

MDM and OE Orientation

## Students' Awareness about the MDM Degree And Open Electives



Orientation in a Phased manner between 22<sup>nd</sup> Feb – 22<sup>nd</sup> March 2024

Number of Orientation Programmes: 8



MDM and OE Orientation

## ICT Off Campuses Activities Jalna and Bhubaneshwar



ICT Jalna Campus: 23<sup>rd</sup> March 2024



Sr. No.	MDM Program	Time	Coordinator/ Instructors	Venue
1	Food Technology	10:30 – 11:00 am	Dr. Ramesh Chavan	Auditorium
2	Pharma Technology	11:00 – 11:30 am	Dr. Navnath Hatvate	Auditorium
3	Lipids Technology	11:30 am – 12:00 pm	Dr. Parag Nemade	Auditorium
4	Materials and Polymers Technology	12:00 – 12:30 pm	Dr. Girish Joshi	Auditorium
5	Energy Technology	01:35 – 02:00 pm	Dr. Supriyo Kumar Mondal	Auditorium
6	Petro Technology	02:00-02:30 pm	Dr. Atul Bari	Auditorium
7	Chemical Sciences	02:30 – 03:00 pm	Dr. Manoj Gawande	Auditorium
8	Physical Sciences	03:00 – 03:30 pm	Dr. Girish Joshi	Auditorium

ICT Bhubaneshwar Campus: 2<sup>nd</sup> and 6<sup>th</sup> March 2024





# Multi-Disciplinary Minor (MDM) Degree In Biotechnology and Bioengineering

Under the National Education Policy (NEP 2020)

(2023-2024)

Offered by

---

**DEPARTMENT OF BIOLOGICAL SCIENCES AND  
BIOTECHNOLOGY**

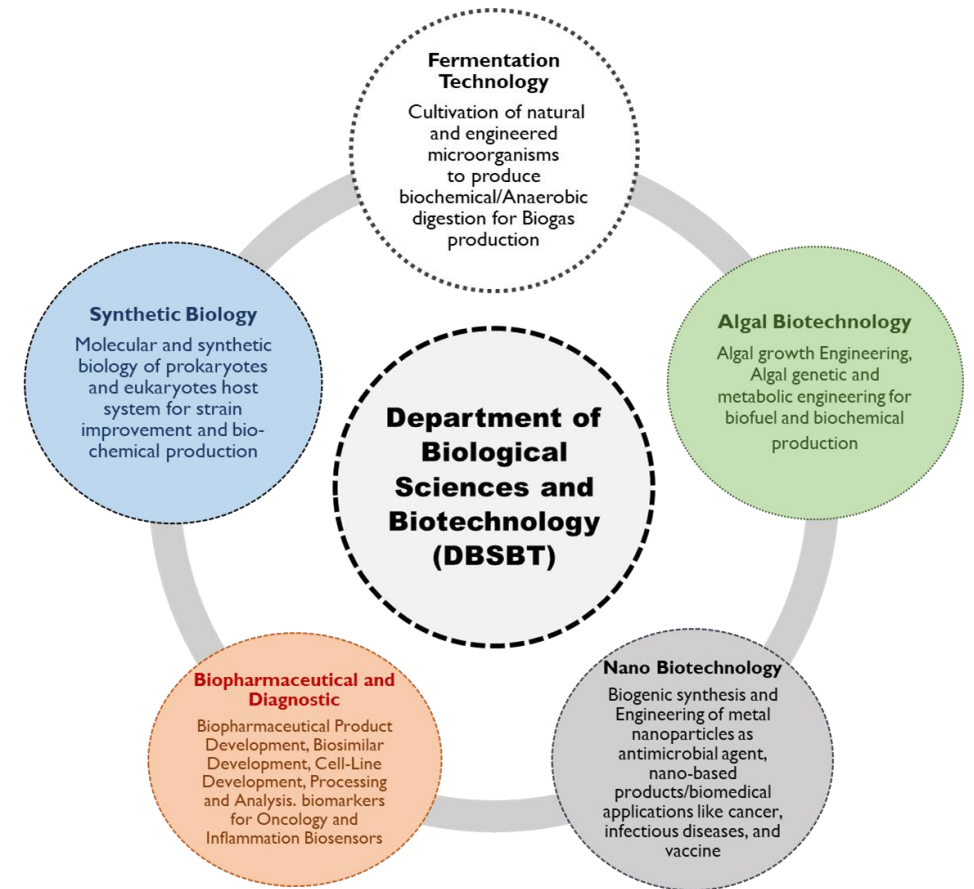
**INSTITUTE OF CHEMICAL TECHNOLOGY**

(University Under Section-3 of UGC Act, 1956)

Elite Status and Center for Excellence

Government of Maharashtra

# Department of Biological Sciences and Biotechnology (DBSBT)



Genesis

**DBT-ICT Centre for Energy Biosciences:** India's first Bioenergy Centre, established in 2009

**DBSBT:** An extension, evolution of the DBT-ICT Center to develop the research, training and education and outreach programs in subject of Biotechnology

# MDM Degree overview & Structure of the MDM Course

Sr No	Semester	Course Credits	Name of the course
1	III	2	Introduction to Biological Science
2	IV	2	Fundamental of Applied Biotechnology
3	V	4	Lab Techniques in Biotechnology
4	VI	2	Genetic Engineering and Bioinformatics
5	VII	2	Bioprocess Technology
6	VIII	2	Industrial Biotechnology

## Recommended batch size

Minimum 15; Maximum 35

## Eligibility criteria

1. CGPA of the first two semesters.
2. In case the results of the

IInd semester are not available, eligibility will be based on CGPA of

1<sup>st</sup> Semester (50% weightage)

and

CET/JEE score  
(50% weightage)

**Prerequisites:** None

Subject Code	Semester	Subject	Credits	Hrs/Week			Marks for various Exams			
				L	T	P	CA	MS	ES	Total
BBT1201	III	Introduction to Biological Science	2	2	0	0	20	30	50	100
BBT1202	IV	Fundamental of Applied Biotechnology	2	1	1	0	20	30	50	100
BBP1303	V	Lab Techniques in Biotechnology	4	8	0	0	50	-	50	100
BBT1304	VI	Genetic Engineering and Bioinformatics	2	1	1	0	20	30	50	100
BBT1405	VII	Bioprocess Technology	2	2	0	0	20	30	50	100
BBT1406	VIII	Industrial Biotechnology	2	1	1	0	20	30	50	100
<b>Total</b>			14	16						600

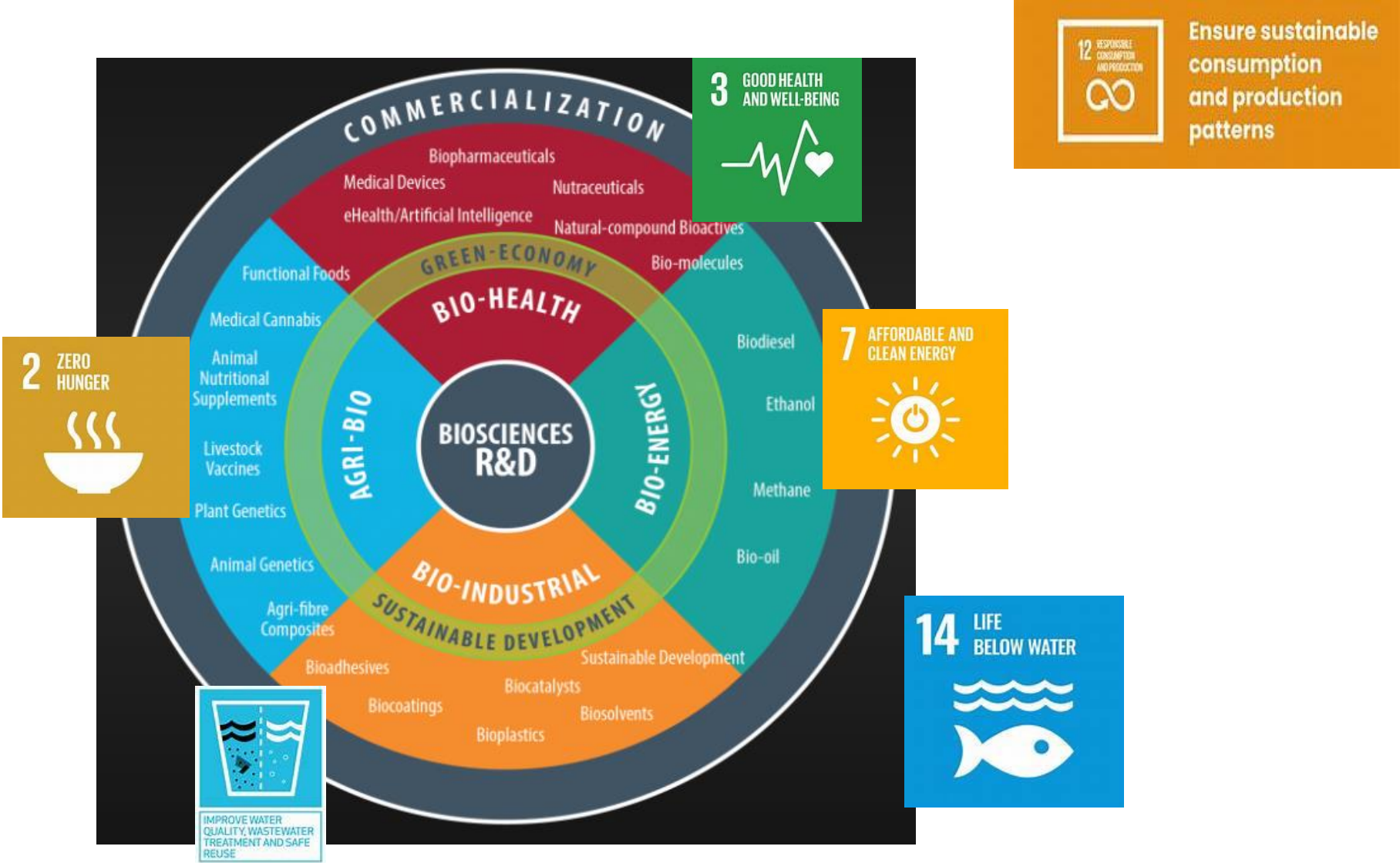
\*5 Theory and 1 Lab course

# Open Elective offered by DBSBT

Subject Code	Semester	Subject	Credit	Hours/ Week			Marks for various Exams			
				L	T	P	CA	MS	ES	Total
BBT1203	III	Introduction to Biological Science	2	2	0	0	20	30	50	100
BBT1204	IV	Fundamental of Applied Biotechnology	2	2	0	0	20	30	50	100



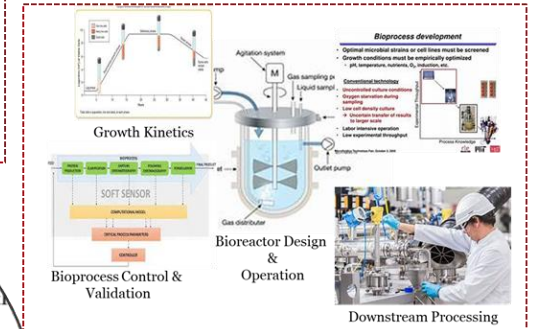
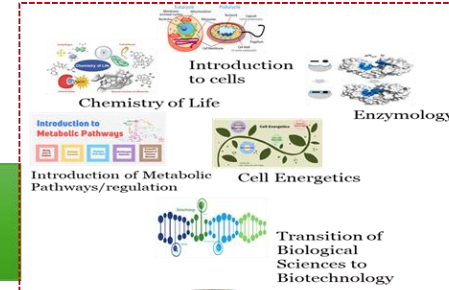
# SDG & Biotechnology correlation



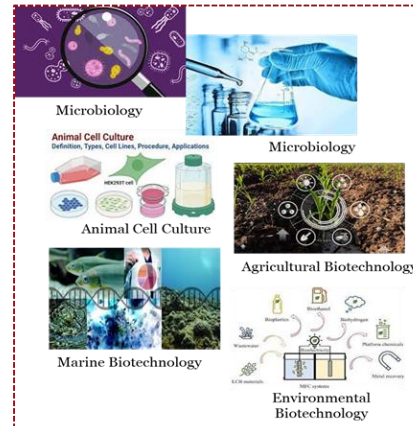
# MDM course progression

- Semester III • Introduction to Biological Science
- Semester IV • Fundamental of Applied Biotechnology
- Semester V • Lab Techniques in Biotechnology (Practical)
- Semester VI • Genetic Engineering and Bioinformatics
- Semester VII • Bioprocess Technology
- Semester VIII • Industrial Biotechnology

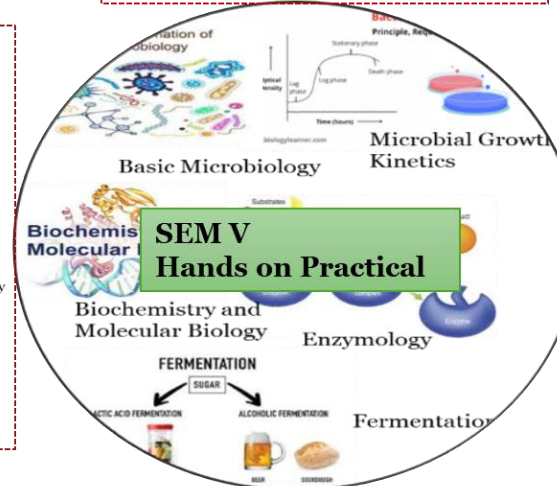
## SEM III Basics of Biotechnology



## SEM VII Specialized domain of Bioprocess Technology



## SEM IV Applied Biotechnology

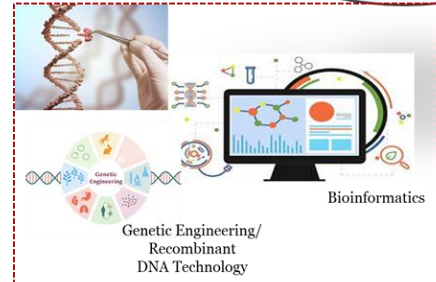


## SEM V Hands on Practical



## SEM VIII Specialized domain of Industrial Biotechnology

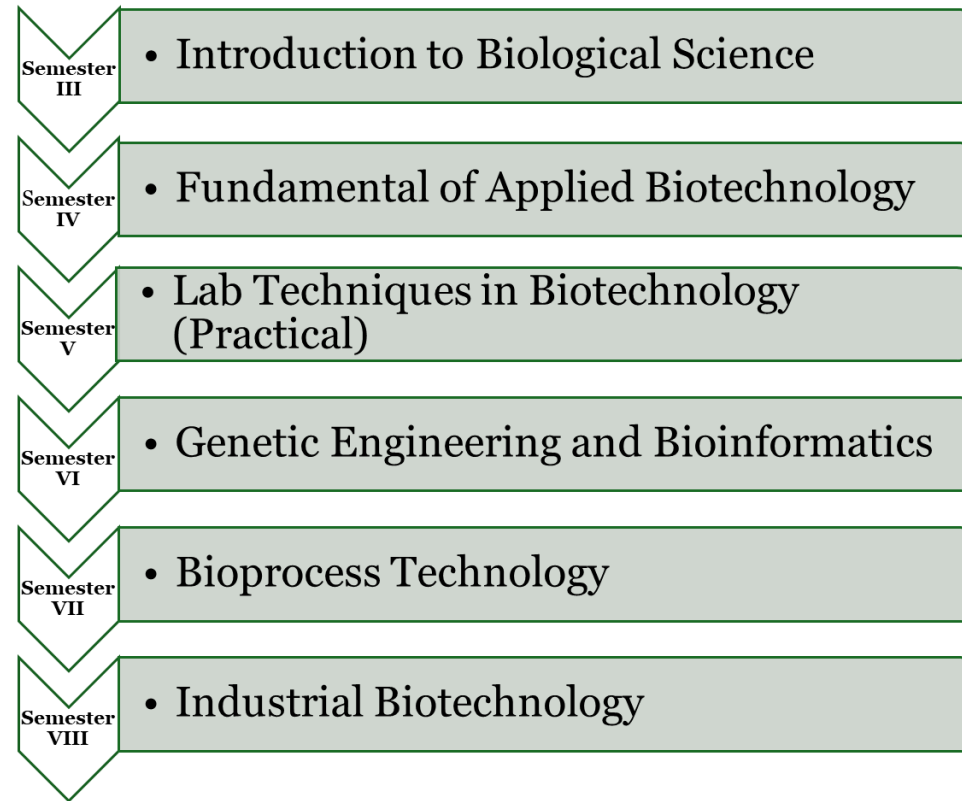
## SEM VI Specialized Domain of Genetic Engineering & Bioinformatics





# Course Significance & Objective

The Minor degree Course in  
“Biotechnology and Bioengineering” has  
been designed  
**To Encompass Diverse Domains of  
Biotechnology and Bioengineering**



**The MDM Degree Will Provide the Opportunity to  
Explore Wide Spectrum of Biotechnology  
And Understand Its  
POTENTIAL and OPPORTUNITIES in Bio-Economy  
and Overall Sustainable Development.**

# Know your Faculty



**Prof. Samir Kulkarni**  
PhD: ICT Mumbai  
**Head**



**Dr. Ratnesh Jain**  
PhD: ICT Mumbai



**Dr. Gunjan Prakash**  
PhD: IIT Delhi



**Dr. Aniket Gade**  
PhD: SGB,  
Amravati University



**Dr. Manju Sharma**  
PhD: G.N.D University  
Amritsar



**Dr. Shamlan Reshamwala**  
PhD: IIT Bombay



**Dr. Hitesh Pawar**  
PhD: ICT Mumbai



**Dr. Mayur Ladole**  
PhD: ICT Mumbai



**Dr. Chandrakant Holkar**  
PhD: ICT Mumbai



**Dr. Anand Jadhav**  
PhD: ICT Mumbai



**Dr. Rohit Sathe**  
PhD: IIT Ropar

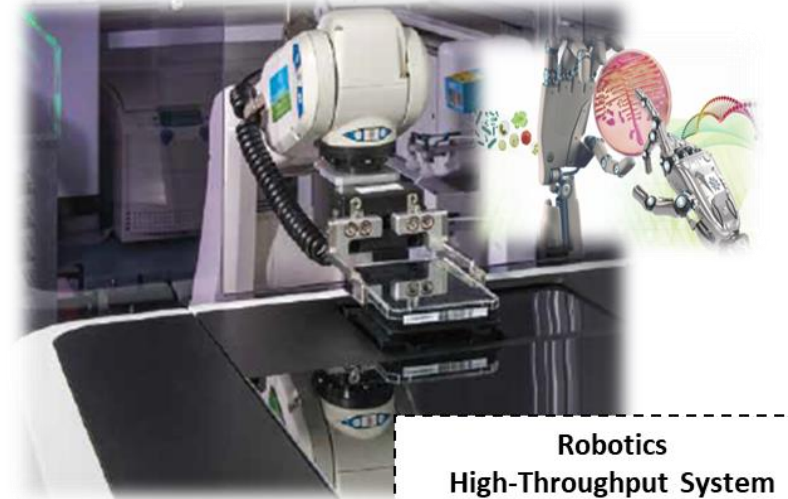
# Laboratories and R&D Facilities at the DBSBT



Fermentation Lab



Synthetic Biology Lab



Robotics High-Throughput System



Biogas fermentation



Liquid Handling System



Algal Biotechnology Lab

## What do you Acquire...

- Exposure to the exciting field of Biotechnology with real life applications
- Development of Technical Know how and Practical Exposure in the field of Applied Biotechnology
- iGEM participation opportunities
- Mentorship from Faculty for skill development possibilities in the field of Biotechnology

## Scope & Opportunities

- Higher Studies in India or abroad
- Ample Entrepreneurship Possibilities In Bio-based Domain.
- Opportunities to align to SDGs for sustainability for our own living and existence.



Thank you

For any further queries  
Please Contact or Write to

---

Head, DBSBT: Prof Samir Kulkarni (sr.kulkarni@ictmumbai.edu.in)

Departmental MDM Coordinator: Dr Gunjan Prakash

g.prakash@ictmumbai.edu.in



# Multi-Disciplinary Minor (MDM) Degree In Pharmaceutical Chemistry and Technology

Under the National Education Policy (NEP 2020)  
(2023-2024)

**Offered by**

**Department of Pharmaceutical Sciences and  
Technology, ICT Mumbai**

# Salient Features:

- Pharmaceutical science and technology have played a crucial role in this evolution, **shaping the manufacturing/preparations/formulations / extractions**, and distributed of drug substances, drug products, biological, phyto-constituents, fermented bioactive molecules etc.
- The commitment of professionals in these fields has been instrumental in ensuring a safe, abundant, and diverse pharmaceutical products supply for an increasingly global population.
- Department of Pharmaceutical Sciences and Technology has vision to provide **demand-driven**, value-based and quality technical education to make India a developed country through socio-economic transformation.
- In tune of this, the minor degree course in “**Pharmaceutical Chemistry and Technology**” has been designed to encompass different domains of pharmaceutical science and technology from fundamental knowledge to scientific and technological advancement.

# Program Specific Outcomes(PSO's)

## Key areas: Students will develop their core expertise

- **Pharmaceutical Products Development and analysis:** Able to translate emerging sciences in developing innovative pharmaceutical products. Able to apply analytical techniques for pharmaceuticals safety, quality assurance & regulations.
- **Pharmaceutical Technology Knowledge:** Apply the knowledge of mathematics, science, chemical engineering and pharmaceutical technology fundamentals, and pharmaceutical technology specialization to the solution of complex problems in pharmaceutical formulation technology, Pharmaceutical Chemistry and phytochemical extraction or Herbal technology.
- **Design & Development of innovative Solutions:** Design solutions for complex pharmaceutical technology 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
- **Fermentative Biotechnology:** Able to translate emerging science in developing innovative Fermentative/Biological products.



# Important Details

**Intake:** Minimum **15**; Maximum **35**

## Eligibility Criteria:

- a. CGPA of the first two semesters.
- b. In case the results of the 2<sup>nd</sup> semester are not available, eligibility will be based on CGPA of the 1<sup>st</sup> Semester (50% weightage) and CET/JEE score (converted into percentile based on admitted students, 50% weightage).
- c. The allotment to the multidisciplinary minor degree programme will be as per the policy of the Institute.

**Prerequisites:** 12<sup>th</sup> Standards subjects and First year B. Tech/B.Chem courses.

## Pedagogy/Teaching Methods:

- ✓ **Lecture/Discussions:** These sessions will discuss the subject matters of the course
- ✓ **Experiential Learning:** The sessions will involve hands on training.
- ✓ **Tutorials:** Problem solving / case studies / relevant real-life applications / student presentations / home assignments / individual or group projects
- ✓ **Hands on Experience:** Few topics will be demonstrated followed by hands on experience.

# Summary of Subjects

Semester	Subject	Credit	Faculty Members
III	Introduction to Technology of Pharmaceuticals and Fine chemicals	02	Prof. Shreerang V. Joshi/ Dr. Nitin Arote
IV	Pharmaceutical Analysis	02	Prof. Ganesh U. Chaturbhuji
V	Phytochemicals-Extraction and Isolation	04	Prof. K.S. Laddha/ Dr Galvina Pereira
VI	Introduction to Formulation Technology	02	Prof. Vandana Patravale/Dr. Sathish Dyawanapelly
VII	Introduction to Fermentative Biotechnology	02	Dr. Prajakta Dandekar Jain /Visiting Faculty
VIII	Pharmaceutical Chemistry and Technology	02	Prof. Shreerang V. Joshi/ Dr. Nitin Arote

# Brief Overview of Courses

## Course title

## Highlights of syllabus

### Introduction to Technology of Pharmaceuticals and Fine chemicals

- ✓ Students are required to know various aspects of the Technology of Pharmaceuticals and Fine Chemicals. This subject will fulfill the need to build the professional career additional in Pharmaceutical Sectors
- ✓ **General Aspects, Medicinal Chemistry and Process Chemistry, Pharmacology and Pharmacognosy, Dosage forms of the drugs, Drug administration, Overview of drug development and Introduction to biological therapeutics.**

### Pharmaceutical Analysis

- ✓ The course is designed to acquaint the students with the basics of Pharmaceutical Analysis.
- ✓ This includes **Pharmacopeial monographs, analytical method validation**, spectroscopic and spectrometric techniques such as **Fourier Transform Infra-Red (FT-IR), Nuclear Magnetic Resonance (NMR), Mass Spectrometry and Hyphenated Techniques.**

# Brief Overview of Courses

## Course title

## Highlights of syllabus

### Phytochemicals -Extraction and Isolation

- ✓ The course is designed to train the students with the basics and application of technology in **Separation, Preparation, Isolation, evaluation and detection of phyto-constituents from drugs of natural origin. Hands on experience on herbal extraction technology.**

### Introduction to Formulation Technology

- ✓ The course is designed for basic and practical understanding on various dosages form.
- ✓ **Overview of Pharmaceutical formulation Industry, Development in Large-scale Manufacturing of Monophasic (Oral and Topical), Biphasic – Suspension and Emulsions, Topical Dosage Forms such as Ointments, Creams, Gels, and Suppositories.**

# Brief Overview of Courses

## Course title

## Highlights of Syllabus

### Introduction to Fermentative Biotechnology

- ✓ To assess the application of biological and engineering principles to problems involving microbial, mammalian, and biological/biochemical systems.
- ✓ To understand the fundamentals of fermentation technology to know the basics in mammalian cell culture and genetic engineering and Recombinant microorganisms in fermentation
- ✓ To understand the current concepts in fermentative biotechnology, with a focus on industrial practices

### Pharmaceutical Chemistry and Technology

- ✓ Introduction to various drug classes with emphasis on synthesis and technology Developments.
- ✓ Industrial Synthetic strategies for implantation of technology in manufacturing of Drug and Drug Intermediates.
- ✓ Understanding of industrial practices.

# Laboratories and R&D Facilities at the DPST

- ✓ Nuclear Magnetic Resonance
- ✓ FTIR
- ✓ Spray Dryers
- ✓ High performance liquid chromatography
- ✓ Gas chromatography
- ✓ Glass reactor assembly
- ✓ Pressure Reactors (Hydrogenators)
- ✓ Flow reactor
- ✓ Herbal Product-Extractors.
- ✓ All formulation equipment's
- ✓ Well equipped biotech facility

# DPST Faculty

Prof. S. V. Joshi  
(Head of Department)



Prof. M. S. Degani



Prof V. N. Telvekar



Prof. G. U. Chaturbhuj



Prof. P. S. Kharkar



Dr. N. D. Arote



Dr. H. K. Chaudhari



Pharmaceutical Chemistry

Dr. P. D. Jain



Pharmaceutical  
Biotechnology

Prof. P. D. Amin



Prof. P. V. Devarajan



Prof. V. B. Patravale



Prof. P. R. Vavia



Dr. Sathish Dyawanapelly



Pharmaceutics

Prof. K. S. Laddha



Dr. Galvina Pereira



Pharmacognosy

Prof. Sadhana Sathaye



Dr. S. D. Ambavade



Pharmacology

**Detailed syllabus uploaded on ICT website. Please feel free to reach out for any further queries.**

For any further queries  
Please Contact or Write to

---

Head, DPST: **Prof Shreerang V. Joshi** (sv.joshi@ictmumbai.edu.in)  
Departmental MDM Coordinator: **Dr Nitin Arote**  
nd.arote@ictmumbai.edu.in



Thank you

ありがとうございました

Dziękuję

ขอบคุณครับ

谢谢

Cảm ơn

Gracias

اشكر

Σας ευχαριστούμε

धन्यवाद

Grazie

Tacka

Danke

Merci

ধন্যবাদ

நன்றி

감사합니다

Большое спасибо

Obrigado



# Chemical Sciences

---

Multi-Disciplinary Minor Degree

Department of Chemistry, ICT Mumbai



# Salient features:

- **Industry relevance:** Equip students for diverse roles in numerous industries such as pharmaceuticals, polymers, dyes, and textile industries
- **Innovation and Entrepreneurship:** Mentor students to successfully combine the expertise in Chemistry and technology to address this expanding market for locally manufactured chemicals
- **Research and Development:** Students will comprehend and combine both aspects – research and development – through their training to be competent researchers on a global level
- **Sustainable development:** Sensitize and train students to address global problems through development of clean technologies for energy-efficient transportation, food security and access to health care

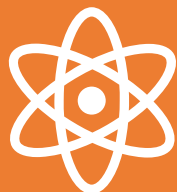


# Program Specific Outcomes

Following are the key areas in which the students will develop their core expertise:



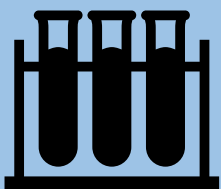
Organic  
Chemistry



Physical  
Chemistry



Computational  
Chemistry



Catalysis



Real life  
problem solving



Chemistry for  
Society



# Summary of Courses offered

Semester	Subject	Credit	Faculty Members
<b>III</b>	Chemical Kinetics	02	Prof. R. V. Jayaram
<b>IV</b>	Interfacial Chemistry	02	Prof. R. V. Jayaram
<b>V</b>	Organic Synthesis	04	Dr. A. R. Kapdi
<b>VI</b>	Organic Spectroscopy	02	Prof. A Chaskar / Visiting faculty
<b>VII</b>	Computational Chemistry	02	Dr. R. V. Pinjari
<b>VIII</b>	Organometallic Chemistry & Catalysis	02	Prof. B. M. Bhanage / Dr. A. Kapdi



# Brief Overview of Courses

## Course title

## Highlights of syllabus

### **Chemical Kinetics**

- Study of industrially relevant reactions for example polymerization reactions, homogenous catalysis, enzyme catalysis, interfacial processes
- Experimental techniques and theory of kinetic models
- Applications in food industry, pharmaceuticals, industrial synthesis

### **Interfacial Chemistry**

- Physical and chemical characteristics of surfactants, micelles, colloids (gels, emulsions, foams) and their stability
- Applications in heterogeneous catalysis, electrochemistry, separation processes and allied technology fields such as paints, dyes, drug formulations, food industry, textiles



# Brief Overview of Courses

## Course title

## Highlights of syllabus

### **Organic Synthesis**

- Functional group transformations (example – carbonyl chemistry), stereochemistry, heteroaromatic compounds, chemistry of natural products
- Applications in speciality chemicals industry, bulk chemicals manufacturing, pharmaceutical manufacturing industry, polymer

### **Organic Spectroscopy**

- Various spectroscopic techniques used for the structural elucidation of organic molecules
- UV-visible spectroscopy, Infrared spectroscopy,  $^1\text{H}$  and  $^{13}\text{C}$  NMR, mass spectrometry
- Key aspects related to speciality chemicals, research and development



# Brief Overview of Courses

## Course title

## Highlights of syllabus

### **Computational Chemistry**

- Introductory course on computational studies of molecules, supramolecular assemblies and biomolecules
- Molecules mechanics, quantum mechanics, molecular dynamics
- Applications in research and development, pharma industry, designing of molecules and materials

### **Organometallic Chemistry and Catalysis**

- Introduction to organometallic chemistry and its contemporary applications in industrial catalysis
- Important reactions include hydrogenation, formylation, hydroformylation, polymerization, CO<sub>2</sub> fixation
- Applications in research and development, pharma industry, speciality chemicals industry, green technology





# Open Electives (Sem 3 to 5)

All courses offered for MDM are open electives – meaning students who have opted for MDM other than Chemical Sciences can enroll under open electives

Sem	Subject	Credits
III	Analytical Chemistry	04
III	Organic Synthesis	04
IV	Advanced Analytical Chemistry	02
IV	Interfacial Chemistry	02
IV	Organic Spectroscopy	02
V	Computational Chemistry	02
V	Chemical Kinetics	02
V	Organometallic Chemistry and Catalysis	02



# Brief Overview of OE Courses

## Course title

## Highlights of syllabus

### **Analytical Chemistry**

- **Combination of lectures and laboratory sessions**
- Spectroscopic techniques, electroanalytical techniques, chromatographic techniques, AAS
- Experiments will be based on applications of the above techniques for chemical analysis

### **Advanced Analytical Chemistry**

- Thermal methods (DSC / TGA), XRD, surface analysis – SEM / TEM, advanced electrochemical methods (coulometry, amperometry, cyclic voltammetry)
- Applications in materials science, QC and QA in industries



**Detailed syllabus uploaded on ICT website. Please feel free to reach out for any further queries.**



**Chemistry matters!**





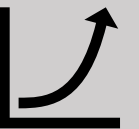
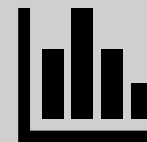
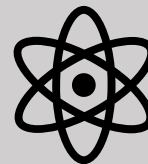
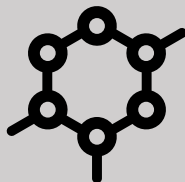
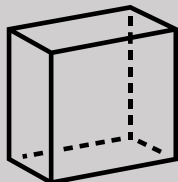
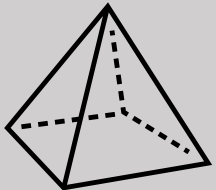
# Minor degree in “Materials Science”

Offered by the Department of Physics

**Why?**

**What?**

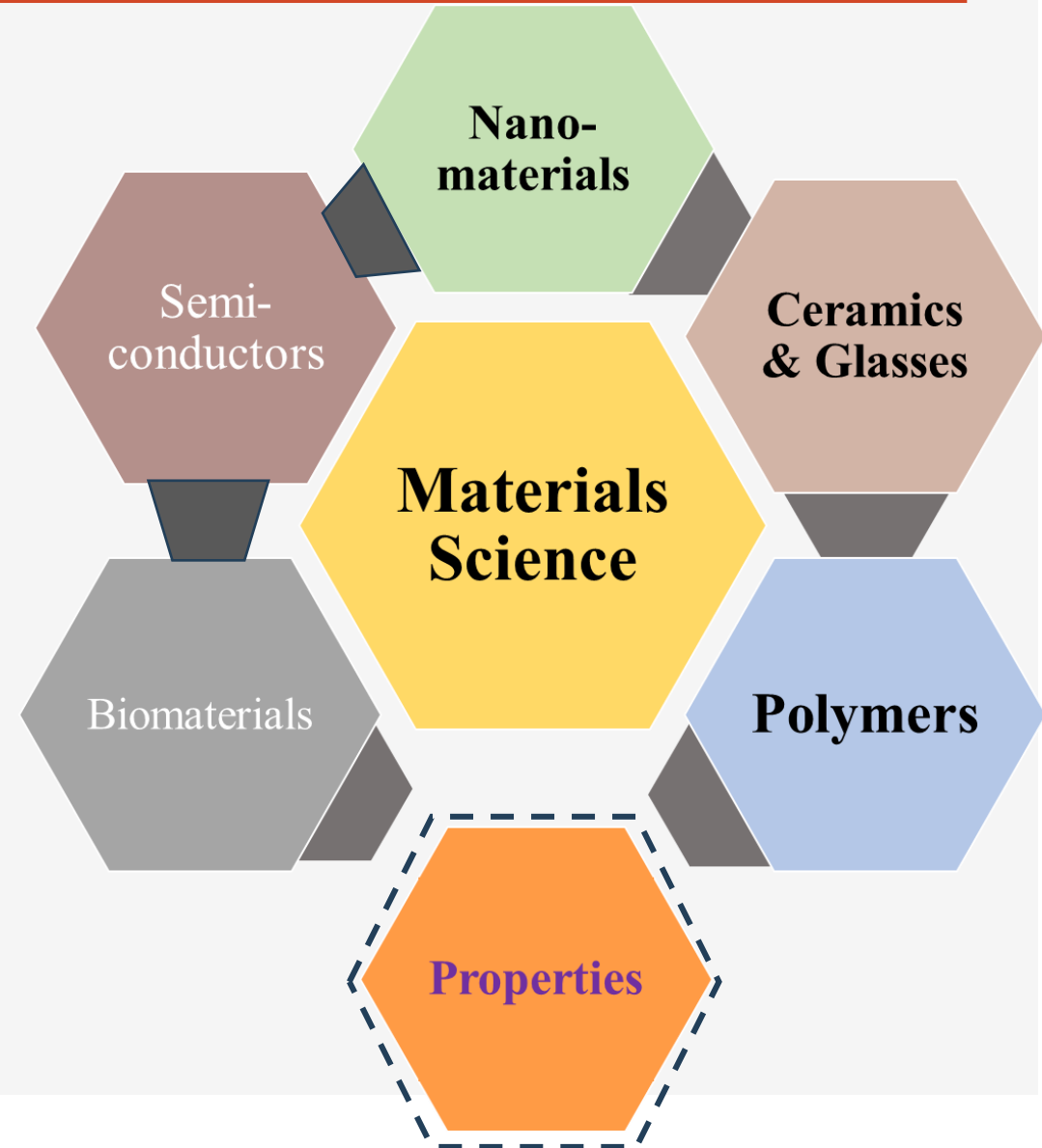
**Whom?**



# Why?

---

- We live in Materials age, drives the **progress of a country/region**
- Material are crucial to many emerging areas for advancing technology
- Semiconductor industry, solar cells manufacturing, renewable energy, automotive and aerospace industry, biomaterials, to name a few.
- Materials selection and design as per applications: **economic and performance optimization**
- **Abundance of critical** materials is an issue, finding suitable alternatives is needed.
- This program will help understand materials from microscopic viewpoint, their processing and materials selection and design for applications



# Structure of Minor degree in Materials Science (Department of Physics)

## Structure of Minor degree in Materials Science

Sr. No.	Course Code	Course	Semester	Credits	Hours/week			Marks distribution			
					L	T	P	CA	MS	ES	Total
1.	PYT1301	Solid state Physics	III	2	1	1	-	20	30	50	100
2.	PYT1401	Introduction to Materials Science	IV	2	1	1	-	20	30	50	100
3.	PYT1501	Introduction to Nanophysics and Applications	V	4	3	1	-	20	30	50	100
4.	PYP1601	Materials Characterization Laboratory	VI	2	-	-	4	50	-	50	100
5.	PYT1701	Introduction to Polymer Physics	VII	2	2	-	-	20	30	50	100
6.	PYT1801	Ceramic Science and Technology	VIII	2	2	-	-	20	30	50	100

# What we do in Materials Science?

---

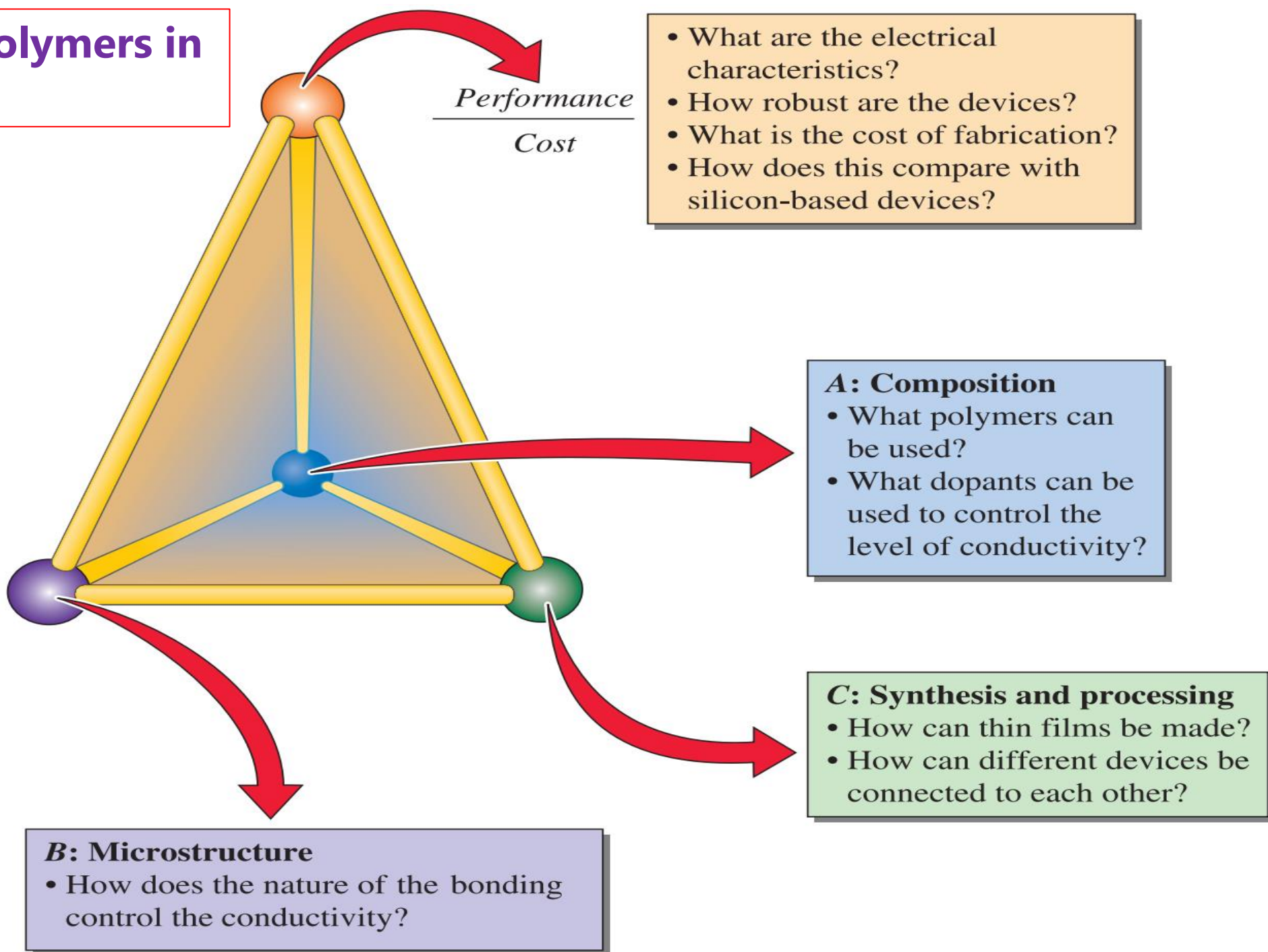


Understand materials behaviour from Atomic to Bulk



Develop strategies for processing and functionalize materials for various applications.

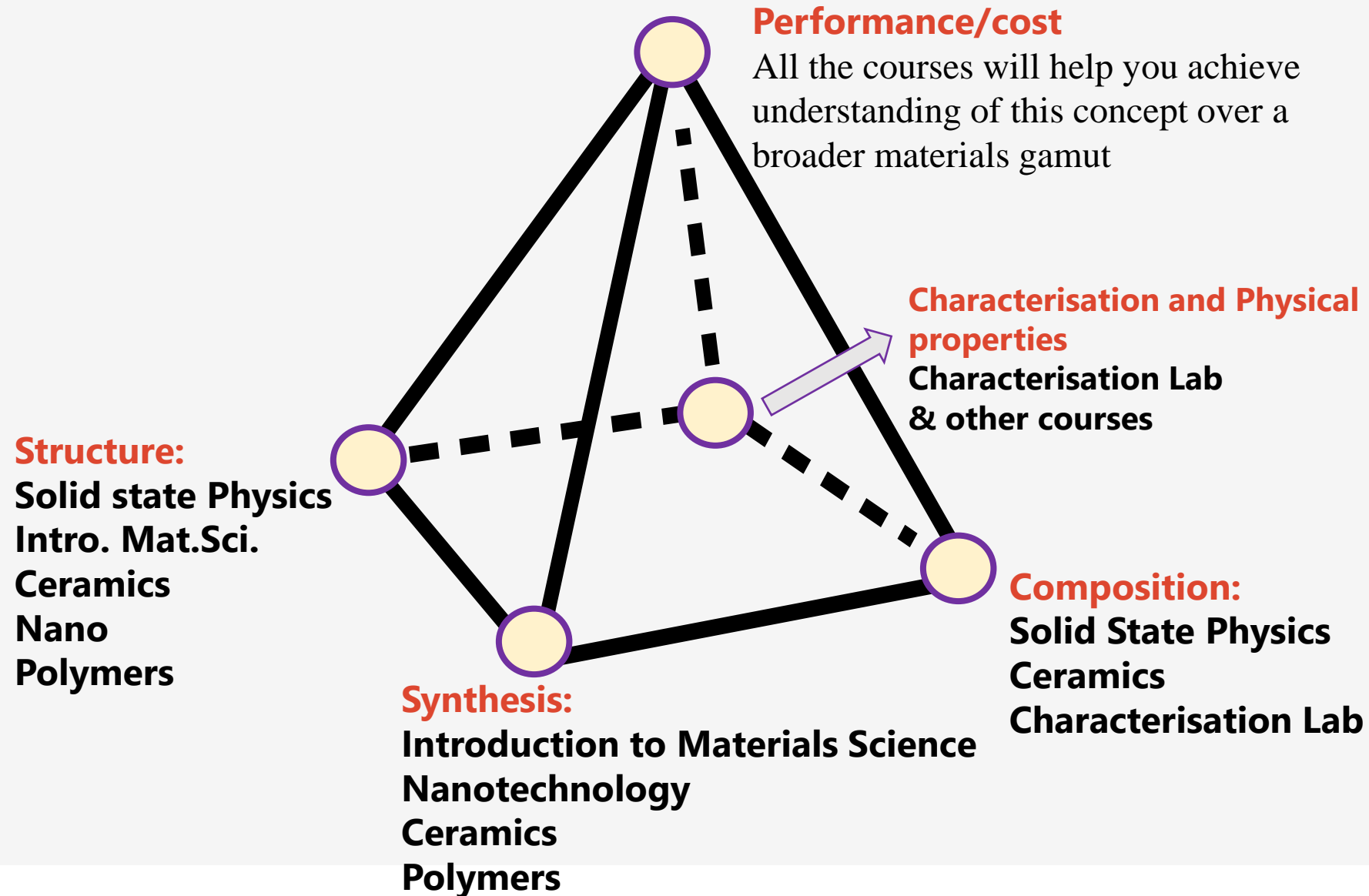
# Replacing Si by polymers in MEMS



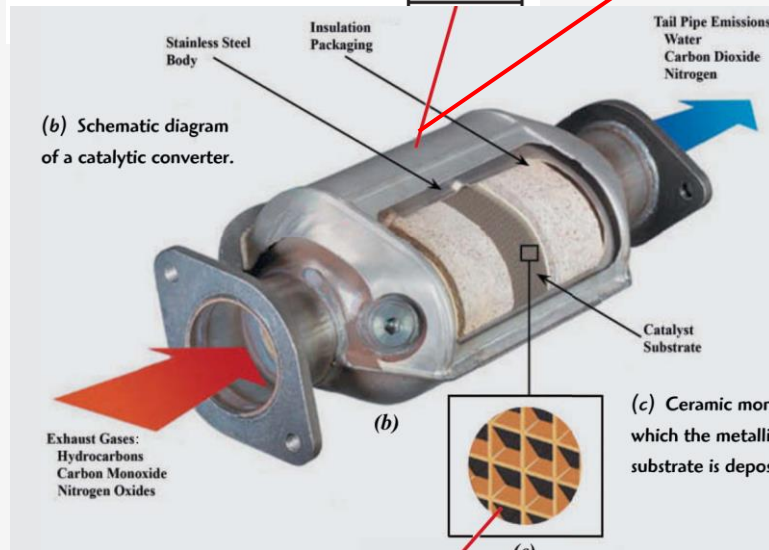
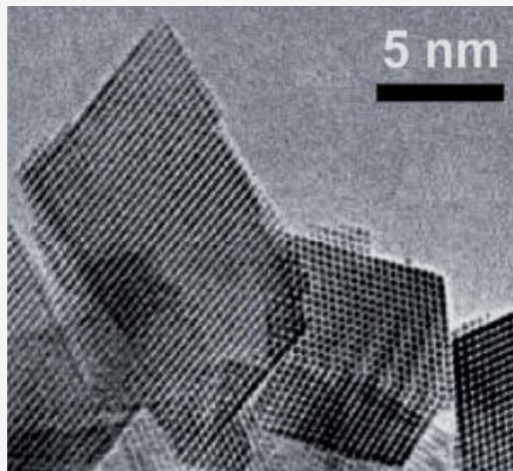
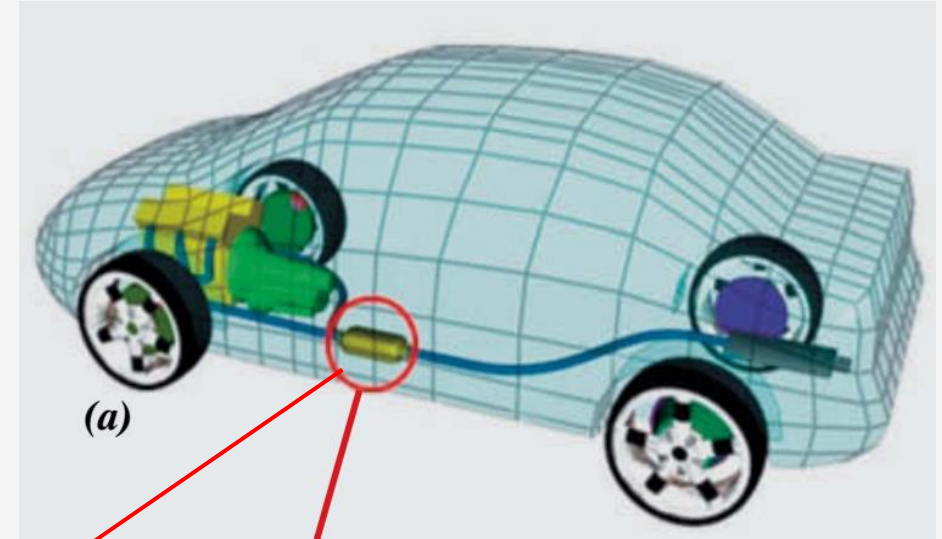
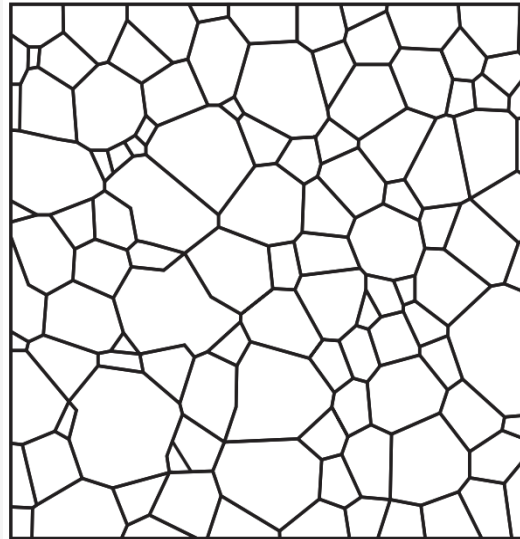
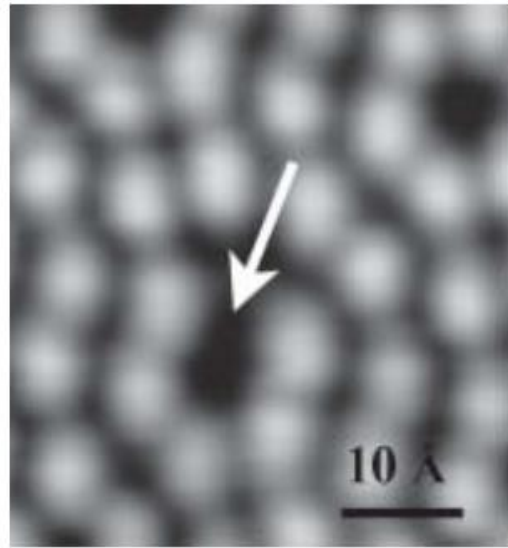


# How are courses aligned to the Philosophy of Materials science?

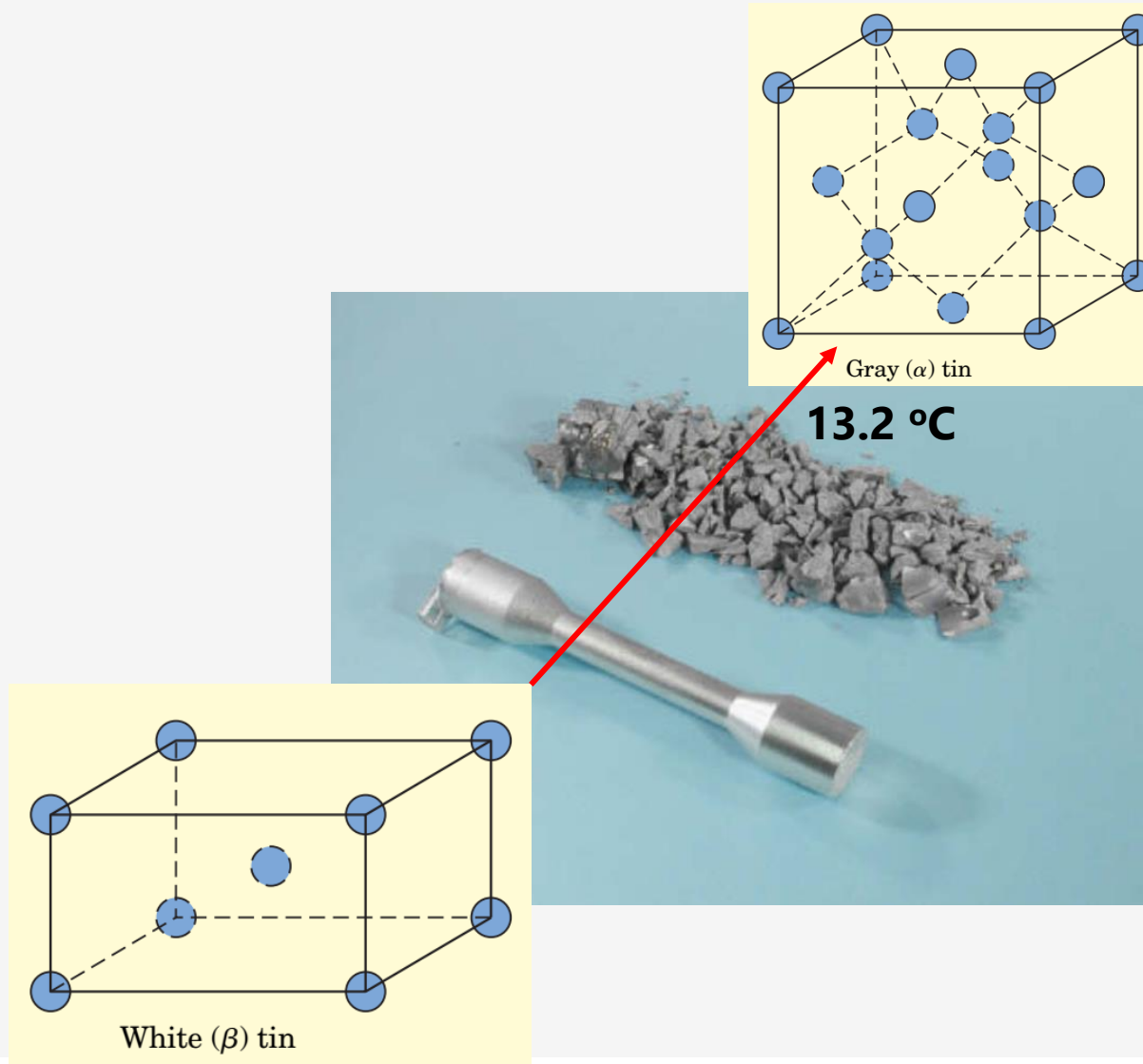
---



# Materials journey from atom to the bulk



# Materials journey from atom to the bulk



# Faculties involved in MDM



**Prof. Mohan Narayan**  
Head,  
Department of Physics

- Chemical Engineering Thermo-dynamics
- Statistical mechanics
- Theoretical High Energy Physics



**Prof. R. R. Deshmukh**  
Sr. Professor

- Plasma Technology
- Polymer Physics
- Functionalization of nano-particles
- Plasma for biomedical applications



**Dr. Neetu Jha**  
UGC Assistant Professor

- Carbon Nanomaterials
- Fuel Cell
- Supercapacitors
- Zn-ion Batteries
- Nano fluids



**Dr. Ashwin Mohan**  
Assistant Professor

- Materials Physics
- Thermal transport
- Magnetism, low temperature physics
- Low-dimensional quantum magnets



**Dr. Archana Kalekar**  
Assistant Professor

- Energy conversion: Solar cells Photocatalysis.
- Energy storage: Supercapacitor, Batteries
- Sensors



**Dr. Paresh Salame**  
Assistant Professor

- Sodium-ion batteries
- Supercapacitors
- Multiferroics
- Colossal Dielectric Materials



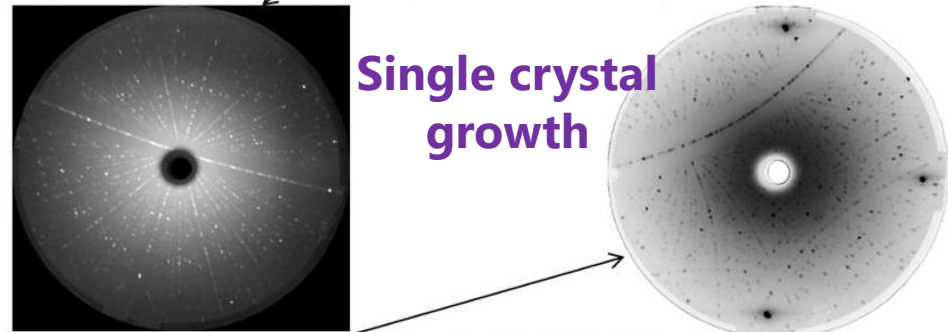
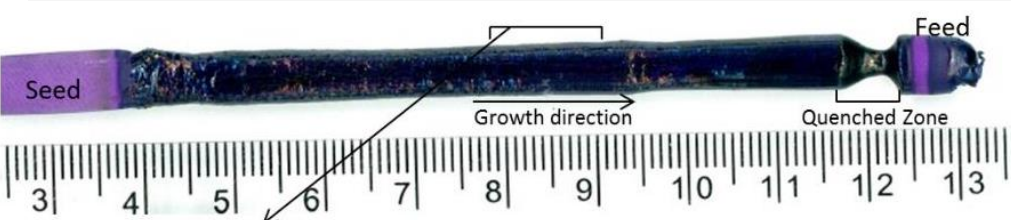
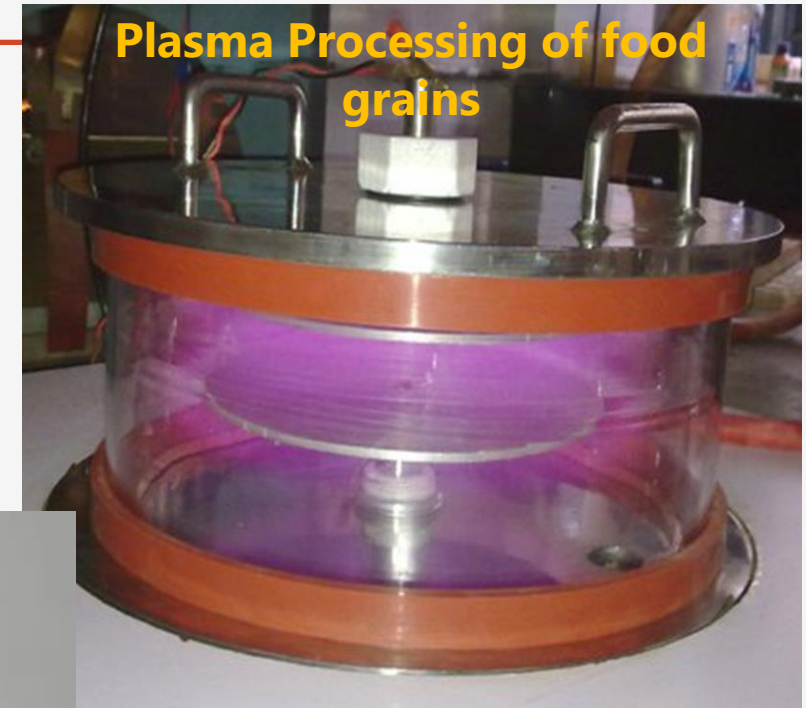
**Dr. Shraddha Shirbhate**  
Assistant Professor

- SOFC Technology, PEM FC
- Solid electrolyte
- Defect chemistry in Solid
- Piezoelectric Materials

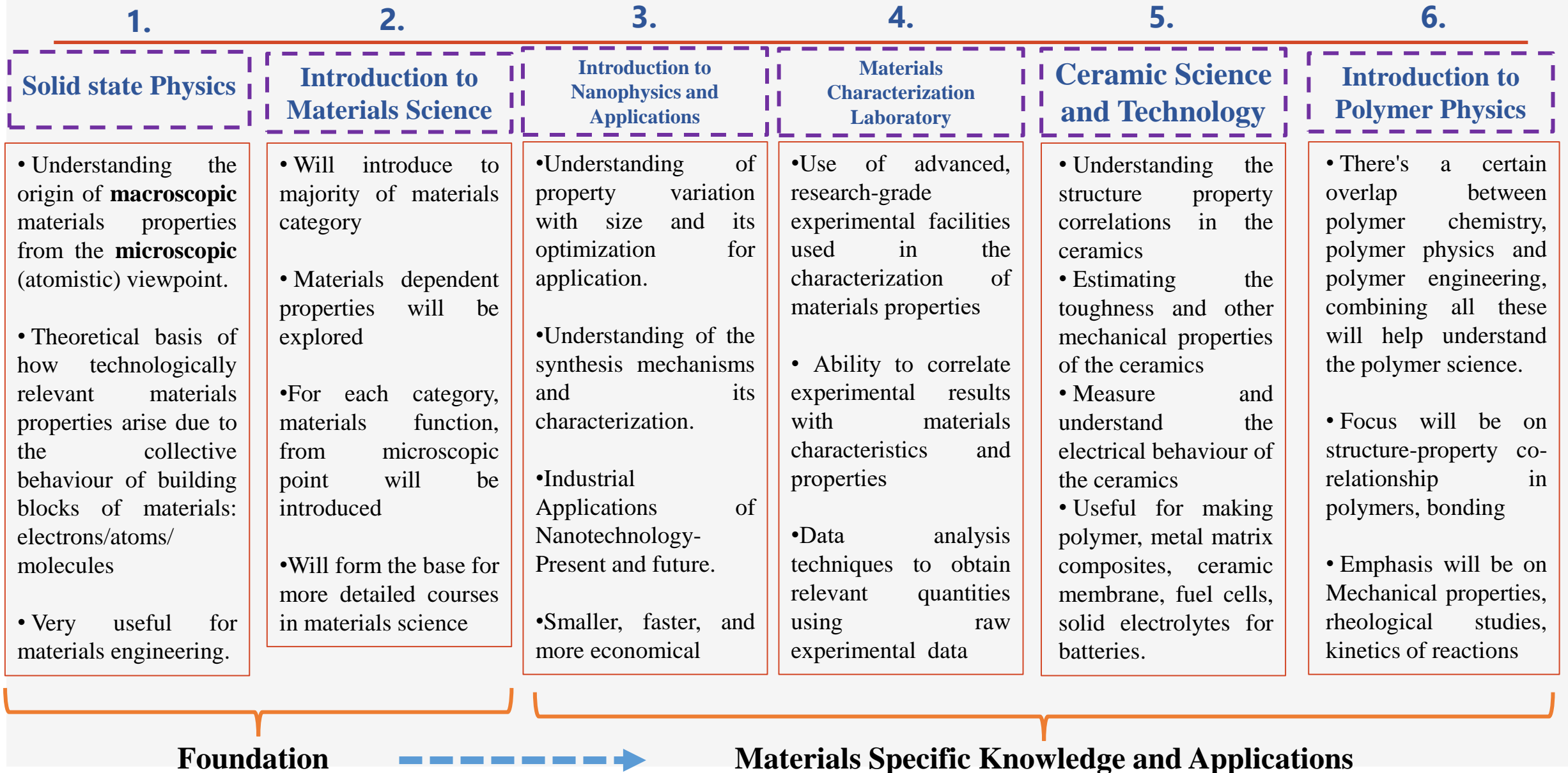
## Research/Expertise

# Department's contribution from basic to applied field

---



# How the courses are shaped?



# Research facilities student will explore

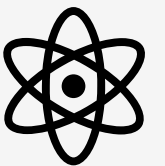
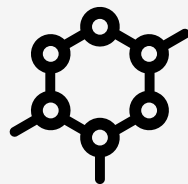
- X-ray diffractometer (XRD)
- Differential Scanning calorimetry (DSC)
- Fourier Transformed Infrared Spectroscopy (FTIR)
- UV Visible Spectrophotometer
- Colour spectrophotometer
- Electrochemical Workstation
- Universal Testing Machine (UTM)
- Rheometer
- Twin screw Extruder
- Hot stage polarising microscope



# Prospects for students opting for this Minor

---

- MS
- PhD
- Industrial R&D





## At the end of the program, you will..

---

- Understand materials from microscopic perspective
- Selecting materials for various applications, understand alternative to existing materials for a particular applications

# What you will ultimately achieve through combining this Minor with major

- Correlate fundamental understanding of various materials through atomic arrangement bonding, structure, microstructure to selecting materials for a particular applications.
- Advance to Functional Materials, witness their applications

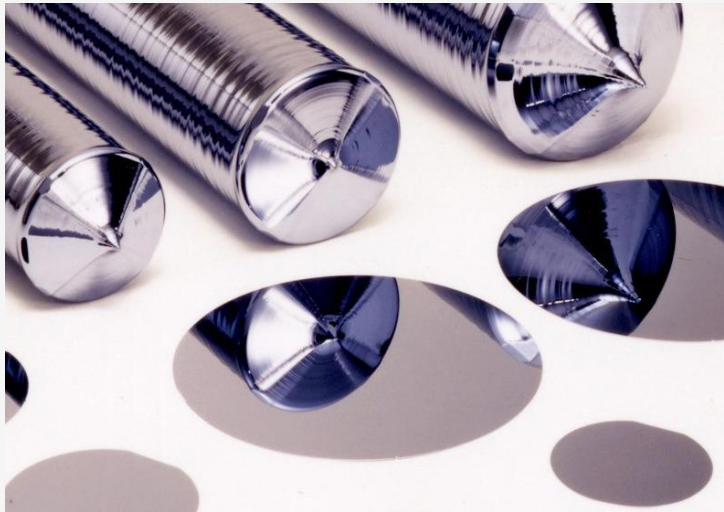
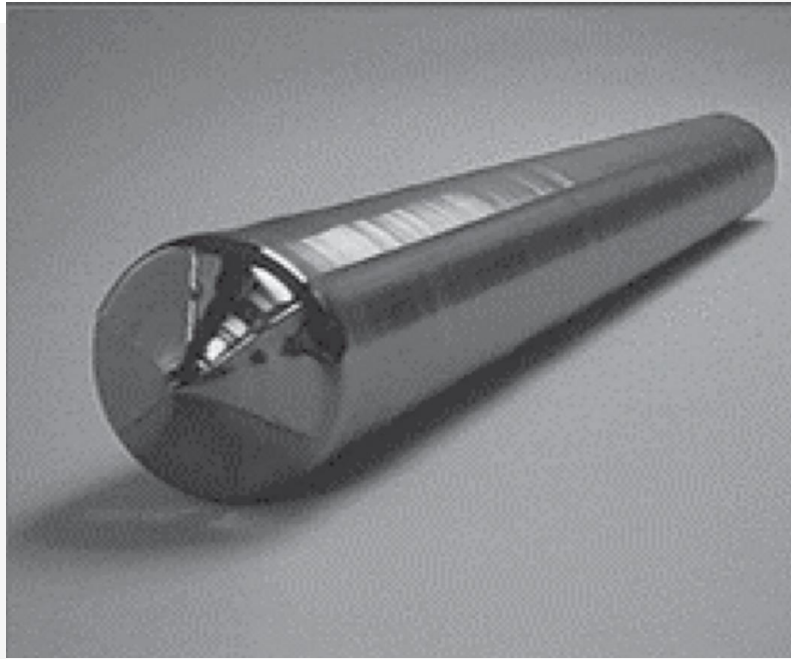
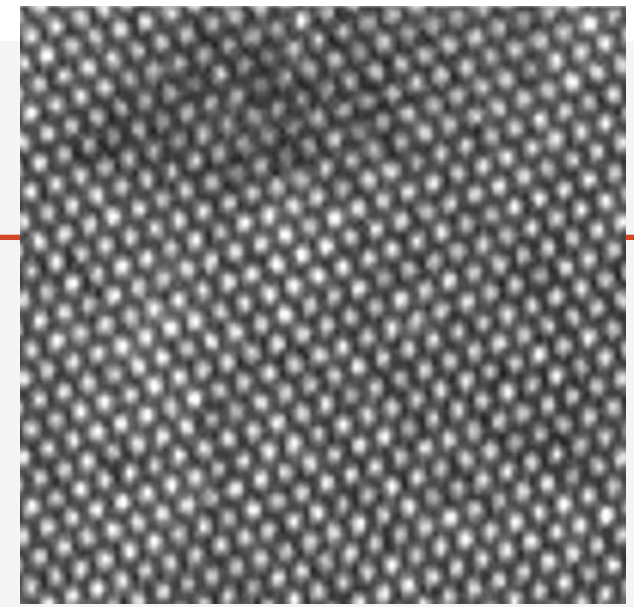
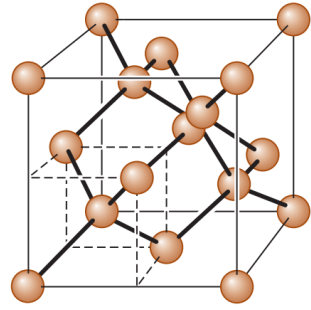
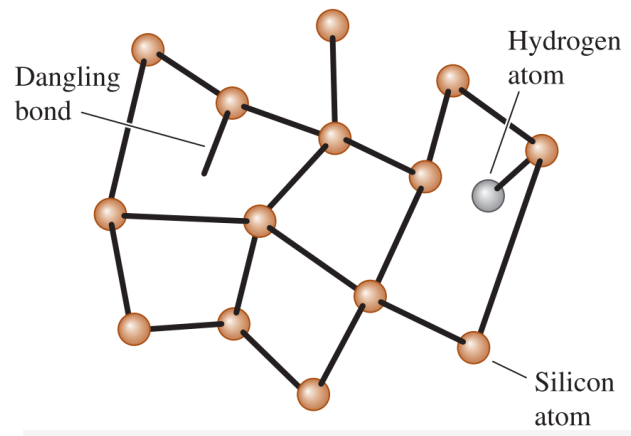


# Whom?

---

Anyone who's interested in learning basic of materials science from fundamental point of view to exploring them from application point of view will find this minor degree in Materials science useful and in tandem with their major program..

**and for those who don't find direct co-relation with this program...join, enjoy and explore fascinating world of materials...**



**Material's Journey...**



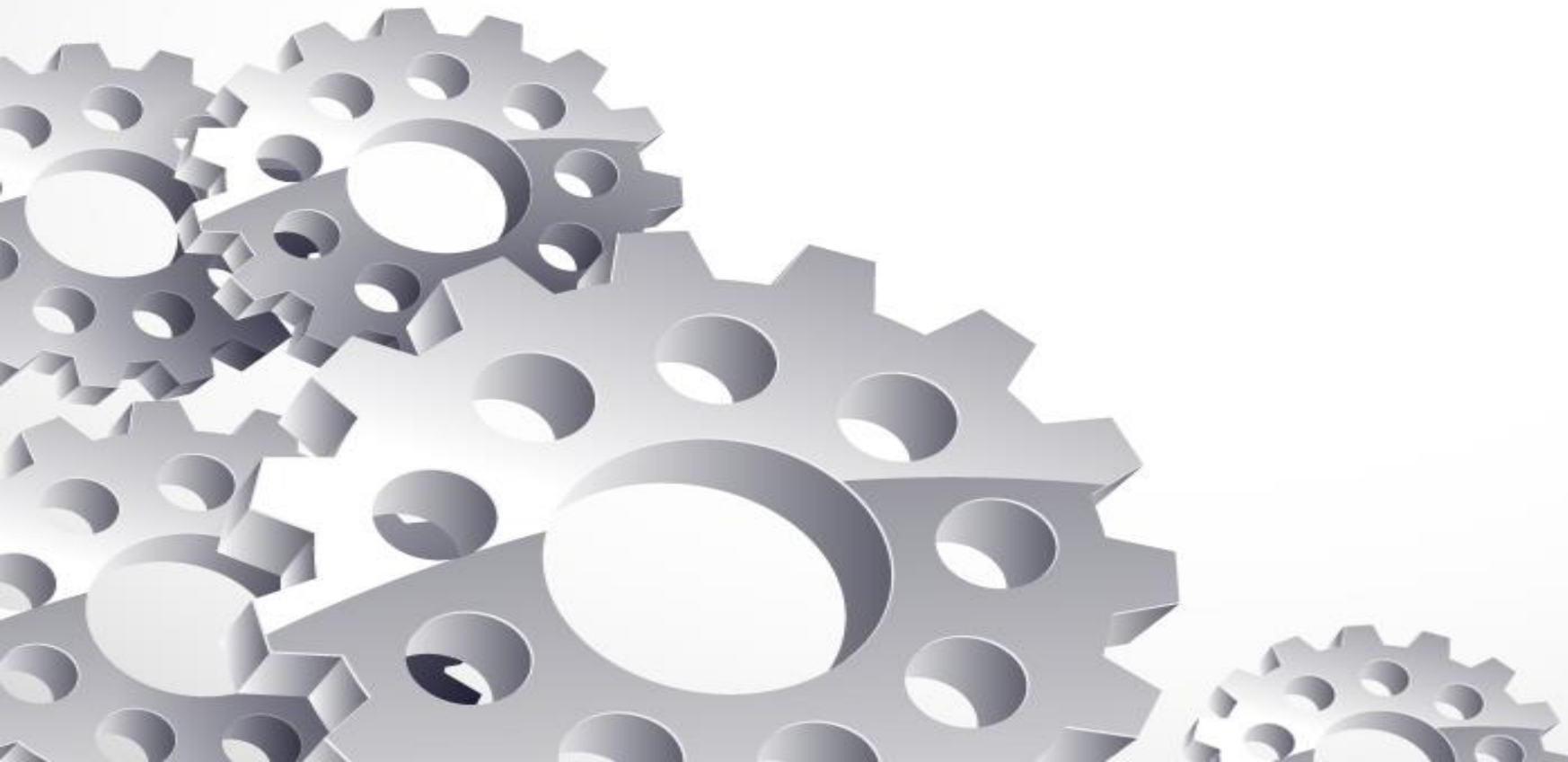
---

**Thank You!**

---

# MANAGEMENT SCIENCE

MDM MINOR  
SEMIII-SEMVIII





# ENGINEERS AS PROBLEM SOLVERS

*(and that is where the problem begins!)*

# Management Teaches Engineers to be More **Collaborative**

- Engineering Problems Are Multifaceted
- Tap into Diverse Perspectives and Skills
- Achieve Better Solutions Together
- Foster innovation and creativity

Subject Code	Sem	Subject	Credits	Hrs/Week			Marks for various Exams			
				L	T	P	C A	M S	E S	Total
MGT1101	III	Organizational Behaviour	2	2	0		20	30	50	100
MGT1102	IV	Principles of management and Organization structures	2	2	0		20	30	50	100
MGT1103	V	Interpersonal processes and Human Resource Management	4	3	1		20	30	50	100
MGT1104	VI	Fundamentals of marketing management and Market research	2	2	0		20	15	25	100
MGT1105	VII	Professional ethics	2	2	0		10	15	25	100
MGT1106	VII I	Operations and Supply Chain management	2	2	0		10	15	25	100
		<b>Total</b>	14							



# Management Teaches Engineers to Speak Business



Profits----Markets---Product---Engg

**CASH** ←-----→ **KASH**

Language 'Architecture' understood globally

(Fin mgmt/economics/production mgmt/ covered in major)

Subject Code	Sem	Subject	Credits	Hrs/Week			Marks for various Exams			
				L	T	P	C A	M S	E S	Total
MGT1101	III	Organizational Behaviour	2	2	0		20	30	50	100
MGT1102	IV	Principles of management and Organization structures	2	2	0		20	30	50	100
MGT1103	V	Interpersonal processes and Human Resource Management	4	3	1		20	30	50	100
MGT1104	VI	Fundamentals of marketing management and Market research	2	2	0		20	30	50	100
MGT1105	VII	Professional ethics	2	2	0		20	30	50	100
MGT1106	VII I	Operations and Supply Chain management	2	2	0		20	30	50	100
<b>Total</b>			14							

# Management Teaches Engineers to Be Ethical Business Leaders



- Engineering-Organization role fit
- Understand hierarchy, managing engineers and non engineers
- Communicate effectively across the entire organization


Subject Code	Sem	Subject	Credits	Hrs/Week			Marks for various Exams			
				L	T	P	CA	MS	ES	Total
MGT1101	III	Organizational Behaviour	2	2	0		20	30	50	100
MGT1102	IV	Principles of management and Organization structures	2	2	0		20	30	50	100
MGT1103	V	Interpersonal processes and Human Resource Management	4	3	1		20	30	50	100
MGT1104	VI	Fundamentals of marketing management and Market research	2	2	0		20	30	50	100
MGT1105	VII	Professional ethics	2	2	0		20	30	50	100
MGT1106	VIII	Operations and Supply Chain management	2	2	0		20	30	50	100
<b>Total</b>			14							

# Management Creates **New Career Opportunities**



- Roles in project management, engineering sales and marketing, and senior management positions across many different types of organizations and industries
- Technical expertise+ People Understanding

# Management Strengthens the Skills of **Entrepreneurial Engineers**



- Launch own enterprise

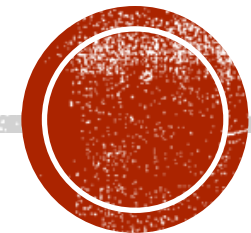
- Job takers Job  
creators →

Subject Code	Sem	Subject	Credits	Hrs/Week			Marks for various Exams			
				L	T	P	CA	M S	ES	Total
MGT1101	III	Organizational Behaviour	2	2	0		20	30	50	100
MGT1102	IV	Principles of management and Organization structures	2	2	0		20	30	50	100
MGT1103	V	Interpersonal processes and Human Resource Management	4	3	1		20	30	50	100
MGT1104	VI	Fundamentals of marketing management and Market research	2	2	0		20	30	50	100
MGT1105	VII	Professional ethics	2	2	0		20	30	50	100
MGT1106	VIII	Operations and Supply Chain management	2	2	0		20	30	50	100
<b>Total</b>			14							

**MULTIDISCIPLINARY MINOR DEGREE**

**IN**

**MACHINE LEARNING AND  
ARTIFICIAL INTELLIGENCE**



**Department of Mathematics**

**22<sup>nd</sup> February 2024**

# THE DEPARTMENT OF MATHEMATICS

- **Established in the year 1944.**
- **Vision**
  - The Department of Mathematics, Institute of Chemical Technology, Mumbai, aims to be an internationally leading mathematics department that will offer innovative educational and research programmes in mathematical sciences and their applications in science and technology
- **Mission**
  - Offer courses and programs that will ensure that the student get practical knowledge in mathematics which will be relevant to the society
  - Provide a modern educational environment for instruction and research
  - Create an environment for the learner to engage in solving real-world problems
  - Contribute to the understanding of complex mathematical structures and their applications.

# FACULTY MEMBERS



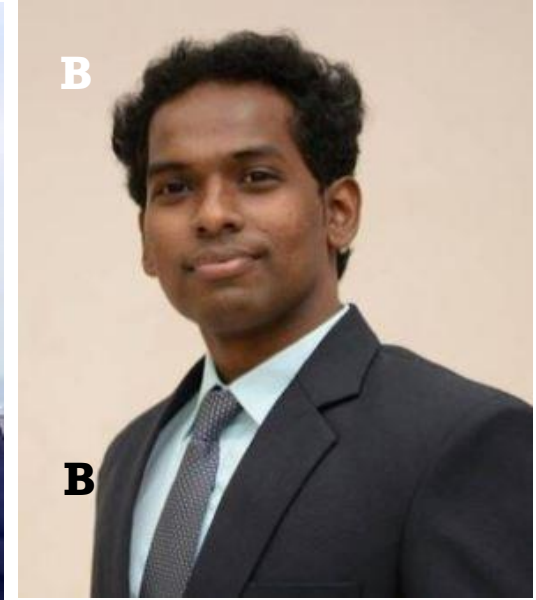
Head  
Dr. Ajit Kumar  
M.Sc. And Ph.D. Mumbai  
University  
(Optimization, Machine  
Learning, Mathematical  
Pedagogy)

- (A) Dr. Amiya Ranjan Bhowmick  
I. M.Sc. IIT Bombay, Ph.D. University of Calcutta  
II. Mathematical Modelling and Data Science
- (B) Dr. Akshay S. Rane  
I. M.Sc. Mumbai University, Ph.D. IIT Bombay  
II. Functional Analysis
- (C) Dr. Vikram Aithal  
I. M.Sc. Mumbai University, Ph.D. IIT Bombay  
II. Differential Geometry
- (D) Dr. Guntant A. Birajdar,  
I. M.Sc. And Ph.D. University of Aurangabad  
II. Fractional Differential Equations

A



B



B

C



D



# PROGRAMMES OFFERED

- **M.Sc. in Engg. Mathematics**
  - UGC Innovative Scheme (2011)
- **Ph.D. in Mathematics**
  - Several students are pursuing their Ph.D. in Mathematics
  - CSIR – JRF, DST-Inspire
  - College Teachers
  - Collaboration with other institutes
- **MDM in ML-AI**

# COMPUTATIONAL FACILITY

- Modern and high-level computational facilities
- 50 All-In-One Computers,
- Two Servers, one workstation,
- High-Performance Computing (HPC) cluster.
- All computers are installed with software such as MATLAB (Campus License) Mathematica, R, Python and Sagemath etc.







PSO1	<b>Foundation of Mathematics:</b> Strong foundation of Applied Mathematics which is directly connected to solving real life problems in different domains by means of mathematical modelling and analysis.
PSO2	<b>Foundation of Statistics and Data Science:</b> Strong foundation of Mathematics and Statistics of Data science and good hold on various statistical methodologies including probability theory, estimation, and testing of hypothesis etc.
PSO3	<b>Foundation of Computer Programming:</b> Understand and employ modern computational methods of Machine Learning, Deep Learning and Artificial Intelligence and use them effectively using free and proprietary advanced computational platforms for solving large scale problems arising from different research areas.
PSO4	<b>Conduct investigations of complex problems using AI:</b> Use research-based knowledge in machine learning and artificial intelligence and research methods including design of experiments, analysis, and interpretation of data to unfold complex problems from industry and academia and provide intelligent solutions.
PSO5	<b>Project based Teaching Learning:</b> Function effectively as an individual, and as a member in large scale data science projects in multidisciplinary settings involving both academic and industrial research.
PSO6	<b>Societal Applications of AI and ML:</b> Apply reasoning informed by the existing knowledge pool and address various societal issues using Machine Learning and AI tools.

# SALIENT FEATURES OF THE PROGRAMME

- **Industry Relevance:** Students develop the skills and knowledge in Machine Learning and Artificial Intelligence which are relevant to the different industry verticals including Finance, Healthcare, Marketing, Chemical Industry, etc.
- **Enhancing Data-driven Problem-Solving abilities:** By integrating data-driven modeling in engineering curriculums, students will be able to overcome intricate engineering challenges more efficiently and effectively.
- **Innovation and Design:** The use of AI and ML enables engineering students to create innovative solutions and optimize designs in analysis of complex systems.
- **Fostering Interdisciplinary Collaboration:** AI and ML intersect with other disciplines, including mathematics, statistics, and computer science. Use of AI and ML in engineering education encourages interdisciplinary collaboration, fostering a comprehensive approach to problem-solving and opening doors to new possibilities.
- **Addressing Ethical and Societal Implications:** Students develop a comprehensive understanding of the ethical implications of AI and ML technologies and learn how to design and deploy them responsibly.



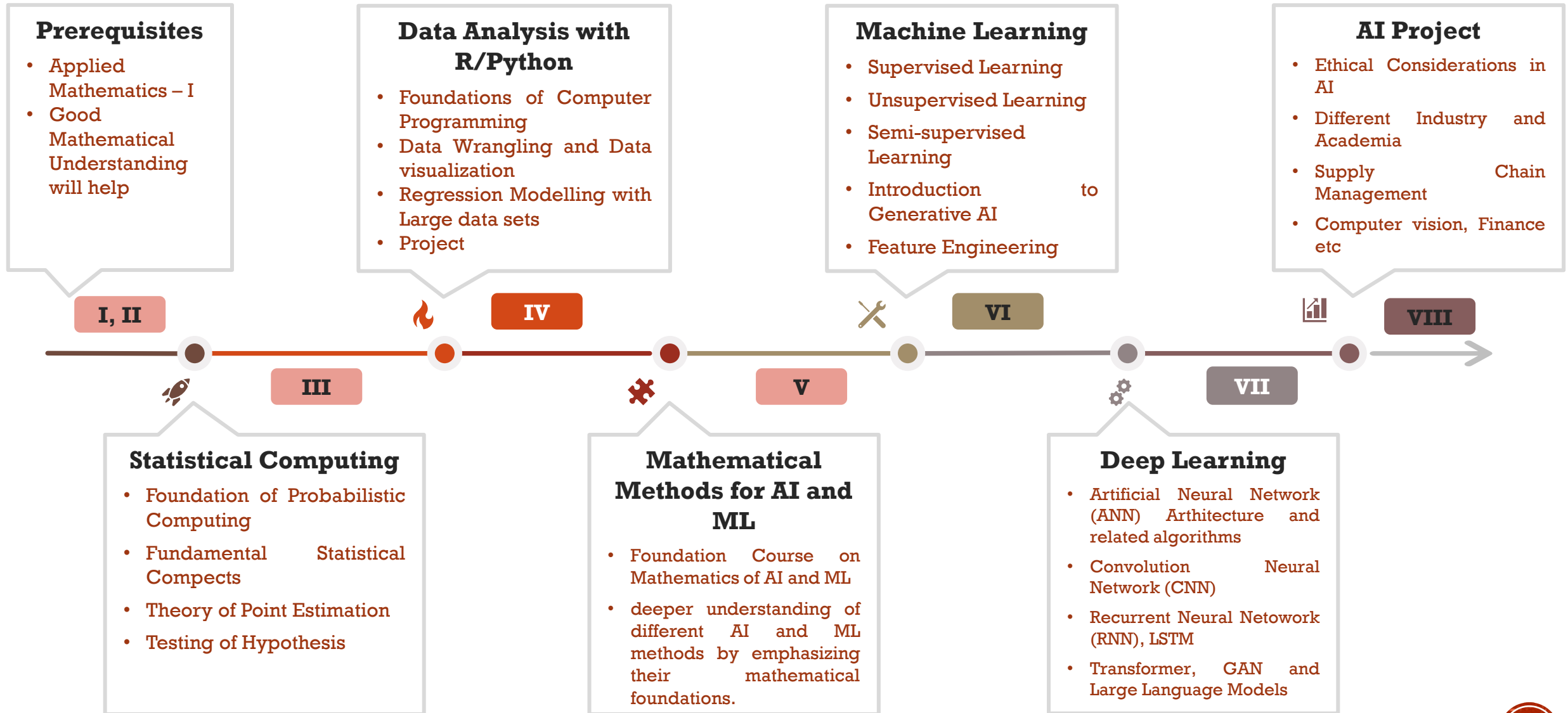
# STRUCTURE OF THE MDM

Subject Code	Semester	Subject	Credits	Hours/ Week			Marks for various Exams			
				L	T	P	CA	MS	ES	Total
<b>MAT 1501</b>	III	Statistical Computing	2	2	0	0	20	30	50	100
<b>MAP 1601</b>	IV	Data Analytics with R/Python	2	0	0	4	20	30	50	100
<b>MAT 1502</b>	V	Mathematical Methods in AI and ML	4	4	0	0	0	50	50	100
<b>MAP 1602</b>	VI	Machine Learning	2	0	0	4	20	30	50	100
<b>MAP 1603</b>	VII	Deep Learning	2	0	0	4	20	30	50	100
<b>MAP 1604</b>	VIII	AI Project	2	0	0	4	0	50	50	100
		<b>Total</b>	<b>14</b>							<b>600</b>

CA: Continuous Assessment; MS: MID Semester; ES: End Semester



# A TRANSFORMATIVE JOURNEY



# WHAT THE DEPARTMENT OF MATHEMATICS CAN OFFER!

## Inter-institutional collaboration

- You can be a part of the existing collaborative research activities going on with several universities and industry
- National and International collaborations with other Institutions
- Industrial collaborations: Rises Analytics AI, Statinfer Solutions etc

## Part of ongoing projects

- Application of Deep Learning Methods in Health Care Domain
- AI-ML in Water and AIR Quality Assessment
- Data Science and Machine Learning Applications in natural sciences

## Computational Mathematics and Optimization

- Faculty members are involved in various domains related to Machine Learning and Optimization including Bayesian computation, Generative AI etc.
- Collaborative research work with Master's and Ph.D. students
- Collaborative research with other departments of ICT

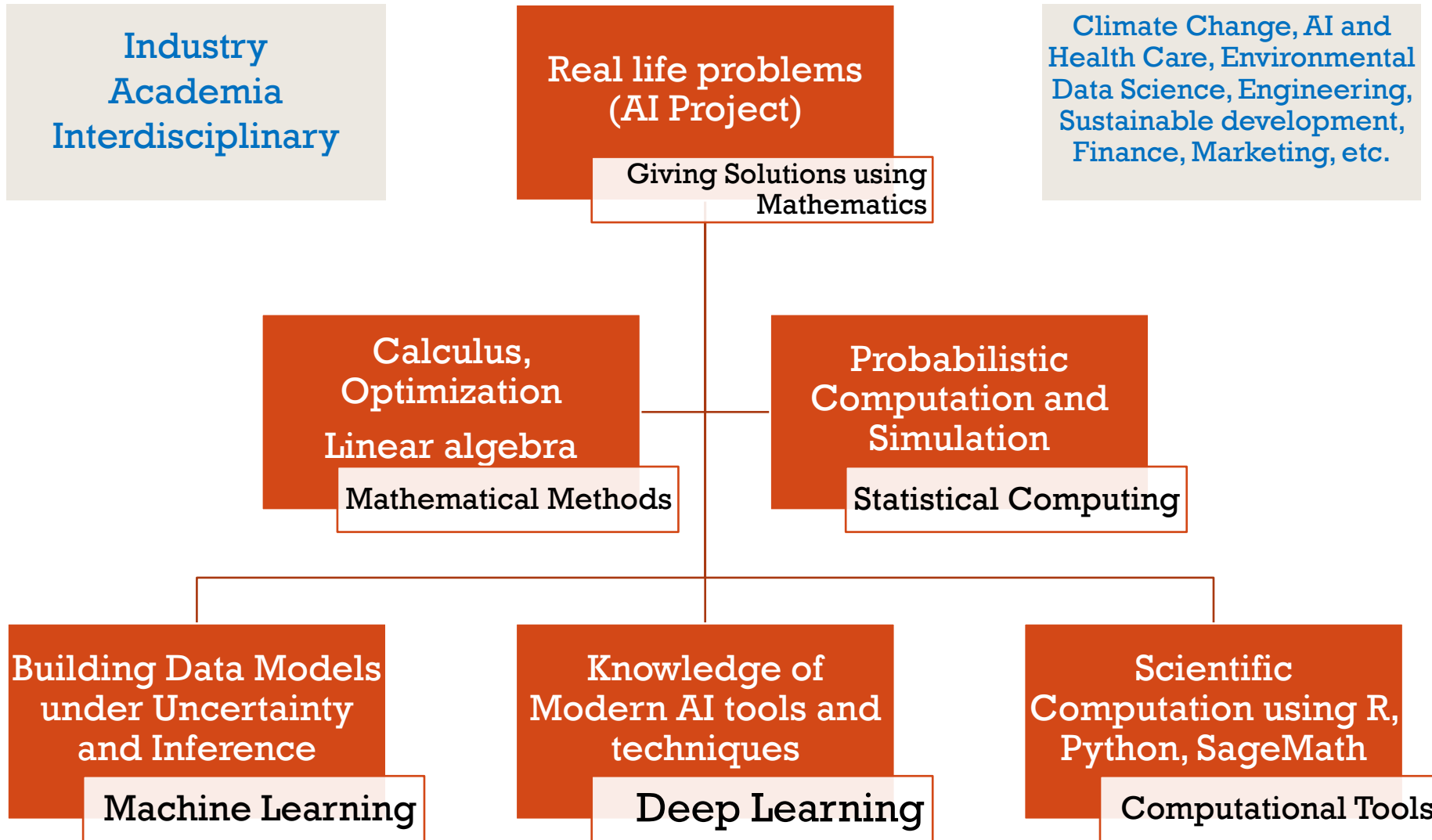
# OPPORTUNITIES

- MS and Ph.D. opportunities
- Data Scientist
- Business Analyst
- AI-ML Researcher in various industry verticals
- AI Engineer in chemical and allied industries
- Finance
- Market Research



# MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE

## A UNIQUE MULTIDISCIPLINARY FRAMEWORK



# LIST OF OPEN ELECTIVES

Subject Code	Semester	Subject	Credit	Hours/ Week			Marks for various Exams			
				L	T	P	CA	MS	ES	Total
<b>MAT1302</b>	III	Differential Equations and Numerical Methods	4	4	0	0	20	30	50	100
<b>MAT2232</b>	III	Optimization Techniques	4	4	0	0	20	30	50	100
<b>MATXXXX</b>	IV	Discrete Mathematics	2	2	0	0	20	30	50	100
<b>MATXXXX</b>	IV	Statistical Inference	2	2	0	0	20	30	50	100
<b>MATXXXX</b>	V	Machine Learning	2	2	0	0	20	30	50	100
<b>MATXXXX</b>	V	Mathematical Modelling	2	2	0	0	20	30	50	100





# ELIGIBILITY CRITERIA: OPEN ELECTIVES

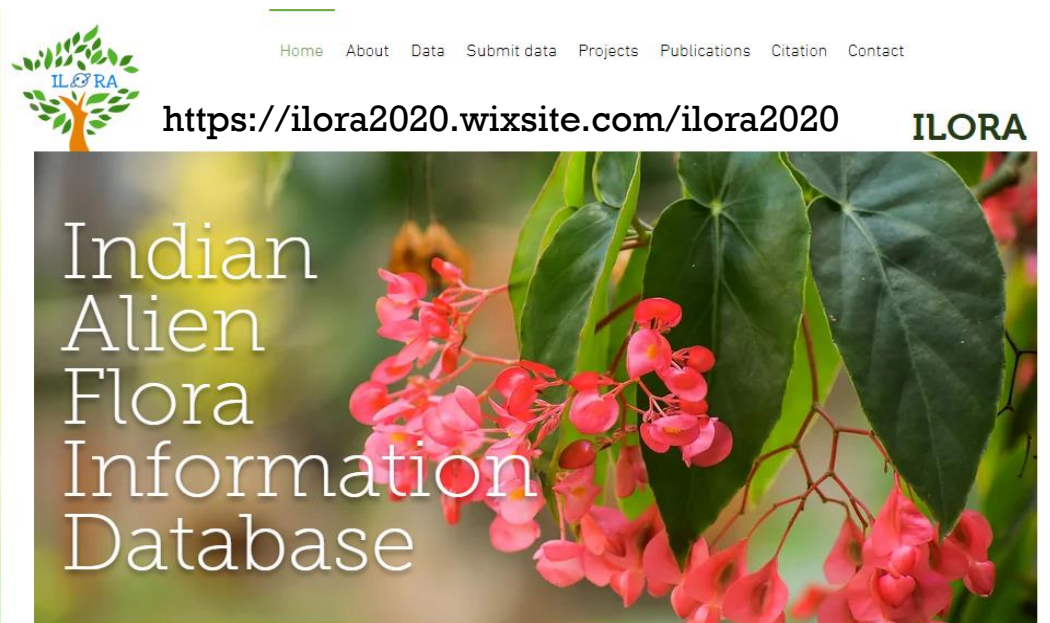
Subject Code	Semester	Subject	Open for	Comment
<b>MAT1302</b>	III	Differential Equations and Numerical Methods	Bachelor of Technology	
<b>MAT2232</b>	III	Optimization Techniques	Bachelor of Chemical Engineering	
<b>MATXXXX</b>	IV	Discrete Mathematics	Bachelor of Technology Bachelor of Chemical Engineering	
<b>MATXXXX</b>	IV	Statistical Inference	Bachelor of Technology Bachelor of Chemical Engineering	Not available for students enrolled in MDM in Machine Learning and Artificial Intelligence
<b>MATXXXX</b>	V	Machine Learning	Bachelor of Technology Bachelor of Chemical Engineering	Not available for students enrolled in MDM in Machine Learning and Artificial Intelligence
<b>MATXXXX</b>	V	Mathematical Modelling	Bachelor of Technology Bachelor of Chemical Engineering	



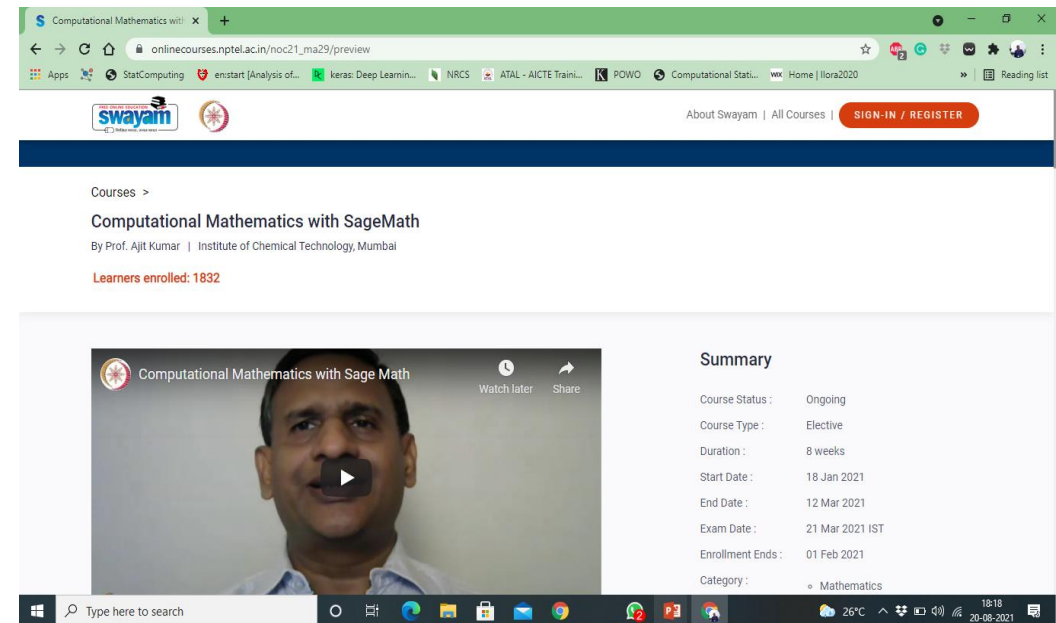
# Multidisciplinary Educational Environment

- Applied Research with Strong foundation on Fundamentals of Mathematics, Statistics and Programming

- NPTEL lectures by Prof. Ajit Kumar on SageMath is training thousands of students, researchers and professionals across the globe.



ILORA) database has ecological, socio-economic, and geographic attributes for more than 1700 alien plant species ever reported from India.



# THANK YOU

## CONTACTS



- **Head of the Department**
  - Ajit Kumar, Ph.D.
  - Professor and Head
  - Email: [a.kumar@ictmumbai.edu.in](mailto:a.kumar@ictmumbai.edu.in)
  
- **Department MDM Coordinator**
  - Amiya Ranjan Bhowmick, Ph.D.
  - Assistant Professor
  - Email: [ar.bhowmick@ictmumbai.edu.in](mailto:ar.bhowmick@ictmumbai.edu.in)





# INSTITUTE OF CHEMICAL TECHNOLOGY, MUMBAI

**(Deemed University under Section 3 of UGC Act 1956;  
Elite Status and Centre of Excellence – Govt. of Maharashtra)**



## WELCOMES





# INSTITUTE OF CHEMICAL TECHNOLOGY, MUMBAI

**(Deemed University under Section 3 of UGC Act 1956;  
Elite Status and Centre of Excellence – Govt. of Maharashtra)**



## ***DEPARTMENT OF SPECIALITY CHEMICALS TECHNOLOGY*** ***(ESTABLISHED IN 1944)***

**By: Prof. N. Sekar**  
**(Head of Department)**



# About the department ..

## History

- ❖ Established - 1944 under the stewardship of Prof. K. Venkatraman
- ❖ Inaugurated and renamed - 1<sup>st</sup> October 2021, Department of Speciality Chemicals Technology



# Courses Offered in the Department



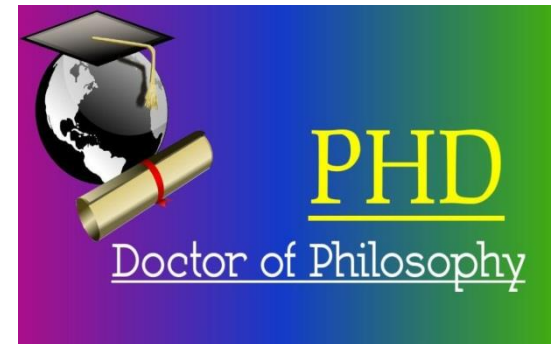
Courses offered B. Tech. (Dyes)



M. Tech. (Dyes)



M. Tech. (Perfumery)



Ph. D. (Tech/Science)

## Outputs

- Trained more than 1000 under graduate students
- Trained more than 500 PG/Ph. D. students

**Late Prof. K. Venkataraman**  
(Head 1943-1957)



His books, "The Chemistry of Synthetic Dyes" in eight volumes are treated as Bible for dyestuff chemists and technologists

**Late Prof. B. D. Tilak**  
(1957-1966)



Extensive work in the field of vat dyes, anthraquinone, and naphthoquinone moieties and on azide chemistry

**Prof. S. V. Sunthakar** (1966-1979)



Synthesis of macro-cyclic compounds involving fragmentation of steroids

**Prof. S. Seshadri**  
(1979-1996)



His enormous contribution to Vilsmeier-Haack reaction and extensive work on coumarin synthesis

**Prof. D. W. Rangnekar**  
(1996-2000)



His work on Gewald reaction for disperse dyes is well appreciated

**Prof. V. R. Kanetkar**  
(2000-2008)



His enormous contribution to pigment and process development intermediates

**Prof. P. M. Bhate**  
(2008-2013)



His work on Carbohydrate chemistry and dyestuff chemicals



## Our Shinning Stars



SUDARSHAN

Narendra  
B. Parekh

K. L.  
Rathi

Dr. S.K.  
Bhumgara

Eskay Dyestuffs & Organic Chemicals Pvt. Ltd.

Department has produced a more than  
80 first generation entrepreneurs

## First Time Entrepreneurship



SUDARSHAN



Techno Color Corporation

B. J. Corporation

Puraj Chemicals





Gauri Fine Chemicals



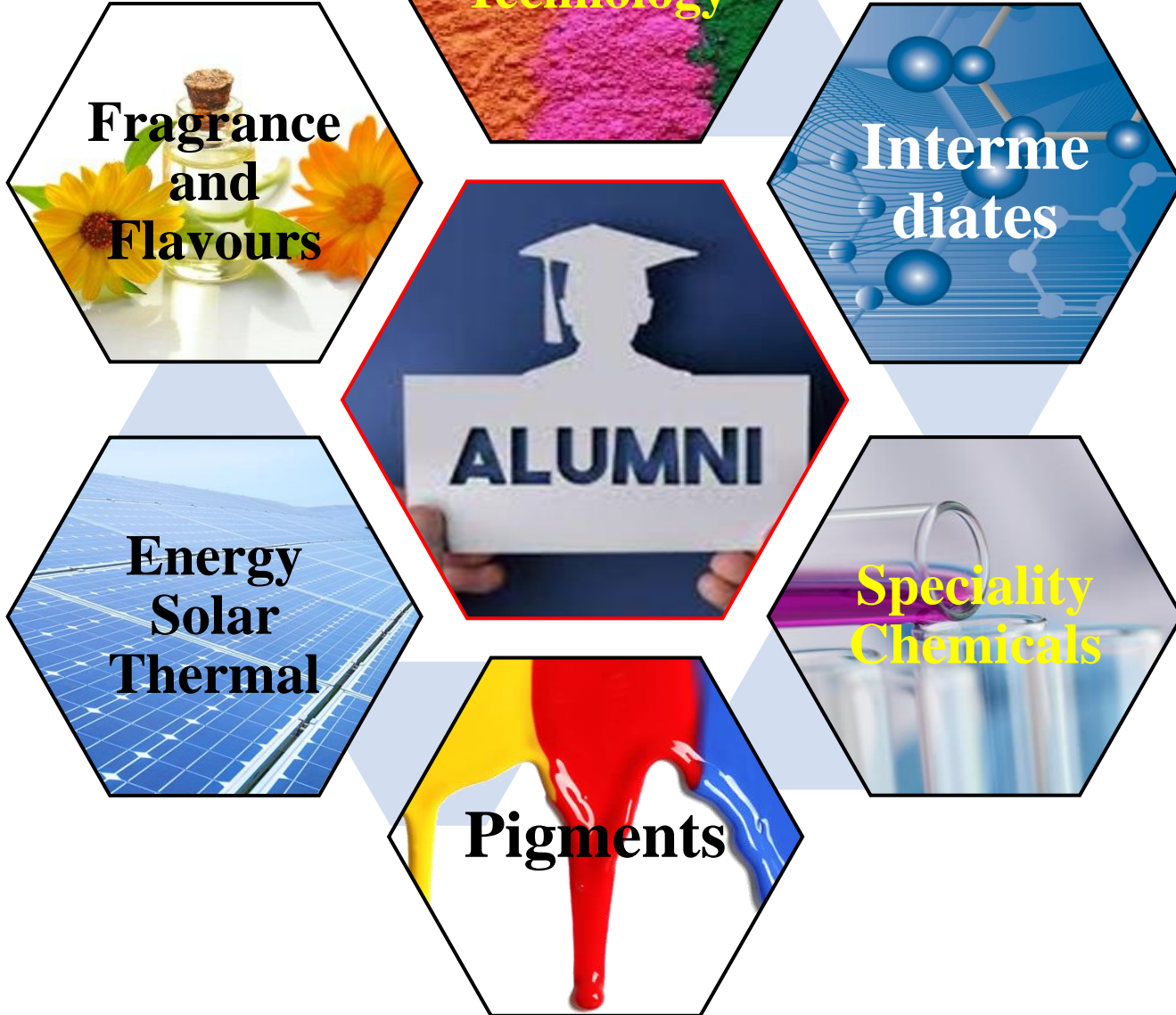
# Our Successful Entrepreneur



Sr. No.	Our Renowned Alumni	Company Name
1.	Dr. Murzban Karai	Jenrashid Consultants
2	Mr. Jayesh Shewale	Swadeshi Food And Beverages Pvt Ltd
3	Mr. Vimal Dosi	Vaibhav Agency
4	Mr. Shivanand Patil	Indu Dyes
5	Mr. Kisan Chavan	Deepak Colour Chem
6	Mr. Siddharth Sikchi	Clean Science and Technology Ltd
7	Shri. N. K. Parikh	<b>Pidilite Industries Ltd</b> 
8	Dr. Jayesh Malankar	Six Sigma Projects
9	Mr. K. L. Rathi	<b>Sudarshan Chemical Industries Ltd</b> 
10	Mr. Parag Zaveri	Yasho Industries Ltd
11	Mr. Dishit Zaveri	Yasho Industries Ltd
12	Mr. Aman Desai	Aether Industries Ltd
13	Dr. Rajagopal	Know Genix

Sr. No.	Our Renowned Alumni	Company Name
14	Mr. Savinder Sarna	Sarna Chemicals Pvt. Ltd
15	Ms. Gauri Bhawe	<b>Gauri Fine Chemicals</b> 
16	Dr. N. Chodankar	Asolutions Pharmaceuticals Pvt. Ltd.
17	Dr. Kishore M. Shah	Sauradip Chemical Industries Pvt. Ltd
18	Mr. R. T. Shah	<b>Techno Colour Corporation</b> 
19	Mr. Sohan Taware	Sohan Industries Pvt
20	Mr. Swapneel Nerkar	Shubham Speciality Products Pvt. Ltd.
21	Mr. Vijay Bujle	GVC Ciba Tech Pvt Ltd
22	Mr. K. R. Datar	Puraj & Sitaram Chemicals
23	Mr. D. G. Udas	Ultraconserve Pvt. Ltd.
24	Mr. Chetan Patel	Casilla Foods
25	Dr. D. R. Tatke	Synthone Laboratories & Consultants Pvt. Ltd.
26	Mr. Mukund Turakia	Neelikon Food Dyes and Chemicals Ltd

**Our alumni spread  
across different sectors  
of the industry**



# Achievements/ Recognitions

## Departmental Achievements

- Placement of students in **renowned industries**
- Produced **26 class entrepreneurs**
- Received **DST-PURSE 2020-21 & DST-FIST 2018-19**
- More than **200 international publications** in the past three years
- Received more than **5 crore** from various industries and **Colourtex Industries Pvt. Ltd.**
- Industry sponsored **felicitation** to **renowned persons**
- **Endowment lectures**

# Faculty level Achievement



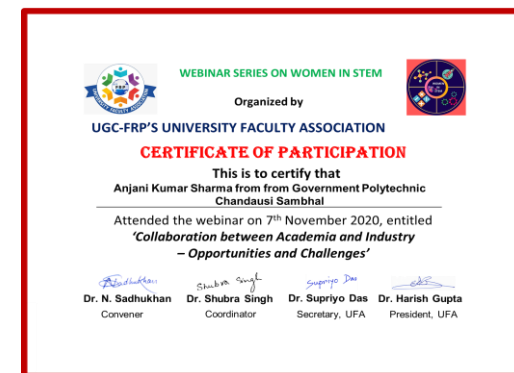
**Prof. N. Sekar (Faculty ranked as top 2% Global scientists – Stanford University’s Precious list)**

**Dr. S. Some (Research Assistant Professor for 2 years at Gwangju Institute of Science and Technology, South Korea )**



**Dr. S. Saha (Associate Editor of Organocatalysis (Specialty section of Frontiers in Catalysis))**

- Prof. G. S. Shankarling
- Welch Award in Technology
- >30 consultancy projects in industry
- Filed 25 patents- 5 accepted



**Dr. Nabanita Sadhukhan (Convener for Webinar series on women in STEM)**

# Student Achievements

1. Graduate as well as post graduate students are severing in various **industrial sectors** such as **colorants, perfumery, pharmaceutical, agrochemical, specialty, chemicals, IPR**, etc.
2. For the year 2021, the **average graduate student package is 5.85 lac**, with the **highest package being 8.5 lac**.
3. **4th International Conference** on Desalination using Membrane Technology, **Perth, Australia**, Oceania, 2019 presented by Krusha Patel and Harsh Patel
4. Poster selected for presentation in **International Conference (SMST-2020)** by Praful Patil and Gauri Ingole
5. **Best Thesis Award Ph.D. (Dr. Pravin Wadekar)**



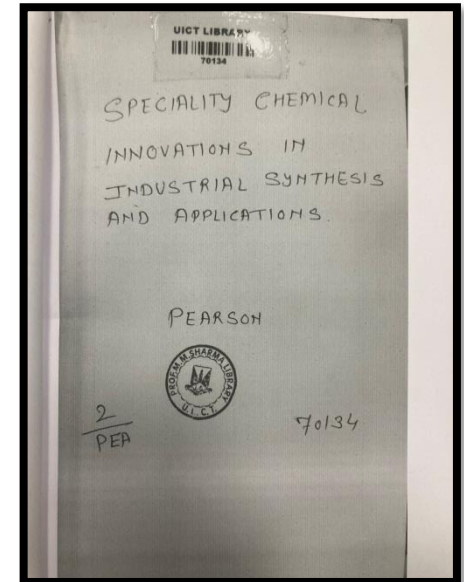
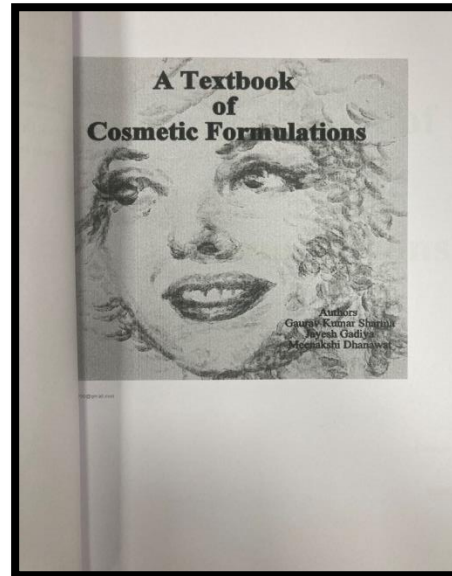
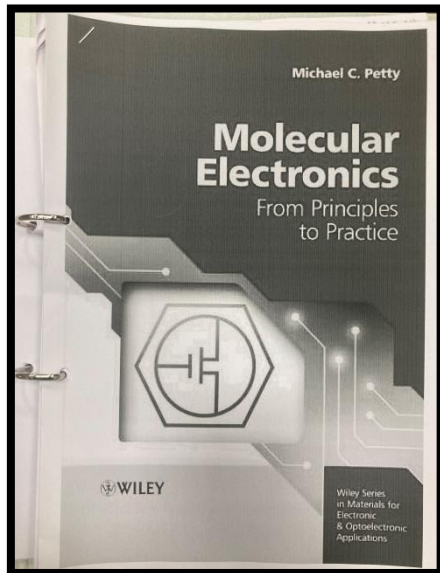
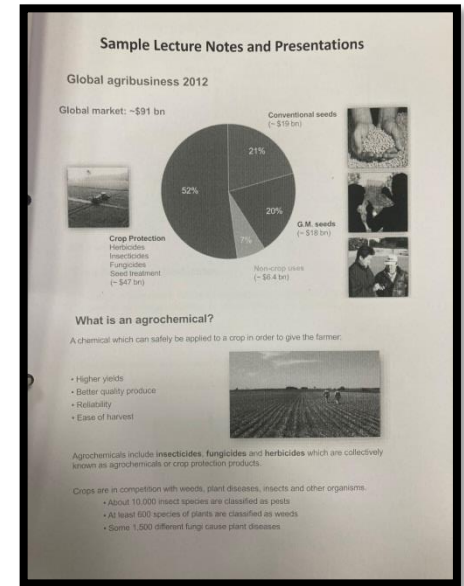
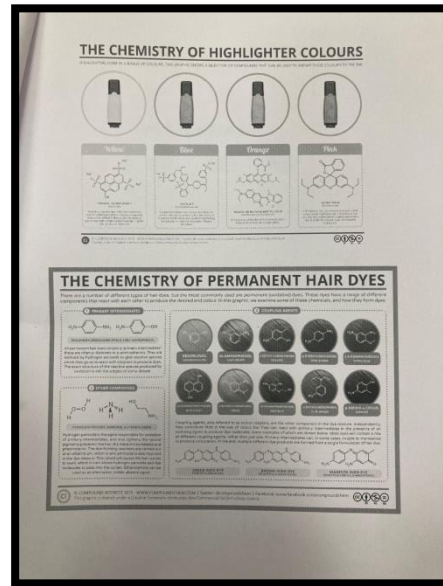
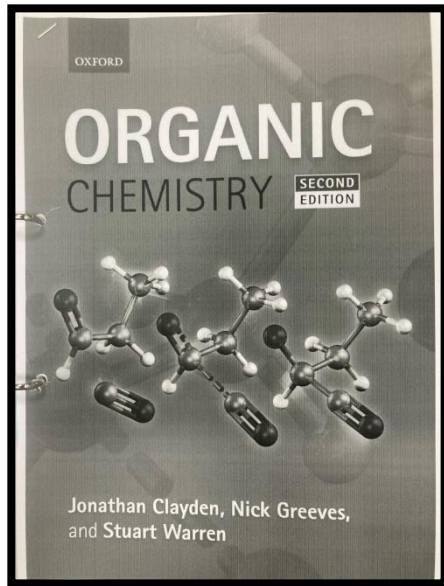
# Content delivery and Teaching methodology

- ❖ Chalk-board
- ❖ Audio-visual from YouTube and JoVe Scientific Journal
- ❖ Practical experience from Practical subject
- ❖ Live demo of analytical instrument and Hand-on experience
- ❖ In-plant training
- ❖ Industry Visit
- ❖ Workshop on literature survey
- ❖ Training on manuscript and scientific report writing





# Contents Beyond Syllabus



Companies	Logo	2019-21	2018-20
Jay chemicals		1	0
Deepak Nitrite		4	0
UPL		1	0
Marico		1	0
SRL		1	0

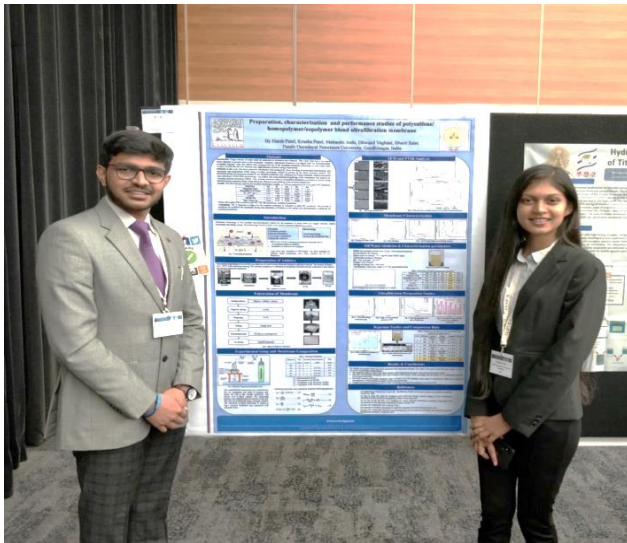
For Academics	Logo	2019-21	2018-20
Institute of Chemical Technology		0	1 (Ph. D.)

# Student Co-Curricular Activities



International Conference (SMST-2020) attended by

1. Praful Patil
2. Gauri Ingole

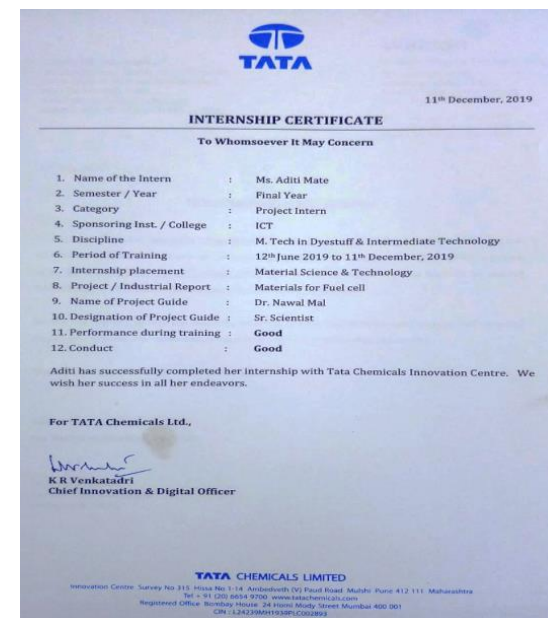


4<sup>th</sup> International Conference on Desalination using Membrane Technology, Perth, Australia, Oceania, 2019

1. Krusha Patel
2. Harsh Patel

# Industrial Training and Internship

Sr. No.	Student Name	Roll No.	Organization
1	Aadeshkumar L. Chordiya	18DYE201	<b>Tata chemicals limited innovation centre, Pune (2019)</b>
2	Praful Suresh Patil	18DYE203	<b>Gopinath Chem-Tech Ltd. Ahmedabad (2019)</b>
3	Aditi Vilas Mate	18DYE204	<b>Tata chemicals limited innovation centre, Pune (2019)</b>



# Student extracurricular activities

## ➤ Publication in Technical Magazine & Newsletter



### Bombay Technologist Journal :

- ✓ It is the in-house peer reviewed research
- ✓ Journal of the Institute of Chemical Technology
- ✓ Published semi-annually.

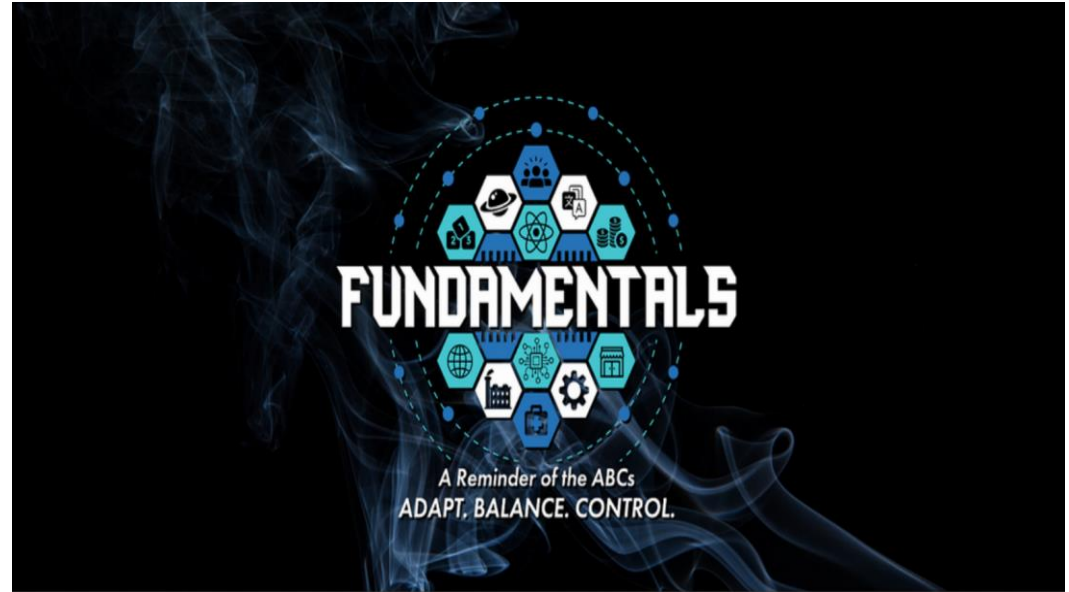


# Professional societies/chapters and organizing engineering events, Extracurricular Activities

## Vortex :

- Industry Defined Problems
- Master Class- Lecture Series
- Papyrus : Oral Presentations
- Manifesto : Poster Presentations
- PharmWiz (Quiz Competition)
- Quantity Sufficient (QS)

❖ Participation in Vortex by 2-4 students



# Student Extra- Curricular Activity

1. Art Club of ICT
2. Music Club of ICT
3. Literary Club of ICT
4. Manthan(Marathi Club)
5. Manzar(Cultural Festival)
6. SPORT-saga
7. Nature Trek
8. Hostel Day Celebration
9. All Religious Festivals
10. Clean Up Drive
11. TEDx ICT Mumbai ()
12. Jazbaa (Story tellor)
13. Cinergy (Cinamography)
14. Christmas photography challenge
15. In a nut shell (Short Film)
16. Fun Tech

❖ Participation in YUVAM by 2-4 students





# Research Scholars participation in Workshops/conferences/seminars Funded by TEQIP-III

Sr. No.	Period of Activity	Activity	Name Of the Student	Location
1.	27 <sup>th</sup> to 30 <sup>th</sup> Dec. 2018	CHEMCON - 2018	Miss Khushbu Patel	Dr. B. R. Ambedkar National Institute of Technology, Jalandhar, Punjab, India.
2.	14 <sup>th</sup> to 18 <sup>th</sup> Jan 2019	Gaussian Workshop	Miss Vandana Kumari Shukla	Kolkata
3.			Mr. Suryapratap J. Sharma	
4.			Mr. Sumeet S. Sonvane	
5.			Miss. Zeba Khan	
6.	28 <sup>th</sup> Feb and 1 <sup>st</sup> March	COC-19	52 participants from the Dyes department (UG,PG, Research scholars)	Mumbai



# Departmental Faculty

**Prof. G. S. Shankarling**  
Professor



**Expertise**  
Looking for...

**Dr. S. Some**  
Asst. Professor



Chemical Technology

Agrochemistry

Chiral chemistry

Fragrance and Flavour chemistry

Nanotechnology

Catalysis

10  
Sanctioned  
Faculty  
Positions

Current Faculty  
Strength



**Prof. N. Sekar**  
Professor and  
Head of the Dept.

**Dr. S. Saha**  
Asst. Professor

**Prof. N. Sadhukhan**  
Asst. Professor

Professor

Assistant  
Professor

02

03

# Departmental Seminars

## Alumni Contribution



**Topic: Job scenario of for dyes and allied industries in US**

**Speaker: Dr. Ram Sabnis**

Date: 1<sup>st</sup> Jan 2019

Venue: Dyes department

Participants: Researchers, Students (UG/PG)

Department of Dyestuff Technology Lecture under “Sauradip Chemical Industries Pvt. Ltd. Visiting Fellow in the areas of Dyestuff Technology and Textiles Processing Technology”

**Topic: Challenges of Dyestuff Industry**

**Speaker: Dr. Nilesh Mistry**

Date: Monday, 15<sup>th</sup> April, 2019

Venue: K. V. Auditorium, ICT, Matunga.

Participants: Faculties, Researchers, Students (UG/PG)



**Topic: Discussion on Management studies**

**Speaker: Sohom D'souza**

Date: 22<sup>nd</sup> March 2019

Venue: Department of Dyestuff Technology, ICT Mumbai

# Funding Agencies

## Departmental Level

- **DST- FIST**
- **DST-PURSE**
- **TEQIP**



## Faculty Level

- **CSIR**
- **DST-SERB**
- **BRNS**
- **WOOL**
- **ONGC**



Department of Sciences  
& Technology  
Government of India



# Industry Supported Laboratories

<b>Sr. No.</b>	<b>Industrial Support</b>
1	Colourtex Industries Pvt. Ltd.
2	Astik Dyestuff Pvt. Ltd.
3	Lakhani Dyestuff Pvt. Ltd.
4	Bharat Organics
5	Gauri Fine Chemicals
6	Dhiren Chemical Industries
7	S.K Dyestuff & Organic Chemicals Pvt. Ltd.
8	Vasant Chemicals Pvt. Ltd.
9	Diamond Dyechem Ltd.
10	Neelikon Food, Dyes & Chemicals
11	Gopinath Chemtech
12	QV labs, Ankleshwar



**Dhiren Chemical Industries**



# Departmental View



Department of Speciality Chemicals  
Front View



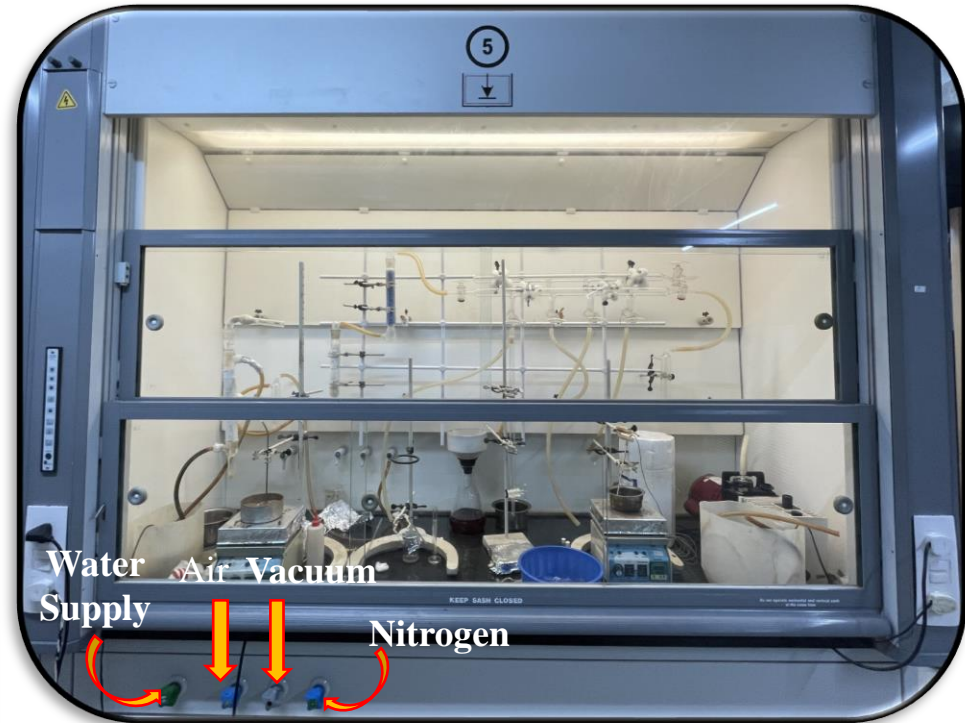
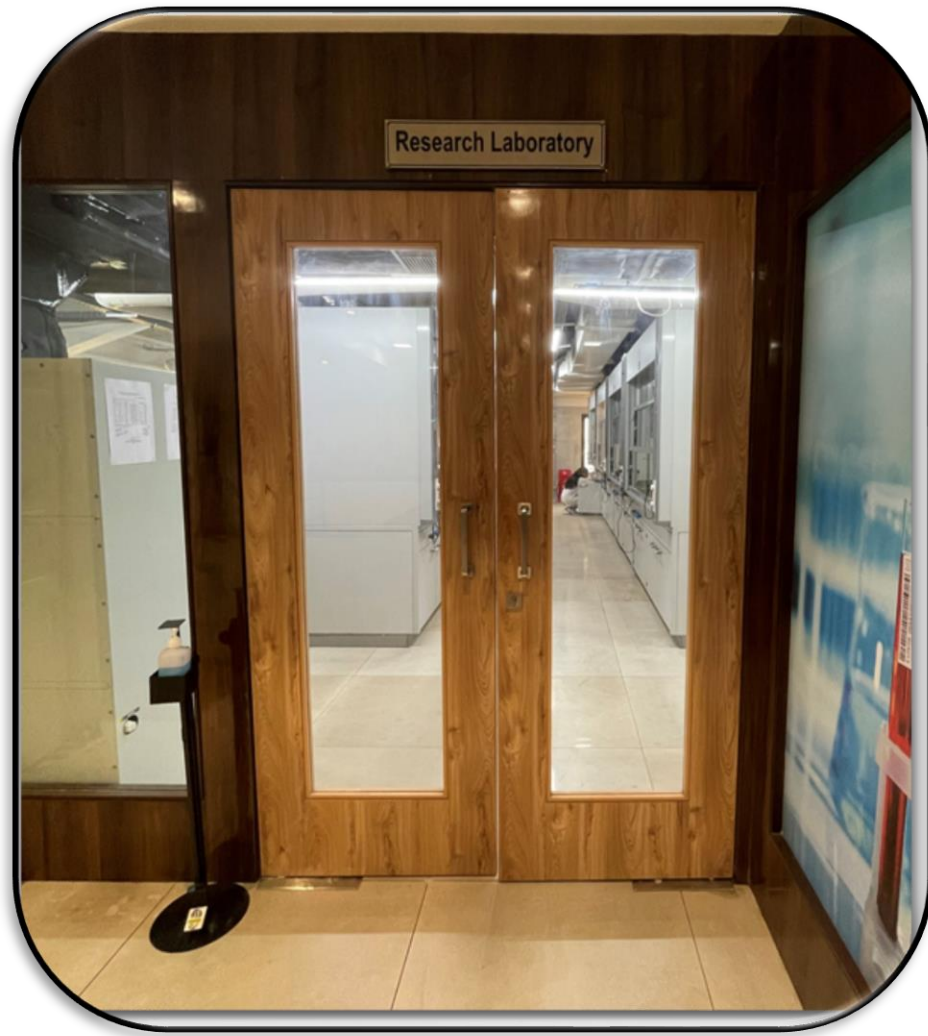
Department of Speciality Chemicals  
Back View



**Lab Capacity : 48 students**

**Process Intensification  
Laboratory**





**Lab Capacity : 16 Fume Hoods  
3 Students per Fume Hood**



**Chemical Storage Room  
With Fireproof Cabinet**

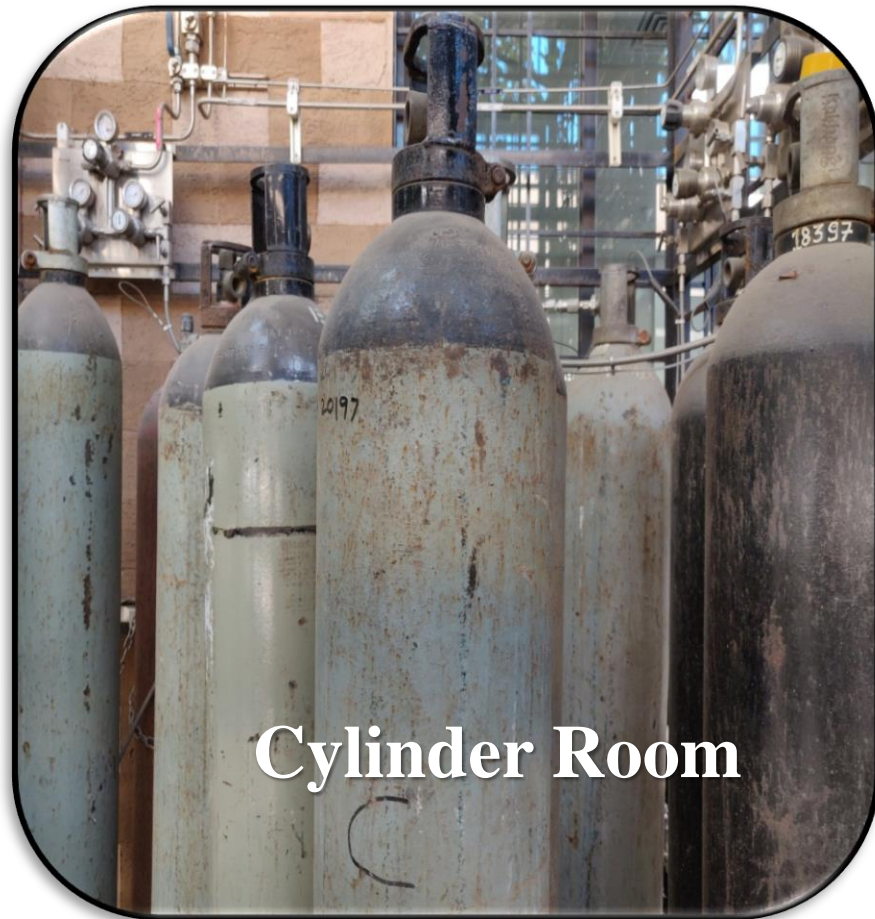


**Shower**

**Eye  
Washer**



**Instrument Laboratory**



**Cylinder Room**



**Air Generator Machine**

# Major Instruments



**500 MHz NMR with Autosampler Facility**

**Grant: 3047/CREATION OF CAPITAL ASSETS/PSA**

**Year: 2012**

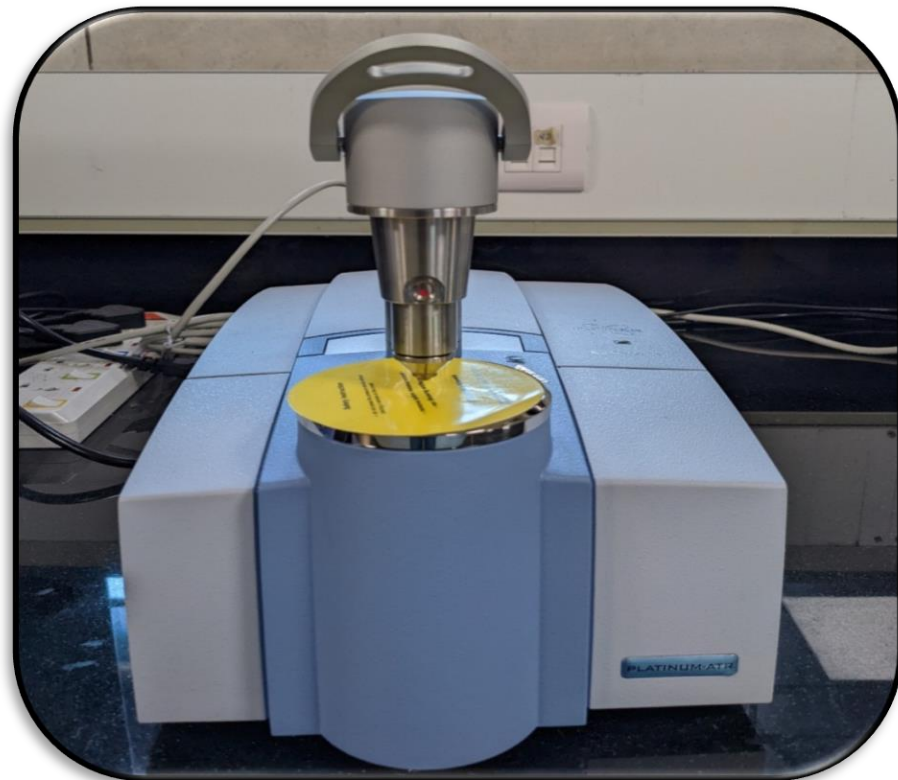
**Make: Agilent Technologies**

## TLC-Mass Analyser



**Grant/Purchase year: DST-FIST/2020**  
**Instrument Make: Advion**  
**Component:**  
**Plate Extractor ; Sprayer with detector**  
**; Vacuum pump ; Computer**

## FTIR-ATR



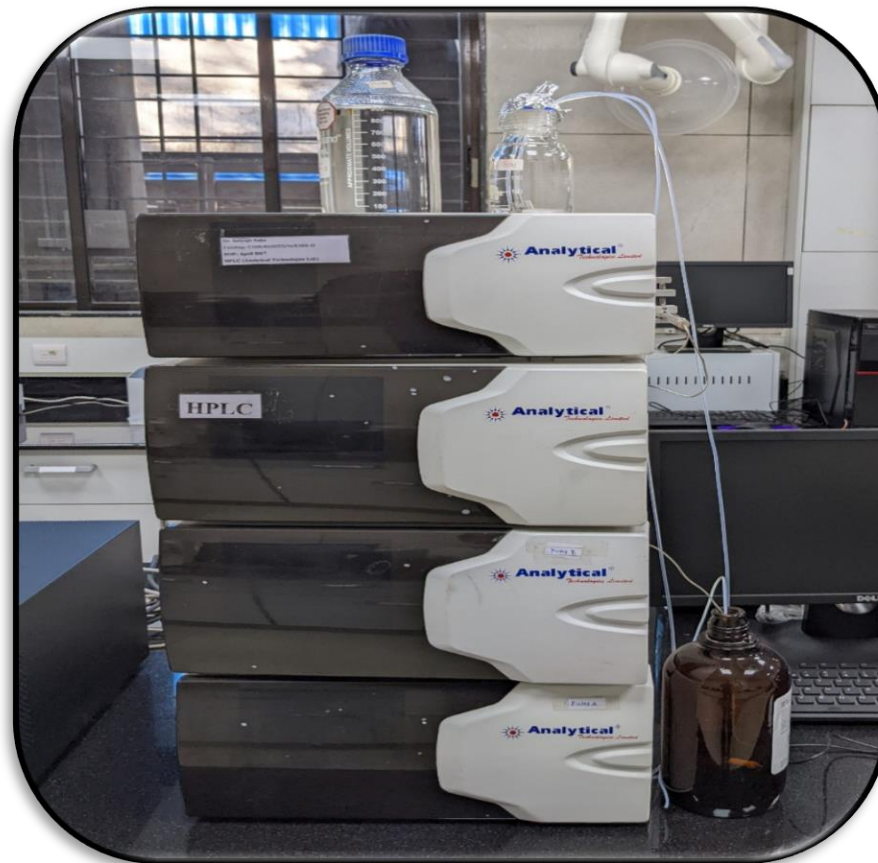
**Grant/Purchase year: DST-FIST/2020**  
**Instrument Make: Bruker**  
**Component:**  
**FTIR with Aattenuated Total**  
**Reflectance (ATR) ; Computer**

# Gas Chromatography (GC)



Grant/Purchase year: **TEQIP-II/2013**  
Instrument Make: **Thermo-Fischer**  
Component:  
**GC with Auto sampler ; Computer**

# HPLC



Grant/Purchase year: **CSIR/2016**  
Instrument Make: **Analytical Technologies**  
Component:  
**Column ; Detector ; Solvent System ; Computer ; Printer**

# Instruments for Photo-Physical Study

## UV-Visible Spectrophotometer



**Grant/Purchase year:**  
**TEQIP-II/2014**  
**Instrument Make:**  
**Labindia**



**Grant/Purchase year:**  
**DST-SERB**  
**/2016**  
**Instrument Make:** **Jasco**

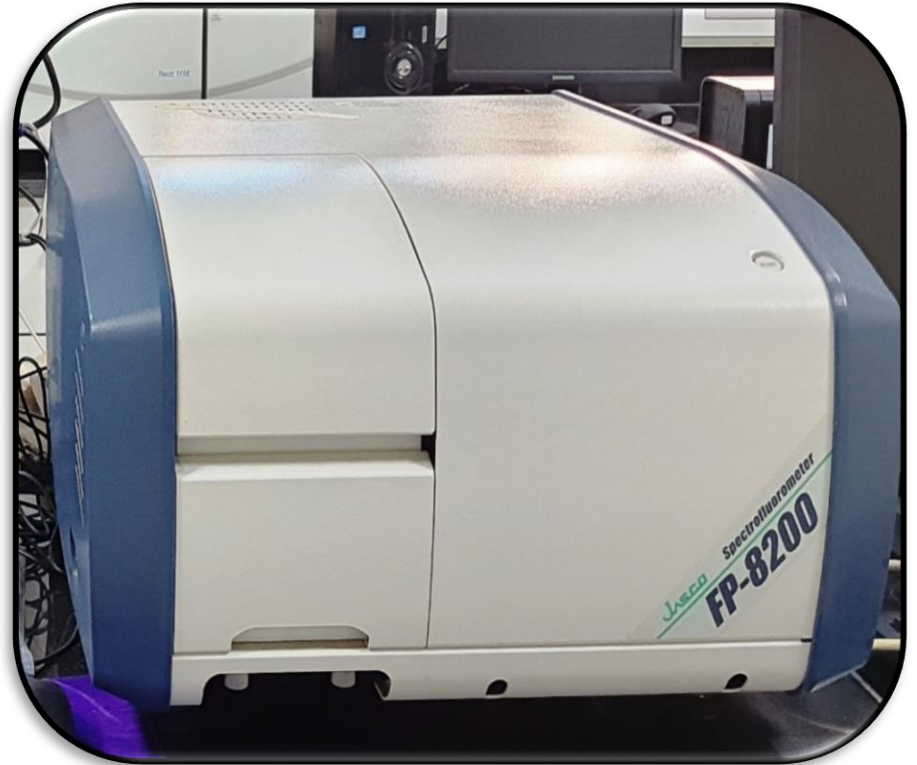
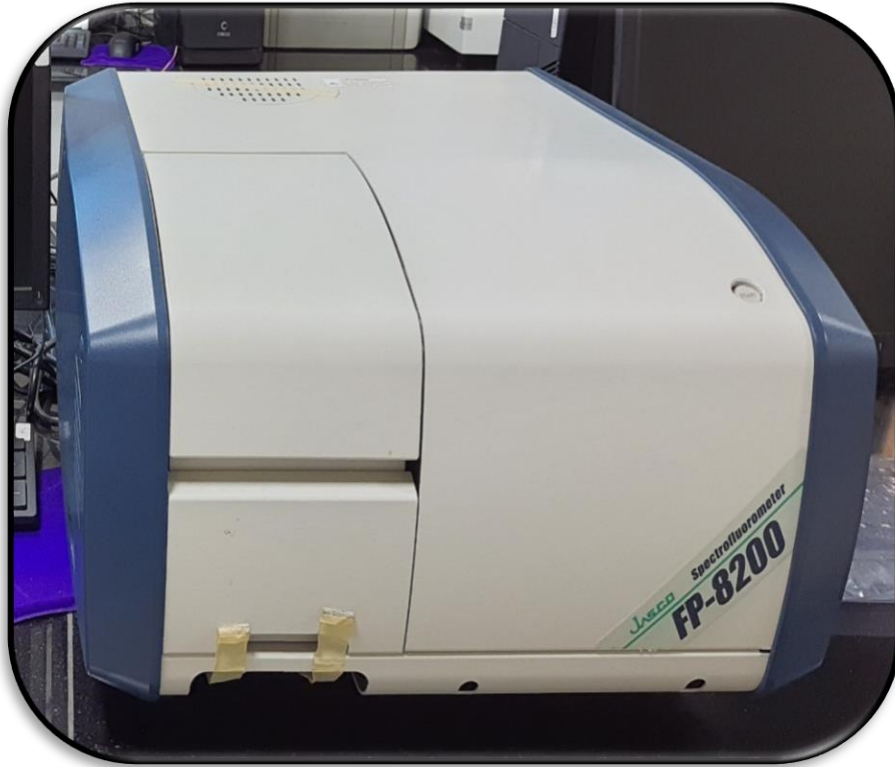


**Grant/Purchase year:**  
**3047/PSA-1 /2011**  
**Instrument Make:**  
**Perkin-Elmer**

**Component:**

**Light source ; Monochromator ; Sample holder ; Detector ; Interpreter ; Computer**

# Spectrofluorometer (Solid state / Solution State)



**Grant/Purchase year: CSIR /2019**

**Instrument Make: Jasco**

**Component:**

**Light source ; Sample holder ;**

**Detector ; Cuvettes ; Computer**

**Specification**

**High sensitivity S/N > 4,500 (RMS)**

**Dynamic range up to six digits**

**High speed scanning up to 20,000 nm/min**

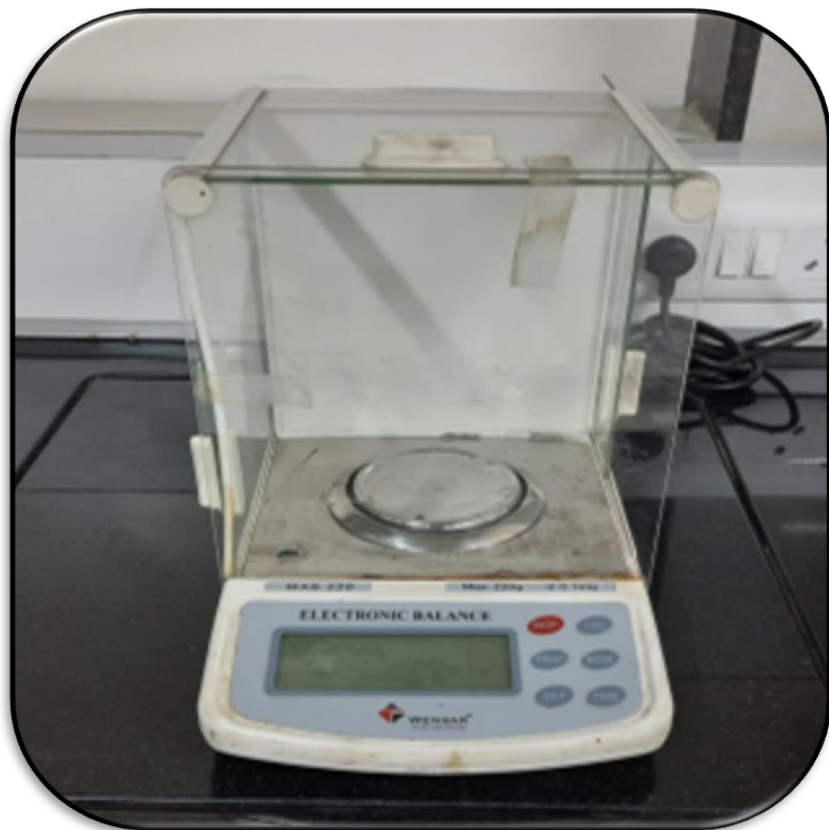
**Wavelength range: 200 to 750 nm**

**Higher order diffraction band-pass filter**



# Lab Specific Instruments

## Lab Weighing Balance



To **weigh the chemicals accurately.**  
Grant/Purchase year: **UGC start-up grant**  
Instrument Make: **Winsar**  
Total No. of Weighing balance: **5**  
Weighing balance capacity: **220g**  
**Least count: 0.1mg**

## ICE Machine



Generating Capacity: **100 Kg/ 24 Hrs.**  
Storing Capacity: **50 Kg**  
No. of ice machine: **2**

## Rotary Evaporator



Grant/Purchase year: **DST-SERB/2016**

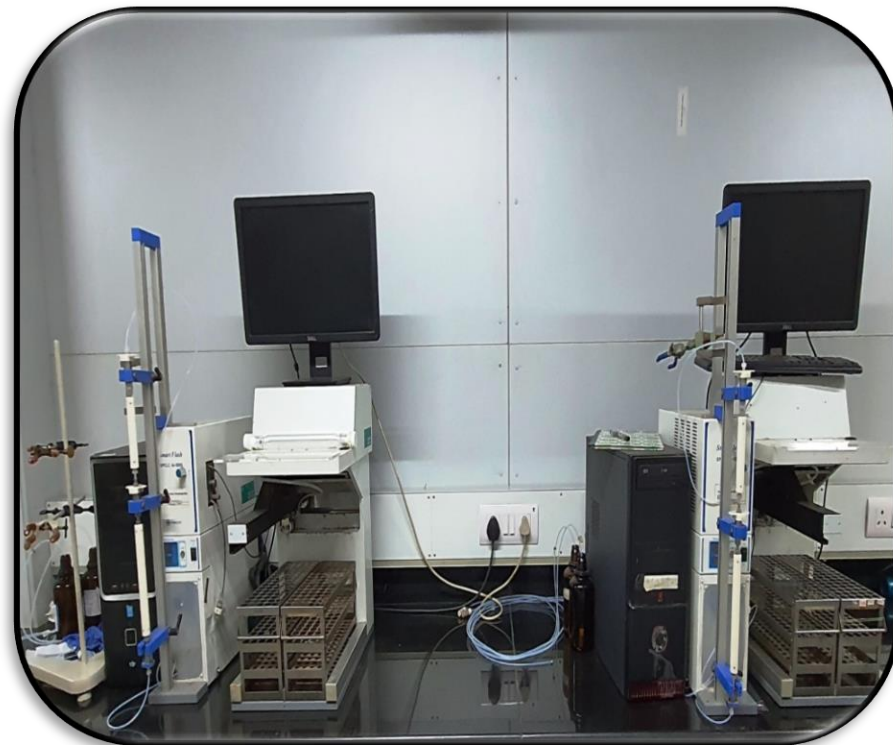
Instrument Make: **Heidolph / IKA**

Total No. of Rotary Evaporator: **6**

Component:

**Water chiller ; Vacuum pump**

## Flash Chromatography



Grant/Purchase year: **TEQIP / 2014**

Instrument Make: **Yamazen**

Total No. of Flash Chromatogram: **2**

Component:

**Pump System ; Pump Control ; Glass columns ; Pre Columns ; Fraction Collector ; Detectors**

## Probe Sonicator

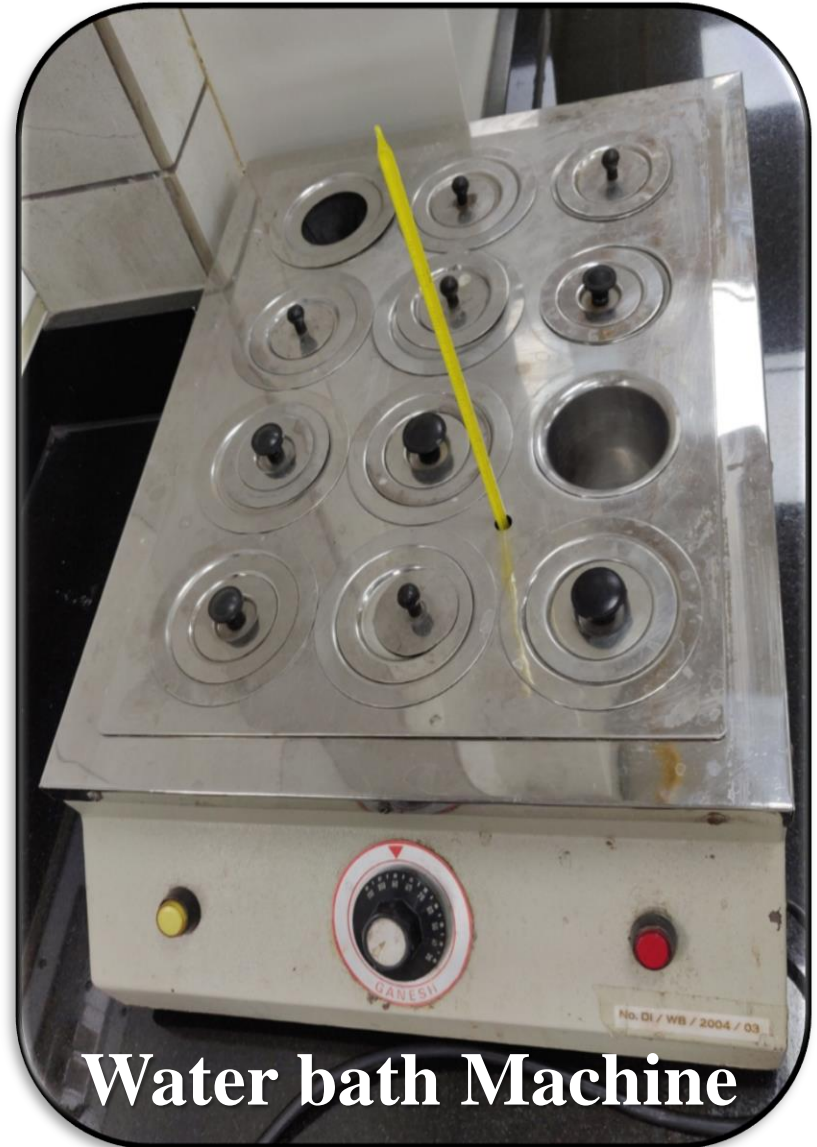


Grant/Purchase year: **TEQIP/2016**  
Instrument Make: **Electro Sonics Ind.**  
Component:  
**Generator ; Converter ; Horn ; Probe**

## Centrifuge Machine



Grant/Purchase year: **UGC star- up grant/2015**  
Instrument Make: **Remi**  
Component:  
**Lid ; Motor ; Rotor**

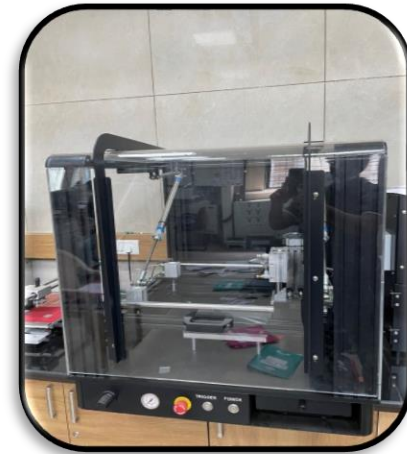


# Program Specific Instruments

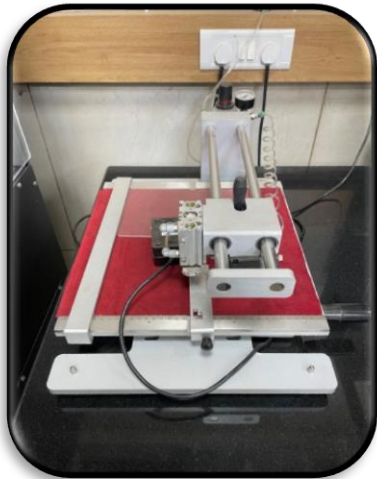
## Dye Sensitized Solar Cell (DSSC) Fabrication System



**Fabrication System**



**TiO<sub>2</sub> Coater**



**Glass Cutter**



**Annealer**

**Grant / Purchase Year: DST-FIST / 2020**

**Instrument Make: Elixir Technologies**



**Solar Simulator**

## DSC-TGA



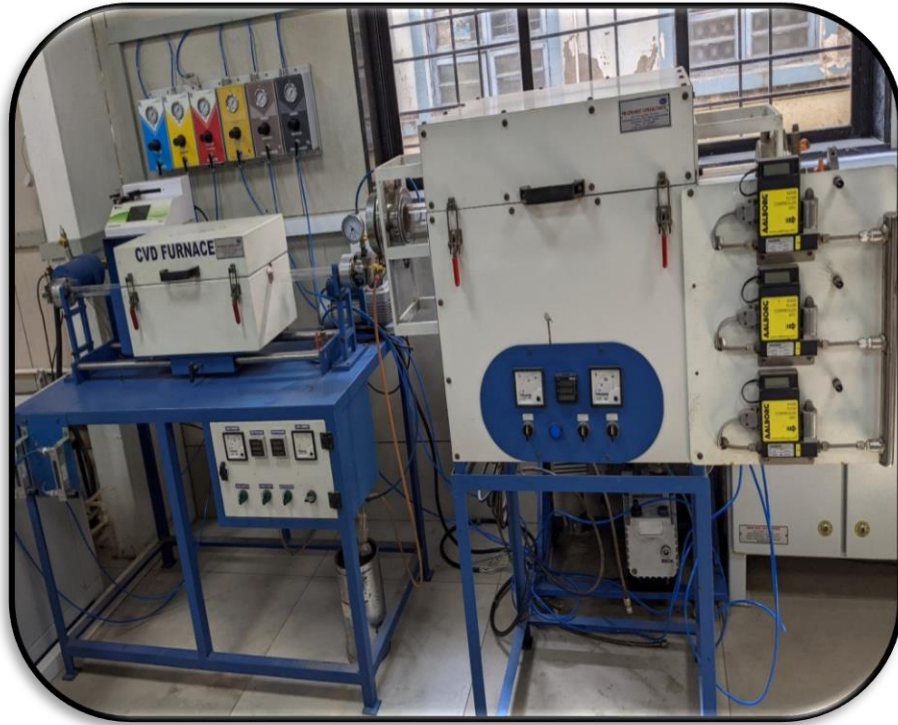
Grant/Purchase year: **TEQIP/2020**  
Instrument Make: **Hitachi**  
Component:  
**Ultra-micro balance ; DSC heat flow measurement ; Computer**

## Micro-Reactor



Grant/Purchase year: **DST-FIST/2020**  
Instrument Make: **Vapourtec Ltd.**  
Component:  
**Monitor ; Reactor Column ; Vacuum pump**

## CVD



**Grant/Purchase year: SERB & BRNS /2016**

**Instrument Make: VB ceramic solutions**

**Component:**

**Furnace ; Gas Controller; Quartz glass tube ; Vacuum Pump**

## Muffle Furnace



**Grant/Purchase year: ICT/Alumni Association / 2019**

**Instrument Make: Labaiders**

**Component:**

**1/2 Quartz window ; PC communication port ; Temperature Controller ; Protection Latch**

## Vacuum Oven



Grant/Purchase year: **DAE/BRNS /2015**

Instrument Make: **Labline**

Component:  
**Vacuum Pump**

## Freeze Dryer



Grant/Purchase year: **TEQIP-II /2016**

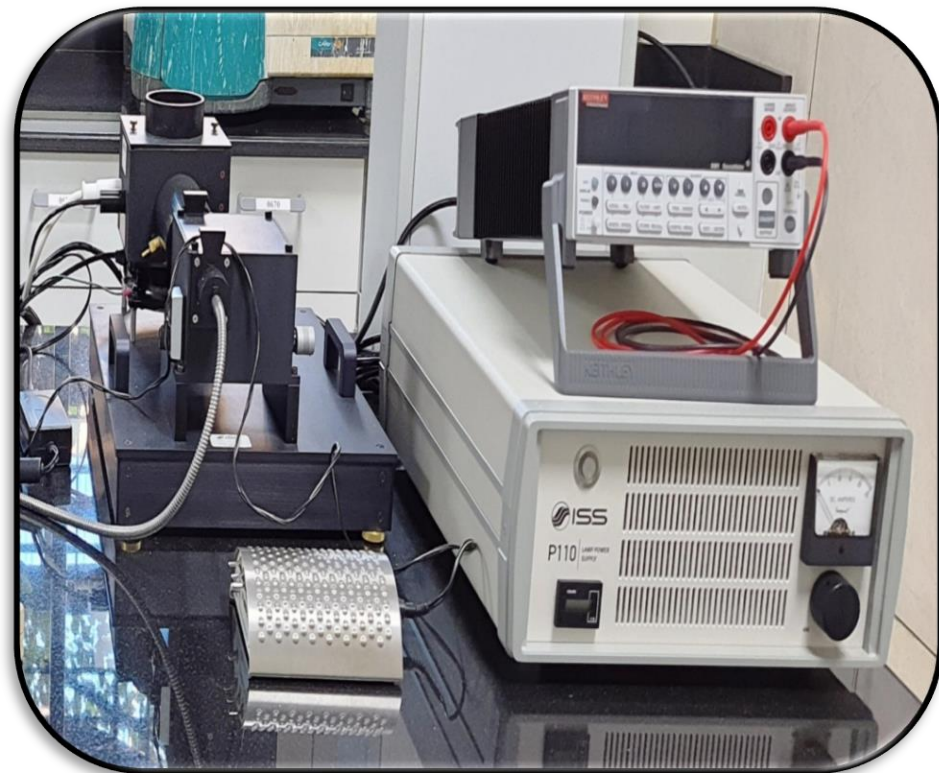
Instrument Make: **Sub-zero**

Component:

**Freeze Tubes ; Bent Tubes ; Rubbers**

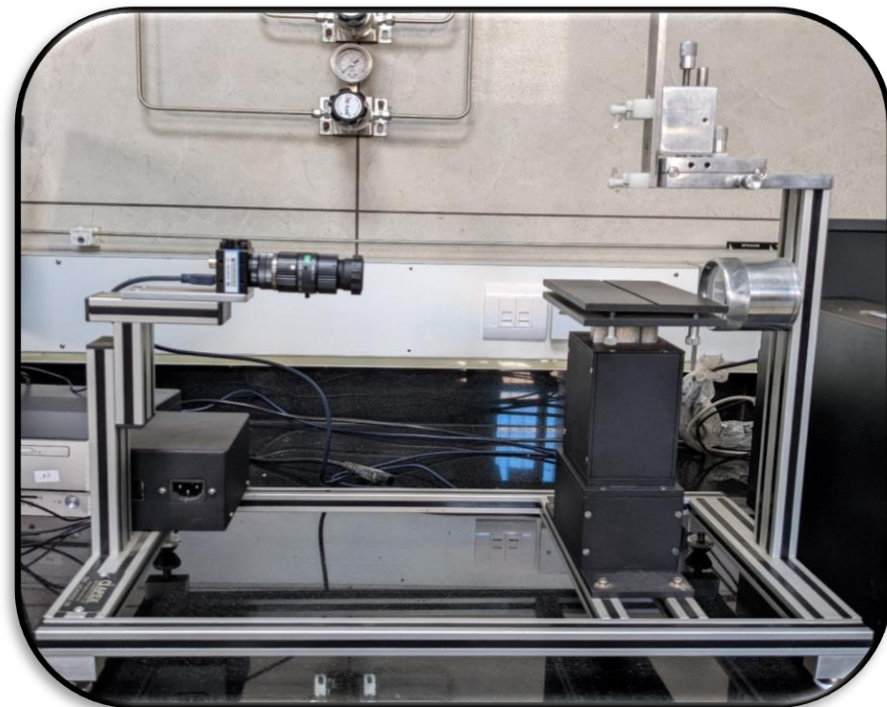


## EL & PL



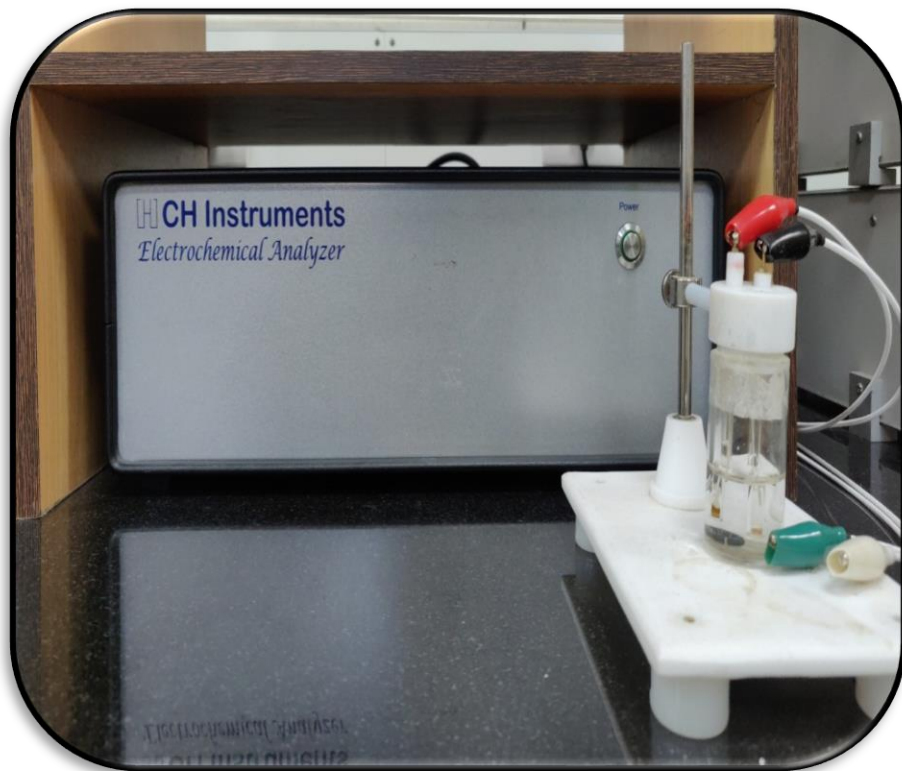
**Grant/Purchase year: DST-FIST /2020**  
**Instrument Make: Sinsil International**  
**Component:**  
**Light source ; Light-pass filter ; link cable ; Monochromator**

## Water Contact Angle



**Grant/Purchase year: ONGC /2019**  
**Instrument Make: Apex instrument Pvt. Ltd.**  
**Component:**  
**Camera ; Computer ; Water Contact Angle Assembly**

## Cyclic Voltammetry (CV aqueous)



Grant/Purchase year: **UGC start-up /2015**

Instrument Make: **Sinsil International**

Component:

**CH-Instrument ; Electrode**

## Oxidation-reduction reaction



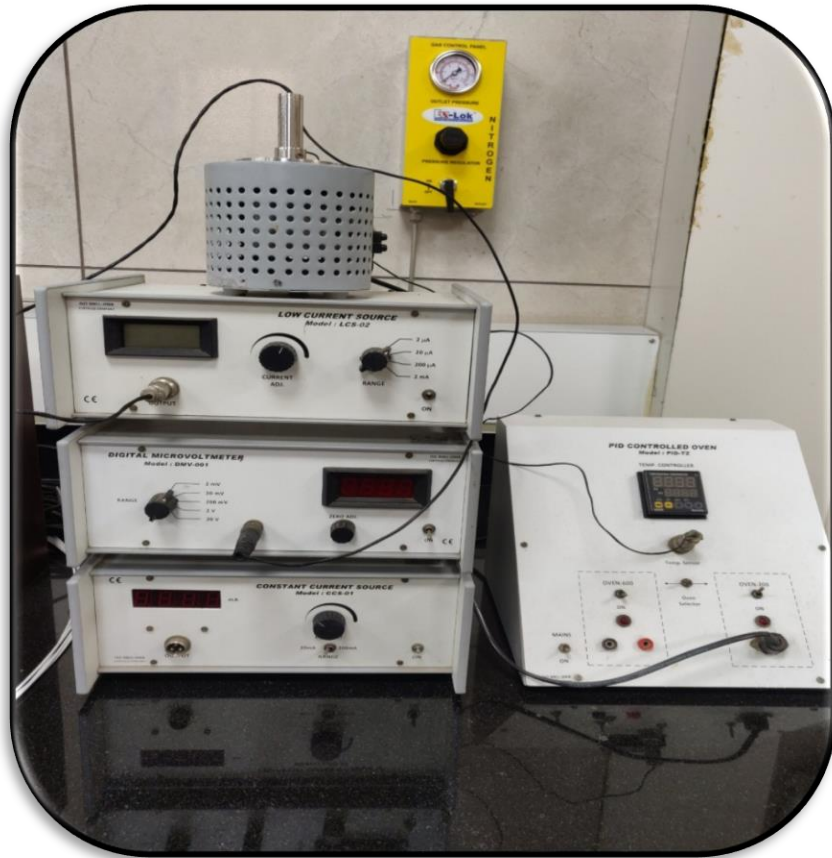
Grant/Purchase year: **ONGC /2019**

Instrument Make: **Sinsil international**

Component:

**ORR Assembly ; Computer ; Printer**

## Four Point Probe Resistivity Measurement



Grant/Purchase year: **TEQIP-III/2018**  
Instrument Make: **ISO9001:2008**  
Component:  
**Four Probe ; Oven ; Resistivity meter**

## De-ionised Water Unit



Grant/Purchase year: **UGC start-up / 2015**  
Instrument Make: **Komal Enterprises**  
Component:  
**Ion Exchange Resin ; Conductivity meter**

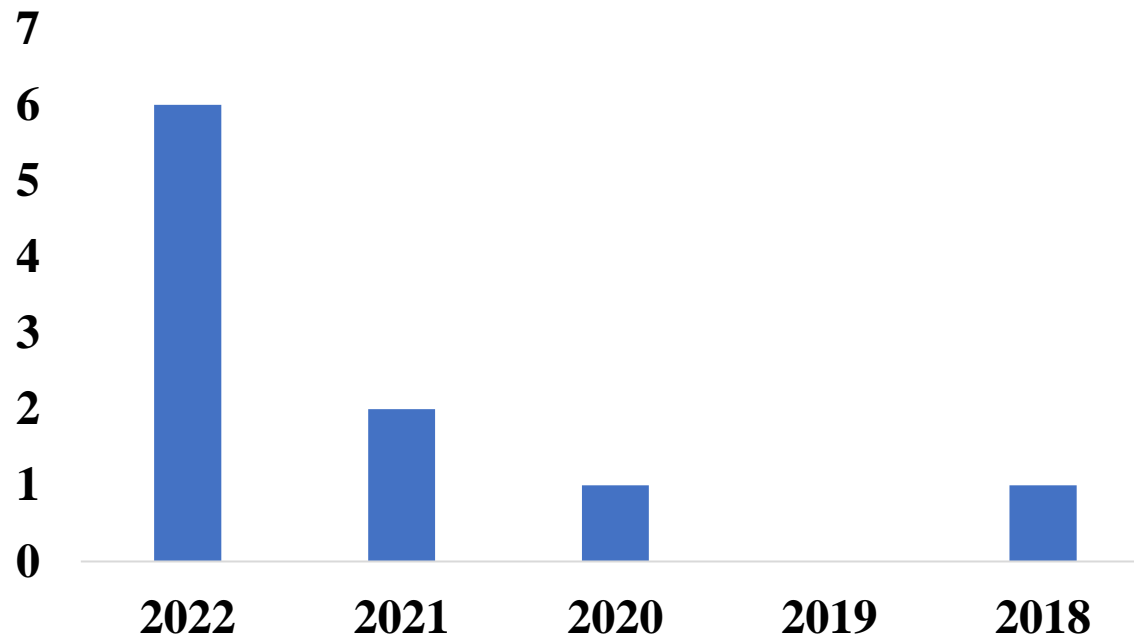
# Improvement in Laboratories

1. A **new laboratory** building constructed
2. Built up a **state-of the art facility** for research laboratory
3. Laboratory equipped with **16 fume hoods**, all connected with centralised **high vacuum pump, water supply** and **inert gas line(N<sub>2</sub>)**.
4. Designed with international safety standards
5. Maintain **pollution and environmental regulations** with **powerful exhaust**.
6. Laboratory has been equipped with various major and minor instruments required for the research and learning the subject.
7. **11 new major** equipment has been procured / sectioned **by DST-FIST**

# Student Publication

Year	No. of Publications	Communicated	Total No. of Publication
2022	2	4	6
2021	2	0	2
2020	1	0	1
2019	0	0	0
2018	1	0	1

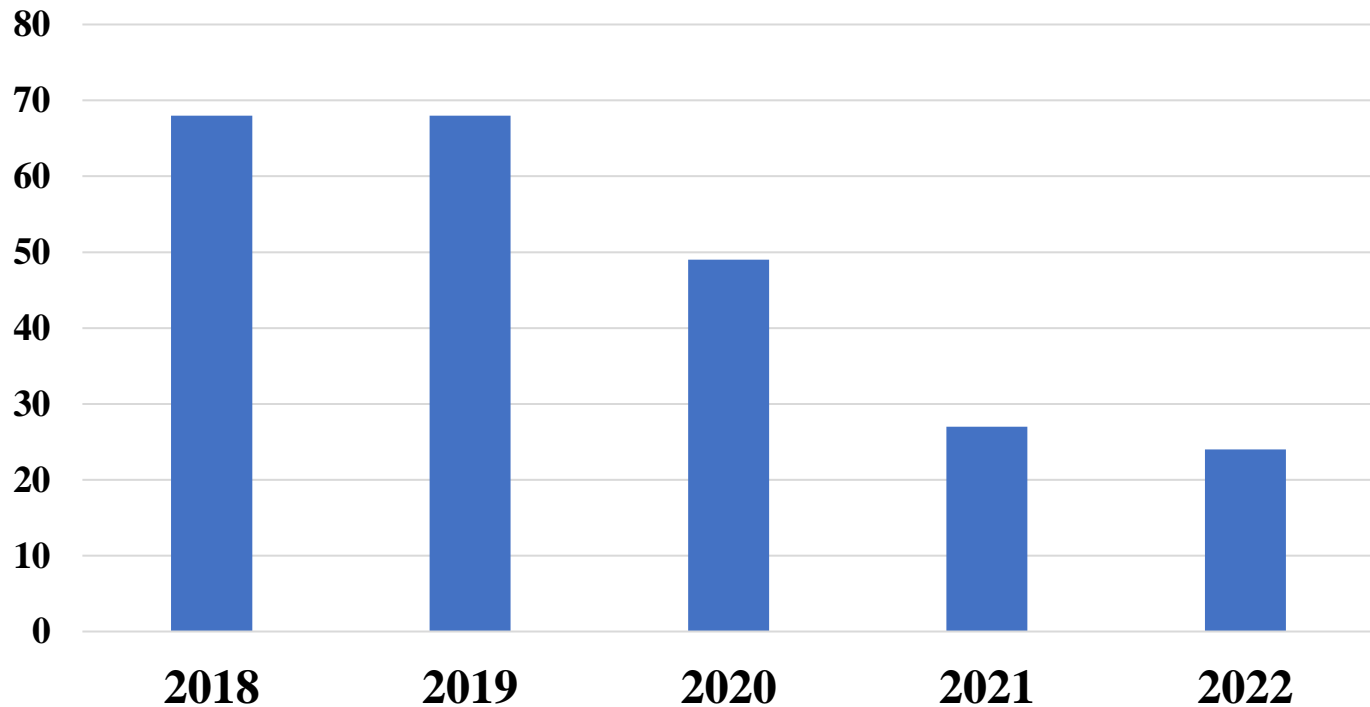
**No. of Student Publication**



# Faculty Publication

Year	2018	2019	2020	2021	2022
Publications	68	68	49	27	24

## Publications



Thank  
you

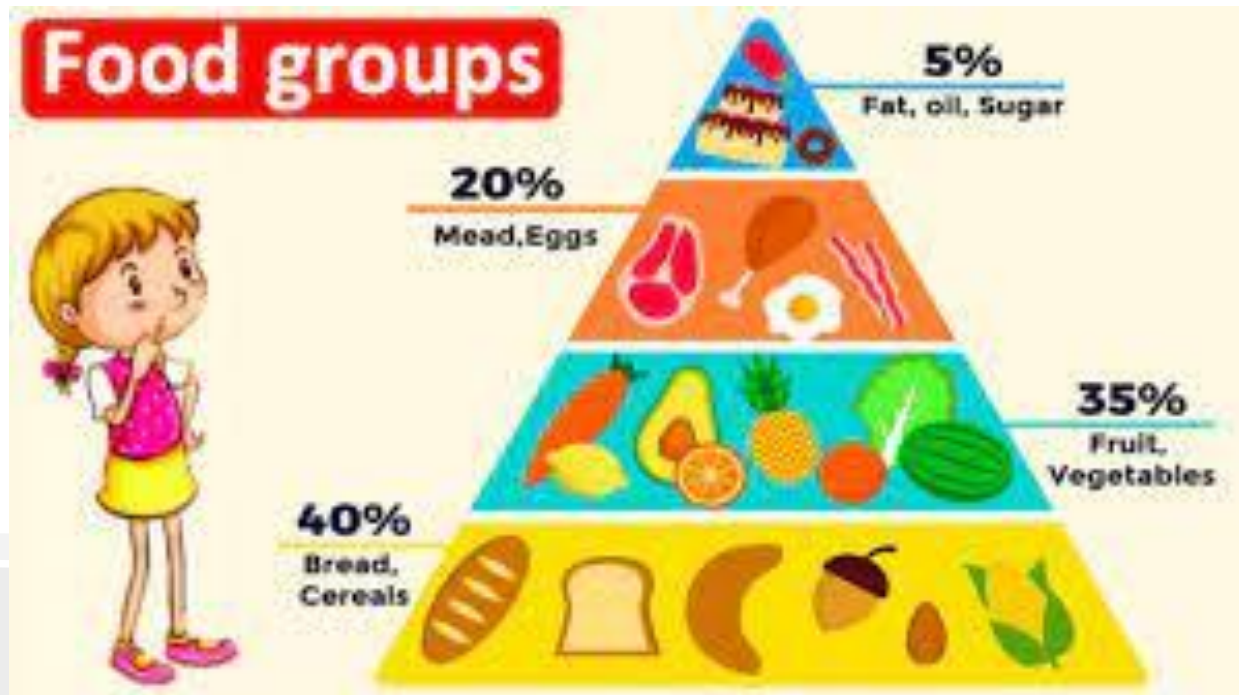




# Multidisciplinary Minor Degree in Food Science and Technology

Professor Rekha S. Singhal

Head, Department of Food Engineering and Technology







# Genesis of the department

1943

- B. Sc. (Tech) in Chemistry of Foods and Drugs

1945

- Masters and Ph.D. (Tech.) programs

1949

- Full fledged B.Sc (Tech) degree course in Food Technology; Masters and Ph. D. (Tech.) programs

1963

- Master's program in Fermentation Technology was initiated
- Renamed as 'Food & Fermentation Technology Department'

2000

- All graduate program aligned as 12+4 pattern
- Name changed to 'Food Engg & Tech Department'

2009

- M.Tech. (Food Biotech) program

2018

- Platinum Jubilee of the department

# Department of Food Engineering & Technology (FETD)



Establishing a center of excellence to provide demand driven, value-based and quality technical education to make India a developed country through socio-economic transformation



To improve food especially Indian traditional food in terms of nutrition, safety and functionality employing fundamental and applied sciences.

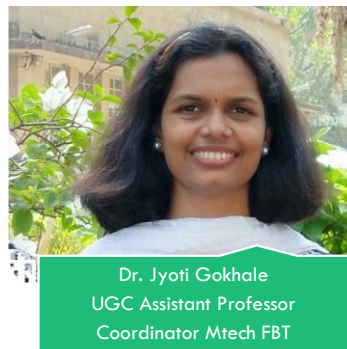
To produce trained personnel of highest standards for the benefit of the industry & society in the field of Food Engineering & Technology & Food Biotechnology.

To provide leadership qualities in areas of education, research, innovations & solutions in food & biotech sciences, technology & engineering in order to direct overall activity towards economic growth of India.

# Courses offered by the department

Sr. No.	Degree	Comments	Intake
1	B.Tech. (Food Engineering & Technology)	<ul style="list-style-type: none"> <li>AICTE Approval in 1993</li> <li>AICTE approval for (12 + 4) Pattern in 2008</li> <li>NBA accredited for 6 years till 2028</li> </ul>	16
2	M. Tech. (Food Engineering & Technology)	<ul style="list-style-type: none"> <li>AICTE Approval in 2008</li> <li>NBA accredited for 6 years till June 2026</li> </ul>	18
3	M. Tech. (Food Biotechnology)	<ul style="list-style-type: none"> <li>AICTE Approval in 2008</li> <li>NBA accredited in 2021 till 2027</li> </ul>	10
4	Ph. D. (Tech.) (Food Engg. & Tech) Ph. D (Tech) (Food Biotechnology) Ph. D (Tech) (Bioprocess Technology) Ph. D (Biotechnology) Ph. D (Biochemistry) Ph. D (Food Science) Ph. D (Microbiology)	<ul style="list-style-type: none"> <li>10 UGC-SAP fellowships from 2007 to 2014.</li> <li>15 UGC-SAP fellowships (Food 10 + 5 BPT) from 2009 to 2014.</li> <li>AICTE NDF</li> </ul>	15

# FETD faculties



# Eminent adjunct faculty of the department



**Prof. Mukund Karwe**

Dean of International Programs,  
Dept of Food Science,  
Rutgers University, USA  
Editor, Journal of Food Engineering



**Prof. R.C. Anantheswaran**

Professor of Food Engineering & Director for Education by Non-Traditional Delivery  
Penn State University, USA  
Editor, International Food Research Journal



**Prof. K. Niranjana**

Professor of Food Bioprocessing  
University of Reading, UK  
Editor, Journal of Food Engineering



**Prof. Shyam S. Sablani**

Associate Department Chair  
Biological Systems Engineering,  
Washington State University, USA  
Editor, Journal of Food Science



**Prof. Kalidas Shetty**

Associate Vice President for International Partnerships  
Plant Metabolism & Food Security  
North Dakota State University, USA  
Editor Journal Food Science and Technology

# Department facilities



DVR-CAFT Lab



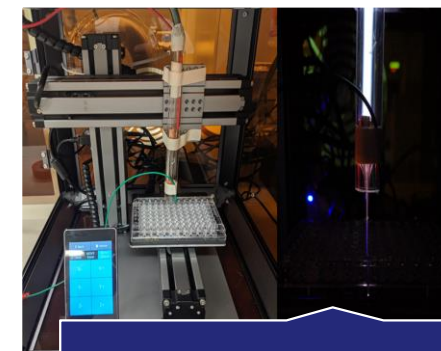
Food Processing Lab



Continuous Microwave  
Pasteurizer



Twin Screw Extruder



Atmospheric Plasma



Pulsed Light Treatment



Rheometer



Texture analyzer



GCMS



HPLC



# MDM in FST: Programme Specific Outcomes

## Food Analysis

- Able to apply analytical techniques for food safety, quality assurance

## Innovations in Food Products Development

- Able to translate emerging science in developing innovative food products.

## Food Preservation

- Able to apply principles of food preservation techniques in processed foods

## Food Biotechnology

- Able to apply biological sciences in food processing and preservation

## Fostering collaboration

- Facilitating understanding and working in interdisciplinary areas

## Food sustainability

- Ability to work for food and nutritional security



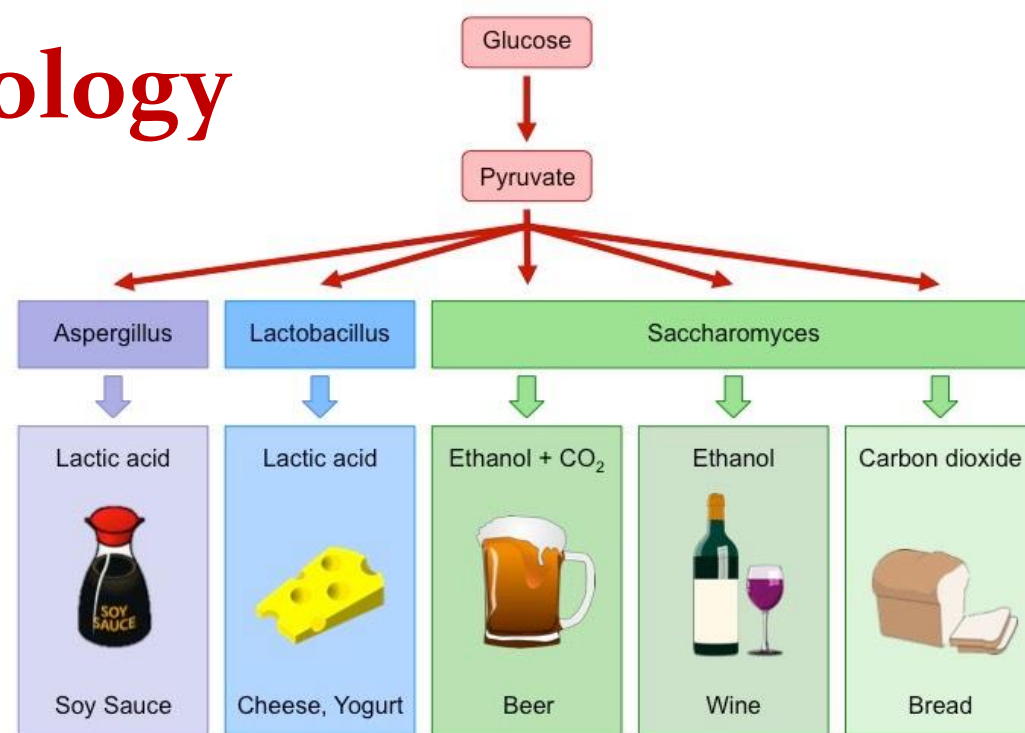
## MDM structure

Semester	Course Code	Subjects	Faculty
III	FDT1071	Principles of Food Microbiology	VF
IV	FDP1013	Food Microbiology Lab	BSBT Faculty
V	FDT1072	Fundamentals of Food Science and Technology	SSA/ YSG
VI	FDT1073	Food Preservation Technology	USA/ SC
VII	FDP1018	Food Analysis Lab	JSG/ NJD
VIII	FDT1074	Food Quality and Regulations	RBW

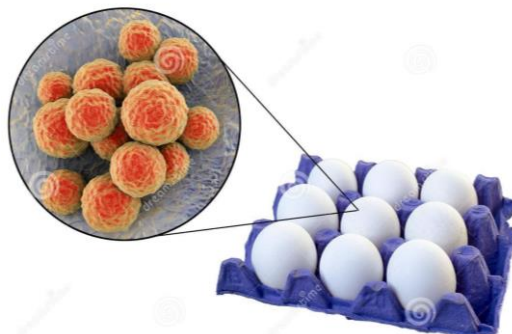
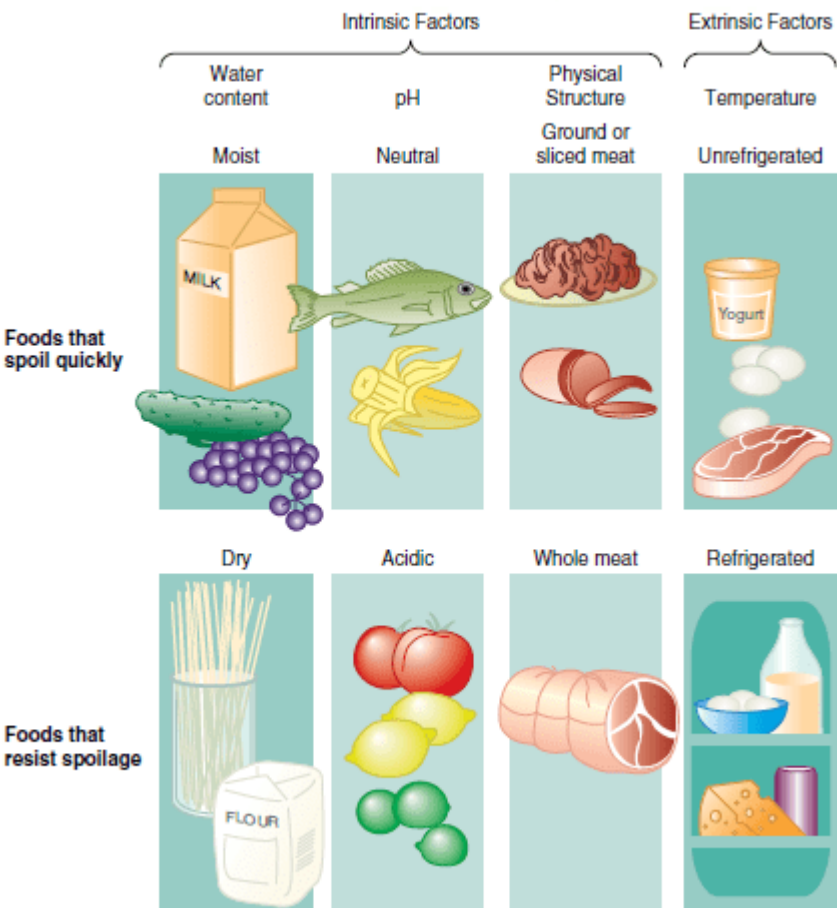




# Food Microbiology



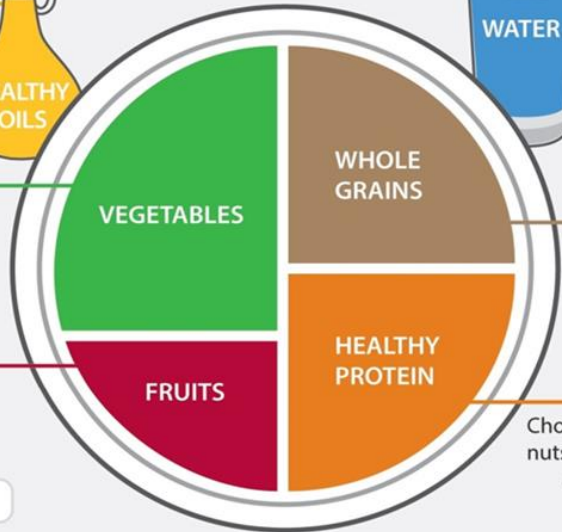
## Food Spoilage



# HEALTHY EATING PLATE



Use healthy oils (like olive and canola oil) for cooking, on salad, and at the table. Limit butter. Avoid trans fat.



The more veggies – and the greater the variety – the better. Potatoes and French fries don't count.

Eat plenty of fruits of all colors.



Drink water, tea, or coffee (with little or no sugar). Limit milk/dairy (1-2 servings/day) and juice (1 small glass/day). Avoid sugary drinks.

Eat a variety of whole grains (like whole-wheat bread, whole-grain pasta, and brown rice). Limit refined grains (like white rice and white bread).

Choose fish, poultry, beans, and nuts; limit red meat and cheese; avoid bacon, cold cuts, and other processed meats.

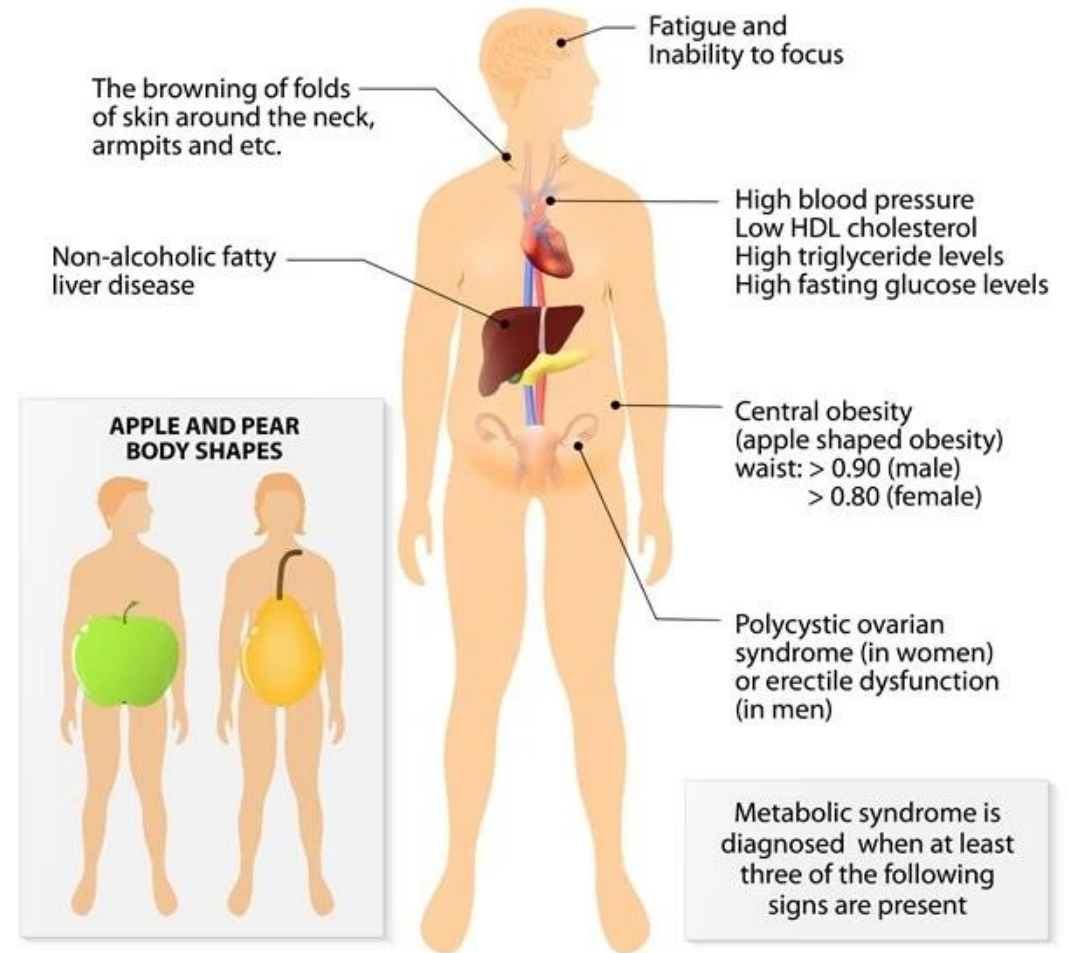
**STAY ACTIVE!**  
© Harvard University

Harvard School of Public Health  
The Nutrition Source  
[www.hsph.harvard.edu/nutritionsource](http://www.hsph.harvard.edu/nutritionsource)

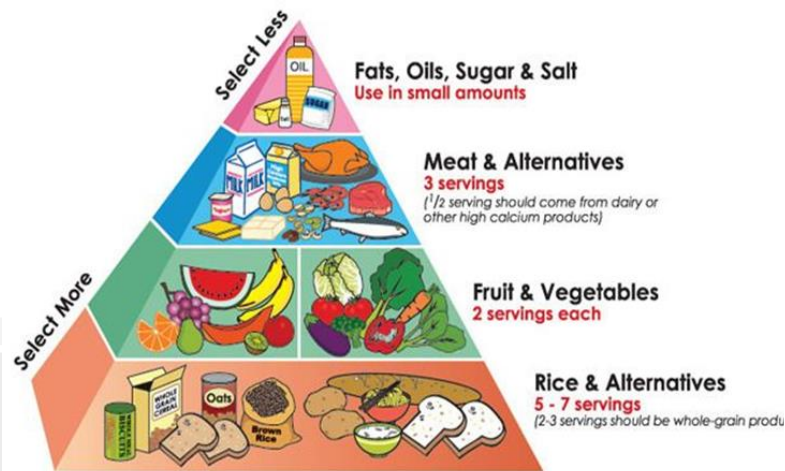
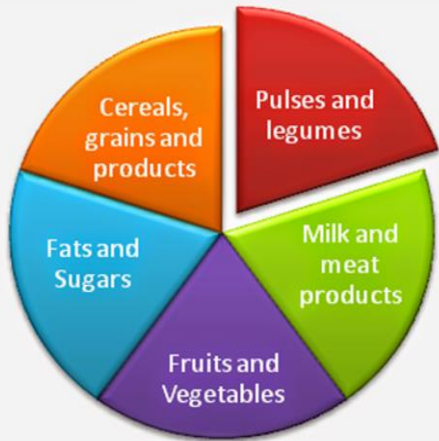
Harvard Medical School  
Harvard Health Publications  
[www.health.harvard.edu](http://www.health.harvard.edu)

# Introduction to Food Science & Technology

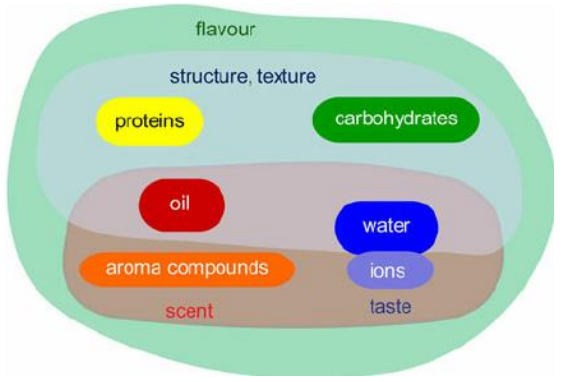
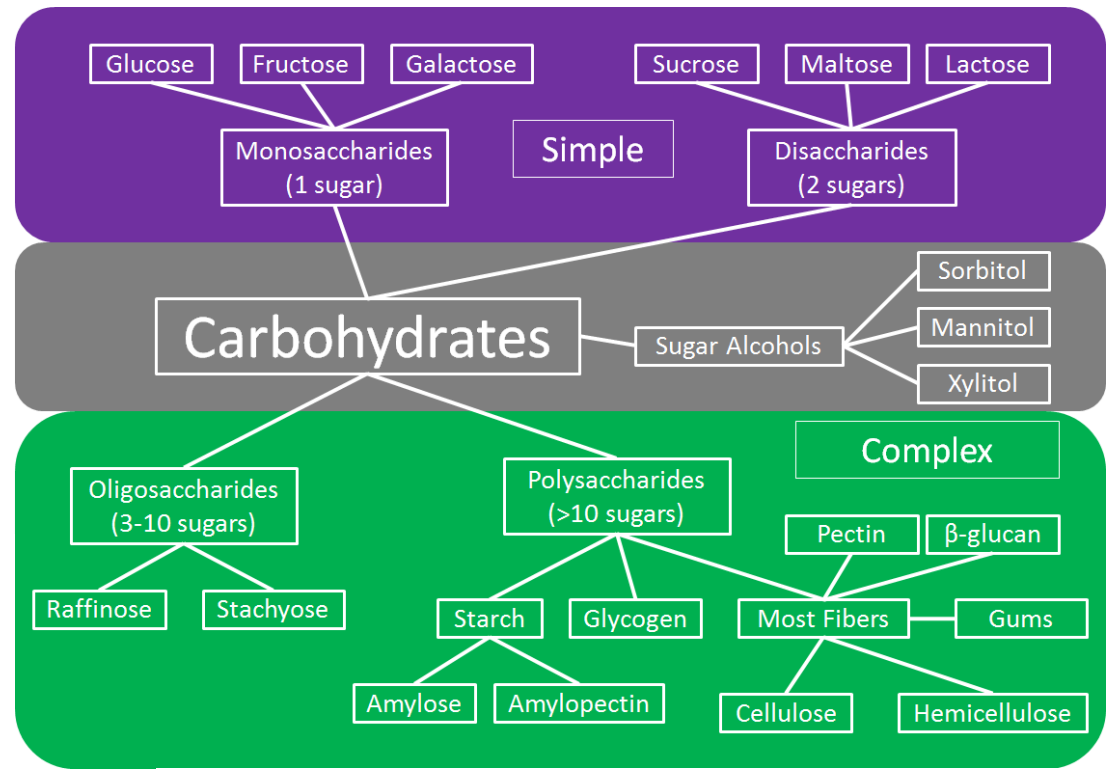
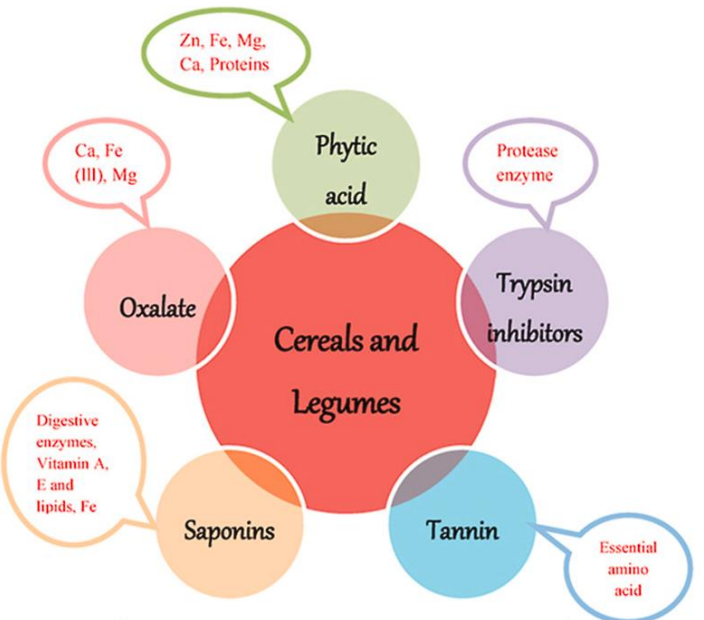
## THE SYMPTOMS of metabolic syndrome



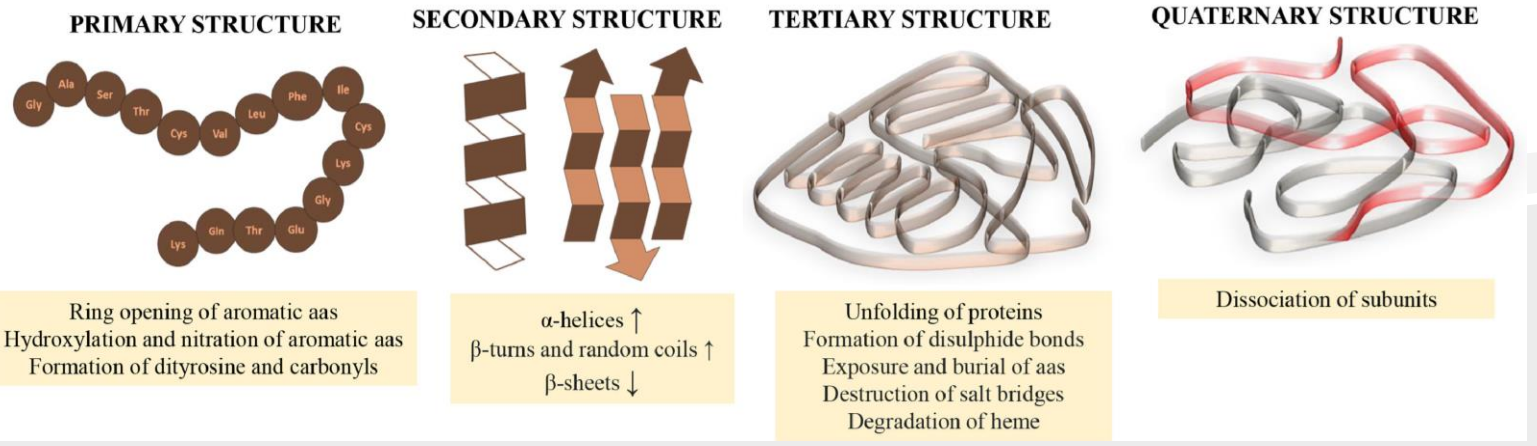
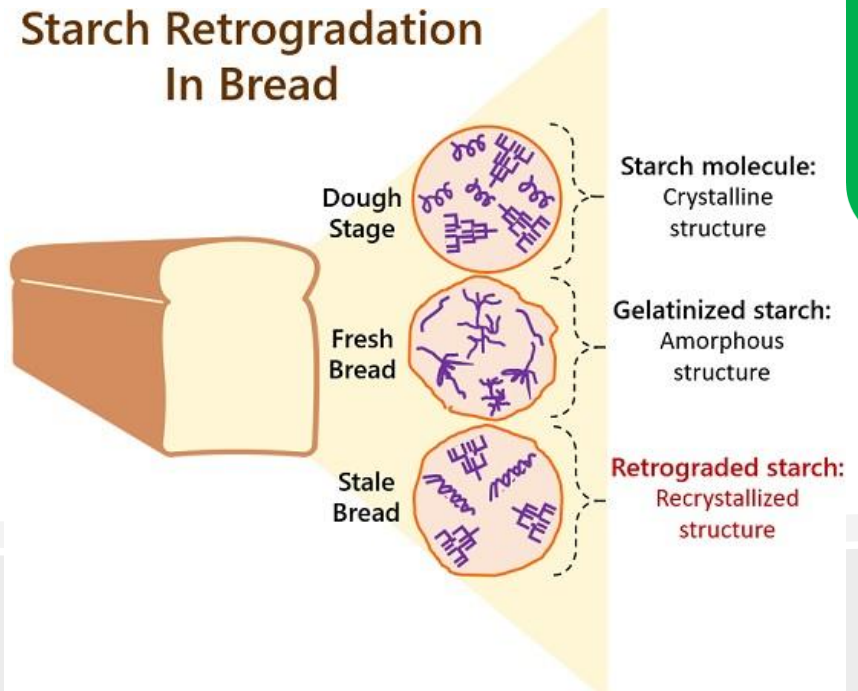
Metabolic syndrome is diagnosed when at least three of the following signs are present




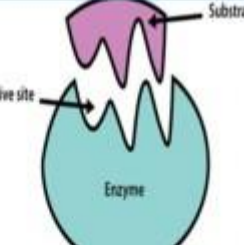



# Introduction to Food Science & Technology

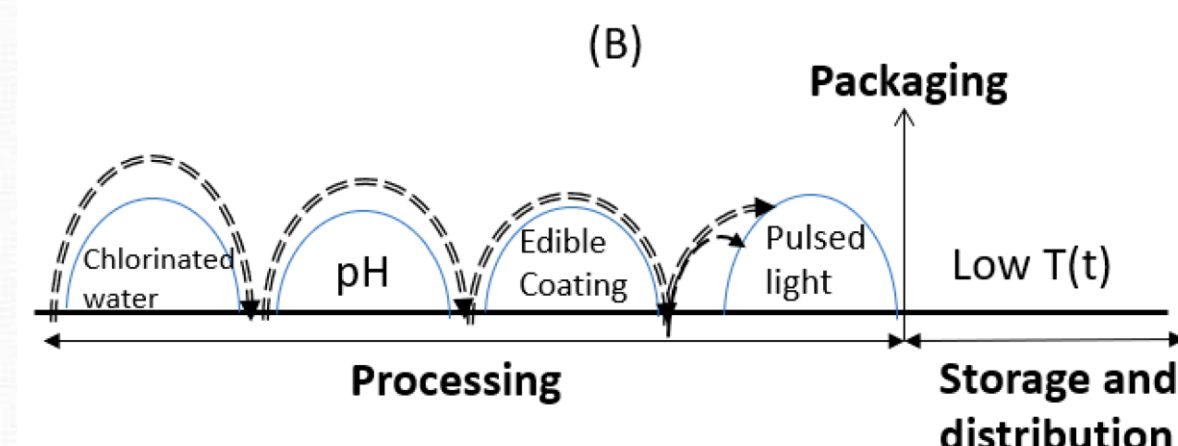
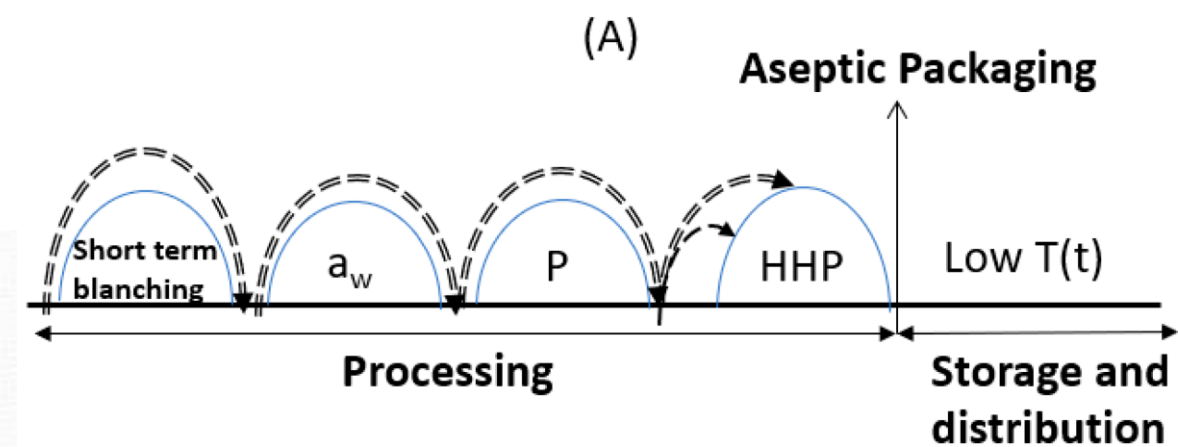
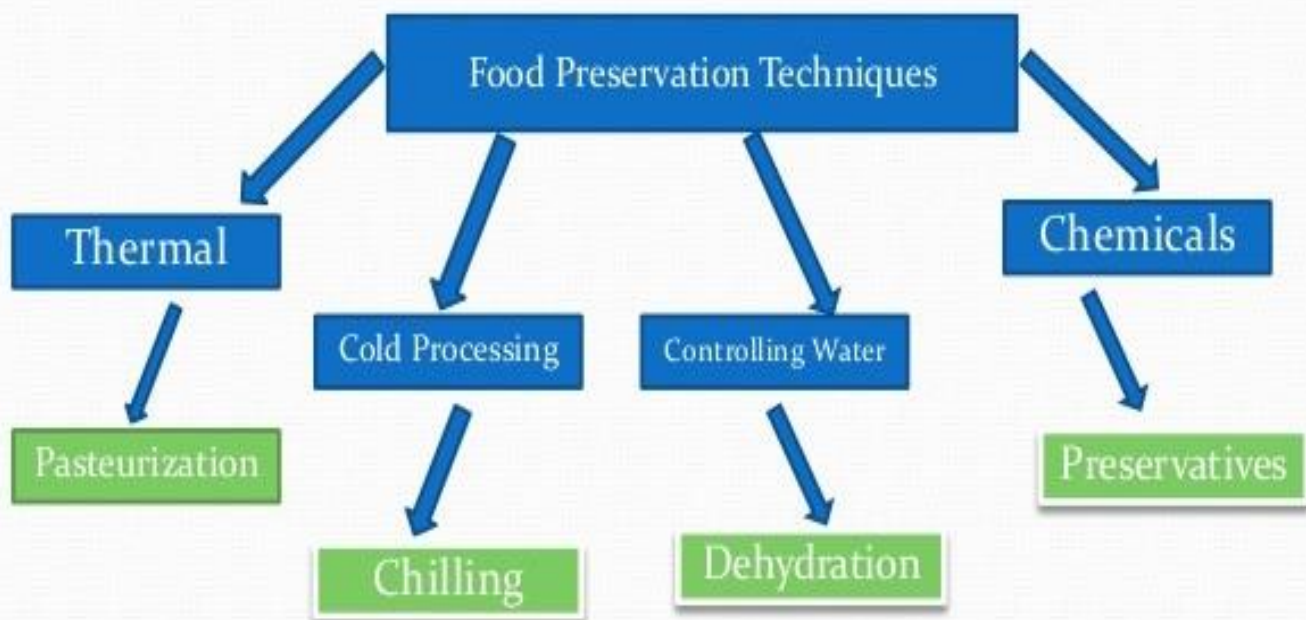


## Starch Retrogradation In Bread

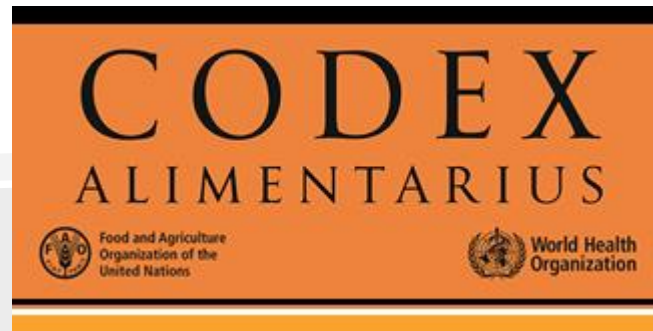


# Food Preservation Technology

				
<b>Microbiological</b> <ul style="list-style-type: none"> <li>• Microorganism Growth</li> <li>• Off-flavor</li> <li>• Toxin production</li> </ul>	<b>Enzymatic</b> <ul style="list-style-type: none"> <li>• Browning</li> <li>• Color change</li> <li>• Off flavor</li> </ul>	<b>Chemical</b> <ul style="list-style-type: none"> <li>• Color loss</li> <li>• Flavor loss</li> <li>• Nonenzymatic browning</li> <li>• Nutrient loss</li> <li>• Oxidation-reduction</li> <li>• Rancidity</li> </ul>	<b>Physical</b> <ul style="list-style-type: none"> <li>-Collapse</li> <li>-Controlled release</li> <li>-Crystallization</li> <li>-Flavor encapsulation</li> <li>-Phase changes</li> <li>-Recrystallization</li> <li>-Shrinkage</li> <li>-Transport of component</li> </ul>	<b>Mechanical</b> <ul style="list-style-type: none"> <li>-Bruising due to vibration</li> <li>-Cracking</li> <li>-Damage due to pressure</li> </ul>



# Food Quality and Regulations





Do join **Department of Food Engineering and Technology**  
to know

“Science & Technology behind your favourite foods”

**Thank you!!!**

For any further queries  
Please contact or write to  
Head, FETD: **Prof Rekha Singhal**  
(rs.singhal@ictmumbai.edu.in)

Departmental MDM Coordinator: **Dr Jyoti Gokhale**  
(js.gokhale@ictmumbai.edu.in)

**Fibres and Textile**

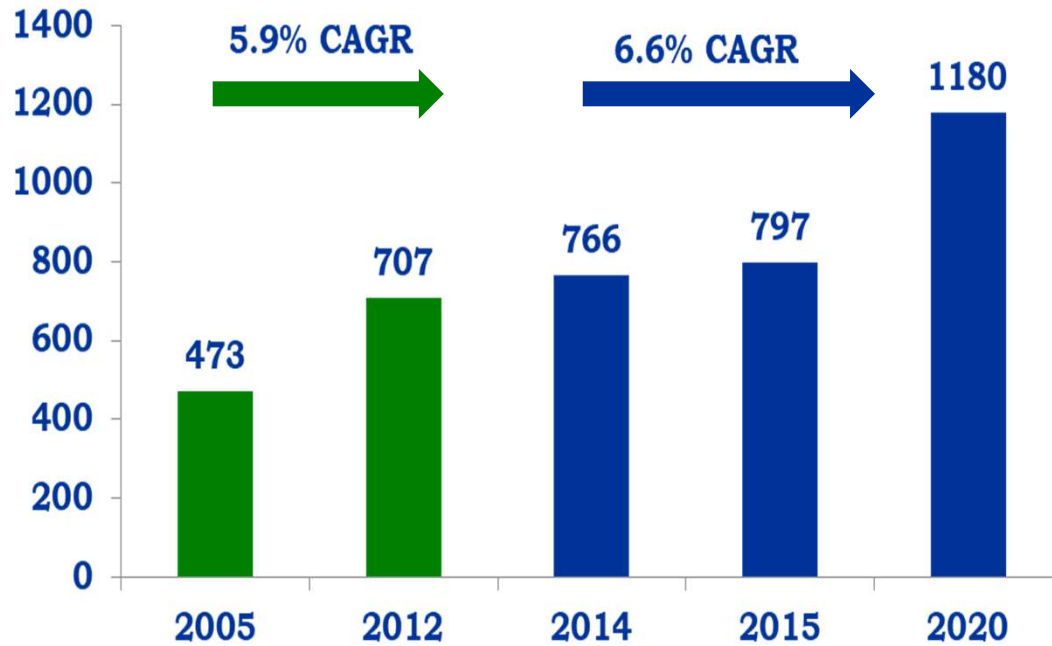
**Processing Technology**

# Global Textile Market

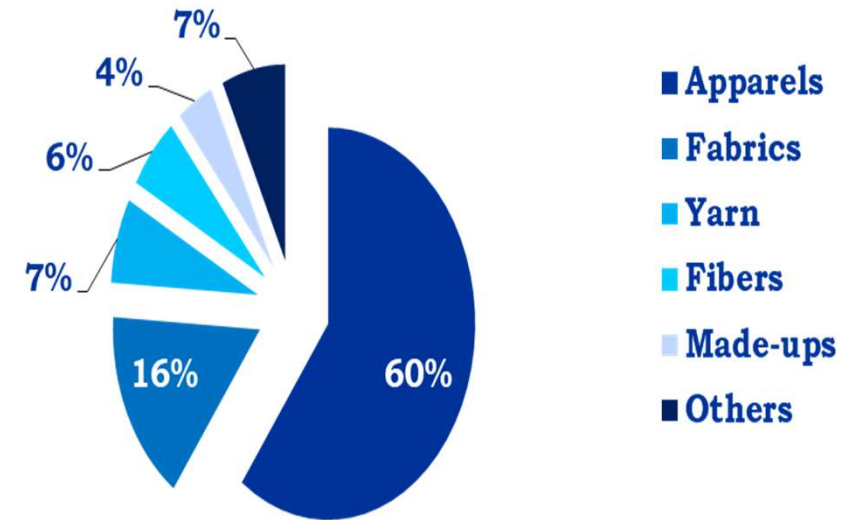


US\$ bn

Global Textile & Apparel Trade



Category-wise share



**Global Textile and Apparel trade for 2025 estimated to be \$1500 bn**







# Textile Segments

- **Apparel Wear**

- intimates, casual, formal, outerwear, occasional, festive

- **Home Decor**

- carpets, curtains, mats, seat covers, towels, bed covers

- **Outdoor Coverage**

- tarpaulins, tents, awnings, umbrella, canopy

- **Specialised Function**

- tyre, belt, parachute, sail, ropes, flags

# Changing trend of Consumer's Wardrobe



**10 years ago**



**Current**



**After 10 years**



**Need-Based Clothing**

**Shirts  
Trousers  
Jackets  
Sarees  
Salwar Kameez**

**Occasion Specific Clothing**

**Sports | Gym wear  
Specific ethnic wear  
Casual wear  
Office wear  
Night wear  
Party wear  
Work wear**

**Detail Oriented**

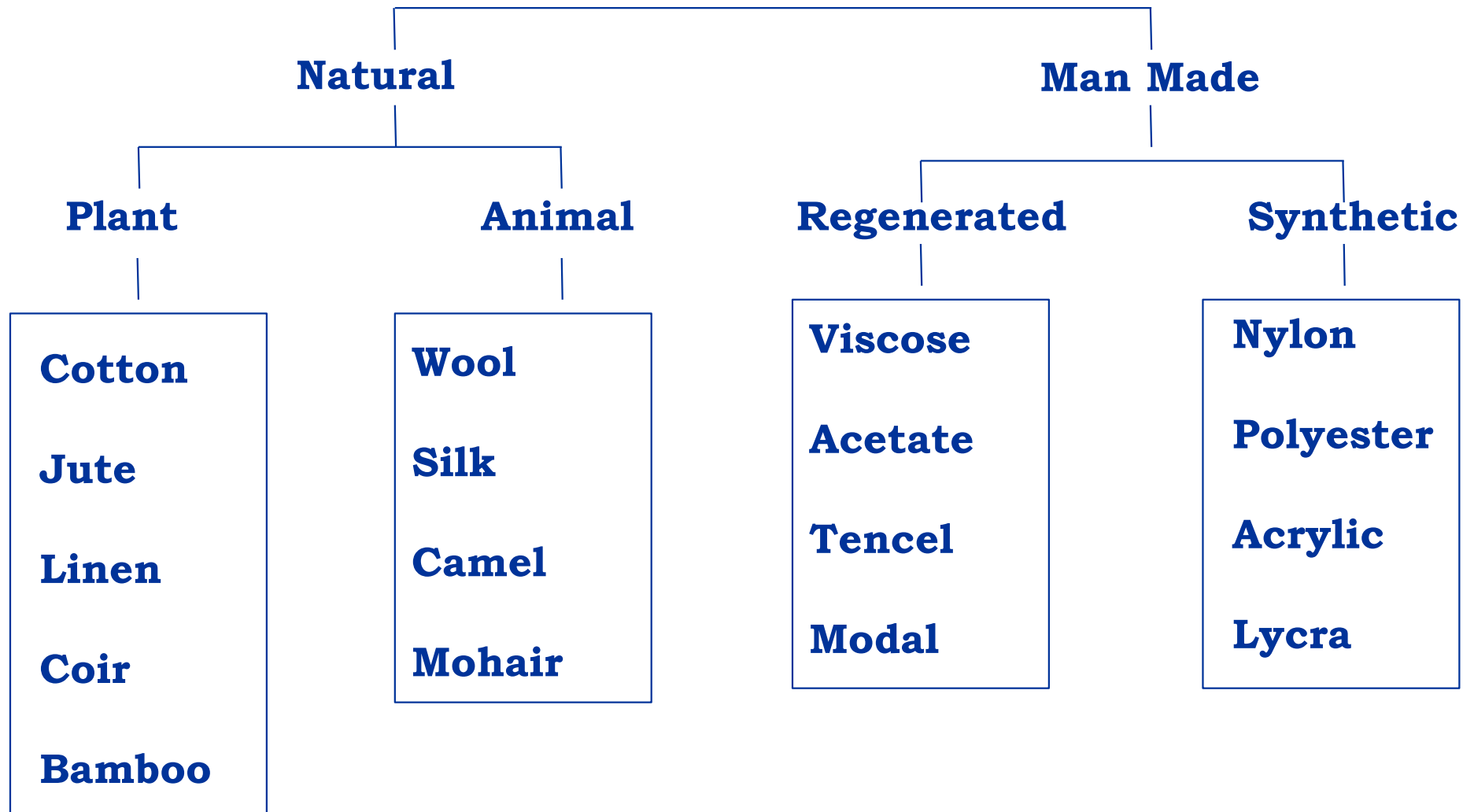
**Design-based assortments  
occasion wear  
Fast fashion  
Eco-friendly apparel  
  
Technical Garments  
(Temperature controlled |  
IT embedded)**

**Basic function + Comfort +  
Price**

**Look + Trend**

**Fashion + Exclusivity +  
Technical function**

# Types of Textile Substrates



# Textile Industry in India



- **No 1** producer of Cotton & Jute
- **No 2** producer of Polyester & Silk
- **No 3** producer of Viscose Rayon
- **No 4** producer of Nylon & Acrylic
- **About 5 cr** people employed in the value chain
- **Earn 15 %** of export revenue
- **Consume 5.2 kg** per person & growing fast

# Desired Effects

## Casual wear

- Easy care
- Shape retention
- Comfort feel



## Denim

- Fading effects
- Shape fitness
- Soil release



## Corporate Wear

- Wrinkle resistance
- Dimensional Stability
- Stain release



## Work wear

- Flame Retardancy
- Water & Oil Repellent
- Anti microbial
- Moisture management

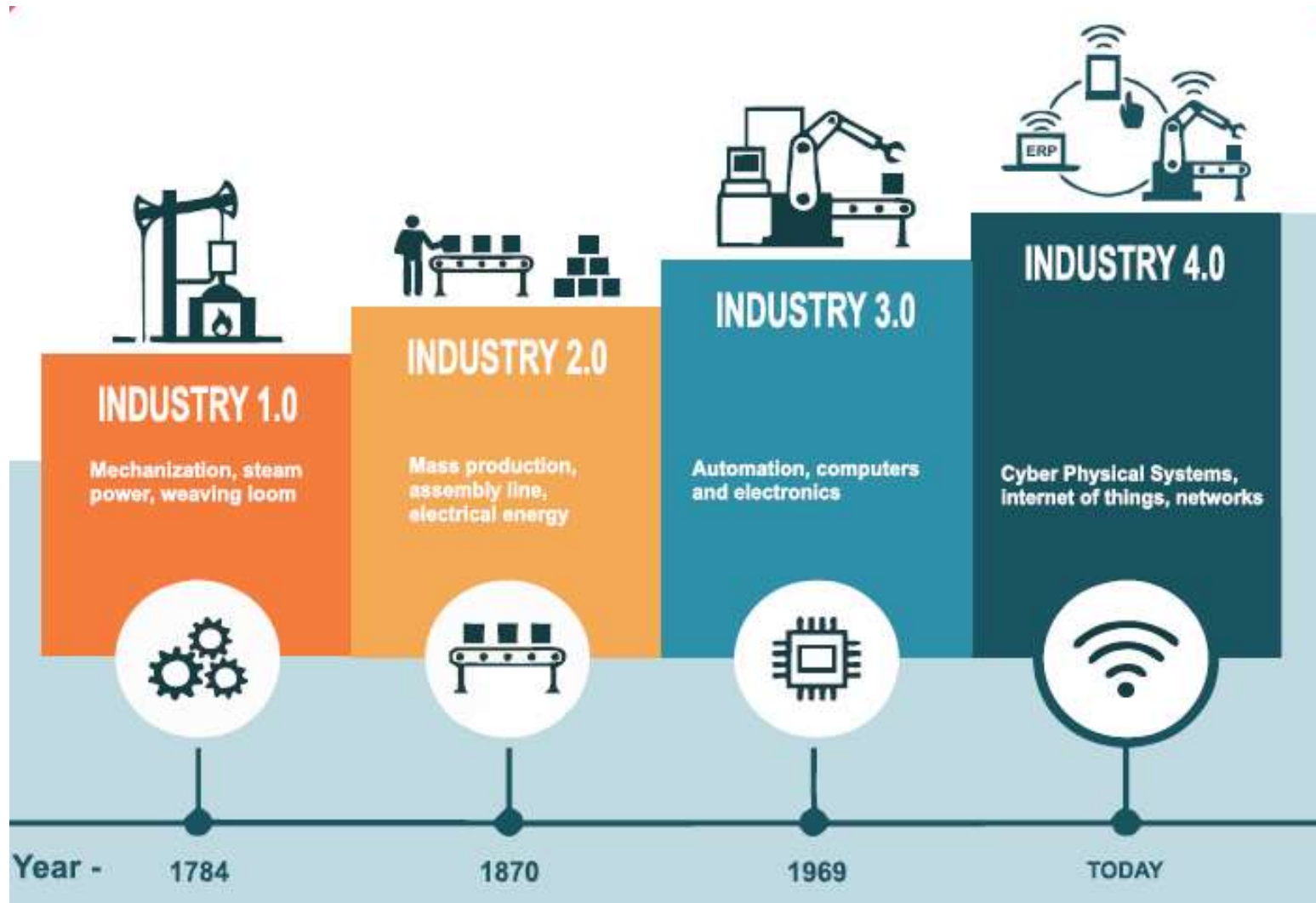




# Textile 4.0



What is it and how it is applicable to textile industry globally



# Performance Enhancement



- **Nano - Technology**
- **Bio – Technology**
- **Information – Technology**

Converging these technologies in a textile material to develop

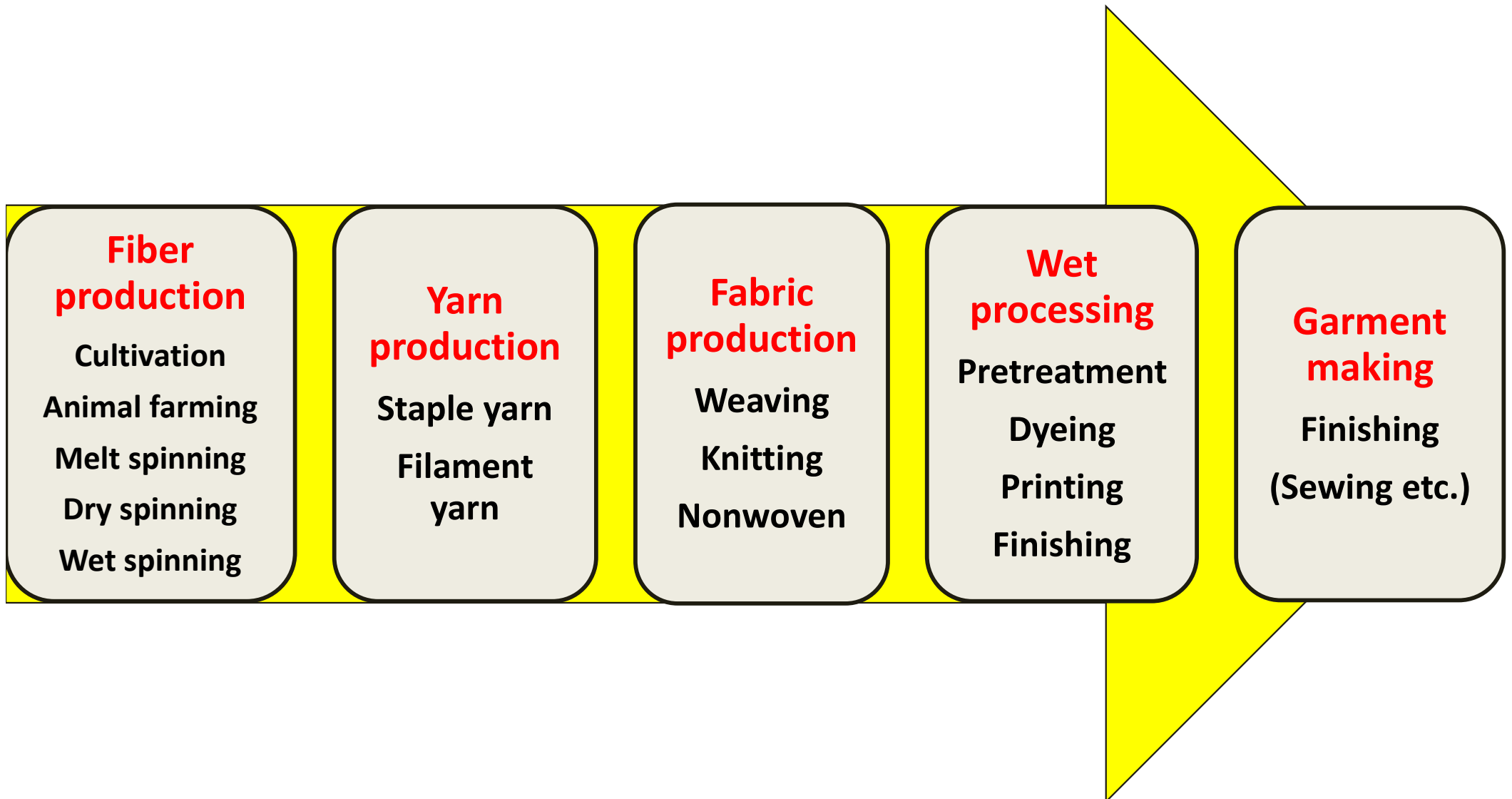
- Smart components
- Specialty effects
- Synergistic improvement
- Engineered marvel



# Technical Textile



# TEXTILE PRODUCTION FLOWCHART



# Forms of Textile Processing



- **Fiber - loose stock, tops**



- **Yarn - hank, package, beam**



- **Fabric - woven, knit, terry towel**



- **Made up - garment**



# Popular blends



**Polyester + Cotton**

**Polyester +  
Viscose**

**Polyester + Wool**

**Nylon + Viscose**

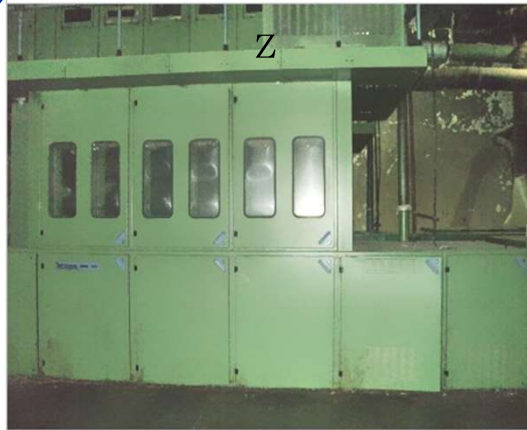
**Acrylic + Cotton**

**Blends with  
Lycra**

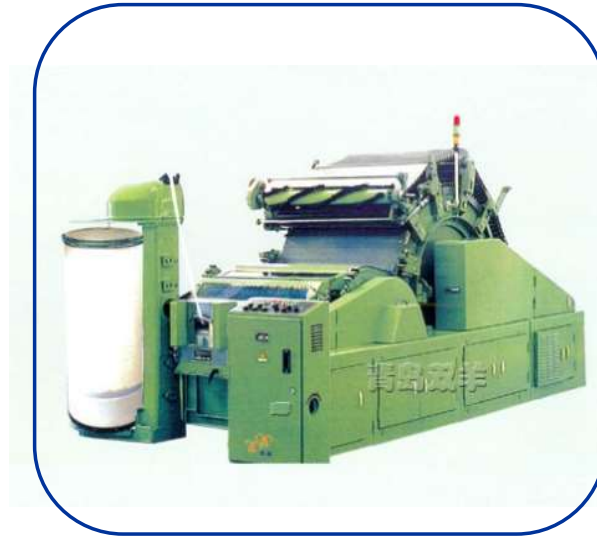
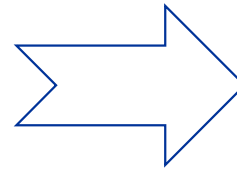


# Textile Manufacturing - Overview

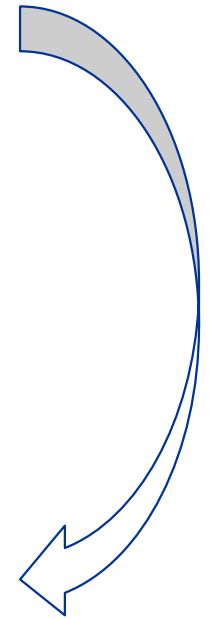
(Cotton: Yarn Manufacturing)



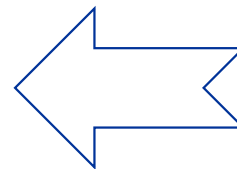
**Blow room**



**Carding**



**Spinning**



**Drawing**

# Textile Processing - Overview

(Cotton: Yarn dyed woven fabric)



Inspection of  
Grey yarn  
packages

Scouring |  
Bleaching

Package  
dyeing

Winding &  
Rewinding



Weaving

Sizing

Warping |  
Beaming

Singeing &  
Desizing

Mercerisation |  
Mild Bleaching

Chemical  
finish

Garment  
preparation

Sanforising

Calendering



# Dyestuffs & Substrates



<b>Class of Dyestuff</b>	<b>Principal Substrates</b>
<b>Vat</b>	<b>Cellulosic fibre (Cotton   Rayon   Linen)</b>
<b>Sulphur</b>	<b>Cellulosic fibre (Cotton   Rayon)</b>
<b>Reactive</b>	<b>Cotton   Rayon   Linen   Wool   Silk</b>
<b>Disperse</b>	<b>Polyester   Nylon   Cellulose Acetate   Acrylic   Plastics</b>
<b>Direct</b>	<b>Cellulosic fibre (Cotton   Rayon   Linen)   Paper   Leather</b>
<b>Acid</b>	<b>Nylon   Wool   Silk   Paper   Leather   Inks</b>
<b>Basic</b>	<b>Acrylic   Cationic Dyeable Polyester   Modified Nylon</b>
<b>Azoic</b>	<b>Cotton   Rayon   Cellulose acetate</b>

# PRINTING

- Special Styles of Printing



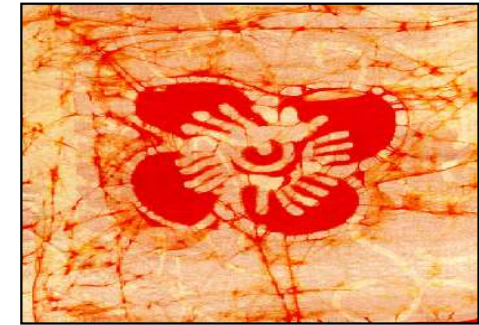
***Crimp/Crepon***



***Carbonized/Burnt-out***



***Brasso***



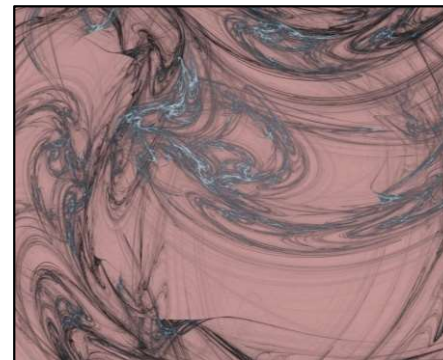
***Batik***



***Damask effect***



***Kalamkari***



***Marble effect***



***Tie & Dye***



# Methods of Printing



- **Direct**
- **Discharge**
- **Resist**
- **Camouflage**
- **Transfer**
- **Inkjet**



# Value Addition



## Fashion

Design, Print, Colour,  
Fit, Accessories

## Skincare

Aloe vera, Vitamins,  
Aromatherapy,  
Anti allergy, Medicinal

## Comfort

Comfort, Skin  
friendly, Breathable,  
Moisture transport,  
Stretch

## Sustainability

Eco-friendly  
Non toxic  
chemicals



## Protection/Safety

UV absorbent,  
Anti allergy, Protection  
from wind, cold and  
adverse weather  
conditions

## Freshness & Hygiene

Fragrance, Anti-  
odour,  
Antimicrobial

## Special Finishes

Mosquito/ Insect  
repellent, Antistatic,  
Soil repellent

## Strength

Fabric  
construction,  
Dimension stability

# Perceptive & Protective



- **Eye** - Color enhancement
  - **Ear** - Rustling/scrooping sound
  - **Nose** - Aroma/fragrance, feel good factor
  - **Skin** - Feel & Comfort wear
  - **Taste** - Baby wear, bitter/sour
- **Skin care** –anti-ageing/rejuvenating
  - **Health care** –antimicrobial
  - **Fire protective** – flame retardant
  - **Sun protection** – UV absorbers
  - **Soil free** - antistatic
  - **Stain free**- oil & water repellent
  - **Quick dry** - moisture management

# Fastness properties



## Popular Test methods:

- **ISO** International Organisation for Standardisation
- **AATCC** American Association of Textile Chemists and Colorists
- **M&S** Marks & Spencer



**Wash  
Fastness tester**



**Perspiration | Water  
Fastness tester**



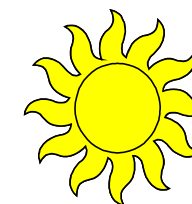
**Rub  
Fastness tester**



**Sublimation  
Fastness tester**



**Light  
Fastness tester**



# Sustainability - Challenges

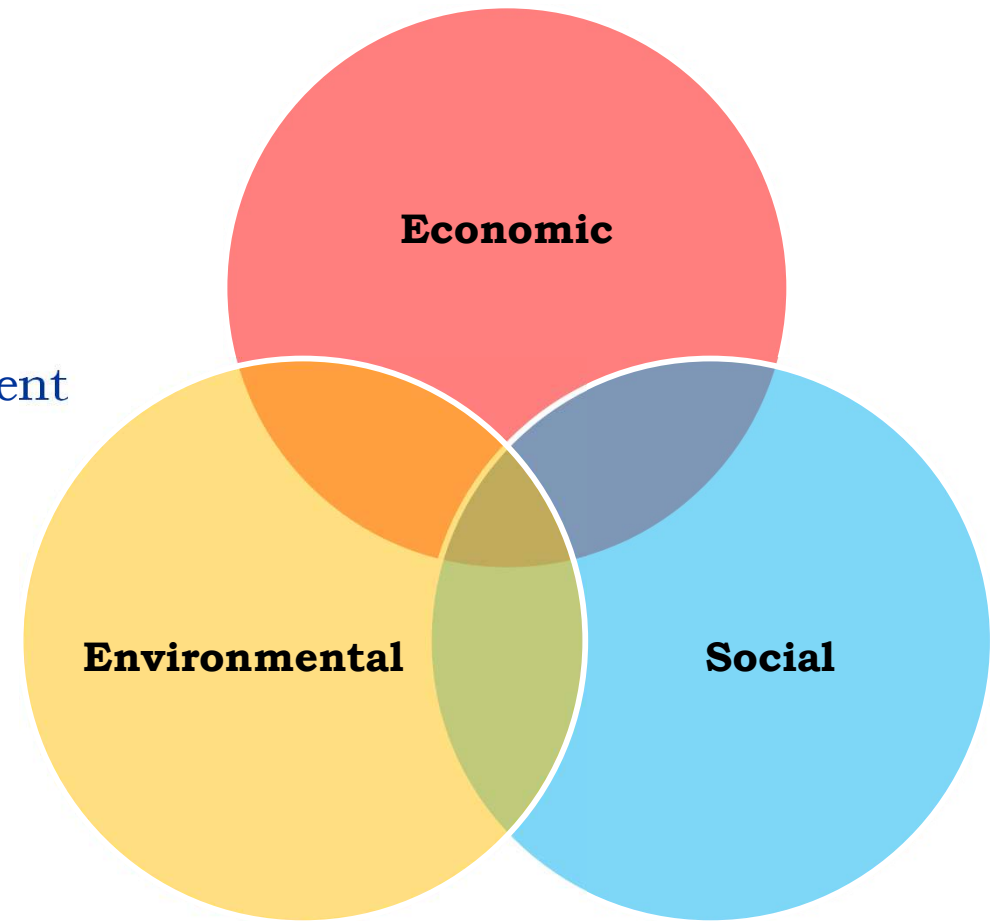


## Synthetic fibres

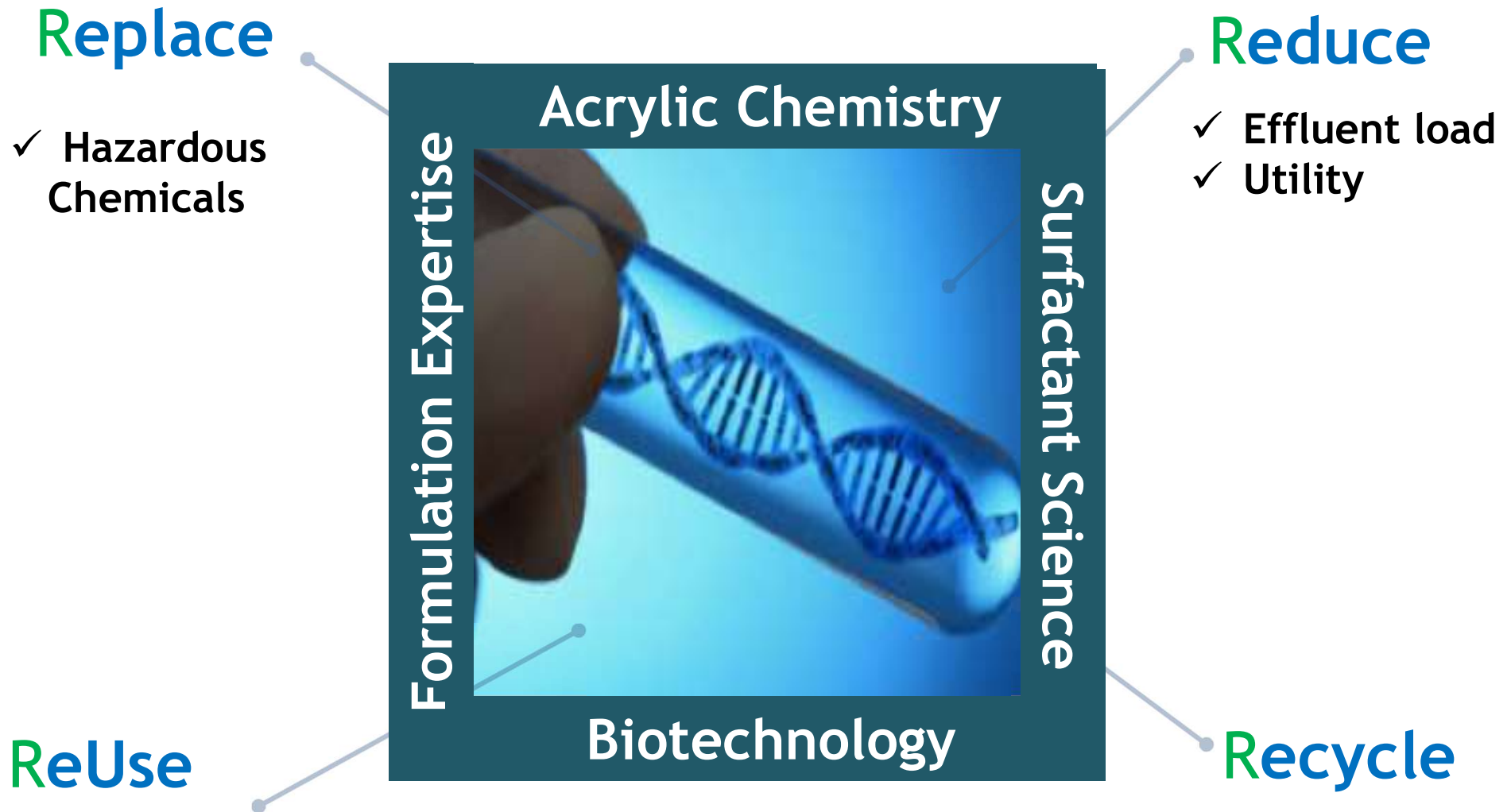
- ❖ Non bio-degradable
- ❖ Higher carbon footprint

## Natural fibres

- ❖ High water footprint
- ❖ Heavily pesticides dependent



# Circularity



‘Disposable’ products are Unsustainable

# Opportunities & Prospects



- **Farming** – Organic, sericulture, rearing
- **Manufacturing** -Fibre production Nylon, PES, Rayon,
- **Engineering** – Spinning, Weaving, Knitting, Garmenting
- **Machinery** – Preparatory, Colouration, Finishing
- **Processing** - Apparels, home furnishing, technical textiles
- **Instruments** - Computer color matching and lab equipments
- **Fashion** - Designing, garmenting
- **Merchandising** – Retail and Brands
- **Laboratory** - Academy | Independent testing | R & D | QC labs | IP
- **Government** - Textile Ministry departments, Pollution control board
- **Marketing** - Dyes, chemicals, machinery and accessories

**Multi-Disciplinary Minor (MDM) Degree  
in  
Mechanical Engineering**

**Under the National Education Policy-NEP 2020 in  
(2023-2024)**



**Offered by**

**DEPARTMENT OF GENERAL ENGINEERING**

**INSTITUTE OF CHEMICAL TECHNOLOGY**

**(University Under Section-3 of UGC Act, 1956) Elite Status and**

**Center for Excellence Government of Maharashtra**



## Preamble:

The mechanical engineering minor is tailored to students who want to understand the fundamentals of mechanical engineering other than courses covered in engineering sciences. The students will develop abilities in design, analysis and experimentation through foundation of math, physics, chemistry including modelling, energy engineering, mechanics of materials, product design and hydraulics.

The students can combine the skills and technological expertise of this minor with a major in technology of aligned branch and chemical engineering to prepare for a wide variety of opportunities in industrial fields and in demand careers.

## Programme Specific Outcomes of MDM:

<b>PSO1</b>	Use of Mechanical engineering knowledge in the design of chemical process equipment's, energy conservation systems.
<b>PSO2</b>	To provide specialized aspects of mechanical engineering to enhance their skill set and capabilities within their discipline specific field.
<b>PSO3</b>	To expand the working knowledge of Mechanical engineering principles to broader engineering activities.

# Details of Programs offered by the department



## Master of Engineering (Plastic Engineering) : Programme started in 1972

Sr. No.	PG Program Name	Corresponding UG Program/Department Name	Current Year Sanctioned Intake
1	M.E. (Plastic Engineering)	N.A.	18

Ph.D.

- Plastic Engineering
- Mechanical Engineering
- Civil Engineering
- Electrical Engineering
- Electronics Engineering



Department of General Engineering (M.E. Plastic Engineering) : ICT Mumbai : October 2729, 2023

## Faculties in the Department:

Name of Faculty	Specialization / Research Area
Prof. D. D. Sarode	Concrete Technology – Performance Enhancing Construction Chemicals Plasticizers, Superplasticizers, VMA. Risk Analysis and its mitigation. Recycling of wastes. Recycling of agricultural waste and improving soil fertility
Prof. S.P. Deshmukh	Polymeric Composites, Engineering Materials, Plastic Processing, Design of Molds, Analysis of Plastic component using CAD, CAE tools. Solar Hybrid Energy,

	Refrigeration Air Conditioning, Heat Transfer through the microchannel.
<b>Prof. V. R. Gaval</b>	Particulate filled polymer composites, conversion of Metal parts into plastic using design software's, Tribology, Mold flow analysis
<b>Dr. R.S.N. Sahai</b>	Polymer Composites, Nanocomposites and its applications in Mechanical Engineering, Mould design, Energy Engineering.
<b>Dr. Prerna Goswami</b>	Sustainable Energy, MATLAB simulations, Electrical Engineering
<b>Dr. Sachin G. Solanke</b>	Materials engineering, Composite materials, Tribology, Plasma coating, Load bearing biomaterials and Electrospinning
<b>Dr. V. S. Korpale</b>	Plastic products design and analysis, computational fluid dynamics, Equipment design and analysis, powder-flow equipment designs.
<b>Dr. D. Biswas</b>	Renewable energy, Solar Thermal, Heat Exchanger, Heat Transfer, Polymer composites

# Laboratories Facility:

## Plastic Processing and Testing laboratory:

### The laboratories of the department



GEP 2104 Plastic Processing and Testing laboratory:

Sr. No.	Name of experiments/ syllabus	Equipment
1	Extrusion of various polymer	Twin-screw extruder
2	Preparation of polymer composites	Twin-screw extruder
3	Compression molding	Compression Moulding machine
4	Injection molding	Injection Moulding machine
6	Preparation of composite samples and plastic components	3D printer
7	Impact test to find out impact strength of the polymer	Izod impact testing machine
8	To find the melt flow index of various polymers	Melt flow index apparatus
9	Measurement of heat deflection temperature	Heat Deflection temperature tester
10	Measurement of Hardness	Shore Hardness Tester
11	Determination of Tensile Strength and percentage elongation	Universal Testing Machine



Rotational Molding



Blow Molding



Injection Molding



Twin Screw Extruder



Mixer



Compression Molding

Department of General Engineering (M.E. Plastic Engineering) : ICT Mumbai : October 2729, 2023

## Plastic Testing laboratory:



Testing Lab



Impact Tester



Compression testing machine



HDT Tester & Melt Flow Index Tester



Universal Testing machine



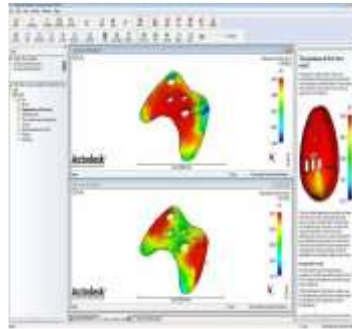
Shore Hardness tester

Department of General Engineering (M.E. Plastic Engineering) : ICT Mumbai : October 2729, 2023

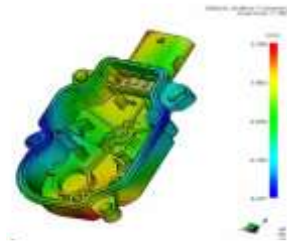
## CAD/CAM/CAE Laboratory

GET 2110 Design of molds and CAD/CAM/CAE laboratory:

Sr. No.	Name of experiments/syllabus	Equipment/lab
1	Design and draw compression molds for plastic products	Drawing hall
2	Design and draw transfer molds for plastic products	Drawing hall
3	Design and draw Injection molds for plastic products	Drawing hall
4	Understand the basic principles of design of extrusion dies	Drawing hall
5	Make solid models of plastic and mechanical components	CAD/CAM lab
6	Design various molds and dies using computer-aided design	CAD/CAM lab
7	Understand the basics of the computer-aided manufacturing program	CAD/CAM lab
8	Analyze variation in pressure, temperature and time graph using Computer Aided program	CAD/CAM lab



CAD/CAM/CAE lab



Department of General Engineering (M.E. Plastic Engineering) : ICT Mumbai : October 2729, 2023

## Research Facilities

Sr. No.	Name of Facility	Specialized Equipment Name	Equipment details
1.	3D Printing	3D Printer	3D Prototype Printer, FDM/ FFF Wanhao Duplicator-6 Plus; DLP Resin Wanhao Duplicator-7
2.	Optimization Software	Optimization Software	Statistical Module
3.	Altair HyperWorks CAE	Altair HyperWorks CAE	125 Units Research Bundle with Unlimited Nodes
4.	Workstation Computer	Workstation Computer	Intel i7-8 <sup>th</sup> Gen, 16GB RAM, 250GB SSD, 1TB HDD, 2GB Graphics, Win10
5.	Minitab 18	Minitab 18	Statistical Module
6.	NX-Unigraphics	NX-Unigraphics	CAD CAM software by SIEMENS for CAD Design, NX Tooling, Mold wizard
7.	Moldex3D	Moldex3D	Mold Design Software, Educational Perpetuity: Professional – Generic Solution/ Project/ Designer/ Designer BLM/ MDE/ MFE/ Flow/ Pack/ Cool/ Warp/ 3D Coolant CFD

## A. Structure of the MDM course:

Subject Code	Semester	Subject	Credits	Hrs./Week			Marks for various Exams			
				L	T	P	CA	MS	ES	Total
GEP1132	III	Workshop Practice	2	0	0	4	50	-	50	100
GET1133	IV	Advanced strength of Materials	2	1	1	0	20	30	50	100
GET1134	V	Energy Engineering & Management	4	3	1	0	20	30	50	100
GET1135	VI	Mechanical design of chemical process equipment's.	2	1	1	0	20	30	50	100
GET1136	VII	Industrial Hydraulics	2	1	1	0	20	30	50	100
GET1137	VIII	Product Design and Development	2	1	1	0	20	30	50	100
		<b>Total</b>	14							600

**B. Intake:** Minimum 15 and maximum 35 students

**C. Duration:** 3 years (6 semesters)

**D. Eligibility criteria:** Students enrolled in B. Chem. Engg and B. Tech programme are eligible. The allotment of minor degree programme will be as per the policy of the Institute.

**E. Pedagogy/Teaching Method:**

Lecture/Discussions: These sessions will discuss the subject matters of the course.

Experiential Learning: The sessions will involve hands-on training.

Tutorials: Problem solving / case studies / relevant real-life applications / student presentations / home assignments / individual or group projects.

## F. Method of Evaluation/Delivery

Subject Code	Semester	Course	Method of Evaluation	Methods of Delivery
GEP 1132	III	Workshop Practice	a) Continuous internal Evaluation on assigned Job. b) Skill based end exam.	a) Hands on Training
GET 1133	IV	Advanced strength of Materials	a) Minimum 2 class tests b) Assignments c) Seminar/ Presentation d) Report submission	a) Lectures/Face to face training b) Tutorials c) Case study d) Presentation (PPT) e) Group Projects

GET 1134	V	Energy Engineering & Management	a) Minimum two class test b) Assignments c) Seminar/ Presentation d) Report submission	a) Lectures/Face to face training b) Tutorials c) Case study d) Presentation (PPT) e) Group Projects
GET 1135	VI	Mechanical design of chemical process equipment's.	a) Minimum two class tests b) Assignments c) Seminar/ Presentation d) Report submission	a) Lectures/Face to face training b) Tutorials c) Case study d) Presentation (PPT) e) Group Projects
GET 1136	VII	Industrial Hydraulics	a) Minimum two class test b) Assignments c) Seminar/ Presentation d) Report submission	a) Lectures/Face to face training b) Tutorials c) Case study d) Presentation (PPT) e) Group Projects
GET 1137	VIII	Product Design and Development	a) Minimum two class tests b) Assignments c) Seminar/ Presentation d) Report submission	a) Lectures/Face to face training b) Tutorials c) Case study d) Presentation (PPT) e) Group Projects

**G. Faculty/Instructor for the course**

Subject Code	Semester	Course	Instructor/Faculty
GEP 1132	III	Workshop Practice	Dr. Sachin Solanke
GET 1133	IV	Advanced strength of Materials	Prof. Dilip Sarode
GET 1134	V	Energy Engineering & Management	Dr. D. Biswas
GET 1135	VI	Mechanical design of chemical process equipment's.	Prof. Suresh Deshmukh/Prof V. R. Gaval
GET 1136	VII	Industrial Hydraulics	Prof. R.S.N. Sahai
GET 1137	VIII	Product Design and Development	Dr Vikram Korpale

## H. Detailed syllabus:

	Course Code: <b>GEP 1132</b>	Course Title: <b>Workshop Practice</b>	Credits = 2		
			L	T	P
	Semester: III	Total contact hours: 60	0	0	4
<b>List of Prerequisite Courses</b>					
	Engineering Graphics				
<b>List of Courses where this course will be prerequisite</b>					
	Equipment Design and Drawing, Design and fabrication of Molds				
<b>Course Contents (Topics and subtopics)</b>					<b>Reqd. hours</b>
1	Introduction to various Production Processes				5
2	Study of Construction, Mechanism and Application of Lathe Machines, Drilling Machine, Milling etc.				16
3	One composite job using a minimum of four Machining operations such as plane turning, taper turning, external threading and knurling etc. with its process sheet.				16
4	Classification of various Joining and metal forming processes and their applicability such as adhesive bonding, mechanical fastening, welding, and allied processes.				10
5	Industrial visit to Chemical process equipment fabricators demonstrating use of forming, bending, rolling, and welding processes.				8
6	Basics of CNC Machines and 3D Printing technology.				5
<b>List of Textbooks/ Reference Books</b>					
1	Mechanical Workshop Practice by K C John, PHI Learning 1. Workshop Technology Vol. 1 and 2 by Raghuvanshi B. S. Dhanpat Rai & Sons, 1998.				
2	Workshop Technology by Chapman W.A. J and Arnold E. Viva low priced, student edition, 1998.				
3	Workshop Practices, H S Bawa, Tata McGraw-Hill, 2009.				
4	Workshop Practices and Materials, B J Black, CRC Press.				
5	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Media promoters and publishers private limited, Mumbai, Vol. I 2008 and Vol. II 2010.				
<b>Course Outcomes (students will be able to....)</b>					
CO1	Understand different operations performed using Lathe, drilling, and milling machine				K2
CO2	Apply knowledge of lathe operations to fabricate engineering part				K3
CO3	Justify the choice between joining and forming process for a suitable application.				K4
CO4	Understand fabrication methods such as forming, bending, rolling and CNC machines				K2

<b>Mapping of Course Outcomes (COs) with Programme Outcomes (PSOs)</b>			
	PSO1	PSO2	PSO3
CO1	1	3	3
CO2	1	3	2
CO3	3	2	1
CO4	3	2	2



	Course Code: <b>GET 1133</b>	Course Title: <b>Advanced Strength of Materials</b>	Credits = 2		
			L	T	P
	Semester: <b>IV</b>	Total contact hours: <b>30</b>	1	1	0
<b>List of Prerequisite Courses</b>					
	Structural Mechanics, Basic Mechanical Engineering, Applied Mathematics				
<b>List of Courses where this course will be prerequisite</b>					
	Equipment design and drawing, Design and fabrication of molds, Home paper				
	<b>Course Contents (Topics and subtopics)</b>				<b>Reqd hour</b>
1	Thick and Thin cylinders - concept of radial, longitudinal stresses, behavior of thin cylinders. Problems on thin cylindrical and spherical shells. Behavior of thick cylinders (theory only).				3
2	Torsion of a circular shaft - concept, basic derivation, shear stress distribution, simple problem.				3
3	Short and Long columns (Struts) - Basic concept, crippling load, end conditions. Euler's and Rankine's approach (without derivations)				3
4	Advance stresses and strains – Representation of stress and strain at a point, Stress strain 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.				6
5	Basics of Engineering Design - Steps in the engineering design, Importance of analysis, 1-D, 2-D and 3-D analysis and interpretation of results. Force displacement relationship, Strain deformation relationship, Introduction to finite element Analysis. Computer aided analysis and design.				5
6	Different types of loads, load factor, factor of safety, Design philosophies, Working stress approach, Ultimate stress approach and Limit state theory. Performance based design Approach.				2
7	Natural Materials, Manmade materials, Alloys, Composite Materials – Types of composite materials, Cement and its varieties, cement composites, properties, recycling of waste, Sustainable materials				4
8	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.				3
9	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				4
<b>List of Textbooks/ Reference Books</b>					
	<ol style="list-style-type: none"> <li>1. Engineering Materials by Rangwala</li> <li>2. Strength of Materials by Ferdinand Singer and Andrew Pytel, Harper Colins Publishers</li> <li>3. Introduction to Mechanics of Solids by Egor Popov, Prentice Hall of India Pvt. Ltd Strength of Materials by S. Timoshenko and D. H. Young, McGraw Hill Publications.</li> <li>4. Concrete Technology by A. M. Neville, Pearson Education ltd</li> <li>5. Concrete Technology – Theory and Practice by M. S. Shetty, S. Chand &amp; Co.</li> </ol>				

	6. Fundamental of Fibre reinforced composite materials by A. R. Busell and J. Renard, 7. Taylor & Corrosion and Corrosion Protection Handbook by Philip A. Schweitzer, CRC press	
--	---	--

<b>Course Outcomes (students will be able to....)</b>		
CO1	Understand stresses induced in thin cylinders, shafts and columns.	K2
CO2	Apply knowledge of equilibrium for analysis of complex stress situations.	K3
CO3	Analyse different complex problems in engineering design.	K3
CO4	Understand Force displacement relationship, Strain deformation relationship.	K2
CO5	Apply knowledge of materials for various engineering applications.	K3

<b>Mapping of Course Outcomes (COs) with Programme Outcomes (PSOs)</b>			
	PSO1	PSO2	PSO3
CO1	3	1	2
CO2	3	1	2
CO3	3	2	2
CO4	1	1	2
CO5	2	2	2

3-Strong Contribution; 2-Moderate Contribution; 1-Low Contribution

	<b>Course Code: GET 1134</b>	<b>Course Title: Energy Engineering and Management</b>	<b>Credits = 4</b>		
			<b>L</b>	<b>T</b>	<b>P</b>
	<b>Semester: V</b>	<b>Total contact hours: 60</b>	<b>3</b>	<b>1</b>	<b>0</b>
<b>List of Prerequisite Courses</b>					
	Elements of Mechanical Engineering, Basic Mechanical Engineering, Applied Mathematics				
<b>List of Courses where this course will be prerequisite</b>					
	Heat Transfer Equipment design, Chemical Project Economics, Chemical Industrial Management				
	<b>Course Contents (Topics and subtopics)</b>				<b>Reqd. hours</b>
1.	<b>Energy Scenario:</b> <ul style="list-style-type: none"> <li>Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security</li> <li>Energy Conservation and its Importance, Features of Energy Conservation Act-2001,</li> <li>Basics of Energy and its various forms, Material and Energy balance.</li> </ul>				06
2.	<b>Energy Audit Principles:</b> <ul style="list-style-type: none"> <li>Definition, Energy audit- need, Types of energy audit, Energy audit and management, approach-understanding energy costs, Bench marking, Energy performance, maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution.</li> <li>Elements of monitoring &amp; targeting: Energy audit Instruments; Data and information-analysis.</li> <li>Financial analysis techniques: Simple payback period, NPV.</li> </ul>				16
3.	<b>Energy Management and Energy Conservation in Electrical Systems</b> <ul style="list-style-type: none"> <li>Electricity billing, Electrical load management and maximum demand Control, Energy efficient equipment and appliances, star ratings.</li> </ul> <b>Energy efficiency measures in lighting system, Lighting control</b> <ul style="list-style-type: none"> <li>Occupancy sensors, daylight integration, and use of intelligent controllers, Energy conservation opportunities in water pumps, industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.</li> </ul>				16
4.	<b>Energy Management and Conservation in Thermal Systems</b> <ul style="list-style-type: none"> <li>Steam Power Plant: Rankine cycle, Reheat cycle, Regenerative cycle.</li> <li>Boilers and furnaces: Classification, Study of various Boilers such as Babcock &amp; Wilcox Boiler, Cochran Boiler, La-Mount Boiler, Benson Boiler, Boiler Mountings and Accessories, Boiler Performance</li> <li>Steam Turbine: Classification, Calculation of Power Developed by Steam Turbine, Compounding of Steam Turbine</li> <li>Elements of Steam condenser, various types of steam condenser, Condenser Efficiency</li> <li>Waste heat recovery, use of insulation- types and application.</li> </ul>				16
5.	<b>Non-Conventional Energy Sources:</b> <ul style="list-style-type: none"> <li>Role and importance of non-conventional and alternate energy sources such as solar thermal, solar Photo-voltaic, Cooling techniques to cool Photovoltaic cells, wind, ocean, bio-mass and geothermal.</li> </ul>				06
<b>List of Textbooks/ Reference Books</b>					

	<ol style="list-style-type: none"> <li>1. Handbook of Electrical Installation Practice, Geofry Stokes, Blackwell Science</li> <li>2. Designing with light: Lighting Handbook, By Anil Valia, Lighting System</li> <li>3. Energy Management Handbook, By W.C. Turner, John Wiley and Sons</li> <li>4. Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata Energy Research Institute (TERI).</li> <li>5. Energy Management Principles, C. B. Smith, Pergamon Press</li> <li>6. Energy Conservation Guidebook, Dale R. Patrick, S. Fardo, Ray E. Richardson, Fairmont Press</li> <li>7. Handbook of Energy Audits, Albert Thumann, W. J. Younger, T. Niehus, CRC Press</li> <li>8. Thermodynamics by P.K. Nag</li> <li>9. Power plant by Morse</li> <li>10. Heat Engines by P.L. Balani</li> <li>11. Renewable Energy resources by Tiwari and ghosal, Narosa publication.</li> <li>12. Non-conventional energy sources, Khanna publications</li> </ol>	
<b>Course Outcomes (students will be able to ....)</b>		
CO1	To identify and describe the present state of energy security and its importance.	K2
CO2	To identify and describe the basic principles and methodologies adopted in energy audit.	K3
CO3	To describe the energy performance evaluation of electrical and thermal installations and identify the energy saving opportunities.	K3
CO4	To analyse the data collected during performance evaluation and recommend energy saving measures.	K4
CO5	Discuss the steam formation process, working of steam boilers, mountings, and accessories and their properties.	K2
CO6	Explain the need for and importance of various renewable energy sources.	K2
CO7	Employ this knowledge for energy saving in various devices.	K3

<b>Mapping of Course Outcomes (COs) with Programme Outcomes (PSOs)</b>			
	PSO1	PSO2	PSO3
CO1	3	1	2
CO2	3	1	2
CO3	3	1	2
CO4	3	1	1
CO5	1	1	2
CO6	3	1	1
CO7	3	1	2

3-Strong Contribution; 2-Moderate Contribution; 1-Low Contribution

	<b>Course Code:</b> <b>GET 1135</b>	<b>Course Title: Mechanical Design of Chemical Process equipment</b>	<b>Credits = 2</b>		
			<b>L</b>	<b>T</b>	<b>P</b>
	<b>Semester: VI</b>	<b>Total contact hours: 30</b>	<b>1</b>	<b>1</b>	<b>0</b>
<b>List of Prerequisite Courses</b>					
	Structural Mechanics, Basic Mechanical Engineering, Advanced Strength of Materials, Engineering Graphics				
<b>List of Courses where this course will be prerequisite</b>					
	Chemical Process Equipment Design and drawing, Home paper, Internship/ On Job Training Project				
	<b>Course Contents (Topics and subtopics)</b>				<b>Reqd. hour</b>
1	Introduction to Basic Design concepts				2
2	Design of Pressure Vessel Introduction to Pressure vessels used in process Industries. Design consideration for pressure vessels Design criteria, Design stresses, factor of Safety, Types of stresses on Vessels Vessels operating at Elevated and low temperatures. Cyclic loading and consideration for corrosion for design Design of vessel Shell for Internal pressure, combined loading and for external stresses, Use of reinforcement rings for shells Design of various types of head or cover Design and types of Nozzles, Design and types of Flange Joints for shell and nozzles Various types of supports for pressure vessels				16
3	Design of Storage Vessel, Types and uses of storage Vessels used for storing various fluids and gases. Loss mechanism in storage vessels. Design of Rectangular tank Design of Vessel shell, Design of bottom Plate Wind girders, roof top angle curbs, Design of self-supporting tank roof Use of support columns for roof				12
<b>List of Textbooks/ Reference Books</b>					
	1. Process Equipment Design by, V. V. Mahajani 2. Equipment Design by Dawande 3. Equipment Design by Young 4. Welding Technology by O. P. Khanna				
<b>Course Outcomes (students will be able to...)</b>					
CO1	Understand Basic Design concepts.				K2
CO2	Design of Pressure Vessel and Storage Vessel				K4
CO3	Design with real time data				K5

<b>Mapping of Course Outcomes (COs) with Programme Outcomes (PSOs)</b>			
	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	2	1
CO3	3	2	1

3-Strong Contribution; 2-Moderate Contribution; 1-Low Contribution

	<b>Course Code: GET 1136</b>	<b>Course Title: Industrial Hydraulics</b>	<b>Credits = 2</b>		
			<b>L</b>	<b>T</b>	<b>P</b>
	<b>Semester: VII</b>	<b>Total contact hours: 30</b>	<b>1</b>	<b>1</b>	<b>0</b>
<b>List of Prerequisite Courses</b>					
	Applied Physics, Basic Mechanical Engineering,				
<b>List of Courses where this course will be prerequisite</b>					
	Instrumentation and process control, Home Paper				
	<b>Course Contents (Topics and subtopics)</b>				<b>Reqd. hours</b>
1.	<b>Introduction to Hydraulics:</b> Basics of hydraulics, Pascal law, Advantages of Hydraulic drives, Quality requirement of hydraulic fluids and its requirements, Standard symbols for hydraulic lines, pumps, valves, motors, Check valves, its functions, various types and its applications, Directional control valve, two way and four way, Two positions and three positions direction valve, Rotary valve				8
2.	<b>Valves:</b> Pilot operated check valve, working and its applications, Flow control valve, its functions, various types and its applications, Pressure compensated flow control valve, Relief valve, simple and compound, Balanced Piston relief valve, Sequence valve and its applications. Study of various types of filters.				9
3.	<b>Pumps and Hydraulic motors:</b> Pumps, Gear pumps, vane pumps, Positive displacement axial piston pump, Pressure intensifier, Accumulator, Hydraulic motors				5
4.	<b>Hydraulic circuits:</b> Study of various Hydraulic circuit used in industry; Study of various Hydraulic circuit used in Polymer processing				4
5.	<b>Pneumatic systems &amp; components:</b> Compressor, Receiver / Reservoir Tank, Starting Unloader & Controller, Filters, Regulators / Valves, Lubricators, Mufflers / Silencer, After Cooler, Air Dryers, and Indicators (Pressure, Temperature etc.)				4
<b>List of Textbooks/ Reference Books</b>					
	1. Hydraulics by Vickers 2. Esposito A, Fluid Power with application, Prentice Hal 3. Majumdar S.R, Oil Hydraulic system- Principle and maintenance, Tata McGraw Hill 4. Majumdar S.R, Pneumatics Systems Principles and Maintenance, Tata McGraw Hill 5. Stewart H. L, Hydraulics and Pneumatics, Taraporewala Publications				
<b>Course Outcomes (students will be able to....)</b>					
CO1	Understand basics of hydraulics.				K2
CO2	Analyse applications of valves in hydraulics.				K5
CO3	Applications of pumps in hydraulics.				K3
CO4	Design hydraulic circuits for industrial applications.				K6
CO5	Applications of pneumatics in industry.				K3

<b>Mapping of Course Outcomes (COs) with Programme Outcomes (PSOs)</b>			
	PSO1	PSO2	PSO3
CO1	1	2	2
CO2	1	2	2
CO3	2	2	1
CO4	1	1	1
CO5	3	2	1

3-Strong Contribution; 2-Moderate Contribution; 1-Low Contribution

<b>Course Code:</b> <b>GET 1137</b>	<b>Course Title: Product Design and development</b>	<b>Credits = 2</b>		
		<b>L</b>	<b>T</b>	<b>P</b>
<b>Semester: VIII</b>	<b>Total contact hours: 30</b>	<b>1</b>	<b>1</b>	<b>-</b>
<b>List of Prerequisite Courses</b>				
	Engineering Graphics, Structural Mechanics, Elements of Mechanical Engineering, Materials Engineering			
<b>List of Courses where this course will be prerequisite</b>				
	Internship/ On Job Training Project			
	<b>Course Contents (Topics and subtopics)</b>			<b>Reqd. hours</b>
1	<b>Basics of Design:</b> Design definitions and attributes, Product configurations and component matrix, Understanding and analysing product contexts, Modularity, and design of modular systems, understanding design situations-parallel and future			08
2	<b>Product design aspects:</b> Design issues, Selection of materials and technical requirements, Dimensional accuracy and functional requirements, Surface finish, Making a product specification etc.			04
3	<b>General Design features:</b> Effect of wall thickness, corner radius, drafts, shrinkage, and warpage, inserts and parting lines. Design of ribs, bosses, threads etc., Cost economics.			06
4	<b>Design thinking:</b> Steps in design thinking, relevance of design thinking with product development			06
5	<b>Product design procedures:</b> Product design of engineering load bearing components such as gears, bearings, filament wound storage tanks, pipes etc.			06
<b>List of Textbooks/ Reference Books</b>				
1.	Plastic product design handbook by Edward Miller			
2.	Product design and development by Karl T. Ulrich			
3.	Change by Design by Tim Brown			
<b>Course Outcomes (students will be able to...)</b>				
CO1	Understand the product design and development procedure			K2
CO2	Apply the product design concepts to prepare industrial product			K3
CO3	Analyse basics of plastic product design			K4
CO4	Design engineering plastic products based on technical requirements			K6

<b>Mapping of Course Outcomes (COs) with Programme Outcomes (PSOs)</b>			
	PSO1	PSO2	PSO3
CO1	1	1	2
CO2	3	2	1
CO3	2	1	2
CO4	1	2	3

3-Strong Contribution; 2-Moderate Contribution; 1-Low Contribution