endeavours.

For GMM Pfaudler Limited

Geetanjali

Geetanjali Barretto
General Manager- HR & Admin

GMM Pfaudler Limited
Corporate Office: 902, Lodha Excelus, Commercial Tower 1, New Cuffe Parade, Sewri - Chembur Road, Mumbai-400022. • O: +91 22 6650 3900
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sales@gmmpfaudler.com • www.gmmpfaudler.com

Figure 2.13: In-Plant training Completion certificate (Sample 1)

Tridiagonal™ Solutions
compute | innovate | develop

Regd. Office
100 NCL Innovation Park,
Dr. Homi Bhabha Road,
Pune – 411 008 (India)

9th August 2021

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Tanay Jawdekar** has successfully completed his industrial internship programme with us from 3rd May 2021 upto 30th July 2021.

During the period of his internship programme with us, he was found hard working, punctual and inquisitive.

We wish him all the success in future.

Tridiagonal Solutions Pvt. Ltd.

Tridiagonal Solutions Pvt. Ltd.

Apeksha Jadhav
HR Manager

Tridiagonal Solutions Pvt. Ltd.
Operations: Plexus, 134/1, CTS No.1337/1, 3rd floor, ITI Road, Aundh, Pune – 411 007, India
T: +91 20-41432000 / **F**: +91 20-41432050 / info@tridiagonal.com / www.tridiagonal.com

Figure 2.14: In-Plant training Completion certificate (Sample 2)

Table 2.14: List of Invited Guest Lectures by Industry Professionals (2016-2022)

Sr. No.	Date	Title	Name of Professional	Affiliation
1	2016-17	Polymer Recovery and reuse using Membrane Technology	Mr. Jack Noble	General Manager, Water & Waste Water Division, Koch Membrane, Darlington United Kingdom
2	2016-17	Refinery – Products and Economics	Antony Francis	Asst Vice President – Long term Projects and Initiatives, Reliance Industries Limited, Mumbai, India
3	2016-17	Developing & Commercializing New Technologies	Dr. Sameer Bharadwaj	Vice President & GM at Cabot Corporation, Boston, Massachusetts, USA.
4	2016-17	Integrating Stochastic Model Predictive Control and Experiment Design for Nonlinear Systems	Vinay Anil Bavdekar	
5	2016-17	Golden Jubilee Visiting Fellowship	Dr. S. Ganapathy, M.S., FIE	Director, Sales & Marketing, Chirag Ice Factory Pvt. Ltd.
6	2016-17	Shri. B. S. Rajpurohit Visiting Faculty and Oration Endowment	Dr. Deepanjan Bhattacharya	Director, Eastman Chemical Company, Global Technology
7	2016-17	Professor R.A. Rajadhyaksha Memorial Lecture Series	Dr. Mugdha Gadgil,	Senior Scientist, Chemical Engineering Division, CSIR-NCL, Pune
8	2016-17	K. J. Somaiya Visiting Professor of Chemical Engineering Endowment	Dr. Rajender S. Varma,	Sustainable Technology Division, Clean Processes Branch, National Risk Management Research Laboratory, U. S. Environmental Protection Agency
9	2016-17	Dr. KKG Menon Memorial Lecture Endowment	Dr. Mukund Keshao Gurjar	Director (R&D) & Chief Scientific Officer, Emcure Pharmaceuticals Limited.
10	2016-17	Professor V. M. Kulkarni Endowment Fund	Dr. B. Gopalan,Ph.D.	Chief Scientific Officer & Executive Director, Drug Discovery Research, Orchid Pharma Ltd.
11	2016-17	AAIPS- Dr. R. S. Baichwal Pharmaceutical Seminar	Dr. Kailas Thakker	Co-Founder and Chief Operating Officer, Tergus Pharma, USA
12	2016-17	Jayvee Organics & Polymers (P) Ltd., Visiting Fellow in Polymer Additives and Compounding.	Dr. Phool Kumar Patanjali,	Institute of Pesticide Formulation Technology, (Under Department of Chemicals & Petrochemicals, Ministry of Chemicals & Fertilizers, (Govt. of India)
13	2017-18	Sauradip Chemical Industries Pvt. Ltd. Visiting Fellowship	Dr. Swarnendu Bikas Kar,	Managing Director, Behr Process Paints India Pvt. Ltd
14	2017-18	Golden Jubilee Visiting Fellowships	Dr. Mohan Karmarkar,	Consultant, Group Manager-SHEQ, Jacobs Engineering UK Ltd

15	2017-18	Dr. KKG Menon Memorial Lecture Endowment	Dr. D. Srinivasa Reddy,	Senior Scientist, Organic Chemistry Division (OCD), CSIR-National Chemical Laboratory
16	2017-18	Professor S.K. Pradhan Endowment" in Pharmaceuticals Science & Technology	Dr. Krishnan Ravikumar,	Chief Scientist & Head, Center for X-ray Crystallography, CSIR-Indian Institute of Chemical Technology, Hyderabad
17	2017-18	Sauradip Chemical Industries Pvt. Ltd. Visiting Fellowship	Shri Tapan Kumar Dhar,	Vice President (R&D), Berger Paints India Ltd
18	2018-19	Golden Jubilee Visiting Fellowships	Dr. Ms. Carmen Guguta,	Product Manager, Technobis, Netherlands.
19	2018-19	Mechanism and Dynamics of Charge Separation in Water Splitting	Kazuo Takatsuka	Fukui Institute for Fundamental Chemistry,
20	2018-19	Golden Jubilee Visiting Fellowships	Dr. Michel Wong Chi Man	EcoleNationaleSupérieure de Chimie de Montpellier, France
21	2018-19	Professor W. B. Achwal Oration	Dr. Vijay G. Habbu	Senior Vice President (Chemicals), Reliance Industries Ltd.
22	2018-19	K. J. Somaiya Visiting Professor of Chemical Engineering Endowment	Dr. Deepak Jain	Director, Zotis Pharmaceutical Research Pvt. Ltd., D-3/CL, MIDC Industrial Area, Turbhe, Mumbai.
23	2018-19	Dr. KKG Menon Memorial Lecture Endowment	Dr. Arun Chandavarkar	The Chief Executive Officer (CEO) & Joint Managing Director of Biocon Ltd
24	2018-19	Professor (Mrs.) M.R. Baichwal Visiting Fellowship in Pharmaceutical Science and Technology	Dr. Santylal Daya	Faculty of Pharmacy, Rhodes University, Grahamstown, South Africa.
25	2018-19	Professor V. M. Kulkarni Endowment Fund	Dr. Mukund Shankar Chorghade (adjunct Prof.)	Associate of the Department of Chemistry and Chemical Biology FAS, FCOR, CCB-Oth, Harvard, FAS Chemistry &Chem Biology, Mallinckrodt Chemistry Lab
26	2018-19	Tipco - UICT Diamond Jubilee Visiting Fellowship in Thermosets	Dr. Prakash D. Trivedi	(Adjunct Prof.) SBU HEAD - POLYMERS, Gharda Chemicals, Raigad.
27	2018-19	Sauradip Chemical Industries Pvt. Ltd. Visiting Fellowship	Shri S. Mahesh Anand	President-Decorative Business, Nippon Paint (India) Private Limited, No 3, 3rd floor, club house Road, Chennai.
28	2018-19	Dr. M.V. Nimkar Foundation Endowment Lecture	Dr. Swaminathan Sivaram	Honorary Professor and INSA Senior Scientist, Former Director, CSIR- NCL, Pune
29	2018-19	Sauradip Chemical Industries Pvt. Ltd. Visiting Fellow in the areas of Dyestuff Technology and Textiles Processing Technology	Dr. Nilesh V. Mistry (GSS)	Chief Technology Officer, Lonsen-Kiri Chemicals Industries Ltd., Vadodara, Gujrat, India.

30	2019-20	Professor A. Sreenivasan Felicitation Lectureship	Dr. Nagendran Balasundram,	Regional Manager (South Asia), MPOB
31	2019-20	Cipla Distinguished Fellowship in Pharmaceutical Science	Dr. Narendra Chirmule	Co-founder, Symphonytech Biologics, Bangalore/Philadelphia.
32	2019-20	AAIPS- Dr. R. S. Baichwal Pharmaceutical Seminar	Dr. Kailas D. Thakker	Co-Founder and Chief Operating Officer, Tergus Pharma, USA
33	2019-20	AAIPS- Dr. R. S. Baichwal Pharmaceutical Seminar	Mrs. Maharukh Rustomjee	Managing Partner of Amaterasu Lifesciences LLP
34	2019-20	Sauradip Chemical Industries Pvt. Ltd. Visiting Fellowship	Shri Laxman Nikam (Polymer)	Vice President-Technical, Kansai Nerolac Paints Limited
35	2019-20	Dr. M.V. Nimkar Foundation Endowment Lecture	Dr. Dietmar Hueglin	Director Innovation Campus Mumbai at BASF Chemicals India Pvt Ltd, Vice President Advanced Materials & Systems Research, Mumbai
36	2019-20	Using Computational Fluid Dynamics to Solve Polymer Processing and Delivery Challenges	Laura Dietsche	Senior Research Scientist/Technology Leader, Dow Chemicals- Materials Science & Engineering
37	2020-21	The Dow Professor M.M. Sharma Distinguished Visiting Professorship in Chemical Engineering	Dr. Prasad Ramanathan(ICT Mumbai-IOC Odisha Campus)	Sr. Director – AI/ML Center of Excellence, Automation Development Center
38	2020-21	Research in Industry	Narayan Ramesh	Lead R & D Director, Engineering & Process Sciences (E&PS), Core R&D, The Dow Chemical Company, USA
39	2021-22	Practical Reactor Design	Dr. Mohan Karmarkar	Group Manager-SHEQ at Jacobs Engineering UK Ltd
40	2021-22	Advances and Applications of Microwaves and Ultrasound for Chemical Reactions	Prof. Erico M.M. Flores	Department of Chemistry, Federal University of Santa Maria, Brazil. Executive Editor of Ultrasonics Sonochemistry
41	2021-22	Superhydrophobic Sand for Enhanced Food Production in Hot and Dry Regions (Golden Jubilee Visiting Fellowship)	Prof. Himanshu Mishra	King Abdullah University of Science and Technology (KAUST), Thuwal 23955 - 6900 Saudi Arabia
42	2021-22	Scale-up and commercialization of several fermentation based (biotech) processes	Dr. Alex Patist	COO Geltor, Inc. Senior Director of BioProcess Technology at Genomatica and Director of Technology at Cargill

2.1.1. Initiatives towards the New Education Policy (5) **(Institute Marks 5)**

National Education Policy 2020 was released on 29th July 2020 and in enforced from this date. The Institute and the Department of chemical engineering has taken a step forward towards implementing the National Educational Policy (NEP) in our program by revising the syllabus in 2021. The highlights of those plans are appended below.

Major suggestions in NEP:

1. The focus is shifting from teaching to learning. From perceptual learning to conceptual learning.
3. Teaching models to Learning models.
4. Time spent in the institute is not equivalent to education. Emphasis on learning outcome.
5. Multidisciplinary courses.
6. Creators of knowledge rather than users of knowledge.
7. From Job seekers to job providers.
8. Research in UG and honors degree in UG would directly admit students into Ph.D.

Major highlights that Institute and Department have implemented and working on a process to meet suggestions by NEP:

1. Since last year, the faculties of the department have been shifted more towards blended learning. The intention is to provide the students with more flexibility and involvement in active learning. The students will be more involved in collaborative learning with an enriched experience. The tools used for this blended learning are Google classroom or MS Teams, Virtual labs, Virtual industry visits, Interactive video tutorials, Open Educational Resources (OERs) like NPTEL, and SWAYAM courses. These are in line with the National Educational Policy for higher education.
2. More focus on practical and hands on training-based courses are given in the recently revised syllabus. Choice-based credit systems with open electives and MOOCs have been introduced in the recently revised syllabus in 2021.
3. In 2021, Institute has implemented a new Career Advancement Scheme (CAS) which is in line with the NEP policy – 'Promoting Teacher Education'. Under the scheme, every incumbent faculty has to undergo a set of Faculty Development Programme (FDP) in the relevant area and advanced pedagogy. They also have to attend FDP through a MOOCS course with E-Certification by NPTEL/AICTE. Besides, Industrial Training or Professional Training has been mandated for any promotion.
4. The incumbent faculty needs to complete 8 modules of teachers training by the National Institute of Technical Teachers Training and Research (NITTTR) on different aspects of teaching such as Orientation Towards Technical Education and Curriculum Aspects, Professional Ethics & Sustainability, Communication Skills Modes & Knowledge Dissemination, Instructional Planning and Delivery, Technology Enabled Learning & Life-Long Self Learning, Student Assessment and Evaluation, Creative Problem-Solving Innovation and Meaningful R&D, Institutional Management & Administrative procedures.
5. All the students are given equal importance. Due attention is paid to both advanced and slow learners as the need arises. For instance, for advanced learners, there are research and review papers published in Scopus-indexed journals based on the seminar and project work at the UG level. For slow learners, one-to-one interaction as the case may be is done in the courses where it is required.

CRITERION 3	Students' Performance	71.30/75

Table 3.1: Student Intake

Item	CAY (2021-22)	CAYm1 (2020-21)	CAYm2 (2019-20)
Sanctioned intake of the program (*N*)	75	75	75
Total number of students admitted in first year *minus* number of students migrated to other programs/institutions, plus no. of students migrated to this program (*N*1)*	87	88	87
Number of students admitted in 2nd year in the same batch via lateral entry (*N*2)	0	0	0
Separate division students, if applicable (N3)	0	0	0
Total number of students admitted in the Program (*N*1 + *N*2 + N3)	87	88	87

Table B.3a

***NOTE:** *The sanctioned intake provided by AICTE is fixed for each academic year. In addition, supernumerary seats such as PMSSS/JKSSS are also allotted by AICTE. Therefore, the no of admitted students is more than the sanctioned intake.*

CAY – Current Academic Year
CAYm1- Current Academic Year minus1= Current Assessment Year
CAYm2 - Current Academic Year minus2 = Current Assessment Year minus 1
LYG – Last Year Graduate
LYGm1 – Last Year Graduate minus 1
LYGm2 – Last Year Graduate minus 2

Table 3.2: Students successfully graduated without backlogs

Year of entry	*N*1 + *N*2 + N3 (As defined above)	Number of students who have successfully graduated **without backlogs** in any semester/year of study (Without Backlog means no compartment or failures in any semester/year of study)			
		I Year	II Year	III Year	IV Year
CAY (2021-22)	87				
CAYm1 (2020-21)	88	80			
CAYm2 (2019-20)	87	82	80		
CAYm3 (2018-19)	80	65	75	74	
CAYm4 (LYG) (2017-18)	80	72	73	71	76

CAYm5 (LYGm1) (2016-17)	80	64	69	59	73
CAYm6 (LYGm2) (2015-16)	80	73	72	72	78

Table B.3b

Table 3.3: Students successfully graduated without backlogs + with backlogs

Year of entry	*N1* + *N2* + N3 (As defined above)	Number of students who have successfully graduated in stipulated period of study) [Total of with Backlog + without Backlog]			
		I Year	II Year	III Year	IV Year
CAY (2021-22)	87				
CAYm1 (2020-21)	88	80+6			
CAYm2 (2019-20)	87	82	80+1		
CAYm3 (2018-19)	80	65+7	75	74+2	
CAYm4 (LYG) (2017-18)	80	72+0	73+4	72	76
CAYm5 (LYGm1) (2016-17)	80	64+2	69+1	59+12	73
CAYm6 (LYGm2) (2015-16)	80	73+1	72+0	72+6	78

Table B.3c

3.1. Enrolment Ratio (15) **(Institute Marks 15)**

Enrolment Ratio = N1/N (If Enrolment Ratio >=90% students enrolled = 15 Marks)

Table 3.4: Enrolment Ratio

	N (From table B.3a)	N1 (From table B.3a)	Enrolment Ratio (N1/N)*100
2021-22 (CAY)	87	75	116
2020-21 (CAYm1)	88	75	117
2019-20 (CAYm2)	87	75	116

Table B.3.1

3.2. Success Rate in the stipulated period of the program (15) **(Institute Marks 14.15)**

3.2.1. Success rate without backlogs in any semester/year of study (10) **(Institute Marks 9.43)**

SI= (Number of students who have graduated from the program without backlog)/ (Number of students admitted in the first year of that batch and actually admitted in 2nd year via lateral entry and separate division, if applicable)

Average SI = Mean of Success Index (SI) for past three batches

Success rate without backlogs in any semester/year of study = 10 × Average SI

Table 3.5: Success rate without backlogs

Item	Last Year of Graduate, LYG (2017-18)	Last Year of Graduate minus 1, LYGm1 (2016-17)	Last Year of Graduate minus 2, LYGm2 (2015-16)
Number of students admitted in the corresponding First Year + admitted in 2nd year via lateral entry and separate division, if applicable	81	80	79
Number of students who have graduated without backlogs in the stipulated period	76	73	78
Success Index (SI)	0.94	0.9	0.99
Average SI [(SI1 + SI2 + SI3) / 3]	0.943		
Assessment [10 * Average SI]	**9.43**		

Table B.3.2.1

3.2.2. Success rate in stipulated period of study [Total of with backlog + without backlog] (5)

(Institute Marks 4.72)

SI= (Number of students who graduated from the program in the stipulated period of course duration)/ (Number of students admitted in the first year of that batch and actually admitted in 2nd year via lateral entry and separate division, if applicable)

Average SI = mean of Success Index (SI) for past three batches

Success rate = 5 × Average SI

Table 3.6: Success rate without backlogs + with backlogs

Item	Last Year of Graduate, LYG (2017-18)	Last Year of Graduate minus 1, LYGm1 (2016-17)	Last Year of Graduate minus 2, LYGm2 (2015-16)
Number of students admitted in the corresponding First Year + admitted in 2nd year via lateral entry and separate division, if applicable	81	80	79
Number of students who have graduated in the stipulated period	76	73	78
Success Index (SI)	0.94	0.9	0.99
Average Success Index [(SI1 + SI2 + SI3) / 3]	0.943		
Assessment [5 * Average SI]	**4.72**		

Table B.3.2.2

3.3. Academic Performance in Second Year (5) **(Institute marks 4)**

*Academic Performance = 0.5 * Average API (Academic Performance Index), where*

API *= ((Mean of 2nd Year Grade Point Average of all successful Students on a 10-point scale) or (Mean of the percentage of marks of all successful students in Second Year/10)) x (number of successful students/number of students appeared in the examination)*

Successful students are those who are permitted to proceed to the Third year.

Table 3.7: Academic performance in second year

Academic Performance	CAY*m2* (2019-20)	CAY*m3* (2018-19)	LYG (2017-18)
Mean of CGPA or Mean Percentage of all successful students (X)	8.21	7.77	7.96
Total no. of successful students (Y)	81	75	77
Total no. of students appeared in the examination (Z)	81	75	77
API = X* (Y/Z)	AP1 (8.21)	AP2 (7.77)	AP3 (7.96)
Average API = (AP1 + AP2 + AP3)/3	**7.98**		
Academic Performance = 0.5 * Average API (Academic Performance Index)	**3.99**		

Table B.3.3

3.4. Academic Performance in Third Year (5) **(Institute marks 4)**

*Academic Performance = 0.5 * Average API (Academic Performance Index)*

API *= ((Mean of 3rd Year Grade Point Average of all successful Students on a 10-point scale) or (Mean of the percentage of marks of all successful students in Third Year/10)) x (number of successful students/number of students appeared in the examination)*

Successful students are those who are permitted to proceed to the final year.

Table 3.8: Academic performance in third year

Academic Performance	CAY*m3* (2018-19)	LYG (2017-18)	LYGm1 (2016-17)
Mean of CGPA or Mean Percentage of all successful students (X)	7.97	8.044	7.92
Total no. of successful students (Y)	76	72	71
Total no. of students appeared in the examination (Z)	76	72	71
API = x* (Y/Z)	AP 1 (7.97)	AP 2 (8.044)	AP 3 (7.92)
Average API = (AP1 + AP2 + AP3)/3	**7.97**		
Academic Performance = 0.5 * Average API (Academic Performance Index)	**3.98**		

Table B.3.4

3.5. Placement, Higher Studies and Entrepreneurship (15) (Institute marks 14.15)

Table 3.9: Placement and higher studies

Item	CAY (2020-21)	CAYm1 (2020-21)	CAY*m2* (2019-20)	CAY*m3* (2018-19)
Total No. of Final Year Students (N)	80	80	75	80
No. of students placed in companies or Government Sector (x)	36	44	50	37
No. of students admitted to higher studies with valid qualifying scores (GATE or equivalent State or National Level Tests, GRE, GMAT etc.) (y)	41	29	21	38
No. of students turned entrepreneur in engineering/technology (z)	0	0	1	0
x + y + z =	77	73	72	75
Placement Index: (x + y + z)/N	0.9625	0.9125	0.96	0.9375
Average placement: = (P1 + P2 + P3 + P4)/4	**0.9431**			
Assessment Points = 15 × average placement	**14.15**			

Table B.3.5

Table 3.10a: Placement and higher studies data 2021-2022

Sr No	Roll number	Student's name	Company Name
1	16CHE172	Suraj Bhagwat Shinde	Alfa Laval
2	16CHE178	Varun Raina	Haber (Elixa Technologies private limited)
3	17CHE159	Sanket Bhojraj Dadmal	Higher Studies
4	18CHE101	Arun Sadotra	Aarti Industries
5	18CHE102	Shikhar Dinesh Singh	Higher Studies
6	18CHE103	Tanmay Nitin Kothawade	BASF
7	18CHE104	Vrushali Rajendra Varude	Higher Studies
8	18CHE105	Shekhar Ganapati Shinde	Higher Studies
9	18CHE106	Vaishnavi Rajendra Bhalekar	BASF
10	18CHE107	Aditya Rajesh Gedam	Aarti Industries
11	18CHE108	Tanvi Swapnil Varadkar	Higher Studies
12	18CHE109	Aniruddha Dhondiram Pinjari	Higher Studies
13	18CHE110	Akanksha Sanjay Chougule	Higher Studies
14	18CHE111	Saloni Surendra Varunkar	Jubilant Pharmova Limited
15	18CHE112	Aditya Mahaveer Patil	Higher Studies
16	18CHE113	Anuj Pundalik Farakate	UPL Ltd.
17	18CHE114	Tanay Ashish Jawdekar	Higher Studies
18	18CHE115	Monil Manish Shah	ZS Associates
19	18CHE116	Neha Madhukar Sangle	Aarti Industries
20	18CHE117	Siddharth Mangesh Petare	ZS Associates
21	18CHE119	Shubhalaxmi Dillip Swain	UPL Ltd.
22	18CHE120	Mayur Devendra Kulmethe	Aarti Industries
23	18CHE121	Prajwal Shilkumar Shambharkar	Jubilant Pharmova Limited
24	18CHE122	Advay Naval Shirwalkar	Higher Studies

25	18CHE123	Krishnakant Pandey	GAIL
26	18CHE124	Geet Arun Chheda	Higher Studies
27	18CHE125	Mihir Dakappagari	Higher Studies
28	18CHE126	Gayatri Chickermane	Exxonmobil
29	18CHE127	Yash Subhash Butale	ZS Associates
30	18CHE128	Anushka Manoj Khodake	Deloitte
31	18CHE129	Tanvi Mahendra Apte	Higher Studies
32	18CHE130	Sayalee Chandrasing Pawara	Exxonmobil
33	18CHE131	Saad Jamal	Higher Studies
34	18CHE132	Durgeshnandini Rajendra Shinde	Akash Institute
35	18CHE133	Aakanksha Gubbala	Higher Studies
36	18CHE134	DURVESH EKNATH PARAB	Higher Studies
37	18CHE136	SHRUTI SARJERAO KADAM	Higher Studies
38	18CHE137	Abhishek Devendra Avhad	Deloitte
39	18CHE138	Rushad Dumasia	Higher Studies
40	18CHE139	Neil Graig Dias	Higher Studies
41	18CHE140	Aniket Rajendra Mali	Higher Studies
42	18CHE141	Shrinivas Anand Acharya	Higher Studies
43	18CHE142	Naresh Khushalchand Dhanwani	Higher Studies
44	18CHE143	Kushagra Manoj Dwivedi	Higher Studies
45	18CHE144	Dhaval Divakar Dhande	Higher Studies
46	18CHE145	Bharat Prasad	DFPCL
47	18CHE146	Vyankatesh Nagesh Puri	Aditya Birla
48	18CHE147	Harikrishnan Rajesh Namboothiri	Higher Studies
49	18CHE148	Shantanu Uttam Kadam	Gharda Chemicals
50	18CHE149	Krishna Jakhotiya	Higher Studies
51	18CHE150	Sonti Siddharth	Higher Studies
52	18CHE152	Aryan Razdan	Higher Studies
53	18CHE153	Amey Suryavanshi	Higher Studies
54	18CHE154	Abhinav Umesh Patil	Sterlite Technologies
55	18CHE155	Harshali Valmik Shardul	Higher Studies
56	18CHE156	Mayank Mukesh Kumrawat	Deccan Chemicals
57	18CHE157	Ramakrishna S	Higher Studies
58	18CHE158	Jayesh Saraogi	Higher Studies
59	18CHE159	Akshayu Ambatkar	Reliance Industries
60	18CHE160	Rajas Milind Mehendale	Higher Studies
61	18CHE161	Akash Dilip Pawar	Higher Studies
62	18CHE162	Yash Anil Bartakke	DFPCL
63	18CHE163	Atharv Hemendra Tiwari	BASF
64	18CHE164	Omkar Sambhaji Thube	Exxonmobil
65	18CHE165	Anmol Rathi	Exxonmobil
66	18CHE167	Tejas Abhyankar	Higher Studies
67	18CHE168	Aditya Namdeo Naik	Alfa Laval
68	18CHE169	Shubham Maruti Mali	Aarti Industries
69	18CHE170	Nagashravan Hemadri	Higher Studies
70	18CHE171	Aditya Rajkumar Ratnapagol	Higher Studies
71	18CHE172	Dharam Dilip Parwani	Aarti Industries
72	18CHE173	Snehal Sakharam Bhalekar	Higher Studies
73	18CHE175	Meenal Rawlani	Higher Studies
74	18CHE176	Aniruddha Jain	Axxela Advisory services
75	18CHE178	Amey Santosh Murudkar	Aarti Industries

76	18CHE180	Atharva Shailesh Sonavane	Higher Studies
77	18CHE181	Varun Inamdar	Higher Studies

Table 3.10b: Placement and higher studies data 2020-2021

Sr No	Roll number	Student's name	Company Name
1	17CHE112	Ankit Kolpe	Aarti Industries
2	17CHE161	Shantanu Sanjay Shembade	ExxonMobil Lubricants Private Limited
3	17CHE178	Siddharth Gautam Vaishnav	Biocon
4	17CHE107	Aishwarya Khandekar	ExxonMobil Lubricants Private Limited
5	16CHE137	Kovi Rishya Shrung	Higher Studies
6	16CHE174	Sushmita Shekhar Khole	Higher Studies
7	17CHE101	Junaid Gul Naikoo	BYJU's
8	17CHE104	Abhishek Kundu	Aarti Industries
9	17CHE108	Akshaykumar Dundappa Bhangari	GAIL
10	17CHE109	Alankrita Shreekant Patil	ExxonMobil Lubricants Private Limited
11	17CHE110	Amitkumar Harigovind Chauhan	BASF
12	17CHE111	Aniket Rajay Surwade	JSW One Platforms Limited
13	17CHE113	Anosh Mehernosh Dumasia	Indian Institute of Management, Kozikode
14	17CHE114	Apurva Ajay Pawar	Higher Studies
15	17CHE115	Arya Kirti Pavani	Technip
16	17CHE116	Ashlesha Girish Tiple	Carnegie Mellon University
17	17CHE117	Ashutosh Arvind Kulkarni	UPSC
18	17CHE118	Atharva Vijay Suryavanshi	UCLA (University of California Los Angeles)
19	17CHE119	Burhanuddin Husain	Lupin Ltd.
20	17CHE120	Burhanuddin Esmail Samiwala	Georgia Institute of Technology
21	17CHE121	Chinmay Prasad Deshpande	University of Massachusetts Amherst
22	17CHE122	Chinmayee Pradeep Sarode	ZS Associates
23	17CHE123	Chirag Mandar Mule	Colarado School of mines
24	17CHE124	Chirag Sanjay Jain	Biocon
25	17CHE125	Dev Pramod Malu	Indian Institute of Management, Indore
26	17CHE126	Gautam Manoj Borkar	SRF
27	17CHE127	Harsh Prakash Solanki	JSW One Platforms Limited
28	17CHE128	Himanshu Prashant Sail	Stanford University
29	17CHE129	Hrishikesh Girish Mane	North Carolina State University
30	17CHE130	Hritik Rakesh Jain	NMIMS,Mumbai
31	17CHE131	Jay Dinesh Sankhe	Aarti Industries
32	17CHE132	Joel Biju	JSW One Platforms Limited
33	17CHE133	Kshitija Dipak Waikar	Sudarshan Chemicals
34	17CHE134	Kunal Pralhad Magare	L & T Limited
35	17CHE135	Lakshay Vashist	KTH Royal Institute of Technology
36	17CHE136	Madhur Ramesh Khadke	Galaxy Surfactants Limited
37	17CHE137	Mahesh Subhash Patil	Colorado school of Mines
38	17CHE138	Makrand Ravindra Jagtap	GAIL
39	17CHE139	Mayur Surendra Pimpalkar	Deepak Nitriate
40	17CHE140	Merul Ritesh Shah	BASF
41	17CHE142	Neha Rajendra Gadekar	Galaxy Surfactants
42	17CHE143	Niraj Devdas Bhavar	HMEL
43	17CHE144	Nirmit Shantilal Solanki	ZS Associates
44	17CHE145	Nitin Ramchandra Karande	SRF
45	17CHE146	Omkar Narayan Korke	JSW One Platforms Limited
46	17CHE147	Palkita Vinod Shahdadpuri	NMIMS, Mumbai
47	17CHE148	Pranav Vinayak Mhatre	XLRI, Jamshedpur
48	17CHE149	Prasanna Prasad Khare	We Gyan Venture Ltd.
49	17CHE150	prateek shriram badgujar	Lupin Ltd.
50	17CHE151	Priyanka Subhash Humane	Dow
51	17CHE152	Purva Harshad Paranjape	Purdue University
52	17CHE153	R.Ramya Ragunathan	UCSB (University of California Santa Barbara)
53	17CHE154	Rajarshi Samajdar	University of Illinois at Urbana Champaign
54	17CHE155	Rasik Gurunath Wathare	Aditya Birla

55	17CHE156	Rushikesh Rathod	UPSC
56	17CHE157	Salil Sandeep Narvekar	Aarti Industries
57	17CHE160	Saurabh Sukhdeo Bagal	UPSC
58	17CHE163	Shruti Unnikannan	ZS Associates
59	17CHE164	Shubham Wanje	Chegg India
60	17CHE165	Srushti Sanjeevkumar Sindagi	JSW One Platforms Limited
61	17CHE166	Siddhant Sanjay Mehta	Higher Studies
62	17CHE167	Siddhi Santosh Kotnis	Texas A&M University
63	17CHE168	Sriram Pramod Tendulkar	University at Buffalo-SUNY
64	17CHE169	Sukhada Sanjeev Gharat	ZS Associates
65	17CHE170	Sumant Yogesh Salphale	KTH Royal Institute of Technology
66	17CHE171	Tanmay Nagesh Salvi	Ohio State University
67	17CHE172	Tushar Chaudhari	Moonshot Academy
68	17CHE173	Uma Gopinath Kulkarni	Higher Studies
69	17CHE174	Vedant Kiran Wankhede	ZS Associates
70	17CHE175	Vipul Moreshwar Karekar	Lupin Ltd.
71	17CHE176	Yash Ghanashyam Barhate	Purdue University
72	17CHE177	Yashraj Sanjay Jagtap	L & T Limited
73	17CHE179	Samiksha Jugalkishor Asawa	SP Jain School of Global Management
74	17CHE180	Riddhesh Nitin Kumtakar	Carnegie Mellon University
75	17CHE181	Meenal Shyam Rathi	University of Minnesota
76	17CHE182	Sarvesh Subhash Pandey	Tata AIG General Insurance Co. Ltd.

Table 3.10c: Placement and higher studies data 2019-2020

Sr no	**Roll number**	**Student's name**	**Company Name**
1	14CHE1062	Rohan Parlikar	Ninjacart
2	15CHE187	Rupanshi Anand	ACG World
3	16CHE101	Aadesh Bhakkad	Aditya Birla
4	16CHE102	Aagamkumar Khandor	Sailife
5	16CHE104	Abhinav Handu	LARSEN & TOUBRO LIMITED
6	16CHE105	Aditi Sawant	Thermax
7	16CHE106	Aditya Phad	Galaxy Surfactants Limited
8	16CHE108	Akshay Patil	Alfa Laval
9	16CHE109	Amitej Rao	DFPCL
10	16CHE112	Amrut Bagdi	Reliance Industries Ltd.
11	16CHE113	Aniket Murumkar	Savita Oil Technology
12	16CHE114	Aniket Pote	Fluor
13	16CHE116	Ankit Gaikwad	Alfa Laval
14	16CHE117	Anu Deshmukh	DFPCL
15	16CHE119	Ashish Tangade	BASF
16	16CHE121	Avinash Nayak	Jayant Agro
17	16CHE122	Bharthi Ponrathnam	Aarti Industries Ltd.
18	16CHE123	Bosco	HPCL
19	16CHE124	Kaustubh Rane	Honeywell
20	16CHE126	Darshana Malusare	Deccanchemicals
21	16CHE129	Dnyanesh Sarawate	GATE
22	16CHE131	Gaurav Mampally	Alfa Laval
23	16CHE133	Harshada Gabhale	Biocon
24	16CHE135	Kaushal Kaloo	Reliance Industries Ltd.
25	16CHE136	Keith Dsouza	GEP
26	16CHE139	Malhar Mankar	Technip India Limited
27	16CHE140	Mihir Kulkarni	Hikal
28	16CHE141	Monik Magiya	Aarti Industries Ltd.
29	16CHE142	Naman Joshi	Jubilant Life Sciences
30	16CHE144	Nayantara Pradhan	MBA
31	16CHE145	Ninad Khelukar	Fluor
32	16CHE146	Nishant Pardeshi	Sudarshan Chemicals
33	16CHE148	Prathamesh Bolaj	Biocon
34	16CHE149	Pujit Juneja	Mcdermott
35	16CHE150	Raunak Balkote	Aditya Birla

36	16CHE152	Rounak Naryani	ZS Associates
37	16CHE153	Saagar Gandhi	GEP
38	16CHE154	Saaksshi Tenpe	Sailife
39	16CHE156	Sahil Khatavkar	Tata consulting Engineers Ltd.
40	16CHE157	Sai Nazare	Galaxy Surfactants Limited
41	16CHE159	Shalaka Dhande	HPCL
42	16CHE160	Shital Suryavanshi	Aditya Birla
43	16CHE162	Shivani Bisen	LARSEN & TOUBRO LIMITED
44	16CHE164	Shriram Chavan	Jubilant Life Sciences
45	16CHE165	Shubham Shinde	DFPCL
46	16CHE166	Shubham Ravan	Jubilant Life Sciences
47	16CHE167	Shubham Adarkar	Biocon
48	16CHE168	Siddhesh Sarda	Family Business
49	16CHE176	Vaishnavi Honavar	Aker Solutions
50	16CHE177	Vartul Jain	ZS Associates
51	16CHE181	Vishal Kumar	GEP
52	16CHE107	Akash Nogaja	Purdue
53	16CHE110	Amogh Nagarkar	ETH Zurich
54	16CHE115	Anirudh Venkatesh	Purdue University
55	16CHE118	Ashin Sunny	OSU
56	16CHE120	Asmee Prabhu	NTU Singapore
57	16CHE125	Chinmay Mhatre	University of Pittsburgh
58	16CHE127	Dhiraj Jain	Rice University
59	16CHE128	Dishit Ghumra	University of Minnesota
60	16CHE130	Eashaan Godbole	GaTech
61	16CHE132	Gautami Kelkar	NC State University
62	16CHE134	Kalash Pai	Cornell Univercity
63	16CHE143	Namita Jadhav	Higher Studies
64	16CHE147	Ojaswi Rathi	UC Berkeley
65	16CHE151	Razeen Shaikh	Texas A&M University
66	16CHE161	Shivani Kulkarni	Rensselaer Polytechnic Institute
67	16CHE163	Shreekant Gokhale	University of Illinois at Urbana-Champaign
68	16CHE169	Snehal Patil	OSU
69	16CHE170	Sreejith Nair	University of Minnesota
70	16CHE171	Surabh KT	The City College of New York
71	16CHE175	Suyog Shaha	Harvard
72	16CHE179	Vidit Shah	University of Washington, Seattle
73	16CHE182	Yash Budhe	University Of Pennsylvania

Table 3.10d: Placement and higher studies data 2018-2019

Sr. No.	Roll No.	Student's Name	Company Name
1	15CHE1001	shah akshay snehal falguni	Higher studies
2	15CHE1002	gite prajwal pramod ujjwala	LARSEN & TOUBRO LIMITED
3	15CHE1003	kulmethe amol khushal savita	Higher studies
4	15CHE1004	aditya avinash pol	Higher studies
5	15CHE1005	shetty roshan raghuram vanita	Georgia Institute of Technology
6	15CHE1007	vikram sudarshan	Univ of Pennsylvania
7	15CHE1008	prabhala sai vivek balaramakrishna	OSU
8	15CHE1009	bodemwad shubham govindrao	Higher studies
9	15CHE1010	gosrani tej bhavin bhumika	Amazon
10	15CHE1011	wasnik sakshi bhupendra	Aker Solutions
11	15CHE1012	kamble yash laxman	UIUC
12	15CHE1013	mankad nisarg amit neha	Reliance
13	15CHE1014	sheikh nihan ashfaq	Aarti Industies
14	15CHE1016	parsharam shivtej kashinath	Reliance
15	15CHE1017	baser aditya swapneshu shubhangi	Columbia University
16	15CHE1018	varun sundarkumar priti	Purdue
17	15CHE1019	gokhale yash shailendra sonali	Carnegie Mellon University
18	15CHE1021	patel riddhesh ashokbhai sangitaben	Upitts
19	15CHE1022	godbole apurva rajeev	UIUC

20	15CHE1023	ashutosh trivedi sunil archana	Deccan chemicals
21	15CHE1024	sharma shubham sunil rekha	Reliance
22	15CHE1025	anikhindi chinmay umesh asawari	Reliance
23	15CHE1026	thakur charul hemant urmila	Reliance
24	15CHE1027	kapadia talha afzal sufia	Darthmouth College
25	15CHE1028	anantwar sakshi chandrakant suhasini	Aarti Industies
26	15CHE1030	deshmukh gaurav sanjay jayashree	Purdue
27	15CHE1032	shah vaidik rashesh shital	Cornell University
28	15CHE1033	mhatre ninad vinayak manisha	UMinn
29	15CHE1034	jog sachin hemant amruta	ETH Zurich
30	15CHE1035	gathadi mayank mahendra nilima	University of California San Diago
31	15CHE1036	vora maitri viren alpa	Amazon
32	15CHE1037	patel bhargav bhavesh swati	ETH Zurich
33	15CHE1038	joshi rushikesh kishor seema	OSU
34	15CHE1040	pandare rahul vishwas shraddha	Aker Solutions
35	15CHE1041	chaudhari tanmay omvijay sonali	Higher studies
36	15CHE1042	rangari mrugal anup pradnya	Byju's
37	15CHE1044	prakash supriya suraj jaya	Harvard SEAS
38	15CHE1045	pai kaivalya waman madhura	Byju's
39	15CHE1046	dapurkar omkar yogesh vaishali	Aker Solutions
40	15CHE1049	lakhekar lalit namdev rekha	GAIL
41	15CHE1050	maity samadarshi shambhu charan tripti	T.U. Delft
42	15CHE1051	khan abusaif abdul khalik nazma khatoon	Aarti Industies
43	15CHE1052	bansal prateek dinesh rekha	UIUC
44	15CHE1054	kumbhojkar ninad aniruddha kumud	Harvard SEAS
45	15CHE1055	joshi aaditya upendra aditi	Purdue
46	15CHE1056	thakkar shreya akshay chetna	UMass
47	15CHE1057	pawar prathamesh shankar pooja	Reliance
48	15CHE1058	shah arjun apurva sangeeta	ETH Zurich
49	15CHE1059	ramteke anvita narendra shalini	ALFA Laval
50	15CHE1060	shah rushabh manishbhai paritaben	UMass
51	15CHE1061	balla shivani shrikrishna radha	Technimont
52	15CHE1062	lakhwani sagar vinod rajani	Technip
53	15CHE1063	gandhi darshak ketan keyuri	BASF
54	15CHE1064	badsewal devesh mukesh sneha	GAIL
55	15CHE1065	sontakke mrunal vijayanand archana	RPI
56	15CHE1066	yewale gaurav prafull swati	T.U. Delft
57	15CHE1067	deshpande tejaswini makarand namrata	Byju's
58	15CHE1068	trivedi varun mehul jagruti	UC Riverside
59	15CHE1069	sarda sarvesh gopal bharati	Glenmark
60	15CHE1070	valia raj anil hina	Jayant Agro
61	15CHE1071	swamy dhananjay revanasiddayya shobha	Honeywell
62	15CHE1073	tinghase vaibhav dnyaneshwar sadhana	DMCC
63	15CHE1074	chatterjee shreya sampa	Technip
64	15CHE1075	jalan aashna sanjay ruchi	Exxonmobil
65	15CHE1076	aroskar pratik laxman prerana	Shirdi Sai Nutraceuticals Pvt. Ltd
66	15CHE1077	padwal neha amol asmita	UCSB
67	15CHE1078	chikhalikar atharva shashank alka	UMinn
68	15CHE1079	rishikesh ramnarayan jaiswal	PI Industries
69	15CHE1080	lodaya badal girish shilpa	MSU
70	15CHE1081	pande devyani sanjay varsha	Deccan chemicals
71	15CHE1082	agrawal paresh anil arti	IIM/NITIE
72	15CHE1083	biyani aditya vinay namrata	Carnegie Mellon University
73	15CHE1084	pawar sunny jitendra anita	Aarti Industies
74	15CHE1085	kumavat yeshwant prakash viju	Thermax
75	15CHE1086	mansi sharma	CleanChem Laboratories

Table 3.10e: Placement and higher studies data 2017-2018

Sr. No.	Roll no.	Student's name	Company Name
1	14CHE1001	Ashwin Rajesh Turkar	BPCL
2	14CHE1002	Shantanu Sunil Malani	Higher studies

3	14CHE1003	Lahu Dnyaneshwar Chavan	Aarti Industries
4	14CHE1005	Akash Sandeep Tandale	Honeywell
5	14CHE1006	Saiprasad Suresh Iralwad	Alkyl Amines
6	14CHE1007	Akshata Sanjiv Gujar	Pfizer
7	14CHE1008	Subhash Hadke Ankita	BPCL
8	14CHE1010	Parth Sunil Vora	Exxonmobil
9	14CHE1011	Abhishek Pawankumar Dhand	University of Pennsylvania
10	14CHE1012	Aman Jayesh Jain	MSIE at Columbia University
11	14CHE1013	Mangesh Sudhakar Hase	BPCL
12	14CHE1014	Shivani Shivkumar Butte	Biocon
13	14CHE1015	Ameya Uddhav Harmalkar	Johns Hopkins University
14	14CHE1016	Harshit Shailesh Mehta	Piddilite
15	14CHE1018	Shubham Vijay Veer	Reliance
16	14CHE1019	Kajal Sunil Patil	Danone
17	14CHE1020	Akash Madhav Gondaliya	Michigen state university
18	14CHE1021	Shubham Sukumar Awate	University of Pittsburgh
19	14CHE1022	Chetan Nitin Pandere	Higher studies
20	14CHE1023	Raiesaah Murtuzza Kutiyanawala	Columbia University
21	14CHE1024	Meheryar Rohinton Kasad	Michigen state university
22	14CHE1025	Kanishk Sanjay Mair	Carnegie Mellon University
23	14CHE1026	Sanket Prakash Kalode	Technip
24	14CHE1027	O.Nilesh Varadan	University of Alberta
25	14CHE1028	GAIKWAD Sanika RAVINDRA	Reliance
26	14CHE1029	Dixeet Gaurang Purohit	SRF
27	14CHE1030	Parth Rajesh Shah	University of California
28	14CHE1031	Paras Vasant Bhanushali	SRF
29	14CHE1032	Abhijeet Surendra Subudhi	BPCL
30	14CHE1033	Rushant Satej Sabnis	Texas A & M University
31	14CHE1034	Anuj Sanjiv Joshi	The Ohio State University
32	14CHE1035	Ankit Udit Thakker	Toyo Engg.
33	14CHE1036	Akshaya Anil Kulkarni	Texas A & M University
34	14CHE1037	Niranjan Arvind Sitapure	Texas A & M University
35	14CHE1038	Chinmay Vishwas Gogate	Reliance
36	14CHE1039	Mansi Rajinder Vashodia	IIM Indore
37	14CHE1040	Gouree Vijaykumar Kumbhar	Michigen state university
38	14CHE1041	Nipun Jaikrishna Jagtap	Chembond
39	14CHE1042	ASHIMA CHOPRA	Thermax
40	14CHE1043	Vikrant Sanjay Kshirsagar	SRF
41	14CHE1044	Sachin Shyam Shirpurkar	Georgia Institute of Technology
42	14CHE1046	Durgesh Prasad Kavishvar	University of Toronto
43	14CHE1047	SOHAM Sunjay ASRANI	University of California, Berkeley
44	14CHE1048	Nikita Gerald Lewis	J.P. Morgan
45	14CHE1049	Labdhi Kiran Haria	Carnegie Mellon University
46	14CHE1050	Patange Anushree Ravindra	Reliance (PPO)
47	14CHE1051	Jay Naresh Walendra	Tata Consultancy Engineers Ltd
48	14CHE1052	Rajiv Ranjit Nair	Johns Hopkins University
49	14CHE1053	Brijesh Deepak Nayak	Higher studies
50	14CHE1054	VIDHISHA NAKHWA	Sciative Solutions
51	14CHE1055	Ankita Rajendra Morankar	Purdue University
52	14CHE1056	Himani Raju Verma	Century Cement
53	14CHE1057	Raj Shantaram Shirke	Higher studies
54	14CHE1058	Shraavya Rao	The Ohio State University
55	14CHE1059	Ameet Balaji Jaybhaye	Reliance
56	14CHE1060	Vyom Krishan Thakker	The Ohio State University
57	14CHE1064	Meghana Ravindra Dande	Technip
58	14CHE1066	M ISWARYA	Rensselaer Polytechnic Institute
59	14CHE1068	Sandesh Ram Honmane	Century Cement
60	14CHE1070	Dhanashree Rajendra Shinde	Marico
61	14CHE1071	Aman Sandeep Shah	Reliance (PPO)
62	14CHE1072	Kaustubh Jaywant Sawant	Purdue University
63	14CHE1073	Shubham Vilasrao Rampalliwar	Reliance (PPO)
64	14CHE1074	Srinidhi Suresh	Georgia Institute of Technology

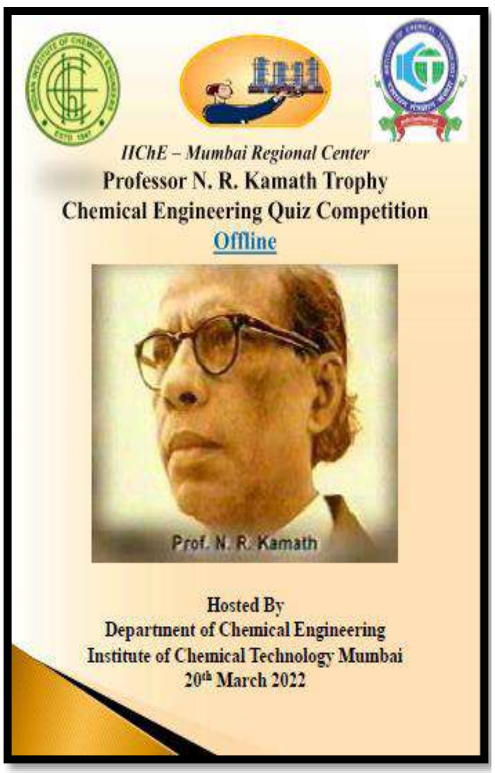
65	14CHE1075	Ishita Chirag Talati	Technip
66	14CHE1076	Karan Vijay Waghela	Rubamin
67	14CHE1077	Pratik Jaiprakash Gupta	Deccan chemicals
68	14CHE1079	Ayushi Arun Mehta	Technip
69	14CHE1080	Dhruv Amit Jhaveri	BPCL
70	14CHE1081	Premkumar Ashwin Mohite	Aarti Industries
71	14CHE1082	Vidhi Sundeep Khetan	Exxonmobil
72	14CHE1083	Krishna Rajaram Iyer	University of Minnesota
73	14CHE1084	Gaurav Murali Iyer	University of Maryland
74	14CHE1085	SAUMIL Praphool CHHEDA	University of Minnesota
75	13CHE	Hurshvardhan Srivastava	University of California, Berkeley
76	13CHE	Neel Shah	University of Washington, Seattle

3.6. Professional Activities (20) **(Institute marks 20)**

3.6.1. Professional societies/chapters and organizing engineering events (5) **(Institute marks 5)**

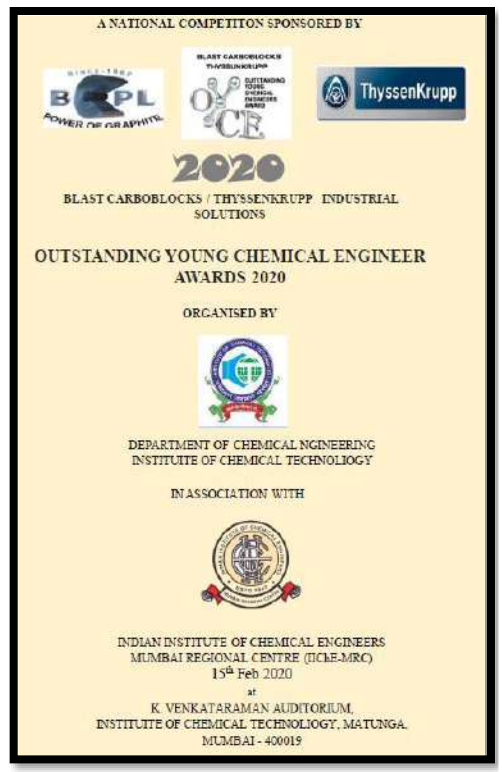
Student Chapter IIChE: Nearly 50 students registered

Students Chapter IIChE Office Bearers:
Chairperson: Arya Shah
Secretary: Shlok Mishra
Treasurer: Aryan Tibrewala
Design Head/Secretary: Nakshatra Patil and Soham Narvekar



NR Kamath Quiz 2022

SChemcon 2018



OYCE 2020

Figure 3.1: Professional Chapters

Engineering event(s): Vortex

1] Industry defined problems
2] Master class- Lecture series
3] Papyrus – Oral presentations
4] Manifesto – Poster presentations
5] Chemifuge – Quiz competition
6] ChemCodes – Coding competition

7] Chemquotient – MCQs, visual, written, Oral tests
8] YATN – Awareness on environmental issues
9] Ignite – Oral presentations (Non-technical)
10] Entrepreneurs blueprint: Idea presentation
11] Corporate tycoon – Management aptitude

Figure 3.2a: Engineering events

Figure 3.2b: Engineering events

Extra-curricular activities:

1] Art club of ICT
2] Music club of ICT
3] Literary club of ICT
4] Manthan (Language club)
5] Manzar (Cultural fest)
6] Sport-saga (Sports fest)
7] Marathons
8] Hostel Day
9] Religious festivals
10] Clean up drive

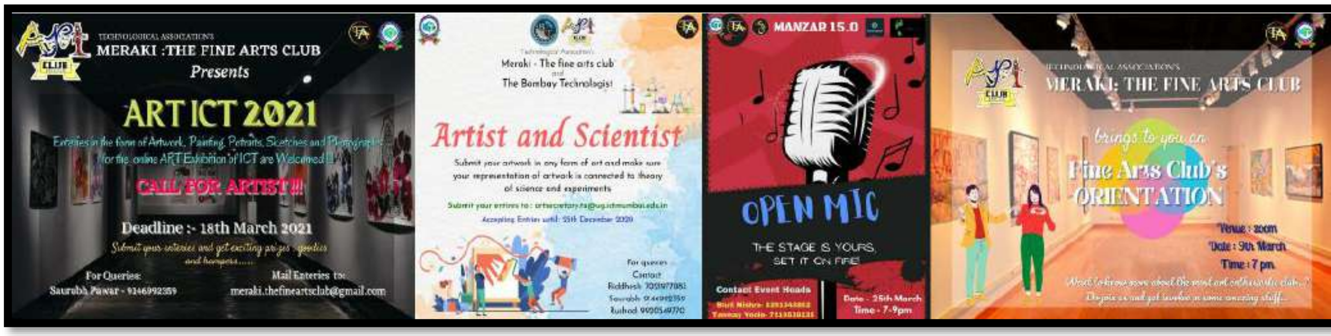


Figure 3.3a: Extra-curricular activities

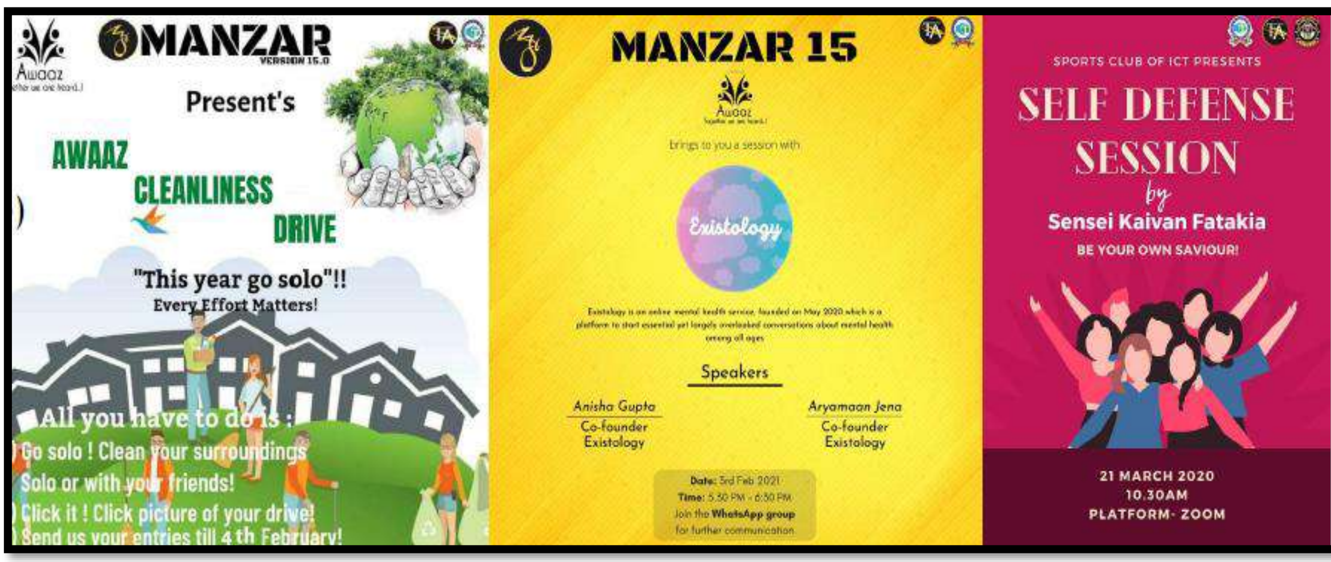


Figure 3.3b: Extra-curricular activities

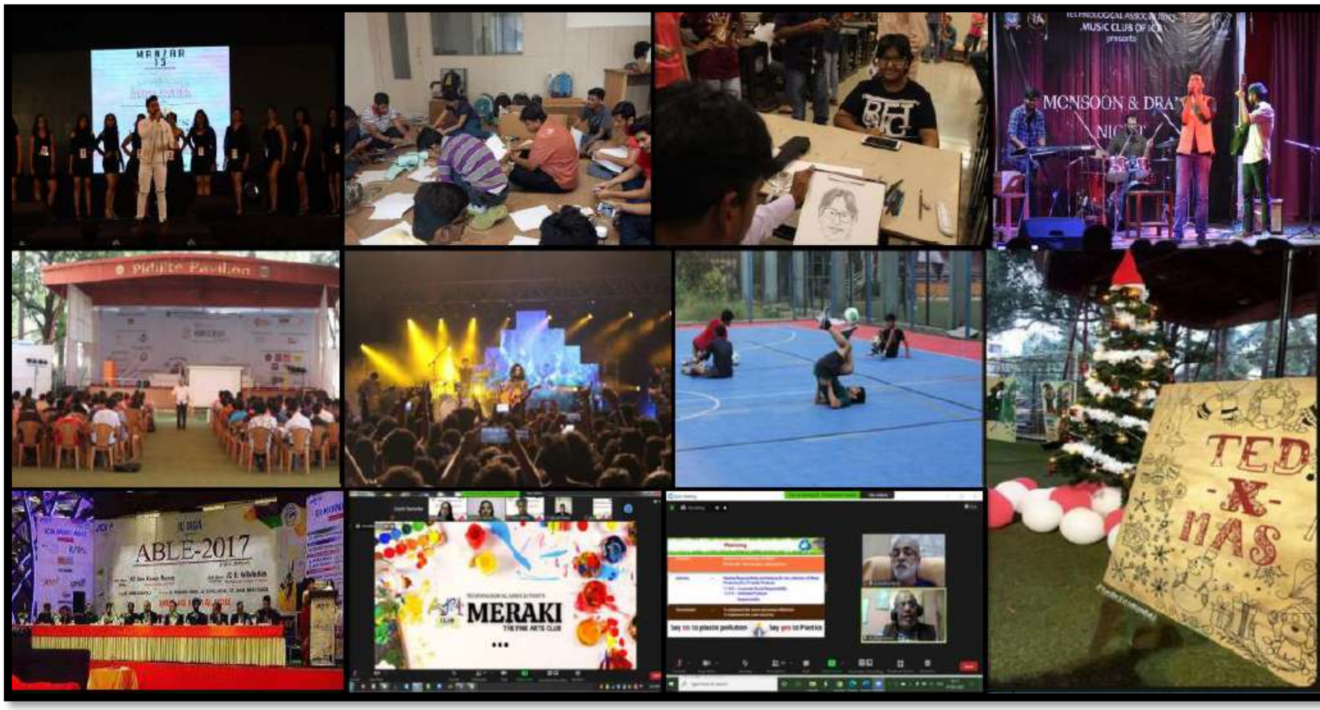


Figure 3.3c: Extra-curricular activities

Figure 3.4a: UAA activities

Figure 3.4b: UAA Certificate distribution Ceremony April 2022

Figure 3.4c: UAA Pune Chapter, 2022

Figure 3.4d: UAA Marathwada Chapter, 2022

3.6.2. Publication of technical magazines, newsletters, etc. (5) **(Institute marks 5)**

Table 3.11: Student Publications in International Journals

Sr No	Authors	Research paper title	Journal	Editors	Publisher	Details
1	R. Jawale**, O. Dapurkar** and P. Gogate	Treatment of atrazine containing wastewater using cavitation based hybrid treatment approaches	Chemical Engineering and Processing - Process Intensification	Marc-Olivier Coppens, PhD University college London, United Kingdom	Elsevier	Volume 130, August 2018, Pages 275-283
2	**Bharat Honmane, Tejaswini Deshpande, Abhishek D, and Rhea Bhansali,** Pushpito K.Ghosh	Channelizing the osmotic energy of proximate sea bittern for concentration of seawater by forward osmosis under realistic conditions to conserve land requirement for solar sea salt production	Journal of Membrane Science	Rong Wang, PhD. Singapore Jerry Y.S.Lin, PhD. USA	Elsevier	Volume 567, 1 December 2018, Pages 329-338
3	Pranav H Nakhate, Hrushikesh G Patil, **Vidit Shah, Tanmay Salvi,** Kumudini Marathe	Process validation of integrated bioelectrochemical and membrane reactor for synchronous bioenergy extraction and sustainable wastewater treatment at a semi-pilot scale	Biochemical Engineering Journal	Wilfred Chen, Masahiro Goto, Apostolis Koutinas	Elsevier	Volume 151, November 2019, 107309
4	**Sabnis S.S., Singh S.D.**, Gogate P.R.	Improvements in azithromycin recrystallization using ultrasound for size reduction	Ultrasonics Sonochemistry	Muthupandian Ashokkumar	Elsevier	Volume 83, February 2022, 105922
5	**Sarode C., Jagtap Y.,** Gogate P.	Ultrasound for Improved Encapsulation and Crystallization with Focus on Pharmaceutical Applications	Springer Optimization and Its Applications	Antonios Fytopoulos, Rohit Ramachandran, Panos M. Pardalos	Springer	Book Chapter of Optimization of pharmaceutical processes, 193-229
6	**Tiple A.**, Sinhmar P.S., Gogate P.R.	Improved direct synthesis of TiO2 catalyst using sonication and its application for the desulfurization of thiophene	Ultrasonics Sonochemistry	Muthupandian Ashokkumar	Elsevier	Volume 73, May 2021, 105547
7	Sinhmar P.S., **Tiple A.**, Gogate P.R.	Combined extractive and oxidative desulfurization approach based on ultrasound and ultraviolet irradiation with additives for obtaining clean fuel	Environmental Technology and Innovation	Ravi Naidu, Duc Long Nghiem, Kirk Semple	Elsevier	Volume 22, May 2021, 101487
8	**Ghumra D.P.**, Agarkoti C., Gogate P.R.	Improvements in effluent treatment technologies in Common Effluent	Process Safety and	Guohua Chen,	Elsevier	Volume 147, March

		Treatment Plants (CETPs): Review and recent advances	Environmental Protection	Faisal Khan		2021, 1018-1051
9	Khaire R.A., **Sunny A.A**., Gogate P.R.	Ultrasound assisted ultrafiltration of whey using dual frequency ultrasound for intensified recovery of lactose	Chemical Engineering and Processing - Process Intensification	Marc-Olivier Coppens	Elsevier	Volume 142, August 2019, 107581
10	Jawale R.H., **Dapurkar O**., Gogate P.R.	Treatment of atrazine containing wastewater using cavitation based hybrid treatment approaches	Chemical Engineering and Processing - Process Intensification	Marc-Olivier Coppens	Elsevier	Volume 142, August 2019, 107581
11	Subhedar P.B., **Ray P.**, Gogate P.R.	Intensification of delignification and subsequent hydrolysis for the fermentable sugar production from lignocellulosic biomass using ultrasonic irradiation	Ultrasonics Sonochemistry	Muthupandian Ashokkumar	Elsevier	Volume 40, Part B, January 2018, 140-150
12	**Ganju S**., Gogate P.R.	A review on approaches for efficient recovery of whey proteins from dairy industry effluents	Journal of Food Engineering	Ferruh Erdodgu, Paul Singh	Elsevier	Volume 215, December 2017, 84-96
13	Jawale R.H., **Tandale A**., Gogate P.R.	Novel approaches based on ultrasound for treatment of wastewater containing potassium ferrocyanide	Ultrasonics Sonochemistry	Muthupandian Ashokkumar	Elsevier	Volume 38, September 2017, 402-409
14	Mohod A.V., **Subudhi A.S**., Gogate P.R.	Intensification of esterification of non edible oil as sustainable feedstock using cavitational reactors	Ultrasonics Sonochemistry	Muthupandian Ashokkumar	Elsevier	Volume 36, May 2017, 309-318
15	SunilS.Bhagwat, **Ashwin Kane, Sparsh Ganju**, Prafulla chandra P.Vora	Simple correlation for critical isotherm of pure compounds	Chemical Engineering Science	Anton Middleberg	Elsevier	Volume 192, December 2018, 1036-1040
16	**Purva Paranjape**, Manishkumar D. Yadav	Recent advances in the approaches to recover rare earths and precious metals from E-waste: A mini-review	Canadian journal of chemical engineering	Joao Soares	Wiley	May 2022, Page and volume no. is yet to be assigned
17	**B Honmane, R Bhansali, T Deshpande, A Dhand, S Mogha,** J Mukherjee, **D. Ghosh, G Sarode, S Srivastava, A Dive, D**	Harnessing the osmotic energy of cane molasses by forward osmosis: process studies and implications for a sugar mill	International Journal of Environmental Studies	Dr M. R. Brett-Crowther	Taylor & Francis Online	August 2020, 247-270

	Deshmukh, P K Ghosh					
18	**Pai, K. R., Sindhuja, V., Ramachandran, P. A.,** & Thorat, B. N.	Mass Transfer “Regime” Approach to Drying	Industrial & Engineering Chemistry Research	Phillip E. Savage	ACS Publications	Volume 60, issue 26, 9613-9623
19	**Shah, S. H., Pai, K. R., Shinde, S. R.,** & Thorat, B. N.	Analysis of a vapor compression refrigeration system using a fog-cooled condenser.	Applied Thermal Engineering	Chirtos Markides	Elsevier	Volume 196, 117299
20	**Bhatkar, N. S., Shirkole, S. S., Mujumdar, A. S.,** & Thorat, B. N.	Drying of tomatoes and tomato processing waste: a critical review of the quality aspects.	Drying Technology	Arun S. Mujumdar	Taylor & Francis Online	Volume 39, Issue 11, 1720-1744
21	**Ghadge S.**, Shrivastava S., Kausley S.B., Satpute S., Badve M., Pandit A.A., Rai B., Pandit A.B.	ANN modelling of Hydrodynamic Cavitation for the degradation of Rhodamine B dye	Journal of Water Process Engineering	Nick Hankins Abdul Wahab Mohammad Xiochang Wang	Elsevier	Volume 47, June 2022, 102759
22	Yadav S., Gaikwad G., **Chaturvedi A.**, Ananthasivan K., Pandit A.B., Jain R.	Fabrication of CeO2 microspheres by internal gelation process using T junction droplet generator	Brazilian Journal of Chemical Engineering	Reinaldo Giudici	Springer	January 2022
23	**Mule C.M.**, Doltade S.B., Pandit A.B.	A review on pesticide degradation from irrigation water and techno-economic feasibility of treatment technologies	Water Environment Research	Jason He	Wiley online library	August 2021
24	Ladole M.R., Pokale P.B., **Varude V.R.**, Belokar P.G., Pandit A.B.	One pot clarification and debittering of grapefruit juice using co-immobilized enzymes@chitosanMNPs	International Journal of Biological Macromolecules	Aichun Dong John F. Kennedy	Elsevier	Volume 167, January 2021,, 1297-1307
25	Sahu A., Rane N.V., **Lodaya B.G.**, Pandit A.B.	Green synthesis and kinetic study of eco-friendly chelating agent by hydrothermal process for remediation of heavy metals	Indian Chemical Engineer	Prof. Suddhasatwa Basu	Taylor & Francis Online	August 2021
26	Sahu A., **Lodaya B.G.**, **Handu A.V.**, Pandit A.B.	Expeditious synthesis and kinetic study of biodegradable amide 2,2-((3-(2-((carboxymethyl)amino)-2-oxoethyl)-3-hydroxypentanedioyl) bis (azanediyl) diacetic acid (COHBDA) under ultrasound irradiation	Indian Chemical Engineer	Prof. Suddhasatwa Basu	Taylor & Francis Online	February 2020, 252-266

27	Dastane G.G., Thakkar H., **Shah R.**, Perala S., Raut J., Pandit A.B.	Single and multiphase CFD simulations for designing cavitating venturi	Chemical Engineering Research and Design	Jerry Heng	Elsevier	Volume 149, Septemb er 2019, 1-12
28	Badnore A.U., **Chaudhari A.P.**, Patel J.K., Pandit A.B.	Effect of solvents on properties of the ultrasound-assisted synthesized ceria nanoparticles and its performance as an adsorbent	Advanced Powder Technology	Masayoshi Fuji	Elsevier	Volume 30, Issue 5, May 2019, 1058-1066
29	Tambat S.N., Sane P.K., **Suresh S.**, Varadan O. N., Pandit A.B., Sontakke S.M.	Hydrothermal synthesis of NH2-UiO-66 and its application for adsorptive removal of dye	Advanced Powder Technology	Masayoshi Fuji	Elsevier	Volume 29, Issue 11, Novembe r 2018, 2626-2632
30	**Iyer G**, **Dyawanapelly S**, Jain R*, & Dandekar, P	An overview of oral insulin delivery strategies	International Journal of Biological Macromolecules	Aichun Dong John F. Kennedy	Elsevier	Volume 208, May 2022, 565-585
31	**Patil S, Pandit A, Godbole A,** Dandekar P, Jain R	Chitosan based co-processed excipient for improved tableting performance	Carbohydrate Polymer Technologies and Applications	John F. Kennedy	Elsevier	Volume 2, Decembe r 2021, 100071
32	**Pandit A, Indurkar A, Deshpande C**, Jain R*, Dandekar P*	A systematic review of physical techniques for chitosan degradation	Carbohydrate Polymer Technologies and Applications	John F. Kennedy	Elsevier	Volume 2, Decembe r 2021, 100033
33	**RA Krishnan, O Mhatre, J Sheth, S Prabhu**, Jain R*, P Dandekar	Synthesis of zinc oxide nanostructures using orange peel oil for fabricating chitosan-zinc oxide composite films and their antibacterial activity	Journal of Polymer Research	Show-An S.-A. Chen	Springer	volume 27, Article number: 206 (2020)
34	**Krishnan RA, Pant T, Sankaranarayan S, Stenberg J,** Jain R*, Dandekar P*	Protective nature of low molecular weight chitosan in a chitosan–Amphotericin B nanocomplex – A physicochemical study	Materials Science & Engineering	Manuel Salmeron-Sanchez	Elsevier	Volume 93, Decembe r 2018, 472-482

The Bombay Technologists is an in-house peer-reviewed research journal of the Institute of Chemical Technology, published semi-annually. Over sixty volumes have been published. The latest issue is volume 68.

Figure 3.5: Bombay Technologist sample issues

Figure 3.6: Bombay Technologist events

Table 3.12: Student Publications in Bombay Technologist

Sr. No.	Authors	Research paper title	Details
1	Swarali Paranjape, Mihika Yeoleka	Liposome Technology for Cancer treatment	Bombay Technologist 2020, 67
2	Susmit Mhatre, Nitisha Gurav	Enhancing bioavailability of probiotics using microencapsulation	Bombay Technologist 2020, 67
3	Rahul Kamath	Formulation of vegan health beverage using coconut milk and fortifying it with flaxseed oil	Bombay Technologist 2020, 67
4	Hrithik R. Shetty	Substitution of synthetic colorants by Betalain pigment extracted from beetroot peels in baked foods: Muffins	Bombay Technologist 2020, 67

5	Yogesh D. Jagdale, Swapnil R. Chaudhari, Anand V. Patwardhan	Extraction of zinc in presence of cobalt through hollow fibre supported liquid membrane from simulated industrial wastewater	Bombay Technologist 2020, 67
6	Yogesh Pandit Palve, K Mohanapriya, Neetu Jha	Solar Reduced Graphene Oxide Based Enzyme Free Ascorbic Acid Sensor	Bombay Technologist 2020, 67
7	Srinivasan Savitha	Non-thermal microbial decontamination of onion and dehydrated onion products	Bombay Technologist 2021, 68
8	Harini Srikant	A Review of plant-and fungi-based meat and cellular meat: an Indian perspective	Bombay Technologist 2021, 68
9	Pooja Paresh Savla	The Selection and Screening of Conformers	Bombay Technologist 2021, 68
10	Karthik Sinha	Drug Release Medical Textiles: Fundamentals, Classification and Methods of Fabrication	Bombay Technologist 2021, 68
11	Ekta Jagtiani	COVID-19 outbreak: An Overview	Bombay Technologist 2021, 68
12	Ekta Jagtiania, Darsh Vithlani	COVID-19: Vaccines on Their Marks	Bombay Technologist 2021, 68
13	Tanvi S. Karve, Chirag M. Muleb, Rupesh S. Pawar, Meenal B. Rawlani	Applications of Electroactive polymers: Review	Bombay Technologist 2021, 68
14	Saumya Saxena, Gurpreet Bharj, Mohd. Arsalan Pasha	A Review Study on Advancements in the Recycling Methods of Polyethylene terephthalate	Bombay Technologist 2021, 68
15	M. Arsalan Pashaa, Shubham Utekara, Ritoban Ghosha	Recent advances in Microencapsulation Technology and their Applications	Bombay Technologist 2021, 68
16	Anooshka Arun Avasare	A Review on Immune-Boosting Activity of Functional Foods- Prebiotics and Probiotics	Bombay Technologist 2021, 68
17	Rimjhim Balia and Harshita Sheta	Transition metal-based nanoparticles catalyzed esterification reactions	Bombay Technologist 2021, 68
18	Swareena Jaina, Raman Sehgal, Radha V. Jayaram	Quantum Computation - A sign of quantum supremacy	Bombay Technologist 2021, 68

For many years, SPIRIT has been an official student-run newsletter of the Institute of Chemical Technology.

Figure 3.7: Spirit magazine

3.6.3. Participation in inter-institute events by students of the program of study (5)
(Institute Marks 5)

Table 3.13: Student participation in inter-institute events

Sr. No.	Name of the student	Award name	Year
1	Aditya Joshi	His solution to problem posed in Romanian Mathematical Magazine was published	2018
2	Ninad Kumbhojkar, Supriya Prakash, Bhargav Patel, Atharva Chikhalikar, Marwan Malik (Xaviers college)	Team Ict won bronze medal at iGEM award 2018 (340 teams participated), Project topic: "Smart Soil"	2018
3	Omkar Dapurkar	The Chemical Weekly Prize for Best Research Paper Published in a High Impact Factor	2018
4	Mr. Anirudh Venkatesh, Eeshan Godbole and Surabh K. T	won 2nd Prize in N. R. Kamath Memorial Quiz, Held in Datta Meghe College of Engineering, Organized by IIChE Mumbai Regional Centre, March 2019	2019
5	Mr. Nilesh Hendre, along with Mr. Nilesh Veer HWB	first prize at the Outstanding Young Chemical Engineer 2019, National Level competition organized by IIChE-MRC	2019
6	Kaustubh Rane, Snehal Patil, Asmee Prabhu, Sreejith Nair and Surabh KT	won first prize in Smart India Hackathon Hardware edition 2019, for the problem, Conversion of CO2 to CO.	2019
7	Abhishek Bharadwaj, Akshay Bhangari, Himanshu Sail, Hrishikesh Mane, Ramya Raghunatha	won the first prize in the Smart India Hackathon2019, for the problem, Electrodialysis and Reverse Osmosis based water purification, reduction of Reject in RO process.	2019
8	Amogh Nagarkar	won the "Pankaj P Patel Trust" Essay Competition, organized by IIChE for the year 2019.	2019
9	Tejaswini Deshpande	the IIChE's, Chemical Weekly prize for Best Research Paper published in High Impact Factor International Journal by an Undergraduate Chemical Engg Student, First Prize for the Year 2019.	2019
10	Anirudh Venkatesh, Akash Nogaja, and Atharva Suryavanshi	won 2nd Prize in N. R. Kamath Memorial Quiz, Held in D. J. Sanghvi College of Engineering, Organized by IIChE Mumbai Regional Centre, March 2020	2020
11	Bhushan Murjani, Manasi Bansod, Pankti Savla, Sudarshan Shrinivas, Saloni Vaidya, Parikshit Kundu	Won Second Prize in the undergraduate category at the New Generation Ideation Contest 2021 organized by Hindustan Petroleum Corporation Limited.	2021

3.6.4. Participation in national/international competitive events by students of the program of study (5)
(Institute marks 5)

The National/International competitions:

1] IIT Bombay's Chemical Engineering Symposium AZEOTROPY
2] NR Kamath Quiz
3] New Generation Ideation Contest
4] SChemCon
5] ChemCon
6] TEDx ICT Mumbai
7] Modern day industrialist–Manzar
8] Vortex
9] Bombay technologist
10] OYCE

VORTEX:
This prepares itself for pan-India involvement, with participation from across 70 colleges in 35 cities. In the previous academic year, the separate Technical festivals received total combined participation of around 6,000, and over 100 industrialists visit the institute during the festival. "VORTEX: The ChemFest" aims at surpassing the previous participation and pervading all the entities pertaining to the chemical diaspora.

Bombay Technologist:
The Bombay Technologist is the annual technical journal of the Institute of Chemical Technology Mumbai. Fondly known as The BT the journal invites scientific research and review articles from students of all disciplines i.e. Chemical Engineering Chemical Technology and Pharmacy studying in the Institute. The BT aims to create awareness and encouragement amongst the students regarding various aspects of technical writing.
Conceptualized and initiated by students and Faculty, the Bombay Technologist has an awe-inspiring collection of archives that has been helping the students keep abreast with the ongoing scientific developments. We aim to reach out to the students' academicians and the industry by web archiving all the many volumes of the BT.
Through seminars and workshops dedicated to a specific group of students, BT inculcates and encourages the culture of technical writing and presentation. Articles are reviewed strictly by use of modern plagiarism software and by a critical review of Professors and Researchers.

Figure 3.8: Participation in competitive events

Figure 3.9: Students winning award at New Generation Ideation Contest 2021 organized by HPCL

CRITERION 4	Faculty Information and Contributions	98.8/100

Table 4.1: Faculty Information and Contributions

Sr. No.	Name	Qualification			Association with the Institution	Designation	Date on which Designated as Prof./Assoc. Prof.	Date of Joining the Institution	Department	Area of Specialization	Academic Research			Currently Associated (Y/N) Date of Leaving (In case Currently Associated is (" No")	Nature of Association
		Degree (highest degree)	University	Year of attaining higher qualification							Research Paper Publication	Ph.D. guidance	Faculty Receiving Ph.D. during the Assessment Years		
1	Professor A. B. Pandit	PhD	Institute of Chemical Technology	1984	Teaching/Research	Professor	01-01-1996	01-01-1991	Chemical Engineering	Sono chemical processes, reactor design and process intensification	422	50	15	Yes	Regular
2	Professor V. G. Gaikar	PhD	Institute of Chemical Technology	1986	Teaching/Research	Professor	01-07-2002	17-07-1984	Chemical Engineering	Intensification, Material Science	189	52	10	Yes	Regular
3	Professor A. W. Patwardhan	PhD	Institute of Chemical Technology	1999	Teaching/Research	Professor	01-01-2011	08-06-1998	Chemical Engineering	Process intensification	135	29	15	Yes	Regular
4	Professor S. S. Bhagwat	PhD	Institute of Chemical Technology	1989	Teaching/Research	Professor	18-11-2003	18-11-1991	Chemical Engineering	Interfacial science	94	41	10	Yes	Regular
5	Professor V. K. Rathod	PhD	Institute of Chemical Technology	2008	Teaching/Research	Professor	21-07-2011	21-07-2008	Chemical Engineering	Biotechnology, Environmental engineering	227	28	13	Yes	Regular
6	Professor P. R. Gogate	PhD	Institute of Chemical Technology	2002	Teaching/Research	Professor	05-07-2018	03-07-2007	Chemical Engineering	Process intensification	401	22	17	Yes	Regular
7	Dr. V. H. Dalvi	PhD	The University of Texas at Austin	2009	Teaching/Research	Assistant Professor		09-05-2011	Chemical Engineering	Energy engineering	31	2		Yes	Regular
8	Dr. P. R. Nemade	PhD	University of Colorado	2008	Teaching/Research	Assistant Professor		01-08-2013	Chemical Engineering	Process intensification, Environmental engineering	28	4	4	Yes	Regular

9	Professor P. D. Vaidya	PhD	Institute of Chemical Technology	2005	Teaching/Research	Professor	12-02-2018	01-08-2007	Chemical Engineering	Separation, Reaction Engineering	100	24	19	Yes	Regular
10	Dr. C. S. Mathpati	PhD	Institute of Chemical Technology	2010	Teaching/Research	Associate Professor	18-05-2018	16-09-2008	Chemical Engineering	Computational fluid dynamics, Reactor design, Mathematical modeling & simulation	53	10	10	Yes	Regular
11	Professor B. N. Thorat	PhD	Institute of Chemical Technology	2001	Teaching/Research	Professor	17-02-2006	17-02-2006	Chemical Engineering	Process intensification	91	27	3	Yes	Regular
12	Professor L.K. Mannepalli	PhD	Kurukshetra University	1982	Teaching/Research	Professor	02-12-2015	02-12-2015	Chemical Engineering	Catalysis, Materials, Process chemistry, Nanotechnology	367	40		Yes	Regular
13	Professor P. K. Ghosh	PhD	Princeton University	1981	Teaching/Research	Professor	15-04-2015	15-04-2015	Chemical Engineering	Applied chemistry, Sustainability	123	8		Yes	Regular
14	Dr. S. V. Jadhav	PhD	Institute of Chemical Technology	2018	Teaching/Research	Assistant Professor		22-05-2018	Chemical Engineering	Separation, Nanotechnology, Process intensification	14	0		Yes	Regular
15	Dr. K. V. Marathe	PhD	Institute of Chemical Technology	2020	Teaching/Research	Associate Professor	02-01-2012	01-02-1992	Chemical Engineering	Process intensification, Environmental engineering	43	3	2	Yes	Regular
16	Professor A. V. Patwardhan	PhD	Institute of Chemical Technology	1988	Teaching/Research	Professor	18-12-2007	18-12-2007	Chemical Engineering	Membrane separation, Heterogeneous reaction, Green technology	122	14	6	Yes	Regular
17	Dr. R. D. Jain	PhD	Institute of Chemical Technology	2005	Teaching/Research	Assistant Professor		01-01-2014	Chemical Engineering	Biotechnology	89	7	5	Yes	Regular
18	Dr. M. D. Yadav	PhD	Institute of Chemical Technology	2019	Teaching/Research	Assistant Professor		24-09-2019	Chemical Engineering	Nanotechnology	12	0		Yes	Regular
19	Professor A. M. Lali	PhD	Institute of Chemical Technology	1989	Teaching/Research	Professor	09-01-2002	09-01-2002	Chemical Engineering	Biotechnology	140	62	27	Yes	Regular
20	Professor J. B. Joshi	PhD	Institute of Chemical Technology	1977	Teaching/Research	Emeritus Professor	01-08-1986	03-10-1972	Chemical Engineering	Reactor Design and CFD	521	80		Yes	Contract
21	Professor D. D. Sarode	PhD	I.I.T. Bombay	2010	Teaching/Research	Professor	01-03-2014	12-06-1997	Chemical Engineering	Construction Chemicals, Risk Analysis	26	2	1	Yes	Regular

22	Professor V. R. Gaval	PhD	Institute of Chemical Technology	1991	Teaching/Research	Professor	06-01-1992	06-01-1992	Chemical Engineering	Polymer composites	17	2	2	Yes	Regular
23	Dr. P. Goswami	PhD	Institute of Chemical Technology	2018	Teaching/Research	Associate Professor	08-02-2017	06-06-1998	Chemical Engineering	Sustainable Energy	77	12		Yes	Regular
24	Shri. M. A. K. Kerawalla	M.E	VJTI, Mumbai	1984	Teaching/Research	Associate Professor	16-02-1987	16-02-1987	Chemical Engineering	Power Systems	18	0		Yes	Regular
25	Dr. R. S. N. Sahai	PhD	Institute of Chemical Technology	2013	Teaching/Research	Associate Professor	23-02-2013	17-10-1998	Chemical Engineering	Polymer composites	14	5		Yes	Regular
26	Professor S. P. Deshmukh	PhD	Institute of Chemical Technology	2009	Teaching/Research	Professor	02-01-2012	13-05-1997	Chemical Engineering	Renewable energy, Heat transfer, Sustainable plastic composites	57	7	6	Yes	Regular
27	Professor G.D. Yadav	PhD	Institute of Chemical Technology	1980	Teaching/Research	Professor	01-10-1996	01-07-1980	Chemical Engineering	Green chemistry, Material science	447	100		Yes	Regular
28	Dr. Annamma Anil Odaneth	PhD	Institute of Chemical Technology	2008	Teaching/Research	Associate Professor	27-01-2017	20-02-2009	Chemical Engineering	Biotechnology, Applied Chemistry	42	10	8	Yes	Contract
29	Dr. Ramajanaki Iyer	PhD	Symbiosis International	2017	Teaching	Assistant Professor		01-01-2021	Chemical Engineering	Management, Organizational behaviour	14			Yes	Contract
30	Dr. Deepankar Biswas	PhD	Institute of Chemical Technology	2020	Teaching/Research	Assistant Professor		09-01-2020	Chemical Engineering	Solar thermal systems, CFD	3			Yes	Contract
31	Dr. V. S. Korpale	PhD	Institute of Chemical Technology	2021	Teaching/Research	Assistant Professor		01-01-2020	Chemical Engineering	Heat Transfer, CFD	4			Yes	Contract
32	Dr. Sanghamitra Chatterjee	PhD	I.I.T. Roorkee	2010	Teaching/Research	Assistant Professor		25-08-2014	Chemical Engineering	Organic electrochemistry	31	2		Yes	Regular
33	Dr. S.M.S. Reshamwala	PhD	I.I.T. Bombay	2012	Teaching/Research	Assistant Professor		02-12-2019	Chemical Engineering	Biotechnology	12			Yes	Contract

Table B.4

4.1 Student-Faculty Ratio (SFR) (15) **Institute Marks (15)**

UG

No. of UG Programs in the Department 1

Table 4.2: Student intake for UG

Bachelor of Chemical Engineering						
Year of Study	**CAY (2021-22)**		**CAYm1 (2020-21)**		**CAYm2 (2019-20)**	
	Sanction Intake	**Actual admitted through lateral entry students**	**Sanction Intake**	**Actual admitted through lateral entry students**	**Sanction Intake**	**Actual admitted through lateral entry students**
2nd Year	75	0	75	0	75	0
3rd Year	75	0	75	0	75	0
4th Year	75	0	75	0	75	0
Sub-Total	**225**	**0**	**225**	**0**	**225**	**0**
Total	**225**		**225**		**225**	

PG

No. of PG Programs in the Department 1

Table 4.3: Student intake for PG

Master of Chemical Engineering			
Year of Study	**CAY (2021-22)**	**CAYm1 (2020-21)**	**CAYm2 (2019-20)**
	Sanction Intake	**Sanction Intake**	**Sanction Intake**
1st Year	30	30	**30**
2nd Year	30	30	**30**
Total	**60**	**60**	**60**

SFR

No. of UG Programs in the Department 1

No. of PG Programs in the Department 1

Table 4.4: Student-Faculty Ratio (SFR)

Description	CAY (2021-22)	CAYm1 (2020-21)	CAYm2 (2019-20)
Total No. of Students in the Department(S)	285 **Sum total of all (UG+PG) students**	285 **Sum total of all (UG+PG) students**	285 **Sum total of all (UG+PG) students**
No. of Faculty in the Department(F)	32 **F1**	32 **F2**	30 **F3**
Student Faculty Ratio (SFR)	8.9 **SFR1=S1/F1**	8.9 **SFR2=S2/F2**	9.5 **SFR3=S3/F3**
Average SFR	9.11 **SFR=(SFR1+SFR2+SFR3)/3**		

Table B.4.1

4.1.1 Provide the information about the regular and contractual faculty as per the format mentioned below:

Table 4.5: Regular and contractual faculties

	Total number of regular faculty in the department	Total number of contractual faculty in the department
CAY(2021-22)	27	5
CAYm1(2020-21)	27	5
CAYm2(2019-20)	27	3

Table B.4.1.1

4.2 Faculty Cadre Proportion (10)

Institute Marks (10)

Table 4.6: Faculty Cadre Proportion

Year	Professors		Associate Professors		Assistant Professors	
	Required F1	Available	Required F2	Available	Required F3	Available
CAY (2021-22)	1.58	16.00	3.16	6.00	9.50	**10.00**
CAYm1 (2020-21)	1.58	16.00	3.16	6.00	9.50	**10.00**
CAYm2 (2019-20)	1.58	16.00	3.16	6.00	9.50	**8.00**
Average Numbers	**1.58**	**16.00**	**3.16**	**6.00**	**9.50**	**9.33**

Table B.4.2

Cadre Ratio Marks [(AF1 / RF1) + [(AF2 / RF2) * 0.6] + [(AF3 / RF3) * 0.4]] * 5 = [(16 / 1.58) + [(6 / 3.16) * 0.6] + [(9.33 / 9.5) * 0.4]] * 5 = **58.30**

4.3 Faculty Qualification (10)

Institute Marks (10)

FQ = (10X +4Y)/F) where x is No. of available faculty with Ph.D., Y is No. available faculty with M. Tech., F is No. available faculty required to comply with 20:1 Faculty-Student ratio (no. of faculty and no. of students required are to be calculated as per 4.1)

Table 4.7 Faculty Qualification

	X	Y	F	FQ = 2 x [(10X + 4Y) / F)]
2021-22(CAY)	31	1	14.25	**44.00**
2020-21(CAYm1)	31	1	14.25	**44.00**
2019-20(CAYm2)	29	1	14.25	**42.00**

Table B.4.3

Average Assessment: 43.10

4.4 Faculty Retention (5)

Institute Marks (5)

Table 4.8 Faculty Retention

Description	2019-20 (CAYm2)	2020-21 (CAYm1)	2021-22 (CAY)
No of Faculty Retained	30	32	**32**
Total No of Faculty	30	32	**32**
% of Faculty Retained	**100**	**100**	**100**

Table B.4.4

Average: 100.00

4.5 Faculty competencies in correlation to curriculum (5) **Institute Marks (5)**

Table 4.9: Faculty Competency

Name of Faculty	Relevant Area of Specialization
	2021-22
Professor A.B.Pandit	Physical and Chemical Processing applications of Cavitation phenomena, Sonochemistry, Ballast Water Treatment, Mixing in Mechanically agitated contactors: Experimental and CFD Investigations, Modeling of Stoves, Use of non-conventional energy sources, Synthesis of Nano-materials Biotechnology: Protein modification, Cell disruption and Microbial fuel cell.
Professor V.G.Gaikar	Renewable Energy Resources, Reactive Separation Processes, Molecular Simulation for Reactive Sorption and Metal Ion Complexation, Interfacial Science and Engineering and Hydrotropy, Complex Fluid Behaviour, Synthesis of nanoparticles and development of applications, Process Intensification, Biofuels by pyrolysis, CO_2 conversion to liquid fuel
Professor A.W.Patwardhan	Computational Fluid Dynamics, Transport Phenomena, Membrane Separation Processes, Liquid- Liquid Extraction
Professor S.S.Bhagwat	Interfacial Science and Engineering, Microemulsions, Energy and Exergy Engineering, Absorption Cycles, Utilization of low grade energy, applications of artificial neural network, Computer process simulation
Professor V. K. Rathod	Separation Processes, Process Intensification, WasteWater Treatment, Enzyme Modification and Treatment, Bio-separation, Nuclear reprocessing, Extraction of natural ingredients, Nanoparticles preparation, Biodiesel Manufacturing, Enzymatic Catalyzed Reactions
Professor P.R.Gogate	Sonochemistry, Hydrodynamic Cavitation, Process Intensification, Water and Wastewater Treatment, Enzymatic Reactions, Polymer Chemistry, Advanced Oxidation Processes
Dr. V. H. Dalvi	Molecular Simulations, Process Simulations, Solar Thermal Systems, Statistical Thermodynamics, Anaerobic Digestion, Energy Engineering.
Dr. P. R. Nemade	Membrane separation, Development of polymeric and graphene based materials for membranes, catalysts, and sensors applications, sustainable sanitation
Professor P.D.Vaidya	Carbon dioxide capture, reforming reaction, hydrotreatment, wet air oxidation, hydrogenation
Dr. C. S.Mathpati	Computational Fluid Dynamics, Multiphase Flow, Reactor Design, Interface Heat and Mass Transfer, High temperature corrosion analysis
Professor B.N. Thorat	Drying Technology and Particle Handling, Process Development, Multiphase Reactors, Industrial Crystallization and Filtration, Food Processing
Professor L.K.Mannepalli	Catalysis, Materials and Process Chemistry, Nanotechnology.
Professor P.K. Ghosh	Salt and Marine Chemicals; Membrane-based processes; Green Chemistry, Renewable Energy, Chemical Technology; Analytical Studies
Dr. S. V.Jadhav	Water and Wastewater Treatment, Membrane-based Separation, Nanomaterials Synthesis and their Applications, Adsorption-based Separation, Waste Valorization, Petrochemicals, Chemical and Enzymatic Kinetics, Process Modeling and Simulation, Drying Technology, Life Cycle Assessment

Dr. K. V.Marathe	Bio - Electrochemical Membrane Reactor, Sustainability Studies, Algae Water Separation, Membrane Fabrication and modification Studies, Hydrometallurgical Extraction, Wastewater treatment, Membrane separation, Corrosion, Metal composites, Development of new materials
Professor A.V.Patwardhan	Membrane separation, Green Technology, Bioprocess Technology, Heterogeneous reactions
Dr. R. D. Jain	Biosimilar/Biologics Characterization, Biopharmaceutical/ Pharmaceutical, Continuous process for polymeric/metal nanoparticles synthesis, Product Development using Traditional, Microfluidics and 3D Printing Technology, Nanomedicine, Cell Culture engineering
Dr. M. D. Yadav	Chemical Reaction Engineering, Nanotechnology, Crystallization
Professor A. M. Lali	Bioenergy, Biofuels and biomass to other chemicals, Purification of Proteins, nucleic acids and other Biomolecules, natural and synthetic APIs high value organic/inorganic chemicals,Continuous chromatography, Modeling and Adsorptive separations, Biocatalysis and Biotransformations, Bioreactor design, Mixing and dynamics of solid liquid fluidized bed, Dynamics of gas-solid circulating fluidized bed, Process integration and intensification, Process development, characterization and scale up.
Prof. D.D. Sarode	Construction Chemicals, Formwork for R.C.C, Advance Concrete Technology, Anticorrosive coatings and inhibitors, Glass and Carbon fiber composites and Geotechnical Engineering, Risk Management
Prof. V.R. Gaval	Polymer Composites, Injection mould design, Conversion of metal parts into plastic parts
Dr. P.Goswami	Sustainable Energy, Power systems, MATLAB simulations
M. A.K. Kerawalla	Power Electronics applications in Power systems analysis
Dr. R. S. N.Sahai	Polymer Composites, Nanocomposites and its application in Mechanical Engineering, Mould Design
Professor S. P. Deshmukh	Renewable Energy, Heat transfer, Plastic composites
Dr. Annamma Anil Odaneth	Extractive Biotransformation, Design & Engineering of enzymes, Selective Isolation & Capture of Natural Bioactive Molecules, Secondary Agriculture & its products, Process integration & intensification, Process development, characterization & scale up
Dr. Ramajanaki Iyer	Management, organizational behaviour
Dr. Deepankar Biswas	Design of Solar thermal systems, Computational Fluid Dynamics
V. S. Korpale	Heat Transfer, Computational Fluid Dynamics, Plastic Product Design and Analysis
Dr. Sanghamitra Chatterjee	Organic Electrochemistry, Biomedical applications of nanomaterial modified sensors, Materials science and Nanotechnology, Electrochemical sensing techniques for clinical diagnostics and environmental monitoring, Development of sensors for biomolecules, drugs and doping agents, Electrochemical catalysis, Biosensors and arrays.
Dr. S.M.S. Reshamwala	Molecular and synthetic biology, recombinant protein expression in prokaryotic and eukaryotic host cells, enzyme engineering for improved catalysis and robustness, metabolic and pathway engineering to design novel biosynthetic routes for high-value chemicals, bioprospecting to explore metabolic diversity, science communication and pedagogy, IP policy
Professor G.D. Yadav	Green Chemistry and Technology, Catalytic Science and Engineering, Nanomaterials and nanocatalysis, Biotechnology, Energy Engineering.

Table 4.10: Faculty Achievements

Faculty name	Achievement	Year
Prof. S. S. Bhagwat.	Distinguished Alumnus Award, ICT	2016
Prof. S. S. Bhagwat.	INSA Best Teacher Award' by Indian National Science Academy	2016
Prof. P.R.Gogate	Maharashtra State National Award for Outstanding Research Work in Engineering & Technology of the Indian Society of Technical Education	2016
Prof. V.G. Gaikar	'UAA Distinguished Alumnus Award in (Academics)' by the UDCT Alumnus Association (UAA).	2016
Prof. D. V. Pinjari	INAE Young Engineer Award by the Indian National Academy of Engineering (INAE).	2016
Prof. P. D. Vaidya	Bioenergy - Awards for Cutting Edge Research (B- ACER) Fellowship Program 2017 supported by the Department of Biotechnology, Govt. of India, and the Indo-U.S. Science and Technology Forum (IUSSTF)	2017
Prof. A. W. Patwardhan	Professor M.M. Sharma Science and Technology Award	2017
Prof. A.M. Lali	Eminent Scientist Award by KG Foundation, Coimbatore	2017
Prof. G. D. Yadav	Loknete Sadashivrao Mandlik Smriti Puraskar by Sadashivrao Mandlik Sugar Factory, Kolhapur	2017
Prof. P. R. Gogate	Prof. M M Sharma award for Science and Technology given by Marathi Vidnyan Parishad	2017
Prof. L.K.Mannepally	Dr. Mary Curie Memorial Award by APSC-2017.	2017
Prof. B. N. Thorat	Gunther Oertel Startup Innovation Award for Microbutor Innovation, Covestro	2017
Prof. P. K. Gosh	Lifetime Achievement Award, Indian Chemical Council	2017
Prof. P. K. Gosh	Lifetime Achievement Award, Indian Desalination Association	2017
Prof. P.R.Gogate	Most Outstanding Faculty Research Award in the Chemical Engineering Discipline, Careers 360	2018
Prof. A. B. Pandit	DST-Lockheed Martin-Tata Trusts, India Innovation Growth Programme (IIGP) 2.0 Awards	2018
Prof. V. G. Gaikar	Dr. G. M. Nabar Memorial Award	2018
Prof. P.R.Gogate	Outstanding Professor Award given by Indian Specialty Chemicals Manufacturing Association	2018
Prof. P.R.Gogate	A.V. Rama Rao award by Indian Institute of Chemical Engineers	2018
Prof. P.R.Gogate	Rajib Goyal Prize	2018
Prof. A. B. Pandit	G. M. Marve Prize for Most Research-Oriented Group from Chemical Engineering	2018

Prof. A. B. Pandit	‘Best Oral Presentation Award’ at ‘International Conference on Desalination organized by Indian Desalination Association & NIT Trichi	2018
Prof. A. B. Pandit	C-Zero Challenge (Insulating Ceramics), IIT Madras	2018
Prof. A. B. Pandit	Best Oral Presentation Award’ at 3rd National Seminar on Advanced Oxidation Processes organized by SECAS	2018
Prof. A. B. Pandit	Best Papyrus Oral Presentation Award	2018
Dr.C.S.Mathpati	2017 Class of Influential Researchers of Ind. Eng. Chem. Res	2018
Prof. P.R.Gogate	Citations of Prof. Parag Gogate crossed 15000	2018
Prof. L.K.Mannepally	Fellow of TWAS in 2017, swearing in ceremony happened in Nov 2018	2018
Prof. V.K.Rathod	IIChE's Hindustan Lever Biennial award for the most outstanding Chemical Engineer under the age of 45	2018
Prof. P.R.Gogate	lSCMA Award for an outstanding professor at ICT	2018
Prof. P.R.Gogate	Rajib Goyal Prize in Applied Science for 2016-2017 from Kurukshetra University	2019
Prof. A. B. Pandit	Arohan Social Innovation Award- Gold Category, INFOSYS	2019
Prof. A. B. Pandit	CHEMTECH Leadership and Excellence Award Outstanding Achievement- R&D Excellence	2019
Prof. A. B. Pandit	Book "Drinking Water Treatment for Developing Countries", Published by RSC	2019
Prof. L.K.Mannepally	Goyal Award, Applied Sciences, Kurukshetra University	2019
Prof. V. G. Gaikar	'Eminent Engineering Personality the year' by the Assam State Centre of the Institution of Engineers (INE) in their 35th National Convention of Chemical Engineers	2019
Dr.C.S.Mathpati	Dr. M. Visvesvaraya Award of Marathi Vidnyan Parishad for Excellence in Research Relevant and Beneficial to Society.	2019
Prof. L.K.Mannepally	Most coveted ICC D. M. Trivedi Lifetime Achievement Award for the year 2018	2019
Prof. P.R.Gogate	Fellow of Indian National Academy of Engineering	2019
Prof. V.K.Rathod	Prof. Man Mohan Sharma Award for Science and Technology of Marathi Vidnyan Parishad	2019
Prof. S. S. Bhagwat	UAA-Distinguished Alumnus award in the Academics category for the year 2019	2019
Prof. P.D.Vaidya	Fellow of Maharashtra Academy of Sciences	2019

Prof. V.K.Rathod	ISCMA Award for an outstanding Professor of ICT	2020
Prof. P.R.Gogate	FY2020 JSPS Invitational Fellowships for Research in Japan	2020
Prof. P.R.Gogate	Mid career award of UGC.	2020
Dr.R.A. Mashelkar	Top 2% of the world research scientists - The Standford University through @ PLOS Biology Journal, announced faculty of ICT (superannuated as well as ongoing).	2020
Prof. J.B. Joshi	Top 2% of the world research scientists - The Standford University through @ PLOS Biology Journal, announced faculty of ICT (superannuated as well as ongoing).	2020
Prof. G.D. Yadav	Top 2% of the world research scientists - The Standford University through @ PLOS Biology Journal, announced faculty of ICT (superannuated as well as ongoing).	2020
Prof. A.B. Pandit	Top 2% of the world research scientists - The Standford University through @ PLOS Biology Journal, announced faculty of ICT (superannuated as well as ongoing).	2020
Prof. V.G. Pangarkar	Top 2% of the world research scientists - The Standford University through @ PLOS Biology Journal, announced faculty of ICT (superannuated as well as ongoing).	2020
Prof. L.K.Mannepally	Top 2% of the world research scientists - The Standford University through @ PLOS Biology Journal, announced faculty of ICT (superannuated as well as ongoing).	2020
Prof. A.W.Patwardhan	Top 2% of the world research scientists - The Standford University through @ PLOS Biology Journal, announced faculty of ICT (superannuated as well as ongoing).	2020
Prof. P.R.Gogate	Top 2% of the world research scientists - The Standford University through @ PLOS Biology Journal, announced faculty of ICT (superannuated as well as ongoing).	2020
Prof. A.B. Pandit	Vice President of the Indian National Academy of Engineering.	2020
Prof. P.R.Gogate	Dr. Naresh J. Suchak Innovation Award	2020
Dr. R. D. Jain	BIRAC Innovator Award	2021
Prof. P.R.Gogate	Dr K Anji Reddy Innovator of the Year Award of IIChE	2021
Prof. G.D. Yadav	INAE, Professor Jai Krishna Memorial Award	2021
Dr. V.H. Dalvi	AICTE- Visvesvaraya Best Teacher Award	2021
Prof. A.B. Pandit	The survey carried out by Research.com ranked Professor A.B. Pandit as the number ONE scientist in India in area of Engineering and Technology	2022
Prof. P.R.Gogate	The survey carried out by Research.com ranked Professor P.R.Gogate as the number TWO scientist in India in area of Engineering and Technology	2022
Prof. J.B. Joshi	The survey carried out by Research.com ranked Professor J.B. Joshi as the number FOUR scientist in India in area of Engineering and Technology	2022
Prof. A.B. Pandit	Eminent Engineer Award 2021 of Engineering Council of India	2022
Prof. G.D. Yadav	Professor G.D. Yadav, former Vice Chancellor has been elected to the US National Academy of Engineering: For research, innovation, and education in green chemistry, catalysis, nanotechnology, and chemical engineering leading to clean and green technologies	2022
Prof. G.D. Yadav	Prof. G.D. Yadav has been selected as the National Science Chair (Mode 1) by the Science and Engineering Research Board (SERB) of the DST, Govt of India	2022

Table 4.11: Faculty Recognitions & Memberships

Faculty Name	Recognitions & Membership
Prof. S. S. Bhagwat	• Indian Institute of Chemical Engineers - Life Member and Past Chairman of Mumbai Regional Center. • Oil Technologists Association of India - Life Member. • Society for Industrial Chemistry - Life Member. • Indian Society for Surface Science and Technology - Life Member, Hon Secy, Western India. • Maharashtra Academy of Sciences - Fellow (2008) • Industrial and Engineering Chemistry, American Chemical Society - Former Member, Editorial Advisory Board. • Journal of Surface Science and Technology - Member, Editorial Board. • Expert Member –NBA committee. • Member – RRC, University of Mumbai. • Member - Journal of Surface Science and technology.
Dr. V. H. Dalvi	• Membership in Editorial Boards with many scientific journals and agencies.
Prof. V. G. Gaikar	• Fellow, Indian National Academy of Engineering. • Bharat Petroleum Distinguished Professor of Chemical Engineering (from 2nd March 2019). • Fellow, Maharashtra Academy of Sciences. • Life Member, Indian Institute of Chemical Engineers. • Life Member, Indian Society for Surface Science and Technology. • Fellow Member, Oil Technologists Association of India. • Life Member, Asian and Mid-East Institute of Chemists. • Chairman, Wester Region, AICTE(2017). • Member, Western Region Board of Apprenticeship and Training(2017). • Chairman, Expert Committee, Research, Innovation and Technology Transfer, RUSA-SPD, Maharashtra(2016). • Member, RUSA Council, Maharashtra State (2017-19). • Member, Sectional Committee (Chem Engg), Indian National Academy of Engineering (INAE) (2015-2018), New Delhi. • Member, TASK Force, Bioenergy Sciences, Department of Biotechnology, Ministry of Science and Technology, GoI.(2014-2018). • Member, Working group-Innovation Council, Maharashtra State(2015-2018). • Member, National Program on Carbon Capture, Department of Science and Technology, GoI(2016-2019). • Member, Advisory Committee, UGC-CAS program in Chemical Engineering, IISc(2019).
Dr. P. K. Ghosh	• Fellow, Indian Academy of Sciences. • Chairman, Water Technology Initiative, Department of Science & Technology, GoI. • Chairman, Project Evaluation Committee, Bilateral Programmes in Clean Tech Sector, DST-GITA. • Co-Chairman, CSIR Mission Mode Project on Sustainable Development through Catalysis. • Member, Asian Paints Technology Council. • Member, Board of Directors, Barefoot College, Tilonia, Rajasthan.

	• Member, Expert Committee for Appraisal of programmes and projects undertaken by the Department of Biotechnology, GoI during the 12th Plan. • Member, NRDC National Prize Award Committee • Member, Advisory and Screening Committee of the Common Research & Technology Development Hubs Programme of DSIR. • Vice President, Materials Research Society of India (MRSI).
Dr. P. R. Gogate	• Member, Indian Institute of Chemical Engineers, 2003. • Young Associate of Maharashtra Academy of Sciences, 2007. • Member, National Academy of Sciences, Allahabad, 2009. • Young Associate, Indian Academy of Sciences, Bangalore, 2009-2012. • Member, Indian Society for Technical Education, 2011. • Young Associate, Indian National Academy of Engineering, 2012. • Member, Editorial Board, Ultrasonics Sonochemistry, 2013-onwards. • Chartered Member, Institution of Chemical Engineers, UK, 2013. • Fellow, Maharashtra Academy of Sciences, 2014. • Member, Board of Governors & Honorary Secretary, UDCT Alumni Association, 2013-2015, 2015-2017, 2017-2019. • Member, Editorial Board, Desalination and Water Treatment (Taylor & Francis), 2016- 2018. • Associate Editor, Chemical Engineering Processing, Process Intensification (Elsevier), 2016-2019. • Member, Board of Governors & Honorary Secretary, UDCT Alumni Association. • Member, Editorial Board, Desalination and Water Treatment (Taylor & Francis), 2016- 2018. • Associate Editor, Chemical Engineering Processing, Process Intensification (Elsevier), 2016-2019. • Member, Editorial board, Ultrasonics Sonochemistry (Elsevier), 2015-2018.
Prof. J.B. Joshi	• Fellow, The World Academy of Sciences (TWAS). • Fellow, Indian National Science Academy (INSA). • Fellow of Indian Academy of Science (IASc). • Hon. Fellow, Indian Institute of Chemical Engineers. • Fellow, Maharashtra Academy of Sciences. • Patron Fellow, Marathi Vidnyan Parishad. • Coal Cleaning Initiative, DST, Government of India. • Chairman Science Advisory Committee, CSIR-IICT Hyderabad. • Fellow, Indian National Academy of Engineers(INAE).
Dr. R.D. Jain	• Member, European Respiratory Society, Switzerland. • Member, Young Scientist Committee, Controlled Release Society, USA. • Mentor, Mentor-Protégé Program, Member, Controlled Release Society, USA. • Member, Controlled Release Society- USA and Indian Chapter. • Member, Association of Biotechnology Led Enterprises (ABLE), India. • Member, American College of Clinical Pharmacology, USA . • Member, Proteomics Society, India.

Prof. A.M. Lali	• Member, Task Force on Production of Methanol using Biomass/Municipal Solid Waste/source other than coal , NITI Aayog, New Delhi, 2017-2018. • Member, Scientific Advisory Committee (SAC), Centre of Innovative and Applied Bioprocessing (CIAB), Mohali, 2016 – 2019. • Research Council as a Scientific Expert/Member for Bharat Petroleum Corporation Ltd. (BPCL), 2016-2018. • Consultant to a number of Companies in India and abroad for chemical/biochemical and biopharmaceutical/pharmaceutical manufacturing • Member, Task Force Committees on Biofuels; Algal Biotechnology; and Nutrition and Food Security, Department of Biotechnology, Ministry of Science & Technology, Government of India, 2011 onwards. • Member, core group of scientists in the area of bioenergy with Ministry of New and Renewable Energy, Government of India. • Member, Department of Biotechnology, Ministry of S&T of India Task Force in Biofuels, Algal Biotechnology and Bioproducts and Bioprocesses • Member, Maharashtra Academy of Sciences. • Member, Apex Committees, Food and Nutritional Safety, DBT, India. • Member, Task Force Committees on Biofuels, Bioprocesses and Bio-products, DBT, India. • Member of the Scientific Advisory Committee (SAC) on Industrial Biotechnology. • Member, Research Council Committee, IMTECH, Chandigarh. • Member, Scientific Advisory Committee, IIT, Indore • Adjunct Professor, School of Mechanical and Chemical Engineering, The University of Western Australia, Australia. • Member Editorial Journal of Preparative Biochemistry and Biotechnology.
Prof. L. K. Mannepalli	• Dr. B. P. Godrej Distinguished Professor. • Independent Board of Directors- Indo Amines Ltd. • Independent Board of Directors-VOL. • Independent Board of Directors- GBL. • Member, CSIR-HRDG- Inorganic & Physical Chemistry Research Committee. • Member, Research Advisory Council, GAIL, (2018-2021). • Member, Department of Science and Technology-FIST (Chemical Sciences)(2015-till date). • Member, Research Council, HEMRL(High Energy Materials Research Laboratory), Pune (DRDO)(2015-tilldate). • Member, DST, SSR committee. • Member, Department of Science and Technology-SAIF (Chemical Sciences)(2019-till date). • Member, Third Part Evaluation Committee, R& D projects, Department of Science and Technology. • Member, Board of Governors, IIT-Hyderabad. • Member, Standing Committee for Promoting Women in Science. • Member, RAC- DRDO. • Chairperson , DST-PAC , I&PC, DST, India. • Member, Selection Committee, Raja Ramanna Fellowship Scheme, DAE, India. • Fellow of The World Academy of Sciences (TWAS). • Fellow of the Maharashtra Academy Sciences.

	• Fellow of the Indian National Science Academy. • Fellow of The Royal Society of Chemistry, UK. • Fellow of National Academy of Sciences, India. • Fellow of Andhra Pradesh Academy of Sciences, Hyderabad.
Dr. K. V. Marathe	• M.Ind.Soc.Comp.Mat. • M.I.I.Metal. • M.I.W.S.A. • Member scientific advisory committee SWDEWES-2013.
Dr. C. S. Mathpati	• Life Member, IIChE.
Dr. P. R. Nemade	• Member, Indian Membrane Society. • Member, Oil Technologists Association of India. • Member, Indian Institution of Chemical Engineers. • Membership of important Committees. • Membership of Editorial Boards many scientific journals and agencies.
Prof. A. B. Pandit	• Fellow, The World Academy of Sciences, 2015. • Fellow, National Academy of Sciences in India, Allahabad, 2009. • Fellow, Indian National Science Academy, 2008. • Fellow, Indian Academy of Sciences, 2008. • Fellow, Indian National Academy of Engineering, 2006. • Fellow, Maharashtra Academy of Sciences, 1996. • Member of DST-FIST. • Member of UGC-SAP. • Member of DST ChemEngg PAC. • Member of DST MOFPI PAC. • Adjunct Professor at BIT's Goa Campus. • Member, Board of Governor of IIT Bombay. • Chairman, HyCa Technology Pvt. Ltd., Mumbai. • President, Land Research Institute (LRI).
Prof. A. W. Patwardhan	• Fellow of Indian National Academy of Engineering.
Prof. A. V. Patwardhan	• Life member of Indian Institute of Chemical Engineers. • Member – Experts' panel formed by the DSIR (New Delhi) for accreditation of Research and Development units of various industries. • Member – reviewers' panel of Global Initiative of Academic Networks (GIAN), IIT Kharagpur. • PhD / Master's Open Defence Examinations of IIT Kharagpur; IIT Bombay; NIT Rourkela. • Faculty selection committees: IIT Kharagpur; Mumbai University; NMU Jalgaon.

	• BOG Member: UDCT Alumni Association; Thadomal Shahni Engineering College, Mumbai. • Member – Research and Recognition Committee in Chemical Engineering, Chemical Technology and Biotechnology (Engineering) under the faculty of Science and Technology. • Membership of Editorial Boards with many scientific journals and agencies.
Prof. V. K. Rathod	• Fellow of Maharashtra Academy of Sciences • Member of IIChE. • Member of UDCT alumina Association. • Member of OTA. • Member, Academic Counsel, Dr. BATU, Lonere, Maharashtra. • Treasurer, Chemcon 2013. • Member Technical Committee Chemcon 2013. • Member, organizing committee for "Chemcareers 2012" organized by ICT-Royal Society of Chemistry (RSC)" October 2012. • Member, 2nd International Indo German Symposium on Green Chemistry and Catalysis for Sustainable Development, 2012. • Member, Technical Committee, Asia Pacific Congress on Catalysis (APCAT 7). • Membership of Editorial Boards with name of journal and agency : • Editorial board of Catalysis Green Chemistry and Engineering (Begell House Publication, USA). • Guest editor for two special issues i.e. Journal of Chemical Sciences (Springer) and Chemical Records (Wiley).
Prof. B. N. Thorat	• President, World Forum for Crystallization, Filtration and Drying (WFCFD). • Member, State Environment Appraisal Committee, MoEF, Maharashtra Govt. • Organizer 13th International Workshop on Crystallization, Filtration and Drying. • Member, CAC Advisory committee, Maharashtra Pollution Control Board. • Scientific member, Nordic Baltic Drying Conference, Saint Petersburg, Russia. • USAID and IKP: Solar Conduction Dryer scale up in Bangladesh, 2017.
Dr. P. D. Vaidya	• Life Member, Indian Institute of Chemical Engineers. • Alumnus, Alexander von Humboldt Foundation, Germany. • Membership in Editorial Boards with many scientific journals and agencies.
Prof. G.D. Yadav	• Life Fellow, Maharashtra Academy of Sciences • Life Fellow, Indian Institute of Chemical Engineers • Life Fellow, Indian Chemical Society • Member, American Chemical Society • Life Member, Catalysis Society of India • Life Member, Indian Society for Surface Science and Technology • Life Member, Membrane Society of India • Life Member, UDCT Alumni Association • Life Member, National Society of the Friends of Trees • Life Patron, Marathi Vidnyan Parishad • Member, Organizing Committee: 3rd International Workshop on Crystallization, Filtration and Drying, February 2008

	• Current Catalysis, Bentham Science Publishers, 2011-on • Member, International Advisory Board • Member or chaired several national and international committees of MHRD, DST, DBT, UGC, AICTE, CSIR, the PSA's on Green Chemistry, the Planning Commission's Pan India S&T Committee, and the Government of Maharashtra's Rajiv Gandhi S&T Commission Peers Group. He is Chairman, Research Council, CSIR-CSMCRI. • Member of RC of IICT Hyderabad and NIIST Trivandrum. • Member of Selection Committees of directors of many CSIR labs. • Member of Maharashtra Innovation Council. • Member of many committees of UGC, AICTE, NAAC, DST, DBT, CSIR, CII, FICCI, ICC, IIChE, ACS. • Jagdish Chandra Bose National Fellow, Dept of Science & Technology, GoI • Chief Coordinator, Centre for Nanosciences& Nanotechnology, U of Mumbai • Chief Coordinator, Centre for Green Technology, U of Mumbai • Coordinator, UGC Centre for Advanced Studies in Chemical Engineering, ICT • Coordinator, UGC Networking Resource Centre in Chemical Engineering, ICT. • Co-P.I., DBT-ICT Centre for Energy Biosciences , ICT • Co-P.I., ICT-DAE Centre for Chemical Engineering Education and Research, ICT • Johansen Crosby Visiting Chair Professor of Chemical Engineering , Michigan State U, East Lansing, MI, USA. • Senior Visiting Fellow (Reader's grade), Loughborough U, UK • Reader (Associate Professor) in Chemical Engineering, UDCT, U of Mumbai • Herdillia Chemicals-UDCT Diamond Jubilee Distinguished Fellow (Professor's grade), UDCT, U of Mumbai • Consultant, Bombay Oil Industries Ltd, Mumbai • NSERC Post Doctoral Fellow, U of Waterloo, Canada • Research Officer, Bombay Oil Industries Ltd, Mumbai • Leverhulme Overseas Visiting Fellow, Loughborough U, UK

4.6 Innovations by the Faculty in Teaching and Learning (5) **Institute Marks (5)**

In order to make the teaching-learning process interesting and interactive a lot of measures are taken by the faculties. There mainly rely on the use of ICTs common practices undertaken are listed below:

1. Use of Email to communicate with the students – Notices, Assignments, Deadlines, etc. are communicated to the students via email thereby making communication very prompt. Teachers other than using the available material also try to develop their own videos or animations to explain a concept more clearly.
2. The college website has been made very student-friendly wherein academic years are made available to the students via their individual log-ins.
3. The best way to judge the student's grasp of a subject is by the means of class tests and quizzes. To make this job more interesting, tests are

generated in the forms of crosswords, mazes, puzzles, etc. so that the students find them engaging.

4. As a part of our continuous efforts to groom our students, Final Year B Chem students are required to take up a major project which consists of Literature Survey, Process & site selection block diagram, Kinetics & thermodynamic feasibility, Material & Energy Balance, Sizing of all the equipment, Detailed mechanical design, one equipment fabrication, P & ID diagram, controls, safety costing, references, waste management system, Report Submission, and Examination.

Biometric Attendance System:

Recording Facilities Available in classrooms

Figure 4.1: Innovations in teaching

During the Covid -19 pandemic, the departmental faculties had to reinvent their teaching methods and develop innovative ways to engage students. The following teaching methods were employed by the faculties:

1. Online teaching platforms such as MS Teams, Google Classrooms, Zoom meetings, and Webex Meetings.
2. The students were offered flipped classrooms.
3. The faculties conducted live lectures whenever possible.
4. The faculties used to send the pre-recorded video lectures to the students
5. The faculties also conducted online doubt-solving sessions, group activities, viva sessions, etc.

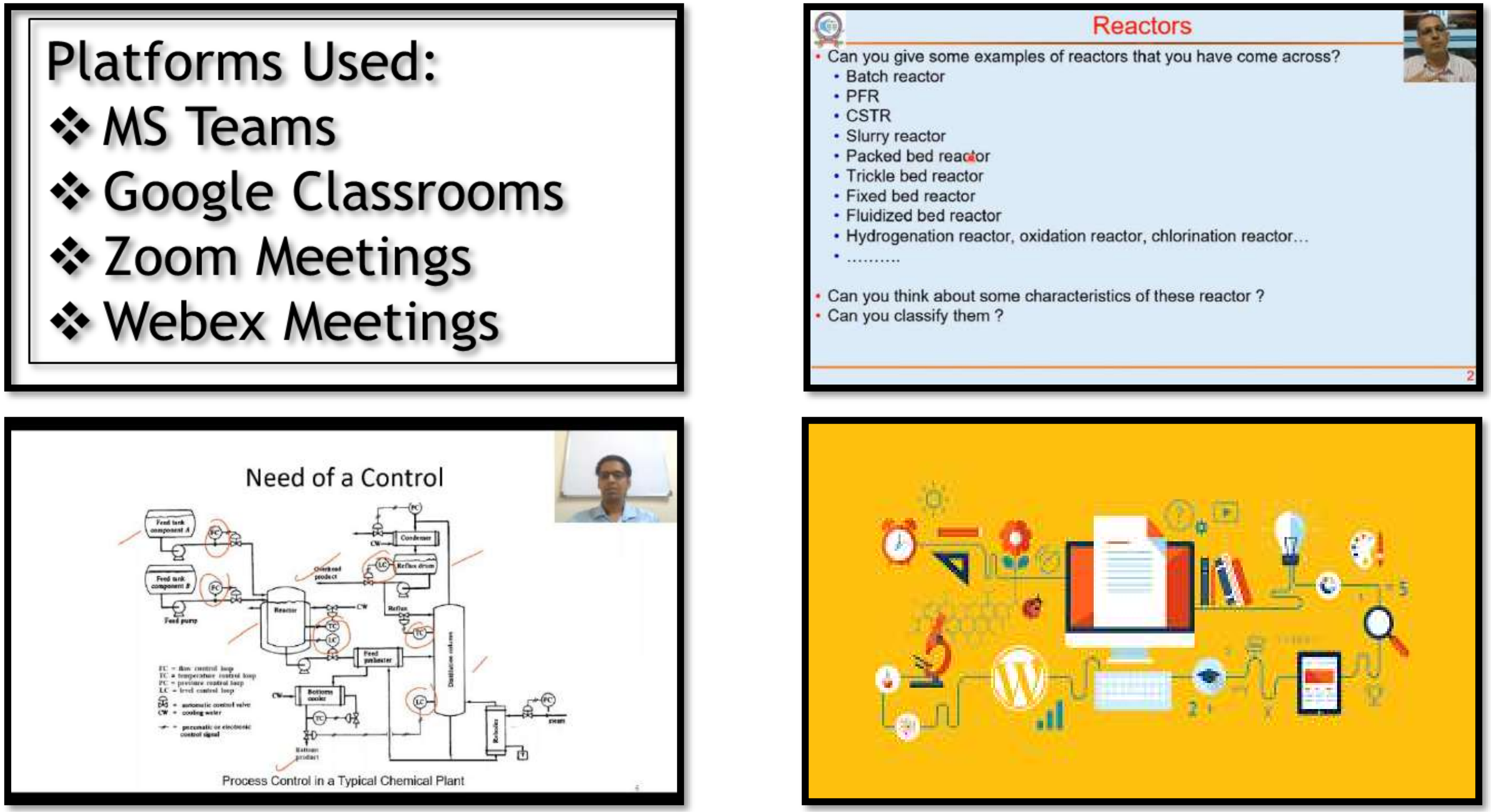


Figure 4.2: Online mode of teaching and innovations by faculties in teaching and learning

Management Information System (MIS)

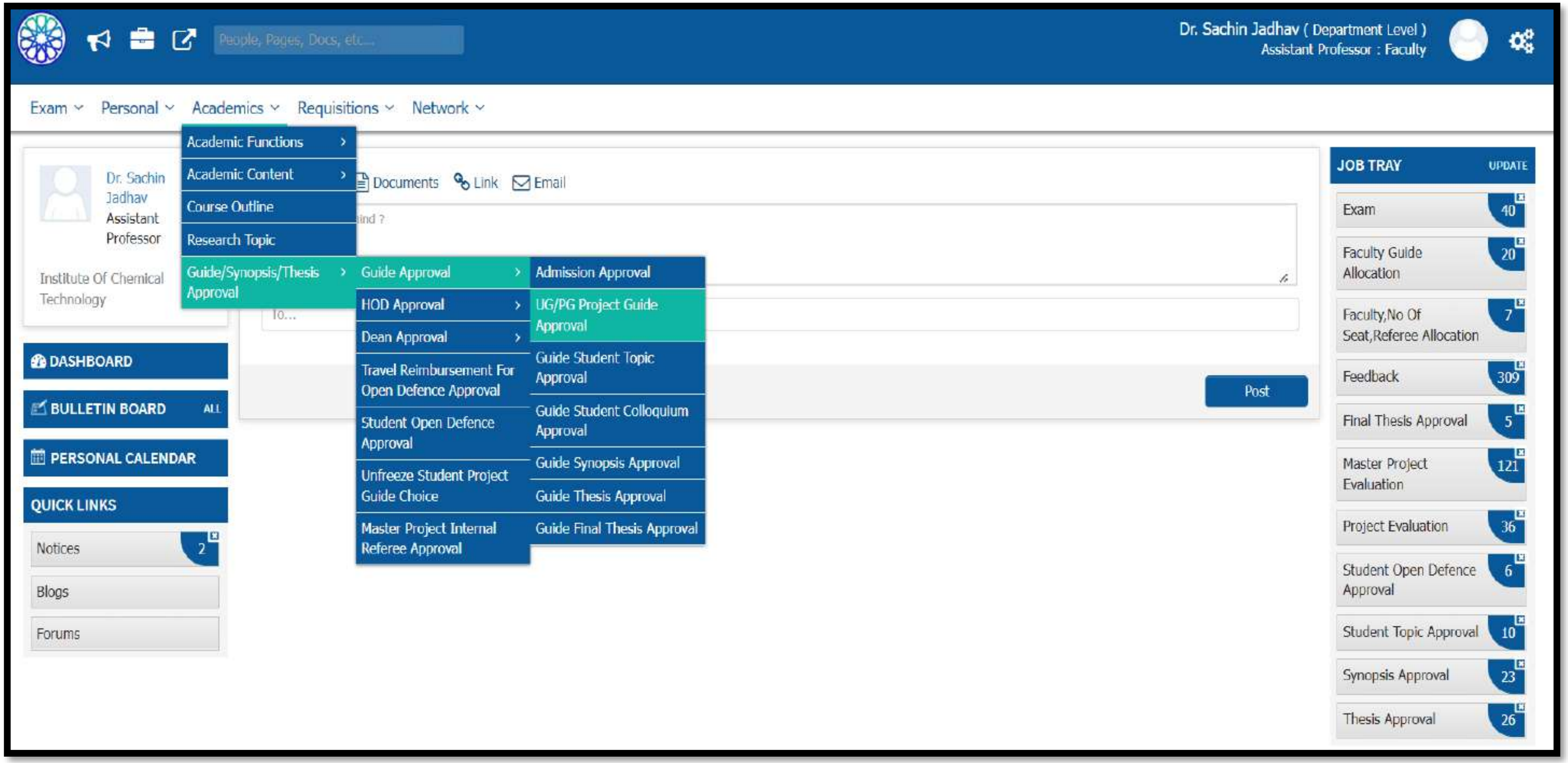


Figure 4.3: Faculty MIS portal login window

4.7 Faculty as participants in Faculty development/training activities/STTPs (10) **Institute Marks (8.8)**

Table 4.12: Faculty as participants in Faculty development/training activities/STTPs with calculations

Name of the faculty	Max 5 Per Faculty		
	2020-21 (CAYm1)	2019-20 (CAYm2)	2018-19 (CAYm3)
Prof. V. K. Rathod	0.00	5.00	5.00
Prof. P. R. Gogate	3.00	0.00	5.00
Dr. S. V. Jadhav	5.00	5.00	5.00
Dr. P. D. Vaidya	3.00	0.00	0.00
Dr. V. H. Dalvi	5.00	5.00	0.00
Prof. S. S. Bhagwat	0.00	3.00	0.00
Prof. A. W. Patwardhan	0.00	3.00	0.00
Prof. A. V. Patwardhan	3.00	0.00	0.00
Prof. D. D. Sarode	3.00	0.00	0.00
Dr. M. D. Yadav	5.00	5.00	0.00
Sum	27.00	26.00	15.00
RF = Number of Faculty required to comply with 20:1 Student Faculty Ratioas per 5.1	14.00	14.00	14.00
Assessment [3*(Sum / 0.5RF)]	10	10	6.43
Average	**8.81**		

Table B.4.7

Table 4.13: Faculty as participants in Faculty development/training activities/STTPs

Faculty name	Title	Symposia/Seminar	Place	Duration	Year
Prof. V. K. Rathod	Training Programme on “Digital Transformation through E-Governance and Information & Communication Technology (ICT)”.	Training at ICT	ICT, Mumbai	5 Days	2018

Prof. P. R. Gogate	Training Programme on “Digital Transformation through E-Governance and Information & Communication Technology (ICT)”.	Training at ICT	ICT, Mumbai	5 Days	2018
Prof. V. K. Rathod	Attended the faculty development programme on " Machine Learning with Business Applications" with Primer on Big Data Al & Deep Learning	Training at ICT	ICT, Mumbai	5 days	2019
Dr. S. V. Jadhav	Enhancing accountability and responsiveness in Scientific organization	Faculty Development Programme	Osmania university, Hydrabad	1 week	2019
Dr. P. D. Vaidya	Participation & oral Presentation titled "Butanol reforming for hydrogen production in 7th International Hydrogen & fuel cell conference	Faculty Development Programme	Jodhpur	2 days	2019
Prof. V. K. Rathod	Participate in the meeting of “Design and Development of a customised ERP system for a group of technical institutes, whose functions are similar in nature under TEQIP-III”.	Meeting	NPIU office, New Delhi	1 day	2019
Dr. V. H. Dalvi	The faculty development programme on" Machine Learning with Business Applications" with Primer on Big Data Al & Deep Learning	Faculty Development Programme	ICT, Mumbai	5 Days	2019
Prof. S. S. Bhagwat	Management Development Programme for Teaching Staff	Faculty Development Programme	ICT, Mumbai	4 days	2019
Prof. A. W. Patwardhan	Management Development Programme for Teaching Staff	Faculty Development Programme	ICT, Mumbai	4 days	2019
Prof. A. V. Patwardhan	Professional development training programme	Management Development Programme	IIT Trichy	4 days	2019
Prof. V. R. Gaval	Proficiency Improvement Programme on Advances in Plastic Moulding The Automotive Research Association of India	Faculty Development Programme	ARAI, Pune	1 day	2019

Prof. V. R. Gaval	Swayam Course on "Fundamentals of surface engineering mechanisms, processes and characterizations"	Faculty Development Programme	ICT, Mumbai	1 day	2019
Dr. M. D. Yadav	Faculty Development Programme on "Teaching and Learning of Advanced Control Systems"	Faculty Development Programme	ICT, Mumbai	1 week	2020
Dr. M. D. Yadav	webinar on "Technical Manuscript writing and publishing in reputed journal"	Faculty Development Programme	ICT, Mumbai	One day	2020
Dr. S. V. Jadhav	Programming for Everybody	Online Training	University of Michigan	8 weeks	2020
Dr. S. V. Jadhav	AI for everyone	Online Training	deeplearning.ai (Stanford University)	4 weeks	2020
Prof. P. R. Gogate	Online The Art of Living Productivity Enhancement Program (PEP)	Training at ICT	ICT, Mumbai	3 days	2020
Prof. D. D. Sarode	Training on scolarship Fellowship offered by Ministry of Tribal Affers Department	Faculty Development Programme	ICT, Mumbai	3 days	2021
Dr. S. V. Jadhav	Renewable Energy Engineering_ Solar, Wind and Biomass Energy Systems	Faculty Development Programme	SWAYAM	8 weeks	2021
Dr. S. V. Jadhav	Innovation to Entrepreneurship A Roadmap	Faculty Development Programme	ICT, Mumbai	1 week	2021
Dr. S. V. Jadhav	Application of Artificial Intelligence in Research and development	Faculty Development Programme	ATAL Academy	1 week	2021
Dr. S. V. Jadhav	Mentoring Pedagogy and Online Teaching in Higher Education	Faculty Development Programme	IIT, Guwahati	1 week	2021
Dr. M. D. Yadav	Recent trends in chemical and allied Industries	Faculty Development Programme	Government Polytechnic Daman	5 days	2021
Dr. M. D. Yadav	Environment, Energy , Health and Safety: Trends & Industrial Aspects	Faculty Development Programme	KK Wagh, Nashik	5 days	2021

Dr. M. D. Yadav	Recent Development in Sustainable processes	Faculty Development Programme	IICT Bhadohi	5 days	2021
Dr. M. D. Yadav	Refresher course in Material Science and Nanotechnology	Faculty Development Programme	North Eastern Hill University	14 days	2021
Dr. M. D. Yadav	Pedagogical Innovations and Research Methodology (Interdisciplinary)	Faculty Development Programme	SWAYAM	4 months	2021

Table 4.14: Faculty Conducted/Participated in Symposia/Seminar/Conference/Workshop

Name of Faculty	**Title**	**Conducted /Participated in Symposia/Seminar/Conference /Workshop**	**Place**
2021-22			
Dr P.R. Nemade	Ultrasound-assisted water-based GO/BiOI photocatalyst for visible light photodegradation	Sustainable Technologies in Water Treatment and Desalination (STWTD 2022	NIT Calicut
Dr. S.V. Jadhav	Life Cycle Assessment of FDCA Production From Cellulose.	Advances in Chemical and Material Sciences conference (ACMS) 2022, Conference organized by IIChE, Kolkata.	Kolkata
Dr. R. D. Jain	Shimadzu 8th Global Pharma Summit.	Shimadzu Corporation.	Mumbai
Prof. A. V. Patwardhan	Studies in Nano-Filtration of Dyes in Industrial Effluent.	Advances in Chemical and Material Sciences conference (ACMS) 2022, Conference organized by IIChE, Kolkata.	Kolkata
Dr P.R. Nemade	Ultrafast removal of hexavalent chromium ions from water using amide covalent triazine framework	Sustainable Technologies in Water Treatment and Desalination (STWTD 2022)	NIT Calicut
2020-21			
Dr. S. V. Jadhav	Life Cycle Assessment of Heat Pump and Microwave Vacuum Dryers.	International Chemical Engineering Conference (ICHEEC) 2021, Conference organized by NIT, Jalandhar.	Jalandhar
Prof. A. V. Patwardhan	Evaluation of thermodynamic models for the prediction of solubility of antibiotics in various solvents, CHEMCON 2021.	Conference by CSIR-Institute of Minerals and Materials Technology, Bhubaneshwar	Bhubaneshwar
Dr. S. V. Jadhav	Life cycle assessment of methanol production by natural gas route.	International Chemical Engineering Conference (ICHEEC) 2021, Conference organized by NIT, Jalandhar.	Jalandhar
Dr. M.D. Yadav	Evaluation of thermodynamic models for the prediction of solubility of antibiotics in various solvents, CHEMCON 2021.	Conference by CSIR-Institute of Minerals and Materials Technology, Bhubaneshwar	Bhubaneshwar
Dr P.R. Nemade	Mono Disperse BiOl/GO by ultrasonic synthesis for effects in visible light photocatalytic degradation of reactive dyes.	U.K Catalysis Conference (UKCC 2021), University of Belfast, UK.	Belfast, U.K.
2019-20			
Dr. V. H. Dalvi	Fundamentals of Molecular Simulations.	Seminar at Centre for Continuing Education, IIT Kanpur	Kanpur
Dr. V. H. Dalvi	Machine Learning with Business Applications	Workshop at DCAL, IIM Bangalore	Bangalore
Prof. A. V. Patwardhan	Python and Machine Learning	Workshop by TEQIP	ICT, Mumbai

Prof. P. R. Gogate	Improved wastewater treatment using hydrodynamic cavitation	Training	Lviv Polytechnic, Lviv, Ukraine
Dr P.R. Nemade	Graphene Oxide incorporated BiOl Photocatalyst for solar degradation of reactive violet.	International Conference on Emerging Trends in Catalysts, VIT, T.N.	Vellore.
Prof P.R.Gogate	Convenor, OYCE-2020.	Department of Chemical Engineering, ICT Mumbai.	Mumbai.
Prof A.V.Patwardhan	FDP-Perspectives on the past, present & future of advanced materials.	Seminar at Gadag, Karnataka.	Karnataka.
Prof B.N.Thorat	14th International Workshop on Industrial Crystallization, Theme: Industrial Crystallization.	Workshop at K.V Auditorium, Matunga, Mumbai-400019.	Mumbai.
Dr C.S.Mathpati	Faculty Development Programme on Innovation to Entrepreneurship- A Roadmap.	Institutions Innovation Council.	Mumbai.
Dr C.S.Mathpati	Recent Advancement in Chemical Biology & Drug Discovery.	TEQIP-III	Mumbai.
Dr S.V.Jadhav	Certificate Programme on Intellectual Property Rights & Patenting.	Starcore Technologies.	Online.
Dr S.V.Jadhav	Certificate Webinar on Technical Paper Writing and Publishing in Reputed Journals.	Starcore Technologies.	Online.
Dr S.V.Jadhav	Mentoring Pedagogy & Online Teaching In Higher Education.	E&ICT Academy, IIT Guwahati.	IIT Guwahati.
2018-19			
Prof. S.S. Bhagwat	National Institute of Educational Planning & Administration	NIEPA	University of Oxford
Prof. S.S. Bhagwat	International Conference on Energy and Environment	Keynote speaker at International Conference on Energy and Environment	VIT, Pune
Prof. S.S. Bhagwat	Interfacial Science & Engineering: Basics and Applications	Invited as speaker for Research seminar on Interfacial Science & Engineering: Basics and Applications	Ahmedabad University, Gujrat.
Prof. S.S. Bhagwat	Environment and Green Technology for Sustainable Development	Keynote speaker for National seminar on Environment and Green Technology for Sustainable Development	Pune
Prof. S.S. Bhagwat	Energy and Exergy Engineering	Delivered a lecture on "Energy and Exergy Engineering	KLES Science & Commerce College
Prof. S.S. Bhagwat	Importance of Sciences in Engineering	Invited to talk on Importance of Sciences in Engineering	Don Bosco Institute of Technology
Prof. P.K. Ghosh	Eye on Green Technology, International Conference on Green Methods for Separation, Purification and Nanomaterial Synthesis (GMSP&NS-2018)	Invited as Guest Speaker	Jain University, Bengaluru
Prof. P.K. Ghosh	Illustrations of Opportunities to Convert Waste into Value	ICC Seminar on Wealth from Waste	Ankleshwar, Gujarat
Prof. P.K. Ghosh	Discovery of Cozaar, Losartan Potassium Salt at DuPont	Conference on an Interdisciplinary Approach from Fundamental Sciences to Translational Medicine	St. Xavier's College, Mumbai,
Prof. P.K. Ghosh	How SMEs can partner and benefit from the expertise	Seminar on Technology options for sustainable growth of Indian chemical industry	UAA Ahmedabad
Prof. P.K. Ghosh	Practical applications of Forward Osmosis with eye on energy conservation	National Conference on Novel Chemical Systems for Therapeutic and Energy	Anand, Gujarat

		Applications (NCSTEA-2019)	
Prof. P.K. Ghosh	Technology pull and technology push are both important	ChemProtech India / Chemspec India 2019	CSIR-CSMCRI, Bhavnagar
Prof. P.R. Gogate	Chemical Reaction Engineering	Training program for Field officers of Maharashtra Pollution Control Board	Maharashtra
Prof. P.R. Gogate	Process Calculations, Distillation & Extraction, Crystallization & Filtration	Invited Faculty in Refresher course on Chemical Engineering organized by Indian Chemical Council	Ranipet, Tamilnadu
Prof. P.R. Gogate	Hydrodynamic cavitation for wastewater treatment	Invited Lecture in School on Advanced Oxidation Processes	BITS, Goa,
Prof. P.R. Gogate	Cavitation Technologies for Wastewater treatment", Invited lecture organized by MITCOE	Invited lecture organized by MITCOE	Alandi, Pune
Prof. P.R. Gogate	Chemical Reaction Engineering	Invited Faculty in Refresher course on Chemical Engineering organized by Indian Chemical Council	Mumbai
Prof. P.R. Gogate	Process Intensification using Cavitational reactors	Invited lecturer	Kurukshetra University
Prof. P.R. Gogate	Process Calculations, Chemical Reaction Engineering, Distillation & Extraction, Crystallization & Filtration	Invited Faculty in Refresher course on Chemical Engineering organized by Indian Chemical Council	Southern Regional Center, Cuddalore, TN
Prof. P.R. Gogate	Sono-crystallization	Industrial training program on crystallization	Cipla, Mumbai
Dr. R.D. Jain	Continuous synthesis of trimethyl chitosan/palladiumnano particles as potential anti-cancer therapy	Presentation at 17th International Symposium of Controlled Release Society	The Lalit, Mumbai
Dr. R.D. Jain	Chitosan based coprocessed excipients for improved tableting	Seminar at Wadhwani Research Center for Bioengineering	IIT, Mumbai
Dr. R.D. Jain	Split and Recombine Micromixer based continuous Synthesis of Chitosan Nanoparticles	Oral Presentation at Microfluidics and Lab on a Chip conference, SELECTBIO	Mumbai
Dr.S.V. Jadhav	Enhancing Accountability and Responsiveness in Scientific Organisations	TEQUIP III	Osmania University, Hyderabad
Prof.A.M. Lali	2nd EU-India Conference on Advance Biofuels	Conference on Advance Biofuels" organized by Ministry of Petroleum & Natural Gas, Govt. of India & European Commission	New Delhi
Prof.A.M. Lali	Clean Energy "Development of Enzymes & Microbial Technologies for Clean Energy	ICGEB	New Delhi
Prof.A.M. Lali	Guest Lecturer	Toray India Forum Series	The Claridges, New Delhi
Prof.A.M. Lali	AIDA's National Technical Seminar	AIDA's National Technical Seminar	New Delhi
Prof.A.M. Lali	An Energy Science & Technology Agenda for India organized by Shell Technology	Workshop on Chemical Conversion of bio- feedstocks in the context of the energy transition	Bangalore
Prof.A.M. Lali	Refining & Petrochemicals Technology	Centre for High Technology Ministry of Petroleum & Natural Gas, Govt. of India	Mumbai

Prof.A.M. Lali	Recent innovations in algal biofuels and bio-energy technologies	Delivered a lecture & attended a workshop	Dehradun
Prof.A.M. Lali	DBT National Workshop	Keynote Speaker	Department of Biotechnology, Govt. of India, New Delhi
Prof.A.M. Lali	ACHEMA 2018	ACHEMA 2018	Frankfurt am Main, Germany
Prof.A.M. Lali	Ethanol Summit	Panelist for the Ethanol Summit of the Asia-Pacific	Minneapolis, Minnesota, USA
Prof.A.M. Lali	Challenge and opportunities in lignocellulosic Biorefining	3rd LBNet Conference	Cheshire, UK
Prof.A.M. Lali	National Technical Seminar	by AIDA	New Delhi
Prof.A.M. Lali	Guest speaker at A K Dorle Memorial lecture series III	Guest speaker at A K Dorle Memorial lecture series III	University Department of Pharmaceutical Sc. Nagpur University
Prof.A.M. Lali	Advanced Biofuels	EU-India Conference	University Department of Pharmaceutical Sc. Nagpur University
Prof. A.M. Lali	Mining marine by-products for functional molecules	Lecture by Ms. Aishwarya Mohan, Research Manager, Cape Breton University	Canada
Prof. A.M. Lali	Cyber Colloids: a small Irish company with a big interest in seaweed	Lecture by Dr. Sarah Hotchkiss, Project Manager Cybercolloids Ltd.	Ireland
Prof. A.M. Lali	Staged bioprocessing- Maximizing economic value and biomass utilization	Lecture by Dr. John Sewuster, Waypoint Business Solutions Inc	Canada
Prof. A.M. Lali	Overview of hand harvesting Ascophyllum nodosum from Ireland's pristine Atlantic waters to being a world leader in the marketplace	Lecture by Dr. Noreen Breathnach	Ireland
Prof. A.M. Lali	Exploring Solar Radiation Relations of Seaweeds Floating at Sea: A Tool to Counteract Ocean Warming?	Lecture by Prof. Ricardo Radulovich, Dept. of Biosystems Engineering, University of Costa Rica	Costa Rica
Prof. A.M. Lali	The Role of UKRI-GCRF Global Seaweed STAR in meeting the challenges of the Philippine Seaweed Industry	Lecture by Dr. Anicia Hurtado, Scientist-Consultant in Seaweed Tissue Culture and Aquaculture	Philippines
Prof. A.M. Lali	Computational Modelling in Synthetic Biology	Lecture by Prof. K.V. Venkatesh, Department of Chemical Engineering, IIT Bombay	IIT Mumbai
Prof. A.M. Lali	International and National Perspectives of Sustainability and CSR	Lecture by Mr. Bibhuti Pradhan, General Manager (CSR), Indian Oil Corporation Limited (IOC)	New Delhi
Prof. A.M. Lali	Engineering mammalian cell factories for production of recombinant proteins, vesicles and gene therapies	Lecture by Prof. Mark Smales, University of Kent	UK
Prof. L. K. Mannepalli	IZC-2019	Keynote lecture at IZC-2019	Perth, Australia
Dr. C.S.	Computational Fluid Dynamics Of Heat transfer in Packed And Fluidized	National Conference on Fluid Mechanics and Fluid	MNNIT Allahabad

Mathpati	Bed Systems	Power	
Dr. C.S. Mathpati	Application of Computational Fluid Dynamics	Workshop on Computational Fluid Dynamics and its application	VJTI, Mumbai
Dr. C.S. Mathpati	CFD modeling of a dual Fluidized Bed Gasifier	8th Global Conference on Global Warming	Doha, Qatar
Prof. A.B. Pandit	Sustainable Waste Management: Municipal Solid Waste and e- Waste	IGCS Winter School	IIT Madras
Prof. A.B. Pandit	Groundnut shell Biochar-Production, characterization, and study of its interactive mechanism with crop fertilizer	2nd International Conference on Bioresources, Energy, Environment & Materials Technology	Gangwon Province, South Korea
Prof. A.B. Pandit	A two stage treatment of alkyd resin wastewater: Hydrodynamic cavitation followed by Peroxane process in gas inducing reactor	DAE BRNS 8th Biennial Symposium on emerging trends in Separation Sciences and Technology	BITS-Pilani-Goa
Prof. A.B. Pandit	INAE DST initiative on Laboratory safety and hazardous waste management	Lecture at Indian Institutes of Science Education and Research (IISER)	Pune
Prof. A.B. Pandit	Process Intensification Strategies for Chemical Industry	ICT-UAA Silver Jubilee Seminar	Ahmadabad
Prof. A.B. Pandit	Intensification of intracellular enzyme recovery	Key note Speaker at 'ACES-2019'	IISER Bhopal
Prof. A.B. Pandit	National Opportunities for Chemical Engineers	Key note Lecture, CHEMIX 2019	VNIT Nagpur
Prof. A.B. Pandit	Laboratory Safe Practices and Waste Disposal in Academic and R & D Institutes	Invited Talk at 'INAE-DST'	Savitribai Phule Pune University, Pune
Prof. A.W. Patwardhan	CFD Modeling for Reactor Design	Symposium on Chemical Reaction Engineering	NCL, Pune
Prof. A.W. Patwardhan	Synthesis of boron doped carbon nanotubes using floating catalyst chemical vapor deposition	Second International Conference on Nano Science and Engineering Applications ICONSEA	JNTU-Hyderabad
Prof. A.W. Patwardhan	Synthesis of high aspect ratio graphene oxide sheets using one pot electrochemical exfoliation	Conference on Nano Science and Engineering Applications ICONSEA-2018	JNTU-Hyderabad
Prof. A.W. Patwardhan	Numerical Simulations of the Gas-Liquid two phase flow using population balance modelling in Vertical Pipe	16th Multiphase flow conference	Dresden, Germany
Prof. A.W. Patwardhan	Sensitivity Analysis for CFD Simulations of Randomly Arranged Packed Beds of Spheres	12th International Conference on Complex Fluids and Soft Matter	IIT-Roorkee
Prof. A.W. Patwardhan	Experimental and Computational Studies for Two Phase Flow Pressure Drop in Vertical Tube Boiling	7th International and 45th National Conference on Fluid Mechanics and Fluid Power (FMFP)	IIT-Bombay, Mumbai
Prof. A.W. Patwardhan	Direct Numerical Simulation for comparison of Flow Structures in Three-Dimensional Wake Flow	7th International and 45th National Conference on Fluid Mechanics and Fluid Power (FMFP)	IIT-Bombay, Mumbai
Prof. A.W. Patwardhan	New methodology for modeling pressure drop and thermal hydraulic characteristics in long vertical boiler tubes at high pressure	National Conference on Critical Heat Flux and Multiphase Flow	IIT-BHU, Varanasi
Prof. A.W. Patwardhan	Thermal Hydraulics Study of High-Pressure Flow Boiling in Vertical Tube	71th Annual Session of Indian Institute of Chemical Engineers, (CHEMCON-2018)	NIT-Jalandhar
Prof. A.W.	Residence Time Distribution Studies in Multi-stage Extraction Column	71th Annual Session of Indian Institute of	NIT-Jalandhar

Patwardhan		Chemical Engineers, (CHEMCON-2018)	
Prof. A.W. Patwardhan	Comparison of the Turbulence Models for Flow Fields Prediction of the Jet Flow Decay	71th Annual Session of Indian Institute of Chemical Engineers, (CHEMCON-2018)	NIT-Jalandhar
Prof. A.W. Patwardhan	Mathematical Modeling of Tea Bag Infusion Kinetics.	71th Annual Session of Indian Institute of Chemical Engineers, (CHEMCON-2018)	NIT-Jalandhar
Prof. A.W. Patwardhan	Numerical Simulations of the Slug Flow for the Air-Water Two Phase Flow System in Vertical Pipe	71th Annual Session of Indian Institute of Chemical Engineers, (CHEMCON-2018)	NIT-Jalandhar
Prof. A.W. Patwardhan	Single step Electrochemical Exfoliation of Graphite: Synthesis, Optimization and Characterization.	71th Annual Session of Indian Institute of Chemical Engineers, (CHEMCON-2018).	NIT-Jalandhar
Prof. A.W. Patwardhan	Synthesis of boron doped carbon nanotubes and study of variation in boron concentration	71th Annual Session of Indian Institute of Chemical Engineers, (CHEMCON-2018	NIT-Jalandhar
Prof. A.W. Patwardhan	Hydrodynamics of asymmetric rotating agitated extractor: Investigation of drop size , holdup and mass transfer	71th Annual Session of Indian Institute of Chemical Engineers, (CHEMCON-2018	NIT-Jalandhar
Prof. A.W. Patwardhan	Direct Numerical Simulation for External and Internal Flows in Open FOAM	71th Annual Session of Indian Institute of Chemical Engineers, (CHEMCON-2018)	NIT-Jalandhar
Prof. A.W. Patwardhan	Mathematical Modeling of Tea Bag Infusion Kinetics.	2nd International Conference on Engineering Future Food, (EFF2019).	Bologna, Italy
Prof. A.W. Patwardhan	CFD PBM simulations of asymmetric rotating impeller column,	14th International Conference on Gas-Liquid and Gas-Liquid-Solid Reactor Engineering (GLS-14)	Guilin, China
Prof. A.W. Patwardhan	Direct Numerical Simulation (DNS) to Investigate the Effect of Schmidt Number on Mass Transfer through Packed Beds	14th International Conference on Gas-Liquid and Gas-Liquid-Solid Reactor Engineering (GLS-14)	Guilin, China
Prof. A.V. Patwardhan	Cleaning of polyamide nanofiltration membranes: Comparison between conventional and ultrasound-assisted technology	1st International Conference Materials & Environmental Science (ICMES)	Kolhapur, Maharashtra
Prof. A.V. Patwardhan	COD reduction of industrial effluent by polyamide nanofiltration membranes	Paper presented at 1st International Conference Materials & Environmental Science (ICMES)	Kolhapur, Maharashtra
Prof. A.V. Patwardhan	Safety Week	Safety Week Workshop	ICT Mumbai
Dr. P.D. Vaidya	Distillation & Absorption	11th International Conference on Distillation & Absorption	Florence
Dr. P.D. Vaidya	Hydrogen & Fuel Cell	7th International Hydrogen & Fuel Cell Conference (IHFC – 2018),	Jodhpur
Dr. P.D. Vaidya	Orientation to Chemical Safety and Risk Management	Sandia National Laboratory’s Workshop	ICT, Mumbai.
Prof. B.N. Thorat	Mathematical Analysis of Solar Conduction Dryer using Reaction Engineering Approach	Nordic Baltic Drying Conference	Saint Petersburg, Russia
Prof. B.N. Thorat	New theories discerning drying kinetics	Nordic Baltic Drying Conference	Saint Petersburg, Russia
Prof. B.N. Thorat	Lecture on Filtration and Drying	13th International Workshop on Crystallization	ICT, Mumbai.
Prof. V.K. Rathod	Application of Enzyme for conversion of Biomass in to value added product	Keynote Lecture	Rowan University, USA

Prof. V.K. Rathod	Heat Transfer and its application in heat exchanger design	BPCL Training programme	Mumbai
Prof. V.K. Rathod	'Utilization of solid waste from Food Industry for value added products' and 'Utilization of liquid waste from Food Industry for value added products'	Keynote Lecture	North Maharashtra University Jalgaon
2017-18			
Prof. B.N. Thorat	CFD modelling and experimental study of Solar Conduction Dryer	Oral Presentation at Asia-Pacific Drying Conference	Wuxi, China
Prof. B.N. Thorat	Augmenting natural convection and conduction based solar dryer	21st International Drying Symposium 2018	Valencia, Spain
Prof. B.N. Thorat	12th International Workshopon Crystallization, Filtration and Drying. Theme: Drying and Granulation	International Workshop	ICT, Mumbai
Prof. A.M. Lali	ACHEMA 2018, World Forum	ACHEMA 2018, World Forum	Germany
Prof. A.M. Lali	Ethanol Summit of the Asian –Pacific organized by The U.S Grains Council and Sponsors Growth Energy and the Renewable Fuels	Guest panalist	Minneapolis, Minnesota, USA
Prof. A.M. Lali	Challenge and opportunities in Lignocellulosi Biorefinery	LBNet Conference	Shrigley Hall, Cheshire, UK
Prof. A.M. Lali	Cascade processes for integrated bio-refining of agricultural waste in India & Vietnam	Meeting of our International partners as a part of BBSRC	Aston University
Prof. A.M. Lali	AIDA'S	Technical Seminar & Exhibition	Technical Seminar & Exhibition
Prof. A.M. Lali	Dr. A.K. Dorle Memorial Lecture III	Guest speaker	Nagpur
Prof. A.M. Lali	Advance Biofuels	EU-India Conference	New Delhi
Prof. A.M. Lali	Bioenergy for the Future	Mission Innovation/International Energy Agency Event	Ottawa, Canada
Prof. A.M. Lali	Burning Fields, Biofuels and Bettering Farm Life	Conference on Biomass Innovation organized by Maastricht University	New Delhi
Prof. A.M. Lali	Lignocellulosic Ethanol	International Conference	Brussels, Belgium.
Prof. A.M. Lali	Biofuture Summit 17	Biofuture Summit 17	Paulo, Brazil
Prof. A.M. Lali	Bioenergy- Urja Utsav	Bioenergy- Urja Utsav Workshop	Pune
Prof. A.V. Patwardhan	Synthesis and characterization of ultrafiltration ceramic membranes using solid spent material doped in α-alumina from chemical industries	Recent Trends on Membranes and Separation Technology (RTMST-17) Workshop	CSMCRI, Bhavnagar
Prof. A.V. Patwardhan	Synthesis and characterization of ultra-filtration ceramic membranes using solid spent material doped in alpha alumina from chemical industries	DAE – BRNS Biennial "Symposium on Emerging Trends inSeparation Science and Technology (SESTEC –2018	BITS Pilani, K.K. Birla Goa
Prof. A.V. Patwardhan	Development of grafted resins and membranes (extractants) for precious metals	CHEMIX-18	VNIT, Nagpur
Prof. A.V. Patwardhan	Synthesis and characterization of ultra-filtration ceramic membranes using solid spent material doped in alpha alumina from chemical industries	DAE –BRNS Biennial Symposium on Emerging Trends	BITS Pilani, K.K. Birla Goa
Prof. A.V. Patwardhan	Application of ceramic membranes in treating laundry wastewater	Outstanding Young Chemical Engineers (OYCE)	Mumbai

Prof. A.W. Patwardhan	Controlling the carbon nanotubes type with processing parameters from floating catalyst chemical vapor deposition synthesis	International Conference on Nanotechnology	IIT Roorkee
Prof. A.W. Patwardhan	Synthesis of modified carbon nanotubes	International Conference on Nanotechnology	IIT Roorkee
Prof. A.W. Patwardhan	Flow Patterns, Flow Pattern Map And Void Fraction Measurement Of Air/Water Two Phase Flow In Vertical Pipe	NationalConference on Fluid Mechanics and Fluid Power	Amrita University, Kerala
Prof. A.W. Patwardhan	Design and Scale-up of Asymmetric Rotary Agitated Liquid – Liquid Extraction Columns, Eighth Biennial Symposium On EmergingTrends In Separation Science And Technology	SESTEC – 2018	BITS Goa
Prof. A.W. Patwardhan	Hydrodynamic Characteristics between Pulsed Disc and Doughnut Column and Asymmetric Rotating Impeller Column	Eighth Biennial Symposium On Emerging Trends In Separation Science And Technology, SESTEC – 2018	BITS Goa
Prof. A.W. Patwardhan	CFD-PBM Simulations of Asymmetric Rotating Impeller Column	Eighth Biennial Symposium On Emerging Trends In Separation Science AndTechnology, SESTEC – 2018	BITS Goa
Prof. A.W. Patwardhan	Synergistic Behavior of Tri-butyl Phosphate and Di-(2-ethylhexyl) Phosphoric Acid	Eighth Biennial Symposium On Emerging Trends In Separation Science And Technology, SESTEC – 2018	BITS Goa
Prof. A.W. Patwardhan	Recovery of Lithium from Sea Water Bitterns byLiquid – Liquid Extraction	Eighth Biennial Symposium On Emerging Trends In Separation Science And Technology, SESTEC – 2018	BITS Goa
Prof. P. R. Gogate	Hydrodynamic cavitation for Wastewater treatment	Invited for presentation	Saudi Arabia
Prof. P. R. Gogate	Intensified Hybrid oxidation processes based on hydrodynamic cavitation for treatment of emerging contaminants	Invited Lecture at AOSS-3	SRM University
Prof. P. R. Gogate	Cavitational Reactors	Annual Convention of Marathi Vidnyan Parishad	Kudal, Maharashtra
Prof. P. R. Gogate	Intensification of Chemical processing applications using Cavitational Reactors	Invited Lecturer	PREC, Loni
Prof. P. R. Gogate	Intensified Production of Biofuels from Sustainable Raw Materials using Ultrasonic Reactors	Invited Lecture at the Indo- Japan Bilateral Symposium	IIT-Guwahati
Prof. P. R. Gogate	Crystallization using ultrasonic irradiation	Invited lecture at WFCFD	ICT Mumbai
Prof. P. R. Gogate	Process Intensification of Chemical Processing applications using cavitational reactors	Tantr Avishkar 2K18,	TSEC, Mumbai
Prof. K.V. Marathe	Mechanical Behavior of Materials	TEQIP	ICT, Mumbai
Prof. P.D. Vaidya	6th International Conference on Hydrogen and Fuel Cells	6th International Conference on Hydrogen and Fuel Cells	Pune`
Prof. P.D. Vaidya	Orientation to Chemical Security Risk Management	3-Day Seminar	SANDIA National Laboratories (USA)
Prof. C.S. Mathapati	National Conference on Fluid Mechanics and Fluid Power	National Conference on Fluid Mechanics and FluidPower	MNNIT Allahabad
Dr. R.D. Jain	Skinon- a-chip: An alternativeto- animal, 3D in-vitro skin model for preclinical and biomedical applications	Microfluidics and Lab, SELECTBIO	Mumbai

Prof. L. K. Mannepalli	RACI National Centenary Conference 2017	RACI National Centenary Conference CHEMECA-2017	Melbourne, Australia
Prof. L. K. Mannepalli	NENCS	Guest speaker	Tokyo, Japan
Prof. L. K. Mannepalli	ACS Asia-Pacific International Chapters Conference	Invited speaker	Jeju, South Korea
Prof . J.B. Joshi	12th International conference on Gas, liquid and solid (GLS- 12),	Invited speaker	Brussels, Belgium

4.8 Research and Development (30) **Institute Marks (30)**

4.8.1 Academic Research (10) **Institute Marks (10)**

Table 4.15: Faculty academic research

		Academic Research											
Sr. No.	**Name of Faculty**	**Number of quality publications in refereed/SCI Journals, citations, Books/Book Chapters etc.**						**Ph.D. awarded during the assessment period while working in the institute**					
		2021-22	**2020-21**	**2019-20**	**2018-19**	**2017-18**	**2016-17**	**2021-22**	**2020-21**	**2019-20**	**2018-19**	**2017-18**	**2016-17**
1	Professor A. B. Pandit	7	14	13	20	11	21	0	3	6	2	3	1
2	Professor V. G. Gaikar	1	1	1	8	8	5	2	3	0	3	0	2
3	Professor A. W. Patwardhan	4	2	7	13	7	14	3	4	2	2	2	2
4	Professor S. S. Bhagwat	3	5	6	1	5	7	2	0	2	3	2	1
5	Professor V. K. Rathod	10	23	29	23	25	25	1	1	0	6	3	2
6	Professor P. R. Gogate	20	38	26	32	27	24	1	4	4	3	3	2
7	Dr. V. H. Dalvi	3	7	1	2	3	5	0	0	0	0	0	0
8	Dr. P. R. Nemade	2	3	2	4	3	2	0	1	0	0	3	0

9	Professor P. D. Vaidya	4	5	9	9	11	8	0	0	2	4	8	5
10	Dr. C. S. Mathpati	3	5	8	4	8	8	0	4	3	2	0	1
11	Professor B. N. Thorat	6	12	7	2	0	2	0	1	1	1	0	0
12	Professor G. D. Yadav	5	22	18	28	26	18	3	2	2	6	6	3
13	Professor L.K. Mannepalli	2	2	1	3	2	0	0	0	0	0	0	0
14	Professor P. K. Ghosh	0	2	1	5	2	3	0	0	0	0	0	0
15	Dr. S. V. Jadhav	2	2	2	0	0	0	0	0	0	0	0	0
16	Dr. K. V. Marathe	0	0	1	1	5	3	0	0	1	1	0	0
17	Professor A. V. Patwardhan	0	2	2	4	3	2	1	0	2	2	1	0
18	Dr. R. D. Jain	7	22	18	20	8	8	2	0	1	1	1	0
19	Dr. M. D. Yadav	1	3	3	0	0	0		0	0	0	0	0
20	Professor A. M. Lali	6	13	15	10	10	18	2	1	8	8	2	6
21	Professor D. D. Sarode	1	2	1	2	1	0	0	0	1	0	0	0
22	Professor V. R. Gaval	0	5	6	0	0	0	0	2	0	0	0	0
23	Dr. P. Goswami	0	0	0	1	2	2	0	0	0	0	0	0
24	Shri. M. A. K. Kerawalla	0	0	0	0	1	2	0	0	0	0	0	0
25	Dr. R. S. N. Sahai	0	2	1	0	0	0	0		0	0	0	0
26	Professor S. P. Deshmukh	1	3	6	3	2	4	0	3	0	3	0	0
27	Dr. Annamma Anil	2	2	1	2	0	1	1	2	1	2	0	2

4.8.2 Sponsored Research (10) **Institute Marks (10)**

Table 4.16: Sponsored Research

Project Title	Duration	Funding Agency	Amount (in Rs)
Year 2021-2022			
Extraction of fluorine, uranium and rare earth elements from rock phosphate, phosphoric acid and phosphate fertilizers	4 years	Rubamin Industries	3300000
Synthesis of Nicotinic acid	1 year	Jubilant Ingravia Ltd.	1540000
Development of process for the synthesis of sulfentrazone	1 year	Rallis India Ltd.	2266000
Water and wastewater treatment using hybrid advanced oxidation processes	3 years	Department of Science and Technology, Water Treatment initiative	7448000
Explore Downstream Processed Gycol products for Value addition	1 year	Akry Organics Pvt Limited	800000
Development of process for the synthesis of sulfentrazone	1 year	Rallis India Ltd.	2266000
Synthesis of Nicotinic acid	1 year	Jubilant Ingravia Ltd.	1540000
Improved hydrogen production from biogas using sorption-enhanced reforming	3 year	DST	4062000
Study on new green CO2- capturing solvents	3 year	DST	5791000
Catalytic aqueous-phase reforming of model compounds of microalgae and activated sludge	3 year	DBT	5080000
Development of superior absorbents for CO2 separation from biogas	3 year	Centre for High Technology	8556000
Dehydrogenation of Liquid Organic Hydrogen Carriers	1 year	Reliance Industries Ltd.	2000000
Extraction of Fluorine, Uranium and rare earth elements from Rock Phosphate, phosphoric acid and phosphate fertilizers	1 year	Rubamin Ltd.	3290000
Design Aspects of Mixer Settlers Employed by Heavy Water Board	1 year	BRNS	3375000
Recovery of acids from waste streams of PDDP complex	2 years	Bharat Petroleum Corporation Ltd	3542880
Surface studies on lean amine solvents from gas treating units	1.5 years	Amines and Plasticizers	266000
Stability of Hydrogen Peroxide		Hindustan Unilever	1805400
Epoxidation, ring-opening, and allied chemical modification of high C18 methyl esters (C1875ME and C1898) and palm methyl ester (C1618ME) to produce plasticizers and lubricants	2 years	SUMWIN Solutions, Malaysia	1635000
Treatment of aqueous effluents from refineries and allied industries	4 years	VA Tech Wabag Limited, Chennai	4214000
Recycling of water from the textile processing and auxiliary industry effluents	3 years	Rajiv Gandhi Science & Technology Commission,	5266000

		Maharashtra State	
Year 2020-2021			
AMCOS	1 year	DST	654689
SERB	1 year	DST	341210
FIST	1 year	DST	862012
WasteWater Treatment	1 year	DST/WTI	1188298
SERB	1 year	DST	1900000
SERB	1 year	DST	1906395
TDT	1 year	DST	8073
TDT	1 year	DST	12328880
BioGas	1 year	Centre for High Tech.	3503937
Waste management Tech	1 year	DST	151709
Waste water management	1 year	DST	2532802
COLD TRAP	1 year	IGCAR	258000
MHRD - STARS	1 year	MHRD - STARS	1729000
HINDUSTAN UNILEVER	1 year	Hindustan Unilever	110133
Bharat Petroleum Ltd	1 year	Bharat Petroleum Ltd	836120
Bharat Petroleum Ltd	1 year	Bharat Petroleum Ltd	27124731
Harvard Global Research Support Centre	1 year	Harvard Global Research Support Centre	735643
Catalysist & Process Devt	1 year	RIL-I	462500
CIPLA LTD	1 year	CIPLA LTD	2201551
Hydrogen Carriers	1 year	RIL-III	462500
Covestro India Pvt Ltd	1 year	Covestro India Pvt Ltd	795600
Daicel Chiral Technology	1 year	Daicel Chiral Technology	158844
SERB	1 year	DST	205598
Godavari Biorefineries Ltd	1 year	Godavari Biorefineries Ltd	426684
Godavari Biorefineries Ltd	1 year	Godavari Biorefineries Ltd	871292
Godavari Biorefineries Ltd	1 year	Godavari Biorefineries Ltd	765000
Methyl Methacrylate	1 year	RIL-II	462500
Rallis India Ltd.	1 year	Rallis India Ltd.	1790100
University of Leeds	1 year	University of Leeds	4826139
Vinati Organics Ltd 2	1 year	Vinati Organics Ltd-2	721680
Vinati Organics Ltd 3	1 year	Vinati Organics Ltd 3	584545
Vinati Organics Ltd 4	1 year	Vinati Organics Ltd 4	1320000

Balance Industrial Res Project	1 year	Balance Industrial Res Project	161925
Salicylates & Chemicals Pvt Ltd/	1 year	Salicylates & Chemicals Pvt Ltd/	1105000
S.A. Pharmachem P. Ltd.	1 year	S.A. Pharmachem P. Ltd.	670040.5
Biosimilar 2017	1 year	Biosimilar workshop 2017	7085247
CO_2 Conversion	1 year	ICT-OEC	827728
CO_2 Conversion	1 year	ICT-OECT	4517646
CO_2 Conversion Phase II	1 year	Ongc	900751
Year 2019-2020			
STARS	1 year	STARS	1729000
BRNS	1 year	DAE	483905
D.A.E	1 year	Centre For C.E.	26911478
DBT	1 year	BCIL	437969
Catalytic Aqueousphase	1 year	DBT	1571585
CO_2-Capturing Solvents	1 year	DST	1514765
DST/FIST	1 year	DST/FIST/CE	33339752
hydrogen From Biogas	1 year	DST	2432408
Indo-Japanese Lecture	1 year	DST	230000
Nanofibrous Bandage	1 year	DST	6236280
SERB-Brownian Movement	1 year	DST	220000
DST-SERB	1 year	DST-SERB	400000
SERB-Sea-Water	1 year	DST	424245
CFD Study	1 year	IGCAR	542800
BIRAC	1 year	BIRAC	942000
Agricultural Waste	1 year	RGSTC	7310933
Recycling of Water	1 year	RGSTC	3270608
RELIANCE IND. LTD	1 year	RELIANCE IND. LTD	351000
RELIANCE IND. LTD	1 year	RELIANCE IND. LTD	1326000
COLD TRAP	1 year	IGCAR	896800
Start-Up Grant	1 year	UGC-FRP	1226736
Aditya Birla Science and Tech Co	1 year	Aditya Birla Science and Tech Co	330748
Bajaj Consumer Care Ltd	1 year	BAJAJ CONSUMER CARE LTD	209250
Amines & Plasticizer Ltd.	1 year	Amines & Plasticizer Ltd.	243458

Bharat Petroleum Ltd	1 year	Bharat Petroleum Ltd	910379
Biocon SDN	1 year	Biocon SDN	2156216
Devt of Additive	1 year	BPCL	1175200
Lonic Liquid	1 year	BPCL	1279200
BPCL	1 year	BPCL	104773
Cadila Healthcare Ltd.	1 year	Cadila Healthcare Ltd.	405000
BioGas	1 year	Centre for High Tech	723668
CIPLA LTD.	1 year	CIPLA LTD.	824851
Coca Cola Ltd	1 year	Coca Cola Ltd	17146
Covestro India Pvt Ltd	1 year	Covestro India Pvt Ltd	1591200
Harvard Global Research Support Centre	1 year	Harvard Global Research Support Centre	300000
Equinox Environments	1 year	Equinox Environments	94500
Godavari Biorefineries Ltd	1 year	Godavari Biorefineries Ltd	913360
Haridevka Inc	1 year	HARIDEVKA INC	128125
2^{nd} Project	1 year	HUL	283500
ICPE	1 year	ICPE	625050
CO_2 Conversion	1 year	ICT-OEC-	1884708
Phase III	1 year	ICT/ OECT	7702239
Kesar Petroproducts Ltd	1 year	Kesar Petroproducts Ltd	410400
Ephidrine	1 year	Malladi Drugs	408240
Mangalam Organic Ltd-1	1 year	Mangalam Organic Ltd	270000
Mangalam Organics Ltd.-2	1 year	Mangalam Organics Ltd	1017048
Mangalam Organics Ltd.	1 year	Mangalam Organics Ltd	383400
Marvel Drugs Pvt Ltd	1 year	Marvel Drugs Pvt Ltd	227700
Ms.IRELTDC	1 year	Ms.IRELTDC	1610000
Prasol Chemicals Pvt Ltd	1 year	Prasol Chemicals Pvt Ltd	594000
Raj Petro Specialities Ltd.	1 year	Raj Petro Specialities Ltd.	157424
RELIANCE IND. LTD	1 year	Reliance Ind. Ltd	387810
RELIANCE IND. LTD	1 year	Reliance Ind. Ltd	108000
SPARC	1 year	SPARC	1000000
Stelis Bio Pharma Pvt.Ltd.	1 year	Stelis Bio Pharma Pvt.Ltd.	502910
S S Techno Ltd	1 year	S S Techno Ltd	129600
University of Leeds	1 year	University of Leeds	5202391
UPL Limited/	1 year	UPL Limited/	2493190
Vinati Organics Ltd-2	1 year	Vinati Organics Ltd-2	1407720

Vinati Organics Ltd 3/	1 year	Vinati Organics Ltd 3/	787320
Wipro Limited	1 year	Wipro Limited	147876
Unilever Ltd.	1 year	Unilever Ltd.	623700
Year 2018-2019			
Cold storage facility for storage of fruits and vegetables using heat based refrigeration system	5 years	Rajiv Gandhi Science and technology Commission	12300000
Design of in situ photocatalytic systems for CO_2 conversion into useful organic materials using CdS Nanoparticles on the new polymeric CO_2 specific adsorbents and graphene supports	4 years	Department of Science and Technology, Science and Engineering Research Board	5481000
Selection and Regeneration of potential ionic liquid for hydro processing feed stocks	3 years	Bharat Petroleum Corporation Limited	2000000
Development of additive for use in Delayed Coker Unit (DCU) to improve liquid yield	3 years	Bharat Petroleum Corporation Limited	2000000
Mitigation of water problems in Ausa town, Latur: wastewater management, Gaothan Lake rejuvenation, Potable water production through desalination of lake water and training of residents in matter of sanitation and water conservation	2 years	Department of Science & Technology, New Delhi	17300000
Use of composite foam to tackle the problems of oil spill and undesirable oil-in-water emulsion	2 years	ONGC	1800000
Treatment of Wastewater containing pesticides and emerging contaminants using novel approach of combined hydrodynamic cavitation and oxidation processes	3 years	Department of Science & Technology (WTI Scheme), New Delhi	5440000
Intensified recovery of valuable products from whey using ultrasound	3 years	Department of Science & Technology (MOFPI Scheme), New Delhi	4140000
Improved process for $CaSO_4$ crystallisation in concentrated brine using Ultrasound	3 years	Department of Atomic Energy-ICT	3500000
Water and wastewater treatment using hybrid advanced oxidation processes	3 years	Department of Science & Technology	7448000
Hydrodynamic cavitation based intensified and low cost technology for industrial wastewater treatment containing toxic organic compounds and solid particles	2 years	Department of Science and Technology, India-Ukraine collaboration	1302000
Conjugation and Radio labelling of various nano platforms for image guided theranostic applications	3 years	ICT-DAE	6532000
Green Process for the production and purification of low molecular weight Chitosan Oligomer using solid acid catalyst	3 years	DBT	5164000
Microfuidic Platform for Developing bioartificial Retina	2 years	DBT	6152000

Designing & Commercialization of affordable chemically defined serum free media & feed for high value Biosimilars Manufacture	2 years	BIRAC-BIPP	6544000
Preclinical Evaluation of Full Thickness Wound Healing Using Starch Based Artificial Skin Substitute in Rat Model	2 years	Rajiv Gandhi Science and Technology Commission	1400000
Bio-printing of 3D skin in a microfluidic device for a pre-clinical investigation	1 year	BIRAC-PACE	4940000
Development of Hydrodnamic flow focusing droplet generator for preparation of monodisperse Actinide Oxide microsperes	3 years	ICT-DAE	7021000
DBT-ICT Centre for Energy Biosciences: New and Extension Proposals	5 years	DBT, India	180000000
Energy Biosciences Overseas Fellowship & Chairs	11 years	DBT, India	147221000
Setting up Demonstration Plant to 1 ton/day MSW Into Energy	2 years	DBT, India	67039000
Performance and durability improvements in the solar thermal desalination system at Narippaiyur and utilization of reject sea water for algae cultivation to produce biogas	5 years	DST-KGDS	6135000
Customized, Demand Driven Convergent Water solutions to address prevalent and emerging water challenges in Mission Mode in Narrippaiyur Village, Ramanathapuram District, Tamil Nadu	3 years	DST-KGDS	1448000
Setting up Demonstration Plant to convert 1 MLD Barapullah Nallah Sewage into Clean Water and Energy	2 years	DBT, India	146771000
Biomass to Chemicals	5 years	DST	9171000
Thermal hydraulic studies related to coolants for new generation reactors	5years	DAE	7240000
Design aspects of Two opposed jet microextractor: Experimental and Computational Fluid Dynamics	1 year	Centre of Excellence in Process Intensification (TEQIP-II)	1600000
Computational fluid dynamics and experimental study of fluidization of lithium titanate particles in fluidized and packed fluidized bed	3 years	DAE- BRNS	2500000
Design and scale-up of impinging jet crystallizer using experimental and computational fluid dynamics	3 years	Science & Engineering Research Board (SERB)	1557000
Graphene oxide based membranes for desalination	3 years	DAE-ICT Center	7324000
Microbial enzyme based natural fiber (Ramie) finishing: an ecofriendly approach	4 years	DBT under Twinning Program	3500000
Sustainable processes for the development of keratin hydrolysate for the use as fertilizer, animal feed, and pet food	4 years	DST WMT	7500000
Characterization of the regeneration process for liquid sodium cold trap in a secondary system of fast	3 years	Indira Gandhi Center for Atomic Research (IGCAR)	3800000
Bioenergy, Fertilizer and Clean Water from Invasive Aquatic Macrophytes (UK 131,584 Sterling Pounds)	3 years	BBSRC, UK	11080000
J.C. Bose Fellowship	5 years	DST- Science and Engineering Research	8250000

		Board	
A compact and cost-effective technology for on-site treatment & reuse of wastewater containing bio-refractory compounds	1 year	Indo US Science and Technology – IIGP 2.0 2018	1000000
CFD Modeling of Asymmetric Rotating Disc Contactors	3 years	DAE	5800000
Synthesis and modification of carbon nanotubes: modeling, experimentation and application	3 years	DAE	5430000
Thermal Hydraulic Studies on Boiling in Long Vertical Tubes	3 years	IGCAR	4375000
Development of grafted resins and membranes (extractants) for precious metals	3 years	DAE-ICT Centre	6900000
Development of grafted resins and membranes (extractants) for precious metals	3 years	RGSTC	6600000
Economic Non-food sugar from variable mixed solid waste for high value chemical products	3 years	Department of Biotechnology (Govt. of India)	32296000
Development of superior absorbents for CO_2 separation from biogas	3 years	Center for High Technology	8556000
Hydrogen production from macroalgal biomass via catalytic aqueous-phase reforming	2 years	TEQIP Phase 3	710000
Improved hydrogen production from biogas using sorption-enhanced reforming	3 years	Department of Science and Technology (HFC-2018)	4062000
Study on new green CO_2-capturing solvents	3 years	DST-DBT (Mission Innovation India - IC#3)	5791000
Catalytic aqueous-phase reforming of model compounds of microalgae and activated sludge	3 years	DST-DBT (Mission Innovation India - IC#4)	5080000
Rice bran Oil refining	3 years	Marico	2700000
Surface studies on lean amine solvents from gas treating units	2 years	Amines and Plasticizers	253000
Oil water interfacial tension of polymerised oil in presence of surfactants	1 year	Hindustan Unilever Ltd	1391000
Study of Interfacial properties of oil and surfactant solutions	6 month	DOW Chemical International Pvt.Ltd	337000
BEFWAM – Bioenergy Fertilizer and Freshwater for Invasive Aquatic Macrophytes	3 years	University of Leeds	GBP 130,000/-
Development of PCM Poultry Warmer for Open Shed Poultries	17 months	Covestro India Pvt Ltd	500000
Thermodynamics of Solubility of Tea components in water	4 years	Hindustan Unilever Ltd, Mumbai	4500000
Study of Forward Osmosis related to Sugar Industry	3 years		2400000
Dehydrogenaton reactions for industrial utility	4 years		3000000
Improved processing of camphor, terpenes and resins	2 years	Mangalam Organics Ltd.	1500000
Evaluation of advanced technologies for waste water treatment of Fiber plants of ABG	3 years	Aditya Birla Science and Technology Center	1167000
Dehydrogenaton reactions for industrial utility	4 years		3000000
Technoforce	5 years	Technoforce	2600000

Technoforce	5 years	Technoforce	2600000
United Phosphorous Limited	4 years	United Phosphorous Limited	2600000
New Formulations from Cannabis sp	2 years	Akseera Pharma, Canada	2285000
Chemo-Enzymatic Synthesis of Anti-infectives	3 years	Bajaj Healthcare Mumbai and AUA General,UAE	12876000
Activity Reduction of Peptidase Enzymes by various Metal Ion-Reducing agent combination	16 months	Anya Biopharma, Taiwan	5606000
Structural Characterization of Recombinant Protein	5 months	Stelis Biopharma	1095000
Evaluation New Probiotic Compositions	9 months	SA Pharmachem, Mumbai	3109000
To study the effect of increasing the enzyme concentration upon the reaction rate	17 months	Himedia Lab,Mumbai	443000
HMWP Characterization of Insulin Products	2 years	Biocon, Malaysia	4102000
Development of laboratory scale SMB chiral separation method for either Brivaracetum (S,R) from its disterioisomer (S,S) from OR for BRT-III (S,R) from its disterioisomer	1 year	Lupin Ltd	2800000
On-Shore Cultivation of Macroalgae at Bhavnagar District's Gujarat	1 year	Pidilite Industries Ltd.	4200000
Lab scale synthesis of fine and bulk chemicals	1 year	VOL, Mumbai	1180000
Development of economical processes for Important organic Intermediates	1 year	Marvel Drugs, Mumbai	800000+ Tax
Synthesis of terpene derivatives	1 year	Mangalam Organics, Mumbai	1500000+Tax
Hydroxylation of phenol	1 year	GACL, Baroda	3000000 + Tax
Surface-Charge Driven Algal-Water Separations: Fundamentals, Measurement, and Process Control Strategy	4 years	Reliance Industries Ltd	1794000
Recycle and reuse of membranes in waste water treatment	3 years	Konark Industries Ltd	1794000
Hygienic water free toilet	3 years	BIRAC- Bill and Melinda Gates Foundation	2122000
CFD simulation of the piping network inside the human body	4 years	United Phosphorous Limited	2600000
Liquid-Liquid Dispersion Studies in Static Mixers	6 months	Reliance Industries Ltd.	2360000
Development of Natural esters for Dielectric Applications	1.5 years	Raj Petro Specialties Pvt. Ltd	1750000
LDH Formation and Converging Diverging Cavitating Nozzles	3 year	Hindustan Unilever Ltd., Bangalore	7500000
Pyrolysis of biomass, coconut shell and peanut shell for value added products	4 years	Shri. K. V. Mariwala - Mariwala Trust	2600000
Integration of Sustainability Concepts in Chemical Engineering Education	2 years	WIPRO Foundation	456000
Modelling of Kinetics of Tea Infusion	4 years	Unilever	3020000
- Extraction of curcumin from turmeric	1 year	Konark Industries, Gujarat	8000000

- Synthesis and characterization of catalysts, Standardization of separation methods using synthetic mixture - Synthesis of intermediates for pharmaceutical application - Synthesis of chemical by ammoxidation and optimization study - Development of economical process for FDCA - Conversion of alcohols to amines		Alkali Ltd., Marvel Drugs, Kesar Petro products, Godavari Biorefineries Ltd, Indo Amines Ltd.	
PU as Flame retardant	3 years	Covestro (India) Pvt. Ltd	4320000
Year 2017-2018			
Jaggery Granulation	18 months	Rajiv Gandhi Commission for S&T, Government of Maharashtra	10000000
Cold storage facility for storage of fruits and vegetables using heat based refrigeration system	5 years	Rajiv Gandhi Science and technology Commission	12300000
• Selection and Regeneration of potential ionic liquid for hydroprocessing feed stocks • Development of additive for use in Delayed Coker Unit (DCU) to improve liquid yield	2 years	Bharat Petroleum Corporation Limited	5000000
Design of in situ photocatalytic systems for CO 2 conversion into useful organic materials using CdS Nanoparticles on the new polymeric CO 2 specific adsorbents and graphene supports	4 years	Department of Science and Technology, Science and Engineering Research Board	5480000
Biphasic Fermentation for Triacyl Glycerol (TAG) production from pretreated lignocellulosic biomass hydrolysates using Mixed Microbial Cultures	3 years	DBT, India	3984000
Setting up Demonstration Plant to 1 ton/day MSW Into Energy	2 years	DBT, India	67039000
International Genetically Engineered Machines Contest (iGEM)	2 years	DBT, India	2000000
Pilot scale translational facility for value added chemicals from biomass	1 year	DBT-CEB-BIPP	5000000
Performance and durability improvements in the solar thermal desalination system at Narippaiyur and utilization of reject sea water for algae cultivation to produce biogas	3 years	DST-KGDS	6135000
Integrated biorefinery for production of sorghum Grain protein Phase II	2 years	DBT-AISRF, India	11374000
Design of selective nanoporous membrane bioreactor for efficient production of bio-butanol from lignocellulosic sugar (SeNaMeB)	3 years	IGSTC, DST, India	11540000
Green enzymatic fat-splitting technology for production of fatty acids and Acyl Glycerols	3 years	DST, India	84753000
Transnational approaches to resolving biological bottlenecks in macroalgal biofuel production	3 years	DBT- BBSRC/ SuBBSea	20167200
Integrated technologies for economically sustainable bio-based	2 years	DBT, India	11374000
DBT-ICT Centre for Energy Biosciences: New and extension proposals	5 years	DBT, India	180000000
Improved production of biogas and bio-CNG from lignocellulosic biomass	4 years	MNRE	26716000
Energy Biosciences Overseas Fellowship & Chairs	11 years	DBT, India	147221000

Microbial enzyme based natural fiber (Ramie) finishing: an ecofriendly approach	3 years	DBT under Twinning Program	3500000
Indira Gandhi Center for Atomic Research (IGCAR)	3 years	Indira Gandhi Center for Atomic Research (IGCAR)	3800000
Development of grafted resins and membranes (extractants) for precious metals	3 years	DAE-ICT Centre	6900000
Synthesis of novel membranes and their applications in waste minimisation and recovery of valuable chemicals from dilute aqueous streams	3 years	Department of Science and Technology (SERB – Green Technology)	3500000
CFD Modeling of Assymetric Rotating Disc Contactors	3 years	DAE	5800000
Synthesis and modification of carbon nanotubes: modeling, experimentation and application	3 years	DAE	5430000
Thermal Hydraulic Studies on Boiling in Long Vertical Tubes	3 years	IGCAR	4375000
Utilization of Reetha fruit for value added products Utilization of curcumin industry waste to produce value added products	3 years	RGSTC	6600000
Treatment of Wastewater containing pesticides and emerging contaminants using novel approach of combined hydrodynamic cavitation and oxidation processes	3 years	Department of Science & Technology (WTI Scheme), New Delhi	5440000
Intensified recovery of valuable products from whey using ultrasound	3 years	Department of Science & Technology (MOFPI Scheme), New Delhi	4140000
Improved process for $CaSO_4$ crystallisation in concentrated brine using Ultrasound	3 years	Department of Atomic Energy-ICT	3500000
Polymeric Nanocarrier for siRNA Delivery	5 years	DBT	3250000
Development and evaluation of siRNA loaded nanomedicine in computational and cellular Models	3 years	DST	28200000
Conjugation and Radiolabelling of various nanoplatforms for image guided theranostic applications	3 years	ICT-DAE	6532000
Green Process for the production and purification of low molecular weight Chitosan Oligomer using solid acid catalyst	3 years	DBT	5164000
Microfuidic Platform for Developing bioartificial Retina	2 years	DBT	6151600
Development of Hydrodnamic flow focusing droplet generator for preparation of monodisperse Actinide Oxide microsperes	3 years	ICT-DAE	7020000
Skin on a chip for preclinical and biomedical applications	1 year	RUSA	3500000
Designing & Commercialization of affordable chemically defined serum free media & feed for high value Biosimilars Manufacture	2 years	BIRAC-BIPP	6544000
Thermal hydraulic studies related to coolants for new generation reactors	5 years	DAE	7240000
Design aspects of Two opposed jet microextractor: Experimental and Computational Fluid Dyanmics	1 year	Centre of Excellence in Process Intensification	1600000

		(TEQIP-II)	
Computational fluid dynamics and experimental study of fluidization of lithium titanate particles in fluidized and packed fluidized bed	3 years	DAE-BRNS	2500000
Development of graphene oxide based membranes for desalination	3 years	DAE	
Development of ionic liquid membranes for gas separation	3 years	SERB	
Mitigation of water problems in Ausa town, Latur: wastewater management, Gaothan Lake rejuvenation, Potable water production through desalination of lake water and training of residents in matter of sanitation and water conservation	2 years	Department of Science & Technology, New Delhi	17300000
Studies on the drying and fluidization of algal slurry	1 year	Reliance Industries Limited	2100000
Rice bran Oil refining	3 years	Marico	2700000
Thermodynamics of Solubility of Tea components in water	4 years	Hindustan Unilever Ltd, Mumbai	4500000
Developed of improved animal feed ingredient from seed meals	3 years	Godrej Agrovet Ltd	10000000
Research & Development of Chloroplast Derived Enzyme Mixtures	2 years	Gencrest LLP	24600000
Research & Development & Generation, protection & Deployment of Innovation & Technologies in the field of Cellulosic Ethanol Technology & its scale up	2017 & ongoing	L&T Hydrocarbon Engineering Ltd	50000000
Kinetics of Synthesis of p-Hydroxy Benzaldehyde	1 year	ATUL LTD	2000000
Recovery of Water of Esterification	1 year	Asian Paints	300000
LDH Formation and Converging Diverging Cavitating Nozzles	5 years	Hindustan Unilever Ltd., Banglore	7500000
Conversion of 2,6-Dichloroacetophenone to 2,6-Dichlorobenzamide	1 year	Val Organics Pvt. Ltd Mumbai	500000
Purification of aqueous effluents from refineries and allied industries	6 months	VA Tech Wabag	1618800
Modelling of Kinetics of Tea Infusion	3 years	Unilever	3020000
• Extraction of curcumin from turmeric • Synthesis and characterization of catalysts, Standardization of separation methods using synthetic mixture • Synthesis of intermediates for pharmaceutical application • Synthesis of chemical by ammoxidation and optimization study • Development of economical process for FDCA • Conversion of alcohols to amines		Konark Industries, Gujarat Chlor Alkali Ltd., Marvel Drugs, Kesar Petro products, Godavari Biorefineries Ltd, Indo Amines Ltd.	
Improved processing of camphor, terpenes and resins	3 years	Mangalam Organics Ltd.	1500000
Recycle and Reuse of membrane in waste water treatment	3 years	Konark industries	
p-Hydroxy benzaldehyde production from p-cresol -A study on reaction kinetics	1 year	Atul Ltd.	1150000
Preclinical Evaluation of Full Thickness Wound Healing Using Starch Based Artificial Skin Substitute in Rat Model	2 years	Rajiv Gandhi Science and Technology Commission	1400000
New Formulations from Cannabis sp	2 years	Akseera Pharma, Canada	2285000

Chemo-Enzymatic Synthesis of Anti-infectives	3 years	Bajaj Healthcare Mumbai and AUA General,UAE	12800000
Quantification of Coating Material on Excipients	1 year	FMC, Bengaluru	197000
Characterization of Pharmaceutical Excipients	3 years	FamyCare, Mumbai	363000
Activity Reduction of Peptidase Enzymes by various Metal Ion-Reducing agent combination	16 months	Anya Biopharma, Taiwan	5606000
Interaction of API and Excipient	16 months	Wockhardt, Aurangabad	91000
Structural Characterization of Recombinant Protein	4 months	Stelis Biopharma,Bengaluru	1095000
Evaluation New Probiotic Compositions	9 months	SA Pharmachem, Mumbai	3109000
To study the effect of increasing the enzyme concentration upon the reaction rate	17 months	Himedia Lab,Mumbai	442000
Characterization of aggregates MW related variants generated in mAb by SV-AUC	7 months	Hetero Biopharma, Hyderabad	302000
HMWP Characterization of Insulin Products	2 years	Biocon, Malaysia	4102000
Hygienic water free toilet	3 years	BIRAC- Bill and Melinda Gates Foundation	2122000
United Phosphorous Limited	4 years	United Phosphorous Limited	2600000
Technoforce	4 years	Technoforce	2600000
PM-Fellow (Company Sponsor- United Phosphorous Limited)	4 years	PM Fellow	2600000
Hydroxylation of phenol.	1 year	GACL, Baroda	3000000 + Tax
Lab scale synthesis of fine and bulk chemicals	1 year	VOL, Mumbai	600000 + Tax
Development of economical processes for Important organic Intermediates	1 Year	Marvel Drugs, Mumbai	800000 + Tax
Phthalonitrile	1 year	Kesar Petro products, Mumbai	1360000 + Tax
Synthesis of terpene derivatives	1 year	Mangalam Organics, Mumbai	1500000 + Tax
Syntheis of FDCA	1 year	GBL, Mumbai	1570000 + Tax

4.8.3 Development activities (5) **Institute Marks (5)**

Our institute always emphasizes the continued development of the students and the faculty members. The faculty members are continuously engaged in research activities supported by various funding agencies. The department's research and development activities are well supported by the state-of-the-art analytical instrumentation facility. Every year new instruments are purchased and the laboratories are continuously upgraded to support academic research. Instruments available in all the laboratories are provided with Standard Operating Procedures. The students are provided with printed journals which are used by them as easy instruction materials. Informative charts prepared by the students under the guidance of teaching staff members are displayed in the laboratories to assist them in understanding and remembering the concepts. Students of our college actively participate in various social awareness programs. They are involved in the preparation of pamphlets that are distributed in the society for health awareness.

Table 4.17: List of equipment facilities created for strengthening the curriculum and/or meeting the POs

Sr. No.	**Description**	**Model**	**Procurement Year**
1	Water purification system	Sartorius: arium mini	2017
2	Ion chromatography	Dionex 5000+	2017
3	HPLC-VWD	Themo: Ultimate 3000	2017
4	HPLC-DAD	Themo: Ultimate 3000	2017
5	HPLC-RI	Themo: Ultimate 3000	2017
6	Microspin centrifuge	Eltek TC 4815D	2018
7	UV-Visible spectrophotometer	Labman: LMSP UV-1900	2018
8	HPLC-VWD	Themo: Ultimate 3000	2018
9	Orbital shaker incubator	Athena: Galaxy 1NCS	2018
10	Densitometer	Anton paar: DMA 501	2018
11	Ultrasonic bath	Dakshin 6.5L 200DF	2018
12	KF titrator	Athena AT-630	2018
13	Plate heat exchanger	Alfa laval M3-FG	2019
14	Stirred tank reactor	Fabex Engineer	2019
15	Hot water generator	Thermax, AMW-02	2019
16	Laser partical size analyser	Bettersizer 2600	2019
17	DI water sysytem	PALL CASCADA ll 10L/H	2019
18	UV-Visible spectrophotometer	Shimadzu UV-1900	2019
19	High resolution mass spectroscopy	Thermo Fischer	2019
20	X-ray Photoelectron spectrometer	Kratos Axis Supra	2019
21	Inductively coupled plasma-MS	Thermo iCAP RQ	2020
22	Biochemistry Analyzer	Labmete 2950D3, YSI	2021
23	High temp tubular split furnace	Nano Tec	2021
24	Hydrodynamic cavitation setup	Zero-D Industries	2021
25	Invenio FTIR Spectrometer	Bio Zed Engineering	2021
26	Microscope Labomed LX400	Scientific apparatus Mfg.	2021
27	UHPLC	Spincotech	2021

28	Ultrasonic crystallization system	Dakshin	2021
29	Ultrasonic bath 6.5L, 1.5, Horn	Dakshin	2021

Following tasks have been completed/undergoing:

1. Civil work including flooring, the colouring of walls, false ceiling, tiling the walls, drainage, etc.
2. Electrical work including all the wiring, and installation of new fresh air conditioners (Hitachi HVAC system)' and exhaust systems.
3. Disposal of rusted and unused equipment and storage boxes.
4. Installation of new water purifiers and heaters.
5. Civil work for new Chemical Engineering Department Pilot Plant near Advance Lab.
6. New space is being created for new labs near Gate 13.

Table 4.18: Facilities in various laboratories

Sr. No	**Name of the Facility**	**Specialized Equipment Name**	**Equipment details**
1	Central Computational Facility	Computational cluster (160 nodes)	Computational analysis, molecular dynamics, reactor designs
2	Analytical Instrumentation Laboratory	Gas Chromatography; Extractive Gas Chromatography; High Pressure Liquid Chromatography x 4	Thermo Scientific Trace 1310; Thermo Scientific Trace 1310; Thermo Scientific Ultimate 3000
3	X-Ray Photoelectric Spectroscopy Lab	Sorptometer; Protein Characterization System; X-Ray Photoelectric Spectroscope	BET 201-A Beckman Coulter XL-I Kratos Analytical Axis Supra
4	Gas Chromatography Lab	Pharmaceutical Analysis System; Gas Chromatography; High Pressure Liquid Chromatography x 2	Chemito GC8610. Beckman Coulter PA 800 Plus; Thermo Scientific Trace 1310; Thermo Scientific Ultimate 3000
5	UGC Networking Lab	Fourier-transform infrared spectroscopy; Particle Size Analyzer; Mass Spectrometer; Laser Particle Analyzer; Centrifuge; Fourier-transform infrared spectroscopy; XID; Transmission electron microscopy	Vertex 80V; Coulter LS230; Thermo Scientific Trace 1300; Bettersizer 2600 Beckman Coulter Optima MAX-XP Perkin Elmer Bruker D8 Advance JEOL JEM 2100
6	Advanced Laboratory	Vapour Phase Reactor; Autoclave x 4; Rota Vaporizer; Bench Top Fixed Bed Flow Reactor; Tubular Furnace	Amar Equipment's PVT Ltd. custom build setup; Amar B(F); Heidolph Hei-Vap Value Digital; BEEM (Custom); Ants Pro-Sys

4.8.4 Consultancy (from Industry) (5)

Institute Marks (5)

Table 4.19: Consultancy (from Industry)

Project	Duration	Funding Agency	Amount (in Rs.)
Year 2021-2022			
Dr. V. H. Dalvi			
Consultancy Project	1 year	Devson Catalyst	460200
Prof A.W. Patwardhan			
Consultancy Project	1 year	M/s. Rallis India Pvt Ltd	2100000
Consultancy Project	1 year	M/s. NOCIL	1200000
Dr. S.V. Jadhav			
Consultancy Project	1 year	Devson Catalyst	460200
Dr. P. D. Vaidya			
Consultancy Project	1 year	Center for High Technology	300000
Prof. P. R. Gogate			
Consultancy Project	1 year	Rallis India Limited	1050000
Consultancy Project	6 months	Gharda Chemicals	750000
Consultancy Project	6 months	Gharda Chemicals	750000
Consultancy Project	1 year	Khepra Inc USA	1300000
Year 2020-2021			
Dr. V. H. Dalvi			
Consultancy Project	1 year	Sudorghan Chemicals Ltd	1500000
Consultancy Project	1 year	Matic Products Pvt Ltd	450000
Consultancy Project	1 year	Embio Limited	30000
Consultancy Project	1 year	Panorama Consulting	90000
Consultancy Project	1 year	Hindustan Organic Chemical Limited	600000
Prof. A. V. Patwardhan			
Consultancy Project	1 year	Aegis Logistics Limited, Mumbai	300000
Consultancy Project	1 year	Sadhana Nitro Chem Limited	300000

Consultancy Project	1 year	Kwality Chemical Industries Pvt Ltd	300000
Consultancy Project	1 year	VVF India Limited	300000
Dr. C. S. Mathpati			
Consultancy Project	1 year	Zoetis Pharmaceutical Research India Pvt Ltd	300000
Consultancy Project	1 year	UPL Ltd	415000
Consultancy Project	1 year	Jayant Agro	575000
Consultancy Project	1 year	Embio Limited	30000
Consultancy Project	1 year	Ultramarine & Plgments ltd	600000
Consultancy Project	1 year	Desha engineer	60000
Dr. R. D. Jain			
Consultancy Project	1 year	Cipla	300000
Consultancy Project	1 year	Biocon, Malaysia	489400
Dr. P. D. Vaidya			
Consultancy Project	1 year	Center for High Technology	300000
Prof. P. R. Gogate			
Consultancy Project	1 year	Rallis India	1050000
Consultancy Project	1 year	Anshul Speciality Molecules	90000
Consultancy Project	1 year	Gujarat Gas Limited	120000
Consultancy Project	1 year	Natural Remedies Pvt Ltd.	750000
	1 year	Kosharch LLP	75000
Consultancy Project	1 year	Khepra (USA)	215601
Consultancy Project	1 year	UPL Limited	45000
Prof. S.S Bhagwat			
Consultancy Project	1 year	Unilever industries Pvt. Ltd.	600000
Consultancy Project	1 year	Galaxy Surfactants Limited	1045440
Consultancy Project	1 year	K.V. Fire	150000
Consultancy Project	1 year	Aditya Birla Science & Technology Company Pvt. Ltd.	600000
Consultancy Project	1 year	Kiri Industries Ltd	600000
Consultancy Project	1 year	Hindiusta unileve Ltd	360000

Consultancy Project	1 year	UPL Limited	150000
Consultancy Project	1 year	National Paroxide Limited	150000
Prof. Lakshmi Kantam			
Consultancy Project	1 year	Prasol Chemical Pvt Ltd.	100000
Consultancy Project	1 year	Raill India Pvt Ltd	250000
Prof A.W.Patwardhan			
Consultancy Project	1 year	NOCIL	600000
Consultancy Project	1 year	Rallis India Pvt Ltd	1037750
Prof. V.K. Rathod			
Consultancy Project	1 year	Gujarat Gas Limited	240000
Consultancy Project	1 year	Natural Remedies Pvt Ltd	750000
Consultancy Project	1 year	Prasol Chemicals Pvt Ltd	100000
Consultancy Project	1 year	Raills India Limited	250000
Prof. G.D. Yadav			
Consultancy Project	1 year	OEC Project Manager	200000
Consultancy Project	1 year	Rallis I Pvt Ltd	250000
Prof. B.N. Thorat			
Consultancy Project	1 year	Covestro India Pvt Ltd.	450000
Consultancy Project	3 years	Akry Organics Pvt Limited	200000
Consultancy Project	6 months	Maharashtra Pollution Control Board	2225000
Consultancy Project	6 Months	Westins Resins & Polymers Pvt Limited	200000
Consultancy Project	1 year	Shiva Performnce Materials Pvt Limited	500000
Dr. M.D. Yadav			
Consultancy Project	1 year	Kiri Industries Limited	300000
Dr. Annamma Odaneth			
Consultancy Project	1 year	Lupin Limited	500000
Consultancy Project	1 year	UPL Limited	900000
Prof. A.B. Pandit			
Consultancy Project	17 years	M/s. Encore Natyral Polymers	1800000

Consultancy Project	18 years	M/s. Technova Imaging System Pvt Ltd	900000
Year 2019-2020			
Prof. S. S Bhagwat			
Consultancy Project	1 year	Unilever industries Pvt. Ltd.	240000
Consultancy Project	1 year	Galaxy Surfactants Limited	348480
Consultancy Project	1 year	K.V. Fire	300000
Consultancy Project	1 year	Aditya Birla Science & Technology Company Pvt. Ltd.	900000
Consultancy Project	1 year	Asian Paints Limited	175000
Consultancy Project	1 year	Marico Limited	42000
Consultancy Project	1 year	AZB and Partners	75000
Consultancy Project	1 year	K.V. Fire	150000
Consultancy Project	1 year	Aditya Birla Science & Technology Company Pvt. Ltd.	900000
Consultancy Project	1 year	Marico Limited	140000
Consultancy Project	1 year	Unilever industries Pvt. Ltd.	60000
Dr.V. H. Dalvi			
Consultancy Project	1 year	Whirlwind project	150000
Consultancy Project	1 year	Sudarshan Chemical	150000
Consultancy Project	1 year	Super Fresh	210000
Consultancy Project	1 year	Zoetis Pharmaceutical Research pvt ltd	300000
Prof.P. R. Gogate			
Consultancy Project	1 year	Green galaxy global environment services installment	89984
Consultancy Project	1 year	S. techno limited	60000
Consultancy Project	1 year	kesar petroproducts limited	135000
Consultancy Project	1 year	Cipla house	120000
Consultancy Project	1 year	Hisun adhesives	120000
Consultancy Project	1 year	Indoco remedies limited	180000
Consultancy Project	1 year	supreme petrochem ltd	90000
Consultancy Project	1 year	shyam chemical pvt ltd	150000
Consultancy Project	1 year	Hikal limited	270000

Consultancy Project	1 year	Loknete parshuram envirment protection co op soc ltd	300000
Consultancy Project	1 year	S. techno limited	150000
Consultancy Project	1 year	Vardhaman dyestuff industries pvt ltd	150000
Consultancy Project	1 year	Rallis India Pvt Ltd	550000
Prof. P.K.Ghosh			
Consultancy Project	1 year	Rubamin Limited	100000
Prof. V.G. Gaikar			
Consultancy Project	1 year	Fossil Liquid And Minerals Exim Pvt Ltd	1200000
Dr. Ratnesh Jain			
Consultancy Project	1 year	Mangalam Drugs & Organics Limited	600000
Consultancy Project	1 year	Sakar Healthcare Pvt Ltd	700000
Consultancy Project	1 year	Biocon Limited	708400
Prof. L.K. Mannepalli			
Consultancy Project	1 year	Mangalam Organics Ltd	50000
Consultancy Project	1 year	Marvel Drugs Pvt Ltd	100000
Consultancy Project	1 year	Prasol Chemical Pvt Ltd	100000
Consultancy Project	1 year	Vinati Organics Ltd	100000
Dr. C.S. Mathpati			
Consultancy Project	1 year	Fabex Engineering	150000
Consultancy Project	1 year	Jayant Agro- organices Ltd	280000
Consultancy Project	1 year	Fabex Engineering	150000
Consultancy Project	1 year	Zoetis Pharmaceutical Research Pvt Ltd	300000
Consultancy Project	1 year	Jayant Agro- organices Ltd	143750
Consultancy Project	1 year	Fabex Engineering	150000
Dr. Parag R. Nemade			
Consultancy Project	1 year	Galaxy Surfactants Ltd	150000
Prof A.W.Patwardhan			
Consultancy Project	1 year	NOCIL Limited	1200000

Consultancy Project	1 year	Rallis India Pvt Ltd	1050000
Prof.A.V.Patwardhan			
Consultancy Project	1 year	Aegis Logistics Limited	950000
Prof. V.K.Rathod			
Consultancy Project	1 year	Asian paints limited	200000
Consultancy Project	1 year	Amarjyot chemical coration	100000
Consultancy Project	1 year	Marvel drugs pvt ltd	100000
Consultancy Project	1 year	Gujarat Alkalies & chemical limited	250000
Consultancy Project	1 year	kesar petroproducts limited	200000
Consultancy Project	1 year	Godavari bio-irefiners ltd	200000
Consultancy Project	1 year	Mangalam organics ltd	50000
Consultancy Project	1 year	Indo amines limted	200000
Consultancy Project	1 year	Vivid global ind ltd	150000
Consultancy Project	1 year	IPCA labortories ltd	325000
Consultancy Project	1 year	Heubach Colour pvt ltd	100000
Consultancy Project	1 year	mangalam organics ltd	300000
Consultancy Project	1 year	Prasol chemical pvt ltd	100000
Consultancy Project	1 year	Egulnox Enviroments I pvt ltd	150000
Consultancy Project	1 year	Vinat Organics ltd	100000
Consultancy Project	1 year	Aaradhana Energy Pvt Ltd	100000
Prof. P.D.Vaidya			
Consultancy Project	1 year	Centre For High Techology	300000
Prof. G.D. Yadav			
Consultancy Project	1 year	OEC Project Manager	160000
Dr. S. V. Jadhav			
Consultancy Project	1 year	Amarjyot Chemical Corporation	50000
Year 2018-2019			
Prof. S.S Bhagwat			
Consultancy Project	1 year	Sumwin Solution Malaysia	500000

Consultancy Project	1 year	Toyo Engineering India Pvt.ltd.	75000
Consultancy Project	1 year	Lorel India Pvt.Ltd	60000
Consultancy Project	1 year	Aditya Birla Science & Tech. Co. Ltd.	900000
Consultancy Project	1 year	Marico Ltd.	350000
Consultancy Project	1 year	K.V.Fire	400000
Consultancy Project	1 year	Aditya Birla Science & Tech. Co. Ltd.	300000
Consultancy Project	1 year	Dow Chemicals International Pvt. Ltd.(R & P)	150000
Consultancy Project	1 year	Balmer Lawrie	300000
Consultancy Project	1 year	Reliance Utilities Power Pvt.Ltd.	300000
Consultancy Project	1 year	Galaxy Surfactants Ltd	348480
Consultancy Project	1 year	Hindustan Unilever ltd	375000
Dr. V. H. Dalvi			
Consultancy Project	1 year	Zoetis Pharmaceutical Research Pvt.Ltd/st Inst	600000
Consultancy Project	1 year	Panorama Consulting	90000
Consultancy Project	1 year	Eternis Fine Chemicals Ltd.	1500000
Prof.P.R. Gogate			
Consultancy Project	1 year	A.B.S.&T.C.L.	150000
Consultancy Project	1 year	Green Galaxy Global Enviromental Services	65800
Consultancy Project	1 year	Supreme Petrochem Ltd.	150000
Consultancy Project	1 year	Excel Industries	175000
Consultancy Project	1 year	Whirlpool of India Ltd	180000
Consultancy Project	1 year	Excel Industries Ltd.	45000
Consultancy Project	1 year	Mangalam Organics	270000
Consultancy Project	1 year	Green Galaxy Global Enviromental Services	100000
Consultancy Project	1 year	S.S.Techno Limited	600000
Consultancy Project	1 year	Mangalam Organics	270000
Consultancy Project	1 year	Shree Pushkar Chemicals & Fertilisers Ltd.	165000
Consultancy Project	1 year	Deepak Nitrite Ltd.	180000
Consultancy Project	1 year	Hikal Ltd.	150000

Consultancy Project	1 year	SI Group	180000
Consultancy Project	1 year	A.B.S.&T.C.L.	37000
Consultancy Project	1 year	Mangalam Organics	291600
Prof. P. K. Ghosh			
Consultancy Project	1 year	Asian Paints	300000
Consultancy Project	1 year	Rubamin Limited	100000
Dr. R. D. Jain			
Consultancy Project	1 year	Advy Chemicals Pvt Ltd	1100000
Consultancy Project	1 year	Gangwal Chemicals Pvt.Ltd.	500000
Consultancy Project	1 year	Mangalam Drugs & Organics Ltd.	2400000
Consultancy Project	1 year	S.A. Pharmachem Pvt Ltd.	675000
Prof. L.K. Mannepalli			
Consultancy Project	1 year	Kesar Petroproducts Ltd.	200000
Consultancy Project	1 year	Godavari Biorefineries	200000
Consultancy Project	1 year	Chrom Specialities Ltd	500000
Prof A.M. Lali			
Consultancy Project	1 year	Gencrest LLP	675000
Consultancy Project	1 year	Lupin Ltd	600000
Consultancy Project	1 year	Kanoria Chemicals & Industries Ltd.	150000
Consultancy Project	1 year	Lupin Ltd	150000
Dr. C.S. Mathpati			
Consultancy Project	1 year	Jayant Agro-Organics Ltd.	500000
Consultancy Project	1 year	UPL	500000
Consultancy Project	1 year	Zoetis Pharmaceutical Research Pvt.Ltd/	300000
Consultancy Project	1 year	Jayant Agro-Organics Ltd.	135000
Consultancy Project	1 year	Fabex Engineering	600000
Consultancy Project	1 year	Jayant Agro-Organics Ltd.	575000
Dr. K. V. Marathe			
Consultancy Project	1 year	PACE (India)	125000

Consultancy Project	1 year	Indian Center For Plastics in the Environment	1500000
Prof. A.B. Pandit			
Consultancy Project	1 year	A.B.S.&T.C.L	150000
Consultancy Project	1 year	Gothi Impex	600000
Consultancy Project	1 year	Encore Natural Polymer Pvt. Ltd	1800000
Consultancy Project	1 year	Gothi Impex	600000
Consultancy Project	1 year	Jayant-Agro Organics Ltd	60000
Prof A. W. Patwardhan			
Consultancy Project	1 year	Nocil Ltd	1200000
Prof. V. K. Rathod			
Consultancy Project	1 year	IG Petrochemicals Ltd	150000
Consultancy Project	1 year	Kesar Petroproducts Ltd.(Research & Projects)	200000
Consultancy Project	1 year	Godavari Biorefineries Ltd	200000
Consultancy Project	1 year	Amarjyot Chemical Corporation	100000
Consultancy Project	1 year	Johnson Matthey Chemical India Ltd	150000
Consultancy Project	1 year	Aditya Envirnmental services pvt ltd	450000
Prof. B. N. Thorat			
Consultancy Project	1 year	Sharon Bio-Medicine Ltd.	200000
Consultancy Project	1 year	Pidlite Industries Ltd.	150000
Consultancy Project	1 year	Maldeep Catalysts India	200000
Consultancy Project	1 year	Relicane Industries Ltd.	150000
Consultancy Project	1 year	Piramal Enterprises Ltd	250000
Prof. G. D. Yadav			
Consultancy Project	1 year	ONGC Centre Alternative to Plat.	4000000
Consultancy Project	1 year	McKinsey & Company	1800000
Year 2017-18			
Prof. S.S. Bhagwat			
Consultancy Project	1 year	Jayant Agro Organics	900000
Consultancy Project	1 year	Jayant Agro Organics,	450000

Consultancy Project	1 year	Galaxy Surfactants Ltd.	950400
Consultancy Project	1 year	Galaxy Surfactants Ltd.	150000
Consultancy Project	1 year	Marico Ltd.	350000
Consultancy Project	1 year	K.V.Fire	300000
Consultancy Project	1 year	Balmer Lawrie	300000
Consultancy Project	1 year	Aditya Birla Science & Tech. Co. Ltd.	450000
Consultancy Project	1 year	Marico Ltd.	180000
Consultancy Project	1 year	Sumwin Solution, Malayasia	300000
Consultancy Project	1 year	Reliance Utilities Power Pvt.Ltd	300000
Consultancy Project	1 year	Aditya Birla Science & Tech. Co. Ltd.	300000
Dr. V. H. Dalvi			
Consultancy Project	1 year	Sheney Enterprises Pvt.Ltd.	15000
Consultancy Project	1 year	Zoetis Pharmaceutical Research Pvt.Ltd	300000
Prof. P. R. Gogate			
Consultancy Project	1 year	Privi Organics Ltd..from 2016-17	300000
Consultancy Project	1 year	Y. Cube Tech. Pvt. Ltd	24000
Consultancy Project	1 year	Mangalam Organics Ltd.	675000
Consultancy Project	1 year	Navin Flurine International Ltd	120000
Consultancy Project	1 year	Autus International	100000
Consultancy Project	1 year	Privi Organics Ltd.	150000
Consultancy Project	1 year	Godavari Drugs Ltd.	90000
Consultancy Project	1 year	Zirconium Chemical Pvt. Ltd.	75000
Consultancy Project	1 year	Asetic Life Sciecne Ltd.	180000
Consultancy Project	1 year	Innovassynth Technologies (India)Ltd.	90000
Consultancy Project	1 year	Chemco Innovative Chemie Pvt.Ltd.	90000
Consultancy Project	1 year	Chemference	45000
Consultancy Project	1 year	Green Galaxy Global Enviromental	658600
Consultancy Project	1 year	Lasons India Pvt. Ltd.	180000
Consultancy Project	1 year	Excel Industries Ltd.	45000

Consultancy Project	1 year	Hikal Ltd.	150000
Consultancy Project	1 year	Mangalam Organics	270000
Prof. P. K. Gosh			
Consultancy Project	1 year	Rubamin Ltd	300000
Dr. R.D. Jain			
Consultancy Project	1 year	Wackhord Ltd	30000
Consultancy Project	1 year	Galaxo Smitkline	63600
Consultancy Project	1 year	Anya Biopharma	731800
Consultancy Project	1 year	Famy Care Ltd.	60000
Consultancy Project	1 year	Advy Chemicals Pvt. Ltd.	600000
Consultancy Project	1 year	Anya Biopharma, Taiwan	731800
Consultancy Project	1 year	Hetro Biopharma	100000
Prof. L.K. Mannepalli			
Consultancy Project	1 year	Muncipal Corporation	249900
Consultancy Project	1 year	Relience Industrial Ltd.	450000
Prof A.M. Lali			
Consultancy Project	1 year	Godrej Agrovet Ltd	1000000
Consultancy Project	1 year	Gencrest LLP	750000
Dr. C.S. Mathpati			
Consultancy Project	1 year	Jayant Agro -Organics Ltd.	500000
Consultancy Project	1 year	UPL Ltd.	333333
Consultancy Project	1 year	Sun Pharma Technical Trading Academy	150000
Consultancy Project	1 year	Zoetis Pharmaceutical Research Pvt.Ltd	300000
Dr. P.R. Nemade			
Consultancy Project	1 year	MRIB Chemicals	150000
Prof. A.B. Pandit			
Consultancy Project	1 year	Khaitan And Co	90000
Consultancy Project	1 year	GMM Pfaudler	900000
Consultancy Project	1 year	B.P.C.L.	500000

Consultancy Project	1 year	Narendra Karnavat	150000
Consultancy Project	1 year	SRF Ltd.	10000
Consultancy Project	1 year	Encore Natural Polymer Pvt. Ltd	590000
Prof A.W.Patwardhan			
Consultancy Project	1 year	Siemens Ltd	84000
Consultancy Project	1 year	Nocil Ltd	1200000
Consultancy Project	1 year	GMM Pfaudler Ltd	900000
Consultancy Project	1 year	SRF Ltd.	100000
Prof. A.V.Patwardhan			
Consultancy Project	1 year	National Peroxide Ltd.	300000
Consultancy Project	1 year	Siemens Ltd	84000
Consultancy Project	1 year	Bajaj Allianz General Insurance Company Ltd.	150000
Prof. V.K.Rathod			
Consultancy Project	1 year	Nautraplus India Ltd.	150000
Consultancy Project	1 year	Harman FinochemLtd.	225000
Consultancy Project	1 year	Navin Fluorine Internatinal Ltd.	120000
Consultancy Project	1 year	Marvel Drugs Pvt.Ltd.	200000
Consultancy Project	1 year	Crystal Surfactants & Chemical	90000
Consultancy Project	1 year	Godrej Agrovate Ltd	100000
Consultancy Project	1 year	Godavari Biorefineries Ltd	200000
Consultancy Project	1 year	Hikal Ltd.	500000
Consultancy Project	1 year	Gitanjali Chemicals Pvt. Ltd.	100000
Consultancy Project	1 year	Aditya Enviromental Services Pvt. Ltd.	450000
Consultancy Project	1 year	Indo Amines Ltd	200000
Prof. B.N.Thorat			
Consultancy Project	1 year	Marvel Drugs Pvt Ltd	150000
Consultancy Project	1 year	Kansai Nerolac	450000
Consultancy Project	1 year	Aquapharma Chemicals Pvt. Ltd.	250000
Consultancy Project	1 year	Sharon Bio-Medicine Ltd.	200000

Prof. P.D.Vaidya			
Consultancy Project	1 year	Aquapharma Chemicals Pvt. Ltd.	250000
Consultancy Project	1 year	Indian Oil Corparation Ltd	900000
Prof. G.D. Yadav			
Consultancy Project	1 year	ONGC Energy Centre (Altermative to Platimum)	280000.00
Consultancy Project	1 year	Malladi Drugs & Pharmaceutical Ltd.	1500000
Consultancy Project	1 year	ONGC (ICT-OEC/Phase III)	3000000
Year 2016-17			
Prof. S.S. Bhagwat			
Consultancy Project	1 year	Unicorn Laboratories Ltd.	450000
Consultancy Project	1 year	Marico,Ltd.	350000
Consultancy Project	1 year	Balmer Lawries&Co,Ltd.	225000
Consultancy Project	1 year	K.V.Fire Chemicals	300000
Consultancy Project	1 year	Galaxy Surfactants Ltd.	950400
Consultancy Project	1 year	Lubrizol India Pvt.Ltd.	75000
Consultancy Project	1 year	Hindustan Unilever Ltd.,	360000
Consultancy Project	1 year	Aarti Industries Ltd.	50000
Consultancy Project	1 year	Aditya Birla Science & Technology,	900000
Consultancy Project	1 year	Atul India Ltd.	250000
Consultancy Project	1 year	Miuro Trading &Finvest Pvt. Ltd.	150000
Consultancy Project	1 year	Hindustan Unilever Ltd.	375000
Consultancy Project	1 year	Unilever Industries Ltd.	360000
Consultancy Project	1 year	Glaxo Smith.K.Ltd	120000
Consultancy Project	1 year	Jayant Agro-Organics	450000
Prof. V. H. Dalvi			
Consultancy Project	1 year	Bhavi Plast Pvt. Ltd	75000
Consultancy Project	1 year	Adya Entersies	150000
Prof. P. R. Gogate			
Consultancy Project	1 year	Excel Industries Ltd.	175000

Consultancy Project	1 year	Innovassynth Technologies India Ltd.	90000
Consultancy Project	1 year	Anshul Specialty Molecules Ltd.	75000
Consultancy Project	1 year	Gharda Chemical Ltd.	90000
Consultancy Project	1 year	Deepak Nitrite Ltd.	90000
Consultancy Project	1 year	Hikal Ltd.	120000
Consultancy Project	1 year	Deepak Nitrite Ltd.	240000
Consultancy Project	1 year	Anek Prayog Pvt Ltd.	90000
Consultancy Project	1 year	Y Cube Technologies Pvt. Ltd.	183000
Consultancy Project	1 year	RPG Life Sciences Ltd.	120000
Consultancy Project	1 year	Hospira Healthcare India Pvt Ltd.	120000
Consultancy Project	1 year	Dombivli Common Effluent Treatment Plant	150000
Consultancy Project	1 year	Deepak Nitrite Ltd.	30000
Consultancy Project	1 year	Deepak Nitrite Ltd.	120000
Consultancy Project	1 year	Eskay Dyestuff Organic Chemical Pvt. Ltd.	210000
Consultancy Project	1 year	Mangalam Organics Ltd.	225000
Prof. P. K. Gosh			
Consultancy Project	1 year	Atul Limited.	100000
Consultancy Project	1 year	Rubamin Limited.	100000
Prof. V. G. Gaikar			
Consultancy Project	1 year	Unilever Industries Ltd	270000
Dr. Ratnesh Jain			
Consultancy Project	1 year	FMC India Pvt. Ltd.	72000
Consultancy Project	1 year	Glaxo Smithkline Pharmaceutical Ltd.	75000
Consultancy Project	1 year	Glaxo Smithkline Pharmaceutical Ltd.	122400
Prof. L. K. Manipalli			
Consultancy Project	1 year	Eternis Fine Chemical Ltd.	600000
Consultancy Project	1 year	Aarti Drugs Ltd.	600000
Prof. A. M. Lali			
Consultancy Project	1 year	Godrej Agrovet Ltd.	1000000

Dr. C. S. Mathpati			
Consultancy Project	1 year	Bhavi Plast Pvt. Ltd.	75000
Consultancy Project	1 year	U.P.L. Ltd.	500000
Dr. P. R. Nemade			
Consultancy Project	1 year	Galaxy Surfactants Ltd.	150000
Prof. A. B. Pandit			
Consultancy Project	1 year	SRF Ltd.	900000
Consultancy Project	1 year	Encore Natural Polymers Pvt.Ltd.	1800000
Consultancy Project	1 year	Ideal Chemi Plast Pvt. Ltd.	102000
Consultancy Project	1 year	Dr. Aykan Textiles Pvt. Ltd.	75000
Consultancy Project	1 year	L & T Tech	600000
Prof. A. W. Patwardhan			
Consultancy Project	1 year	Praj Industries Ltd.	300000
Consultancy Project	1 year	Nocil Ltd.	1200000
Consultancy Project	1 year	Lubrizol India Pvt. Ltd.	225000
Consultancy Project	1 year	Siemens Ltd.	84000
Prof. A. V. Patwardhan			
Consultancy Project	1 year	Lubrizol India Pvt. Ltd.	150000
Consultancy Project	1 year	National Peroxide Ltd.	300000
Consultancy Project	1 year	Sudarshan Chemical Industries Ltd.	45000
Consultancy Project	1 year	Hindusthan Chemicals Company, Surat	30000
Consultancy Project	1 year	Atul Ltd.	250000
Consultancy Project	1 year	Seimens Ltd.	84000
Prof. V. K. Rathod			
Consultancy Project	1 year	Innovative Eco-Care Pvt. Ltd.	252000
Consultancy Project	1 year	Three M Paper Manufacturing Co Pvt.. Ltd.	250000
Consultancy Project	1 year	Nichem Solutions	51000
Consultancy Project	1 year	Konark Herbals And Health Care	600000
Consultancy Project	1 year	Aditya Environmental Services Pvt. Ltd.	225000

Consultancy Project	1 year	Arch Pharmalabs Ltd.	150000
Consultancy Project	1 year	Prasol Chemicals Ltd.	173913
Consultancy Project	1 year	Natroplus India Ltd.	150000
Consultancy Project	1 year	Vetpharma Ltd.	150000
Consultancy Project	1 year	Natroplus India Ltd.	150000
Prof. B. N. Thorat			
Consultancy Project	1 year	J. S. Industries Ltd.	150000
Consultancy Project	1 year	RPG Life Sciences Ltd.	100000
Consultancy Project	1 year	Pidilite Industries Ltd.	200000
Consultancy Project	1 year	Excel Industries Ltd.	225000
Consultancy Project	1 year	Gulbrandsen Chemicals Pvt. Ltd.	500000
Consultancy Project	1 year	Aquapharma Chemicals Pvt. Ltd.	250000
Consultancy Project	1 year	Pulera Chemicals India Pvt. Ltd.	50000
Consultancy Project	1 year	Spectrochem Pvt. Ltd.	50000
Consultancy Project	1 year	Khanna & Khanna Ltd.	50000
Consultancy Project	1 year	Marvel Drugs Pvt. Ltd.	150000
Prof. P. D. Vaidya			
Consultancy Project	1 year	Atul Ltd.	150000
Consultancy Project	1 year	Indian Oil Corporation Ltd.	300000
Consultancy Project	1 year	Excel Industries Ltd.	225000
Consultancy Project	1 year	Aquapharma Chemicals Pvt. Ltd.	250000
Prof. G. D. Yadav			
Consultancy Project	1 year	Delta Finochem Pvt. Ltd.	900000
Consultancy Project	1 year	Resonance Specialities Ltd.	600000
Consultancy Project	1 year	Heubach Colour Pvt. Ltd.	
Consultancy Project	1 year	ONGC Energy Centre	100000
Consultancy Project	1 year	ONGC Energy Centre	120000
Consultancy Project	1 year	ONGC Energy Centre	160000

4.9 Faculty Performance Appraisal and Development System (FPADS) (5) **Institute Marks (5)**

The faculty performance is assessed annually by the Self-Appraisal method, Peer Evaluation, and a robust Student Feedback System. The analysis is done based on the following parameters: student feedback, number of seminars, conferences and QIPs attended, contribution to the college and community, books, papers and patents published, consultancy work, grants received and special awards. Student feedback is, however, given top priority and a teacher who secures 100% results in his/her subject is motivated by being presented with a Certificate of Appreciation.
The "Best Teacher" award has also been instituted wherein a teacher receives a certificate and memento during the annual function at the hands of the Chief Guest. The college also encourages Faculty Self- Development through upgrading education by offering full support in terms of facilities provided. Faculty participation in continuing education programs, various national and international conferences, sponsored registration, and workshops is encouraged. This appraisal system has given way for further enhancement and up-gradation of their skills and knowledge.

The faculty who qualify for the promotions after the prescribed years of service as per the government norms, are required to follow the self-appraisal system to apply for the promotion. The applications are screened and faculty interviews are taken before the committee to grant the promotions. The self-appraisal form has five sections:

- Teaching process
- Student feedback
- Departmental activities
- Institutional activites
- Annual confidential report

List of Best Teacher Awards:

- Dr. V.H. Dalvi was felicitated with AICTE-Visvesvaraya Best Teacher Award in September 2021
- Professor S. S. Bhagwat, has been selected for 'INSA Best Teacher Award' by the Indian National Science Academy during 2017

INSTITUTE OF CHEMICAL TECHNOLOGY

(University under Section 3 of UGC Act- 1956)

[Elite Status and Centre of Excellence - Government of Maharashtra]

Matunga, Mumbai - 400 019

ANNUAL SELF –ASSESSMENT OF FACULTY

[Performance Based Appraisal System (PBAS)- AICTE]

July 01, ______ to June 30, _______

(To be completed and submitted at the end of each academic year)

FORMAT FOR CONFIDENTIAL REPORT

PART A

(GENERAL INFORMATION)

1.	Full Name (in Block Letters)	
2.	Department	
3.	Current Designation (With pay scale & grade pay)	
4.	Date of last Promotion (Regular/ CAS & Stage of Promotion)	
5.	Address for Correspondence (With Pin code, Tel./ Mobile No. & E-mail)	
6.	Permanent Address (With Pin code, Telephone No.)	
7.	Whether acquired any degree or fresh academic qualification during the year	

ANNEXURE - B

Institute Notification No. CAS Policy/7th pay commission/95/2021, **dated 1st September, 2021**

CALCULATION OF 360° FEEDBACK SCORE

Name	
Present Position	
Period of Assessment	

a. Teaching Process (maximum points 25)

SN	Semester	Course Code/ Name	No. of scheduled classes	No. of actually held classes	Points earned (x/25)	Enclosure
1						
2						
		Total				

*Refer Annexure – 1

b. Students feedback (maximum points 25)

SN	Semester	Course Code/ Name	Average student feedback on the scale of 25	Enclosure No.
1				
2				
		Total average		

*Refer Annexure – 2

c. Departmental activities (maximum points 20)

Sr. No.	Semester	Activity	Credits	Criteria	Enclosure No.
1					
2					

*Refer Annexure – 3

d. Institutional activity (maximum points 20)

Sr. No.	Semester	Activity	Credits	Criteria	Enclosure No.
1.					
2.					

*Refer Annexure – 4

e. Annual Confidential Report (maximum points 10)

Sr. No.	Year	Activity	Credits	Criteria	Enclosure No.
1.					
2.					

*Refer Annexure –5

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RRD

Fig 4.4: Faculty Self-Appraisal Form

4.10 Visiting/Adjunct/Emeritus Faculty etc. (5) **Institute Marks (5)**

The institute encourages association with Industry Leaders for their contribution to teaching-learning and research-related activities. These experts are appointed as Visiting/Adjunct/Emeritus faculty, wherein many of them actively participate in conducting UG/PG/PhD courses as well as several activities related to research such as Thesis Evaluation, External Examiners for Project/Seminar viva, Distinguished Lectures, Faculty Development Programs, Seminars, Conferences and many others. Further details of these Industry Faculties association with the Department and the Institute (UG Programs) can be found below:

Table 4.20: List of Adjunct Faculties

Name of Adjunct Professors	**Description**
Prof. Suresh K. Bhargava	Dean of Applied Sciences, College of Science, Engineering and Technology, RMIT University
Dr. Ajit Sapre	Group President (Research and Technology) Reliance Technology Group Reliance Corporate Park, Navi Mumbai
Dr. Ashwini Nangia	Formerly Professor, School of Chemistry, University of Hyderabad, Director, CSIR-National Chemical Laboratory, Pune
Dr. Ram Sabnis	1120 Lyndhurst Way Roswell, GfA 30075 USA
Dr. Sanjeev S. Katti	Director General ONGC Energy Centre 8th Floor, Core - 4 SCOPE Minar, Laxmi Nagar, Delhi
Dr. Rajendra Sardesai	520, Arbolada Drive Arcadia, California 91006-2112 U.S.A.
Distinguished Adjunct Professor (2019-23)	
Prof. Arun S. Mujumdar	Director, M3TC, Faculty of Engineering and Department of Mechanical Engineering National University of Singapore
Prof. Rakesh Agrawal	Winthrop E. Stone Distinguished Professor of Chemical Engineering, Purdue University
Prof. Samir Mitragotr	Hiller Professor of Bioengineering and Hansjorg Wyss Professor of

	Biologically Inspired Engineering; Area Chair for Bioengineering
Prof. Doraiswami Ramkrishna	H.C. Peffer Distinguished Professor Forney Hall of Chemical Engineering, 480 Stadium Mall Drive, Purdue University
Dr. A.V. Rama Rao	Chairman and Managing Director Avra Laboratories Pvt. Ltd.
Dr. Srikumar Banerjee	DAE-Homi Bhabha Chair Professor, BARC; Chancellor, Central University of Kashmir Chancellor, Homi Bhabha National Institute, Central Complex, BARC
Prof. Rajamani Krishna	Emeritus Professor University of Amsterdam Van ‘t Hoff Institute for Molecular Sciences. Amsterdam, The Netherlands
Dr. S. Sivaram	INSA Senior Scientist and Honorary Professor, Indian Institute of Science Education and Research, Dr. Homi Bhabha Road, Pune
Shri. Vijay B. Samant	President and CEO VICAL, 93/73, Powne Centre Drive Suite 100, Sandiago California, CL 92121-3088, USA
Prof. Damodar Acharya	Formerly Director IIT, Kharagpur, Formerly Vice Chancellor, Biju Patnaik University of Technology, Bhubaneswar, Chairman Advisory Board, SOA University, Khandagiri Square, Bhubaneswar
Prof. Sanjoy Banerjee	Distinguished Professor and Director, CUNY Energy Institute Steinman Hall, 326, Mechanical Engineering, The City College of New York
Prof. Chennupati Jagadish	Distinguished Adjunct Professor of Physics and Chemical Engineering ANU College of Science, Australian National University
Prof. Ryoji Noyori, Nobel Laureate	Director-General of CRDS, Japan Science and Technology Agency (JST) Director of Science Museum, Japan Science Foundation RIKEN Fellow, RIKEN University Professor, Nagoya University, JAPAN

Table 4.21: List of Visiting Faculties

SN	CourseCode	Title	Visiting Faculty	Affiliation
1	CET1604	Basic course in Entrepreneurship	Mr. Vikrant S. Potnis	Founder at FundEnable, Director at Fortemagna Advisors, Founder at Indian Academy of Venture Capital (IAVC)
2	CET1401	Chemical Engineering Operations	Mr. Aniruddha Shenvi	Freelance Technical Consultant
3	HUT1102	Persp. of Society, Sci. & Tech.	Dr. Rama Iyer	Former Chairman & CEO of Aker Kvaerner
4	CET1509	Refinery Science & Engineering	Mr. Ravindra Kubade	Dy. General Manager (DGM) Process Technology BPCL-Mumbai Refinery (MR)
5	CET1509	Refinery Science & Engineering	Mr. Sunil Balwant	DGM OPERATIONS (ARU, ISOM, CCR, CCU, FCCU, GTU) BPCL-Mumbai Refinery (MR)
6	CET1509	Refinery Science & Engineering	Mr. Nilesh Kandalkar	DGM Technical Services (Energy & Environment) BPCL-Mumbai Refinery (MR)
7	CET1503	Environmental Engg. & Process Safety	K. Sahasranaman	Independent consultant in areas of Process Engineering and Design, Energy, Utilities, and Safety for the Chemical Process Industry.
8	CET1509	Refinery Science & Engineering	O.P. Goyal	Freelance Technical Consultant
9	HUT1103	Industrial Psychology and Human Resource	Dr. Rama Iyer	Former Chairman & CEO of Aker Kvaerner
10	HUP1101	Communication Skills	Yogesh. Anvekar	Head, Department of English, G.N. Khalsa College, Mumbai.
11	CET1511	Plant Utilities	K. Sahasranaman	Independent consultant in areas of Process Engineering and Design, Energy, Utilities, and Safety for the Chemical Process Industry.
12	HUT1105	Industrial Management (II)	O.P. Goyal	Freelance Technical Consultant
13	HUT1104	Industrial Management (I)	Dr. Rama Iyer	Former Chairman & CEO of Aker Kvaerner

CRITERION 5	Resources	75/75

5.1 Adequate and well-equipped laboratories, and technical manpower (25)

Institute Marks (25)

Table 5.1: Laboratories and technical manpower

Sr. No.	Name of the Laboratory	Students per setup (per Batch Size)	Specialized Equipment Name	Utilization	Technical Manpower support		
					Name of the Technical staff	Designation	Qualification
1	Chemical Engineering Lab	2 (20)	Bubble Column, Stirred Tank, packed column, Steam, packed, plate, spinning band distillation, diffusivity of acetone in air, benzoic acid, Cu-disc dissolution, liq-liq equilibrium	Study of gas-liq dispersion, liq-liq & solid-liq suspension, mass transfer, separation, extraction	Mr. P.P. Bhole Mr. Rahul Mohite Mrs. Seema Kurade Mrs. Amita Pawshe Mr. Avadhut Prabhu Mr. Chandrakant Kasle Mr. Anil Salvi Mrs. Jyoti Sarkaniya	Lab Assistant Lab Assistant Lab Assistant Lab Attendant Lab Attendant Lab Attendant Hamal cum attendant	S.S.C. B.Sc Chemistry M.Sc Chemistry 9th pass S.S.C. 9th Pass 9th Pass 8th Pass
2	Heat Transfer Lab	2 (10)	Double Pipe heat exchanger, distillation column, Plate Heat Exchanger, Steam Generator, unsteady-state heat transfer, Shell and Tube Heat Exchanger	Study of heat transfer with different equipment	Mr. Vishal Bhambid Mr. Shivram Sawant Mr. Anil Salvi	Lab Assistant Lab Attendant Hamal cum attendant	B.Sc in Chemistry 9th Pass 9th Pass
3	Process Control Lab	2 (10)	Process simulator, GC, HPLC, Densitometer, Sonication bath	Study of process analysis, optimization ; Simulation of process	Mr. Lalit Sawant Mr. Amol Kargutkar Mrs. Jyoti Sarkaniya	Lab Assistant Lab Attendant Hamal cum attendant	B.Sc. in Physics S.S.C. 8th Pass
4	Analytical instrument Laboratory	1 (5)	Pharmaceutical Analysis System; GC, HPLC, Water purification, AAS, ICP	Analytical determination of compounds	Shri Mahesh Harkar	Sr. Technical Assistant	M. Sc.

Table B.5.1

Table 5.2: Laboratory facilities/Centre of excellence

Sr. No	Name of the Facility	Specialized Equipment Name	Equipment details
1	Central Computational Facility	Computational cluster (160 nodes)	Computational analysis, molecular dynamics, reactor designs
2	Analytical Instrumentation Laboratory	Gas Chromatography; Extractive Gas Chromatography; High Pressure Liquid Chromatography x 4	Thermo Scientific Trace 1310; Thermo Scientific Trace 1310; Thermo Scientific Ultimate 3000
3	X-Ray Photoelectric Spectroscopy Laboratory	Sorptometer; Protein Characterization System; X-Ray Photoelectric Spectroscope	BET 201-A Beckman Coulter XL-I Kratos Analytical Axis Supra
4	Gas Chromatography Laboratory	Pharmaceutical Analysis System; Gas Chromatography; High Pressure Liquid Chromatography x 2	Chemito GC8610. Beckman Coulter PA 800 Plus; Thermo Scientific Trace 1310; Thermo Scientific Ultimate 3000
5	UGC Networking Laboratory	Fourier-transform infrared spectroscopy; Particle Size Analyzer; Mass Spectrometer; Laser Particle Analyzer; Centrifuge; Fourier-transform infrared spectroscopy; XID; Transmission electron microscopy	Vertex 80V; Coulter LS230; Thermo Scientific Trace 1300; Bettersizer 2600 Beckman Coulter Optima MAX-XP Perkin Elmer Bruker D8 Advance JEOL JEM 2100
6	Advanced Laboratory	Vapour Phase Reactor; Autoclave x 4;	Amar Equipment's PVT Ltd. custom build setup; Amar B(F);

		Rota Vaporizer; Bench Top Fixed Bed Flow Reactor; Tubular Furnace	Heidolph Hei-Vap Value Digital; BEEM (Custom); Ants Pro-Sys

5.2. Laboratories maintenance and overall ambiance (5) **Institute Marks (5)**

Laboratories maintenance:

The laboratories are well maintained. There is a dedicated cleaning team for maintaining the daily cleanliness of all the laboratories and their premises in the department.

1. Well trained and qualified lab technicians are available for maintenance of equipment on regular basis in all the laboratories
2. Service, cleaning, and maintenance of equipment are carried out regularly.
3. Periodic lubrication of machines is a must to avoid the breakdown of machines.
4. Calibration of laboratory equipment is done by the lab technicians regularly.
5. Minor repairs are carried out by the technical staff of the department based on available resources and expertise.
6. Major repairs are outsourced by following the procedure of the Institute.
7. Dead stock register is maintained in laboratories.
8. All laboratories are adequately ventilated.
9. Whiteboards are provided in all laboratories to demonstrate the experimental methodologies to the students.
10. The machines are arranged so that the students can be accommodated comfortably.
11. The area of each laboratory is sufficiently high as per the requirement of machine size.
12. All the chemicals have been kept in the packed cupboard, so no hazards from chemicals and their fumes too.
13. Empty bottles of chemicals are thrown out every month.
14. Safety measurements are provided in every laboratory.

Overall Ambiance

1. All laboratories are well furnished. Necessary furniture for students is provided in each laboratory. Based on the requirement, the students utilize them in the laboratories.
2. All laboratories are equipped with sufficient equipment to meet the requirements of the curriculum.
3. All laboratories are open for students and faculties for research.
4. All laboratories are well ventilated. The lighting system is very effective, along with the natural light in every laboratory.
5. All the laboratories are equipped with white/chalkboard, computer, Internet, and other such teaching-learning aids.
6. The Department has a couple of funded research laboratories. Students and faculty members are always encouraged to carry out research in these exclusive research laboratories. However, the research work is not constrained only to these laboratories.

7. Department has a sufficient number of laboratories that are used throughout the year on a periodic timeline basis to meet the curriculum requirements and based on the requirements of the students.

8. Every laboratory has a dedicated technical staff resource. It is ensured that the deputed technical staff has sufficient skills for handling the equipment and software pertaining to that particular laboratory

5.3 Safety measures in laboratories (5) Institute Marks (5)

Table 5.3a: Safety measures in laboratories

Sr. No.	Name of the Laboratory	Safety measures
1.	Chemical Engineering Laboratory	• Students are compulsory to wear a lab coat/apron, cap, masks, safety goggles, gloves, and shoes in order to protect them. • The acids are stored separately in a fuming cupboard with exhaust fans. • In addition to diluting the chemicals, teachers and supporting staff should warn about the possible dangers of mishandling or careless handling of those chemicals. • Fire Extinguishers (SolidCO_2, Sand, Blanket), showers, eye washers, and First Aid Box are provided in the laboratory. • Exhaust fans are arranged outside in order to limit exposure to hazardous or toxic fumes, vapours, or dust. • Fume hoods are provided wherever necessary. • Lab safety training is provided to the staff. • Lab safety posters and fire-exit signs/maps are installed at relevant places. • Laboratories are provided with a good drainage system to remove the odorous chemicals and flush out the used chemicals in the sink.
2.	Process Control Laboratory – Chemical Engineering Laboratory	• Students are compulsory to wear a lab coat/apron, cap, masks, safety goggles, gloves, and shoes in order to protect them • Fire Extinguishers (SolidCO_2, Sand, Blanket), showers, eye washers, and First Aid Box are provided in the laboratory. • Lab safety posters and fire-exit signs/maps are installed at relevant places. • Lab safety training is provided to the staff. • The lab is provided with an air conditioner for analytical instruments and sealed well in order to limit exposure to hazardous or toxic fumes, vapours, or dust. • Laboratories are provided with a good drainage system to remove the odorous chemicals and flush out the used chemicals in the sink.
3.	Heat Transfer Laboratory – Chemical Engineering Laboratory	• Students are compulsory to wear a lab coat/apron, cap, masks, safety goggles, gloves, and shoes in order to protect them

		• Fire Extinguishers (SolidCO_2, Sand, Blanket), showers, eye washers, and First Aid Box are provided in the laboratory. • Exhaust fans are arranged outside in order to limit exposure to hazardous or toxic fumes, vapours, or dust. • Lab safety training is provided to the staff. • Lab safety posters and fire-exit signs/maps are installed at relevant places. • All the laboratories are provided with a good drainage system to remove the odorous chemicals and flush out the used chemicals in the sink.
4.	Analytical Instrumentation Laboratory	• Students are compulsory to wear a lab coat/apron, cap, masks, safety goggles, gloves, and shoes in order to protect them • Fire Extinguishers (SolidCO_2, Sand, Blanket), showers, eye washers, and First Aid Box are provided in the laboratory. • Lab safety training is provided to the staff. • Lab safety posters and fire-exit signs/maps are installed at relevant places. • The lab is provided with air conditioners for analytical instruments and sealed well in order to limit exposure to hazardous or toxic fumes, vapors, or dust. • Laboratories are provided with a good drainage system to remove the odorous chemicals and flush out the used chemicals in the sink.
5.	Advanced Laboratory	• Students are compulsory to wear a lab coat/apron, cap, masks, safety goggles, gloves, and shoes in order to protect them • The acids are stored separately in a fuming cupboard with exhaust fans. • In addition to diluting the chemicals, teachers and supporting staff should warn about the possible dangers of mishandling or careless handling of those chemicals. • Fire Extinguishers (SolidCO_2, Sand, Blanket), showers, eye washers, and First Aid Box are provided in the laboratory. • Exhaust fans are arranged outside in order to limit exposure to hazardous or toxic fumes, vapours, or dust. • Fume hoods are provided wherever necessary. • Lab safety posters and fire-exit signs/maps are installed at relevant places. • All the laboratories are provided with a good drainage system to remove the odorous chemicals and flush out the used chemicals in the sink.
6.	UGC Networking Laboratory	• Students are compulsory to wear a lab coat/apron, cap, masks, safety goggles, gloves, and shoes in order to protect them

		• Fire Extinguishers (SolidCO_2, Sand, Blanket), showers, eye washers, and First Aid Box are provided in the laboratory. • Lab safety training is provided to the staff. • Lab safety posters, and fire-exit signs/maps are installed at relevant places. • The lab is provided with air conditioners for analytical instruments and sealed well in order to limit exposure to hazardous or toxic fumes, vapours, or dust. • Laboratories are provided with a good drainage system to remove the odorous chemicals and flush out the used chemicals in the sink.

Table B.5.3

Table 5.3b: Safety training and equipment training

Lab/Facility	**Training/ instrument**	**Details of instrument**	**Training/Service given by**	**Year**
Chemical Engineering Department	Safety training	PPE products, fire extinguisher	Mr. V.R. Marathe, Dr. Swayajith Sahadevan, Dr. P. T. Gadekar, Mr. Nilesh Vani	2019
Chemical Engineering Department	Safety training	PPE products, fire extinguisher	Dow Chemicals	2020
Process Control lab - Chemical Engineering Laboratory	High-Pressure Liquid Chromatography	Ultimate 300 with variable wavelength distribution	Thermo scientific	2019
Process Control lab - Chemical Engineering Laboratory	UV Spectrophotometer	LMSP – UV 1900	Labman	2019
Process Control lab – Chemical Engineering Laboratory	Yokogawa Process Simulator	Pilot plant	Renew Instruments	2019
Process Control lab - Chemical Engineering Laboratory	Karl Fischer Titrator	80-630	Athena	2019
Process Control lab - Chemical Engineering Laboratory	Densitometer	DMA 501	Anton Paar	2019

Heat lab - Chemical Engineering Laboratory	Hot Water Generator	AMW 02/678	Thermax	2020

5.4. Project laboratory (15)

Institute Marks (15)

Table 5.4: Project laboratories and their utilization

Sr No.	Name of Lab	Name of Equipment	Utilization
1.	GDY Lab (A110, A114)	ASAP; TDP-TPR; Gas chromatography; HPLC; Micro reactor; High pressure reactor; Vapor phase reactor; DCS-TGA: Thermal Analysis	Preparation of membrane Vapor phase reaction High-pressure reaction Synthesis of Nanomaterials Extraction of enzymes Synthesis of different Acid/ Base Catalyst
2.	SSB Lab (Basement 004)	Kruss Tensiometer; Goniometer; UV spectrophotometer; Foaming apparatus; Maximum Bubble pressure apparatus; Turbidity Meter; Stop flow apparatus; Ross mill apparatus	Synthesis of Novel surfactants Study of Mixed micellar systems Thermodynamic model study of surfactant mixtures Study of biosurfactants Exergy analysis ANN Molecular modelling Thermodynamic and mathematical Modelling and simulations of power cycle
3.	VGG Lab (Basement 001, 002, 003)	HPLC; GC; UV Spectrophotometer; DSC; SFC-SFE; Spectrofluorometer; Servers, Ultrasonic probe sonicator, Muffle furnace 1200C, High pressure Autoclave 500ml, High temp tubular split furnace,	Biodiesel and Thermochemical conversions of Biomass Process Intensification by microwave, Soft Condensed Matter, Reactive Adsorptive Separations and Molecular Design of Functionalized Polymers, Interfacial Science and Engineering, Clean Technology and Organic Synthesis in Aqueous Solutions, Synthesis of nanoparticles, Photochemical reduction of CO_2
4.	VHD Lab (LDA)	SGI Cluster, HPC; High Speed Camera; PIV; UVP	Molecular Simulations, Process Simulations, Solar Thermal Systems, Energy Engineering Environmental Engineering

5.	PRG Lab (G-109)	Ultrasound bath; Ultrasound Horn; Distillation unit; Hexagonal ultrasonic flow cell; COD set-up; Sieve Shaker; Spray dryer; Microwave oven; Ultrafiltration unit	Sonochemistry Hydrodynamic Cavitation, waste water treatment, process intensification, enzymatic reactions, depolymerization
6.	AML Lab	GC; HPLC; Ultrafiltration; Chromatography; CAD tools	Bioenergy, Biofuels and biomass to other chemicals Purification of Proteins, nucleic acids & other biomolecules, natural & synthetic APIs high value organic/inorganic chemicals Continuous chromatography, Modeling & Adsorptive Separations Biocatalysis & Bio Transformations Bioreactor design, Mixing & dynamics of solid- liquid fluidized bed Dynamics of gas-solid circulating fluidized bed Process integration & Intensification, Process development, characterization & scale up
7.	KVM Lab (G-109)	pH meter; Ozoniser; Photochemical reactor; Membranes; Dead end Filtration set-up; Bio electrochemical membrane reactor; Membrane bioreactor	Membrane separations, Effluent treatment Membrane Bioreactor, Electrochemical Membrane Bioreactor, Sustainability Assessment, Lifecycle Assessment Hydrometallurgical Extraction, Corrosion Development of new materials, Metal composite
8.	CSM Lab (LDA)	SGI Cluster, HPC High Speed Camera; PIV; UVP;	Computational and experimental Fluid Dynamics, Transport Phenomena, Design of Multiphase Reactors, Bioreactor Design Process modelling and Simulation
9.	PRN Lab (Basement 007)	Furnace; Reactor; Centrifuge; Oven; Autoclave; GC	Membrane separation processes, Advanced construction materials, Sustainability engineering, valuable products from industrial wastes catalysis
10.	ABP Lab	HPLC; Total organic content; Ozonator; Autoclave; Ultrasound bath;	Physical and Chemical Processing applications of Cavitation phenomena

		Ultrasound Horn; Rota Evaporator; Incubator; Oven; Centrifuge; Hydrodynamic set-up; Gas Chromatography	Sonochemistry Ballast Water Treatment Mixing in Mechanically agitated contactors: Experimental and CFD Investigations Modeling of Stoves, Use of non-conventional energy sources, Biotechnology: Protein modification Cell disruption, Synthesis of Nanomaterials Microbial Fuel Cell
11.	AVP Lab	Furnace (1800 C); Hydraulic Press; Ultrasound bath; Rota evaporator; Incubator; Oven; Membrane filtration set-up, Multipoint magnetic stirrer + heat	Membrane separation (separation and recovery of organic chemicals and metals from organic and aqueous streams; pollution control development of ceramic membranes) Green Technology (ionic liquids for solvent extraction and reactions; value-added chemicals from non-edible oils; greener organic chemical process development) Bioprocess Technology (synthesis of chemicals and microbial colorants/pigments)
12.	AWP Lab (C-106)	High performance Computing 160 core; 256 GB RAM, 32 TB storage; ARIC	Membrane Separations Computational Fluid Dynamics Transport Phenomena Multiphase Reactors Mixing
13.	VKR Lab (G-109, Basement 005)	HPLC; UV Spectrophotometer; Supercritical extractor; Microwave extractor Cold Centrifuge; Ultrasound Bath; Ultrasound Horn, Pelleting Machine Chipper shredder Washer Dryer	Extraction & purification of natural ingredients Biocatalysis/Enzyme Catalysis Nanotechnology Biodiesel Waste water Catalysis (Heterogeneous)
14.	PDV Lab (HP Lab, Basement 006)	Stirred Reactor; Autoclave Reactor; Sea Water Pond; High & low pressure VLE; Trickel Bed Reactor; PH meter; BOD incubator; COD apparatus; CO2 Titrator;	Gas chromatography CO2 capture & Utilization Wet air oxidation Hydrogenation Steam reforming Hydrotreatment Bio oil/ Bio fuel
15.	BNT Lab (ADL)	Freeze Dryer; Hot Air Dryer; Microwave Dryer; Heat Pump Dryer; Vacuum Dryer; Spray Dryer; Moisture Analyser; HPLC;	Indian Cottage cheese Dehydration, Modelling Simulation & Exergy study of Dryer, Alternative Binder for

		Laminar Air flow; Fluidized Bed Dryer; Autocave; Powder Flow Tester Texture Analyser	coke briquetter, Filtration of waste activated sludge, Validation of solar conduction dryer, Fish dehydration from viewpoint of product, Quality Making Jaggery in powder form & upscale process to establish a Green Method for clarification & isolation of stevia glycoside
16.	RDJ Lab (BCL)	Rota Evaporator; Autoclave; Dissolution Apparatus I & II USP; Mini Water Bath; High Pressure Homogenizer; SDS-PAGE Electrophoresis; Freezer 4° C; Deep Freezer -20° C and -40° C; Cooling Centrifuge; Zetasizer; Imaging Flow Cytometer; Class II Biosafety Cabinet; Inverted Microscope; Cell Culture, Incubator; HPLC System; Automated Cell Counter; Ultra turrax; 10 Point Magnetic Stirrer; Desiccator, UHPLC Fully Automated, Ultrasonic crystallization system Ultrasonic flow cell, Invenio FTIR Spectrometer Biochemistry Analyzer 2950D3, YSI	Modification & Characterization of Biodegradable Polymers Molecular imaging Synthesis of polymeric & metallic nanoparticles, Pharmaceutical Formulation Development
17.	Polymer Processing Lab	Twin Screw Extruder; Injection Moulding Machine; Compression Testing Machine; Blow Moulding Machine; Rotational Moulding Machine; Plastic Granules Mixing Machine; Hot Air oven	Extruding, moulding, and compressing various polymer components to study their plastic and material properties to make failure and deformation predictions
18.	Testing Lab	Metflow Index Tesing Equipment; Impact Test Equipment Comp	Testing Equipment; Universal Testing Machine

		Izod Impact Tester; HDT/VST Apparatus; Hardness	Testing and indexing various components of various materials to identify plastic properties such as hardness, elasticity and creep etc.
19.	CAD/CAM Lab	Altair Hyperworks CAE; Minitab 18; NX Unigraphics; Moldex 3D	Modelling and simulating various theoretical and practical machining components and to check feasibility/compatibility of various components with one another
20.	Electronics and Electrical Lab	Transformer X-2; Induction Motor/Generator coupled with DC shunt X-2; Cathode Ray Oscilloscope; Synchronous Machine and DC Machine	To study various drives used in the industry and calculate various efficiency parameters of electrical equipment's such as power factor, mechanical efficiency. Study of different kinds of waveforms and signals in electronics circuits.

5.5 Feedback analysis and reward /corrective measures taken, if any for resources (5)

Institute Marks (5)

Feedback collected for all courses: Yes

Feedback collection process:
Electronic: On our ICT intranet, each student has a separate account and fills up feedback for each course at the semester's end.
Average percentage of students participating: 80% - 100 %

Feedback analysis process:
Feedback is taken electronically and the activity is coordinated by the Institute and the Department. A feedback form, which contains several questions, is circulated to the students. The general assessment points of the feedback are based on the syllabus covered, adequacy of the syllabus, assessment of answer books, Satisfaction about teaching methodology, teachers' approachability towards students, Teachers ability to teach the subject and control the class, organization of lectures, use of modern tools of Pedagogy, etc. on a grade of 5 scales with number 5 meaning excellent and zero meaning poor performance. The feedback is collected, compiled, and specific comments are sent to the faculties electronically. If a teacher gets a low overall grade, they take corrective actions to improve teaching-learning on their own. In some cases, the teacher is called by the institute authorities such as the Head of the Department, Dean academic, Registrar, and Vice-chancellor and is informed about his/her performance in the particular course. The teachers are accordingly instructed by the authorities to improve their performances.

Corrective measures:
1. Changes are made in teaching and continuous assessment practices based on students' input.
2. Many faculty members attended special programs for teaching skills and mentoring skills.
3. Corrective steps include special sessions for students as and when required.

Feedback on facilities and resources:
The feedback on taken facilities such as chemical engineering laboratory, computational facility, internet, library, etc., is a continuous process. This feedback is provided by the students, staff, and

the faculties. For example, if a student, staff, or faculty spots faulty equipment during the running lab, they report such incidences to the lab in-charge or the HoD. The corrective actions are taken immediately on such incidences. Similarly, feedback on safety gear and equipment is taken, and corrective actions are taken, such as restocking fire extinguishers, first-aid boxes, etc., as and when required. The IPC department resolves the faulty computer peripherals or internet issues centrally at the institute level.

The institute and the department collect feedback electronically from the student every semester on laboratory courses and facilities. The students give feedback based on planned experiments, observations during the investigation, timely conduct, and efficacy of the experimental equipment. The instructors accordingly take corrective actions to improve the teaching and laboratory equipment. Based on the feedback received from the students and recent alumni, the department has upgraded the chemical engineering laboratory, heat transfer laboratory, and the process control laboratory extensively (Figures 5.1 and 5.2). Moreover, many modern equipment and analytical instruments, including GC, HPLC, UV-Spectrometer, plate-heat exchanger, stirred tank reactor, Karl Fischer apparatus, orbital shaker, ultrasonicator, centrifuge, densitometer, Process simulator, etc., are made available to the undergraduate students for their experimentation.

Institute of Chemical Technology

Institute Of Chemical Technology

Feedback Report

Feedback Jan- May 2021
Total No Of Student Who given feedback: 82
Total No Of Student For This Course: 94

Feedback Given By Student

Comments

Student Feedback Jan-May 2019

Course Name : CEP 1701- Chemical Engineering Laboratory-I
Feedback Given / Total Student : 82 / 91
Feedback (%) : 90.11%

Course Evaluation Parameters	Poor (%)	Inadequate (%)	Average (%)	Good (%)	Very Good (%)	Excellent (%)
1. Nature of experiments planned for the course- Were the experiments based on theory covered in the current/previous semester?	0	0	7.32	18.29	29.27	45.12
2. Did the experimental observations/results help in enhancing the understanding of subject?	0	0	9.76	20.73	28.05	41.46
3. Were the experiments sufficient in number and time for the time slot given for the practicals?	0	1.22	8.54	20.73	29.27	40.24
4. Was the correction of journals and conducting Viva/Tests carried out in all fairness?	0	1.22	10.98	19.51	28.05	40.24
5. The break-up of marks was transparent to the student?	0	2.44	15.85	19.51	20.73	41.46

Figure 5.1: Sample laboratory feedback report

5.6. Program Specific Budget Allocation, Utilization (10) **Institute Marks (10)**

Total Budget at program level: For CFY, CFY*m1*, CFY*m2* & CFY*m3*
CFY: Current Financial Year – CFY*m1* (Current Financial Year minus 1) CFY*m2* (Current Financial Year minus 2) CFY*m3* (Current Financial Year minus 3)

Table 5.5a: Budget and expenditure for CFY (2021-2022)

Total Budget in CFY: 1829.64		**Actual expenditure in CFY:** ***Actual expenditure will be available after academic audit***		**Total No. of students in CFY: 360**
Non-recurring	**Recurring**	**Non-Recurring**	**Recurring**	**Expenditure per student**
315.75	1513.9	-	-	-

Table B.5.6a

Table 5.5b: Budget and expenditure for CFYm1 (2020-2021)

Total Budget in *CFYm1*: 2759.82		**Actual expenditure in *CFYm1*: 1742.52**		**Total No. of students in *CFYm1*: 360**
Non-recurring	**Recurring**	**Non-Recurring**	**Recurring**	**Expenditure per student**
1118.46	1641.35	300.72	1441.8	4.84

Table B.5.6a

Table 5.5c: Budget and expenditure for CFYm2 (2019-2020)

Total Budget in *CFYm2*: 2899.22		**Actual expenditure in *CFYm2*: 2453.04**		**Total No. of students in *CFYm2*: 360**
Non-recurring	**Recurring**	**Non-Recurring**	**Recurring**	**Expenditure per student**
1296.46	1602.76	994.14	1458.9	6.814

Table B.5.6a

Table 5.5d: Budget and expenditure for CFYm3 (2018-2019)

Total Budget in *CFYm3*: 2650.59		**Actual expenditure in *CFYm3*: 2524.07**		**Total No. of students in *CFYm3*: 360**
Non-recurring	**Recurring**	**Non-Recurring**	**Recurring**	**Expenditure per student**
1164.48	1486.1	1105.2	1418.87	7.011

Table B.5.6a

Table 5.6: Budget and expenditure for CFY 2021-2022, 2020-2021, 2019-2020, 2018-2019.

Items	Course	Budgeted in CFY	Actual expenses in CFY	Budgeted in CFY*m*1	Actual Expenses in CFY*m*1	Budgeted in CFY*m*2	Actual Expenses in CFY*m*2	Budgeted in CFY*m*3	Actual Expenses in CFY*m*3
		2021-2022	2021-2022	2020-2021	2020-2021	2019-2020	2019-2020	2018-2019	2018-2019
Infrastructure Built-up	UG	142.12		550.59	135.35	335.64	378.75	304.3	288.66
	PG	28.42		110.12	27.07	184.79	208.52	173.34	164.43
	Total	170.54		660.71	162.42	520.43	587.27	477.64	453.09
Library	UG	12.98		64.64	12.36	36.32	44.46	34.29	31.23
	PG	2.6		12.93	2.47	19.99	24.48	19.53	17.79
	Total	15.58		77.56	14.84	56.31	68.94	53.82	49.02
Laboratory equipment	UG	121.01		381.46	115.25	483.07	262.4	437.58	415.46
	PG	24.2		76.29	23.05	265.96	144.47	249.26	236.65
	Total	145.21		457.75	138.3	749.03	406.86	686.84	652.11
Laboratory consumable	UG	45.35		95.28	43.19	54.39	65.54	47.52	46.78
	PG	9.07		19.06	8.64	29.95	36.08	27.07	26.65
	Total	54.43		114.33	51.83	84.34	101.62	74.58	73.42
Teaching & Non-teaching staff salary	UG	773.87		719.39	737.02	437.46	494.86	402.85	376.23
	PG	154.77		143.88	147.4	240.85	272.45	229.47	214.31
	Total	928.64		863.27	884.42	678.31	767.31	632.33	590.54
Maintenance and spares	UG	26.02		25.3	24.78	20.11	17.41	18.86	17.29
	PG	5.2		5.06	4.96	11.07	9.58	10.74	9.85
	Total	31.23		30.36	29.74	31.18	26.99	29.6	27.15
R & D	UG	38.13		19.63	36.31	86.66	13.5	74.81	74.53
	PG	7.63		3.93	7.26	47.71	7.44	42.61	42.45
	Total	45.75		23.56	43.58	134.37	20.94	117.42	116.99
Training and Travel	UG	26.42		41.09	25.16	62.97	28.27	54.77	54.16
	PG	5.28		8.22	5.03	34.67	15.56	31.2	30.85
	Total	31.7		49.31	30.19	97.65	43.83	85.96	85.01
Miscellaneous expenses *	UG	25.31		36.26	24.1	12.95	24.94	12.21	11.14
	PG	5.06		7.25	4.82	7.13	13.73	6.96	6.35
	Total	30.37		43.51	28.92	20.08	38.68	19.17	17.48
Other (Consultancy. Building, Recurring etc.)	UG	313.49		366.2	298.57	340.21	251.91	301.49	292.59
	PG	62.7		73.24	59.71	187.31	138.69	171.73	166.67
	Total	376.19		439.44	358.28	527.52	390.6	473.23	459.26
Total	UG	1524.7		2299.84	1452.09	1869.78	1582.04	1688.68	1608.07
	PG	304.94		459.98	290.41	1021.68	871	961.91	916
	Total	**1829.64**		**2759.82**	**1742.52**	**2899.22**	**2453.04**	**2650.59**	**2524.07**

Table B.5.6b

5.6.1. Adequacy of budget allocation (5) **Institute Marks (5)**

The institute makes a budget based on the expenditure for the last three years for various activities. The amount is allocated for various activities for the requirements of the individual department. Any further requirement of funds is met through project funding. We are making constant efforts to increase the quantum of this account.

As per the requirement, laboratories are upgraded regularly with new equipment and accessories (More information in Continuous Improvement Section 6).

- New facilities are introduced for R & D works.
- Existing labs are upgraded and improved for ambiance and facilities.
- Purchase of new software and renewal of software already exists.
- Purchase of E-Resources, E-Books, and E-Journals.
- Faculty members are encouraged to attend faculty development programs.
- Training programs for non-faculty staff are arranged for up-gradation of skills.

Table 5.7: List of new equipment purchased

Sr. No.	Description	Model	Procurement Year
1	Water purification system	Sartorius: arium mini	2017
2	Ion chromatography	Dionex 5000+	2017
3	HPLC-VWD	Themo: Ultimate 3000	2017
4	HPLC-DAD	Themo: Ultimate 3000	2017
5	HPLC-RI	Themo: Ultimate 3000	2017
6	Microspin centrifuge	Eltek TC 4815D	2018
7	UV-Visible spectrophotometer	Labman: LMSP UV-1900	2018
8	HPLC-VWD	Themo: Ultimate 3000	2018
9	Orbital shaker incubator	Athena: Galaxy 1NCS	2018
10	Densitometer	Anton paar: DMA 501	2018
11	Ultrasonic bath	Dakshin 6.5L 200DF	2018
12	KF titrator	Athena AT-630	2018
13	Plate heat exchanger	Alfa laval M3-FG	2019
14	Stirred tank reactor	Fabex Engineer	2019
15	Hot water generator	Thermax, AMW-02	2019
16	Laser partical size analyser	Bettersizer 2600	2019
17	DI water sysytem	PALL CASCADA ll 10L/H	2019
18	UV-Visible spectrophotometer	Shimadzu UV-1900	2019
19	High resolution mass spectroscopy	Thermo Fischer	2019
20	X-ray Photoelectron spectrometer	Kratos Axis Supra	2019
21	Inductively coupled plasma-MS	Thermo iCAP RQ	2020
22	Biochemistry Analyzer	Labmete 2950D3, YSI	2021
23	High temp tubular split furnace	Nano Tec	2021
24	Hydrodynamic cavitation setup	Zero-D Industries	2021
25	Invenio FTIR Spectrometer	Bio Zed Engineering	2021
26	Microscope Labomed LX400	Scientific apparatus Mfg.	2021
27	UHPLC	Spincotech	2021
28	Ultrasonic crystallization system	Dakshin	2021
29	Ultrasonic bath 6.5L, 1.5, Horn	Dakshin	2021

Figure 5.1: Upgradation of Chemical Engineering Laboratory

Figure 5.2: New facilities created

5.6.2. Utilization of allocated funds (5) **Institute Marks (5)**

The utilization of allocated funds is satisfactory as can be seen from Table 5.9. Provisions are made for the utilization of funds for research activities in terms of the budget allocated and used for Laboratory equipment, R & D activities, consumables, etc.

Table 5.8: Actual expenditure for CFY 2020-2021, 2019-2020, 2018-2019

Sr. No.	**Items**	**Actual expense 2020-21**	**Actual expense 2019-20**	**Actual expense 2018-19**
1	Infrastructure Built-up	162.42	587.27	453.09
2	Library	14.84	68.94	49.02
3	Laboratory Equipment	138.30	406.87	652.11
4	Laboratory Consumables	51.83	101.62	73.42
5	Teaching & Non-teaching staff salary	884.42	767.31	590.54
6	Maintenance & spares	29.74	26.99	27.15
7	R & D	43.58	20.94	116.99
8	Training and Travel	30.19	43.83	85.01
9	Miscellaneous expenses	28.92	38.68	17.48
10	Other specify (Consultancy. Building, Recurring etc.)	358.28	390.60	459.26
11	**TOTAL**	**1742.52**	**2453.04**	**2524.07**

Table 5.9: Percent utilization of allocated funds for CFY 2020-2021, 2019-2020, 2018-2019

Sr. No.	**Financial Year**	**Funds Allocated**	**Funds Utilized**	**% Utilization**
1	2020-21	2759.82	1742.52	63.14
2	2019-20	2899.22	2453.04	84.61
3	2018-19	2650.59	2524.07	95.23

5.7. Library and Internet (10) — Institute Marks (10)

5.7.1. Quality of learning resources (hard/soft) (6) — Institute Marks (6)

Relevance of available learning resources including e-resources (Digital Resources):

All the printed and electronic resources available under library collection are acquired by proper recommendation process and by studying user needs. Renowned publishers in the field of Science and Technology are covered. It has a specialized collection in Chemical Engineering, Chemical Sciences, Chemical Technology, and Pharmacy and its allied fields. Textbooks recommended according to the syllabus are also available in multiple copies. E-Resources include e-Journals, e-books and citation databases, Patent databases, etc. The collection also includes Research tools like Plagiarism check software, language help software, etc.

Digital library information: Digitized Theses (1000 completed), BIOS, CIOS, FIAT reports

Other E-Resources: eDatabases: Scopus, Reaxys, Web of Science, Sci-Finder, Derwent Innovation, Jove Video Journals

eResearch Tools: iThenticate, Urkund (eSS), Grammarly, Remote XS

Accessibility to students:

Printed Resources: The library is open for students to access the printed resources for 361 days in the year from 8.30 AM to 8.30 PM on working days and 10.30 AM to 6.00 PM on holidays. E-

Resources: The e-resources subscribed by the library are available for access 24X7 to all students in-campus (IP based access) and off-campus (Remote access, RemoteXS)

Support to students for self-learning activities:

Training programs and workshops for e-resources, Literature Review, Author workshops, and publication workshops are conducted regularly for UG, PG, and PhD Scholars. Availability of workstations to access e-resources, engage in swayam courses, coursera, etc.

Students can also view the recorded lectures of ICT faculty in the e-library if required.

Also available are some digital databases like language learning lab (For all students).

Library learning resources Information:

1. No. of volumes: 77881
2. National Journals (Hard copy): 22
3. International (Hard copy): 25
4. National e-Journals: 0
5. International e-Journals: 4401
6. Magazines: 14
7. Books (soft & hard copy): Volumes 32434 Print + 790 Soft, Titles 22735 Print + 790 soft
8. Digital library information: Digitized Theses (1000 completed), BIOS, CIOS, FIAT reports
9. Other E-Resources: eDatabases: Scopus, Reaxys, Web of Science, Sci-Finder, Derwent Innovation, Jove Video Journals,
10. eResearch Tools: iThenticate, Urkund (eSS), Grammarly, Remote XS

Library Staff:

Professional staff: 3 (All 3 with Library Science Degree)

Semi-professional staff: 2 (1 with Library Science Degree)

Attendants (two shifts): 12

Trainee: 1

Total Staff with Library Science Degree: 4

Library Layout:

The Library is a ground plus two-storied building.

Carpet Area of the library (in m^2): 1391

Reading space (in m^2): 1391

Total seats in reading space: 200

5.7.2. Internet (4) **Institute Marks (4)**

Table 5.10: Information on internet availability and access

Name of the Internet provider	**NKN, Bharti, Reliance**
Available bandwidth	1 GB (NKN), Bharti (75 mbps), 100 mbps (TATA)
Wi Fi availability	Whole campus

Internet access:	• Available in all Labs • Available in all Computing Labs • Availability in departments and other units, Lecture theatres, Class and Tutorial Rooms, Labs, Departments, Library, Administrative Office, Hostels • Availability in faculty rooms
Security arrangements	Eset antivirus, Hardware Firewall installed, Mac address authentication of the systems for local network/internet access & user id for internet access

Internet Bandwidth: 75Mbps Bharti
100Mbps Tata
1Gbps NKN – NIC

These Leased Lines are distributed throughout the ICT Campus (Faculty, Support Staff and all Students).
LAN users in the all-buildings 1000+ and 2 LAN points in each room of Hostel-5
Wireless Network at Hostel No. 1 to 4 (availability 24 x 7) and at some part of the main building area.

Informative Website : ictmumbai.edu.in
Intranet : intranet.ict
Computers : IPC Dept: UG Lab - 100 Computers, (All-in-One, i7, 16Gb RAM, 1TB HDD), 35 Computers (All-in-One, i3, 2Gb RAM, 500 GB HDD) in the internet access room for all students
All are connected to a Network having an Internet facility.

Servers : Lenovo Servers 3No's (virtualization of servers with Hyper-V. Libsys, TallyERP, Ridgeline, ESSL, Solidworks) and DHCP, DNS connected to EMC SAN Box, NFS server.

HP blade – Class Room Lecture Recording, connected to HP SAN Box
Lenovo Server – Estores Software

Firewalls : Sophos xg 310 (2 No's)

CCTV : Campus – 400+ camera's

Studio : Video-Conferencing, connectivity to off-campuses at a time.

License Software :
1) Microsoft Campus Licensing Agreement (Windows and Server o/s, Office365, SQL Processor Based license)
2) Matlab 2009b -(50 users)
3) Aspen -(1 user Research license)
4) MOE -single user license
5) SolidWorks -(60 users)
6) Ansys CFD -(35 users)
Ansys Mechenical - (5 users)
7) Gabbi - Academic - 50 users, professional - 1

MIS (Management Information System)
Modules in working

1. **Admission**:
    a. Admissions of UG, PG, and PhD students.
2. **Exam**:
    a. Result process of UG and PG students through MIS software.
    b. Filling Feedback forms by students and Generating Teacher Evaluation reports.
3. **Account**:
    a. Generating Student Fees Receipt.

CRITERION 6	Continuous Improvement	75/75

6.1. Actions taken based on the results of evaluation of each of the COs, POs & PSOs (30)
Institute Marks (30)

Being one of the most sought-after programs for chemical engineering in India, the students are expected to do extremely well throughout their curriculum and professional life after their studies. Therefore, we keep the target value for the CO and PO attainment levels reasonably high, which is 85-90%. However, thanks to our students, alumni, employers, and our own continuous efforts, we meet the target values comfortably (Figure 6.1). Nevertheless, we still feel that there is always a scope for improvement and we are actively committed to upgrades and improvements. A more through data analysis of CO, PO and PSO attainment is presented with charts in Criteria 1 (Section 1.6 – Figures 1.5, 1.6, 1.7, 1.8, 1.9, 1.10 & 1.11).

Table 6.1: PO and PSO Attainment and Actions for improvement – 2018-2019, 2019-2020, 2020-2021

POs	Target Level	Attainment Level				Observations
PO1: Engineering knowledge:						
Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems						
PO1	**80-85%**	2018-19	2019-20	2020-21	2021-22	PO1 attainment is successful.
		84.34	83.96	89.03	84.42	
Action 1: More emphasis put on hands-on training as well as experiential learning.						
Action 2: Demonstration of models and use of simulations is encouraged.						
PO2: Problem analysis:						
Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.						
PO2	**80-85%**	2018-19	2019-20	2020-21	2021-22	PO2 attainment is successful.
		83.71	83.54	88.58	83.95	
Action 1: More practice of problem-solving and thought-provoking problems rather than straightforward ones						
Action 2: More emphasis is put on understanding the problem at hand rather than directly jumping on solving the problem.						
PO3: Design/development of solutions:						
Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.						
PO3	**80-85%**	2018-19	2019-20	2020-21	2021-22	PO3 attainment is successful.
		83.96	83.37	88.67	84.02	
Action 1: More emphasis on design thinking and simulations.						
Action 2: Motivating the students for lateral thinking**.**						
PO4: Conduct investigations of complex problems:						
Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions						
PO4	**80-85%**	2018-19	2019-20	2020-21	2021-22	PO4 attainment is successful.
		82.9	83.22	88.62	83.94	

Action 1: More emphasis put on understanding the problem statement and exploratory data analysis						
PO5: Modern tool usage:						
Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.						
PO5	**80-85%**	2018-19	2019-20	2020-21	2021-22	PO5 attainment is successful.
		81.82	81.91	87.66	83.03	
Action 1: Creating awareness on the modern tools and techniques through webinars, videos, and hands-on training sessions						
Action 2: Use of e-teaching platforms (MS Teams, Google Classroom, Zoom, WebEx), flipped classrooms, and sharing of e-resources**.** Group exercises for the simple problems to explore the utility of tools and techniques.						
PO6: The engineer and society:						
Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.						
PO6	**80-85%**	2018-19	2019-20	2020-21	2021-22	PO6 attainment is successful.
		82.78	82.62	88.04	83.51	
Action 1: Creating social awareness on the use of technology for protecting the environment.						
Action 2: Design processes and products with societal and environmental impact in mind.						
PO7: Environment and sustainability:						
Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.						
PO7	**80-85%**	2018-19	2019-20	2020-21	2021-22	PO7 attainment is successful.
		83.4	83.54	88.62	83.94	
Action 1: Emphasis is given on greener and more sustainable technologies in teaching and practice.						
PO8: Ethics:						
Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.						
PO8	**80-85%**	2018-19	2019-20	2020-21	2021-22	PO8 attainment is successful.
		82.58	83.72	88.69	84.04	
Action 1: Emphasis is given on the importance of ethics and integrity in professional activities.						
Action 2: Use of case studies to imbibe the importance of ethical behavior in science and technology**.**						
PO9: Individual and team work:						
Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.						
PO9	**80-85%**	2018-19	2019-20	2020-21	2021-22	PO9 attainment is successful.
		83.32	83.12	88.29	83.63	
Action 1: Designing the group activities and assignments to nurture team spirit**.**						
Action 2: Counselling of students so that they can excel in tasks at hand.						
PO10: Communication:						
Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.						

PO10	**80-85%**	2018-19	2019-20	2020-21	2021-22	PO10 attainment is successful.
		83.1	83.19	88.27	83.65	
Action 1: Motivating students to take part in extra- and co-curricular activities so that their communication skills can be improved further.						
Action 2: Individual assignments are given during class and allow students to present.						
PO11: Project management and finance:						
Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.						
PO11	**80-85%**	2018-19	2019-20	2020-21	2021-22	PO11 attainment is successful.
		82.94	83.01	88.24	83.57	
Action 1: Imbibing the importance of systematic planning of project activities and time management with time-bound activities including assignments during class and practicals.						
PO12: Life-long learning:						
Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.						
PO12	**80-85%**	2018-19	2019-20	2020-21	2021-22	PO12 attainment is successful.
		83.96	83.26	88.8	84.22	
Action 1: Motivating students to take up courses on SWAYAM, NPTEL, Coursera, Udemy, and other portals to learn and hone their skills.						
Action 2: Leading by example - Teachers explain to students on their learning curves and courses they are currently enrolled in on the SWAYAM portal or Coursera.						
PSO1: Higher Studies:						
To ensure that students are acquainted with the fundamental chemical engineering principles and most recent advances in the chemical and allied fields, thereby enabling them to undertake higher studies or research and development activity.						
PSO1	**80-85%**	2018-19	2019-20	2020-21	2021-22	PSO1 attainment is successful.
		83.13	83.12	88.41	83.71	
Action 1: We have a good track record of students opting for higher studies (from 2020 onwards) as evidenced by Section 6.3. Trying to maintain the level and targeting for higher.						
PSO2: Employment:						
To impart the chemical engineering knowledge and industry-ready skills, thereby enabling them for a successful career in the chemical and allied industries as entrepreneurs and professionals.						
PSO2	**80-85%**	2018-19	2019-20	2020-21	2021-22	PSO2 attainment is successful.
		83.29	83.2	87.45	82.81	
Action 1: As a greater number of students opt for higher studies, a smaller number of students choose campus placement and jobs in general (Section 6.3). We are encouraging our students to take up jobs and serve the industry.						

Table B.6.1

Table 6.2: CO Attainment and Actions for improvement – 2018-2019, 2019-2020, 2020-2021

CourseCode	**CO**	**CO Attainment**			**Target**	**Comments**
		2018-2019	**2019-2020**	**2020-2021**		
BST1102	CO1	91.64	91.93	94.15	80-85	CO Attainment is satisfactory.

	CO2	87.4	87.11	96.63	80-85	
	CO3	88.06	89.17	95.13	80-85	
	CO4	83.24	81.43	98.23	80-85	
	CO5	89.74	87.2	98.23	80-85	
	CO6	87.55	84.51	96.23	80-85	
CEP1701	CO1	95.55	73.7	99.29	80-85	CO Attainment is not satisfactory in 2019-2020. This is a laboratory course. The CO Attainment in the year 2019-2020 was impacted by the COVID-19 pandemic. The laboratory courses were taken online in 2019-2020. The attainment is again back to better than expected in 2020-2021.
	CO2	95.63	77.23	98.84	80-85	
	CO3	95.55	82.16	99.34	80-85	
	CO4	95.39	77.23	99.12	80-85	
CEP1702	CO1	96.58	96.23	88.6	90-95	CO Attainment is satisfactory.
	CO2	97.12	96.46	90.38	90-95	
	CO3	97.12	96.46	90.38	90-95	
CEP1704	CO1	99.27	98.61	91.49	80-85	CO Attainment is satisfactory.
	CO2	99.55	98.6	89.69	80-85	
	CO3	99.55	98.6	89.69	80-85	
CEP1705	CO1	82.64	63.73	97.27	80-85	CO Attainment is not satisfactory in 2019-2020. This is a laboratory course. The CO attainment in the year 2019-2020 was impacted by the COVID-19 pandemic. The laboratory courses were taken online in 2019-2020. The attainment is again back to better than expected in 2020-2021.
	CO2	81.32	60.73	97.47	80-85	
	CO3	77.01	50.92	98.03	80-85	
CEP1706	CO1	94.47	62.75	95.91	80-85	CO Attainment is not satisfactory in 2019-2020. This is a laboratory course. The CO attainment in the year 2019-2020 was impacted by the COVID-19 pandemic. The laboratory courses were taken online in 2019-2020. The attainment is again back to better than expected in 2020-2021.
	CO2	95.71	70.17	96.63	80-85	
	CO3	96.03	72.45	96.81	80-85	
CEP1715	CO1	88.99	86.25	89.33	80-85	CO Attainment is satisfactory.
	CO2	93.1	86.25	93.17	80-85	
	CO3	87.26	85.27	89.33	80-85	
	CO4	88.36	86.25	88.78	80-85	
	CO5	89.68	86.83	89.33	80-85	
CEP1717	CO1	91.54	99.35	99.23	90-95	CO Attainment is satisfactory.
	CO2	96.08	98.19	99.06	90-95	
CET1101	CO1	73.69	64.29	65.22	60-65	CO Attainment is satisfactory. Based on the rigorous evaluation and expected outcomes from the students this CO attainment is set low.
	CO2	69.19	64.62	67.06	60-65	
	CO3	68.06	65.42	62.82	60-65	
	CO4	78.21	64.8	64.89	60-65	
	CO5	73.61	63.66	63.98	60-65	
	CO6	78.74	63.64	63.06	60-65	
CET1102	CO1	77.4	70.82	76.07	70-75	CO Attainment is not satisfactory. More numericals were included to understand the concepts and troubleshooting of various heat transfer equipment. Extra lectures were also organized for modern design software such as HTRI.
	CO2	74.13	66.54	67.57	70-75	
	CO3	74.23	67.03	67.79	70-75	
	CO4	72.63	64.83	63.69	70-75	
	CO5	74.13	66.54	67.57	70-75	
	CO6	71.47	62.11	60.92	70-75	
CET1201	CO1	80.95	93.61	83.53	80-85	CO Attainment is not satisfactory in 2018-2019. More emphasis was given to understanding the
	CO2	72.41	92.07	90.09	80-85	

	CO3	72.41	92.07	90.09	80-85	problem statement, problem-solving and thought-provoking problems resulted in better CO attainment in subsequent years.
	CO4	57.33	92.07	87.4	80-85	
	CO5	80.95	81.06	80.9	80-85	
CET1202	CO1	87.05	86.81	88.21	80-85	CO Attainment is satisfactory.
	CO2	87.91	84.25	86.9	80-85	
	CO3	93.43	80.34	86.76	80-85	
CET1203	CO1	74.32	76.55	79.3	75-80	CO Attainment is not satisfactory in 2018-2019. Industry problems were added to understand the design concepts. Lectures by eminent professors contributed to better CO attainment in subsequent years.
	CO2	73.82	76.56	76.2	75-80	
	CO3	74.15	76.07	78.94	75-80	
	CO4	73.93	76.56	76.82	75-80	
CET1301	CO1	78.13	69.56	78.13	75-80	CO Attainment is not satisfactory in 2019-2020. More emphasis put on understanding the problem at hand rather than directly jumping on solving the problem resulted in better CO attainment in the subsequent year.
	CO2	78.13	69.56	78.13	75-80	
	CO3	78.97	69.39	78.97	75-80	
	CO4	76.71	69.13	76.71	75-80	
	CO5	75.85	68.99	75.85	75-80	
	CO6	74.04	67.6	74.04	75-80	
CET1302	CO1	74.91	76.54	67.92	75-80	CO Attainment is not satisfactory in 2020-2021. Encouraged students for lateral thinking and group exercises for the various problems should result in better CO attainment in the next year.
	CO2	74.14	78.17	69.41	75-80	
	CO3	73.27	79.35	70.68	75-80	
	CO4	73.3	77.36	69.51	75-80	
	CO5	70.3	76.9	70.71	75-80	
CET1401	CO1	83.04	79.57	96.85	75-80	CO Attainment is satisfactory.
	CO2	83.76	81.65	97.16	75-80	
	CO3	85.11	80.52	96.85	75-80	
	CO4	88.5	87	94.61	75-80	
	CO5	86.79	86.62	93.07	75-80	
CET1402	CO1	84.23	97.76	89.59	80-85	CO Attainment is satisfactory.
	CO2	84.23	97.76	89.59	80-85	
	CO3	84.32	97.9	89.73	80-85	
	CO4	84.32	97.9	89.73	80-85	
	CO5	84.63	98.35	90.19	80-85	
	CO6	84.63	98.35	90.19	80-85	
CET1501	CO1	66.6	76.38	64.49	60-65	CO Attainment is satisfactory. Based on the rigorous evaluation and expected outcomes from the students this CO attainment is set low.
	CO2	66.9	71.42	63.58	60-65	
	CO3	67.83	68.73	63.04	60-65	
	CO4	67.98	73.8	63.14	60-65	
	CO5	67.58	75.2	65.38	60-65	
CET1502	CO1	74.68	74.31	80.05	75-80	CO Attainment is not satisfactory in 2018-2019 and 2019-2020. The students were given case studies to analyze the problems and find the appropriate solutions in the manufacturing sector resulting in better CO attainment in 2020-2021.
	CO2	70	73.17	78.59	75-80	
	CO3	72.27	72.11	81.13	75-80	
	CO4	70.76	68.52	87.32	75-80	
	CO5	73.62	71.07	84.21	75-80	
	CO6	71.94	68.52	87.47	75-80	
CET1503	CO1	83.97	79.74	98.36	75-80	CO Attainment is satisfactory.
	CO2	80.58	78.64	97.59	75-80	
	CO3	81.38	77.84	97.83	75-80	
	CO4	79.44	77.61	97.3	75-80	
	CO5	80.58	78.64	97.59	75-80	
	CO6	75.73	79.94	95.43	75-80	
CET1504	CO1	85.54	87.27	90.46	80-85	CO Attainment is satisfactory.
	CO2	84.89	87.56	90.2	80-85	

	CO3	85.15	87.11	91.04	80-85	
	CO4	85.22	87.63	91.04	80-85	
	CO5	84.67	87.11	89.26	80-85	
	CO6	85.28	88.71	91.98	80-85	
CET1505	CO1	92.19	61.1	97.64	80-85	CO Attainment is not satisfactory in 2019-2020. More emphasis was given to understanding the problem statement, practice problems, and the use of e-teaching platforms and flipped classrooms resulted in better CO attainment in the subsequent year.
	CO2	93.4	60.11	97.32	80-85	
	CO3	96.13	64.47	97.08	80-85	
	CO4	95.12	65.06	96.51	80-85	
	CO5	93.04	50.74	97.34	80-85	
	CO6	88.92	56.05	97.34	80-85	
CET1509	CO1	82.98	89.61	86.05	80-85	CO Attainment is satisfactory.
	CO2	82.28	90.68	81.4	80-85	
	CO3	85.02	90.6	81	80-85	
	CO4	84.88	90.96	82.42	80-85	
CET1515	CO1	87.86	88.52	81.69	80-85	CO Attainment is satisfactory.
	CO2	87.43	87.8	80.63	80-85	
	CO3	87.23	90.57	81.99	80-85	
CET1601	CO1	62.13	82.19	64.59	70-75	CO Attainment is not satisfactory in 2018-2019 and 2020-2021. Emphasis is given to the material failure analysis and mechanical failure of chemical process equipment to understand the root cause analysis. This should contribute positively to CO attainment in subsequent years.
	CO2	56.68	80.19	67.87	70-75	
	CO3	59.74	80.21	64.69	70-75	
	CO4	62.11	81.31	63.5	70-75	
	CO5	43.94	77.06	77.16	70-75	
	CO6	43.94	77.06	77.16	70-75	
CET1608	CO1	83.52	93.56	95.8	80-85	CO Attainment is satisfactory.
	CO2	84.86	95.66	97.57	80-85	
	CO3	84.88	95.98	98.23	80-85	
	CO4	87.75	97.75	99.06	80-85	
CET1703	CO1	72.36	70.95	82.86	75-80	CO Attainment is not satisfactory in 2018-2019 and 2019-2020. More real-world problems and assignments were given to the students on the design of multivariable control systems resulting in better CO attainment in 2020-2021.
	CO2	60.22	60.01	76.1	75-80	
	CO3	57.71	56.57	73.49	75-80	
	CO4	64.47	61.03	75.87	75-80	
	CO5	62	60.77	76.34	75-80	
CET1716	CO1	92.49	99	99.21	90-95	CO Attainment is satisfactory.
	CO2	91.21	98.92	99.13	90-95	
	CO3	91.56	99.29	96.47	90-95	
GEP1101	CO1	85.2	92.43	83.92	80-85	CO Attainment is satisfactory.
	CO2	85.2	92.43	81.67	80-85	
	CO3	85.83	92.97	81.07	80-85	
	CO4	85.83	92.97	87.59	80-85	
GEP1103	CO1	95.32	91.33	98.11	80-85	CO Attainment is satisfactory.
	CO2	94.81	91.3	98.22	80-85	
	CO3	95.32	91.33	98.11	80-85	
	CO4	95.25	91.28	97.8	80-85	
GEP1108	CO1	94.38	97.5	94.32	80-85	CO Attainment is satisfactory.
	CO2	87.05	97.5	93.3	80-85	
	CO3	91.29	97.5	84.33	80-85	
	CO4	91.29	97.5	92.03	80-85	
GEP1112	CO1	99.91	99.97	100	80-85	CO Attainment is satisfactory.
	CO2	99.77	100	100	80-85	
	CO3	99.88	100	100	80-85	

GET1102	CO1	81.75	78.39	95.91	75-80	CO Attainment is satisfactory.
	CO2	82.56	79.44	95.02	75-80	
	CO3	79.35	79.3	95	75-80	
	CO4	82.56	79.17	94.25	75-80	
	CO5	77.78	78.18	94.25	75-80	
	CO6	75.7	80	93.13	75-80	
GET1107	CO1	82.43	87.64	93.55	80-85	CO Attainment is satisfactory.
	CO2	83.13	86.76	92.72	80-85	
	CO3	79.83	88.3	96.11	80-85	
	CO4	83.36	88.02	94.68	80-85	
	CO5	81.54	87.04	92.73	80-85	
	CO6	79.4	100	96.28	80-85	
HUT1102	CO1	88.88	93.09	99.41	80-85	CO Attainment is satisfactory.
	CO2	87.91	94.8	99.33	80-85	
	CO3	88.88	95.13	99.68	80-85	
	CO4	88.88	95.13	99.68	80-85	
	CO5	90.24	95.36	99.28	80-85	
	CO6	87.2	95.61	99.19	80-85	
MAT1106	CO1	93.25	64.98	99.17	80-85	CO Attainment is not satisfactory in 2019-2020. More emphasis was given to understanding the design of the experiments, hands-on problem solving and assignments resulted in better CO attainment in the subsequent year.
	CO2	93.25	64.98	99.17	80-85	
	CO3	85.93	90.16	98.53	80-85	
	CO4	85.93	90.16	98.64	80-85	
	CO5	85.82	95.56	98.1	80-85	

Figure 6.1: Yearwise PO and PSO attainment levels

6.2. Academic Audit and actions taken thereof during the period of Assessment (10)

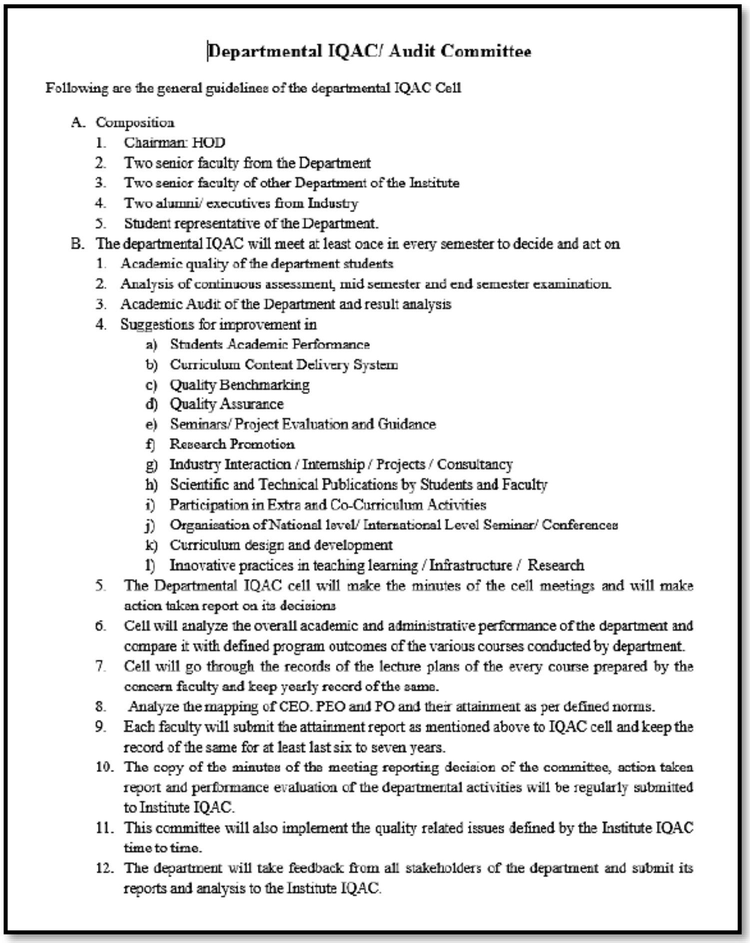
Institute Marks (10)

Institute of Chemical Technology has been funded by MHRD under Technical Education Quality Improvement Program (TEQIP). Under TEQIP, regular academic audits are conducted and the suggestions are incorporated into curriculum development and delivery. The indirect academic audit is conducted with the help of industry experts who visit as an examiner for undergraduate projects, Masters' degree open defense, and Ph.D. degree open defense.

The Institute has an Internal Quality Assurance Cell which audits the Academic and Research activities of the Institute. The quality of teaching is judged through feedback from the graduating class and it is fully taken into account for changes, if any, in academic and other activities. The format for the Academic Audit, audit committee guidelines and the Minutes of Meeting and approval of the Audit Committee are as follows:

	Format for Internal / External Auditor	
	(1) Auditors to go through the information in self-assessment PBAS form,	
	(2) Verify the facts and collect evidence on different parameters in self-assessment forms	
	(3) Based on collected information, make a judgement and evaluate each parameter below	
	Evaluate Each Parameter on a scale of	
	0 (Poor or Very low) to 5 (Excellent or Very High)	
	Academic Aspects – Teaching and Learning	
1	Syllabus Related: last revision, new courses added, methodology of revision	
2	Adequacy of weightage to Basic Sciences, Core courses, Electives, Humanities, etc. in the syllabus	
3	Extent of Coverage of Prescribed Syllabus and Lectures taken	
4	The extent to which the teaching – learning process is oriented towards Course Outcomes	
5	Quality and Extent of Continuous Assessment, mid and End Semester Examination	
6	The extent to which the Evaluation Process is geared towards Assessing Attainment of Course Outcomes	
7	Degree to which Program Objectives are met	
8	Availability and adequacy of learning Resources, such as library, laboratory experiments, etc.	
9	Steps taken for improvement of weak students, and Student support system	
	Academic Aspects – Research	
1	Involvement of faculty members in Research and Development	
2	Outcome of Research in terms of papers, patents, technology Transfer, etc.	
3	Generation of Human Resource PGs and Ph. D.s	
4	Revenue generation through Research Projects	
5	Quality and adequacy of Research and Development facilities, such as Instruments and facilities	
	Academic Aspects – Consultancy and Extension	
1	Involvement of faculty members in Consultancy and Extension	
2	Outcome of Consultancy Projects in terms of Technology developed,	
3	Revenue generation through Research Projects	
4	Industry – Institute Interaction	
5	Society – Institute Interaction	
6	Participation in National and International bodies and committees	
7	Training Programs, workshops, conference conducted for Industry, other Institutes, etc.	
	Administrative Aspects	
1	Functioning of Committees in the Department	
2	Level of Administrative and Financial Support in the Department	
3	Involvement of stake-holders in the Departmental Decision Making	
4	Frequency of Departmental Faculty and Support staff meetings	
5	Mechanism of Addressing issues and grievances	
6	Cleanliness, Maintenance and upkeep of infrastructure within the Department	
	Other Comments, Observations and Remarks of Auditor / Teacher	

Figure 6.2: Format for Internal Audit



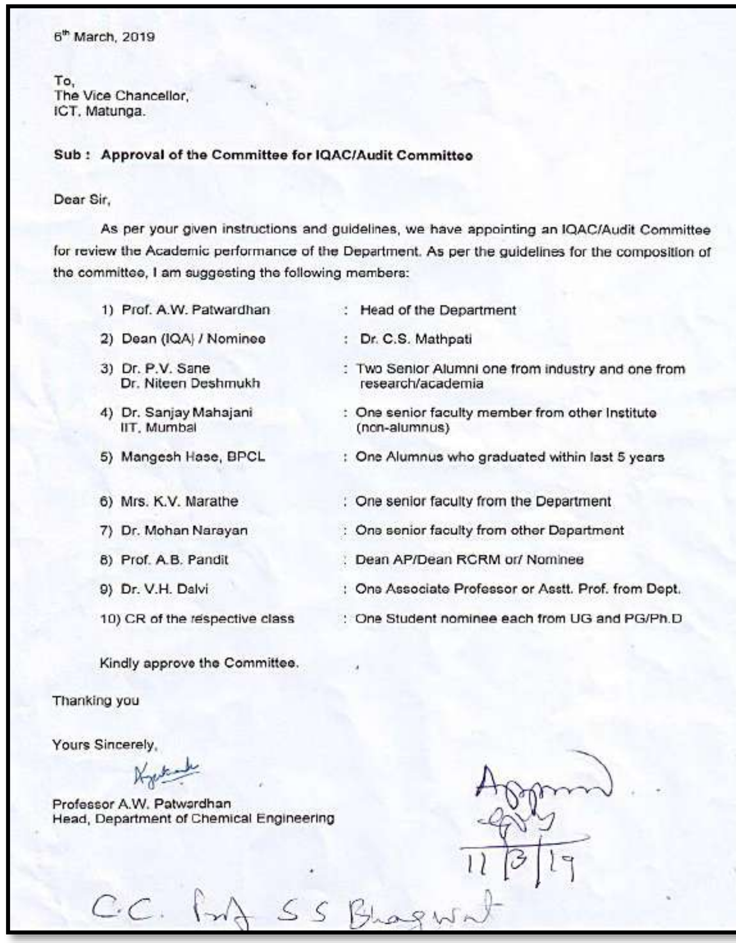
Departmental IQAC/ Audit Committee

Following are the general guidelines of the departmental IQAC Cell

A. Composition
1. Chairman: HOD
2. Two senior faculty from the Department
3. Two senior faculty of other Department of the Institute
4. Two alumni/ executives from Industry
5. Student representative of the Department.

B. The departmental IQAC will meet at least once in every semester to decide and act on
1. Academic quality of the department students
2. Analysis of continuous assessment, mid semester and end semester examination.
3. Academic Audit of the Department and result analysis
4. Suggestions for improvement in
   a) Students Academic Performance
   b) Curriculum Content Delivery System
   c) Quality Benchmarking
   d) Quality Assurance
   e) Seminars/ Project Evaluation and Guidance
   f) Research Promotion
   g) Industry Interaction / Internship / Projects / Consultancy
   h) Scientific and Technical Publications by Students and Faculty
   i) Participation in Extra and Co-Curriculum Activities
   j) Organisation of National level/ International Level Seminar/ Conferences
   k) Curriculum design and development
   l) Innovative practices in teaching learning / Infrastructure / Research
5. The Departmental IQAC cell will make the minutes of the cell meetings and will make action taken report on its decisions
6. Cell will analyze the overall academic and administrative performance of the department and compare it with defined program outcomes of the various courses conducted by department.
7. Cell will go through the records of the lecture plans of the every course prepared by the concern faculty and keep yearly record of the same.
8. Analyze the mapping of CEO. PEO and PO and their attainment as per defined norms.
9. Each faculty will submit the attainment report as mentioned above to IQAC cell and keep the record of the same for at least last six to seven years.
10. The copy of the minutes of the meeting reporting decision of the committee, action taken report and performance evaluation of the departmental activities will be regularly submitted to Institute IQAC.
11. This committee will also implement the quality related issues defined by the Institute IQAC time to time.
12. The department will take feedback from all stakeholders of the department and submit its reports and analysis to the Institute IQAC.

Figure 6.3a: Departmental IQAC Guidelines



6th March, 2019

To,
The Vice Chancellor,
ICT, Matunga.

Sub : Approval of the Committee for IQAC/Audit Committee

Dear Sir,

As per your given instructions and guidelines, we have appointing an IQAC/Audit Committee for review the Academic performance of the Department. As per the guidelines for the composition of the committee, I am suggesting the following members:

1) Prof. A.W. Patwardhan	:	Head of the Department
2) Dean (IQA) / Nominee	:	Dr. C.S. Mathpati
3) Dr. P.V. Sane Dr. Niteen Deshmukh	:	Two Senior Alumni one from industry and one from research/academia
4) Dr. Sanjay Mahajani IIT, Mumbai	:	One senior faculty member from other Institute (non-alumnus)
5) Mangesh Hase, BPCL	:	One Alumnus who graduated within last 5 years
6) Mrs. K.V. Marathe	:	One senior faculty from the Department
7) Dr. Mohan Narayan	:	One senior faculty from other Department
8) Prof. A.B. Pandit	:	Dean AP/Dean RCRM or/ Nominee
9) Dr. V.H. Dalvi	:	One Associate Professor or Asstt. Prof. from Dept.
10) CR of the respective class	:	One Student nominee each from UG and PG/Ph.D

Kindly approve the Committee.

Thanking you

Yours Sincerely,

Professor A.W. Patwardhan
Head, Department of Chemical Engineering

Approved
11/3/19

C.C. Prof S S Bhagwat

Figure 6.3b: Approval of Committee for IQAC

6.3. Improvement in Placement, Higher Studies and Entrepreneurship (15)

Institute Marks (15)

Our placement record is steady year over year, and the number of students getting placed or going for higher studies is almost the number of students completing their studies (Figure 6.4). Also, as can be seen in Figure 6.5, the average and minimum salaries received by the students through campus placement have also increased throughout the years. Even during the ongoing COVID-19 pandemic when companies really weren't looking to recruit new candidates our placement records are excellent and we still managed to place almost every student. Further, the average salaries are also consistently growing year-over-year. This is a testament to our outstanding Bachelor of Chemical Engineering program that the companies are always looking to hire our students even in this period of crisis.

Table 6.3: Placement records

Item	CAY (2021-22)	CAYm1 (2020-21)	CAY*m2* (2019-20)	CAY*m3* (2018-19)
Total No. of Final Year Students (N)	80	80	75	80
No. of students placed in companies or Government Sector (x)	36	44	50	37
No. of students admitted to higher studies with valid qualifying scores (GATE or equivalent State or National Level Tests, GRE, GMAT etc.) (y)	41	29	21	38

No. of students turned entrepreneur in engineering/technology (z)	0	0	1	0
x + y + z =	77	73	72	75
Placement Index: (x + y + z)/N	0.9625	0.9125	0.96	0.9375

Table B.3.5

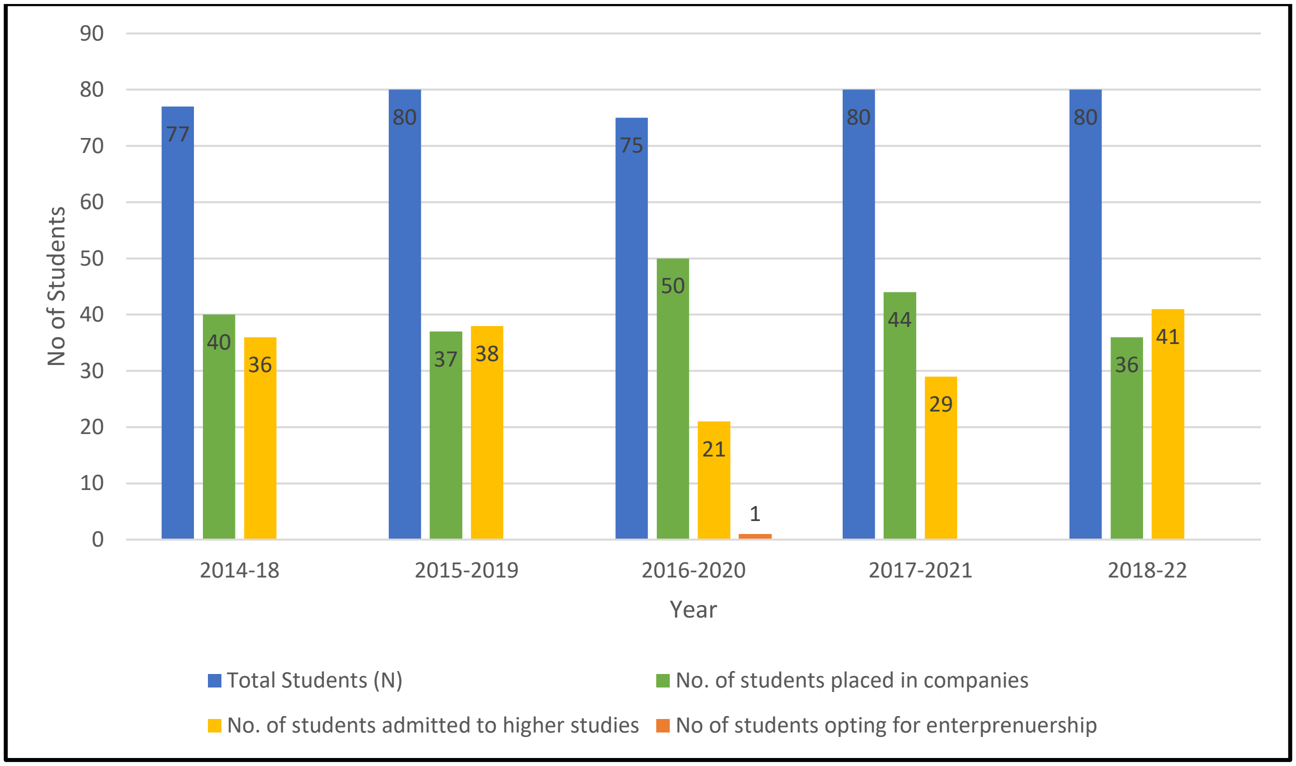


Figure 6.4: Placement records

Table 6.4: Improvement in placement packages being offered

CTC in lakhs	2018-19	2019-20	2020-21	2021-22
Median	6.5	6.5	8	8
Average	7.03	7.09	8.22	9.2
Minimum	2.4	6.5	4.25	8
Maximum	17	10	16	11.5

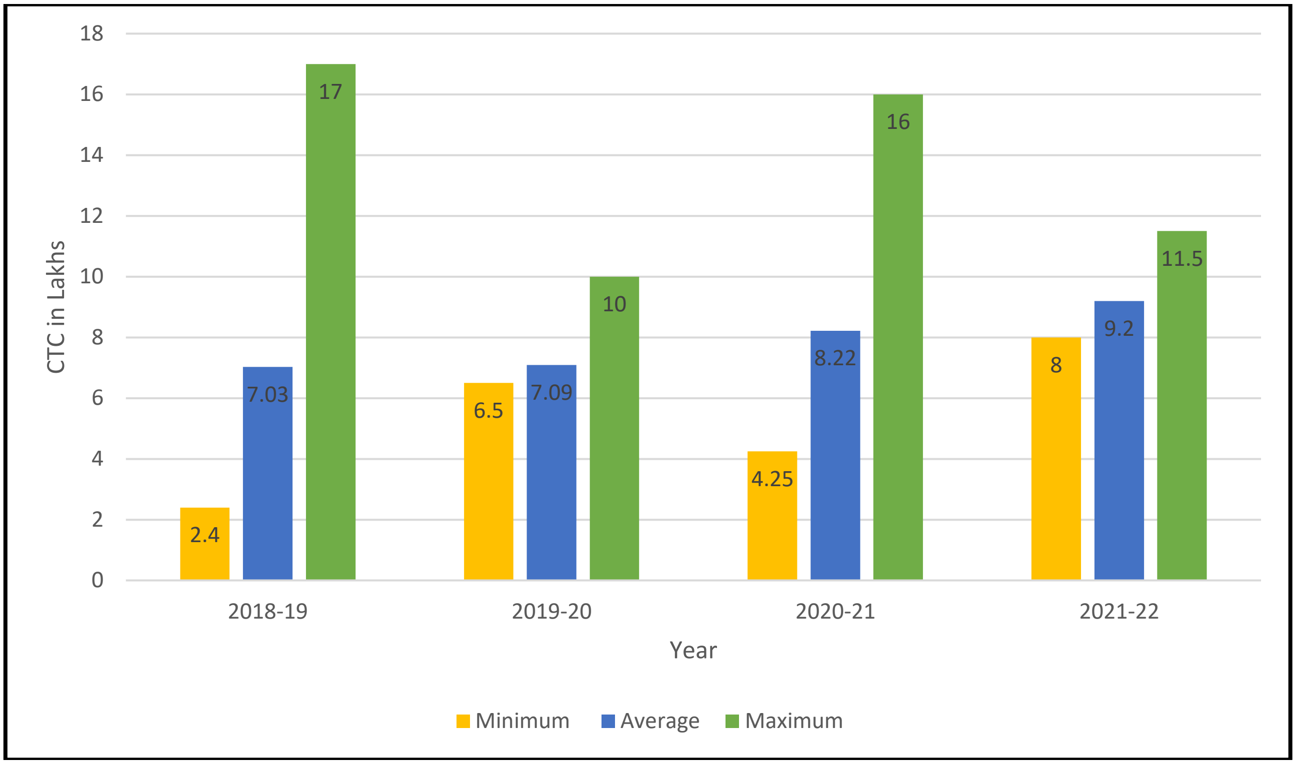


Figure 6.5: Improvement in placement packages being offered

6.4. Improvement in the quality of students admitted to the program (10) Institute Marks (10)

As mentioned earlier in section 6.3, better quality students get attracted to our engineering programs. One of the reasons students choose our Bachelor of Chemical Engineering program is because of our exemplary placement record and higher study opportunities for the students. The students prefer ICT and our Bachelor of Chemical Engineering program because of the higher chance of getting the placement. An improvement in the physics, chemistry, and mathematics scores can be seen for our admitted students in Figure 6.6. Additionally, our faculty deliver lectures nationally and internationally in various institutions/conferences/seminars where they promote the institute and its offered courses that help attract better-quality students. The institute now has a media cell that regularly promotes ICT as a brand and its programs through social media options such as Facebook, Twitter, etc. All of this has propelled our Bachelor of Chemical Engineering program to the regions far and wide in the country.

Table 6.5: Improvement in the quality of students admitted

Item		**CAY (2021 -22)**	**CAYm1 (2020 – 21)**	**CAYm2 (2019 – 20)**
National Level Entrance Examination (JEE Mains I)	**No. of Students admitted**	23	23	23
	Opening Score/Rank	99.019/188	98.617/128	99.522/113
	Closing Score/Rank	96.976/975	96.520/764	98.677/568
State/Institute/Level Entrance Examination/Others (MHT CET)	**No. of Students admitted**	52	52	52
	Opening Score/Rank	99.889/122	100/16	99.977/49
	Closing Score/Rank	98.899/1497	99.233/1041	99.527/909

Name of the Entrance Examination for Lateral Entry or lateral entry details	**No. of Students admitted**	0	0	0
	Opening Score/Rank	NA	NA	NA
	Closing Score/Rank	NA	NA	NA
Average CBSE/Any other Board Result of admitted students	**Physics %**	89.89	84.48	80.07
	Chemistry %	90.05	80.17	78.76
	Mathematics%	91.59	90.33	88.00

Table B.6.4

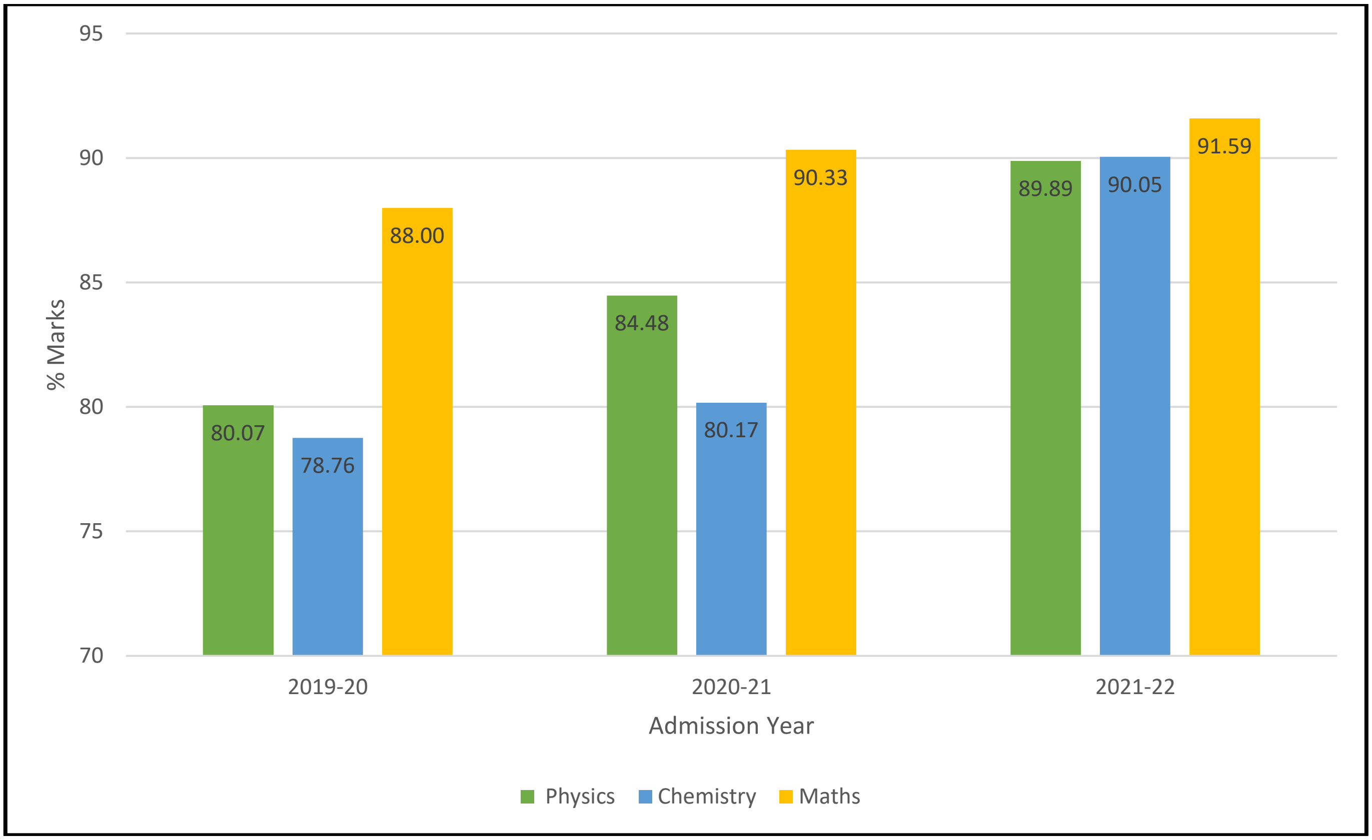


Figure 6.6: Quality of students admitted

6.5. Remedial action taken on the observations made during last accreditation visit/New initiatives taken/New Facilities Introduced/Improvement made after last visit. (10)

Institute Marks (10)

Table 6.6: Remedial action taken on the observations made during the last accreditation visit

Comment	Resolution
Lab safety concerns	Lab safety training for the staff is provided regularly (Figure 6.7).
	Lab safety posters installed. Installed fire-exit signs/maps at relevant places (Figure 6.8).
	Created safety manual along with regular safety training. Signed MOU with Sion hospital for emergency (Figure 6.9).
	Lab safety equipment like showers, eyewash, and first aid installed (Figure 6.8).
	Operation training provided for fire extinguishers, and chemical fume hoods maintained for safety.

Lack of Start-up/ Entrepreneurship program	Entrepreneurship course introduced as an elective (CET1604) for the final year students. (Basic course in Entrepreneurship and Advanced course in Entrepreneurship).
	Introduced innovation & start-up policy for paving the way for Entrepreneurship (Figure 6.11).
	Introduced S. M. Mokashi Incubation Center ICT-NICE to invite ideas for Pre-incubation in the areas of Chemical Technology, Pharmaceutical Technology, Biotechnology, and Allied Technologies including Education Technology (Figure 6.11).
	Introduced Tinkerers Lab to empower budding engineers to pursue their creative and innovative ideas (Figure 6.11).
Industrial Training	Students go for a compulsory industrial internship after completing their third year of engineering. This industrial internship is a part of their syllabus offered for 6 credits (Table 6.7).
	An option is provided for the students to go for industrial training after completing their second year of engineering (during the summer break).
	Regular industrial visits are provided to the students (Figure 6.13).
Academic Audit, Faculty improvement	Regular academic audits are conducted and the suggestions are incorporated into curriculum development and delivery (Figure 6.2).
	Indirect audits are conducted with the help of industry experts who visit as an examiner for undergraduate projects.
	The Institute has an Internal Quality Assurance Cell which audits the Academic and Research activities of the Institute (Figure 6.3a and 6.3b).
	The quality of teaching is judged through feedback from the graduating class and it is fully taken into account for changes.
	Young and mid-career faculties are regularly sent for faculty development programs as a part of their pedagogical improvement.
	Faculties are encouraged to take MOOC courses on SWAYAM, NPTEL, ATAL, and various other platforms.
	Young faculties are involved in curriculum design, accreditation, laboratory, purchase, scholarship, examination, and admission for their overall development.
	Being an elite institute, ICT has excellent research and industrial outreach. Every faculty in the department is striving to establish new research areas. The publication record is constantly improving year over year which itself is a measure of faculty improvement.
Process of PO and PSO evaluation is not clear	The POs and PSOs are mapped and evaluated correctly through direct and indirect assessment to eliminate the previous shortcomings. The process of PO and PSO evaluation is thoroughly explained in Criteria 1 (Section 1.6).
Process of feedback from all the stakeholders and the data analysis is not presented.	The feedback is taken from the following stakeholders: alumni, students, and employers. The questions asked to these stakeholders are mapped to the POs and PSOs for evaluation through indirect assessment. Further, the data analysis is presented in Criteria 1 (Section 1.6 – Figures 1.5, 1.6, 1.7, 1.8, 1.9, 1.10 and 1.11).
One to one relation exists but there must be composite relation between COs and POs	The COs are mapped with the POs and PSO for each subject and is presented in Criteria 1 to address this concern (Table 1.2 and 1.3).
Assessment questions need reworking	The indirect assessment questions asked to alumni, students, and employers are based on the predefined POs and department-defined

	PSOs. The questions are thoughtfully formulated as can be seen in Criteria 1 before asking the stakeholders (Figures 1.5, 1.6, and 1.7).
Complete Assessment process may further be improved	A complete overhaul of the assessment process has been carried out and performed through modern tools of assessment such as coding and programming. The assessment process can be referred to at the time of the NBA expert visit.
Information in the website is not adequate	The institute (and department) website is now updated regularly with adequate information.

Figure 6.7: Safety training and demonstrations

Figure 6.8: Improvement related to Safety


INSTITUTE OF CHEMICAL TECHNOLOGY

10th January, 2020

To whomsoever it may concern

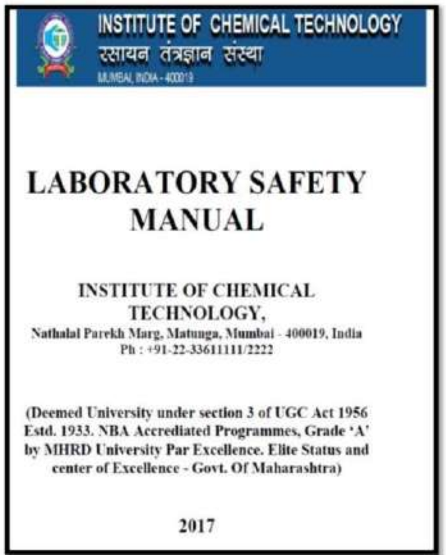
This is to state that:

Lokmanya Tilak Municipal General Hospital (LTMGH) locally known as "Sion Hospital", is a general municipal hospital situated at Sion, Mumbai, Maharashtra 400022.

Lokmanya Tilak Municipal General Hospital will provide medical emergency to faculty, support staff, their families and students of Institute of Chemical Technology at Nathalal Parekh Marg, Matunga, Mumbai 400019, on priority.

Professor Aniruddha B Pandit
Vice Chancellor
Institute of Chemical Technology

Dr. Mohan A Joshi
Dean
Lokmanya Tilak Municipal General Hospital


INSTITUTE OF CHEMICAL TECHNOLOGY
रसायन तंत्रज्ञान संस्था
MUMBAI, INDIA - 400019

LABORATORY SAFETY MANUAL

INSTITUTE OF CHEMICAL TECHNOLOGY,
Nathalal Parekh Marg, Matunga, Mumbai - 400019, India
Ph : +91-22-33611111/2222

(Deemed University under section 3 of UGC Act 1956 Estd. 1933. NBA Accredited Programmes, Grade 'A' by MHRD University Par Excellence. Elite Status and center of Excellence - Govt. Of Maharashtra)

2017


Institute of Chemical Technology, Mumbai

Safety Week- 5th to 8th March 2019

Program Schedule

DATE	TIME	PROGRAM
5th March	10:00 AM	Inauguration of the Safety week (CE Conf. Room)
	11:00 AM	Lecture by Mr. V. R. Marathe on "Safety from R&D to Process" (CE Conf. Room)
	03:00 PM	Lecture by Dr. Swayajith Sahadevan on "Chemical Safety Management in R&D Laboratories" (KV Auditorium)
6th March	10:00 AM	Quiz Competition on Safety (KV Auditorium)
	03:00 PM	Lecture by Dr. P. T. Gadekar on "Safety in Paints and Pigment Industries" (CE Conference Room)
	04:30 PM	Lecture by Nilesh Vani on "Safety in Paints and Pigment Industries" (CE Conference Room)
7th March	10:00 AM	Broadcast of Safety Videos
	04:00 PM	Exhibition on Safety and Fire Extinguisher demonstration
8th March	03:00 PM	Lecture by C. J. Iyer on "Safety in Refineries" (H-104 / CE Conference Room)
	04:30 PM	Vote of Thanks (H-104)

SAFETY FIRST

Figure 6.9: Safety manuals, medical emergency and safety programs

Figure 6.10: Improvement related to space

Figure 6.11: Entrepreneurship Activities

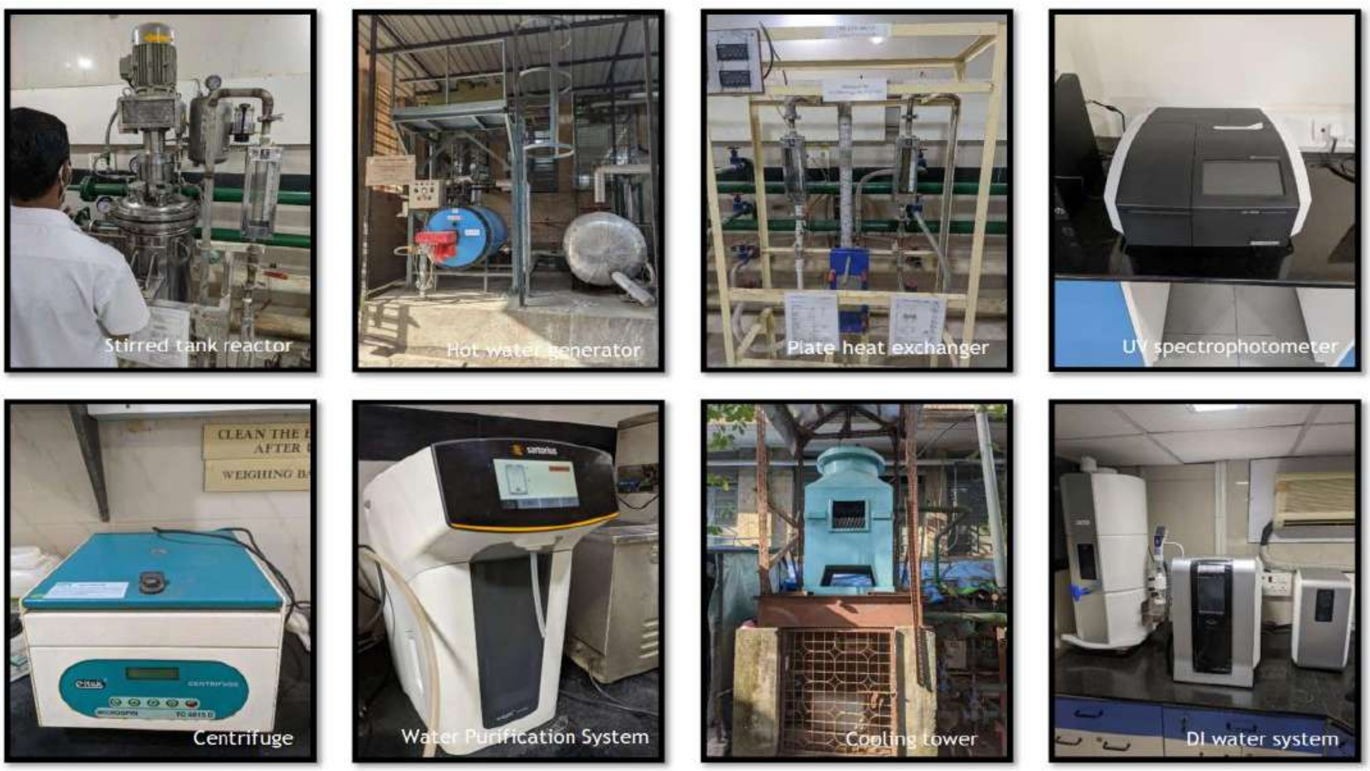


Figure 6.12a: Improvement in Lab facilities

Figure 6.12b: Upgradation of Lab facility

Figure 6.12c: New facilities created

Figure 6.13: Industrial Visit at BPCL

Table 6.7: List of students completing In-plant training 2021-22

Sr. No.	Name of the student	Roll Number	Company
1	Aayush Bhat	19CHE101	Lanxess
2	Shivani Manhas	19CHE102	RCF ltd
3	Sagar Vivek Mudaliar	19CHE103	Reliance Industries Ltd
4	Aquil Abdulhamid Attar	19CHE104	Reliance
5	Parth Thakkar	19CHE105	BASF
6	Pranay Shah	19CHE106	BASF
7	Parth Patel	19CHE108	AMI Lifesciences Ltd
8	Sahil Birwatkar	19CHE111	Aarti Industries
9	Tanish Agrawal	19CHE112	Jubilant Ingrevia
10	Anant Prasanna Sohale	19CHE113	Eternis
11	Prithvi Dake	19CHE114	Tridiagonal Solutions Ltd
12	Adwait Joshi	19CHE115	Tridiagonal Solutions Ltd
13	Jay Piyushbhai Thakkar	19CHE116	Kiri Industries ltd
14	Aditi Sachin Patil	19CHE117	RCF ltd
15	Dhruv Gohil	19CHE118	Fairmate
16	Sudarshan Shreenivas	19CHE119	Jayant Agro
17	Shaikh Mohd Shoeb Sher Ali	19CHE120	Reliance
18	Hrishabh Singh	19CHE121	Deccan Fine Chemicals Ltd.
19	Nimish Vaidya	19CHE122	Beetachem Industries
20	Harsh Upadhyay	19CHE123	Thyssenkrupp Industrial Solutions
21	Pankti Paresh Savla	19CHE124	Jayant Agro
22	Gargee Yadav	19CHE125	Akry Organics
23	Vivin Sibi	19CHE126	Piramal - Ennore

24	Abhishek Shashikant Kulkarni	19CHE127	Tridiagonal Solutions Ltd
25	Uma Rajesh Tulsiani	19CHE128	Rubamin Pvt Ltd
26	Shrivatsa Korde	19CHE129	Tridiagonal Solutions Ltd
27	Amoghraj Prabhu S S	19CHE130	Gmm Pfaudler
28	Aditya Agarwal	19CHE131	Sudarshan Chemicals
29	Darshil Jain	19CHE132	Aarti Inds
30	Saloni Vaidya	19CHE133	Atul Ltd
31	Siddharth Nitin Shah	19CHE134	Jayant Agro
32	Vyankatesh Shyam Tarkase	19CHE135	Gharda Chemicals
33	Akshat Jain	19CHE136	Lanxess
34	Animesh Chaturvedi	19CHE137	Gharda Chemicals (Absent)
35	Vikram Vinayak Shanbhag	19CHE138	Tridiagonal Solutions
36	Prathamesh Patil	19CHE139	Atul ltd
37	Sahil Unmesh Patil	19CHE140	Harman Finochem ltd
38	Makrand Tanaji Barge	19CHE141	Piramal Thane
39	Ria Gada	19CHE142	JB Pharmaceuticals Pvt Ltd
40	Vignesh Krishnan	19CHE143	Solara
41	Sanskar Shridhar Tanvidkar	19CHE144	Excel
42	Parikshit Subhash Kadu	19CHE145	Lanxess
43	Vinod Mamraj Rathod	19CHE146	Lanxess
44	Utkarsh Pravin Patil	19CHE147	Reliance
45	Abhijeet Agatrao Tarange	19CHE148	Laxmi Organics
46	Gouresh Vinay Gargate	19CHE149	Piramal Thane
47	Snehal Bhosale	19CHE150	Vanita Agrochem pvt ltd
48	Vaibhav Khapekar	19CHE151	Eternis
49	Umesh Jaiswal	19CHE152	Shell
50	Vashishth Purohit	19CHE153	Jubilant ingrevia
51	Akanksha Warade	19CHE154	Biocon
52	Aditya Sangave	19CHE155	Eternis
53	Sanmesh Pravin Kharade	19CHE156	Jubilant ingrevia
54	Priyanshu Singh	19CHE157	Deccan Fine Chemicals Ltd.
55	Prehas Madke	19CHE158	Eternis
56	Falguni Akulwar	19CHE159	Jubilant ingrevia
57	Shivraj Chandrakant Gove	19CHE160	Lanxess
58	Vaidehi Padamwar	19CHE161	Jubilant ingrevia
59	Bhushan Murjani	19CHE162	Piramal Thane
60	Suraj Kekane	19CHE163	Solara
61	Shyam Gandhi	19CHE164	Reliance
62	Dhaval Chaudhari	19CHE165	UPL
63	Nikita Mohta	19CHE166	Akry Organics
64	Soham Mamidwar	19CHE167	Aarti inds
65	Atharv Prasad Kulkarni	19CHE168	Tridiagonal Solutions Ltd
66	Rutuja Pingale	19CHE169	Gharda Chemicals, Lote
67	Akshayaa Jagtap	19CHE170	Exxon Mobil
68	Priya Katkar	19CHE171	Gharda Chemicals, Lote
69	Harsh Mohane	19CHE172	Aarti Inds
70	Ashish Bhave	19CHE174	Tridiagonal Solutions Ltd
71	Sahil Sabne	19CHE175	Deepak Nitrite - Baroda

72	Manasi Bansod	19CHE176	Biocon
73	Amogh Subhash Gaikwad	19CHE178	Gharda Chemicals, Dombivli
74	Janhavi Sunil Waghachoude	19CHE179	Aarti Industries, Vapi
75	Ruchita Baban Laswante	19CHE180	Aarti Industries, Vapi
76	Rakhi Narnaware	19CHE181	Gharda Chemicals, lote
77	Sushant Hemant Moule	19CHE182	Aarti inds
78	Onkar Rajendra Salavi	19CHE185	Excel
79	Vinay Sharma	19CHE186	Deepak Nitrite - Baroda
80	Amit Dinesh Yadav	19CHE187	UPL
81	Yashvir Koul	19CHE188	Aarti Industries
82	Sakshi Pandit Patil	19CHE189	Gharda Chemicals, Lote
83	Prasanna Gangawane	19CHE190	Harman Finochem Ltd
84	Abhigyan Ray	17CHE103	Piramal Thane
85	Siddhesh Borole	18CHE151	Laxmi Organics
86	Kalyan Hanumant Mali	18CHE179	UPL

Declaration

The head of the institution needs to make a declaration as per the format given below:

I undertake that, the institution is well aware about the provisions in the NBA's accreditation manual concerned for this application, rules, regulations, notifications and NBA expert visit guidelines in force as on date and the institute shall fully abide by them.

It is submitted that information provided in this Self-Assessment Report is factually correct. I understand and agree that an appropriate disciplinary action against the Institute will be initiatedby the NBA in case any false statement/information is observed during pre-visit, visit, post visit and subsequent to grant of accreditation.

Date: 06/06/2022

Place: Mumbai

Signature

Head of the Institution with seal

VICE CHANCELLOR
Institute of Chemical Technology
(University under Section-3 of UGC ACT OF 1956)
N. P. Marg, Matunga, Mumbai - 400 019.

06/06/2022

ANNEXURE I (A) PROGRAM OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

(B) PROGRAM SPECIFIC OUTCOMES (PSOs)

1. **Higher Studies**: To ensure that students are acquainted with the fundamental chemical engineering principles and most recent advances in the chemical and allied fields, thereby enabling them to undertake higher studies or research and development activity.
2. **Employment**: To impart the chemical engineering knowledge and industry-ready skills, thereby enabling them for a successful career in the chemical and allied industries as entrepreneurs and professionals.

INSTITUTE OF CHEMICAL TECHNOLOGY

Bachelor of Chemical Engineering

(B. Chem. Engg.) Syllabus

(2021 – 2022)

The revised syllabus comes into effect for first year Bachelor of Chemical Engineering students from the academic year, July 2021.

Preamble

The B. Chem. Engg. Course of ICT is highly sought after. The Department has been in existence from inception in 1934. The Syllabus is upgraded and revised from time to time to reflect the current needs and demands of society and technology. The last revision had come into effect from Academic year 2015. As per AICTE mandate, the revision was undertaken in December 2020 and this revised syllabus will come into effect from Academic year 2020-2021. The syllabus has been revised in the framework of Outcome based Education. For each course, course outcomes are defined. The course outcomes are related to program outcomes. The syllabus is consistent with the AICTE model curriculum in terms of weightages of different components: Basic Science, Other Engineering disciplines, Core Engineering, Humanities, Electives, Projects, etc.

A syllabus committee was formed within the Department. The committee sought feedback from the alumni, industrial experts, Academicians from other academic Institutes. This feedback was compiled. Discussions were held with other Departmental faculty from Physics, Chemistry, Mathematics, General Engineering, Management experts, etc. Taking into considerations the feedback and discussions the revision has been made. The revised syllabus proposes alternatives to some of the humanities courses which the students can be taken from MOOCs. A provision is also made for an "Open Elective", which the student can choose from MOOC. The "Open Elective" will be a course which student can take from reputed MOOCs and can be from any discipline, Engineering and Technology, Humanities, Arts, etc. It offers freedom to students to choose a subject of their liking. These changes have been proposed to make the syllabus according to the UGC, AICTE and NEP Guidelines, to give freedom to students, to make the learning more holistic and to encourage students to take subjects from Platforms like Swayam and NPTEL.

INSTITUTE OF CHEMICAL TECHNOLOGY

Degree of Bachelor of Chemical Engineering (B. Chem. Engg.) Syllabus

Syllabus Structure for B. Chemical Engineering Course

Semester – I

No	Subjects	Credits	Hrs/Week			Marks for various Exams			
			L	T	P	C. A.	M.S.	E. S.	Total
CHT 1131	Organic Chemistry-I	4	3	1	0	20	30	50	100
CHT 1211	Analytical Chemistry	3	2	1	0	10	15	25	50
MAT 1101	Applied Mathematics-I	4	3	1	0	20	30	50	100
PYT 1101	Applied Physics – I	4	3	1	0	20	30	50	100
GEP 1101	Engineering Graphics-I	4	2	0	6	50	---	50	100
PYP 1102	Physics Laboratory	2	0	0	4	25	---	25	50
CHP 1132	Organic Chemistry Laboratory	2	0	0	4	25	---	25	50
	TOTAL:	23	13	4	14				550

SEMESTER – II

No.	Subjects	Credits	Hrs/week			Marks for various Exams			
			L	T	P	C. A.	M. S.	E. S.	Total
CHT 1231	Organic Chemistry-II	4	3	1	0	20	30	50	100
CHT 1341	Physical Chemistry	3	2	1	0	10	15	25	50
CET 1501	Material & Energy Balance Calculations	4	3	1	0	20	30	50	100
MAT 1102	Applied Mathematics-II	4	3	1	0	20	30	50	100
PYT 1103	Applied Physics – II	3	2	1	0	10	15	25	50
CHP 1342	Physical & Analytical Chemistry Lab.	2	0	0	4	25	---	25	50
HUP 1101	Communication Skills	2	0	0	4	50	---	---	50
	Total	22	13	5	8				500

SEMESTER – III

No.	Subjects	Credits	Hrs /week			Marks for various Exams			
			L	T	P	C. A.	M. S.	E. S.	Total
CET 1301	Chem. Eng. Thermodynamics-I	4	3	1	0	20	30	50	100
CET 1105	Momentum Transfer	4	3	1	0	20	30	50	100
GET 1102	Structural Mechanics	3	2	1	0	10	15	25	50
GET 1109	Electrical Engineering and Electronics	3	2	1	0	10	15	25	50
CET 1502	Industrial & Engineering Chemistry	4	3	1	0	20	30	50	100
GEP 1103	Structural Mechanics Lab.	2	0	0	4	25	---	25	50
GEP 1110	Electrical Engg and Electronics Laboratory	2	0	0	4	25	---	25	50
CEP 1715	Engineering Applications of Computers	2	0	0	4	25	---	25	50
	Total	24	13	5	12				550

SEMESTER – IV

No.	Subjects	Credits	Hrs/week			Marks for various Exams			
			L	T	P	C. A.	M. S.	E. S.	Total
GET 1107	Energy Engineering	4	3	1	0	20	30	50	100
BST 1102	Introduction to Biological Sci.	4	3	1	0	20	30	50	100
CET 1401	Chemical Engineering Operations	4	2	2	0	20	30	50	100
CET 1302	Chem. Eng. Thermodynamics-II	4	3	1	0	20	30	50	100
GEP 1108	Engineering Graphics -II	2	0	0	4	25	---	25	50
BSP 1103	Biological Sciences Laboratory	2	0	0	4	25	--	25	50
CEP 1701	Chemical Engineering Laboratory-I	3	0	0	6	50	---	50	100
	Total	23	11	5	14				600

SEMESTER – V									
No.	**Subjects**	**Credits**	**Hrs /week**			**Marks for various Exams**			
			L	**T**	**P**	**C. A.**	**M. S.**	**E. S.**	**Total**
CET 1716	Mathematical Methods in Chem. Engg.	4	3	1	0	20	30	50	100
CET 1102	Heat Transfer	4	2	2	0	20	30	50	100
CET 1201	Chemical Reaction Engineering	4	2	2	0	20	30	50	100
CET 1402	Separation Processes	4	2	2	0	20	30	50	100
CET 1202	Biochemical Engineering	3	2	1	0	10	15	25	50
CEP 1704	Chemical Engineering Laboratory-II	3	0	0	6	50	---	50	100
CEP 1702	Process Simulation Lab – I	2	0	0	4	25	---	25	50
	Total	24	11	8	10				600

SEMESTER – VI									
No.	**Subjects**	**Credits**	**Hrs/week**			**Marks for various Exams**			
			L	**T**	**P**	**C. A.**	**M. S.**	**E. S.**	**Total**
CET 1601	Material Science and Engineering	3	2	1	0	10	15	25	50
CET 1203	Multiphase Reaction Engineering	3	2	1	0	10	15	25	50
CET 1503	Process Safety and Environmental Engg	4	2	2	0	20	30	50	100
CET 1703	Chemical Process Control	4	3	1	0	20	30	50	100
	Institute Elective – I	3	2	1	0	10	15	25	50
CEP 1706	Chem. Eng. Laboratory-III	3	0	0	6	50	---	50	100
CEP 1705	Process Simulation Lab – II	2	0	0	4	25	---	25	50
GEP 1XXX	Equipment Design and Drawing	4	2	0	4	25	---	25	50
	Total	26	13	6	14				550

CEP 1710 Internship

- After the end of the sixth semester examination and before the start of the seventh semester, every student will have to undergo an internship. The Internship would be of 6 credits.
- The internship (preferably Industrial Internship) would be assigned to the student by the Departmental Internship Coordinator, with the approval of Head, Chemical Engineering Department.
- The total duration of the internship would be for a period equivalent to 8 - 10 Calendar weeks. This period typically start from 1st May and end before 30th July every year. This means the end semester examination of T. Y. B. Chem. Engg. (Semester VI) should be completed by 25th April every year. The Semester VII (4th Year B. Chem. Engg.) should commence w.e.f. 1st Aug every year. The internship may be completed in one or more organizations as described below.
- The internship could be of the following forms:
  (i) industrial internship in a company (within India or Abroad) involved in R&D / design / manufacturing (QA/QC/Plant Engineering/Stores and Purchase) / marketing / finance / consultancy / Technical services / Engineering / Projects, etc.
  (ii) research internship in reputed Institutes (within India or Abroad) like, ICT, IITs, NITs, IISC, NCL, IICT etc.
- At the end of the internship, each student will submit a written report based on the work carried out during the Internship. The report will be countersigned by the Supervisor from Industry / Institute as the case may be.
- Performance of the student will be assessed based on the written report and a presentation to a committee consisting of two faculty members from the Chemical Engineering Department.
- Students will be assigned a grade based on the written report and a presentation; evaluated by a committee of faculty members.

SEMESTER – VII									
No.	**Subjects**	**Credits**	**Hrs/week**			**Marks for various Exams**			
			L	**T**	**P**	**C. A.**	**M. S.**	**E. S.**	**Total**
CET 1504	Chemical Project Engg. & Economics	3	2	1	0	10	15	25	50
CET 1505	Process Development and Engineering	4	3	1	0	20	30	50	100
HUT 1102	Perspectives of Society, Sci. & Tech.*	3	2	1	0	10	15	25	50
	Institute Elective – II	3	2	1	0	10	15	25	50
CEP 1717	Optimization of Chem. Engg. Systems	4	2	0	4	25	---	25	50
CEP 1708	Project 1: Seminar	2	0	0	4	50	---	---	50
CEP 1709	Project 2: Home Paper – I	2	0	0	4	50	---	---	50
CEP 1710	Internship	6	---	---	---	---	---	---	50
	Total	27	11	4	12				450

SEMESTER – VIII									
No.	**Subjects**	**Credits**	**Hrs /week**			**Marks for various Exams**			
			L	**T**	**P**	**C. A.**	**M. S.**	**E. S.**	**Total**
HUT 1114	Principles of Management - I*	3	2	1	0	10	15	25	50
HUT 1115	Principles of Management - II*	3	2	1	0	10	15	25	50
CET 1515	Innovations in Chemical Engineering and Technology	3	2	1	0	10	15	25	50
MAT 1106	Design & Analysis of Experiments	4	2	2	0	10	15	25	50
	Engineering Sciences / Basic Sciences Elective (GET/CHT/PYT/MAT)	3	2	1	0	10	15	25	50
	Open Elective from MOOC – I**	3	2	1	0	10	15	25	50
	Institute Elective – III	3	2	1	0	10	15	25	50
CEP 1711	Project 3: Home Paper – II	3	0	0	6	50	---	100	150
	Total	25	14	8	6				500

*** This courses may be offered in the usual classroom mode or online mode as an NPTEL / Swayam course. The Equivalent NPTEL course will be identified by the Department every year.**

**** Students can choose a subject from reputed online platforms like NPTEL, Coursera, Edx, MIT OpenCourseWare, etc. The course can be from any discipline: Engineering and Technology, Humanities, Arts. The course would need to be pre-approved by the Department every year. The Department may also offer specialized courses taught by experts in an online mode.**

Detailed Contents of Syllabus

Semester – I										
No	**Subjects**	**Credits**	**Hrs/Week**			**Marks for various Exams**				
			L	**T**	**P**	**C. A.**	**M.S.**	**E. S.**	**Total**	
CHT 1131	Organic Chemistry-I	4	3	1	0	20	30	50	100	
CHT 1211	Analytical Chemistry	3	2	1	0	10	15	25	50	
MAT 1101	Applied Mathematics-I	4	3	1	0	20	30	50	100	
PYT 1101	Applied Physics – I	4	3	1	0	20	30	50	100	
GEP 1101	Engineering Graphics-I	4	2	0	6	50	---	50	100	
PYP 1102	Physics Laboratory	2	0	0	4	25	---	25	50	
CHP 1132	Organic Chemistry Laboratory	2	0	0	4	25	---	25	50	
	TOTAL:	23	13	4	14				550	

	Course Code: CHT 1131	**Course Title: Organic Chemistry 1**	**Credits = 4**		
			L	**T**	**P**
	Semester: I	**Total contact hours: 60**	**3**	**1**	**0**
List of Prerequisite Courses					
	HSC Chemistry				
List of Courses where this course will be prerequisite					
	Organic Chemistry – II, Organic Chemistry Laboratory, Other Chemistry Courses, Material and Energy Balance Calculations, Ind. Eng. Chem.,				
Description of relevance of this course in the B. Chem. Engg. Program					
To train the students with respect to basics of mechanism of organic reactions, stereochemistry, and aliphatic chemistry					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	**Basic introduction to organic chemistry**: Reactive intermediates – carbocations, carbanions, carbon radicals, carbenes; their generation.		04		
2	**Structure activity relationship in organic molecules**: Use of bond length and bond energies to explain the reactivity of functional groups. Acidity & basicity values for organic molecules such as alkynes, alcohols, acids, ketones, amines		06		
3	**Stereochemistry:** Importance of stereochemistry in molecules around us. Elements of symmetry, stereochemistry of compounds containing one and two carbon atoms. Stereo descriptors – R, S, E, Z. Enantiomers and Diastereomers. Conformations of cyclic and acyclic system.		10		
4	**Haloalkanes:** General reactions. Mechanisms of nucleophilic substitutions reactions (S_N1 & S_N2) and elimination reactions.		12		
5	**Chemistry of carbonyl compounds**: Concept of acidity in carbonyl compounds. Enolate chemistry of carbonyl compounds. Aldol and related reactions with mechanisms-Aldol reaction, Michael addition, Robinson annulation, Stork enamine reaction.		12		
6	**Aromatic compounds**: Resonance stabilization energy, Huckel's rule, substituent effects. Common names of aromatic compounds.		04		
7	**Aromatic electrophilic substitution**: Activating and deactivating functional groups on aromatic compounds, resonating structures, reactions such as Halogenation, Nitration, Friedel Crafts alkylation and acylation, sulfonation of aromatic compounds		12		
List of Text Books/ Reference Books					
1	Organic Chemistry, J. McMurry, Brooks/Cole				
2	Organic Chemistry, T.W.G. Solomons, C.B. Fryhle, John Wiley and Sons Inc				
3	Organic Chemistry, L.G. Wade Jr, Pearson Education				
4	Stereo Chemistry of Carbon compounds, E.L. Eliel, Mcgraw-Hill				
5	Organic Chemistry, Paula Y. Bruice, Pearson Education				
Course Outcomes (students will be able to…..)					
1	Identify functionalities in organic compounds				
2	Write simple mechanism				
3	Appreciate aliphatic chemistry				
4	Appreciate stereochemistry				

	Course Code: CHT 1211	**Course Title: Analytical chemistry**	**Credits = 3**		
			L	**T**	**P**
	Semester: I	**Total contact hours:45**	**2**	**1**	**0**

	List of Prerequisite Courses	
	HSC Chemistry	
	List of Courses where this course will be prerequisite	
	Other Chemistry Courses, Physical and Analytical Chemistry Laboratory	
	Description of relevance of this course in the B. Chem. Engg. Program	
The course introduces the students to key concepts of chemical analysis – sampling, selection of analytical method and data analysis. It presents basic techniques like spectroscopy and chromatography. The students should be able to select an appropriate analytical technique and apply it in accordance with its strengths and limitations.		
	Course Contents (Topics and subtopics)	**Reqd. hours**
1	Introduction to chemical analysis, terminology (technique / method / procedure / protocol), broad classification of analytical techniques, good laboratory practices	03
2	Sampling – basics and procedures, preparation of laboratory samples Criteria for selecting analytical methods – precision, sensitivity, selectivity, and detection limit, Calibration and validation	06
3	Data analysis: errors – systematic and random errors, statistical treatment of experimental results, least square method, correlation coefficients	06
4	**Spectroscopic methods:** general principles, UV-visible spectroscopy, fluorescence spectroscopy	08
5	**Electrochemical methods:** general principles, potentiometry, coulometry, voltammetry	08
6	**Chromatographic methods:** general principles, GC, HPLC	08
7	**Applied analysis:** analytical procedures in environmental monitoring, water, soil and air quality, BOD and COD determinations	05
	List of Text Books/ Reference Books	
1	Modern Analytical Chemistry by David Harvey, McGraw-Hill, 1999.	
2	Quantitative Analysis by R. A. Day and A. L. Underwood, Prentice Hall of India, 2001.	
3	Instrumental Methods of Analysis by H. H. Willard, L. L. Merritt, J. A. Dean and F. A. Settle, Wadsworth Publishing, USA	
4	Fundamentals of Analytical Chemistry by D. A. Skoog, D. M. West, F. James Holler and S. R. Crouch, Cengage Learning, 2014.	
5	Principles of Instrumental Analysis by D. A. Skoog, F. James Holler and S. R. Crouch, Cengage Learning, 2007	
	Course Outcomes (students will be able to…..)	
1	Describe the fundamental concepts related to spectroscopic, electrochemical and chromatographic analysis	
2	Differentiate the analytical methods based on advantages and limitations	
3	Select an optimum technique and measurement conditions for enabling the best selectivity and sensitivity of measurement	
4	Analyze the data to identify any potential sources of errors and plausible ways to minimize the same	

<table>
<tr><td rowspan="3"></td><td rowspan="2">Course Code: MAT 1101</td><td rowspan="2">Course Title: Applied Mathematics I</td><td colspan="3">Credits = 4</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td>Semester: I</td><td>Total contact hours: 60</td><td>3</td><td>1</td><td>0</td></tr>
<tr><td colspan="6">List of Prerequisite Courses</td></tr>
<tr><td></td><td colspan="2">HSC Standard Mathematics</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td colspan="6">List of Courses where this course will be prerequisite</td></tr>
<tr><td></td><td colspan="2">This is a basic Mathematics course. This knowledge will be required in almost all subjects later on</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td colspan="6">Description of relevance of this course in the B. Chem. Engg. Program</td></tr>
<tr><td colspan="6">This is a basic Mathematics course. This knowledge will be required in almost all subjects later on. This knowledge is also required for solving various mathematical equations that need to be solved in several chemical engineering courses such as MEBC, momentum transfer, reaction engineering, separation processes, thermodynamics, etc.</td></tr>
<tr><td></td><td colspan="2">Course Contents (Topics and subtopics)</td><td colspan="3">Reqd. Hours</td></tr>
<tr><td>1</td><td colspan="2">Review of Mean Value theorems, Higher order differentiation and Leibnitz Rule for the derivative, Taylor’s and Maclaurin’s theorems and applications to error estimates, convexity of functions, Local Maxima/Minima</td><td colspan="3">8</td></tr>
<tr><td>2</td><td colspan="2">Functions of two or more variables, Limit and continuity, Partial differentiation, Directional derivatives, Total derivatives, Chain Rules of partial derivatives, Taylor’s theorem for multivariable functions and its application to error calculations, Local and absolute Maxima/Minima</td><td colspan="3">10</td></tr>
<tr><td>3</td><td colspan="2">Beta and Gamma functions, Differentiation under the integral sign, Multiple Integrals, Line and surface integrals and applications to Greens, Gauss-Divergence and Stokes theorem.</td><td colspan="3">12</td></tr>
<tr><td>4</td><td colspan="2">Systems of linear equations, matrices and Gauss elimination, Vectors in IRn, notion of linear independence and dependence. Vector subspaces of IRn, basis of a vector subspace., row space, null space, and column space, rank of a matrix. Determinants and rank of matrices.
Abstract vector spaces, linear transformations, matrix of a linear transformation, change of basis and similarity, rank-nullity theorem and its applications</td><td colspan="3">7</td></tr>
<tr><td>5</td><td colspan="2">Inner product spaces, orthonormal bases, Gram-Schmidt orthogonalization process, Eigenvalues and eigenvectors, characteristic polynomials, eigenvalues of special matrices (orthogonal, unitary, Hermitian, symmetric, skew- symmetric, normal), Orthogonal projection and its application to least methods
Diagonalization of matrices and its applications stochastic matrices, Matrix Factorization, Applications such as SVD, PCA etc.</td><td colspan="3">8</td></tr>
<tr><td>6</td><td colspan="2">Review of first and second order ODEs (constant coefficient), Existence and Uniqueness theorems for first order ODEs. Higher order Linear ODE with constant and variable coefficient, Solutions of Initial and Boundary value problems, Solving initial value system of linear ordinary differential equations,</td><td colspan="3">8</td></tr>
<tr><td>7</td><td colspan="2">Power series method of solving ODE's and special functions, Legendre Polynomials Bessel functions and applications</td><td colspan="3">7</td></tr>
<tr><td colspan="6">List of Text Books/ Reference Books</td></tr>
<tr><td></td><td colspan="2">G. Strang, Linear Algebra and its Applications (4th Edition), Thomson (2006).</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Howard Anton, Elementary Linear Algebra, Wiley (2016)</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Arnold J. Insel, Lawrence E. Spence, and Stephen H. Friedberg, Linear Algebra, Pearson</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">E. Kreyszig, Advanced Engineering Mathematics (8th Edition), John Wiley (1999). (Officially prescribed)</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">S. R. K. Iyengar, R. K. Jain, Advanced Engineering Mathematics Narosa.</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Marsden, J.E., Tromba, Anthony, Weinstein, Alan, Basic Multivariable Calculus.</td><td colspan="3"></td></tr>
<tr><td colspan="6">Course Outcomes (students will be able to…..)</td></tr>
<tr><td>1</td><td colspan="2">Students should be able to understand the notion of differentiability and be able to find maxima and minima of functions of one and several variables.</td><td colspan="3"></td></tr>
<tr><td>2</td><td colspan="2">Students should be able to compute surface and volume integrals.</td><td colspan="3"></td></tr>
<tr><td>3</td><td colspan="2">Students should be able to solve systems of linear equations and eigenvalue problems analytically and numerically.</td><td colspan="3"></td></tr>
<tr><td>4</td><td colspan="2">Students should be able to apply concepts of linear algebra in engineering problems.</td><td colspan="3"></td></tr>
<tr><td>5</td><td colspan="2">Students should be able to solve simple first and second order ODE by Analytical methods</td><td colspan="3"></td></tr>
<tr><td>6</td><td colspan="2">Students should be able to solve ordinary differential equations using power series method.</td><td colspan="3"></td></tr>
</table>

			Credits = 4		
	Course Code: PYT 1101	**Course Title: Applied Physics I**	**L**	**T**	**P**
	Semester: I	**Total contact hours: 60**	**3**	**1**	**0**

	List of Prerequisite Courses	
	XIIth Standard Physics	
	List of Courses where this course will be prerequisite	
	Applied Physics – II, Physics Laboratory, Chemical Engineering Thermodynamics, Momentum and Mass Transfer, Heat Transfer, Material Science and Engineering, Structural Mechanics, etc.	
	Description of relevance of this course in the B. Chem. Engg. Program	
	This is a basic physics course. This knowledge will be required in almost all subjects later on. This knowledge is also required for understanding various chemical engineering concepts that will be introduced in courses such as momentum transfer, reaction engineering, separation processes, thermodynamics, heat transfer, etc.	
	Course Contents (Topics and subtopics)	**Reqd. Hours**
1	**Solid State Physics** Crystal structure of solids: unit cell, space lattices and Bravais lattice, Miller indices, directions and crystallographic planes, Cubic crystals: SSC, BCC, FCC, Hexagonal crystals: HCP, atomic radius, packing fraction, Bragg's law of x-ray diffraction, determination of crystal structure using Bragg spectrometer Semiconductor Physics: Formation of energy bands in solids, concept of Fermi level, classification of solids: conductor, semiconductor and insulator, intrinsic and extrinsic semiconductors, effect of doping, mobility of charge carriers, conductivity, Hall effect.	15
2	**Fluid Mechanics** Basic concepts of density and pressure in a fluid, ideal and real fluids, Pascal's law, absolute pressure and pressure gauges, basic concepts of surface tension and buoyancy, fluid flow, equation of continuity, Bernoulli's equation, streamlined and turbulent flow, concept of viscosity, Newton's law of viscosity.	10
3	**Optics and Fibre Optics Diffraction** Introduction to interference and example; concept of diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits; diffraction grating, characteristics of diffraction grating and its applications. Polarisation: Introduction, polarisation by reflection, polarisation by double refraction, scattering of light, circular and elliptical polarisation, optical activity. Fibre Optics: Introduction, optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with optical fibres, step and graded index fibres, application of optical fibres.	15
4	**Lasers** Introduction to interaction of radiation with matter, principles and working of laser: population inversion, pumping, various modes, threshold population inversion, types of laser: solid state, semiconductor, gas; application of lasers.	10
5	**Ultrasound** Mechanical, electromechanical transducers; propagation of ultrasound, attenuation, velocity of ultrasound and parameters affecting it, measurement of velocity, cavitation, applications of ultrasound.	10
	List of Text Books/ Reference Books	
	Physics:Vols. I and II – D. Halliday and R. Resnick, Wiley Eastern.	
	Lectures on Physics: Vols. I, II and III – R. P. Feynman, R. B. Leighton and M. Sands, Narosa.	
	Concepts of Modern Physics – A. Beiser, McGraw-Hill.	
	Introduction to Modern Optics – G. R. Fowles , Dover Publications.	
	A Course of Experiments with LASERs – R. S. Sirohi, Wiley Eastern.	
	Optical Fibre Communication – G. Keiser, McGraw-Hill.	
	Optoelectronics – J. Wilson and J. F. B. Hawkes, 2nd ed, Prentice-Hall India.	
	Ultrasonics: Methods and Applications – J. Blitz, Butterworth.	
	Applied Sonochemistry – T. J. Mason and J. P. Lorimer, Wiley VCH.	
	Course Outcomes (students will be able to…..)	
1	Students will be able to state Bragg's Law	
2	Student will be able to apply Bernoulli equation in simple pipe flows	
3	Students will be introduced to the principles of lasers, types of lasers and applications.	
4	Students should be able to calculate resolving power of instruments.	
5	Students should be able to describe principles of optical fibre communication.	

6	Application of acoustic cavitation of Chemical Engineering Processes.	

<table>
<tr><td rowspan="2"></td><td>Course Code: GEP 1101</td><td>Course Title: Engineering Graphics-I</td><td colspan="3">Credits = 4</td></tr>
<tr><td></td><td></td><td>L</td><td>T</td><td>P</td></tr>
<tr><td></td><td>Semester: I</td><td>Total contact hours: 90</td><td>2</td><td>0</td><td>6</td></tr>
<tr><td colspan="6" align="center">List of Prerequisite Courses</td></tr>
<tr><td></td><td colspan="2">Basic Geometry</td><td colspan="3"></td></tr>
<tr><td colspan="6" align="center">List of Courses where this course will be prerequisite</td></tr>
<tr><td></td><td colspan="2">Engineering Graphics – II, Equipment Design and Drawing-I, Equipment Design and Drawing-II, Home Paper – II, Structural Mechanics,</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td colspan="6" align="center">Description of relevance of this course in the B. Chem. Engg. Program</td></tr>
<tr><td colspan="6">A student of Chemical Engineering is required to know the various processes and also the equipment used to carry out the processes. Some of the elementary processes like filtration, size reduction, evaporation, condensation, crystallization etc., are very common to all the branches of technology. These and many other processes require machines and equipments. One should be familiar with the design, manufacturing, working, maintenance of such machines and equipments. The subject of "drawing" is a medium through which, one can learn all such matter, because the "drawings" are used to represent objects and processes on the paper. Through the drawings, a lot of accurate information is conveyed which will not be practicable through a spoken word or a written text. Drawing is a language used by engineers and technologists. This course is required in many subjects as well as later on in the professional career.</td></tr>
<tr><td></td><td colspan="2" align="center">Course Contents (Topics and subtopics)</td><td colspan="3">Reqd. hours</td></tr>
<tr><td>1</td><td colspan="2">Orthographic projections</td><td colspan="3"></td></tr>
<tr><td>2</td><td colspan="2">Sectional views</td><td colspan="3"></td></tr>
<tr><td>3</td><td colspan="2">Isometric projections</td><td colspan="3"></td></tr>
<tr><td>4</td><td colspan="2">Missing views (or interpretation of views.)</td><td colspan="3"></td></tr>
<tr><td>5</td><td colspan="2">Projection of solids</td><td colspan="3"></td></tr>
<tr><td>6</td><td colspan="2">Sections of solids</td><td colspan="3"></td></tr>
<tr><td>7</td><td colspan="2">Development of surface</td><td colspan="3"></td></tr>
<tr><td>8</td><td colspan="2">Interpenetration of solids</td><td colspan="3"></td></tr>
<tr><td colspan="6" align="center">List of Text Books/ Reference Books</td></tr>
<tr><td></td><td colspan="2">1.Engineering Drawing by N.D.Bhat</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">2. Engineering Drawing by N.H.Dubey</td><td colspan="3"></td></tr>
<tr><td colspan="6" align="center">Course Outcomes (students will be able to…..)</td></tr>
<tr><td>1</td><td colspan="2">Read Drawing</td><td colspan="3"></td></tr>
<tr><td>2</td><td colspan="2">Can understand different views.</td><td colspan="3"></td></tr>
</table>

	Course Code: PYP 1102	**Course Title: Physics Laboratory**	**Credits = 2**		
			L	**T**	**P**
	Semester: I	**Total contact hours: 60**	**0**	**0**	**4**
List of Prerequisite Courses					
	Applied Physics - I				
List of Courses where this course will be prerequisite					
	This is a basic physics Laboratory course. This knowledge will be required in almost all subjects later on.				
Description of relevance of this course in the B. Chem. Engg. Program					
This is a basic physics course. Students will be able to learn various concepts by doing experiments on different topics. This knowledge will be required in almost all subjects later on. This knowledge is also required for understanding various chemical engineering concepts that will be introduced in courses such as momentum transfer, reaction engineering, separation processes, thermodynamics, heat transfer, etc.					
	Course Contents (Topics and subtopics)		**Reqd. Hours**		
1	Viscosity				
2	Thermistor				
3	Thermal conductivity				
4	Ultrasonic interferometer				
5	Photoelectric effect				
6	Hall effect				
7	Newton's rings				
8	Dispersive power of prism				
9	Laser diffraction				
10	Resolving power of grating				
List of Text Books/ Reference Books					
	Physics:Vols. I and II – D. Halliday and R. Resnick, Wiley Eastern.				
	Lectures on Physics: Vols. I, II and III – R. P. Feynman, R. B. Leighton and M. Sands, Narosa.				
	Concepts of Modern Physics – A. Beiser, McGraw-Hill.				
	Introduction to Modern Optics – G. R. Fowles , Dover Publications.				
	A Course of Experiments with LASERs – R. S. Sirohi, Wiley Eastern.				
	Optical Fibre Communication – G. Keiser, McGraw-Hill.				
	Optoelectronics – J. Wilson and J. F. B. Hawkes, 2nd ed, Prentice-Hall India.				
	Ultrasonics: Methods and Applications – J. Blitz, Butterworth.				
	Applied Sonochemistry – T. J. Mason and J. P. Lorimer, Wiley VCH.				
Course Outcomes (students will be able to…..)					
1	Students will be able to state various laws which they have studied through experiments				
2	Student will be able to measure transport properties like viscosity, conductivity, etc.				
3	Students will be able to state application of acoustic cavitation				

	Course Code: CHP 1132	**Course Title: Organic Chemistry Laboratory**	**Credits = 2**		
			L	**T**	**P**
	Semester: I	**Total contact hours: 60**	**0**	**0**	**4**
List of Prerequisite Courses					
	XIIth Standard Chemistry, Organic Chemistry - I				
List of Courses where this course will be prerequisite					
	Organic Chemistry - II				
Description of relevance of this course in the B. Chem. Engg. Program					
Students should be familiar with common organic compounds, should identify them and should know simple separation methods.					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	Identification of an organic compound through elemental analysis, group detection, physical constants (m.p and b.p) and derivatisation.				
2	Separation and purification of binary mixtures of the type: water soluble-water insoluble, both water soluble, liquid-liquid by distillation, dissociation –extraction ,crystallization, etc				
List of Text Books/ Reference Books					
	Practical Organic Chemistry, by I.L. Finar				
Course Outcomes (students will be able to…..)					
1	Students will be able to list steps for identifying simple organic compounds				
2	Students will be able to list some methods of separation of organic compounds				

SEMESTER – II									
No.	**Subjects**	**Credits**	**Hrs/week**			**Marks for various Exams**			
			L	**T**	**P**	**C. A.**	**M. S.**	**E. S.**	**Total**
CHT 1231	Organic Chemistry-II	4	3	1	0	20	30	50	100
CHT 1341	Physical Chemistry	3	2	1	0	10	15	25	50
CET 1501	Material & Energy Balance Calculations	4	3	1	0	20	30	50	100
MAT 1102	Applied Mathematics-II	4	3	1	0	20	30	50	100
PYT 1103	Applied Physics – II	3	2	1	0	10	15	25	50
CHP 1342	Physical & Analytical Chemistry Lab.	2	0	0	4	25	---	25	50
HUP 1101	Communication Skills	2	0	0	4	50	---	---	50
	Total	22	13	5	8				500

	Course Code: CHT 1231	**Course Title: Organic Chemistry-II**	**Credits = 4**		
			L	**T**	**P**
	Semester: II	**Total contact hours: 60**	**3**	**1**	**0**
List of Prerequisite Courses					
	XIIth Standard Chemistry, Organic Chemistry – I, Organic Chemistry Laboratory				
List of Courses where this course will be prerequisite					
	Other Chemistry Courses, Material and Energy Balance Calculations, Ind. Eng. Chem.,				
Description of relevance of this course in the B. Chem. Engg. Program					
Students will get introduced to aromatic compounds, heterocyclic chemistry and natural products					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	**Aromatic compounds:** Problems associated with S_NAr reactions and how to overcome. Mechanism for aromatic nucleophilic substitutions.		04		
2	**Haloarenes:** Metallation reaction and reactions of metallo derivatives. Synthesis of haloarenes using S_NAr e.g. Sandmeyer reaction for the synthesis of fluorobenzene on large scale. Substitution reactions of haloarenes including Dow's process for phenol synthesis and effect of electron-withdrawing groups on the substitution		12		
3	**Phenols:** Acidity of phenols. Synthesis from Cumene hydroperoxide. General reactions		06		
4	**Nitro and amino arenes:** General reactions. Basicity of aminoarenes. Diazotization and important reacts of arene diazonium salts. Dyes – Chromophore and auxochrome concent. Azo dyes		08		
5	**Heteroaromatic compounds:** Basic structures and common names, comparison of electronic and structural properties to benzenoid compounds, Reactivity and synthetic routes Pyrrole, Furan, Thiophene, Pyridine.		12		
6	**Spectroscopic techniques for the identification of organic compounds:** Infra-red spectroscopy, Nuclear Magentic Resonance, Mass spectrometry		12		
7	**Chemistry of important natural products:** Terpenes, steroids, carotenoids		06		
List of Text Books/ Reference Books					
1	Organic Chemistry, J. McMurry, Brooks/Cole				
2	Organic Chemistry, T.W.G. Solomons, C.B. Fryhle, John Wiley and Sons Inc.				
3	Organic Chemistry, L.G. Wade Jr, Pearson Education				
4	Organic Chemistry, Paula Y. Bruice, Pearson Education				
Course Outcomes (students will be able to…..)					
1	Understand aromaticity and list properties of aromatic compounds				
2	Write simple mechanisms of aromatic reactions				
3	List some of the heterocyclic chemistry and chemistry of natural products				
4	List some properties of heterocyclic compounds and natural products				

	Course Code: CHT 1341	**Physical chemistry**	**Credits = 3**		
			L	**T**	**P**
	Semester: II	**Total contact hours: 45**	**2**	**1**	**0**

	List of Prerequisite Courses	
	Xiith Standard Chemistry	
	List of Courses where this course will be prerequisite	
	Chemical Reaction Engineering, Chemical Engg Thermodynamics – I, Chemical Engg Thermodynamics – II, Multiphase Reactor Engg., Env. Engg. and Proc. Safety,	
	Description of relevance of this course in the B. Chem. Engg. Program	
Relevance of reaction rates and parameters affecting the same, concept of interfaces and surfaces and the importance of disperse systems. These concepts are required in many situations which are faced by Chemical Engineers I their professional career		
	Course Contents (Topics and subtopics)	**Reqd. hours**
1	**Chemical kinetics –** Introduction, concept of reaction rates and order, experimental methods in kinetic studies, differential and integral methods to formulate rate equations of zero, first and second order	03
2	**Complex reactions**- parallel, consecutive and reversible reactions, order and molecularity	03
3	**Kinetics and reaction mechanism**- steady state and rate determining step Mechanism of thermal photochemical chain reactions, polymerization reactions	04
4	**Surface reactions –** Adsorption, kinetics of surface reactions- Hishelwood and Rideal models of surface reactions	02
	Theories of reaction rates and temperature effects- collision theory and TST Theory of unimolecular reactions	04
5	**Kinetics of reactions in solutions-** solvent effects	02
6	**Fast reactions –** experimental techniques	02
7	**Surface and interfacial Chemistry –** introduction, surface tension and surface free energy, methods of determining surface and interfacial tensions	02
8	**Thermodynamics of surfaces –** surface excess, Gibbs adsorption equation, curved surfaces- bubbles, droplets and foams, Kelvin, Young Laplace and Thomson equations, homogeneous nucleation	05
9	**Liquid- liquid and solid liquid interfaces** – contact angle, wetting and spreading, adhesion and cohesion, contact angle measurements and hysterisis	04
10	**Surfactants:** Types, adsorption at surfaces and interfaces, surfactant aggregates, factors affecting aggregation phenomena, applications of surfactants and mixed surfactant systems	07
11	**Disperse systems -** Emulsions microemulsions and foams -. Thermodynamics and stability, HLB values , colloids - preparation, stability, characterization, surface charges and electrical double layer	07
	List of Text Books/ Reference Books	
1	Introduction to colloid and surface chemistry – D.J.shaw, Butterworth publications	
2	Surfaces interfaces and colloids- Drew Myers- Wiley VCH	
3	Surfactants and interfacial phenomena- Milton J Rosen – Wiley Interscience	
4	Industrial utilization of surfactants principles and applications – M.J. Rosen and M Dahanayake, AOCS Press	
5	Foundations of Colloid science – Robert J Hunter – Oxford university Press	
	Course Outcomes (students will be able to…..)	
1	Understand the importance of interfacial phenomena	
2	Importance and application of surface active agents	
3	Understand the stability and importance of disperse systems	

<table>
<tr><td rowspan="2"></td><td rowspan="1">Course Code: CET 1501</td><td>Course Title: Material and Energy Balance Calculations</td><td colspan="3">Credits = 4</td></tr>
<tr><td></td><td></td><td>L</td><td>T</td><td>P</td></tr>
<tr><td></td><td>Semester: II</td><td>Total contact hours: 60</td><td>3</td><td>1</td><td>0</td></tr>
<tr><td colspan="6">List of Prerequisite Courses</td></tr>
<tr><td></td><td colspan="2">XIIth Standard Mathematics, Chemistry, Physics, Applied Mathematics – I, Organic Chemistry – I, Applied Physics – I, Analytical Chemistry,</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td colspan="6">List of Courses where this course will be prerequisite</td></tr>
<tr><td></td><td colspan="2">This is a basic Chemical Engineering Course. This knowledge will be required in ALL subjects later on.</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td colspan="6">Description of relevance of this course in the B. Chem. Engg. Program</td></tr>
<tr><td colspan="6">This is a basic Chemical Engineering course. This knowledge will be required in almost all subjects later on. This subject introduces the various concepts used in Chemical Engineering to the students. The knowledge of this subject is required for in ALL chemical engineering courses such as momentum transfer, reaction engineering, separation processes, thermodynamics, etc. It can be applied in various situations such as process selection, economics, sustainability, environmental impacts</td></tr>
<tr><td></td><td colspan="2">Course Contents (Topics and subtopics)</td><td colspan="3">Reqd. Hours</td></tr>
<tr><td>1</td><td colspan="2">Introduction to Chemical Engineering: Chemical Process Industries, Chemistry to Chemical Engineering, Revision of Units and Dimensions</td><td colspan="3">4</td></tr>
<tr><td>2</td><td colspan="2">Mole concept, composition relationship and Stoichiometry, Behaviour of gases and vapors</td><td colspan="3">6</td></tr>
<tr><td>3</td><td colspan="2">Material balances for reacting and non-reacting chemical and biochemical systems including recycle, bypass and purge</td><td colspan="3">20</td></tr>
<tr><td>4</td><td colspan="2">Introduction to psychrometry humidity and air-conditioning calculations.</td><td colspan="3">10</td></tr>
<tr><td>5</td><td colspan="2">Introduction to Energy Balances, Energy Balances in systems with and without reactions</td><td colspan="3">10</td></tr>
<tr><td>6</td><td colspan="2">Unsteady State Material and Energy Balances</td><td colspan="3">6</td></tr>
<tr><td>7</td><td colspan="2">Material and Energy Balances for multistage processes and complete plants</td><td colspan="3">4</td></tr>
<tr><td colspan="6">List of Text Books/ Reference Books</td></tr>
<tr><td></td><td colspan="2">Chemical Process Principles, Hougen O.A., Watson K. M.</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Basic Principles and Calculations in Chemical Engineering, Himmelblau,</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Stoichiometry, Bhatt B.I. and Vora S.M.</td><td colspan="3"></td></tr>
<tr><td colspan="6">Course Outcomes (students will be able to…..)</td></tr>
<tr><td>1</td><td colspan="2">Students will be able to convert units of simple quantities from one set of units to another set of units</td><td colspan="3"></td></tr>
<tr><td>2</td><td colspan="2">Students will be able to calculate quantities and /or compositions, energy usages, etc. in various processes and process equipment such as reactors, filters, dryers, etc.</td><td colspan="3"></td></tr>
</table>

	Course Code: MAT 1102	**Course Title: Applied Mathematics II**	**Credits = 4**		
			L	**T**	**P**
	Semester: II	**Total contact hours: 60**	**3**	**1**	**0**

	List of Prerequisite Courses	
	XIIth Standard Mathematics, Applied Mathematics - I	
	List of Courses where this course will be prerequisite	
	This is a basic Mathematics course. This knowledge will be required in almost all subjects later on	
	Description of relevance of this course in the B. Chem. Engg. Program	
	This is a basic Mathematics course. This knowledge will be required in almost all subjects later on. This knowledge is also required for solving various mathematical equations that need to be solved in several chemical engineering courses such as MEBC, momentum transfer, reaction engineering, separation processes, thermodynamics, etc.	
	Course Contents (Topics and subtopics)	**Reqd. Hours**
1	**Probability Theory and Sampling Distribution:** Review of probability, Random variables and cumulative distribution function; probability mass function and probability density function; Some common univariate distributions: Binomial, Poisson, Geometric and Uniform, exponential, Normal, Gamma, beta etc; Expectation and Moments (central and raw moments); Generating functions: moment generating function and characteristic function; Multiple random variables and Joint distribution; marginal distributions, independence; Covariance and Correlation; method of least squares and simple linear regression; nonlinear regression	15
2	Partial Differential Equations, Classification of higher order PDEs, Solution of PDEs using separation of variable techniques.	10
3	Solutions of system of linear equations (Gauss-elimination, LU-decomposition etc.), Numerical solution set of linear algebraic equations: Jacobi, Gauss Siedel, and under / over relaxation methods	5
4	Numerical methods for solving non-linear algebraic / transcendental etc.: Newton's method, Secant and Regula Falsi	5
5	Interpolation and extrapolation for equal and non-equal spaced data (Newtons Forward, Newtons backward and Lagrange), Numerical integration (trapezoidal rule, Simpson's Rule)	7
6	Numerical methods for solution of first and higher order ODEs (initial values and boundary value problems) using single step methods (RK, Euler's explicit and implicit methods), Multi-Step methods (predictor – corrector methods etc)	8
7	Finite difference methods: Forward difference, Backward difference, and Central differences application of finite difference methods to ODE Boundary value problem and PDE (parabolic, elliptic and hyperbolic)	10
	List of Text Books/ Reference Books	
	Sheldon Ross, A First Course in Probability, Pearson Prentice Hall	
	W.W. Hines, D. C. Montgomery, D.M. Goldsman, Probability and Statistics in Engineering, John-Wiely.	
	Alexander M. Mood, Duane C. Boes, and Franklin A. Graybill, Introduction to the Theory of Statistics, McGraw Hill; 3rd edition (June 1, 1974).	
	An Introduction to Statistics with Python with Applications in the Life Sciences by Thomas Haslwanter, 2016, Springer	
	Learning Statistics with R by Daniel Joseph Navarro, 2015	
	E. Kreyszig , Advanced Engineering Mathematics, 8th Ed., John Wiley (1999).	
	Advanced Engineering Mathematics, S. R. K. Iyengar, R. K. Jain, Narosa	
	Sastry S. S., Introductory Methods of Numerical Analysis, 5th Ed., PHI	
	M. K. Jain, S R K Iyengar and R K Jain, Numerical Methods: For Scientific and Engineering Computation, New Age International Publication	
	Kenneth J Beers Numerical Methods for Chemical Engineering Application Using MATLAB (2007), Cambridge University Press	
	Mark E. Davis, Numerical Methods and Modelling for Chemical Engineers, Dover Publications (2003)	
	Sandip Mazumder, Numerical Methods for Partial Differential Equations (2015), Elsevier	
	Course Outcomes (students will be able to…..)	
1	Students should be able to apply probability distributions in modelling engineering problems.	
2	Students should be able to fit linear and nonlinear regression models to real data.	
3	Students should be able to classify higher of partial differential equation and solve parabolic equation using separation of variables.	
4	Students should be able to solve system of linear algebraic equations.	

5	Students should be able to do numerical integrations of functions.	
6	Students should be able to solve partial differential equations numerically.	

<table>
<tr><td rowspan="3"></td><td rowspan="2">Course Code: PYT 1103</td><td rowspan="2">Course Title: Applied Physics II</td><td colspan="3">Credits = 3</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td>Semester: II</td><td>Total contact hours: 45</td><td>2</td><td>1</td><td>0</td></tr>
</table>

	List of Prerequisite Courses	
	XIIth Standard Physics, Applied Physics – I, Physics Laboratory,	
	List of Courses where this course will be prerequisite	
	This is a basic physics course. This knowledge will be required in almost all subjects later on	
	Description of relevance of this course in the B. Chem. Engg. Program	
This is a basic physics course. This knowledge will be required in almost all subjects later on. This knowledge is also required for understanding various chemical engineering concepts that will be introduced in courses such as momentum transfer, reaction engineering, separation processes, thermodynamics, heat transfer, etc.		
	Course Contents (Topics and subtopics)	**Reqd. Hours**
1	**Quantum Mechanics** Introduction to quantum physics, black body radiation, explanation using the photon concept, photoelectric effect, Compton effect, de Broglie hypothesis, wave-particle duality, Born's interpretation of the wave function, verification of matter waves, uncertainty principle, Schrodinger wave equation, postulates of Quantum Mechanics, particle in box, quantum harmonic oscillator, hydrogen atom (no detailed derivation)	25
2	**Dielectric and Magnetic Properties of Materials** Introduction to the 'del' operator and vector calculus, revision of the laws of electrostatics, electric current and the continuity equation, revision of the laws of magnetism. Polarisation, permeability and dielectric constant, polar and non-polar dielectrics, internal fields in a solid, Clausius-Mossotti equation, applications of dielectrics. Magnetisation, permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.	20
	List of Text Books/ Reference Books	
	Physics:Vols. I and II – D. Halliday and R. Resnick, Wiley Eastern.	
	Lectures on Physics: Vols. I, II and III – R. P. Feynman, R. B. Leighton and M. Sands, Narosa.	
	Concepts of Modern Physics – A. Beiser, McGraw-Hill.	
	Solid State Physics – A. J. Dekker, 1957, MacMillan India.	
	Perspectives of Modern Physics – A. Beiser, 1969, McGraw-Hill.	
	Course Outcomes (students will be able to…..)	
1	Students will be able to do simple quantum mechanics calculations	
2	Students will be able to define various terms related to properties of materials such as, permeability, polarization, etc.	
3	Students will be able to state some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials	

	Course Code: CHP 1342	**Course Title: Physical and Analytical Chemistry Laboratory**	**Credits = 2**		
			L	**T**	**P**
	Semester: II	**Total contact hours: 60**	**0**	**0**	**4**
List of Prerequisite Courses					
	XIIth Standard Chemistry Courses, Physical Chemistry, Analytical Chemistry				
List of Courses where this course will be prerequisite					
	This is a basic physical and analytical chemistry laboratory course. The knowledge gained here will be required in many subsequent courses				
Description of relevance of this course in the B. Chem. Engg. Program					
Students will become familiar with laboratory experimental skills, plan and interpretation of experimental tasks, understand the relevance of principles of physical and analytical chemistry in chemical processes					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
	(8 to 10 experiments will be conducted from following list) 1. To determine the total hardness of given water sample 2. To determine the dissociation constants of a polybasic acid using pH meter 3. To determine pKa of the given weak acid by potentiometric titration 4. To determine the critical micelle concentration (CMC) of the given surfactant by surface tension measurement using a stalagmometer 5. To determine the normality and volume of weak acid and strong acid in the given mixture using conductometric titration 6. To determine the rate constant of hydrolysis of an ester catalyzed by an acid 7. To study the kinetics of the reaction between $K_2S_2O_8$ and KI and hence, determine rate of the reaction 8. To verify Beer – Lambert's Law 9. To determine the equivalent conductance of strong electrolyte at infinite dilution and verify Ostwald's law of dilution, for dissociation of weak electrolyte 10. To determine the molecular weight of the given polymer by viscosity measurements 11. To determine the vitamin C concentration from the given tablet sample by titration 12. Demo of Gas chromatography and FT-IR				
List of Text Books/ Reference Books					
	Practical physical Chemistry – B.Viswanthan and P.S. Raghavan				
	Practical physical Chemistry- Alexander Findlay				
Course Outcomes (students will be able to…..)					
1	Identify reaction rate parameters				
2	List simple methods of chemical analysis				
3	Determination of physic chemical parameters using simple laboratory tools				

<table>
<tr><td rowspan="3"></td><td rowspan="2">Course Code: HUP 1101</td><td rowspan="2">Course Title: Communication Skills</td><td colspan="3">Credits = 2</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td>Semester: II</td><td>Total contact hours: 60</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td colspan="6">List of Prerequisite Courses</td></tr>
<tr><td></td><td colspan="2">XIIth Standard English</td><td colspan="3"></td></tr>
<tr><td colspan="6">List of Courses where this course will be prerequisite</td></tr>
<tr><td></td><td colspan="2">All</td><td colspan="3"></td></tr>
<tr><td colspan="6">Description of relevance of this course in the B. Chem. Engg. Program</td></tr>
<tr><td colspan="6">This is an important course for the effective functioning of an Engineer. Communication skills are required in all courses</td></tr>
<tr><td></td><td colspan="2">Course Contents (Topics and subtopics)</td><td colspan="3">Reqd. hours</td></tr>
<tr><td>1</td><td colspan="2">Development of communication skills in oral as well as writing.</td><td colspan="3"></td></tr>
<tr><td>2</td><td colspan="2">The writing skills should emphasize technical report writing, scientific paper writing, letter drafting, etc.</td><td colspan="3"></td></tr>
<tr><td>3</td><td colspan="2">The oral communication skills should emphasize presentation skills.</td><td colspan="3"></td></tr>
<tr><td>4</td><td colspan="2">Use of audio-visual facilities like powerpoint, LCD. for making effective oral presentation.</td><td colspan="3"></td></tr>
<tr><td>5</td><td colspan="2">Group Discussions</td><td colspan="3"></td></tr>
<tr><td colspan="6">List of Text Books/ Reference Books</td></tr>
<tr><td></td><td colspan="2">Elements of style – Strunk and white</td><td colspan="3"></td></tr>
<tr><td colspan="6">Course Outcomes (students will be able to…..)</td></tr>
<tr><td>1</td><td colspan="2">Students should be able to write grammar error free technical reports in MS Words or equivalent software.</td><td colspan="3"></td></tr>
<tr><td>2</td><td colspan="2">Students should be able to make power point slides in MS PowerPoint or equivalent software.</td><td colspan="3"></td></tr>
</table>

SEMESTER – III										
No.	**Subjects**	**Credits**	**Hrs /week**			**Marks for various Exams**				
			L	**T**	**P**	**C. A.**	**M. S.**	**E. S.**	**Total**
CET 1301	Chem. Eng. Thermodynamics-I	4	3	1	0	20	30	50	100
CET 1105	Momentum Transfer	4	3	1	0	20	30	50	100
GET 1102	Structural Mechanics	3	2	1	0	10	15	25	50
GET 1109	Electrical Engineering and Electronics	3	2	1	0	10	15	25	50
CET 1502	Industrial & Engineering Chemistry	4	3	1	0	20	30	50	100
GEP 1103	Structural Mechanics Lab.	2	0	0	4	25	---	25	50
GEP 1110	Electrical Engg and Electronics Laboratory	2	0	0	4	25	---	25	50
CEP 1715	Engineering Applications of Computers	2	0	0	4	25	---	25	50
	Total	24	13	5	12				550

	Course Code: CET 1301	**Course Title:** Chemical Engineering Thermodynamics-I	**Credits = 4**		
			L	**T**	**P**
	Semester: III	**Total contact hours: 60**	**3**	**1**	**0**

	List of Prerequisite Courses	
	XIIth Standard Physics and Chemistry, Applied Mathematics – I, Applied Mathematics – II, Physical Chemistry,	
	List of Courses where this course will be prerequisite	
	This is a basic Chemical Engineering course. It is required in all the Chemical Engineering Courses, such as, Chemical Engineering Thermodynamics – II, Chemical Engineering Operations, Separation Processes, Home Paper – I and II, Seminar, etc.	
	Description of relevance of this course in the B. Chem. Engg. Program	
Thermodynamics sets hard limits on performance of processes and equipment. This course gives students the formalism and insights necessary to do a preliminary thermodynamic analysis of a process for the purpose of establishing feasibility assuming ideal mixing.		
	Course Contents (Topics and subtopics)	**Reqd. hours**
1	Concept of Equilibrium: Entropy and Gibbs-Free Energy	4
2	First Law of Thermodynamics (Open and Closed Systems) and Equations of Change (dU, dH, dA, dG)	4
3	Residual Properties. Concept of fugacity and fugacity coefficient.	4
4	P-V-T Correlations, Virial Equation of State, Two and Three Parameter Cubic Equations of State	6
5	First Order Phase Transition (Clausius Clapeyron Equation)	2
6	Maxwell's Relations	2
7	Properties of Real Fluids	4
8	Introduction to Thermal Exergy and Expansions (Isentropic (Joule-Thomson Cooling) and Isenthalpic)	6
9	Thermodynamics of Ideal Mixtures and concept of Activity	2
10	Concept of Partial Molar Properties	2
11	Equilibrium in Mixtures (and the Raoult's Law Simplification)	2
12	Calculation of Bubble and Dew Points and T-x-y and P-x-y diagrams for ideal mixtures	4
13	Isothermal and Adiabatic Flash Calculations	4
14	Gibbs Duhem Equation and Thermodynamic Consistency	6
15	Non-Ideal Mixtures and Concept of Excess Properties	4
16	Equilibrium Measurement and Consistency of Experimental Data	4
	List of Text Books/ Reference Books	
	Introduction to Chemical Engineering Thermodynamics: Smith, van Ness, Abbott	
	Chemical, Biochemical and Engineering Thermodynamics: S. I. Sandler	
	Phase Equilibria in Chemical Engineering: Walas	
	Molecular Thermodynamics of Fluid Phase Equilibria: Prausnitz	
	Reference Books:	
	Properties of Gases and Liquids: Reid, Prausnitz, Pauling	
	Course Outcomes (students will be able to…..)	
1	Calculate enthalpies, entropies and free energies of real gases from (a) equations of state (b) measured quantities	

2	Calculate saturation pressure and latent heats of vapourization from cubic equations of state.	
3	Calculate bubble and dew points of ideal mixtures and construct T-x-y and P-x-y diagrams	
4	Be able to correlate experimental VLE data of pure component and ideal mixtures with suitable equations.	
5.	Do an adiabatic and isothermal flash calculation	
6.	Do a preliminary exergy analysis of non-reacting systems of ideal mixtures.	

	Course Code: CET 1105	Course Title: Momentum Transfer	Credits = 4		
			L	**T**	**P**
	Semester: III	**Total contact hours: 60**	**3**	**1**	**0**

	List of Prerequisite Courses	
	XIIth Standard Physics and Mathematics, Applied Physics – I and II, Applied Mathematics – I and II	
	List of Courses where this course will be prerequisite	
	This is a basic course required in many subjects such as: Heat Transfer, Chemical Engineering Operations, Separation Processes, Chemical Reaction Engineering, Multiphase Reactor Engineering, Env. Eng. And Process Safety, Seminar, Home Paper I and II, Energy Engineering, etc.	
	Description of relevance of this course in the B. Chem. Engg. Program	
This basic course introduces concepts of momentum transfer to students. Various concepts such as pressure, momentum, energy are introduced. Laws related to conservation of momentum, energy are taught. Applications of these laws to various engineering situations and process equipment is explained with the help of several problems		
	Course Contents (Topics and subtopics)	**Reqd. Hours**
1	Fluid Statics and applications to engineering importance.	4
2	Bernoulli's Equation and engineering applications, Pressure drop in pipes and Fittings, Piping systems	8
3	Fluid moving machinery such as pumps, blowers, compressors, vacuum systems, etc.	8
4	Particle Dynamics, Boundary layer separation: skin and form drag, Flow through Fixed and Fluidised Beds,	6
5	Equations of Continuity and Motion (Cartesian, cylindrical, and spherical coordinates) in laminar flows and its applications for the calculation of velocity profiles, shear stresses, power, etc. in various engineering applications.	
6	Boundary Layer Flows: Blasius equations and solution, Von-Karman integral equations and solutions,	8
7	Introduction to turbulence: Turbulent pipe flow, basis of Universal velocity profile and its use	6
8	Similarities in Momentum, Heat and Mass Transfer	8
	List of Text Books/ Reference Books	
	Transport Phenomena, Bird R.B., Stewart W.E., Lightfoot E.N.	
	Fluid Mechanics, Kundu Pijush K.	
	Fluid Mechanics, F. W. White	
	Unit Operations of Chemical Engineering, McCabe, Smith	
	Course Outcomes (students will be able to…..)	
1	Calculate velocity profiles, forces, pressure drops for simple 1 –D laminar flow situations	
2	Calculate pressure drop in pipelines and equipment for different situations such as single and two phase flow, fixed and fluidized beds	
3	Calculate forces on particles and terminal velocities of particles	
4	Design pumps and piping systems for simple situations	
5	Apply Momentum, Heat and mass transfer concepts to simple situations	

<table>
<tr><td></td><td>Course Code: GET 1102</td><td>Course Title: Structural Mechanics</td><td colspan="3">Credits = 3</td></tr>
<tr><td></td><td></td><td></td><td>L</td><td>T</td><td>P</td></tr>
<tr><td></td><td>Semester: III</td><td>Total contact hours: 45</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td colspan="6">List of Prerequisite Courses</td></tr>
<tr><td></td><td colspan="2">XIIth Standard Physics and Mathematics, Applied Mathematics-I and II, Applied Physics-I</td><td colspan="3"></td></tr>
<tr><td colspan="6">List of Courses where this course will be prerequisite</td></tr>
<tr><td></td><td colspan="2">Equipment Design and Drawing I and II, Home Paper, Chemical Project Engineering and Economics</td><td colspan="3"></td></tr>
<tr><td colspan="6">Description of relevance of this course in the B. Chem. Engg. Program</td></tr>
<tr><td colspan="6">This subject will help students to understand use of basics of Applied Mechanics and Strength of Materials. In engineering equipments which different types of forces are to be considered and how to quantify them. What are different conditions of equilibrium and how to apply them analyse the problems. Importance of centre of gravity and moment of Inertia in Engineering Design. Study of different types of stresses and strains occurring in various components of the structure. Advantages and disadvantages of various geometric sections available for engineering design. This is the foundation course for a good Design Engineer.</td></tr>
<tr><td></td><td colspan="2">Course Contents (Topics and subtopics)</td><td colspan="3">Reqd. hours</td></tr>
<tr><td>1</td><td colspan="2">Concepts of forces, their types, Resolution of forces, Composition of forces, Steps in Engineering Design, Different types supports and free body diagram.</td><td colspan="3">4</td></tr>
<tr><td>2</td><td colspan="2">Equilibrium of rigid bodies - Conditions of equilibrium. Determinant and indeterminate structures. Equilibrium of beams, trusses and frames problems on analysis of beams and truss.</td><td colspan="3">6</td></tr>
<tr><td>3</td><td colspan="2">Concept of moment of Inertia (Second moment of area) its use. Parallel axis theorem. Problems of finding centroid and moment of Inertia of single figures, composite figures. Perpendicular axis theorem, Polar M.I., Radius of gyration.</td><td colspan="3">5</td></tr>
<tr><td>4</td><td colspan="2">Shear Force and Bending Moment - Basic concept, S.F. and B.M. diagram for cantilever, simply supported beams (with or without overhang). Problems with concentrated and U.D. loads.</td><td colspan="3">7</td></tr>
<tr><td>5</td><td colspan="2">Stresses and Strains - Tensile and compressive stresses, strains, modulus of elasticity, modulus of rigidity, bulk modulus. Relation between elastic constants. Lateral strain, Poisson’s ratio, volumetric strain. Thermal stresses and strains. Problems based on stresses and strains. Stresses and Strains Relationship and Strain Deformation relationship.</td><td colspan="3">5</td></tr>
<tr><td>6</td><td colspan="2">Theory of Bending - Assumptions in derivation of basic equation, Basic equation, section modulus, bending stress distribution. Advantages of various geometric sections from bending consideration.</td><td colspan="3">4</td></tr>
<tr><td>7</td><td colspan="2">Problems on shear stress - Concept, Derivation of basic formula. Shear stress distribution for standard shapes. Problems of Shear stress distribution. Conditions under which shear stress is the governing criteria of design.</td><td colspan="3">5</td></tr>
<tr><td>8</td><td colspan="2">Slope and Deflection of beams - Basic concept, Slope and Deflection of cantilever and simply supported beams under standard loading. Macaulay’s method. Simple problems of finding slopes and deflections.</td><td colspan="3">5</td></tr>
<tr><td>9</td><td colspan="2">Introduction to computer aided analysis and design. Representation of stresses and strains on a cubical element. 1-D, 2-D and 3-D analysis and its importance. Basics of formulation of any computer aided analysis program. Preprocessing and post processing of computer aided analysis data and information.</td><td colspan="3">4</td></tr>
<tr><td colspan="6">List of Text Books/ Reference Books</td></tr>
<tr><td></td><td colspan="2">Engineering Mechanics Vol I Statics by B. N. Thadani, Publisher Wenall Book Corporation</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Introduction to Mechanics of Solids by Egor Popov, Prentice Hall of India Pvt. Ltd</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Mechanics of Materials by Ferdinand Beer and E. Russel Johnston, Tata McGraw Hill</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Fundamentals of applied Mechanics by Dadhe, Jamdar and Walavalkar, Sarita Prakashan Pune</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Engineering Mechanics by S. Timoshenko and D. H. Young, McGraw Hill Publications</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Strength of Materials by Ferdinand Singer and Andrew Pytel, Harper Colins Publishers</td><td colspan="3"></td></tr>
<tr><td colspan="6">Course Outcomes (students will be able to…..)</td></tr>
<tr><td>1</td><td colspan="2">Understand the use of basic concepts of Resolution and composition of forces.</td><td colspan="3"></td></tr>
<tr><td>2</td><td colspan="2">Analysis of the beams, truss or any engineering component by applying conditions of equilibrium.</td><td colspan="3"></td></tr>
<tr><td>3</td><td colspan="2">List advantages and disadvantages of various geometric sections used in engineering design.</td><td colspan="3"></td></tr>
<tr><td>4</td><td colspan="2">Understand the different stresses and strains occurring in components of structure</td><td colspan="3"></td></tr>
<tr><td>5</td><td colspan="2">Calculate the deformations such as axial, normal deflections under different loading conditions</td><td colspan="3"></td></tr>
</table>

	Course Code: GET 1109	Course Title: Electrical Engineering and Electronics	Credits = 3		
			L	T	P
	Semester: III	Total contact hours: 45	2	1	0

	List of Prerequisite Courses	
	XIIth Standard Physics and Mathematics courses, Applied Physics - II	
	List of Courses where this course will be prerequisite	
	Chemical Process Control, Energy Engineering,	
	Description of relevance of this course in the B. Chem. Engg. Program	
	Students will get an insight to the importance of Electrical Energy in Chemical Plants . The students will understand the basics of electricity, selection of different types of drives for a given application process. They will get basic knowledge as regards to Power supplies, instrumentation amplifiers and thyristor application in industries.	

	Course Contents (Topics and subtopics)	Reqd. hours
1	**Fundamentals of DC Circuits** Voltage and Current Sources, Basic Laws, Network Theorems, Superposition Theorem and Thevenin's Theorem,	5
2	**AC Fundamentals:** A.C. through resistance, inductance and capacitance, simple RL, RC and RLC circuits. Power, power factor	4
3	**Three Phase Systems**: Three phase system of emfs and currents, Star and Delta connections, Three phase power	4
4	**Single phase transformers**: Principle of working, Efficiency, regulation.	5
5	**Electrical drives**: Basic concepts of different types of Electrical motors as drives, Their suitability for various applications.	4
6	**Regulated power supplies**, Diodes as rectifiers, Half wave and Full wave rectifier, Filters and Regulators	6
7	**Bipolar junction transistors**: Different configurations, Characteristics, Concept of basic amplifier circuits, Amplifier gain, Transistor as switch	6
8	**Introduction to data acquisition and signal conditioning,** Basic concept and Block diagram, Introduction to sensors and transducers, Sensors used in chemical industry such as Temperature, Pressure, level, flow sensors, Concept of Smart Sensors, Concept of conversion of physical quantity to electrical signal, signal conditioning, Introduction to A/D and D/A converters	6
9	**Introduction to instrumentation amplifiers and their applications** Operational Amplifier – Notation, Pin diagram, Differential and common mode gain, CMRR, Applications as Non-inverting, inverting, summing, differential amplifiers, integrator, differentiator, comparator and filter circuits	5

	List of Text Books/ Reference Books	
1	Electrical Engineering Fundamentals by Vincent Deltoro	
2	Electronic devices and circuits by Boylstead, Nashelsky	
3	Electrical Machines by Nagrath, Kothari	
4	Electrical Machines by P.S. Bhimbra	
5	Electrical Technology by B.L.Theraja, A.K.Theraja vol I,II,IV	
6	Thyristors and their applications by M.Ramamurthy	
7	Power Electronics by P.S. Bhimbra	

	Course Outcomes (students will be able to…..)	
1	Understand the basic concepts of D.C., single phase and three phase AC supply and circuits Solve basic electrical circuit problems	
2	Understand the basic concepts of transformers and motors used as various industrial drives.	
3	Understand the basic concepts of electronic devices and their applications in power supplies, amplification and instrumentation	
4	Understand the basic concepts of Data acquisition, signal conditioning	

<table>
<tr><td></td><td>Course Code: CET 1502</td><td>Course Title: Industrial & Engineering Chemistry</td><td colspan="3">Credits = 4</td></tr>
<tr><td></td><td></td><td></td><td>L</td><td>T</td><td>P</td></tr>
<tr><td></td><td>Semester: III</td><td>Contact hours: 60</td><td>3</td><td>1</td><td>0</td></tr>
<tr><td colspan="6">List of Prerequisite Courses</td></tr>
<tr><td>1</td><td colspan="2">XIIth Standard Chemistry and Physics, Organic Chemistry I & II, Material & Energy Balance Calculations, Physical Chemistry</td><td colspan="3"></td></tr>
<tr><td colspan="6">List of Courses where this course will be prerequisite</td></tr>
<tr><td></td><td colspan="2">Chemical Reaction Engineering, Multiphase Reactor Engineering, Process Development and Engineering, Env. Engg. and Proc. Safety, Home Paper I and II, Seminar, etc.</td><td colspan="3"></td></tr>
<tr><td colspan="6">Description of relevance of this course in the B. Chem. Engg. Program</td></tr>
<tr><td colspan="6">Students will be able to understand sources and processes of manufacture of various chemicals such as petroleum and petroleum products, petrochemicals, biochemicals, industrial chemicals, clean utilization of coal and advances in fuels.</td></tr>
<tr><td></td><td colspan="2">Course Contents (Topics and subtopics)</td><td colspan="3">Reqd. hours</td></tr>
<tr><td>1</td><td colspan="2">Overview of Indian chemical industry, raw material and energy sources, role of catalysis, inorganic products, organic intermediates and final products</td><td colspan="3">5</td></tr>
<tr><td>2</td><td colspan="2">Petroleum refining and cracking operations</td><td colspan="3">5</td></tr>
<tr><td>3</td><td colspan="2">Industrial processes for ammonia, syngas and hydrogen, methanol, chemicals from oxo-synthesis</td><td colspan="3">4</td></tr>
<tr><td>4</td><td colspan="2">Organic chemicals based on methanol and ethanol (e.g., formaldehyde, acetaldehyde, acetic acid)</td><td colspan="3">4</td></tr>
<tr><td>5</td><td colspan="2">Petrochemicals: e.g., ethylene oxide, α-olefins, vinyl acetate, phenol, aniline, LAB, phthalic anhydride, PTA</td><td colspan="3">10</td></tr>
<tr><td>6</td><td colspan="2">Polymers (e.g., polyethylene / polypropylene)</td><td colspan="3">2</td></tr>
<tr><td>7</td><td colspan="2">Manufacturing of inorganic acids (sulfuric and nitric acid)</td><td colspan="3">4</td></tr>
<tr><td>8</td><td colspan="2">Chlor-alkali industry (chlorine, caustic soda, soda ash)</td><td colspan="3">6</td></tr>
<tr><td>9</td><td colspan="2">Fertilizers (urea and phosphates)</td><td colspan="3">2</td></tr>
<tr><td>10</td><td colspan="2">Industrial processes using bio-catalysts</td><td colspan="3">2</td></tr>
<tr><td>11</td><td colspan="2">Production of industrial gases</td><td colspan="3">2</td></tr>
<tr><td>12</td><td colspan="2">Classification, sampling, analysis, and selection of coal</td><td colspan="3">3</td></tr>
<tr><td>13</td><td colspan="2">Carbonization</td><td colspan="3">2</td></tr>
<tr><td>14</td><td colspan="2">Hydrogenation</td><td colspan="3">2</td></tr>
<tr><td>15</td><td colspan="2">Complete gasification of coal</td><td colspan="3">3</td></tr>
<tr><td>16</td><td colspan="2">Fuel oil specifications</td><td colspan="3">1</td></tr>
<tr><td>17</td><td colspan="2">Combustion of solid, liquid, and gaseous fuels</td><td colspan="3">3</td></tr>
<tr><td></td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td colspan="6">List of Text Books/ Reference Books</td></tr>
<tr><td>1</td><td colspan="2">Encyclopedia of Chemical Technology, Kirk-Othmer</td><td colspan="3"></td></tr>
<tr><td>2</td><td colspan="2">Ulmann’s Encyclopedia of Industrial Chemistry</td><td colspan="3"></td></tr>
<tr><td>3</td><td colspan="2">Industrial Organic Chemistry, Weissermel & Arpe</td><td colspan="3"></td></tr>
<tr><td>4</td><td colspan="2">Chemical Process Industries, Shreve B. Austin</td><td colspan="3"></td></tr>
<tr><td>5</td><td colspan="2">Chemical Process Technology, Moulijn, M. and van Dippen</td><td colspan="3"></td></tr>
<tr><td>6</td><td colspan="2">Dryden’s Outlines of Chemical Technology</td><td colspan="3"></td></tr>
<tr><td>7</td><td colspan="2">Elements of Fuels, Furnaces and Refractories, O.P. Gupta</td><td colspan="3"></td></tr>
<tr><td>8</td><td colspan="2">Fuels handbook, Johnson</td><td colspan="3"></td></tr>
<tr><td colspan="6">Course Outcomes (students will be able to…..)</td></tr>
<tr><td>1</td><td colspan="2">Draw process flow diagrams/process block diagrams for the manufacture of various chemicals from process description</td><td colspan="3"></td></tr>
<tr><td>2</td><td colspan="2">List out various alternatives for carrying out a particular process and provide recommendations for the best choice</td><td colspan="3"></td></tr>
<tr><td>3</td><td colspan="2">List coal utilization technologies and advantages of clean coal technology</td><td colspan="3"></td></tr>
<tr><td>4</td><td colspan="2">List Principles of combustion systems for solid, liquid and gaseous fuel</td><td colspan="3"></td></tr>
</table>

	Course Code: GEP 1103	**Course Title: Structural Mechanics Laboratory**	**Credits = 2**		
			L	**T**	**P**
	Semester: III	**Total contact hours:60**	**0**	**0**	**4**

	List of Prerequisite Courses	
	XIIth Standard Physics, Mathematics, Applied Mathematics I and II, Structural Mechanics	
	List of Courses where this course will be prerequisite	
	Equipment design and Drawing I and II, Home Paper I and II	
	Description of relevance of this course in the B. Chem. Engg. Program	
This subject will help students to understand use of basics of Applied Mechanics and Strength of Materials. In engineering equipments which different types of forces are to be considered and how to quantify them. What are different conditions of equilibrium and how to apply them analyse the problems. Importance of centre of gravity and moment of Inertia in Engineering Design. Study of different types of stresses and strains occurring in various components of the structure. Advantages and disadvantages of various geometric sections available for engineering design. This is the foundation course for a good Design Engineer.		
	Course Contents (Topics and subtopics)	**Reqd. hours**
	Suitable number of experiments from the above list will be performed To determine Law of Machine for (Screw Jack / Single Purchase Crab, Double Purchase Crab, Differential wheel and axle). To verify forces in single roof truss element. To verify bending moment at various sections for Cantilever beam, Simply supported beam. To verify reactions at the supports for simply supported and beam with overhang. To verify basic Laws of concurrent co-planer forces. To study the deflected shape of link and B.M. in equivalent simply supported beam. To study graphical methods of analysis of forces. To study the Universal testing machine and tests. To study the torsion test and impact test. Non-destructive testing: Smith Hammer test, Ultrasonic pulse velocity test To study the carbonation of concrete To study corrosion of re-inforcement. To study properties of cement composites using various admixtures and additives To study water and chloride penetration in cement composites	
	List of Text Books/ Reference Books	
	Engineering Mechanics Vol I Statics by B. N. Thadani, Publisher Wenall Book Corporation	
	Introduction to Mechanics of Solids by Egor Popov, Prentice Hall of India Pvt. Ltd	
	Mechanics of Materials by Ferdinand Beer and E. Russel Johnston, Tata McGraw Hill	
	Fundamentals of applied Mechanics by Dadhe, Jamdar and Walavalkar, Sarita Prakashan Pune	
	Engineering Mechanics by S. Timoshenko and D. H. Young, McGraw Hill Publications	
	Strength of Materials by Ferdinand Singer and Andrew Pytel, Harper Colins Publishers	
	Course Outcomes (students will be able to…..)	
	Further understanding of the concepts in the Theory course of Structural Mechanics	

<table>
<tr><td rowspan="2"></td><td>Course Code: GEP 1110</td><td>Course Title: Electrical Engg and Electronics Laboratory</td><td colspan="3">Credits = 2</td></tr>
<tr><td></td><td></td><td>L</td><td>T</td><td>P</td></tr>
<tr><td></td><td>Semester: III</td><td>Total contact hours: 60</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td colspan="6" align="center">List of Prerequisite Courses</td></tr>
<tr><td></td><td colspan="2">XIIth Standard Mathematics and Physics courses, Applied Physics I, Electrical Engg and Elctronics</td><td colspan="3"></td></tr>
<tr><td colspan="6" align="center">List of Courses where this course will be prerequisite</td></tr>
<tr><td></td><td colspan="2">Chemical Process Control</td><td colspan="3"></td></tr>
<tr><td colspan="6" align="center">Description of relevance of this course in the B. Chem. Engg. Program</td></tr>
<tr><td colspan="6">Students will get an insight to the importance of Electrical Energy in Chemical Plants . The students will understand the basics of electricity, selection of different types of drives for a given application process. They will get basic knowledge as regards to Power supplies, instrumentation amplifiers and thyristor application in industries.</td></tr>
<tr><td></td><td colspan="2" align="center">Course Contents (Topics and subtopics)</td><td colspan="3">Reqd. hours</td></tr>
<tr><td></td><td colspan="2">Suitable no. of experiments related the following concepts will be conducted:
Electrical Engineering:
Verification of Network Theorems
Study of RLC circuits
Load test on transformer
Load test on induction motor
Study of 3 phase circuits
Electronics:
Study of half wave, full wave rectifier circuits
Study of input and output characteristics of a transistor.
Study of operational amplifier circuits
Study of sensors and transducers</td><td colspan="3"></td></tr>
<tr><td colspan="6" align="center">List of Text Books/ Reference Books</td></tr>
<tr><td></td><td colspan="2">Electrical Engineering Fundamentals by Vincent Deltoro</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Electronic devices and circuits by Boylstead, Nashelsky</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Electrical Machines by Nagrath, Kothari</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Electrical Machines by P.S. Bhimbra</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Electrical Technology by B.L.Theraja, A.K.Theraja vol I,II,IV</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Thyristors and their applications by M.Ramamurthy</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Power Electronics by P.S. Bhimbra</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td colspan="6" align="center">Course Outcomes (students will be able to…..)</td></tr>
<tr><td>1</td><td colspan="2">Understand the basic concepts of D.C., single phase and three phase AC supply and circuits Solve basic electrical circuit problems</td><td colspan="3"></td></tr>
<tr><td>2</td><td colspan="2">Understand the basic concepts of transformers and motors used as various industrial drives.</td><td colspan="3"></td></tr>
<tr><td>3</td><td colspan="2">Understand the basic concepts of electronic devices and their applications in power supplies, amplification and instrumentation</td><td colspan="3"></td></tr>
<tr><td>4</td><td colspan="2">Understand the basic concepts of Data acquisition, signal conditioning</td><td colspan="3"></td></tr>
</table>

<table>
<tr><td rowspan="2"></td><td rowspan="2">Course Code: CEP 1715 MAT</td><td rowspan="2">Course Title: Engineering Applications of Computers</td><td colspan="3">Credits = 2</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td></td><td>Semester: III</td><td>Total contact hours: 60</td><td></td><td></td><td>4</td></tr>
</table>

	List of Prerequisite Courses	
1	XIIth Standard Mathematics and Physics Courses, Applied Mathematics – I and II, Material & Energy Balance Calculations	
	List of Courses where this course will be prerequisite	
1	Process Simulation Lab – I and II, Home Paper I and II	
	Description of relevance of this course in the B. Chem. Engg. Program	
	As an engineer, students have to prepare technical reports and give presentations in their professional career and software tools such as word processing, spreadsheet calculations, powerpoint presentations and programming languages such as C/C++ etc help to achieve these objectives. Design and optimization various chemical engineering operations require tedious calculations and writing a computer program to solve these problems help to understand the concepts learned in theory class better. Such calculations are done on repetitive basis in industry and generalized computer programs are useful.	
	Course Contents (Topics and subtopics)	**Reqd. hours**
1	Introduction to Computer Hardware, Architecture, Networking, Operating systems	4
2	Word processing: Fonts, colors, header, footers, page numbers, alignment, page layouts, tables, creating technical reports, references, track changes	4
3	Spreadsheet calculations: Use of cells, formulas, table calculations, graphs, matrix operations, goal seek, solver, curve fitting, regression	12
4	Power-point presentations: slide design. layout, animations, presentation project	6
5	C/C++ programming: basics, arrays, loops, if-else, switch case, functions, pointers, classes	14
6	solving single non-linear equation (Equation of state such as Van der Waal, Peng Robinson, RKS, friction factor equation, Ergun equation, Estimation of Drag Coefficient etc)	12
7	Solving set of linear equations (material balance of distillation column, multiple extraction unit etc)	8
	List of Text Books/ Reference Books	
1	Kanetkar Y. “Let us C”, Fifth Edition	
2	Microsoft Office help	
	Course Outcomes (students will be able to…..)	
1	Operate various operating systems such as (windows, linux)	
2	Prepare a technical report	
3	Prepare a technical / professional presentation	
4	Spreadsheet calculations for chemical engineering problems	
5	Develop programming logic and code it in software	

SEMESTER – IV										
No.	**Subjects**	**Credits**	**Hrs/week**			**Marks for various Exams**			
			L	**T**	**P**	**C. A.**	**M. S.**	**E. S.**	**Total**
GET 1107	Energy Engineering	4	3	1	0	20	30	50	100
BST 1102	Introduction to Biological Sciences	4	3	1	0	20	30	50	100
CET 1401	Chemical Engineering Operations	4	2	2	0	20	30	50	100
CET 1302	Chem. Eng. Thermodynamics-II	4	3	1	0	20	30	50	100
GEP 1108	Engineering Graphics -II	2	0	0	4	25	---	25	50
BSP 1103	Biological Sciences Laboratory	2	0	0	4	25	---	25	50
CEP 1701	Chemical Engineering Laboratory-I	3	0	0	6	50	---	50	100
	Total	24	13	6	10				600

	Course Code: GET 1107	**Course Title: Energy Engineering**	**Credits = 4**		
			L	**T**	**P**
	Semester: IV	**Total contact hours: 60**	**3**	**1**	**0**
	List of Prerequisite Courses				
	Chemical Engineering Thermodynamics-I, Material and Energy Balance Calculations, Applied Physics I and II, Applied Mathematics – I and II				
	List of Courses where this course will be prerequisite				
	Process Dev. and Engg., Home Paper I and II, Env. Eng. And Proc. Safety, Chem. Proj. Engg and Eco.,				
	Description of relevance of this course in the B. Chem. Engg. Program				
Students will be able to understand various equipments like steam turbine, gas turbine, pumps, compressors and power transmission system.					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1.	Properties of steam, T-S Diagram, Calculation of entropy, enthalpy, specific volume of steam, steam table, Dryness fraction,		4		
2.	Introduction to Steam Power Plant, Rankine cycle, Reheat cycle, Regenerative cycle, Back Pressure Turbine,		6		
3.	Steam Turbine, Classification, Calculation of Power Developed by Steam Turbine, Compounding of Steam Turbine		6		
4.	Boilers, Classification, Study of various Boilers such as Babcock & Wilcox Boiler, Cochran Boiler, La-Mount Boiler, Benson Boiler, Boiler Mountings and Accessories, Boiler Performance, Measurement of Steam Quality		6		
5.	Steam Nozzles, Different types of Steam Nozzles, Variation of area, velocity and specific volume		2		
6.	Elements of Steam condenser, various types of steam condenser, Condenser Efficiency		4		
7.	Compressors, Classification of Compressors, Reciprocating Compressors, Single stage compressor and multistage compressor, P-V diagram, Application of Compressors		3		
8.	Rotary Compressors, Fan, Blower & Compressors, Centrifugal and Axial compressors, Calculation of work done by Centrifugal Blower,		4		
9.	Pumps, Classification of Pumps, Reciprocating Pumps, Centrifugal Pumps, Axial Pumps, Gear Pumps, Maintenance of Pumps		3		
10	Refrigeration : COP of refrigerator and heat pumps ,classification of refrigerants , Nomenclature , properties desired by refrigerants . Vapour compression refrigeration cycle . Methods of increasing COP of VCRS . Vapour absorption refrigeration systems .		6		
11	Internal combustion engines : Thermodynamic cycles such as otto ,diesel and dual cycles. Methods of increasing thermal efficiency and performance of internal combustion engines		4		
12	Gas turbines : Constant pressure and constant volume gas turbines , open and closed cycle gas turbines . Methods of increasing thermal efficiency and specific work output of gas turbines .		4		
13	Renewable energy : Role and importance of non conventional and alternate energy sources such as solar , wind , ocean ,bio-mass and geothermal .		4		
14	Transmission of power : Introduction to various drives such as belt ,rope ,chain and gear drives . Introduction to mechanical elements such as keys, couplings and bearings in power transmission .		4		
	List of Text Books/ Reference Books				
	1. Thermodynamics by P.K. Nag 2. Power plant by Morse				

	3. Heat Engines by P.L. Balani 4. Hydraulic Machines by Jagdish Lal 5. Renewable Energy resources by Tiwari and ghosal ,Narosa publication . 6. Non conventional energy sources , Khanna publications 7. Refrigeration and air conditioning by C.P. Arora 8. Theory of Machines by Rattan .S.S 9. Gas turbine theory by HiH Saravanamutoo.	
Course Outcomes (students will be able to…..)		
1	Discuss the steam formation process and its properties. (K2)	
2	Describe the working of steam boilers, mountings and accessories. (K2)	
3	Explain the working principles of power developing systems such as steam turbines, gas turbines and internal combustion engines. (K2)	
4	Describe the working principle of vapour compression and vapour absorption refrigeration systems. (K2)	
5	Discuss different types of power transmission systems and their typical applications. (K2)	
6	Explain the working principles of power absorbing devices such as pumps and compressors. (K2)	
7	Explain need and importance of various renewable energy sources. (K2)	
8	Employ this knowledge for energy saving in various devices. (K3)	

	Course Code: BST 1102	**Course Title: Introduction of Biological Sciences**	**Credits = 4**		
			L	**T**	**P**
	Semester: IV	**Total contact hours: 60**	**3**	**1**	**0**

	List of Prerequisite Courses	
	Xth Standard Biology course, Physical Chemistry	
	List of Courses where this course will be prerequisite	
	Biochemical Engineering, Env. Eng and Proc Safety, Home Paper I and II	
	Description of relevance of this course in the B. Chem. Engg. Program	

The course offers fundamental principles of biochemistry, genetics, molecular biology, and cell biology. Biological function at the molecular level is particularly emphasized and covers the structure and regulation of genes, as well as, the structure and synthesis of proteins, how these molecules are integrated into cells, and how these cells are integrated into multicellular systems and organisms.
The course also offers important contribution to understand chemical reactions present in living organisms. A cell is the smallest self-preserving and self-reproducing unit. Many complex chemical reactions and complex transport processes occur. A cell looks like a chemical plant.

	Course Contents (Topics and subtopics)	**Reqd. hours**
1	Introduction to cells: Eukaryotes and prokaryotes, Microbial cell Physical, chemical, and evolutionary aspect of life Cell architecture and organelles Cell cytoskeleton and its role Asexual and sexual modes of reproduction: Binary fission, budding, fragmentation, formation of spores, bacterial conjugation, mitosis, and meiosis	12
2	Chemical Components of the cell Chemical bonds and groups, chemical properties of water, weak noncovalent bonds Carbohydrates: Function, Monosaccharides and Disaccharides, Polysaccharides; Glycoconjugates: Proteoglycans, Glycoproteins, and Glycolipids; Working with Carbohydrates Proteins: Function, Peptides and Proteins, Structure of amino acids; Working with Proteins, Three-Dimensional Structure of Proteins Nucleic acids: Function, Structure, chemistry, DNA, RNA and Chromosomes Lipids: Function, Storage Lipids, Structural Lipids in Membranes, Lipids as Signals, Cofactors, and Pigments; Working with Lipids	12
3	General Microbiology: Types and forms of microbes, Different phases of growth, Quantitative measurement of growth, synchronous growth and continuous culture, primary & secondary metabolite production, pure culture, selective methods, maintenance, and preservation, Transport and motility, Cell communication, Intracellular compartments	8
4	Energetics and Metabolism: Enzymes and their controls; Free energy and biological reactions, Redox potentials, Metabolic pathways: Introduction, Glycolysis and citric acid cycle; flux analysis Energy Generation in Mitochondria and Chloroplasts	12
5	Genetics: DNA replication, repair, and recombination; From DNA to Protein: How Cells Read the Genome, Gene expression and regulation: Induction and repression; Lac operon Model	12
6	Introduction to biotechnology, need for biotechnology, current applications of biotechnology (Food, fuel, medical and environmental)	4
	List of Text Books/ Reference Books	
1.	Microbiology, M.J. Pelczar, ECS Chang & N. Kriej ISBN 13:978-0-07-462302-6	
2.	Prescott's Microbiology, Joanne Willey, Linda Sherwood, Christopher J. Woolverton ISBN-10 : 1259281590	
3.	Harpers Illustrated Biochemistry 30th Edition (Harper's Illustrated Biochemistry); by Victor W. Rodwell (Author), David Bender (Author), Kathleen M. Botham (Author), Peter J. Kennelly (Author), P. Anthony Weil (Author)	
4.	Lehninger Principles of Biochemistry, David L. Nelson, Albert L. Lehninger, Michael M. Cox ISBN 071677108X, 9780716771081	
	Course Outcomes (students will be able to…..)	
1	Identify the general structure and function of carbohydrates, lipids, proteins, enzymes, and nucleic	

	acids.	
2	Outline the general processes used by the cell to generate cellular energy from sugar and to generate the energy and reducing agent needed for the citric acid cycle.	
3	Describe how DNA was shown to be the genetic material and how DNA is copied.	
4	Describe the structure and regulation of genes, and the structure and synthesis of proteins.	
5	Predict the results of genetic crosses involving two or more traits when the genes involved are linked or unlinked	
6	Describe how cell divides and mutation takes place	
7	Describe different microorganism and their reproduction cycles	

	Course Code: CET 1401	**Course Title: Chemical Engineering Operations**	**Credits = 4**		
			L	**T**	**P**
	Semester: IV	**Total contact hours:60**	**2**	**2**	**0**
List of Prerequisite Courses					
	Material & Energy Balance Calculations, Physical Cheiistry, Organic Chemistry-I and II, Chem. Eng. Thermodynamics-I, Momentum and Mass Transfer				
List of Courses where this course will be prerequisite					
	This is a basic Chem Engg. course. It is required in almost all the courses, such as, Separation Processes, Chemical Engineering Laboratory I, II and III, Process Simulation Lab – I and II, Home Paper I and II, etc.				
Description of relevance of this course in the B. Chem. Engg. Program					
This is a basic Chem Engg. course. The principles learnt in this course are required in almost all the courses and throughout the professional career of Chemical Engineer					

	Course Contents (Topics and subtopics)	Reqd. hours
1	Introduction to Unit Operations and Chemical Engineering Processes, Introduction to mass transfer: Concepts of Convective and diffusive transport	4
2	Distillation of binary mixtures: Differential distillation, Flash or equilibrium distillation, Fractionating column and multistage column, reflux, reflux ratio, need for reflux, McCabe-Thiele, Lewis-Sorel methods of estimation of number of equilibrium stages, Operating and feed lines, minimum and optimum reflux ratio, Tray and column efficiency, Packed column distillation: rate based methods: HETP, HTU, Ponchon Savarit method, Introduction to batch distillation and steam distillation. Methods for multicomponent separations: Fenske-Underwood-Gilliland Method	12
3	Absorption and Stripping of dilute mixtures: Fundamentals of absorption, equilibrium curves, Operating lines from material balances, Number of equilibrium stages, Kremser Equation, Stage efficiency and column performance, Absorption columns, Rate based methods for packed columns (HTU, NTU), Design considerations: loading and flooding zones, pressure drop and column diameter	12
4	Liquid Filtration: Filtration theory: constant pressure, constant rate, and variable pressure-variable rate filtration, Incompressible and compressible cake filtration, Continuous filtration, filter aids, Filtration equipment, Selection, Sizing and Scale-up	10
5	Sedimentation, Classification and Centrifugal Separations: Design and scale up equations, Performance evaluation, Sedimentation equipment, classifiers, centrifugal equipment, Sieving operations, types of sieving (dry, wet, vibro), magnetic separators, and froth flotation, Selection, sizing and scale-up	8
6	Drying of solids: Mechanism of drying, drying rate curves, Estimation of drying time , Drying Equipment, operation, Process design of dryers, material and energy balances in direct dryers, Drying of bioproducts	10
7	Particle Size Reduction: Energy requirements for size reduction and scale-up considerations, Operational considerations, Crushing and grinding equipment: impact and roller mills, fluid energy mills, wet/dry media mills, Selection of equipment	4
List of Text Books/ Reference Books		
1	Richardson, J.F., Coulson, J.M., Harker, J.H., Backhurst, J.R., 2002. Chemical engineering: Particle technology and separation processes. Butterworth-Heinemann, Woburn, MA.	
2	Seader, J.D., Henley, E.J., 2005. Separation Process Principles, 2 ed. Wiley, Hoboken, N.J.	
3	Svarovsky, L., 2000. Solid-Liquid Separation. Butterworth-Heinemann, Woburn, MA.	
4	McCabe, W., Smith, J., Harriott, P., 2004. Unit Operations of Chemical Engineering, 7 ed. McGraw-Hill Science/Engineering/Math, Boston.	
5	Green, D., Perry, R., 2007. Perry’s Chemical Engineers’ Handbook, Eighth Edition, 8 ed. McGraw-Hill Professional, Edinburgh.	
6	Dutta, B.K., 2007. Principles of Mass Transfer and Separation Process. Prentice-Hall of India Pvt. Ltd, New Delhi.	
Course Outcomes (students will be able to…..)		
1	Know the significance and usage of different particulate characterization parameters, and equipment to estimate them	
2	Describe Size reduction energy requirements, estimate performance of equipment, selection and sizing of equipment	
3	Analyze filtration data and select systems based on requirements, estimate filtration area for given	

	requirements, understand filter aids and their usage	
4	Draw T-y-x diagrams, and y-x diagrams, operating lines, feed line, bubble point, dew point calculations, ternary phase diagrams, partition coefficient	
5	Describe two common modes of drying, industrial drying equipment	
6	Calculate mass transfer coefficient in various equipment, Calculate height and diameter required, minimum solvent required in absorption, calculate height and diameter required, minimum reflux required in distillation	

	Course Code: CET 1302	**Course Title:** Chemical Engineering Thermodynamics II	**Credits =** 4		
			L	**T**	**P**
	Semester: IV	**Total contact hours:60**	3	1	**0**

	List of Prerequisite Courses	
	Applied Mathematics- I and II, Physical Chemistry, Chemical Engineering Thermodynamics-I	
	List of Courses where this course will be prerequisite	
	Separation Processes, Chemical Reaction Engineering, Multiphase Reactor Engineering, Env. Engg. and Proc Safety, Proc. Development and Engineering, Home Paper I and II	
	Description of relevance of this course in the B. Chem. Engg. Program	
This course builds on the preceding course by developing the concept of non-ideal mixing and provides students with the formalism and insights necessary to tackle real industrial problems like liquid-liquid phase splitting, azeotropy, non-zero heats of mixing, sparingly soluble gases and solids, electrolytes etc. Student who have taken this course may be expected to intelligently analyze practically the full spectrum of industrial chemical processes.		
	Course Contents (Topics and subtopics)	**Reqd. hours**
1	General Equations of Equilibrium: Equality of Chemical Potentials and Fugacity and Activity Coefficients	2
2	Models of the Liquid Phase: Activity Coefficient Models (Redlich-Kister, Wilson et al, UNIQUAC and NRTL)	8
3	Calculation of Excess Properties.	4
4	Raoult's Law and Modified Raoult's Law. Calculation of Bubble Point, Dew Point, T-x-y and P-x-y diagrams	8
5	Azeotropy	4
6	Phase Stability and Liquid-Liquid Phase Splitting	8
7	Solubility of Gases in Liquids (Unsymmetric Reference states, Henry's Law and the concept of infinite dilution activity coefficient).	2
8	Solubility of Solids in Liquids	2
9	Debye Huckel Theory and Salting out of Non-Electrolytes	6
10	Chemical Equilibrium in Ideal Mixtures	4
11	Chemical Equilibrium in Non-Ideal Reacting Mixtures	2
12	Chemical Equilibrium in Heterogenous Reacting Mixtures	2
13	Chemical Equilibrium in Multi-Reaction Systems	4
11	Estimation of Activity Coefficients by Group Contribution Methods : UNIFAC Model	4
	List of Text Books/ Reference Books	
	Introduction to Chemical Engineering Thermodynamics: Smith, van Ness, Abbott	
	Chemical, Biochemical and Engineering Thermodynamics: S. I. Sandler	
	Phase Equilibria in Chemical Engineering: Walas	
	Molecular Thermodynamics of Fluid Phase Equilibria: Prausnitz	
	Course Outcomes (students will be able to…..)	
1	Use activity coefficient models to calculate excess properties of liquids	
2	Use modified Raoult's law to calculate VLE of non-ideal mixtures	
3	Calculate chemical equilibrium in non-ideal mixtures	
4	Calcuate solubility of gases in liquids including aqueous solutions with electrolyes.	
5	Quantitatively describe salting out effect	
6	Estimate mixture properties from group contribution methods	

	Course Code: GEP 1108	**Course Title: Engineering Graphics II**	**Credits = 2**		
			L	**T**	**P**
	Semester: IV	**Total contact hours: 60**	**0**	**0**	**4**
		List of Prerequisite Courses			
	Engineering Graphics – I				
		List of Courses where this course will be prerequisite			
	Equipment Design and Drawing I and II				
		Description of relevance of this course in the B. Chem. Engg. Program			
A student of Chemical Engineering is required to know the various processes and also the equipment used to carry out the processes. Some of the elementary processes like filtration, size reduction, evaporation, condensation, crystallization etc., are very common to all the branches of technology. These and many other processes require machines and equipments. One should be familiar with the design, manufacturing, working, maintenance of such machines and equipments. The subject of "drawing" is a medium through which, one can learn all such matter, because the "drawings" are used to represent objects and processes on the paper. Through the drawings, a lot of accurate information is conveyed which will not be practicable through a spoken word or a written text. Drawing is a language used by engineers and technologists.					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1.	Introduction to assembly and detail drawings		4hrs/ week		
2.	Hexagonal Headed Bolt & Nut assembly				
3.	Assembly of Plummer Block				
4.	Assembly of Footstep Bearing				
5.	Assembly of Stuffing Box				
6.	Preparing Detail Drawing from Assembly of Stuffing Box				
7.	Assembly of Expansion Pipe Joint				
8.	Assembly of Non-Return Valve				
9.	Assembly of Feed Check Valve				
10.	Introduction to Solid Works				
11.	Preparing part drawing, assembly drawing of Plummer Block, Non-Return Valve etc. using Solid Work				
		List of Text Books/ Reference Books			
	1.Machine Drawing by N.D.Bhat				
	2. Machine Drawing by Gill				
		Course Outcomes (students will be able to…..)			
1	Show assembly drawing and Detail Drawing of simple equipment				
2	Show with a diagram the working of Bearings, Stuffing box, Shaft coupling, Pipe Joints, Valves,				
3	Prepare computer aided drawing.				

	Course Code: BSP 1103	**Course Title: Biological Sciences Laboratory**	**Credits = 2**		
			L	**T**	**P**
	Semester: IV	**Total contact hours: 30**	**0**	**0**	**4**

List of Prerequisite Courses

1	Xth Standard Biology course, Physical Chemistry	

List of Courses where this course will be prerequisite

	Biochemical Engineering, Env. Eng and Proc Safety, Home Paper I and II	

Description of relevance of this course in the B. Chem. Engg. Program

In this course, students will develop basic understanding of biological systems, their monitoring and quantification. The focus is to teach basic skills in handling microorganisms and different qualitative and quantitative analysis techniques. Additionally, analyzing effect of environmental parameters that may have an influence on the growth of the microbe has been addressed through basic experiments.

	Course Contents (Topics and subtopics)	Reqd. hours
1	Microbial Isolation and quantitative measurements • Microscopy • Sample preparation • Dilution & Plating/spectrophotometric • Colony counting (demo of automated colony counter) • Growth kinetics	6
2	Quantitative Analysis • Carbohydrates • Proteins • Lipids • DNA/Nucleic acid (Demo) • CHNS (Demo)	6
3	Enzymology Isolation and assay of enzyme from natural source Primary screening assay for extracellular enzymes	6
4	Environmental stress studies • Aerobic/ Anaerobic stress (Fluorescence microscopy) • Algal growth	6
5	Assays: VitB12 and Antibiotic resistance assays	6

List of Text Books/ Reference Books

1	Microbiology, M.J. Pelczar, ECS Chang & N. Kriej ISBN 13:978-0-07-462302-6	
2	Principles and Techniques of Biochemistry and Molecular Biology Keith Wilson, John Walker; Cambridge University Press (2010) ISBN: 0521516358,9780521516358	

Course Outcomes (students will be able to…..)

1	Develop basic understanding of microbes and their monitoring and quantification	
2	Perform the quantitative analysis of biomolecules	
3	Understand the Enzyme Kinetics	
4.	Understand the responses of biological systems to environment factors	

	Course Code: CEP 1701	**Course Title: Chemical Engineering Laboratory-I**	**Credits = 3**		
			L	**T**	**P**
	Semester: IV	**Total contact hours: 90**	**0**	**0**	**6**
List of Prerequisite Courses					
1	Momentum and Transfer, Chemical Engineering Operations, Chemical Engineering Operations – I and II				
List of Courses where this course will be prerequisite					
	Chemical Engineering Laboratory II and III, and other Chemical Engineering Courses,				
Description of relevance of this course in the B. Chem. Engg. Program					
Chemical Engineering lab provides students the first hand experience of verifying various theoretical concepts learnt in theory courses. It also exposes them to practical versions of typical chemical engineering equipments and servers as a bridge between theory and practice. This particular lab focuses on fluid dynamics, distillation, filtration, drying and sedimentation.					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	9-13 Experiments on fluid dynamics		24		
2	5-7 Experiments on distillation		16		
3	1-2 Experiments on sedimentation		4		
4	2-3 Experiments on filtration		6		
5	1-2 Experiments on drying		4		
6	2-3 Experiments on Thermodynamics		6		
List of Text Books/ Reference Books					
1	McCabe W.L., Smith J.C., and Harriott P. Unit Operations in Chemical Engineering, 2014				
2	Bird R.B., Stewart W.E., and Lightfoot, E.N. Transport Phenomena, 2007				
3	Coulson J.M., Richardson J.F., and Sinnott, R.K. Coulson & Richardson's Chemical Engineering: Chemical engineering design, 1996.				
4	Green D. and Perry R. Perry's Chemical Engineers' Handbook, Eighth Edition, 2007.				
Course Outcomes (students will be able to…..)					
1	Learn how to experimentally verify various theoretical principles				
2	Visualize practical implementation of chemical engineering equipments				
3	Develop experimental skills				

SEMESTER – V										
No.	**Subjects**	**Credits**	**Hrs /week**			**Marks for various Exams**			
			L	**T**	**P**	**C. A.**	**M. S.**	**E. S.**	**Total**
CET 1716	Mathematical Methods in Chem. Engg.	4	3	1	0	20	30	50	100
CET 1102	Heat Transfer	4	2	2	0	20	30	50	100
CET 1201	Chemical Reaction Engineering	4	2	2	0	20	30	50	100
CET 1402	Separation Processes	4	2	2	0	20	30	50	100
CET 1202	Biochemical Engineering	3	2	1	0	10	15	25	50
CEP 1704	Chemical Engineering Laboratory-II	3	0	0	6	50	---	50	100
CEP 1702	Process Simulation Lab – I	2	0	0	4	25	---	25	50
	Total	24	11	8	10				600

	Course Code: CEP 1716	**Course Title: Mathematical Methods in Chem. Engg.**	**Credits = 4**		
			L	**T**	**P**
	Semester: V	**Total contact hours: 60**	**3**	**1**	**0**

List of Prerequisite Courses		
1	Applied Mathematics – I and II, Momentum and Mass Transfer, Chem. Eng. Operations, Chem Engg Thermodynamics I and II	
List of Courses where this course will be prerequisite		
1	Transport Phenomena (CET 1101)	
2	Heat transfer, Chemical Reaction Engineering , Chemical Process Control, Optimization of Chemical Engineering Systems, Home Paper I and II, Seminar, etc.	
Description of relevance of this course in the B. Chem. Engg. Program		
In this course advanced mathematical tools are covered which will help students to solve complex problems in Chemical Engineering. This course will serve as a bridge between the applied mathematics courses and their application to Chemical Engineering problems. Specifically, the techniques learnt in this course will help problem formulation and solution in Chemical Reaction Engineering, Chemical Process Control, Heat Transfer and Transport Phenomena.		
	Course Contents (Topics and subtopics)	**Reqd. hours**
1	Vector algebra: scalar & vector product (application to fluid flow problems)	12
2	PDEs: Types, solution (penetration theory, 2D conduction, counter-current heat exchanger, reaction-diffusion, dispersion model, etc.)	8
3	Fourier series, transforms (diffusion equations)	8
4	Laplace, z transform (process control applications)	8
5	Linear algebra (matrix theory) (stability analysis, scaling of equations)	8
6	Bifurcation analysis (sensitivity analysis)	8
7	Perturbation analysis (for boundary flow problems, solution of equations, model reduction etc.)	8
List of Text Books/ Reference Books		
1	Kreyszig, E. Advanced Engineering Mathematics.	
2	Pushpavanam, S. Mathematical Methods in Chemical Engineering	
3	Kundu, P. and Cohen, I.M. Fluid Mechanics.	
4	Jenson, V.G. and Jeffreys, G.V. Mathematical Methods in Chemical Engineering	
Course Outcomes (students will be able to…..)		
1	Formulate a Chemical Engineering problem into a mathematical problem	
2	Solve (analytically or numerically) ODE and PDE equations encountered in Chemical Engineering Applications	
3	Assess stability of Chemical Engineering systems	

<table>
<tr><td rowspan="3"></td><td rowspan="2">Course Code: CET 1102</td><td rowspan="2">Course Title: Heat Transfer</td><td colspan="3">Credits = 4</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td>Semester: V</td><td>Total contact hours: 60</td><td>2</td><td>2</td><td>0</td></tr>
<tr><td colspan="6" align="center">List of Prerequisite Courses</td></tr>
<tr><td></td><td colspan="2">Momentum and Mass transfer, Applied Mathematics I and II, Material and Energy Balance Calculations</td><td colspan="3"></td></tr>
<tr><td colspan="6" align="center">List of Courses where this course will be prerequisite</td></tr>
<tr><td></td><td colspan="2">Chemical Reaction engineering, Multiphase Reactor Engineering, Process Development and Engineering, Home Paper I and II, Env. Engg. and Process Safety, etc.</td><td colspan="3"></td></tr>
<tr><td colspan="6" align="center">Description of relevance of this course in the B. Chem. Engg. Program</td></tr>
<tr><td colspan="6">This is a basic course that deals with heat transfer, heat exchangers and their design. Heat transfer forms one of the basic pillars of Chemical Engineering Education and is required in all future activities.</td></tr>
<tr><td></td><td colspan="2" align="center">Course Contents (Topics and subtopics)</td><td colspan="3">Reqd. hours</td></tr>
<tr><td>1</td><td colspan="2">Revision of Basics of Heat transfer: Steady state and unsteady state conduction, Fourier’s law, Concepts of resistance to heat transfer and the heat transfer coefficient. Heat transfer in Cartesian, cylindrical and spherical coordinate systems, Insulation, critical radius.</td><td colspan="3">4</td></tr>
<tr><td>2</td><td colspan="2">Convective heat transfer in laminar and turbulent boundary layers. Theories of heat transfer and analogy between momentum and heat transfer.</td><td colspan="3">4</td></tr>
<tr><td>3</td><td colspan="2">Heat transfer by natural convection.</td><td colspan="3">2</td></tr>
<tr><td>4</td><td colspan="2">Heat transfer in laminar and turbulent flow in circular pipes: Double pipe heat exchangers: Concurrent, counter-current and cross flows, mean temperature difference, NTU – epsilon method for exchanger evaluation. Heat transfer outside various geometries in forced convection, such as, single spheres, banks of tubes or cylinders, packed beds and fluidised beds</td><td colspan="3">6</td></tr>
<tr><td>5</td><td colspan="2">Shell and tube heat exchangers: Basic construction and features, TEMA exchanger types, their nomenclature, choice of exchanger type, correction to mean temperature difference due to cross flow, multipass exchangers. Design methods for shell and tube heat exchangers such as Kern Method, Bell – Delaware method</td><td colspan="3">12</td></tr>
<tr><td>6</td><td colspan="2">Finned tube exchangers, air-cooled cross flow exchangers and their process design aspects</td><td colspan="3">3</td></tr>
<tr><td>7</td><td colspan="2">Compact Exchangers: Plate, Plate fin, Spiral, etc.: Construction, features, advantages, limitations and their process design aspects</td><td colspan="3">3</td></tr>
<tr><td>8</td><td colspan="2">Condensation of vapours: theoretical prediction of heat transfer coefficients, practical aspects, horizontal versus vertical condensation outside tubes, condensation inside tubes, Process Design aspects of total condensers, condensers with de-superheating and subcooling, condensers of multicomponent mixture, condensation of vapours in presence of non-condensables.</td><td colspan="3">10</td></tr>
<tr><td>9</td><td colspan="2">Heat transfer to boiling liquids: Process design aspects of evaporators, natural and forced circulation reboilers</td><td colspan="3">10</td></tr>
<tr><td>10</td><td colspan="2">Heat transfer in agitated vessels: coils, jackets, limpet coils, calculation of heat transfer coefficients, heating and cooling times, applications to batch reactors and batch processes</td><td colspan="3">4</td></tr>
<tr><td>11</td><td colspan="2">Basics of Radiative heat transfer and application to Furnace Design</td><td colspan="3">2</td></tr>
<tr><td colspan="6" align="center">List of Text Books/ Reference Books</td></tr>
<tr><td></td><td colspan="2">Process Heat Transfer, Kern D.Q.</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Heat Exchangers, Kakac S., Bergles A.E., Mayinger F</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Process Heat Transfer, G. Hewitt</td><td colspan="3"></td></tr>
<tr><td colspan="6" align="center">Course Outcomes (students will be able to…..)</td></tr>
<tr><td>1</td><td colspan="2">Calculate temperature profiles in a slab at steady state</td><td colspan="3"></td></tr>
<tr><td>2</td><td colspan="2">Calculate heat transfer coefficients in various equipment like double pipe heat exchangers, shell and tube heat exchangers, plate heat exchangers, condensation, evaporation, agitated tanks.</td><td colspan="3"></td></tr>
<tr><td>3</td><td colspan="2">Calculate heat duty/outlet temperatures/pressure drops/area required for various equipment like double pipe heat exchangers, shell and tube heat exchangers, plate heat exchangers, condensation, evaporation, agitated tanks.</td><td colspan="3"></td></tr>
<tr><td>4</td><td colspan="2">Identify and select type of shell and tube exchanger based on TEMA classification.</td><td colspan="3"></td></tr>
</table>

	Course Code: CET 1201	**Course Title: Chemical Reaction Engineering**	**Credits = 4**		
			L	**T**	**P**
	Semester: V	**Total contact hours: 60**	**2**	**2**	**0**

List of Prerequisite Courses

	Physical Chemistry, Material & Energy Balance Calculations, Applied Mathematics I and II, Momentum and Mass Transfer, Chem Engg Thermodynamics I and II	

List of Courses where this course will be prerequisite

	Biochemical Engineering, Environmental Engineering and Process Safety, Proc. Dev and Engg., Multiphase Reactor Engineering, Home Paper I and II	

Description of relevance of this course in the B. Chem. Engg. Program

Chemical Reaction Engineering is concerned with the utilisation of chemical reactions on a commercial scale. This course is very relevant but not limited to the following industries: Inorganic chemicals, organic chemicals, petroleum & petrochemicals, Pulp & paper, Pigments & paints, rubber, plastics, synthetic fibres, Foods, Dyes and intermediates, Oils, oleochemicals, and surfactants, Minerals, cleansing agents, Polymers and textiles, Biochemicals and biotechnology, pharmaceuticals and drugs, Microelectronics, energy from conventional and non-conventional resources, Metals

	Course Contents (Topics and subtopics)	**Reqd. hours**
1	Batch reactor (BR), continuous stirred tank reactor (CSTR), plug flow reactor (PFR), packed-bed reactor (PBR)	2
2	Design equations for BR, CSTR, PFR, PBR, and applications of design equations to various series- and parallel- combinations of flow reactors	6
3	Rate laws and stoichiometry	4
4	Isothermal reactor design applied to BR, CSTR, PFR, PBR	6
5	Analysis of rate data: differential method, integral method	4
6	Multiple reactions	4
7	Reaction mechanisms, pathways, bioreactions	6
8	Catalysis and catalytic reactors, catalyst deactivation, external diffusion effects on heterogeneous reactions, diffusion and reaction in solid catalysts;	8
9	Introduction to non-isothermal reactor design	6
10	Residence time distribution in reactors; models for non-ideal reactors	8
11	Mass transfer with chemical reaction in fluid-fluid and fluid-fluid-solid systems; Model contactors, pilot plants, and collection of scale-up data	6

List of Text Books / Reference Books

1	Elements of Chemical Reaction Engineering – H. Scott FOGLER	
2	Chemical Reaction Engineering – Octave LEVENSPIEL	
3	The Engineering of Chemical Reactions – Lanny D. SCHMIDT	
4	An introduction to Chemical Engineering Kinetics and Reactor Design – Charles HILL	
5	Heterogeneous Reactions, Vol. I and II – L. K. Doraiswamy, M. M. Sharma	

Course Outcomes (students will be able to ...)

1	design chemical reactors optimally, using minimum amount of data	
2	design experiments in a judicious way to get the required data, if not available	
3	fix some problems related to operability and productivity	
4	maintain and operate a process in a safe manner	
5	increase capacity and/or selectivity and/or safety by improving/changing the reactor type/sequence and/or operating conditions	

	Course Code: CET 1402	**Course Title: Separation Processes**	**Credits = 4**		
			L	**T**	**P**
	Semester: V	**Total contact hours:60**	**2**	**2**	**0**

List of Prerequisite Courses

Material & Energy Balance Calculations, Chemical Engineering Operations – I, Chem. Eng. Thermodynamics-I and II, Momentum Transfer, Applied Mathematics I and II

List of Courses where this course will be prerequisite

Chemical Engineering Laboratory, Process Simulation Lab – I and II, Home Paper I and II, Proc Dev and Engg.,

Description of relevance of this course in the B. Chem. Engg. Program

This is a course further built up on and in continuation with Chem. Engg. operations. It forms the basis oc Chemical Engineering Principles and hence it is required in almost all the courses and throughout the professional career of a Chemical Engineer.

	Course Contents (Topics and subtopics)	**Reqd. hours**
1	Extraction and Leaching of ternary systems: Ternary diagrams, Hunter-Nash graphical method and Maloney–Schubert graphical equilibrium-stage method, Solvent Selection, Operating point, number of stages, maximum solvent to feed ratios, minimum reflux, minimum number of stages, Introduction to reactive extraction, aqueous two phase extraction, extraction of biomolecules, supercritical fluid extraction, Solid-liquid extraction: Solid - liquid equilibria, efficiency, performance evaluation, Equipment for extraction, leaching and their sizing, Design considerations	15
2	Adsorption and Ion exchange: Liquid Adsorption, Ion-Exchange Equilibria, Equilibria in Chromatography, Breakthrough Curves, Kinetic and transport considerations, Convection-Dispersion Model, Separation Efficiency (Plate Height or Bandwidth), Correlations for Transport-Rate Coefficients, Equipment for sorption operations, Scale-Up and Process Alternatives, Adsorptive Membranes, simulated-moving-bed operation, modes of operation	12
3	Crystallization: Theory of solubility and crystallization, phase diagram (temp/solubility relationship), Supersaturation, Nucleation, Crystal Growth, Population balance analysis, method of moments for rate expressions for, volume, area and length growth, CSD distribution, MSMPR operation, evaporative and cooling (rate expressions) , most dominant size, ideal classified bed, Precipitation, Melt crystallization, Process design of crystallizers and their operation	12
4	Humidification and Cooling Towers: Method of changing humidity and equipment, Cooling tower process design, counter-current, concurrent and cross current, mass and heat balances in bulk and interfaces, Estimation of air quality, performance evaluation of cooling towers.	9
5	Membrane Separations: Types of separations, reverse osmosis, ultrafiltration, gas separation, vapour permeation and pervaporation, dialysis, electrodialysis, nanofiltration, Transport Through Porous Membranes, Resistance Models, Liquid Diffusion Through Pores, Gas Diffusion Through Porous Membranes, Transport Through Nonporous Membranes, Solution-Diffusion for Liquid Mixtures, Gas Mixtures, Concentration Polarization and Fouling, Membrane modules, arrangement of modules in cascades, performance criteria and design considerations	12

List of Text Books/ Reference Books

1	Richardson, J.F., Coulson, J.M., Harker, J.H., Backhurst, J.R., 2002. Chemical engineering: Particle technology and separation processes. Butterworth-Heinemann, Woburn, MA.	
2	Seader, J.D., Henley, E.J., 2005. Separation Process Principles, 2 ed. Wiley, Hoboken, N.J.	
3	McCabe, W., Smith, J., Harriott, P., 2004. Unit Operations of Chemical Engineering, 7 ed. McGraw-Hill Science/Engineering/Math, Boston.	
4	Green, D., Perry, R., 2007. Perry's Chemical Engineers' Handbook, Eighth Edition, 8 ed. McGraw-Hill Professional, Edinburgh.	
5	Dutta, B.K., 2007. Principles of Mass Transfer and Separation Process. Prentice-Hall of India Pvt. Ltd, New Delhi.	

Course Outcomes (students will be able to…..)

1	List situations where liquid–liquid extraction might be preferred to distillation, Make a preliminary selection of a solvent using group-interaction rules, Size simple extraction equipment	
2	Differentiate between chemisorption and physical adsorption, List steps involved in adsorption of a solute, and which steps may control the rate of adsorption, Explain the concept of breakthrough in fixed-bed adsorption	

3	Explain how crystals grow, Explain the importance of supersaturation in crystallization. Describe effects of mixing on supersaturation, mass transfer, growth, and scale-up of crystallization	
4	Explain membrane processes in terms of the membrane, feed, sweep, retentate, permeate, and solute-membrane interactions. Distinguish among microfiltration, ultrafiltration, nanofiltration, virus filtration, sterile filtration, filter-aid filtration, and reverse osmosis in terms of average pore size. Explain common idealized flow patterns in membrane modules.	

	Course Code: CET 1202	**Course Title: Biochemical Engineering**	**Credits = 3**		
			L	**T**	**P**
	Semester: V	**Total contact hours: 45**	**2**	**1**	**0**

List of Prerequisite Courses		
	Chemical Reaction Engineering, Introduction to Biological Sciences and Bioengineering, Physical Chemistry, Material and Energy Balance Calculations, Chem Engg Thermodynamics I and II, Chem Engg Operations	
List of Courses where this course will be prerequisite		
	Multiphase Reactor Engineering, Env. Engg and Proc Safety, Proc Dev and Engg., Home Paper I and II	
Description of relevance of this course in the B. Chem. Engg. Program		
This course integrates Biological sciences and chemical engineering and a requisite for Biobased Industry		
	Course Contents (Topics and subtopics)	**Reqd. hours**
1	Introduction to Biotechnology: Role of chemical engineers in biotechnology	2
2	Basic of Genetic Engineering and Tissue Culture : Recombinant DNA technology	2
3	Structure function relations of enzymes; Classification,	2
4	Mechanism of Enzyme action, Enzyme kinetics, inhibition and regulation	2
5	Enzyme purification and characterization, Coenzymes, cofactors	2
6	Enzyme reactors, thermostabilization, immobilization of enzymes	2
7	Enzymes as industrial catalysts- Examples	2
8	Bioprocess Development	3
9	Plant and animal cell cultures for the production of biochemicals, Immobilized cells.	4
11	Kinetics of microbial growth, models and simulations, Batch and continuous culture, Mixed microbial culture ,	4
12	Biochemical process development and bioreactors using biological catalysts	4
13	Integration of downstream processing with bioprocessing	4
14	Transport phenomena in bioreactions and bioreactors	4
15	Fundamentals of fermentation-submerged fermentation, Fermenter design and basic biochemical engineering aspects of fermentation	4
16	Reactor design for biochemical reactions and scale up, Process Design for bioproducts, Bioreactor design, Scale up of bioreactions/reactors,	4
List of Text Books/ Reference Books		
	Biochemical Engineering Fundamentals, Bailey and Olis, Wiley	
	Biotransformations and Bioprocesses, Doble,Anilkumar and Gaikar, Marcel Dekker	
Course Outcomes (students will be able to…..)		
1	calculate microbial/enzymatic kinetics parameters	
2	Design enzyme reactors and scale up fermenters	
3	calculate biomass production/substrate requirements	
4	decide process parameters	
5	estimate energy equipments/oxygen requirements	
6	estimate bio-reactor size/time for a given microbial/enzymatic process.	

	Course Code: CEP 1704	Course Title: Chemical Engineering Laboratory-II	Credits = 3		
			L	**T**	**P**
	Semester: V	**Total contact hours: 90**	**0**	**0**	**6**
	List of Prerequisite Courses				
1	Material and Energy Balance Calculations, Momentum and Mass Transfer, Chemical Engineering Thermodynamics – I and II, Chem Engg Operations, Chemical Reaction Engineering, Separation Processes				
	List of Courses where this course will be prerequisite				
	Students will be able to understand pricinples in a better way so it is required in all the courses				
	Description of relevance of this course in the B. Chem. Engg. Program				
	Chemical Engineering lab provides students the first hand experience of verifying various theoretical concepts learnt in theory courses. It also exposes them to practical versions of typical chemical engineering equipments and servers as a bridge between theory and practice. This particular lab focuses on heat and mass transfer principles, chemical engineering thermodynamics, adsorption, extraction and crystallization.				
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	8-10 Experiments on heat transfer		20		
2	5-7 Experiments on mass transfer		16		
3	3-5 Experiments on chemical engineering thermodynamics		10		
4	2-3 Experiments on adsorption		6		
5	1-2 Experiments on extraction		4		
6	1-2 Experiments on crystallization		4		
	List of Text Books/ Reference Books				
1	McCabe W.L., Smith J.C., and Harriott P. Unit Operations in Chemical Engineering, 2014				
2	Kern D.Q. Process heat reansfer, 1950				
3	Treybal R.E. Mass-transfer Operations. 1980				
4	Green D. and Perry R. Perry's Chemical Engineers' Handbook, Eighth Edition, 2007.				
	Course Outcomes (students will be able to…..)				
1	Learn how to experimentally verify various theoretical principles				
2	Visualize practical implementation of chemical engineering equipments				
3	Develop experimental skills				

	Course Code: CEP 1702	**Course Title: Process Simulation Lab - I**	**Credits = 2**		
			L	**T**	**P**
	Semester: V	**Total contact hours: 60**	**0**	**0**	**4**
List of Prerequisite Courses					
1	Applied Mathematics – I and II, Material & Energy Balance Calculations, Chem. Eng. Thermodynamics-I and II, Momentum and Mass Transfer, Chemical Engineering Operations Engineering Applications of Computers, etc.				
List of Courses where this course will be prerequisite					
1	Process Simulation Lab – II, Home paper I and II, etc.				
Description of relevance of this course in the B. Chem. Engg. Program					
The course will help to write programs for chemical engineering problems in various basic as well as advanced programming software such as C/C++, SciLAB, Python etc. Students will solve problems using various numerical methods for chemical engineering subject which they have learnt so far. The course is designed in such a way that students will get an opportunity to revise chemical engineering basic along with developing software skills.					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	C programming/Visual Basic Revisions: Boundary layer on flat plate, Solution of ODE, interpolation, Batch distillation design problem		9		
2	Introduction to Python and SCILAB programming		6		
3	Material and energy balance (a) recycle problems (b) humidity calculations (cooling tower design) (c) adiabatic flame temperature (numerical integration)		6		
4	Thermodynamics: (a) Vapor pressure estimation from equation of state b) VLE data correlation using activity coefficient models (c) High Pressure VLE, gas solubility using EOS		6		
5	Fluid flow: (a) solution to laminar flow problems (numerical) (b) piping system calculations		6		
6	Unit operations: (a) Absorption column design (b) Extractor design		6		
7	Reaction engineering: Concentration profiles of series/parallel reactions, PFR design, estimation of rate constants for catalytic reactions		6		
List of Text Books/ Reference Books					
1	Jelen , B., VBA and Macros: Microsoft Excel 2010				
2	www.scilab.in (Free Books for Chemical Engineering)				
Course Outcomes (students will be able to…..)					
1	Use advanced programming software with built in functions				
2	Write own functions/macros				
3	Solve chemical engineering problems using computers				

SEMESTER – VI										
No.	**Subjects**	**Credits**	**Hrs/week**			**Marks for various Exams**			
			L	**T**	**P**	**C. A.**	**M. S.**	**E. S.**	**Total**
CET 1601	Material Science and Engineering	3	2	1	0	10	15	25	50
CET 1203	Multiphase Reaction Engineering	3	2	1	0	10	15	25	50
CET 1503	Process Safety & Environmental Engg.	4	2	2	0	20	30	50	100
CET 1703	Chemical Process Control	4	3	1	0	20	30	50	100
	Institute Elective – I	3	2	1	0	10	15	25	50
CEP 1706	Chem. Eng. Laboratory-III	3	0	0	6	50	---	50	100
CEP 1705	Process Simulation Lab – II	2	0	0	4	25	---	25	50
GEP 1111	Equipment Design and Drawing-I	4	2	0	4	25	---	25	50
	Total	24	13	6	14				550

	Course Code: CET 1601	**Course Title: Material Science and Engineering**	**Credits = 3**		
			L	**T**	**P**
	Semester: VI	**Total contact hours: 45**	**2**	**1**	**0**
List of Prerequisite Courses					
	Structural Mechanics, Applied Physics I and II,				
List of Courses where this course will be prerequisite					
	Equipment design and drawing I and II, Home Paper I and II, Process Development and Engg. Chem Proj Engg. and Eco				
Description of relevance of this course in the B. Chem. Engg. Program					
Selection of MOC for a given application, maintenance and corrective measures for various engineering materials.					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	Engineering Materials: Classification, study of ferrous and non ferrous materials		3		
2	Phase diagrams of steel, brass and cupronickel and the applications of phase diagrams		5		
3	Effect of structure on properties: subatomic to macroscopic level		5		
4	Modification and control of material properties		4		
5	Polymeric materials , Ceramic materials, Composite materials and Smart materials		4		
6	Corrosion Engineering: Electrochemical principles, different types of corrosion, Polarisation, mechanisms of corrosion control and prevention, preventive coatings. Corrosion behavior of important alloys such as stainless steels, brass etc.		10		
7	Theory of failure: Crystal defects, plastic deformation. Types of mechanical failure, fracture , fatigue and creep		10		
8	Criteria for selection of materials in chemical process industry		4		
List of Text Books/ Reference Books					
1	The Essence of Materials for Engineers, Robert W. Messler, Jr.				
2	Materials Science and Engineering, Raghavan V.				
3	Materials Science and Engineering, Van Vlack L.H.				
4	Engineering Materials and Applications, Flin R.A., Trojan P.K.				
Course Outcomes (students will be able to…..)					
1	Students will be able to draw simple Phase Diagram				
2	Describe causes of mechanical failure				
3	List types of corrosion and describe method to control them				

	Course Code: CET 1203	Course Title: Multiphase Reaction Engineering	Credits = 3		
			L	**T**	**P**
	Semester: VI	**Total contact hours: 45**	**2**	**1**	**0**

	List of Prerequisite Courses	
	Chemical Reaction Engineering , Momentum and Mass Transfer (CET 1101: Semester III), Heat Transfer, Chemical Reaction Engineering, Chemical Engineering Operations Separation Processes, Chem Engg Thermodynamics I and II	
	List of Courses where this course will be prerequisite	
	Home Paper I and II, Proc Dev and Engg.,	
	Description of relevance of this course in the B. Chem. Engg. Program	
	Multiphase Reaction Engineering is concerned with the utilisation of chemical reactions on a commercial scale. This course is very relevant but not limited to the following industries: Inorganic chemicals, organic chemicals, petroleum & petrochemicals, Pulp & paper, Pigments & paints, rubber, plastics, synthetic fibres, Foods, Dyes and intermediates, Oils, oleochemicals, and surfactants, Minerals, cleansing agents, Polymers and textiles, Biochemicals and biotechnology, pharmaceuticals and drugs, Microelectronics, energy from conventional and non-conventional resources, Metals	
	Course Contents (Topics and subtopics)	**Reqd. hours**
1	Classification of multiphase reactors, qualitative description, examples of industrial importance	2
	Hydrodynamics, scale-up, process design and performance of the following major classes of multiphase reactors, case studies and problems, w.r.t:	
	- Stirred tank reactors,	10
	- Bubble columns, packed bubble columns, sectionalised bubble columns,	8
	- Internal loop and external loop air-lift reactors, jet loop reactors,	4
	- Fluid-fluid reactors such as spray columns, packed columns, plate columns, static mixers, rotating disc contactors	6
	- Fixed bed reactors, trickle bed reactors,	7
	- Solid-liquid and gas-solid fluidised bed reactors, solid-gas transport reactors	8
	List of Text Books / Reference Books	
1	Heterogeneous Reactions, Vol. I and II – L. K. Doraiswamy, M. M. Sharma	
2	Fluid Mixing and Gas Dispersion in Stirred Reactors – G. B. Tatterson	
3	Bubble Column Reactors – W. D. Deckwer	
4	Fluidisation – D. Kunni and O. Levenspiel	
5	Gas Liquid Reactions – P. V. Danckwerts	
6	Fluidisation – J. F. Davidson and D. Harrison	
7	Random Packings and Packed Tower Design – R. F. Strigel	
	Course Outcomes (students will be able to ...)	
1	calculate operating regime for a given reaction.	
2	calculate intrinsic kinetics from the data on model contactors.	
3	calculate conversion / selectivity / size / temperature / pressure / power required for conducting a given multiphase reaction equipment.	

	Course Code: CET 1503	Course Title: Process Safety and Environmental Engineering	Credits = 4		
			L	**T**	**P**
	Semester: VI	**Total contact hours: 60**	**2**	**2**	**0**

List of Prerequisite Courses

Material & Energy Balance Calculations, Chemical Reaction Engineering, Chemical Engineering Operations, Momentum and Mass Transfer, Biochemical Engg., Chem Engg Thermodynamics I and II

List of Courses where this course will be prerequisite

Home Paper I and II, Chem Proc Dev and Engg.,

Description of relevance of this course in the B. Chem. Engg. Program

The course 'Environmental Engineering and Process Safety' is highly relevant in all fields of activities, and process industry in particular. A chemical engineer working in any function of process industry should have working knowledge of all the prevailing safety, environment, and health standards, and may be involved in / responsible for any or all of the following:

- site process safety, environmental affairs
- assisting the Health Safety Environment (HSE) team
- employee safety observations and pre-job risk assessments
- implementation of HSE policies and guidelines to help ensure that all employees, contractors, and visitors enjoy high levels of safety, health and environmental protection; this reduces company's liability exposure.
- improvement of process safety performance and reduction of risk by facilitating Process Hazard Analyses and Layer of Protection Analyses
- incident investigations for process safety and environmental incidents
- recognising information that would be pertinent to process safety documentation and follow through with site personnel to ensure information is well documented
- developing and updating site Policies and Procedures related to process safety and environmental.
- capital and other project teams to identify and resolve regulatory issues, analyse process and property hazards, and establish protective measures to mitigate risks to a tolerable level.
- assisting the plant with government interfaces and inspections.
- training using internal and external resources; provides guidance to site management for implementation of programs or controls to comply with environmental requirements.
- managing site environmental programs including but not limited to waste management, spill prevention & response, etc.
- preparation and submission of reports to appropriate agencies to assure compliance with federal, state and local regulations. Responds to corporate requests in a timely manner.
- obtaining new or revised environmental permits that provide operational flexibility within the schedule established for new projects. Ensure that the operating units can meet all provisions and provide tools to enable compliance.
- providing environmental guidance; develop procedures and training, and HSE support as needed.
- participate in site objectives in the areas of community relations.

The above clearly highlights the necessity and significance of the course. This course will certainly add value to our chemical engineering graduates.

	Course Contents (Topics and subtopics)	**Reqd. hours**
1	Introduction to all prevailing international standards of Health, Safety, and Environment (HSE); Environmental laws and regulations; Standards (air quality, noise, water), ISO 14000+	4
2	Environmental impact assessment, Life cycle assessment (LCA)	4
3	Pollution prevention in chemical manufacturing, effluent valorisation	2
4	Air pollution; Air pollutants: sources (specific pollutants), effects, and dispersion modelling, air pollution, air quality, pollutants minimisation and control, fugitive emissions (source and control), Noise pollution	6
5	Wastewater treatment; Groundwater and surface water pollution, removal of specific water contaminants; Solid waste; Hazardous waste	6
6	Inherent safety; Major disasters (e.g. Flixborough, UK; Bhopal, India; Seveso, Italy; Pasadena, Texas; Texas City, Texas; Jacksonville, Florida; Port Wentworth, Georgia)	8
7	Toxicology; Industrial hygiene	2
8	Source models; Toxic release and dispersion models	6
9	Fires and explosions; Concepts to prevent fires and explosions	4
10	Chemical reactivity	2
11	Reliefs and reliefs sizing; Hazard identification; Risk assessment	6
12	Safety procedures and designs	4
13	Some case histories	6

List of Text Books / Reference Books		
1	Chemical Process Safety: Fundamentals with Applications – Daniel A. CROWL and Joseph F. LOUVAR	
2	Guidelines for Process Safety Management, Environment, Safety, Health, and Quality – Center for the Chemical Process Safety of the American Institute of Chemical Engineers (AIChE)	
3	Environmental Engineers' Handbook – Irene LIU (Editor)	
4	Chemical Process Safety Learning from Case Histories – Roy E. SANDERS	
5	Guidelines for Process Safety Documentation – Center for the Chemical Process Safety of the American Institute of Chemical Engineers (AIChE)	
6	Environmental and Health and Safety Management: A Guide to Compliance – Nicholas P. CHEREMISINOFF, Madelyn L. GRAFFA	
7	Environmental Pollution Control Engineering – C. S. Rao	
8	Environmental Engineering – H. S. Peavy	
Course Outcomes (students will be able to…..)		
1	calculate BOD / COD for a given composition of effluent stream, Estimation of bio Kinetics	
2	calculate adiabatic lapse rate and determine conditions for suitability of atmospheric dispersion, effective stack height, chimney design	
3	calculate concentrative of pollutant at any point in the neighbourhood of emission given atmospheric conditions like wind, dispersion, environmental factors etc.	
4	calculate size/time/power required for primary clarifier, secondary treatment, tertiary treatment, sizing of different types of Biological treatments etc.	
5	identify hazards in a given process and assess the same and provide solutions for operating safely.	
6	specify safety requirements for storage and handling of a given chemical.	

	Course Code: CET 1703	**Course Title: Chemical Process Control**	**Credits = 4**		
			L	**T**	**P**
	Semester: VI	**Total contact hours: 60**	**3**	**1**	**0**

List of Prerequisite Courses		
	Material and Energy Balance Calculations, Applied Mathematics I and II, Mathematical Methods in Chem Engg., Momentum and Mass Transfer, Chemical Reaction Engineering, Heat Transfer, Chem Engg Operations, Separation Processes,	
List of Courses where this course will be prerequisite		
	Chemical Engineering Laboratory, Procsess Sim Lab, Home Paper I and II, Proc Dev and Engg.	
Description of relevance of this course in the B. Chem. Engg. Program		
Process control plays a very critical role in the context of actual operation of a chemical plant. Most of the core chemical engineering courses focus on the steady state operation. In the real life environment, process is continuously subjected to various disturbances which deviates the operation from the designed steady state. This course specifically prepares students to assess the impact of such disturbances and equip them with the tools available with the chemical engineer to tackle these situations.		
	Course Contents (Topics and subtopics)	**Reqd. hours**
1	Introduction to process control: Motivation, importance, components of control system, control relevant process modeling	3
2	Dynamics of first, second and higher order systems: Examples systems, characterizing parameters, features, etc.	12
3	Feedback control: Motivation, elements of feedback control, servo problem, regulatory problem, effect of proportional, integral and derivative action, responses of P, PI and PID controllers	6
4	Controller selection and design: Controller selection guidelines, controller design criteria, common control loops (level, pressure, flow, temperature), reactor control, distillation control	6
5	Controller tuning: Open loop tuning, closed loop tuning, direct synthesis, commercial controller tuning packages	6
6	Stability analysis: Laplace domain analysis, frequency domain analysis	6
7	Multivariable and advanced control: Cascade control, dynamic matrix control, internal model control, basics of ratio control, split range control, override control, adaptive control, inferential control, model predictive control, geometric control	12
8	Digital control: Discrete time systems, basics of z-transforms, stability analysis	3
9	Electronics for control systems: Distributed control system, Programmable Logic Controllers, SCADA, HMI	3
10	Instrumentation: Basic measurement devices and working principles for level, flow, pressure and temperature, types of control valves, etc.	3
List of Text Books/ Reference Books		
1	Stephanopoulos, G.Chemical Process Control: An Introduction to Theory and Practice.	
2	Bequette, B.W.Process Control: Modeling, Design, and Simulation.	
3	Seborg, D.E. and Mellichamp, D.A. and Edgar, T.F. and Doyle, F.J.Process Dynamics and Control.	
4	Johnson, C.D.Process Control Instrumentation Technology.	
Course Outcomes (students will be able to…..)		
1	Understand the importance of process dynamics (unsteady state operation)	
2	Design a control strategy for key unit operations (reactor, distillation column, etc)	
3	Tune a controller to reject disturbances or manage operating point transitions	
4	Understand working principles of basic instruments available for flow, pressure, level and temperature measurement	
5	Describe modern industrial control system architecture	

	Course Code: CEP 1706	**Course Title: Chemical Engineering Laboratory-III**	**Credits = 3**		
			L	**T**	**P**
	Semester: VI	**Total contact hours: 90**	**0**	**0**	**6**
List of Prerequisite Courses					
	Material and Energy Balance Calculations, Momentum and Mass Transfer, Heat Transfer, Chemical Reaction Engineering, Chemical Engg Operations, Separation Processes, Chem Engg Lab I and II				
List of Courses where this course will be prerequisite					
	Home Paper I and II, Chem Proc Dec and Engg.,				
Description of relevance of this course in the B. Chem. Engg. Program					
Chemical Engineering lab provides students the first hand experience of verifying various theoretical concepts learnt in theory courses. It also exposes them to practical versions of typical chemical engineering equipments and servers as a bridge between theory and practice. This particular lab focuses on chemical reaction engineering, multiphase reaction engineering, process dynamics and control.					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	5-7 Experiments on Chemical Reaction Engineering		16		
2	2-4 Experiments on Bubble column		6		
3	3-5 Experiments on MACs		10		
4	2-3 Experiments on fluidized beds		6		
5	5-7 Experiments on process dynamics		16		
6	2-4 Experiments on process control		6		
7					
List of Text Books/ Reference Books					
1	Fogler H.S. Essentials of Chemical Reaction Engineering, 2010				
2	Doraiswami L.K. and Sharma M.M. Heterogeneous reactions, volume I and II.				
3	Stephanopoulos, G.Chemical Process Control: An Introduction to Theory and Practice.				
4	Green D. and Perry R. Perry's Chemical Engineers' Handbook, Eighth Edition, 2007.				
Course Outcomes (students will be able to…..)					
1	Learn how to experimentally verify various theoretical principles				
2	Visualize practical implementation of chemical engineering equipments				
3	Develop experimental skills				

	Course Code: CEP 1705	**Course Title: Process Simulation Lab - II**	**Credits = 2**		
			L	**T**	**P**
	Semester: VI	**Total contact hours: 60**	**0**	**0**	**4**
List of Prerequisite Courses					
	Applied Mathematics – I and II, Material & Energy Balance Calculations, Chem. Eng. Thermodynamics-I and II, Momentum and Mass Transfer, Chemical Engineering Operations, Engineering Applications of Computers, Process Simulation Lab - I (CEP1702), Chemical Reaction Engineering (CET 1201)				
List of Courses where this course will be prerequisite					
	Project II – Home paper I and II				
Description of relevance of this course in the B. Chem. Engg. Program					
In this course, students will develop a computer software for design and optimization of various chemical engineering equipments. This course will help students to complete home paper which is Techno-economic feasibility analysis of chemical manufacturing facility. The course content is similar to the activities carried out by any organization working on "detailed engineering packages" In this course student will learn the widely used chemical engineering software such as ASPEN.					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	Introduction to process simulation software (Prediction of multicomponent VLE using Aspen, column design, rating, reactor balances)		9		
2	Heat transfer: triple effect evaporator, STHE design		6		
3	Separation processes: Design of crystallizers, Distillation, Chromatography, spray dryers etc		9		
4	Design of multiphase reactors: stirred vessels, Bubble columns		6		
5	ASPEN simulation: azeotropic distillation, reactive distillation, column sizing		9		
6	Process control: P, PI, PID controller simulations, DCS Control system		6		

List of Text Books/ Reference Books		
1	Coker, Ludwig's Applied Process Design for Chemical and Petrochemical Plants	
2	Perry's Chemical Engineering Handbook	
3	Albright's Chemical Engineering Handbook	
4	ASPEN manual	
Course Outcomes (students will be able to…..)		
1	Design any equipment once the guidelines are available	
2	Optimize the process conditions	
3	Techno-economic feasibility analysis of chemical manufacturing facility	

	Course Code: GEP 1111	Course Title: Equipment Design & Drawing	Credits = 4		
			L	T	P
	Semester:VI	Total contact hours: 90	2	0	4

List of Prerequisite Courses		
	Structural Mechanics, Materials Science and Engineering, Engineering Graphics I and IIm	
List of Courses where this course will be prerequisite		
	Home Paper I and II, Equipment Design & Drawing II, Chemical Project Engineering and Economics, Process Dev and Engineering	
Description of relevance of this course in the B. Chem. Engg. Program		
Knowledge of chemicals and chemical producing equipments and plants are essential for professional Chemical engineer and Technologist. This subject will help students to understand use of basics of applied science in the form of mechanics, strength of materials, selection of materials and suitable manufacturing techniques and the details of operating conditions of equipment and its design procedure. This will help Chemical engineer to understand process equipments and their design concept and section of proper equipments for the designed functions of the plats. It will help them to understand various design codes used for fabrication of these equipments and the various types of destructive and non destructive tests performed on equipments before and after assembly of equipment defining its capacity, reliability, and its life.		
	Course Contents (Topics and subtopics)	**Reqd. hours**
1	Basic design concepts, use of standards and design stresses and factor of safety, selection of materials, working conditions, corrosion and its effects on equipments. Standard design codes	8
2	Design of pressure vessels: stresses acting on pressure vessels, operating conditions, selection of materials, pressure vessel codes, design stress and design criteria's, Design of Shell, Head, Nozzle, Flanged joints for heads and nozzles	8
3	Design of Storage vessels: Storage of various types of fluids and liquids in tanks, Loss mechanism of storage of volatile and non-volatile liquids and gases, Types of storage vessels, Vessels for storing of gases, method of storage of gases, Design of rectangular and cylindrical tank with components such as shell, bottom plate, self-supporting roof design, types of roofs,	8
4	Testing of process equipment, various	8
5	Mechanical Design of Reaction Vessels. a) Design of shells subjected to internal and external pressures. b) Types of Jackets /Coils used for heating and cooling in reaction vessels and their design. c) Type of agitators and their design. Design of agitator system components such as shafts,stuffing box etc.	8 hours(Theory) 12 hours(Practicals)
7	Mechanical Design of Heat Exchangers a) Components of shell and tube type heat exchangers. b) Design of various components of heat exchangers such as Fixed tube sheet type,U tube, Floating head etc. Various codes for heat exchangers.	8 hours (theory) 12 hours (practicals)
8	Mechanical design of distillation columns a) Various components of columns such as trays, packings, downcomers,bubble cap etc b) Design of shell for various stress conditions. Tray supports and their design	6 hours (theory) 12 hours (practicals)
List of Text Books/ Reference Books		
	Process equipment Design By V V Mahajani, S. B. Umarji	
	Equipment Design by Dawande	
	Process equipment Design by Young	
	Welding Technology by O.P. Khanna, Welding Technoloy by Little	
Course Outcomes (students will be able to…..)		
1	Understand the use of basic concepts of science and engineering.	
2	Select of material of construction and fabrication techniques.	
3	Use of design concept for designing process equipment considering its maximum operating conditions.	
4	Use standard equipments and use factor of safety while designing non standard equipments and their components.	
5	Use of safety norms in fabrication of equipments the understand importance of testing of equipments.	

SEMESTER – VII (will be of 10 weeks duration)										
No.	**Subjects**	**Credits**	**Hrs/week**			**Marks for various Exams**			
			L	**T**	**P**	**C. A.**	**M. S.**	**E. S.**	**Total**
CET 1504	Chemical Project Engg. & Economics	3	3	1	0	10	15	25	50
CET 1505	Process Development and Engineering	4	4	2	0	20	30	50	100
HUT 1102	Perspectives of Society, Sci. & Tech.*	3	3	1	0	10	15	25	50
	Institute Elective – II	3	3	2	0	10	15	25	50
CEP 1717	Optimization of Chem. Engg. Systems	2	2	0	4	25	---	25	50
CEP 1708	Project 1: Seminar	2	0	0	4	50	---	---	50
CEP 1709	Project 2: Home Paper – I	2	0	0	4	50	---	---	50
CEP 1710	Internship	6	---	---	---	----	---	---	50
	Total	25	15	6	12				450

*** This courses may be offered in the usual classroom mode or online mode as an NPTEL / Swayam course. The Equivalent NPTEL course will be identified by the Department every year.**

	Course Code: CET 1504	**Course Title: Chemical Project Engg and Economics**	**Credits = 3**		
			L	**T**	**P**
	Semester: VII	**Total contact hours: 45**	**2**	**1**	**0**
List of Prerequisite Courses					
	Material and Energy Balance Calculations, Equip Des and Dwg I, Energy Engineering, Ind Eng Chem.				
List of Courses where this course will be prerequisite					
	Home Paper I and II				
Description of relevance of this course in the B. Chem. Engg. Program					
This course is required for the future professional career					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	Introduction to greenfield projects and global nature of projects; Impact of currency fluctuations on Project justification and cash flows andConcepts of “Quality by Design” including typical design deliverables andunderstanding constructability, operability and maintainability during all stages of project execution. Meaning of Project Engineering, various stages of project implementation		6		
2	Relationship between price of a product and project cost and cost of production, EVA analysis. Elements of cost of production, monitoring of the same in a plant, Meaning of Administrative expenses, sales expenses etc. Introduction to various components of project cost and their estimation. Introduction to concept of Inflation, location index and their use in estimating plant and machinery cost. Various cost indices, Relationship between cost and capacity.		8		
4	Project financing: debt: Equity ratio, Promoters’ contribution, Shareholders’ contribution, source of finance, time value of money. Concept of interest, time value of money, selection of various alternative equipment or system based on this concept. Indian norms, EMI calculations. Depreciation concept, Indian norms and their utility in estimate of working results of project. Working capital concept and its relevance to project.		7		
5	Estimate of working results of proposed project. Capacity utilization, Gross profit, operating profit, profit before tax, Corporate tax, dividend, Net cash accruals. Project evaluation: Cumulative cash flow analysis Break-Even analysis, incremental analysis, various ratios analysis, Discounted cash flow analysis		7		
6	Process Selection, Site Selection, Feasibility Report		4		
7	Project: Conception to Commissioning: milestones, Project execution as conglomeration of technical and non technical activities, contractual details. Contract: Meaning, contents, Types of contract. Lump-sum Turnkey (LSTK), Eng, Procurement and Construction (EPC), Eng, Procurement and Construction Management (EPCM). Mergers and Acquisitions		6		
8	Reading of Balance Sheets and evaluation of Techno-commercial Project Reports.		3		
9	PERT, CPM, bar charts and network diagrams		4		
List of Text Books/ Reference Books					
	Chemical Project Economics, Mahajani V. V. and Mokashi S M.				
	Plant Design and Economics for Chemical Engineers, Peters M.S., Timmerhaus K.D.				
	Process Plant and Equipment Cost Estimation, Kharbanda O.P.				

Course Outcomes (students will be able to…..)		
1	Calculate working capital requirement for a given project	
2	Calculate cost of equipment used in a plant total project cost	
3	Calculate cash flow from a given project	
4	Select a site for the project from given alternatives	
5	List out various milestones related to project concept to commissioning	

	Course Code: CET 1505	**Course Title: Process Development and Engineering**	**Credits = 4**		
			L	**T**	**P**
	Semester: VII	**Total contact hours: 60**	**3**	**1**	**0**
List of Prerequisite Courses					
	All chemical Engineering subjects, Material Science and Engineering, Env Engg and Proc Safety				
List of Courses where this course will be prerequisite					
	Home Paper I and II				
Description of relevance of this course in the B. Chem. Engg. Program					
This course integrates all the chemical engineering and allied subjects for appropriate design of process plants, in selection of processes and evaluating alternatives					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	Development of a preliminary Process System: Modular approach		2		
2	Multiple process synthesis, selection of process, basic economic evaluation		2		
3	Sequencing of operations and integration in processes		2		
4	Batch vs continuous vs semi-batch processes- Scale up		3		
5	Process Engineering aspects of low and medium volume chemicals including process development.		3		
6	Concept of dedicated and multiproduct plant facilities, pilot plant, mini plants		3		
7	Development and evaluation of alternative flow sheets		3		
8	Scale up aspects; identification of controlling steps of process,		3		
9	Green Engineering principles		6		
10	Utilisation of energy; cost of utilities, heat exchange networks		3		
11	Process intensification		3		
12	Preparation of Conceptual process and instrumentation diagrams. .		3		
13	Preparation of process specifications for typical equipment.		3		
14	Safety and Risk of chemical processes		3		
15	Learn from mistakes		3		
List of Text Books/ Reference Books					
	Industrial Chemical Process Design, D. L. Erwine				
	Laboratory Chemical Process Development, Anderson N.				
	Organic Unit Processes, Groggins				
	Chemical Process Engineering: Design and Economics, Silla H.				
	Handbook of Chemical Process Development, Chandalia S. B.				
	Conceptual Chemical Plant Design, Douglas J. M.				
Course Outcomes (students will be able to…..)					
1	to select a strategy for a process from amongst the alternatives				
2	Determine strategy for carrying out a particular process				
3	Prepare specifications for a particular equipment				
4	Calculate utility requirements				

	Course Code: HUT 1102	**Course Title: Perspectives of Society Science and Technology**	**Credits = 3**		
			L	**T**	**P**
	Semester: VII	**Total contact hours: 45**	**2**	**1**	**0**

	List of Prerequisite Courses	
	All the Science and Engineering Courses so far	
	List of Courses where this course will be prerequisite	
	Home Paper I and II	
	Description of relevance of this course in the B. Chem. Engg. Program	
This course is relevant for future professional career of a Chemical Engineer.		
	Course Contents (Topics and subtopics)	**Reqd. hours**
1	History of Science and Technology and its relevance in the respective era	4
2	Recent developments in technology (chemical, biotechnology energy, telecommunications, etc.) and their influence on society	4
3	Economics and Sustainable Development	4
4	Value system and Ethics in the profession of Technology, Science and Engineering.	3
5	Problems before the World and India. Various approaches in solving them.	3
6	Integrating Issue: Society and Science	4
7	Industrial disasters and their effect on science and technology and society	3
8	Environmental degradation, global warming and their effect on science and technology and society	3
9	IPR issues and their relevance to science and technology and society	3
10	Some aspects of future of Society, Technology, Science and Engineering.	3
11	Interdependence of Theology and Science	3
12	Impact of climate change on the nexus of water, energy and water	2
13	Technology and World Peace Role of Innovation and R&D	3
14	Industry-Academia Interaction to Enhance Standard of Living	3
	List of Text Books/ Reference Books	
1	Science, Technology and Society: An Encyclopedia by Sal Restivo, Oxford University Press 2005	
2	Science, Technology and Society: A Sociological Appraoach by Wenda K. Bauchspies, Jennifer Croissant, Sal P. Restivo	
3	Vision of STS: Counterpoints in Science Technology and Society Studies by Stephan H. Cutcliffe, Carl Mitcham, Sunny Press 2012	
	Course Outcomes (students will be able to…..)	
1	List some historical scientific developments	
2	State importance and implications of patents and some of the relevant laws	

<table>
<tr><td rowspan="3"></td><td rowspan="2">Course Code: CEP 1717</td><td rowspan="2">Course Title: Optimization of Chemical Engineering Systems</td><td colspan="3">Credits = 2</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td>Semester: VII</td><td>Total contact hours: 90</td><td>2</td><td>0</td><td>4</td></tr>
<tr><td colspan="6">List of Prerequisite Courses</td></tr>
<tr><td>1</td><td colspan="2">Applied Mathematics – I and II, All the Chemical Engieering Courses</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td colspan="6">List of Courses where this course will be prerequisite</td></tr>
<tr><td>1</td><td colspan="2">Home Paper I and II</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td colspan="6">Description of relevance of this course in the B. Chem. Engg. Program</td></tr>
<tr><td colspan="6">In this course, various optimization encountered in Chemical Engineering are covered. Many Chemical Engineering problems encounter trade-offs between two or more parameters and thus formulation and solution of an optimization problem helps a Chemical Engineer to obtain the best solution.</td></tr>
<tr><td></td><td colspan="2">Course Contents (Topics and subtopics)</td><td colspan="3">Reqd. hours</td></tr>
<tr><td>1</td><td colspan="2">Equation scaling, normalization, convergence</td><td colspan="3">4</td></tr>
<tr><td>2</td><td colspan="2">Integer programming (simple scheduling)</td><td colspan="3">6</td></tr>
<tr><td>3</td><td colspan="2">Linear programming (simple production planning, fuel blending)</td><td colspan="3">6</td></tr>
<tr><td>4</td><td colspan="2">Quadratic programming (data fitting, optimal control)</td><td colspan="3">6</td></tr>
<tr><td>5</td><td colspan="2">Nonlinear programming (Reflux ratio optimization, consecutive reaction, reactor-separator recycle systems)</td><td colspan="3">10</td></tr>
<tr><td>6</td><td colspan="2">Mixed integer linear programming (flowsheet optimization, supply chain optimization)</td><td colspan="3">10</td></tr>
<tr><td>7</td><td colspan="2">Multi-objective optimization (design and operation of chemical processes)</td><td colspan="3">8</td></tr>
<tr><td colspan="6">List of Text Books/ Reference Books</td></tr>
<tr><td>1</td><td colspan="2">Floudas, C.A. Nonlinear and mixed-integer optimization: Fundamentals and applications</td><td colspan="3"></td></tr>
<tr><td>2</td><td colspan="2">Vanderbei, R.J. Linear programming: Foundations and extensions</td><td colspan="3"></td></tr>
<tr><td>3</td><td colspan="2">Collette, Y. and Siarry, P. Multi-objective optimization</td><td colspan="3"></td></tr>
<tr><td colspan="6">Course Outcomes (students will be able to…..)</td></tr>
<tr><td>1</td><td colspan="2">Formulate a Chemical Engineering problem into an optimization problem</td><td colspan="3"></td></tr>
<tr><td>2</td><td colspan="2">Solve (analytically or numerically) optimization problems encountered in Chemical Engineering Applications</td><td colspan="3"></td></tr>
</table>

	Course Code: CEP 1708	**Course Title: Project 1: Seminar**	**Credits = 2**		
			L	**T**	**P**
	Semester: VII	**Total contact hours: 60**	**0**	**0**	**4**
List of Prerequisite Courses					
	All Courses				
List of Courses where this course will be prerequisite					
	Home paper I and II				
Description of relevance of this course in the B. Chem. Engg. Program					
This course enables students to gather scientific information on a particular topic, analyze the information from Scientific principles, present a written and oral summary on that topic. This enables the students to function in a professional environment later on in their career.					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	Students will be required to prepare a critical review of selected topics in Chemical Engineering and allied subjects and submit in the form of a standard typed report. Typically, the report should contain and will be evaluated based on the following points: (i) Introduction: 2 pages maximum, (ii) Exhaustive review of literature (including figures): 10 – 12 pages: 50% weightage (iii) Critical analysis of the literature and comments on the analysis (including figures): 10 – 12 pages: 50% weightage. The critical analysis of literature should include the following points: are the papers technically correct?; are assumptions reasonable; is the reasoning logical? If you think it is not, specify what you think is incorrect and suggest the correct approach. Are the methods used in the literature appropriate? Are there any internal contradictions or computational errors and are there any loopholes in the observations? If so, please explain. Critical analysis of papers should also contain quantitative comparison of observations, results and conclusion amongst the various papers. Each student will also be required to make an oral presentation of the review. Weight age would be 40% for the presentation and 60% for the report. Additional details and requirements are given to the students every year by the coordinator of this activity.				
List of Text Books/ Reference Books					
Course Outcomes (students will be able to…..)					
1	Collect literature on a given topic				
2	Classify the collected literature into various categories.				
3	Summarize and write a few paragraph on each paper				
4	Compare the information content given in different papers				
5	Analyze a particular paper based on principle of Chemical Engineering				
6	Write a report based on his / her work				

	Course Code: CEP 1709	**Course Title: Project 2: Home Paper – I**	**Credits = 2**		
			L	**T**	**P**
	Semester: VII	**Total contact hours: 60**	**0**	**0**	**4**
List of Prerequisite Courses					
	All				
List of Courses where this course will be prerequisite					
	Home Paper II				
Description of relevance of this course in the B. Chem. Engg. Program					
This course enables students to integrate all the subjects that they have learnt and design plants / processes from Chemical Engineering Principles.					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	Every student will be required to solve a problem on design, which will set by one or more of the teachers in the institution. The design will have to be submitted in the form of a standard typed report. Every student will be orally examined. The student will be assessed based on the progress made during the semester. There would be two submissions: (i) Process selection and PFD, (ii) Material and Energy Balance. The submissions will be presented to a panel of faculty members / examiners There will be a weightage of 60% for the submissions and 40% for the presentation. Additional details may be given to the students from time to time by the coordinator.				
List of Text Books/ Reference Books					
Course Outcomes (students will be able to…..)					
1	Identify market requirement related to a particular chemical				
2	Draw a process block diagram from a given process description.				
3	Select a site for the project				
4	Develop a PFD based on block diagram				
5	Do material and energy for all the equipment in PFD.				

SEMESTER – VIII									
No.	**Subjects**	**Credits**	**Hrs /week**			**Marks for various Exams**			
			L	**T**	**P**	**C. A.**	**M. S.**	**E. S.**	**Total**
HUT 1114	Principles of Management – I*	3	2	1	0	10	15	25	50
HUT 1115	Principles of Management – II*	3	2	1	0	10	15	25	50
CET 1515	Innovations in Chemical Engineering and Technology	3	2	1	0	10	15	25	50
MAT 1106	Design & Analysis of Experiments	4	2	2	0	10	15	25	50
	Elective (Outside Chem.Engg.Dept. GET/CHT/PYT/MAT)	3	2	1	0	10	15	25	50
	Open Elective from MOOC-I**	3	2	1	0	10	15	25	50
	Institute Elective – III	3	2	1	0	10	15	25	50
GEP 1112	Equipment Design and Drawing -II	2	2	0	4	25	---	25	50
CEP 1711	Project 3: Home Paper – II	3	0	0	6	50	---	100	150
	Total	20	12	5	10				450

*** This courses may be offered in the usual classroom mode or online mode as an NPTEL / Swayam course. The Equivalent NPTEL course will be identified by the Department every year.**

**** Students can choose a subject from reputed online platforms like NPTEL, Coursera, Edx, MIT OpenCourseWare, etc. The course can be from any discipline: Engineering and Technology, Humanities, Arts. The course would need to be pre-approved by the Department every year. The Department may also offer specialized courses taught by experts in an online mode.**

	Course Code: HUT 1114	**Course Title: Principles of Management - I**	**Credits = 3**		
			L	**T**	**P**
	Semester: VIII	**Total contact hours: 45**	**2**	**1**	**0**
List of Prerequisite Courses					
List of Courses where this course will be prerequisite					
Description of relevance of this course in the B. Chem. Engg. Program					
This course is essential for effective functioning of students in their professional career					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	**Introduction and overview**		01		
2	**Management Theories** Taylor,Fayol,Weber, Hawthorne Basic types of sturtcures Span of control,Delegation, Authority, Responsibility		04		
3	**Recruitment** Philosophies Different methods of attracting candidates		03		
4	**Selection** Application blanks Interviews Talent Management Induction		02		
5	**Performance Management** Goal Setting Process Appraisal Methods Appraisal Interview Rating Errors		03		
6	**Training & Development** Identifying Training Needs Training Methods (On the Job & Off the Job) Evaluation of Training		03		
7	**Change Management** Types of Change Theories of Change		03		

	Hurdles to Change Olmosk Strategies of Change	
8	**Knowledge Management** Importance, Benefits Frame work Innovation	03
9	**Motivation Theories** Need Drive Goal Cycle Classification of Motives Theories (Maslow, Herzberg, ERG, Vroom, Equity, 4 Drive Model)	04
10	**Leadership Theories** Blake Mouton Model Hersey Blanchard Model Michigan Model	03
11	**Organizational Culture** Types Understanding & Influencing	03
12	**Conflict Management**	03
13	**Power & Politics**	03
14	**Personality**	03
15	**Perception**	02
16	**HR Laws**	02
	List of Text Books/ Reference Books	
	Talent management	
	Innovation and Entrepreneurship, Peter Drucker	
	Essentials of Organizational Behavior, S. Robbins	
	Organizational Behaviour, Luthans F	
	Industrial Management, Spriegel U.S.	
	Select Harvard Business Review Articles & Cases	
	Course Outcomes (students will be able to…..)	
1	Students should be able to explain the fundamental concepts of Human Resources Management	
2	Will enable students to understand self and others and thus adapt to Organizational Environment	
3	Will enable students to understand various Management theories and the Organizational Setup	
4	Students should be able to analyze practical situations and be able to provide applicable solutions.	

	Course Code: HUT 1115	**Course Title: Principles of Management - II**	**Credits = 3**		
			L	**T**	**P**
	Semester: VIII	**Total contact hours: 45**	**2**	**1**	**0**

List of Prerequisite Courses		
List of Courses where this course will be prerequisite		
Description of relevance of this course in the B. Chem. Engg. Program		
This course is essential for effective functioning of students in their professional career		
	Course Contents (Topics and subtopics)	**Reqd. hours**
1	**Organizational Structures** Greiner's Model of Organizational Life Cycle Organic & Mechanistic Structures	03
2	**Marketing Management** Introduction Porter's Value Chain Porter's Five Forces Model Porter's Generic Strategies	03
3	**Four Ps of Marketing** Product Place Price Promotion	07
4	**Production Operations Management**: Production Management Modern Approach, Manufacturing systems, Interface Management. Manufacturing / Operations Strategy – Principles & concept Operations as competitive weapon -- Investment strategy, Capacity strategy, Quality strategy, Technology strategy, Customer focus strategy, Facility location strategy, Product flexibility strategy, Short delivery process strategy, Quick time delivery strategy. Concepts of Productivity, Measurement & Improvement Lean Manufacturing, Value Engineering, Business Process Re-engineering. World Class Manufacturing (WCM) - Principles & concepts, Systems, Processes & tools in WCM, Kanban JIT, Waste identification & elimination Poka Yoke system EHSS management in WCM, HR Dimensions in WCM, WCM in reference to Indian industry and Indian scenario, Maintenance practices	08
5	**Financial Management:** Investment decisions, Linking investment to Product Life Cycle Investment risk analysis and risk control / mitigation Accounting system, Step costing diagram Balance sheet evaluation, Fund Flow analysis, Financial ratios & their evaluation / significance, Cost control by variable analysis Comparable Company evaluation, Budgeting and budgetary control.	10
6	**Quality Management:** Quality – concept / meaning, Modern approach to Quality Management, QA versus QC, Acceptance sampling and statistical quality control, Deming's 14 points of QM, TQM Principles & implementation, ISO 9000–2000, ISO 14000 (Environment) & ISO 50000 (Energy) quality standards.	05
7	**Maintenance Management:** Causes, costs, life profiles, Classifications, Organization, Equipment & plant reliability and availability, Management of shutdowns & turnarounds.	05

8	**Materials Management**: Definition, objectives, organization, stages, factors responsible, value analysis Management of project materials and maintenance materials Purchasing and vendor development, Spares strategy Ware-housing, store-keeping and inventory control.	04
	List of Text Books/ Reference Books	
	Production & Operations Management – An Applied Modern Approach, J. S. Martinich	
	Industrial Management – I, Jhamb L. C. and Jhamb S.	
	Industrial Management, Spriegel U.S.	
	Operations Management for Competitive Advantage, Richard B. Chase, F. Robert Jacobs, Nicholas Acquilano	
	World Class Manufacturing - A strategic Perspective, B.S. Sahay, K.B.C. Saxena, A Kumar	
	Management Finance, Varanasay Murthy	
	Financial Management, R. M. Srivastava	
	Quality, John M. Nicholas	
	Quality Planning and Analysis, Juran and Gryna	
	Marketing Management, Philip Kotler	
	Select Harvard Business Review Articles & Cases	
	Course Outcomes (students will be able to…..)	
1	Students should be able to explain the fundamental concepts of Marketing Management& the various aspects therein	
2	Will enable students to understand Fundamental Concepts of Finance and analyse the balance sheet	
3	Will enable students to understand current productivity techniques which could be combined with Engineering knowledge to be applied in the Industry	
4	Students should be able to analyze practical situations and be able to provide applicable solutions.	

<table>
<tr><td rowspan="2"></td><td rowspan="1">Course Code: CET 1515</td><td>Course Title: Innovations in Chemical Engineering and Technology</td><td colspan="3">Credits = 3</td></tr>
<tr><td></td><td></td><td>L</td><td>T</td><td>P</td></tr>
<tr><td></td><td>Semester:</td><td>Total contact hours: 30 Lecture hours + 15 Tutorials</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td colspan="6">List of Prerequisite Courses</td></tr>
<tr><td></td><td colspan="2">Organic Chemistry, Applied Physics, Reaction Engineering, Multiphase reactors, Industrial Engineering & Chemistry, Environmental Engineering, Separation Processes, Chemical Engineering Operations, Process Engineering</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td colspan="6">List of Courses where this course will be prerequisite</td></tr>
<tr><td></td><td colspan="2">This is an important course highlighting the innovations in Chemical Technology and should serve as a specialized course for final year graduating students.</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td colspan="6">Description of relevance of this course</td></tr>
<tr><td colspan="6">Innovations play a crucial role while moving up the learning curve of technology attractiveness. Some innovations are game changing and revolutionary, e.g., Haber process, nuclear fission, transistor effect, Ziegler-Natta catalysis, in vitro fertilization, etc. and have been awarded Nobel prizes. The original Nobel lectures (5-6) delivered by the people behind the innovations will comprise a part of the course material to understand their motivation, prevailing circumstances, the conception of ideas/serendipity, approach to problem solving, personality traits, and conducive factors that led to success.

While many innovations require deep fundamental knowledge and correlation of complex observations, there are many that originate from “street smart” thinking, observation of natural phenomena, shifting of knowledge across boundaries, etc. Then there are innovations that emanate from integration of known observations to derive synergy. About 15-20 such case studies will be covered in the course and original patents will serve as course material. It will be the intention to convey to the students that such inventions are within their reach if they can articulate genuine needs and think unconventionally. It will be emphasised that focus on sustainable development will provide impetus to future innovations in chemical technology. A few lectures will be devoted to Indian innovations, including important innovations from ICT.

The third part of the course will deal with protection of intellectual property, pros and cons of patenting, drafting of a patent application – patent claims in particular – responding to examination reports. Case studies of important patent disputes will also be covered.</td></tr>
<tr><td></td><td colspan="2">Course Contents (Topics and subtopics)</td><td colspan="3">Reqd. Lecture Hours</td></tr>
<tr><td>1</td><td colspan="2">Basic of Innovations with case studies such as e.g., Haber process, β blockers, nuclear fission, transistor effect, Ziegler-Natta catalysis, in vitro fertilization, asymmetric synthesis, olefin metathesis, photovoltaic cell, optical fibre, etc.,</td><td colspan="3">6</td></tr>
<tr><td>2</td><td colspan="2">Overview of Noble Lectures related to innovation to understand Noble laureates’ motivation, prevailing circumstances, the conception of ideas/serendipity, approach to problem solving, personality traits, and conducive factors that led to success.</td><td colspan="3">9</td></tr>
<tr><td>3</td><td colspan="2">Overview of Case studies based on patents highlighting the different concepts in innovation and TRIZ methodology introduced by Soviet inventor and science-fiction author Genrich Altshuller will be discussed</td><td colspan="3">9</td></tr>
<tr><td>4</td><td colspan="2">Overview of Patents and IP protection pros and cons of patenting, drafting of a patent application – patent claims in particular – and responding to examination reports.</td><td colspan="3">6</td></tr>
<tr><td>5</td><td colspan="2">Group Assignments, short review projects related to the above topics will be given in the tutorial hours</td><td colspan="3">15</td></tr>
<tr><td colspan="6">List of Text Books/ References</td></tr>
<tr><td></td><td colspan="2">Innovation and Entrepreneurship, by Peter Drucker</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Original patents</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Nobel lectures</td><td colspan="3"></td></tr>
<tr><td></td><td colspan="2">Case studies (Losartan Case study, etc.)</td><td colspan="3"></td></tr>
<tr><td colspan="6">Course Outcomes (students will be able to…..)</td></tr>
<tr><td>1</td><td colspan="2">Students should be inspired to work on the most worthy problems and think innovatively</td><td colspan="3"></td></tr>
<tr><td>2</td><td colspan="2">Inculcate the personality traits that will foster innovation</td><td colspan="3"></td></tr>
<tr><td>3</td><td colspan="2">Recognise that there is more to innovation than having a good idea if one wants to take the idea to its logical conclusion</td><td colspan="3"></td></tr>
<tr><td>4</td><td colspan="2">Have an appreciation of IPR protection</td><td colspan="3"></td></tr>
</table>

	Course Code: MAT 1106	Course Title: Design and Analysis of Experiments	Credits =4		
			L	T	P
	Semester: VIII	Total contact hours: 60	2	2	0

List of Prerequisite Courses

	Applied Mathematics I	

List of Courses where this course will be prerequisite

	This course is required for graduating engineers to function effectively in Industry, Academia and other professional spheres. This course is in Semester VIII	

Description of relevance of this course in the B. Chem. Engg. Program

Modern day manufacturing activities and R&D activites need decisions taken with a scientific rigour and should be well-supported by ‘statistics’. Chemical engineering graduates who will serve industry as well as postgraduate research students who will serve industry, R&D organisations, or academic research should have a reasonably good background of statistical decision making. This also involves extraction of meaningful data from well-designed minimal number of experiments at the lowest possible material costs. This course will also help the students in all domains of their life by imparting them a vision for critical appraisal and analysis of data.

	Course Contents (Topics and subtopics)	Reqd. hours
1	Fundamental principles of classical design of experiments Strategy of Experimentation, Typical applications of Experimental design, Basic Principles, Guidelines for Designing Experiments.	2
2	Review of Probability and basic statistical inference: Concepts of random variable, probability, density function cumulative distribution function. Sample and population, Measure of Central tendency; Mean median and mode, Measures of Variability, Concept of confidence level. Statistical Distributions: Normal, Log Normal & Weibull distributions, Hypothesis testing.	4
3	Experiments with a Single Factor: The Analysis of Variance Fixed effect model and Random effect model, Model adequacy checking, Contrasts, Orthogonal contrasts, Regression Models and ANOVA, Violation of Normality Assumption: Kruskal-Wallis test. Randomized block designs, Latin square designs, Balanced Incomplete Block Designs	8
4	Factorial designs: Definition, Estimating model parameters, Fitting response curves and surfaces.	4
5	The 2^k Factorial Design, Blocking and Confounding in the 2k Factorial Design; Focus of 2^2 and 2^3 designs, Blocking and Confounding in the 2^k Factorial Design.	8
6	Plackett Burman methods, Central Composite Design (CCD)	4
7	Descriptive Statistics, Probability Distribution and testing of Hypothesis using R	6
8	Regression techniques, diagnostic checks, ANOVA using R and implementation of contrasts.	6
9	Construction of Balanced Incomplete Block Designs and data analysis using R	6
10	Analysis of factorial designs using R, understanding output and interpretation.	6
11	Factorial designs, Data analysis and interpretation.	6

List of Text Books / Reference Books

1	Douglas C. Montgomery, Design and Analysis of Experiments, 8th Edition, John Wiley & Sons, Inc. 2013	
2	Box, G. E., Hunter, W.G., Hunter, J.S., Hunter, W.G., Statistics for Experimenters: Design, Innovation, and Discovery, 2nd Edition, Wiley, 2005.	
3	John Lawson, Design and Analysis of Experiments with R, CRC Press, 2015	
4	Dieter Rasch, Jürgen Pilz, Rob Verdooren, Albrecht GebhardtOptimal Experimental Designs with R. CRC Press, 2011.	
5	José Unpingco, Python for Probability, Statistics, and Machine Learning, Springer, 2019	
6	Response Surface Methodology: Process and Product Optimization using Designed Experiments: R. H. Myers, D. C. Montgomery.	
7	Introduction to Statistical Quality Control: D. C. Montgomery.	
8	Design of Experiments in Chemical Engineering: Živorad R. Lazić.	

Course Outcomes (students will be able to…..)		
1	Students should be able to understand basic principles of design of experiments.	
2	Students should be able to perform statistical analysis of single experiments and do post hoc analysis.	
3	Students should be able to conduct experiment and analyse the data using statistical methods.	
4	Students should be able to choose an appropriate design given the research problem.	
5	Students should be able to perform statistical analysis of different designs using R and interpret the results.	

	Course Code: CEP 1711	**Course Title: Project 3: Home Paper – II**	**Credits = 3**		
			L	**T**	**P**
	Semester: VIII	**Total contact hours: 90**	**0**	**0**	**6**
List of Prerequisite Courses					
	All				
List of Courses where this course will be prerequisite					
Description of relevance of this course in the B. Chem. Engg. Program					
This course enables students to integrate all the subjects that they have learnt and design plants / processes from Chemical Engineering Principles.					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	There would be two submissions: (iii) Process Design, (iv) P&ID, Mechanical design, Costing, feasibility. The submissions will be presented to a panel of faculty members / examiners. The submissions would be given a weightage of 50 marks. There will be a weightage of 60% for the submissions and 40% for the presentation. Final report of the home paper would be given a weightage of 50 marks. There will be a viva-voce after the submission of the report. The weightage for the viva-voce would be 50 marks. Additional details may be given to the students from time to time by the Coordinator				
List of Text Books/ Reference Books					
Course Outcomes (students will be able to…..)					
1	Students should be able to design, calculate size/power/internals, etc required for all the process equipment in the PFD together with necessary instrumentation, safety aspects.				
2	Students should be able to calculate costs of equipment				
3	Students should be able to perform a techno economic feasibility of the selected process.				

ELECTIVE SUBJECTS

The elective subjects may be added from time to time with prior approval from UGPC/Senate.

1. **PYT 1104E – Molecular Quantum Mechanics (Applied Physics Department)**

Revision of Basic Concepts

Schrodinger equation for the hydrogen atom, solution in terms of radial and angular wavefunctions, significance of quantum numbers, atomic spectra.

The quantum harmonic oscillator, eigenvalues and eigenfunctions (no detailed derivation), significance of 'zero-point' energy.

Origin of Molecular Spectra

Analysis of diatomic molecule as a rigid rotator, rotational and vibrational energy levels of a simple diatomic molecule.

Approximation methods in Quantum Mechanics

Brief introduction to perturbation theory with simple examples, variational theorem, analysis of helium atom as an example.

Molecular Quantum Mechanics

Molecular orbital and valence bond theories for diatomic molecules, Born-Oppenheimer approximation, LCAO method in H_2^+ ion and H_2 molecule, valence bond method

2. **PYT 1105E – Statistical Mechanics (Applied Physics Department)**

Basic Statistical Approach to a System

Applicability of the statistical approach to a system, equilibrium and fluctuations, irreversibility and approach to equilibrium, counting of system states – macrostates and microstates, equiprobability postulate, concept of statistical ensemble, number of accessible states of a system, phase space.

Ensemble approach to Thermodynamics of Physical Systems

Isolated system – microcanonical ensemble, system in contact with a heat reservoir, canonical ensemble, Maxwell-Boltzmann distribution as an example, mean values in a canonical ensemble, partition function for a canonical ensemble, relation to thermodynamics.

Generalised Interactions

Grand canonical ensemble, systems with variable number of particles, chemical potential, partition function for a grand canonical ensemble, relation to thermodynamic variables.

Applications to Multi-phase Systems

Stability conditions for a homogeneous system, equilibrium between phases, phase transformations, general relations for a system with several components, general conditions for chemical equilibrium, chemical equilibrium between ideal gases, the equilibrium constants in terms of partition functions.

3. **CHT 1403E – Advanced Spectroscopy (Applied Chemistry Department)**

UV-VIS spectroscopy - Woodward rules, aromatic and heterocyclic compounds

IR spectroscopy: FT technique, group frequencies, vibrational coupling. NIR spectroscopy. New applications

Raman spectroscopy: Stokes, anti-Stokes and Releigh scattering, rotational and vibrational transitions. Raman vs IR.

NMR spectroscopy: Pulse technique, FID, and FT. Relaxation and saturation phenomena, quadrupole relaxation, isotopomers.

H1 NMR: Chemical shifts and factors affecting the same, spin-spin coupling of different systens, different spin systems, coupling constants.

Simplification of complex spectra: Double resonance and decoupling, lanthanide shift reagents, INDOR technique.

C13 NMR: Basics, doble resonance,

2D NMR: H1-H1- COSY, H1-C13 HETCOR- APT and DEPT, C13-C13 connecticity: INADEQUATE

F19 and P31 NMR

Through space interactions: NOE and NOESY

Solid state NMR and MAS.

Mass spectrometry: Basics, EI and CI techniques. Isotopic abundance, fragmentation, rearrengment of ions, Maclaferty rearrangement, retrodiels-alder reaction.

Hyphenated techniques: GC-MS, LC-MS, LC-MS-MS, GC-IR, GC-AIS, GC-NMR, LC-NMR

ESR spectroscopy: Theory, experimental technique, Hyperfine splitting

Mossbaur spectroscopy

Structure elucidation using combined stereoscopic methods

Emission: Flame photometry, ICP, Ark-Spark spectra, Phosphorescence, XRF

4. **CHT 1205E – Organometallic Chemsitry (Applied Chemistry Department)**

Nature of C-M bond: Metal-carbon bond with main group and transition elements.

Factors controlling metal-carbon bond formation. Methods of M-C bond formation. Nomenclature and heptacity.

Electron counting and 16 and 18 electron rules - applications and exceptions. Stability. Stereochemical nonrigidity in organometallic compounds.

Structure and bonding of metal alkyls and aryls. Complexes with CO and related ligands, olefins, acetylenes and related unsaturated molecules. Organic transition metal complexes as protective and stabilizing groups for double bond, triple bond, propyl cation and short lives species. Complexes with cyclopentadiene and arenes and other CnHn sandwich and half-sandwich complexes. Hydride, dinitrogen and dihydrogen complexes

Bimetallic and cluster complexes: Structure and applications in catalysis

Basic organometallic reactions: Ligand substitution, oxidative reactions, migratory reactions, migratory insertion, extrusion, oxidative addition, reductive elimination, reductive elimination –mechanism and stereochemistry.

Nucleophilic regents with C-M bond: Li, Mg, Al, Ti and Ce alkyls; Organicuprates, organic zinc reagents

Alkyne complexes: Pauson Khand reaction. The use of stoichiometric transition metal complexes in the synthesis of complexes organic molecules - enantioselective synthesis via organometallic compounds.

Organo silicon compounds, boranes, carboranes and, metallocarboranes, organo platinum complexes, metallocenes

Importance of organometallic compounds in Biological systems

5. **CHT 1206E – Green Chemistry & Catalysis (Applied Chemistry Department)**

Concept of Green Chemistry: Twelve principles of green chemistry, E factor, Waste management

Types of catalysis: Homogeneous and Heterogeneous catalysis. Catalytic cycles

Organometallic compounds used as catalysts: Pd, Rh, and Ru in C-C bond formation. Catalytic properties of mononuclear compounds

Homogeneous catalysis: Hydrogenation, hydroformylation, hydrocyanation, Hydrosilylation, Wilkinson catalysts, Chiral ligands and chiral induction, Ziegler-Natta catalysts

Mercuration and oxymercuration

Organopalladium catalysts: Suzuki coupling, Heck coupling and related cross coupling reactions.

Alkene oligomerization and metathesis.

Catalytic oxidations and reductions: Epoxidation, dihydroxylations.

including carbonylation, decarbonylation, olefin isomerization, arylation

Important catalytic reactions: Monsanto acetic acid process, Wacker process, Heck reaction.

6. **CHT 1303 – Theoretical and Computational Chemistry (Applied Chemistry Department)**

Basics: Wave character and wave functions, De Broglie equation, normalization and orthogonalization,

Quantum mechanical operators, Schrodinger equation, particle in an infinite square well potential, quantum mechanical harmonic oscillator, angular momentum operator and rigid rotor, Born Oppenheimer approximation, potential energy surfaces, self consistent field wave functions,

Computauional methods: Molecular mechanics, MO theory, semi empirical and ab initio methods, SCF theory, Hartree Fock method, DFT.

7. **MAT 1107E – Momentum, Heat and Mass Transfer (Applied Mathematics Department)**

Derivation of equation of momentum, energy, mass transfer in curvilinear coordinate system, constitutive equation (Newtonian & Non Newtonian fluids), Flow in some simple cases - Flow between two concentric cylinders, flow between two concentric rotating cylinders, hydrodynamics of bearings lubrication, steady flow around a sphere (theory of very slow motion).

Singular perturbation theory, derivation of bounder layer equations (using singular perturbation theory), similar and non similar solutions for some forced, mixed and natural convection problems (using bounder layer theory) .

Flow stability, theory of ordinary diffusion in liquids, diffusion with homogenous chemical reaction, diffusion into a falling liquids films (forced convection mass transfer).

8. **MAT 1108E – Turbulent Flow and CFD (Applied Mathematics Department)**

Derivation of equations of momentum and energy for turbulent flows. Modelling of turbulent flows: kinetic energy, algebraic stress model, Low Reynolds number model, LES model etc.

Turbulent boundary layer flows and similar solutions

Grid generation

Use of Control volume method, Methods of lines, Finite difference, Finite element and various algorithms (SIMPLE, SIMPLER & SIMPLEC etc) to solve the momentum, energy and mass transfer equations for simulation of some practical problems (Simulation of stirred vessel, Natural convection flow inside a closed chamber etc)

9. **GET 1303E – Advanced Strength of Materials (General Engineering Department)**

Analysis of Trusses - Condition for perfect truss, redundancy, stable, unstable truss. Analysis of truss by method of joints, method of sections.

Torsion of a circular shaft - concept, basic derivation, shear stress distribution, simple problem.

Short and Long columns (Struts) - Basic concept, crippling load, end conditions. Euler's and Rankine's

approach (without derivations)
Thick and Thin cylinders - concept of radial, longitudinal stresses, behaviour of thin cylinders. Problems on thin cylindrical and spherical shells. Behaviour of thick cylinders (theory only).
Advance stresses and strains – Representation of stress and strain at a point, Stress stain relationship, plane stress and plane strain. Transformation of stresses and its importance, Principal stresses and strains, maximum shearing stress, Mohr's circle its use and construction.
Basics of Engineering Design - Steps in the engineering design, Importance of analysis, 1-D, 2-D and 3-D analysis and interpretation of results. Design philosophies, factor of safety, Force displacement relationship, Strain deformation relationship, Introduction to finite element packages. Computer aided analysis and design.
Composite Materials – Types of composite materials, fillers for composites, polymer composites, fibres and matrix for a composite material, Types of fibres, their properties, woven and non woven fibres, manufacturing of polymer composite materials. Mechanics of composite materials, Properties and testing of composite materials, Uses of composite materials.
Advance materials for industrial applications - Advances in materials, Materials used for coatings, anticorrosive coatings, special purpose floorings, water proofing compounds, Various polymers and epoxies used for industrial applications. Different types of performance enhancing and special purpose construction chemicals. Plasticizers and super-plasticizers, air entraining agents, accelerators and retarders, viscosity modifying agents, corrosion inhibitors.

10. **HUT 1105E – Industrial Economics (Humanities)**

Nature and Significance of Economics

Demand and supply / elasticity of demand and supply, price determination, demand forecasting

theory of firm : (A) financial aspects : cost analysis, revenue structure, conditions for profit maximisation, different market structures (B) technical aspects : factors of production, role of entrepreneur, laws of return, returns to scale.

Money market and capital market, evolution of money and banking, foreign exchange and currency de-valuation.

Budget, taxation, public expenditure, borrowing and deficit financing

Development issues and economic planning in India, Role of public sector / liberalisation / privatisation / globalization

11. **CET 1506E – Engineering Aspects of Manufacturers of Organic Chemicals (Chemical Engineering Department)**

Special features of process parameters and reactors used for typical organic processes such as hydrogenation, oxidation, alkylation, nitration, sulphonation etc. Different strategies of conducting reactions. Introduction to a few name reactions such as Friedel Crafts reactions, Sandmeyers reaction, Darzens condensation, etc. Typical reaction schemes for the synthesis of medium and low volume chemicals, with an emphasis on the alternative flow sheets of the entire process.

12. **CET 1204E – Electrochemical Engineering (Chemical Engineering Department)**

Introduction to eletrochemical engineering. Theoretical aspects and special features of electrochemical process. Role of mass transfer in a variety of electrochemical processes. Some aspects of electrochemical reactor design. Scale-up and optimization of reactors.

13. **CET 1712E – Mathematical Methods in Chemical Engineering (Chemical Engineering Department)**

Classification of problems in Chemical Engineering. Typical problems from heat transfer, catalysis, mass transfer with chemical reaction, dynamics of process equipments, etc. Numerical evaluation of Laplace Transforms.

Separation of variables, Eigen values, Collocation Techniques.

14. **CET 1713E – Statistical Methods in Engineering (Chemical Engineering Department)**

Continuous and discrete probability distributions, normal, chi-square, gamma, Poisson distributions. Applications. t-Tests, F-Test, Homogeneity tests, Quality Control. Acceptance sampling Linear regression and lack of fit Contingency tables.

15. **CET 1103E – Heat Transfer Equipment Design (Chemical Engineering Department)**

Classification of Heat Transfer Equipment, direct, indirect, boiling, fired, Fluidised, geometry, construction.

Thermal design methods of heat exchangers : survey, capital NTU, LMTD concept, temperature approach, etc.

Shell and Tube heat exchangers : thermal, mechanical design, hydraulic design and equations, introduction to codes and standards

Extended surface heat exchanger design : plates, plate fins, effectiveness factor.

Heat transfer equipment with phase change, two phase flow maps, and design of equipments for heat transfer and pressure drop.

Fluidised bed and direct heat exchangers design methodology.

Synthesis of optimal heat exchanger networks.
Worked Examples

16. **CET 1205E – Mixing (Chemical Engineering Department)**
Examples of industrial importance
Flow pattern, power consumption, classification of impellers, internals
Mechanism of mixing, Blending in viscous and turbulent system, Suspension of solid particles, Heat transfer, Gas-liquid dispersion, Liquid-liquid dispersions, Three phase dispersions, Solid-solid mixing, emulsions, pastes, Mass transfer at gas-liquid, liquid-liquid, solid-solid and solid-liquid interface
Process design and scale-up considerations case studies

17. **CET 1507E – Petroleum Reservoir Engineering (Chemical Engineering Department)**
Energy sources, world scenario, oil pricing, Genesis of petroleum and migration, Composition of petroleum and its classification, Petroleum reservoirs, Exploration and drilling technology, Well logging and well completion, Core analysis, Capillarity and wettability, Models of pore structure and multiphase flow , Well stimulation and production strategy, Well pressure behaviour, Gas reservoir engineering, Fluid displacement and frontal displacement; Buckley-Leverett theory, Material balance, Decline curve analysis, Well patterns and displacement efficiencies, Primary recovery, Gravity drainage, Waterflooding , Mechanisms of microscopic and macroscopic flow, Transportation of oil and gas, Production rate, reservoir life, Heavy oil and tar sand technologies, Residual oil determination, Computer modelling of reservoirs, Tertiary recovery methods

18. **CET 1508 – Enhanced Oil Recovery (Chemical Engineering Department)**
Residual oil and tracer studies, Defining enhanced oil recovery, Basic equations for fluid flow in porous media, Petrophysics and petrochemistry, Phase behaviour and fluid properties, Efficiency of waterflooding , Pore level mechanisms, Mobility control , capillary number, bond number correlations, Heterogeneity of pore structure and reservoirs, Thermal methods , Steam stimulation, steam flooding and hot water drive, Combustion- forward and reverse, Ancillaries in thermal methods, Miscible flooding, Surfactant flooding, Microemulsion flooding, Foam flooding, Polymer flooding, Micellar-polymer flooding, Alkaline flooding, Carbon dioxide flooding, Inert gas injection, Reactive gas injection, Microbial recovery

19. **CET 1104E – Flow Though Porous Media (Chemical Engineering Department)**
Relevance of pore structure in science and technology, Examples from oil reservoirs, catalysis, soil science, membranes, aquifers, foods, polymers, biology, etc., Pore structures and their determination, Capillarity and wettability, Models of pore structure, Wettability and flow histories, Single phase flow, Multiphase flow, Percolation processes and network models, Fractal models, Simulations of macroscopic properties, Pore level mechanisms of flow, Diffusion and dispersion in porous media, Membrane transport, Analysis of trickle and packed beds, Ultrafiltration, Models of catalyst poisoning and deactivation, Geostatistics

20. **CET 1509E – Refinery Science and Engineering (Chemical Engineering Department)**
Terminology, Origin, Kerogen, Occurrence, Recovery, Classification, Composition, Evaluation, Fractionation, Identification, Asphaltic constituents, Refining chemistry, Refining distillation, Thermal cracking, Catalytic cracking, Hydroprocessing, Reforming, Treatment processes, Gas cleaning, Products, Petrochemicals

21. **CET 1206E – Fundamentals of Catalytic Science and Engineering (Chemical Engineering Department)**
Relevance and examples, Atom economy and green chemistry concepts, Homogenous and heterogeneous catalysis, Fundamentals of homogeneous catalysis and mechanisms and kinetics, Fundamentals of adsorption, isotherms, energetics, structural and dynamic considerations, Mechanisms, models and kinetics of surface reactions, Fractal models, Determination of surface structure though modern methods , Significance of Pore structure and models, Solid and surface chemistry of catalysis, Quantum mechanical, molecular mechanical and hybrid models, Catalyst design through artificial intelligence and computer modelling, Poisoning, promotion, deactivation and selectivity , Catalytic process engineering , Measurement of catalytic rates and kinetic parameters, Types of reactors

22. **CET 1207E – Homogeneous Catalysis (Chemical Engineering Department)**
Examples, Single phase and multiphase catalytic reactions, Acid--base catalysis, Transition metal catalysis, Bio-catalysis : Microbes and enzymes, Phase transfer catalysis, Micellar catalysis, Microemulsion catalysis, Electron transfer catalysis, Heteropoly acid catalysis, Homogeneous polymer catalysis, Heterogenisation of homogeneous catalysts, Catalysis by microwaves and ultrasound, Catalyst recovery and reuse

23. **CET 1208E – Catalytic Green Science and Technology (Chemical Engineering Department)**
Green synthesis and heterogeneous catalysis, Metal and supported metal catalysis, metal-support interaction, Metal oxides and determination of acidity and basicity, Nature and type of supports , Solid acid catalysis, Solid base catalysis, Catalyst design, preparation and activation, Clay and modified clays, Ion exchange resins, Zeolites and zeotypes , Heteropoly acids, Inorganic-organic catalysts, Immobilised enzymes, zeozymes, complexes, Electrochemical catalysis, Photocatalysis, Microwave catalysis, Ultrasound catalysis, Synergistic catalysis, Important examples from, Refinery industry -FCC, reforming, platforming, hydroforming, polymerisation, alkylation, isomerisation; hydrodesulfurisation, hydronitrogenation, Pharmaceutical and fine chemical industry,

Dyestuff and intermediate industries, Perfume and flavour industry, Polymer industry, Textile industry, Paint industry, Edible oil industry, Food industry, Waste water treatment, Catalysis for auto-exhaust pollution abatement, DeNox, DeSOx technologies

24. **CET 1602E – Colloid and Interfacial Science (Chemical Engineering Department)**

Capillarity: Definition, Existence of surface tension/surface free energy, Laplace equation, Young Equation, Capillarity rise phenomena, Measurement of surface tension, Contact angle Wetting characteristics

Surface Thermodynamics : Surface thermodynamic properties, Kelvin Eqn. Gibbs eqn, Surface Excess, Monolayer phase

Adsorption: Localised vs Mobile adsorption, Adsorption isotherms Langmuir, Freundlich, BET etc., - Potential theory, Adsorption from solution, Electrical Diffuse Double layer theory, Debye Huckel theory scaled particle theory, Stern layer, Surfactant adsorption

Micelles: Classes of surfactants, synthesis of surfactants, Micelle structures, Determination of HLB, Models for micelle formation, Swollen micelles, Hydrotropy

Solubilization in micelles :Location of solubilizate in micelles, Measurement of solubilization, Spectroscopic methods:NMR, Fluorescence, IR etc, Detergency, selective solubilization

Emulsions :Micro and macro emulsions, Stability of emulsions (Mechanical vs. thermodynamic), Bancroft rule, deemulsification, HLB for emulsion, multiple emulsions, applications

Foams: Gibbs triangle, Film elasticity, drainage of films, Foam, defoaming, applications of foams

25. **CET 1603E – Interfacial Science and Engineering (Chemical Engineering Department)**

Definitions: Chemical and physical properties of interfaces, Introduction to surface mechanisms and thermodynamics, capillarity, meniscus shapes, contact angle, surface tension and its measurement, Laplace Equation, Young's equation, Kelvin Equation, Gibbs equation, equilibrium criteria, dividing surface, monolayers and films, mobile and fixed interfaces Interfacial areas and degrees of wetting, aerosols, liquid-liquid and particulate dispersions, Bubbles,and drops aphrons.

Microphases: Definitions and dynamics, Micelle formation surfactants CMC, structures of micelles,swollen micelle and microemulsions models, phase diagrams, Macroemulsions, Mechanical vs thermodynamic stability, HLB, Bancroft rule and other systems, Foams Colloids, Film elasticity, drainage, association, Langmuir-Blodgets film production. Experimental techniques of measurement of relevant properties: surface tension, solubilization, thermodynamic properties, spectroscopic techniques

Rheological aspects of two phase (involving microphases) flow and transport, visco-elasticity of surfactant solutions.

Solubilization and catalysis by microphases: Models, theories and data, surface potential and equations of state, double layer theory, layer DebyeHuckel theory, Thermodynamics of solubilization, Hydrotropy

Emulsification and Demulsification, foam breakage, theories of coalescence, and agglomeration, Brownian motion, shear and other models.

Applications: Adsorption, foam fractionation, froth floatation Enhanced oil recovery, Novel separation processes, Coagulation, Flocculation, Microelectronics, surface vapour deposition, other applications with techniques

Monte Carlo simulation for molecular dynamics of structures, graphics software for structural display., Diffusion on the surface and in microphases.

26. **CET 1403E – Adsorptive Separations (Chemical Engineering Department)**

Separation Processes: overview, alternative separation techniques, Mass separating agents

Adsorbents: Molecular sieves activate carbon,zeolites alumina, silica ion exchangers, Polymeric adsorbents

Physical and Reactive adsorption: Selectivity engineering in catalysis, Gaseous and liquid adsorption, Thermodynamics of adsorption, Statistical thermodynamics of adsorption phenomena, Surface excess, theories of adsorption. Separations: Bulk separation, purifications, Concentration and recovery from dilute solutions: metals, organic chemicals, microelectronics

Design of adsorbers: Gaseous and liquid phase adsorption

Theoretical analysis of diffusion in relation to adsorption in micropores

Chromatographic separations: Bulk chemicals separations, Purification, refining operations, Biochemical applications

Novel separation techniques using adsorbents, Industrial examples

27. **CET 1209E – Advanced Biochemical Engineering (Chemical Engineering Department)**

Biotechnology, Biochemistry and microbiology, Enzymatic reactions, cell culturing

Enzyme engineering, enzyme modifications, stability, reactivity and selectivity considerations

Genetics and Genetic engineering, DNA recombinant technology, Hybridoma technology, single cell proteins, gene manufacturing

Fermentation and design of fermenters with modified organisms

Bioprocess simulations, molecular modelling for protein synthesis and drug design, protein engineering

Applications in fermentation industry, pharmaceutical industry, medical field such as gene therapy, Biomedical engineering

Bioreactor design, Scale up of bioreactions/reactors, Downstream processing in biochemical industry
Organic synthesis using enzymes

28. **CET 1404E – Downstream Processing in Biochemical Industry (Chemical Engineering Department)**

Separation processes in biochemical industry, Separation processes for bulk chemicals and proteins, special needs, Unit operations on biochemical industry, such as filtration, centrifugation, heat and mass transfer , Solvent extraction: liquid-liquid extractions, phase diagrams, thermodynamics of liquid-liquid extraction, physical vs reactive extraction, liquid ion exchangers, design of extractors, two phase flow in extractors, modelling and simulation of extractors, Aqueous two phase extraction, affinity partitioning, dye ligand partitioning, Reverse micellar extraction of proteins and enzymes, Adsorption: physical and chemical adsorption, theories of adsorption, ion exchange resins and polymeric adsorbents, adsorption of small molecular weight bioproducts such primary and secondary metabolic products of cells, Protein purifications, precipitation, affinity precipitation, adsorptive and chromatographic separations of proteins, design of adsorption columns, Methods of operation., Gel permeation chromatography, metal ligand chromatography, dye ligand chromatography, affinity chromatography, expanded bed chromatography,
Applications in biochemical industry.

29. **CET 1405E – Advanced Separation Processes**

Membrane Processes : Principles of various membrane processes like Reverse Osmosis, pervaporation, gas separation and electro-dialysis. Design equations and module design. Concentration polarization.

Adsorption and Ion Exchange Processes : Adsorption and ion exchange equilibria. Various isotherms. Contact filtration, design of fixed bed adsorber including breakthrough cuurve.

Chromatographic Separations : Principles of chromatographic separation, criteria for effective separation, supports and methodology and process design.

Separation of Racemic Mixtures : Principles of racemic modification and their application in separation of racemic mixtures with specific examples.
Dissocaition Extraction, Reactive Extraction

30. **CET 1210E – Introduction to Polymer Engineering (Chemical Engineering Department)**

Introduction to Polymers : Classification based on application and history, Natural and synthetic polymers and types e.g. fibres, rubbers, adhesives, resins, plastics, etc.

Classification based on properties/structures : Thermoplastic, thermosetting, crystalline, amorphous, molecular weights status, transitions, glass transition temperature

Polymer formation/modification : Functionality and reactions, chain, ionic, condensation, co-ordination, complex polymerisation, Kinetic schemes, Orders of reactions, Cross-linking, Co-polymerisation, Heat effects
Polymerisation Processes and methods of manufacture : Bulk, Solution, Suspension and emulsion polymerisation with examples, polystyrene, polyethylene/propylene, styrene-Butadiene, poly urethane, Epoxy, PET, Kinetics, reaction rates, diffusional limitations, Biodegradable polymers.

31. **CET 1604E – Polymer Processing (Chemical Engineering Department)**

Plastic Technology : Moulding, (injection, blow) extrusion, cold-not and vacuum forming multipolymer systems. Equipments design and operating conditions

Fibre Technology : Textile processing, fibre spinning and after treatment. Equipments design and operating conditions

Elastomer Technology : Vulcanisation, Reinforcement compounding

Equipments- design & operating conditions, environmental impact

Recycle of polymers : Reprocessing techniques and limitations

Selection of polymers : domestic & engineering usage
Rheological and mechanical measurements concept of solution viscosity

32. **CET 1211E – Polymer Reactor Engineering (Chemical Engineering Department)**

Kinetic modelling, concept of reactor design, optimisation and control of polymerisation process, isolation and separation of monomers/catalyst/by products etc for Bulk polymerisation, Solution polymerisation, Emulsion polymerisation, suspension polymerisation with case studies
Kinetic modelling of co-polymerisation processes.

33. **CET 1605E – Advanced topics in Polymer Chemistry/Physics Characterisation/Analysis of Polymers (Chemical Engineering Department)**

Structure/property relationship : Morphology & Cristallinity Mechanical and Chemical properties
Structure/Rheology relationships

Rheology, elasticity, Viscoelasticity, yield and fracture chemical resistance

Properties of commercial polymers. PE, PP, Acrylic, amides & peptides phenolic & Urethane resins

Role of Additives : Type of additives and their role in altering the properties

Polymer composites : Carbon filled, fibre filled etc. Reinforced polymers

Analysis of polymer solubility, thermodynamics and phase equilibrium of polymer solutions, End group analysis, Colligative property measurement, Light scattering, Solution viscosity and molecular size and wt distribution. Spectroscopic methods, microscopy, thermal analysis.

Selection of polymers, domestic and engineering usage.

34. **CET 1510E – Fuels Engineering (Chemical Engineering Department)**

Classification of fuels : G/L/S

Automotive Fuels Bharat Standards II III & IV

Gaseous Fuels:

Natural Gas: Processing for pipe line specs

CO_2/H_2S/COS Removal

Gas dehydration

Gas compression for pipe line transport

Coal bed methane, Bio Gas (methane)

CNG : As auto fuel, Compression, CNG stations

LNG : Liquefaction of NG JT effect, closed & open cycle , Storage of LNG, Transportation of LNG, vessels / truck, terminal, Gasification of LNG to NG for pipeline transport

Liquid Fuels:

- Refinery sources, Reforming for fuels
- LPG : Domestic and Auto LPG Storage and handling,
- Manufacture and Storage (Partly in I&EC) Petrol, Diesel, Aviation Turbine Fuel, HSD, LDO. Furnace oil, Fuel oil, LSHS.
- Biofuels : bioethanol, biodiesel

Solid Fuels : Characterization

- Coal
- Biomass
- Residue from Refinery
- Plastic waste
- Municipal domestic waste

Combustion of Fuels :

- Basic equation, air requirement norms for excess air.
- Heating value : GHV/LHV Calculations for mixture of components
- Wobbe number for Gaseous Fuels definition and significance.
- Burners : Gas/Liquid/Hydrogen
- Flue gas composition, Dew point calculations
- Treatment of flue gas to meet local standards,Carbon Credit

Gasification of i) Coal, Indian Coal

ii) Biomass

iii)Refinery Heavy Residue

Power generation, combined cycle, cogeneration

35. **CET 1511E – Plant Utilities (Chemical Engineering Department)**

Role of Process Utilities in process industries. Impact on Project economics

Water, its characteristics and its conditioning and treatment for process industries e.g. boiler feed water, cooling water. Recycling aspects of water from blow downs.

Application of steam systems in chemical process plants, design of efficient steam heating systems, condensate utilization, flash steam, steam traps.

Characteristics properties, classification, selection and industrial applications

Characteristics of air and air receivers, instrument air. Inert gas generation

Vacuum system engineering.

Electrical Power : HT/LT

Area classification,
Motors/drives selection accordingly.
Single line diagram.
Emergency Drives Identification
Emergency power. Inverters, DG sets. Etc.

Estimation of utilities

Utilities Audit

36. **CET 1512E – Project Management: Case Study Approach (Chemical Engineering Department)**

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution : conception to commissioning.
Project execution as conglomeration of technical and non technical activities.
Detailed Engineering activities.
Pre project execution main clearances and documents
Project team : Role of each member. Importance
Project site : Data required with significance.
Project contracts. Types and contents.
Project execution
Project cost control.
Bar charts and Network diagram.
Project commissioning: mechanical and process.

37. **CET 1606E – Advanced Materials (Chemical Engineering Department)**

Nanostructured Materials: Metal nano particles, their structure and properties
Carbon nano tubes: manufacture, properties and applications.
Nano materials in catalysis.
Composite Materials: Polymer composites, metal-metal composites, polymer-metal composites, metal- ceramic composites.
Superconducting Materials: Principles of superconductivity, properties, advantages and limitations of superconductors. Applications superconductors
Smart Materials: Shape memory alloys, Auxetic materials and Biomimmicking materials. Stimulii for sensors and actuators.

38. **CET 1513E – Process Systems Engineering (Chemical Engineering Department)**

Introduction to Systems Engineering: Systems and their origin, examples of problems in Systems Engineering
Foundations of Systems Engineering: Scope and Formulation of Engineering Problems, Goals, Objectives, Specifications and Constraints, Types of Models; Hierarchical decomposition of systems, Types of Problems: Forward solution and inversion of models
Structural Analysis of Systems: Graphs and digraphs: Representation of systems, Partitioning and Precedence Ordering of systems, Structural analysis of modeling equations, Structural controllability and observability of systems, Applications to engineering problems
Steady State Analysis of Systems: Formulating steady-state models and simulations, Degrees of freedom and design specifications, The Sequential-Modular Strategy, The Equation-Oriented Strategy, Applications to engineering problems
Optimization of Systems: Theory and Algorithms: Basic concepts and definitions, Linear programming, Unconstrained nonlinear optimization, Nonlinear Programming, Combinatorial optimization, Applications to engineering problems
Simulation of Dynamic Systems: Basic concepts: Systems described by ODEs and DAEs, Formulating dynamic simulations; consistent initialization, Numerical integration of ODEs and DAEs, Modeling-simulation of hybrid Discrete/Continuous systems, Applications to engineering systems
Model-Based Process Control: The nature of feedback control, The concept of model-based control systems, Design and analysis of model-based control systems applications

39. **CET 1106 – CFD applications in chemical processes (Chemical Engineering Department)**

Derivation of equations of momentum and energy for turbulent flows.
Finite volume technique
One dimensional heat conduction and flow
Grid generation
Space and time discretization
Pressure velocity coupling (simple, simpler & SIMPLEC)
OpenFOAM software, simulation of pipe flow, backward step, flow past cylinder
Commercial software, simulation of pipe flow, backward step, flow past cylinder, stirred vessel, bubble column, cyclone separator, spray dryer etc.
Suggested Books:
Versteeg and malalasekera, "An introduction to computational fluid dynamics. The finite volume method", (2007)
Patankar S., "Numerical heat transfer and fluid flow", (1980)

40. **CET 1407 – Process Design of Heat and Mass Transfer Equipment**

(3 Credits: 2 Lectures + 1 Tutorial – 3 hours per week, 45 hrs total)
Advanced Process design aspects of various process equipments will be considered through several case studies;

and will cover: hydrodynamic characteristics, heat and mass transfer characteristics, selection criteria, etc. The topics will include some of the following equipment (but not limited to):

(1) Equipment for heat transfer: plate heat exchangers, plate fin exchangers, finned tube exchangers, thermo-siphon reboilers, evaporators, condensers, etc.
(2) Equipment for Unit operations: plate and packed columns, spray towers, etc.
(3) Equipment for Multiphase reactions: Stirred tanks, gas inducing reactors, bubble columns / modified bubble columns, air-lift reactors, packed and plate columns, trickle bed reactors, ejectors, etc.

41. **CET 1408 Advanced Membrane Separations**

Introduction : classification and definitions

Membrane Processes and their applications: Microfiltration, Ultrafiltration and micelle-enhanced ultrafiltration, Nanofiltration, Reverse osmosis, Dialysis, piezodialysis, electrodialysis, Pervaporation and membrane distillation, Gas permeation,Liquid membranes, Ion exchange membranes

Transport mechanisms, and mathematical modelling

Membranes: Design of membranes, Characterization

Polarisation and fouling: Polarisation phenomena and fouling concentration polarization, Characteristic flux behaviour in pressure driven membrane operation, Membrane fouling, Methods to reduce fouling

Process design: modules and configurations: Capillary, hollow fibre, tubular, Plate and frame, Spiral wound

Membrane reactors and their applications in biotechnology

Text books:

Mulder, M.H.V. Membrane Separations, Springer.

Philip, R., Wankat, C. Rate-Based Separations, Springer.

Reference books:

Nunes, S.P., Peinemann, K.V. Membrane Technology in the Chemical Industry, Wiley.

Rautanbach and R. Albrecht, Membrane Processes, Wiley.

Crespo, J.G., Bodekes, K.W. Membrane Processes in Separation and Purification, Kluwer Academic Publications.

Geankoplis, C.J. Transport Processes and Unit Operations, Prentice-Hall.

42. **CET 1607 Biomaterials: Biodegradable Materials for Biomedical Applications**

Introduction of Biomaterials

Biomaterials Surfaces: Structure and Properties, Surface Energy

Adsorption and Reconstruction at Surfaces,

Protein-Surface Interactions

Proteins: Structure, Properties, Functions, Protein Adsorption: Complex Phenomena, Measurement

Cell-Surface Interactions: Host Response to Biomaterials: Cell adhesion mechanism, coagulation cascade, immune response

Surface Characterization: AES, XPS, AFM, Contact Angle

Quantifying Cell Behavior: Cell Culture, Cellular Assays

Biosensors and Diagnostic devices

Drug Delivery: Controlled Release, Diffusion Controlled and Membrane based devices, Mechanical Pumps

Biomaterial for Organ Replacement

Mechanical Properties, Bone Substitutes

Introduction of Tissue Engineering: Cell, Scaffold design, Artificial liver, pancreas, cartilage

Regulatory overview

Text Books:

Ratner, Buddy D., et al. Biomaterials Science: An Introduction to Materials in Medicine. 2nd ed. Burlington, MA: Academic Press, 2004. ISBN: 9780125824637.

43. Elective: Machine Learning

	Machine Learning	
	Machine Learning Concepts: Mean Square Error (MSE), Training Error, Test Error, Bias-variance trade-off, Measuring the quality of fit, Regression Diagnostics, Understanding the concept of model flexibility and prediction accuracy, Universal behaviour of Training and Test MSE. Case study of linear regression with K-nearest neighbour regression	8
	Model Selection and Regularization: Validation set approach, Leave-One-Out-Cross-Validation, K-fold cross validation, Best subset selection, Forward Selection, Backward selection, Hybrid selection, shrinkage methods: Ridge regression, Lasso, Least angle regression.	9
	Decision Trees, Bagging and Boosting, Random Forests, Gradient Boosting, Artificial Neural Network	12

	Classification problem: Logistic Regression, Support Vector Machines, Receiver operating characteristic (ROC) curves, Area under the curve (AUC) and other related accuracy measures	8
	Multivariate methods: Principal Component Analysis, Factor Analysis, Principal component regression, K-means clustering, Hierarchical Clustering, Multi-dimensional scaling	8
	Software used: R/Python/MATLAB	

Course Outcomes (CO)

(1) Students should be able to understand advantages of machine learning algorithms.

(2) Students should be able to apply machine learning techniques to solve regression problems involving real data.

(3) Students should be able to apply machine learning techniques to solve classification problems involving real data.

(4) Students should be able to apply dimension reduction methods to solve problems involving real data.

(5) Student should be able to use software to build machine learning models and interpret the results.

References:

1. Andreas C. Müller and Sarah Guido, Introduction to Machine Learning with Python: David Barber A Guide for Data Scientists, (2016), O'Reilly Media.
2. Hands on Machine Learning with R by Bradley Boehmke and Brandon Greenwell, CRC Press, 2020.
3. Introduction to Statistical Learning with Application in R by James, G., Witten, D., Hastie, T. and Tibshirani, R, 2011.
4. All of Statistics: A concise course on Statistical Inference by Larry Wasserman, 2009.
5. The Elements of Statistical Learning by Jerome H. Friedman, Robert Tibshirani, and Trevor Hastie (2001), Springer.
6. Ethem Alpaydin, Introduction to Machine Learning by (2004), The MIT Press, Cambridge.
7. Ian H. Witten, Eibe Frank, Mark A. Hall, Data Mining: Practical Machine Learning Tools and Techniques by (2011), Elsevier
8. Machine Learning: A Probabilistic Perspective (Adaptive Computation and Machine Learning series) by Kevin P. Murphy (2012)

44. Elective (Optimization Techniques) (3 credits)

Topics	No. of hrs.
Review of local maximum/minimum	2
Method of Lagrange Multipliers and KKT methods	6
One dimensional Optimization Techniques: Fibonacci search method, Golden section method and interpolation method.	4
Direct Search unconstrained optimization: Powell’s method, Nelder-Mead (simplex) method	6
Gradient Search Optimization Methods: Steepest Descent Method, Newton’s Method, Conjugate gradient methods	10
Linear Programming: Simplex Method, Revised Simplex Method and other Advanced Methods, Integer Programming	12
Modern Optimization Techniques; Genetic Algorithms, Simulated Annealing, Ant Colony Optimization	5

COURSE OUTCOMES (CO)

(1) Students should be able to understand classical optimization techniques and their numerical implementation.

(2) Students should be able to solve the engineering problems related to maxima and minima in the optimization framework.

(3) Students should be able to apply different methods of linear programming to solve optimization problems.

(4) Students should be able to apply modern optimization techniques to solve engineering problems.

Reference:

1. Engineering Optimization: theory and practices, S.S. Rao, New Age International Pvt. Ltd.
2. An Introduction to Optimization, Edvin K. P. Chong & Stanislab H. Zak, Wiley Publication
3. Optimization for Engineering Design, K. Deb, Prentice Hall, India