Semester I									
Subject Code	**Subjects**	**Credits**	**Hrs/Week**			**Marks for various Exams**			
			L	**T**	**P**	**C. A.**	**M.S.**	**E. S.**	**Total**
CHT1341	Physical Chemistry-I	3	2	1	0	10	15	25	50
CHT1401	Analytical Chemistry	3	2	1	0	10	15	25	50
MAT1101	Applied Mathematics-I	4	3	1	0	20	30	50	100
PYT1101	Applied Physics-I	4	3	1	0	20	30	50	100
CHP1343	Physical and Analytical Chemistry Laboratory	2	0	0	4	25	-	25	50
GEP1101	Engineering Graphics	4	2	0	6	50	-	50	100
HUP1101	Communication Skills	2	0	0	4	50	-	-	50
	TOTAL:	22	12	4	14	-	-	-	500

Semester II									
Subject Code	**Subjects**	**Credits**	**Hrs/week**			**Marks for various Exams**			
			L	**T**	**P**	**C. A.**	**M.S.**	**E. S.**	**Total**
CHT1342	Physical Chemistry-II	3	2	1	0	10	15	25	50
CHT1132	Organic Chemistry	4	3	1	0	20	30	50	100
CET1507	Process Calculations	4	3	1	0	20	30	50	100
MAT1102	Applied Mathematics-II	4	3	1	0	20	30	50	100
PYT1103	Applied Physics-II	3	2	1	0	10	15	25	50
PYP1101	Physics Laboratory	2	0	0	4	25	-	25	50
CHP1132	Organic Chemistry Laboratory	2	0	0	4	25	-	25	50
	Total	22	13	5	8	-	-	-	500

Syllabus Structure B. Tech. Second Year

Semester III								
Subjects	**Credits**	**Hrs /week**			**Marks for various Exams**			
		L	**T**	**P**	**C. A.**	**M.S.**	**E. S.**	**Total**
TXT1105: Technology of Fibres	4	3	1	0	20	30	50	100
TXT1101: Technology of Yarn & Fabric Formation	4	3	1	0	20	30	50	100
TXT1209: Tech. of Textile Pretreatment	3	2	1	0	10	15	25	50
CHT1133: Chemistry of Colorants and It's Application	4	3	1	0	20	30	50	100
CHT1124: Industrial Inorganic Chemistry	4	3	1	0	20	30	50	100
TXP1002: Pretreatment of Textiles	2	0	0	4	25	-	25	50
MAP1202: Computer Applications Lab	2	0	0	4	25	-	25	50
Total	23	14	5	8	-	-	-	550

Semester IV								
Subjects	**Credits**	**Hrs/week**			**Marks for various Exams**			
		L	**T**	**P**	**C. A.**	**M.S.**	**E. S.**	**Total**
GET1116: Engineering. Mechanics and Strength of Materials	4	3	1	0	20	30	50	100
PYT1202: Colour Physics & Colour Harmony	3	2	1	0	10	15	25	50
CET1105: Transport Phenomena	4	3	1	0	20	30	50	100
GET1105: Basic Electrical Engineering and Electronics	3	2	1	0	10	15	25	50
TXT1210: Technology of Textile Dyeing	4	3	1	0	20	30	50	100
GEP1106:Electrical Engg and Electronics Laboratory	2	0	0	4	25	-	25	50
PYP1203: Colour Physics Lab	2	0	0	4	25	-	25	50
Total	22	13	5	8	-	-	-	500

Syllabus Structure B. Tech. Third Year

Semester V								
Subjects	**Credits**	**Hrs /week**			**Marks for various Exams**			
		L	**T**	**P**	**C. A.**	**M.S.**	**E. S.**	**Total**
CET1401: Chemical Engineering Operations	3	2	1	0	10	15	25	50
CET1212: Chemical Reaction Engineering	3	2	1	0	10	15	25	50
TXT1211: Technology of Finishing	4	3	1	0	20	30	50	100
TXT1212: Technology of Textile Printing	4	3	1	0	20	30	50	100
TXT1802: Environmental Aspects & Advances in Textile Processing	4	3	1	0	20	30	50	100
TXP1004: Experimental Dyeing	4	0	0	8	50	-	50	100
TXP1005: Evaluation of Dyes & Specialty Chemicals	2	0	0	4	25	-	25	50
Total	24	13	5	12	-	-	-	550

Semester VI								
Subjects	**Credits**	**Hrs/week**			**Marks for various Exams**			
		L	**T**	**P**	**C. A.**	**M.S.**	**E. S.**	**Total**
TXT1404: Technology of Garment Manufacturing & Processing	4	3	1	0	20	30	50	100
TXT1213: Theory of Textile Colouration	3	2	1	0	10	15	25	50
HUT 1103: Industrial Psychology and Human Resource Management	3	2	1	0	10	15	25	50
HUT 1104: Industrial Management – I	3	2	1	0	10	15	25	50
TXT1501: Elective – I: High-tech & Industrial Fibres	3	2	1	0	10	15	25	50
TXP1014: Finishing & Evaluation of Textiles	4	0	0	8	50	-	50	100
TXP1015: Analysis of Textile Chemicals and fibres	2	0	0	4	25	-	25	50
TXP1016: Experiments in Printing	2	0	0	4	25	-	25	50
HUT 1106: Environmental Science and Technology	3	2	1					50
Total	27	11	5	16	-	-	-	550

Syllabus Structure B. Tech. Final Year

Semester VII (will be of 10 weeks duration)								
Subjects	**Credits**	**Hrs/week**			**Marks for various Exams**			
		L	**T**	**P**	**C. A.**	**M.S.**	**E.S.**	**Tot al**
CET 1703: Chemical Process Control	3	2	1	0	10	15	25	50
TXT1214: Chemistry, Application & Evaluation of Specialty Chemicals	4	3	1	0	20	30	50	100
TXT1103: Technology of Textile Polymers	3	2	1	0	10	15	25	50
TXT1901: Elective – II: Textile Process House Management	3	2	1	0	10	15	25	50
HUT 1105: Industrial Management – II	3	2	1	0	10	15	25	50
MAT 1106: Design & Analysis of Experiments	3	2	1	0	10	15	25	50
Chem. Eng. Laboratory	2	0	0	4	25	-	25	50
TXP1010: Seminar	2	0	0	4	-	-	50	50
TXP1012: Project I	4	0	0	8	-	-	100	100
TXP1011 In-plant Training	3	-	-	-	-	-	-	50
Total	30	13	6	16	-	-	-	600

Semester VIII								
Subjects	**Credits**	**Hrs /week**			**Marks for various Exams**			
		L	**T**	**P**	**C. A.**	**M.S.**	**E. S.**	**Total**
CET 1504:Chemical Project Engineering and Economics	3	2	1	0	10	15	25	50
TXT1301: Testing of Textile Materials	3	2	1	0	10	15	25	50
TXT1402: Merchandising & Designing of Textiles	3	2	1	0	10	15	25	50
TXT1504: Non Wovens & Technical Textiles	4	3	1	0	20	30	50	100
Spl 20: Elective III: Chemistry of Surfactants(By Oils)	3	2	1	0	10	15	25	50
HUT 1107: Value Education	3	2	1	0	10	15	25	50
TXP1018: Project II	4	0	0	8	-	-	100	100
TXP1019: Shade Matching and Bulk Colouration	4	0	0	8	50	-	50	100
Total	27	1	6	16	-	-	-	550

Semester I

	Course Code: CHT1341	**Course Title: Physical Chemistry I**	**Credits = 3**		
			L	**T**	**P**
	Semester: I	**Total contact hours: 45**	**2**	**1**	**0**
List of Prerequisite Courses					
	HSC chemistry				
List of Courses where this course will be prerequisite					
Description of relevance of this course in the B. Tech programme					
The course will enable the students to understand chemical and phase equilibria , direction of spontaneity and calculation of equilibrium compositions, effect of experimental parameters on phase and chemical equlibria					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	**Introduction-** Thermodynamic systems , work , heat and energy, state and path functions		02		
2	**First law of thermodynamics** – Enthalpy and heat capacities, application of first law to gases, standard states		02		
3	**Second and third laws of thermodynamics -**. Statements and applications, entropy and calculation of entropy changes, absolute entropies ,verification of third law, molecular basis of thermodynamics		03		
4	**Spontaneous process and equilibrium:** Criteria for spontaneous processes, equilibrium states, , Maxwell relations , Gibbs and Helmholtz free energy and their temperature relations, free energy and equilibrium constant , calculation of free energy changes , free energy and entropy of mixing, thermochemistry- Hesses law, Ellingham diagrams		03		
5	**Multicomponent systems -**. Partial molar quantities and chemical potential, Gibbs Duhem equation, thermodynamics of solutions, ideal and non ideal solutionFugacity, activity and activity coefficients, thermodynamic properties of electrolytes in solutions		02		
6	**Phase equlibria -**. Gibbs Phase rule, equilibrium between phases Gibbs enegy and phase transitions, classification of phase transitions, , one component systems – phase diagrams, Clausius- Clapeyron equation, Henry's law and Raoult's law, solubility and extraction		05		
7	**Two and three component** systems – liquid- liquid and liquid vapour systems- pressure -composition and temperature- composition phase diagrams, solid-liquid phase diagrams , three component phase diagrams, colligative properties		05		
8	**Electrochemistry –** thermodynamics of electrochemical systems- electrochemical cells, determination of electrode potentials, types of electrochemical cells, activity and activity coefficients, theory of dissociation of electrolytes, ionic equlibria		08		
List of Text Books/ Reference Books					
1	Physical chemistry – Robert G Mortimer – Elsevier publications				
2	Basic chemical thermodynamics- E. Brian smith – Oxford University press				
3	Introduction to Chemical Engineering Thermodynamics- J.M.smith , Van Ness				
4	Chemical nad Engineering thermodynamics – Milo Koretsky, Wiley publications				
5	Phase rule and its applications-Alexander Findlay, Dover publications				
Course Outcomes (students will be able to….)					

1	Appreciate the significance of thermodynamics in chemical, electrochemical and physical processes	
2	Problem solving skills	
3	significance of equilibrium and spontaneity , phases in equilibrium	

	Course Code: CHT1401	**Course Title: Analytical chemistry**	**Credits = 3**		
			L	**T**	**P**
	Semester: I	**Total contact hours:45**	**2**	**1**	**0**
List of Prerequisite Courses					
	HSC Chemistry				
List of Courses where this course will be prerequisite					
	Other Chemistry Courses, Physical and Analytical Chemistry Laboratory				
Description of relevance of this course in the B. Tech programme					
To introduce the principles and applications of analytical chemistry					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	**Introduction** – Analytical procedures- hazards and handling, treatment of waste, good laboratory practices		04		
2	**Aspects of analysis-** errors – systematic and random errors, statistical treatment of experimental results, least square method, correlation coefficients Sampling – basics and procedures, preparation of laboratory samples		05		
3	**Applied analysis –** analytical procedures in environmental monitoring, water, soil and air quality, BOD and COD determinations,		05		
4	**Instrumental methods –** Criteria for selecting instrumental methods - precision, sensitivity, selectivity, and detection limit, transducers, sensors and detectors, signals and noise		04		
5	**Molecular spectral methods –** Uv-visible, molecular fluorescence, IR and FT-IR Mass spectroscopy		08		
6	**Atomic spectral methods –** atomic emission and absorption methods		03		
7	**Thermal methods –** TGA, DTA and DSC		04		
8	**Chromatographic and other separation methods –** GC, HPLC , ion exchange and size exclusion chromatography , super critical fluid extraction		12		
List of Text Books/ Reference Books					
1	D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, Fundamentals of Analytical Chemistry				
2	J.G. Dick, Analytical Chemistry, R.E. Krieger Pub				
3	Environmental Chemistry, A. K. De, Wiley				
4	Chromatography				
5	Thermal Methods				
Course Outcomes (students will be able to…..)					
1	List different analytical techniques				
2	Describe the basic principles of different analytical techniques				
3	Compute the mean from a set of measurements				
4	Suggest possible analytical techniques for identification and quantification of chemicals				

	Course Code: MAT1101	Course Title: Applied Mathematics I	Credits = 4		
			L	T	P
	Semester: I	Total contact hours: 60	3	1	0
List of Prerequisite Courses					
	HSC Standard Mathematics				
List of Courses where this course will be prerequisite					
	This is a basic Mathematics course. This knowledge will be required in almost all subjects later on				
Description of relevance of this course in the B. Tech programme					
This is a basic Mathematics course. This knowledge will be required in almost all subjects later on. This knowledge is also required for solving various mathematical equations that need to be solved in several chemical engineering courses such as MEBC, momentum transfer, reaction engineering, separation processes, thermodynamics, etc.					
	Course Contents (Topics and subtopics)		**Reqd. Hours**		
1	Solutions of system of linear equations (Gauss-elimination, LU-decomposition etc.) Numerical methods for solving non-linear algebraic / transcendental etc. Newton's method, Secant, Regula Falsi, Jacobi Numerical solution set of linear algebraic equations: Jacobi, Gauss Siedel, and under / over relaxation methods		10		
2	Interpolation and extrapolation for equal and non-equal spaced data (Newtons Forward, Newtons backward and Lagrange) Numerical integration (trapezoidal rule, Simpson's Rule)		10		
3	Probability of Statistics:Functions of random variables, probability distribution functions, expectation, moments Statistical hypothesis tests, t-tests for one and two samples, F-test, χ^2-test Statistical Methods for Data Fitting: Linear, multi-linear, non-linear regression		10		
4	Differential Calculus: Higher order differentiation and Leibnitz Rule for the derivative, Taylor's and Maclaurin's theorems, Maxima/Minima, convexity of functions, Radius of curvature;		10		
5	Functions of two or more variables, Limit and continuity, Partial differentiation, Total derivatives, Taylor's theorem for multivariable functions and its application to error calculations, Maxima/Minima, Jacobian.		10		
6	Integral Calculus: Beta and Gamma functions, Differentiation under the integral sign, surface integrals, volume integrals		10		
List of Text Books/ Reference Books					
1	Advanced Engineering Mathematics, Erwin Kreyszig, John-Wiely.				
2	Advanced Engineering Mathematics S. R. K. Iyengar, R. K. Jain, Narosa				
3	Introductory Methods Of Numerical Analysis, S. S. Sastry, PHI.				
4	A First Course in Probability, Sheldon Ross, Pearson Prentice Hall				
5	Probability and Statistics in Engineering , W.W. Hines, D. C. Montgomery, D.M. Goldsman, John-Wiely				
Course Outcomes (students will be able to…..)					
1	Students should be able to solve system of linear algebraic equations				
2	Students should be able to do numerical integrations of functions.				
3	Students should be able to fit relationship between two data sets using linear, non-linear regression.				
4	Students should be able to calculate maxima/minima and functions.				

	Course Code: PYT1101	Course Title: Applied Physics I	Credits = 4		
			L	T	P
	Semester: I	Total contact hours: 60	3	1	0

	List of Prerequisite Courses	
	XIIth Standard Physics	

	List of Courses where this course will be prerequisite	
	Applied Physics – II, Physics Laboratory, Chemical Engineering Thermodynamics, Momentum and Mass Transfer, Heat Transfer, Material Science and Engineering, Structural Mechanics, etc.	

Description of relevance of this course in the B. Tech. Program

This is a basic physics course. This knowledge will be required in almost all subjects later on. This knowledge is also required for understanding various chemical engineering concepts that will be introduced in courses such as momentum transfer, reaction engineering, separation processes, thermodynamics, heat transfer, etc.

	Course Contents (Topics and subtopics)	Reqd. Hours
1	**Solid State Physics** Crystal structure of solids: unit cell, space lattices and Bravais lattice, Miller indices, directions and crystallographic planes, Cubic crystals: SSC, BCC, FCC, Hexagonal crystals: HCP, atomic radius, packing fraction, Bragg's law of x-ray diffraction, determination of crystal structure using Bragg spectrometer Semiconductor Physics: Formation of energy bands in solids, concept of Fermi level, classification of solids: conductor, semiconductor and insulator, intrinsic and extrinsic semiconductors, effect of doping, mobility of charge carriers, conductivity, Hall effect.	15
2	**Fluid Mechanics** Basic concepts of density and pressure in a fluid, ideal and real fluids, Pascal's law, absolute pressure and pressure gauges, basic concepts of surface tension and buoyancy, fluid flow, equation of continuity, Bernoulli's equation, streamlined and turbulent flow, concept of viscosity, Newton's law of viscosity, brief introduction to non-Newtonian behaviour.	15
3	**Optics and Fibre Optics** Diffraction: Introduction to interference and example; concept of diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits; diffraction grating, characteristics of diffraction grating and its applications. Polarisation: Introduction, polarisation by reflection, polarisation by double refraction, scattering of light, circular and elliptical polarisation, optical activity. Fibre Optics: Introduction, optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with optical fibres, step and graded index fibres, application of optical fibres.	10
4	**Lasers** Introduction to interaction of radiation with matter, principles and working of laser: population inversion, pumping, various modes, threshold population inversion, types of laser: solid state, semiconductor, gas; application of lasers.	10
5	**Ultrasound** Generation of ultrasound: mechanical, electromechanical transducers; propagation of ultrasound, attenuation, velocity of ultrasound and parameters affecting it,	10

	measurement of velocity, cavitation, applications of ultrasound.	
List of Text Books/ Reference Books		
	Physics:Vols. I and II – D. Halliday and R. Resnick, Wiley Eastern.	
	Lectures on Physics: Vols. I, II and III – R. P. Feynman, R. B. Leighton and M. Sands, Narosa.	
	Concepts of Modern Physics – A. Beiser, McGraw-Hill.	
	Introduction to Modern Optics – G. R. Fowles , Dover Publications.	
	A Course of Experiments with LASERs – R. S. Sirohi, Wiley Eastern.	
	Optical Fibre Communication – G. Keiser, McGraw-Hill.	
	Optoelectronics – J. Wilson and J. F. B. Hawkes, 2nd ed, Prentice-Hall India.	
	Ultrasonics: Methods and Applications – J. Blitz, Butterworth.	
	Applied Sonochemistry – T. J. Mason and J. P. Lorimer, Wiley VCH.	
Course Outcomes (students will be able to…..)		
1	Students will be able to state Bragg's Law	
2	Student will be able to apply Bernoulli equation in simple pipe flows	
3	Students will be introduced to the principles of lasers, types of lasers and applications.	
4	Students should be able to calculate resolving power of instruments.	
5	Students should be able to describe principles of optical fibre communication.	
6	Application of acaustic cavitation of Chemical Engineering Processes.	

	Course Code: CHP1343	**Course Title: Physical and Analytical Chemistry Laboratory**	**Credits = 2**		
			L	**T**	**P**
	Semester: I	**Total contact hours: 60**	**0**	**0**	**4**
List of Prerequisite Courses					
	H.S.C. Chemistry laboratory courses				
List of Courses where this course will be prerequisite					
Description of relevance of this course in the B. Tech Programme					
Students will become familiar with laboratory experimental skills , plan and interpretation of experimental tasks, understand the relevance of principles of physical chemistry in chemical processes					
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	Experiments based on chemical reaction kinetics, phase equlibria and electrolyte systems, surface and interfacial phenomena such as surface tension and CMC Measurements.		4h per session		
List of Text Books/ Reference Books					
1	Practical physical Chemistry – B.Viswanthan and P.S. Raghavan				
2	Practical physical Chemistry- Alexander Findlay				
Course Outcomes (students will be able to…..)					
1	Identify and determine physicochemical parameters using simple tools				
2	Interpretation of data and drawing scientific conclusions				

	Course Code: GEP1101	Course Title: Engineering Graphics	Credits = 4		
			L	T	P
	Semester: I	Total contact hours: 90	2	0	6
List of Prerequisite Courses					
	Basic Geometry				
List of Courses where this course will be prerequisite					
	Engineering Graphics – II, Equipment Design and Drawing-I, Equipment Design and Drawing-II, Home Paper – II, Structural Mechanics,				

Description of relevance of this course in the B..Tech. Program

A student of Chemical Engineering is required to know the various processes and also the equipment used to carry out the processes. Some of the elementary processes like filtration, size reduction, evaporation, condensation, crystallization etc., are very common to all the branches of technology. These and many other processes require machines and equipments. One should be familiar with the design, manufacturing, working, maintenance of such machines and equipments. The subject of "drawing" is a medium through which, one can learn all such matter, because the "drawings" are used to represent objects and processes on the paper. Through the drawings, a lot of accurate information is conveyed which will not be practicable through a spoken word or a written text. Drawing is a language used by engineers and technologists. This course is required in many subjects as well as later on in the professional career.

	Course Contents (Topics and subtopics)	Reqd. hours
1	Orthographic projections	
2	Sectional views	
3	Isometric projections	
4	Missing views (or interpretation of views.)	
5	Projection of solids	
6	Sections of solids	
7	Development of surface	
8	Interpenetration of solids	
List of Text Books/ Reference Books		
	1.Engineering Drawing by N.D.Bhat	
	2. Engineering Drawing by N.H.Dubey	
Course Outcomes (students will be able to…..)		
1	Read Drawing	
2	Can understand different views.	

	Course Code: HUP1101	Course Title: Communication Skills	Credits = 2		
			L	T	P
	Semester: I	Total contact hours: 60	0	0	4
List of Prerequisite Courses					
	XIIth Standard English				
List of Courses where this course will be prerequisite					
	All				

Description of relevance of this course in the B.Tech. Program

This is an important course for the effective functioning of an Engineer. Communication skills are required in all courses

	Course Contents (Topics and subtopics)	Reqd. hours
1	Development of communication skills in oral as well as writing.	

2	The writing skills should emphasize technical report writing, scientific paper writing, letter drafting, etc.	
3	The oral communication skills should emphasize presentation skills.	
4	Use of audio-visual facilities like powerpoint, LCD. for making effective oral presentation.	
5	Group Discussions	
List of Text Books/ Reference Books		
	Elements of style – Strunk and white	
Course Outcomes (students will be able to…..)		
1	Students should be able to write grammar error free technical reports in MS Words or equivalent software.	
2	Students should be able to make power point slides in MS PowerPoint or equivalent software.	

Semester II

	Course Code:CHT1342	**Course Title: Physical chemistry II**	**Credits = 3**		
			L	**T**	**P**
	Semester: II	**Total contact hours: 45**	**2**	**1**	**0**
List of Prerequisite Courses					
	Physical Chemistry –I, HSC Chemistry				
List of Courses where this course will be prerequisite					
Description of relevance of this course in the B. Tech programme					
Relevance of reaction rates and parameters affecting the same , concept of interfaces and surfaces and the importance of disperse systems					

	Course Contents (Topics and subtopics)	**Reqd. hours**
1	**Chemical kinetics –** Introduction, concept of reaction rates and order, experimental methods in kinetic studies, differential and integral methods to formulate rate equations of zero, first and second order reactions	02
2	Experimental methods of kinetic studies	01
2	**Complex reactions**- parallel, consecutive and reversible	02
3	**Kinetics and reaction mechanism**- steady state and rate determining step Mechanism of thermal photochemical chain reactions, polymerization reactions	02
4	**Surface reactions –** Adsorption, kinetics of surface reactions- Hishelwood and Rideal models of surface reactions	02
	Theories of reaction rates and temperature effects- collision theory and TST Theory of unimolecular reactions	03
5	**Kinetics of reactions in solutions-** solvent effects	02
6	**Fast reactions –** experimental techniques	01
7	**Surface and interfacial Chemistry –** introduction,surface tension andsurface free energy, methods of determining surface and interfacial tensions	02
8	**Thermodynamics of surfaces –** surface excess, Gibbs adsorption equation, curved surfaces- bubbles, droplets and foams, Kelvin, Young Laplace and Thomson equations, homogeneous nucleation	03
9	**Liquid- liquid and solid liquid interfaces** – contact angle, wetting and spreading, adhesion and cohesion, contact angle measurements and hysterisis	03
10	**Surfactants:** Types, adsorption at surfaces and interfaces, surfactant aggregates, factors affecting aggregation phenomena, applications of surfactants and mixed surfactant systems	03
11	**Disperse systems -** Emulsions microemulsions and foams-. Thermodynamics and stability, HLB values , colloids - preparation, stability, characterization, surface charges and electrical double layer	04

List of Text Books/ Reference Books		
1	Chemical Kinetics – K.J.Laidler	
2	Principles of Chemical Kinetics – James E House	
2	Surfaces interfaces and colloids- Drew Myers- Wiley VCH	
3	Colloids and interfaces with polymers and surfactants - Jim Goodwin, wiley	
4	Surfactants and interfacial phenomena- Milton J Rosen – Wiley Interscience	
5	Industrial utilization of surfactants principles and applications – M.J. Rosen and M Dahanayake, AOCS Press	

6	Principles of colloids and surface Chemistry – Paul C Hemenz and Raj Rajagopalan- Marcel Dekker	
7	Foundations of Colloid science – Robert J Hunter – Oxford university Press	
Course Outcomes (students will be able to…..)		
1	Understand the importance of chemical kinetics in process design	
2	Importance and application of surface active agents	
3	Understand the stability and importance of disperse systems	

	Course Code: CHT1132	**Course Title: Organic Chemistry**	**Credits = 4**		
			L	**T**	**P**
	Semester: II	**Total contact hours: 60**	**3**	**1**	**0**
List of Prerequisite Courses					
	Organic Chemistry –I, HSC Chemistry				
	Course Contents		**Reqd. Hrs.**		
1	**Mechanisms of organic reactions:** Types of Organic Reaction, Reactive intermediates; their generation, structure, stability and general reactions. Acidity and basicity. Mechanisms of simple organic transformations.		12		
2	**Stereochemistry:** Stereodescriptors, Elements of symmetry, stereochemistry of compounds containing one and two carbon atoms. Racemates and their resolution, conformation of cyclic and acyclic systems, Idea of asymmetric synthesis.		5		
3	**Aromaticity:** Huckel's theory of Aromaticity. Aromaticity of simple benzenoid and non benzenoid species.		4		
4	**Aromatic compounds:** Sources. BTX, Aromatic hydrocarbons. General mechanisms of aromatic electrophilic and nucleophilic substitution reactions. Orientation of electrophile in arenes.		6		
5	**Friedel-Crafts and related reactions:** Friedel-Crafts alkylation and acylation reactions. Aromatic formylation reactions. Aromatic carboxylation.		5		
6	**Chemistry of enolates:** Mechanism of aldol and related reactions		5		
7	**Chemistry of ethers, epoxides, sulphonic acids.**		4		
8	**Amines:** Methods of preparation, chemistry of aromatic diazonium salts		4		
	Reference Books				
1	Organic Chemistry, J. McMurry, Brooks/Cole				
2	Organic Chemistry, T.W.G. Solomons, C.B. Fryhle, John Wiley and Sons Inc.,				
3	Organic Chemistry, L.G. Wade Jr, Pearson Education				
4	StereoChemistry of Carbon compounds, E.L. Eliel, Mcgraw-Hill				
5	Organic Chemistry, Paula Y. Bruice, Pearson Education				

	Course Code: CET 1507	**Course Title: Process Calculations**	**Credits = 4**		
			L	**T**	**P**
	Semester: II	**Total contact hours: 60**	**2**	**2**	**0**
List of Prerequisite Courses					

	XIIth Standard Mathematics, Chemistry, Physics	
List of Courses where this course will be prerequisite		
	This is a basic Course. This knowledge will be required in ALL subjects later on.	
Description of relevance of this course in the B. Tech. Program		
This is a basic course. This knowledge will be required in almost all subjects later on. This subject introduces the various concepts used in Chemical Engineering to the students. The knowledge of this subject is required for in ALL B. Tech. courses, etc. It can be applied in various situations such as process selection, economics, sustainability, environmental impacts		
	Course Contents (Topics and subtopics)	**Reqd. Hours**
1	Introduction to Chemical process calculations, overview of single stage and multistage operations, concept of process flow sheets	2
2	Revision of Units and Dimensions, Dimensional analysis of equations, Mathematical techniques	4
3	Mole concept, composition relationship, types of flow rates	2
4	Material balance in non-reacting systems: application to single and multistage processes	8
5	Stoichiometry	2
6	Material balance in reacting systems: application to single and multistage processes	6
7	Behaviour of gases and vapors	4
8	Introduction to psychrometry, humidity and air-conditioning calculations.	6
9	Calculation of X-Y diagrams based on Raoult's law.	2
10	Applications of material balances to Multiphase systems	6
11	Basic concepts of types of Energy and calculations	2
12	Application of Energy balance to non-reacting systems	6
13	Application of Energy balance to reacting systems	6
14	Fuels and combustion.	4
List of Text Books/ Reference Books		
	Elementary Principles of Chemical Processes, Felder, R.M. and Rousseau, R.W.	
	Chemical Process Principles, Hougen O.A., Watson K. M.	
	Basic Principles and Calculations in Chemical Engineering, Himmelblau,	
	Stoichiometry, Bhatt B.I. and Vora S.M.	
Course Outcomes (students will be able to…..)		
1	Students will be able to convert units of simple quantities from one set of units to another set of units	
2	Students will be able to calculate quantities and /or compositions, energy usages, etc. in various processes and process equipment such as reactors, filters, dryers, etc.	

	Course Code: MAT1102	**Course Title: Applied Mathematics II**	**Credits = 4**		
			L	**T**	**P**
	Semester: II	**Total contact hours: 60**	**3**	**1**	**0**
List of Prerequisite Courses					
	XIIth Standard Mathematics, Applied Mathematics - I				
List of Courses where this course will be prerequisite					
	This is a basic Mathematics course. This knowledge will be required in almost all subjects later on				

Description of relevance of this course in the B. Tech. Program		
This is a basic Mathematics course. This knowledge will be required in almost all subjects later on. This knowledge is also required for solving various mathematical equations that need to be solved in several chemical engineering courses such as MEBC, momentum transfer, reaction engineering, separation processes, thermodynamics, etc.		
	Course Contents (Topics and subtopics)	**Reqd. Hours**
1	Differential Equations: Solution of Higher order ODE with constant and variable coefficients and its applications to boundary and initial value problems, Series solution of differential equations, Bessel functions, Legendre Polynomials, Error function. Fourier series, Laplace Transforms and their application in differential equation (both ODEs PDEs). Partial Differential Equations, Classification of higher order PDEs, Solution of parabolic equation using separation of variables	20
2	Numerical methods for solution of initial values problems using RK method, Euler's method and Taylor series method.	20
3	Finite difference methods: Forward difference, backward difference, central differences, application of finite difference methods to ODE Boundary value problem.	20
List of Text Books/ Reference Books		
1	Advanced Engineering Mathematics, Erwin Kreyszig, John-Wiely	
2	Advanced Engineering Mathematics S. R. K. Iyengar, R. K. Jain, Narosa.	
3	Elements of *Applied Mathematics*. Volume 1, P.N.*Wartikar* and J.N.*Wartikar,* Pune Vidyarthi Graha	
4	Introductory Methods Of Numerical Analysis, S. S. Sastry, PHI.	
5	Numerical Solution of differential Equations, M. K. Jain, Wiley Eastern.	
Course Outcomes (students will be able to…..)		
1	Students should be able to solve simple first and second order ODE by Analytical methods	
2	Students will be able to solve simple first and second order differential equations numerically	
3	Students will be able to solve simple parabolic partial differential equations numerically	

	Course Code: PYT 1103	**Course Title: Applied Physics II**	**Credits = 3**		
			L	**T**	**P**
	Semester: II	**Total contact hours: 45**	**2**	**1**	**0**
List of Prerequisite Courses					
	XIIth Standard Physics, Applied Physics – I, Physics Laboratory,				
List of Courses where this course will be prerequisite					
	This is a basic physics course. This knowledge will be required in almost all subjects later on				
Description of relevance of this course in the B. Chem. Engg. Program					
This is a basic physics course. This knowledge will be required in almost all subjects later on. This knowledge is also required for understanding various chemical engineering concepts that will be introduced in courses such as momentum transfer, reaction engineering, separation processes, thermodynamics, heat transfer, etc.					

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

	Course Code: PYP1101	**Course Title: Physics Laboratory**	**Credits = 2**		
			L	**T**	**P**
	Semester: II	**Total contact hours: 60**	**0**	**0**	**4**
	List of Prerequisite Courses				
	Applied Physics - I				
	List of Courses where this course will be prerequisite				
	This is a basic physics Laboratory course. This knowledge will be required in almost all subjects later on.				
	Description of relevance of this course in the B.Tech. Program				
This is a basic physics course. Students will be able to learn various concepts by doing experiments on different topics. This knowledge will be required in almost all subjects later on. This knowledge is also required for understanding various chemical engineering concepts that will be introduced in courses such as momentum transfer, reaction engineering, separation processes, thermodynamics, heat transfer, etc.					

	Course Contents (Topics and subtopics)	Reqd. Hours
1	Viscosity	
2	Thermistor	
3	Thermal conductivity	

4	Ultrasonic interferometer	
5	Photoelectric effect	
6	Hall effect	
7	Newton's rings	
8	Dispersive power of prism	
9	Laser diffraction	
10	Resolving power of grating	
List of Text Books/ Reference Books		
1	Physics:Vols. I and II – D. Halliday and R. Resnick, Wiley Eastern.	
2	Lectures on Physics: Vols. I, II and III – R. P. Feynman, R. B. Leighton and M. Sands, Narosa.	
3	Concepts of Modern Physics – A. Beiser, McGraw-Hill.	
4	Introduction to Modern Optics – G. R. Fowles , Dover Publications.	
5	A Course of Experiments with LASERs – R. S. Sirohi, Wiley Eastern.	
6	Optical Fibre Communication – G. Keiser, McGraw-Hill.	
7	Optoelectronics – J. Wilson and J. F. B. Hawkes, 2nd ed, Prentice-Hall India.	
8	Ultrasonics: Methods and Applications – J. Blitz, Butterworth.	
9	Applied Sonochemistry – T. J. Mason and J. P. Lorimer, Wiley VCH.	
Course Outcomes (students will be able to…..)		
1	Students will be able to state various laws which they have studied through experiments	
2	Student will be able to measure transport properties like viscosity, conductivity, etc.	
3	Students will be able to state application of acoustic cavitation	

CHP1132 Organic Chemistry Laboratory

Synthesis of simple organic compounds to demonstrate various unit processes. Separation and purification of binary mixtures by physical and chemical methods. Purification of organic compounds.

Semester III

Course Code: TXT1105	Course Title: Technology of Fibres (100 marks)	Credits = 4		
		L	T	P
Semester: III	Total contact hours: 60	3	1	0

List of Prerequisite Courses
H. S. C. Science
List of Courses where this course will be prerequisite
Chemistry & Application of Colorants, Technology of Textile Dyeing
Description of relevance of this course in the B.Tech. Program
Students will have better understanding of chemical nature as well as various properties on fibres based on which processing technology can be tuned.

	Course Contents (Topics and subtopics)	Reqd. hours
1	Introduction to textile fibre as polymer, Fibre forming characteristics of polymers, Definition of various basic textile terms, Introduction to Fibre, Yarn, Fabric, Classification of fibres based on sources of origin and on chemical constitution, Brief introduction to the stages of operation for natural and manmade fibres into finished fabrics, The various binary blends and their applications with respect to required end properties, Identification methods of fibres and quantitative estimation of blends.	10
2	Natural fibres of plant, animal and mineral origin, chemistry, production processes, morphology, physical and chemical properties, structure property relationship with application. The commercially important fibres like cotton, organic cotton, jute, linen, bamboo, wool, silk etc. will be studied in detail. Action of various chemicals, micro-organisms, bleaching agent, heat, radiations, etc will be studied. The brief outline of other fibres supporting rural economy will be given. These fibres will include banana, coir, sisal, ramie, pineapple etc. Fibres such as asbestos, glass and metallic will also be studied. Research and development in natural fibres.	18
3	Semi-synthetic fibres such as viscose rayon, cuprammonium rayon, acetate rayon, bamboo rayon and lyocell with respect to chemistry, manufacturing process, physical and chemical properties and structure property relationship with applications. Fibre Spinning techniques.	12
4	Synthetic fibres such as polyester and its variants, polyamides, acrylic, polypropylene, polyethylene, aramid, carbon, polyvinyl alcohol, polyurethane etc. With respect to their raw materials and their synthesis, manufacturing processes, physical and chemical properties, structure property relationship and applications. Action of various chemicals, micro-organisms, bleaching agents, heat, radiations, etc. Crystalline and amorphous structure, orientation, POY, FDY, draw ratio and its effect on dyeability, denier etc. Modified forms of synthetic fibres like antistatic, antipilling, flame retardant etc. Latest advancement in semi-synthetic and synthetic fibres and their application.	20

List of Text Books/ Reference Books	
1	Textile Fibres, Shenai V.A., Vol-1, Sevak Publications, Bombay, 3rd edition, 1991.
2	Joseph's Introductory Textile Science, Joseph, M.L., Hudson P.B., Clapp A. C., Fortworth: Harcourt Brace Jovanovich College Publication, 6th edition, 1993.

3	Modern Textile Characterization Methods, Raheel, M. Marcel Dekker Inc., New York, 1996.
4	Microscopy of Textile Fibres, Greaves, P.H., Saville B.P.Oxford : BIOS Scientific Publishers Ltd., 1995.
5	Handbook of Fibre Chemistry, Lewin Menachem, Eli M. Pearce, Marcel Dekker Inc., New York, 2nd edition, 1998.
6	Textile Fibres-I, Mathews, J.M, 4th edition, 1924.
7	Man-made Fibres, Moncriff, R.W., Butterworth Science, London, 6th edition, 1975.
8	Textile Chemistry, Peters R.H, Vol-1, Elsevier Publishing Company, London, 1963.
Course Outcomes (students will be…..)	
1	Able to understand fibre forming properties with different textile terms following various stages of processing and differentiate them according to the classification Textile Fibres (K4,A3,S2).
2	Able to acquire deeper understanding and insights in basic chemistry, production processes and physical and chemical properties of Natural and Synthetic fibers. (K2, A2, S1).
3	Able to analyze structure property relationship and choose fibres or develop combination of fibres for specific applications to meet novel requirements. (K4, A4,S4).
4	Able to acquire deeper understanding and insights in basic chemistry, production processes and physical and chemical properties of Natural and Synthetic fibers for non-apparel category (K2, A2, S1)
5	Able to analyze structure property relationship and choose fibres or develop combination of fibres for specific applications to meet novel requirements. (A4,K4, S4)
6	Able to justify fibre properties/end uses and depict or design the single or combinations of Fibre system for value addition to meet the strategic requirements. (K6, A5, S5)

	Course Code: TXT1101	**Course Title: Technology of Yarn & Fabric Formation (Marks 100)**	**Credits = 4**		
			L	**T**	**P**
	Semester: III	**Total contact hours: 60**	**3**	**1**	**0**
List of Prerequisite Courses					
H. S. C. Science					
List ofCourses where this coursewill be prerequisite					
Technology of Fibres					
Description of relevance of this course in the B.Tech. Program					
This course will help students to understand structure of fibres based on which choice material and method for processing can be determined.					
	Course Contents (Topics and subtopics)		**Reqd. hours**		

1	Grading of natural and synthetic fibres; Fibre properties and their measurements	2
2	Preparatory processes and machinery used for manufacture of yarn from natural and synthetic fibres;	10
3	Spinning of yarn-ring and rotor spinning, friction spinning, air-jet spinning	4
4	Natural and Synthetic fibres for blended and fancy yarns	2
5	Yarn properties and their measurement; Doubling of yarns; Requirement of yarn for weaving/knitting – based on end use	2
6	Warp and weft preparation, Sizing of yarn – machinery involved	6
7	Weaving of fabric – loom, use of dobby and jacquard	6
8	Shuttless looms – air jet, rapier, etc. for high speed weaving, Sulzer(Projectile), Water jet	4
9	Fabric construction and their effect on various properties – related to end use; Cloth analysis – weaves such as plain, twill, satin, etc.; Subjective evaluation of different fabric qualities	6
10	Fabric defects, causes and remedies	2
11	Stastical quality control for textiles – equipment and testing	2
12	Modernization, automation, recent developments – in spinning and weaving; Productivity evaluation of weaving	2
13	Non woven Fabric, Stretch Yarn	4
14	Basic structure of weft and warp knitted constructions, comparison with woven fabric with respect to production and properties.	2
15	Brief idea of yarn passage through weft and warp knitting machine	3
16	Primary and secondary knitting elements	3

List of Text Books/ Reference Books

1	Weaving: Machines, mechanisms, management, Talukdar, M.K., Sriramulu P.K., Ajgaonkar D.B., Mahajan Publishers Private Ltd., Ahmedabad, 1998.
2	Textiles – Fibre to Fabrics, Corbman B.P., McGraw Hill Book Company Inc., New York,
3	Manual of Textile Technology, Klein, W., The Textile Institute, Manchester, Vol. 1-6, 1987.
4	The Motivate series Textiles, A.Wynne.
5	Textile Yarns, Technology, Structure and Applications, B.C. Goswami, J.G.Martindale and
6	Weaving – Conversion of Yarn to Fabric, P.R.Lord and M.H.A.Mohamed.
7	Knitting Technology, D.B.Ajgaokar...
8	Elements of Spinning,Blow Room, Carding, Comber and Ring Frame, Vol. 1-4, A.R.Khare.
9	Textile Design and Colour, Watson.
10	Knitting technology by Prof. D. B. Ajgaonkar
11	Circular Knitting by Dr. ChandrashekharIyer
12	Knitting Technology by Mr. D. Spenser
13	Warp Knitting by Dr. S. Raz

Course Outcomes (students will be …..)

1	Able to **comprehend** the classification of textile fibres and the basic differences between natural and synthetic fibres. (K2, A2)
2	Able to **comprehend criteria of** properties of polymers to be called as textile fibres. (K2, A2)
3	Able to **understand** the process flow chart of manufacture of fibre to yarn tofabric with each of its processes in details.(K2, A1)
4	Able to **comprehend** the calculations involved in the important processes of manufacture of yarn and fabric. (K2, A2)
5	Able to **comprehend** the count system of yarn and its conversion to different systems to understand the relationship with each other. (K2, A2)
6	Able to **understand and analyze** the designsof various type of fabrics and different types of defects in fabric. (K4, A3, S1)

	Course Code: TXT1209	**Course Title: Technology of Textile Pretreatment (Mark 50)**	**Credits = 3**		
			L	**T**	**P**
	Semester: III	**Total contact hours: 45**	**2**	**1**	**0**

List of Prerequisite Courses

H. S. C. Science

List ofCourses where this coursewill be prerequisite

Technology of Textile Dyeing, Technology of Finishing

Description of relevance of this course in the B.Tech. Program

Being initial stage of wet processing the knowledge on pretreatment stands of utmost importance to understand further processing such as dyeing, printing and finishing.

	Course Contents (Topics and subtopics)	**Reqd. hours**
1	Sizing, Sizing Chemicals; Various pretreatment sequences for different varieties of textiles.	5
2	Shearing and Cropping; Singeing, latest technologies in singeing, gas based singeing – stoichiometric ratios for air gas mixtures, machine specifications for gas singeing, singeing followed by cold bleaching, singeing for open width knit fabrics.	8
3	Desizing of cotton; different desizing methods	4
4	Techniques for scouring and bleaching of cotton; Machinery used for these preparatory processes in batch wise, semi-continuous and continuous operations for different forms of textiles such as loose fibres, yarn and fabric, material and energy balance in bleaching, latest technology in bleaching, reduction in liquor ratios and savings in water and energy. Cold bleaching, shock bleaching	3

5	Mercerization, Chain, chainless and chain cum chainless machinery for mercerization, material and energy balance in mercerization; caustic recovery plant and its efficiency, Ammonia mercerization, its significance, additional benefits, technical specifications of machinery for ammonia mercerization; Heat setting	6
6	Silk degumming and bleaching, Scouring and bleaching of wool; Bioscouring, Carbonization of wool, Scouring and bleaching of synthetics and their blends with natural fibres	4
9	Application of optical brightening agents in bleaching of natural and synthetic fabrics	2
10	Combined preparatory processes for various textiles; Efficiency of various pretreatment processes	2
11	Washing principles and methods used different types of continuous washers for textiles	2
12	Concept of conservation of chemicals, energy and water, Raw materials like water, chemicals andauxiliaries, Pretreatment of Knit goods; Mercerization of Knits	5
15	Pretreatment of Yarn and cone dyed yarns,Ecofriendly pretreatments; Advances in pretreatment techniques, De-mineralization of water	4

List of Text Books/ Reference Books

1	Technology of Bleaching and Mercerizing, Shenai V.A., Sevak Publication, Bombay, Vol. - 3, 3rd edition, 2003.
2	Textile Bleaching, Steven A.B., Pitman and Sons, London.
3	Technology of Scouring and Bleaching, Trotman E.R., Griffin, London, 1968.
4	Technology of Bleaching and Dyeing, Chakraverty, R.R., Trivedi S.S., Vol. 1, Mahajan Publishers Private Ltd., Ahmedabad, 1979.
5	Textile Chemistry, Peters R.H, Vol-2, Elsevier Publishing Company, London, 1967.
6	Sizing by D.B.Ajgaonkar, M.K.Talukdar and V.R.Wadekar
7	Mercerizing by J.T.Marsh
8	Chemical Technology in the Pre-treatment Processes of Textiles by S.R.Karmakar

Course Outcomes (students will be …..)

1	Able to comprehend the need for singeing of loom state fabric and use of latest technologies in singeing (gas based singeing- stoichiometric ratios for air gas mixtures, machine specifications for gas singeing) for open width woven and knit fabrics. (K1, A1)
2	Able to define the need for sizing of yarns and desizing of fabric; sizing chemicals and different desizing methods. (K1, A2)
3	Able to describe the concept of mercerization and the techniques and machinery employed for the same (K2, A2)
4	Able to describe with understanding the pretreatments in wool& silk processing. (K3, A2)

5	Able to explain different bleaching recipes for scouring and bleaching of synthetics and their blends with natural fibres. (K2, A2)

	Course Code: CHT1133	Course Title:Chemistry of Colorants and It's Application	Credits = 4		
			L	T	P
	Semester: III	Total contact hours: 60	3	1	0

List of Prerequisite Courses

	HSC (Science)	

List of Courses where this course will be prerequisite

	Technology of Textile Dyeing, Additives for polymers, Additives for Coatings Compounding and polymer Processing Analysis of Paints Pigment synthesis Lab Experimental Dyeing,Theory of Textile Coloration	

Description of relevance of this course in the B. Pharm. Program

Students will understand the chemistry behind the colorants.
They will be able to explain the its applications in various field according to the chemistry involved..

	Course Contents (Topics and subtopics)	Reqd. hr
1	Introduction of Pigments ,Colour Index Generic Names of Pigments, Colour Constitution Number ,Polymorphism, Properties required in a pigment and extender, Pigment dispersion basics Classification of inorganic and organic pigments with examples, additive and substractivecolour mixing. Definitions of pigment, extenders, dyes, pigment dyestuffs, toner and lakes	5
2	Theory of color formation in organic compounds, effect of auxiliary groups on the shade and hue of the pigment (Bathochromic and hyper chromic shift) Practices and requirement of Pigments	5
3	Inorganic pigments such as titanium dioxide, zinc oxide, carbon black, chromate pigments, molybdate orange, chrome green General methods of processing and synthesis of inorganic pigments: Crushing and grinding, vaporization, co precipitation, filtration, drying, flushing, calcinations/roasting, vapour phase oxidation etc. Raw materials for organic pigments: A brief study of coal tar distillation and the role of distillation products in the manufacture of synthetic dyes: bases and precipitants used in the colour striking, toners and lake formation.	5
4	Ultramarine blue, iron blue, cadmium red, pearlescent and other effect pigments Ceramic pigments, metal flake pigments, extenders	5
5	Organic pigments such as Antraquinone, Benzimidazolonedioxazines, Diazo lakes	5
6	Litholrubones, Monoazo lakes, Napthol AS lakes, Napthol AS, Perylenes, Phthalocyanines, Quinacridones effect pigments	5

7	Pigments for Plastics, Textiles, Paints, Resins,PrintingInk,Cosmetics, Rubbers,Special Application fields.	5
8	Spectral properties of colorants, Jablonski diagram, classification of dyes according to application/constitution, empirical treatment of colour and constitution	5
9	Azo dyes: Diazotisation and coupling reactions, azoic colours, acid dyes, mono azo dye; diasazo, nitro, diphenylamine and anthraquinone dyes; acid mordant dyes, azo metal complex dyes, direct dyes	5
10	Basic dyes: Diphenylmethane and triphenylmethane dyes and heterocyclic analogues thereof, triphenodioxazine dyes. Disperse dyes: azo, anthraquinone, dinitrophenylamine, methine dyes; properties in relation to constitution	5
11	Vat dyes: Indigoid, anthraquinonoid and polycyclic quinonoid dyes; solubilised vat dyes. Sulphur dyes and sulphurised vat dyes	5
12	Reactive dyes: Chlorotriazine and other halo heterocyclic compounds, vinyl sulphone based dyes, high fixation, highly substantive, neutral fixing bifunctional reactive dyes.	5

List of Text Books/ Reference Books	
1	Color Chemistry, 3rd Edition, Heinrich Zollinger, Wiley – VCH 2003
2	Colorants and Auxiliaries: Colorants v. 1: Organic Chemistry and Application Properties, John Shore, Society of Dyers &Colourists; 2nd edition edition (Jan. 2002)
3	The Chemistry of Synthetic dyes, K. Venkataraman, Academic Press (1 January 1971)
4	Industrial Inorganic Pigments, Gunter Buxbaum, Wiley-VCH; 1 edition (March 11, 2005)
5.	Industrial Organic Pigments: Production, Properties, Applications, 3rd, Completely Revised Edition by Herbst, Klaus HungerWilly March 2006
6.	Application Properties of Pigments By A.Karnik, First Edition Thane1999

Course Outcomes (students will be …..)	
1	Able to understand fundamental knowledge on basics of chemistry involved in the colorants. (K2, A2)
2	Able to describe the types of pigments and their applications (K2, A2)
3	Able to understand and explain the physical properties of Pigments and dyes (K2, A2, S1)
4	Able to explain the synthetic methods used for azo dyes and their properties. (K2, A2, S1)
5	Able to explain the types of dyes on the basis of application, properties. . (K2, A3, S1)

	Course Code: CHT1124	**Course Title: Industrial Inorganic Chemistry(Marks 100)**	**Credits = 4**		
			L	**T**	**P**
	Semester: III	**Total contact hours: 60**	**3**	**1**	**0**
List of Prerequisite Courses					

H. S. C. Science		
List ofCourses where this coursewill be prerequisite		
Technology of Finishing, Chemistry, Application and Evaluation of Specialty Chemicals.		
Description of relevance of this course in the B.Tech. Program		
This course will help student to understand chemistry of some of auxiliaries.		
	Course Contents (Topics and subtopics)	**Reqd. hours**
1	PRIMARY INORGANIC MATERIALS: Water, Hydrogen, Hydrogen Peroxide and Inorganic Peroxo Compounds, Nitrogen and Nitrogen Compounds, Phosphorus and its Compounds, Sulfur and Sulfur Compounds, Halogens and Halogen Compounds	12
2	MINERAL FERTILIZERS: Phosphorus-Containing Fertilizers, Nitrogen-Containing Fertilizers, Potassium-Containing Fertilizers	10
3	METALS AND THEIR COMPOUNDS: Alkali and Alkaline Earth Metals and their Compounds Aluminum and its Compounds, Chromium Compounds and Chromium, Silicon and its Inorganic Compounds, Manganese Compounds and Manganese	12
4	ORGANO-SILICON COMPOUNDS: Industrially Important Organo-Silicon Compounds Industrially Important Silanes, Silicones, Industrial Silicone Products	10
5	INORGANIC SOLIDS: Silicate Products, Inorganic Fibers, Construction Materials, Enamel Ceramics, Metallic Hard Materials, Carbon Modifications, Fillers, Inorganic Pigments	10
6	NUCLEAR FUEL CYCLE: Economic Importance of Nuclear Energy, General Information about the Nuclear Fuel Cycle, Availability of Uranium, Nuclear Reactor Types, Nuclear Fuel Production Disposal of Waste from Nuclear Power Stations	6
List of Text Books/ Reference Books		
1	Industrial Inorganic Chemistry, 2nd Completely Revised Edition, Karl Heinz Buchel, Hans-Heinrich Moretto, Dietmar Werner, ISBN: 978-3-527-61333-5, 667 pages, November 2008, Wiley-VCH.	
2	Inorganic Chemistry – an industrial and environmental perspective, T.W.Swaddle, ISBN 0-12- 678550-3 , 482 pages, Academic Press	
Course Outcomes (students will be …..)		
1	Able to **comprehend** the classification of different inorganic materials and their properties. (K1, A1)	
2	Able to **understand** the inorganic chemistry involved in the fertilizers. (K1, A1)	
3	Able to **understand** concept of metal, it's properties and application of different types of metal compounds. (K2, A1)	
4	Able to **understand** the organo-silicon compounds and it's industrial importance. (K1, A1)	
5	Able to **understand** and **analyze** different types of inorganic solids based on their properties and applications. (K2, A2)	

6	Able to **understand** the concept, uses and mechanism of nuclear fuel along with environmental measures. (K1, A1)

	Course Code: TXP1002	**Course Title: Pretreatment of Textiles (50 Marks)**	**Credits = 2**		
			L	**T**	**P**
	Semester: III	**Total contact hours: 60**	**0**	**0**	**4**

List of Prerequisite Courses

H. S. C. Science, Technology of Textile Pretreatment

List ofCourses where this coursewill be prerequisite

Description of relevance of this course in the B.Tech. Program

Being initial stage of wet processing the knowledge on pretreatment stands of utmost importance to understand further processing such as dyeing, printing and finishing.

	Course Contents (Topics and subtopics)	**Reqd. hours**
1	Desizing cotton-acid desizing, enzyme desizing, oxidative desizing of cotton	4
2	Evaluation of desizing efficiency-staining with iodine, loss in weight and estimation of residual starch	4
3	Scouring of cotton-open boil, pressure boil, pad-steam process	4
4	Evaluation of scouring efficiency-wetting time, sinking time, loss in weight	4
5	Bleaching of Cotton by bleaching powder, hydrogen peroxide	4
6	Bleaching of polyester and nylon with sodium chlorite and hydrogen peroxide	4
7	Evaluation of bleaching efficiency -whiteness index and % reflectance	4
8	Mercerisation of cotton with and without tension	4
9	Evaluation of mercerization-Shrinkage, Barium Activity no., dye uptake, strength and elongation and microscopic observation	4
10	Scouring and bleaching of wool	4
11	Degumming and Bleaching of Silk	4
12	Scouring and bleaching of polyester/cotton blends	4
13	Assessment of cotton for degradation by Copper Number, Cuprammonium Fluidity or by Methylene Blue Absorption	4
14	Application of OBA/FBA on natural and synthetic fabrics and evaluation of fabric for whiteness.	4
15	Determination of Damage Factor (Eisenhut)	4

Course Outcomes (students will be …..)

1	Able to carry out desizing , scouring and bleaching of cotton by different methods and its evaluation by suitable methods (K3, K5,A3)
2	Able to carry out mercerisation of cotton with and without tension and measurement of its efficiency by shrinkage, Barium Activity Number (BAN), dye uptake, strength .(K3, K5, A3)

3	To carry out scouring and bleaching of wool, degumming and bleaching of Silk (K3, A3)
4	Able to carry out scouring and bleaching of polyester/cotton blends (K3, A3)
5	Able to carry out assessment of cotton for degradation by Copper Number, Cuprammonium Fluidity (K5, A3)
6	Able to apply OBA/FBA on natural and synthetic fabrics and evaluation of fabric for whiteness. (K5, A3)

Syllabus for Computer Applications,
B. Tech. Semester III

Part I: Spreadsheet Programme (Microsoft Excel or LibreOffice Calc) (3 Lab Sessions)

1. Basic Introduction to Spreadsheet Programmes, Plotting Graphs of Functions and Data Plotting.
2. Exploring Basic Statistics, Hypothesis Testing with Spreadsheet.
3. Numerical Solution of Linear and Non-Linear Equations.

Part II: Statistics with R-Programming (4 Lab Sessions)

1. Basic Introduction to R and Rstudio.
2. Data Management in R.
3. Exploring Distribution Function in R.
4. Hypothesis Testing in R.
5. Basic Regression Analysis in R

Part III: C-Programming

Unit I: (2 Lab Sessions)
What is C-programming? Data Types, Variables, Constants, Arithmetic Operations, Input-Output Statements, Expressions and Expression Evaluations, Type Conversions.

Unit II: (2 Lab Sessions)
Making Decisions-if and switch statement, Repetition Statements-For Loop, While and Do-While Loops, Nested Loops, Use of Break, Continue and Goto in Loops, File Input-Output statements and its use.

Unit III: (3 Lab Sessions)
Functions- User Defined functions, Calling Function and passing arguments, Arrays- Definition, Accessing and Storing elements, Concept of Multi-dimensional Arrays, Array and Functions.

Unit IV: (2 Lab Sessions)
String Manipulation. Basic of Structures and unions. Dynamic Memory allocation.

References:

1. Programming In Ansi C, E Balagurusamy, Tata McGraw-Hill Publishing Company Limited, 2002

2. Let Us C, Yashavant P. Kanetkar, 2008, Infinity Science Press
3. Introductory Statistics with R, Peter Dalgaard, Springer, 2008
4. Basic Statistics: An Introduction with R, Tenko Raykov, George A. Marcoulides, 2013
5. Excel for Chemists: A Comprehensive guide, E. Joseph Billo, WILEY, 2011
6. Mathematical Modeling with Excel, Brian Albright, Jones & Bartlett India Private Limited, 2010
7. Statistics and Probability for Engineering Applications With Microsoft® Excel by W.J. DeCoursey, 2003

Semester IV

	Course Code: GET 1116	Course Title: Engineering Mechanics and Strength of Materials	Credits = 4		
			L	T	P
	Semester: IV	Total contact hours: 60, Marks : 100	3	1	0
List of Prerequisite Courses					
H. S. C. Science					
List ofCourses where this coursewill be prerequisite					
Description of relevance of this course in the B.Tech. Program					

	Course Contents (Topics and subtopics)	Reqd. hours
1	Concepts of forces, their types, Resolution of forces, Composition of forces, Steps in Engineering Design, Different types supports and free body diagram.	4
2	Equilibrium of rigid bodies - Conditions of equilibrium. Determinant and indeterminate structures. Equilibrium of beams, trusses and frames problems on analysis of beams and truss.	5
3	Concept of moment of Inertia (Second moment of area) its use. Parallel axis theorem. Problems of finding centroid and moment of Inertia of single figures, composite figures. Perpendicular axis theorem, Polar M.I., Radius of gyration.	5
4	Shear Force and Bending Moment - Basic concept, S.F. and B.M. diagram for cantilever, simply supported beams (with or without overhang). Problems with concentrated and U.D. loads.	5
5	Stresses and Strains - Tensile and compressive stresses, strains, modulus of elasticity, modulus of rigidity, bulk modulus. Thermal stresses and strains. Problems based on stresses and strains. Basics of Engineering Design - Steps in the engineering design, Importance of analysis, 1-D, 2-D and 3-D analysis and interpretation of results. Design philosophies.	5
6	Theory of Bending - Assumptions in derivation of basic equation, Basic equation, section modulus, bending stress distribution.	4
7	Problems on shear stress - Concept, Derivation of basic formula. Shear stress distribution for standard shapes. Problems of Shear stress distribution	4
8	Slope and Deflection of beams - Basic concept, Slope and Deflection of cantilever and simply supported beams under standard loading. Macaulay's method.	4
9	Short and Long Columns (Struts) – Basic Concept, Crippling load, End conditions, Euler's and Rankine's Approach (Without Derivations)	4
10	Torsion of a circular shaft – Concept, basic derivation, shear stress distribution, power transmitted by shafts, Simple problems	4
11	Thin and Thick Cylinders – Concept of circumferential, longitudinal stresses, Behaviour of thin cylinders, problems on thin cylindrical and spherical shells, Behaviour of thick cylinders (Theory only)	4
12	Natural Materials, Manmade materials, Materials used for coatings, anticorrosive coatings, special purpose floorings, water proofing compounds, Various polymers and epoxies used for industrial applications. Composite Materials – various types of fibres, fabrics used in polymer composites, Glass and Carbon fibre polymer composites, methods of manufacturing, Uses in various industrial applications.	6
13	Concrete – Basics, Ingredients of concrete, properties of concrete, testing of fresh and hardened concrete, uses of concrete. 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, Cement, Basic process of hardening, types of cements, blended cements,	6

	Recycling of waste – value addition.	
List of Text Books/ Reference Books		
	Engineering Mechanics Vol I Statics by B. N. Thadani, Publisher Wenall Book Corporation	
	Introduction to Mechanics of Solids by Egor Popov, Prentice Hall of India Pvt. Ltd	
	Mechanics of Materials by Ferdinand Beer and E. Russel Johnston, Tata McGraw Hill	
	Fundamentals of applied Mechanics by Dadhe, Jamdar and Walavalkar, Sarita Prakashan Pune	
	Engineering Mechanics by S. Timoshenko and D. H. Young, McGraw Hill Publications	
	Strength of Materials by Ferdinand Singer and Andrew Pytel, Harper Colins Publishers	
	Mechanics of composite Materials by Autar K. Kaw, Publisher CRC Press	
	Fundamental of Fibre reinforced composite materials by A. R. Busell and J. Renard, Taylor & Francis	
	Concrete Technology by A. M. Neville, Pearson Education ltd	
	Concrete Technology – Theory and Practice by M. S. Shetty, S. Chand & Co.	
	Corrosion and Corrosion Protection Handbook by Philip A. Schweitzer, CRC press	

Course Outcomes (the student will be able to….)

CO 1	Quantify the actions and able to find reactions by applying conditions of equilibrium
CO 2	Find out the Centroid and Moment of Inertia for various cross sections used in engineering structures and for plane areas.
CO 3	Able to draw the Shear Force and Bending Moment diagram for different types of beams under simple and complex loading.
CO 4	Calculate the forces, reactions, stresses, strains in components of the bodies of a complex engineering structure.
CO 5	To find out the Bending Stresses at different positions and Shear Stress distribution across the cross section at various points.
CO 6	To calculate the Slope and Deflection at different points under simple and complex loading.
CO 7	To know effect of Torsion in shafts, power transmission, Euler's and Rankine's approach for columns.
CO 8	To know Thin and Thick cylinders, stresses and strains in thin cylinders.
CO 9	To know various polymers and epoxies, fibre polymer composites used in various applications in engineering. Corrosion of steel and its mitigation.
CO 10	To know most widely used cement composite – Concrete, Chemicals used to alter the properties of concrete.

	Course Code: PYT1202	**Course Title: Colour Physics & Colour Harmony (Marks 50)**	**Credits = 3**		
			L	**T**	**P**
	Semester: IV	**Total contact hours: 45**	**2**	**1**	**0**
List of Prerequisite Courses					

H. S. C. Science		
List ofCourses where this coursewill be prerequisite		
Chemistry and Application of Colorants		
Description of relevance of this course in the B.Tech. Program		
This subject will be useful for understanding choice of material for dyeing and printing for specific requirement of color or shade.		
	Course contents(topics/subtopics)	**Required hrs**
1	**Introduction:** Colour as a concept, its definition, geometric and chromatic attributes	**3**
2	**Radiation and illumination:** SPD, CT andCCT; Sources and illuminants; Need for artificial sources – various ways of producing light and different artificial sources; efficacy and colour rendering properties of sources.	**6**
3	**Interaction of radiation with matter** : gloss and diffused reflectance, travel, flip and flop colour,polar diagrams; absorption of light in sample- various transitions in dye molecule, Beer – Lambert law and its verification, deviation from Beer – Lambert law, Additivity of absorbances, mixture analysis, various instruments used for the purpose; absorbance and scattering in the sample – Kubelka Munk theory.	**8**
4	**Perception of colour** in **eye \ brain**: various colour coding processes at retina and beyond it, colour constancy, colour theories, anomalous colour visions, metamerism	**6**
5	**Colour specification**: Additive-substractive mixing, Grassmann's law,1931 and1964CIE system-XYZ and L*a*b*colour spaces, colour difference formulae, Munsell colour order system	**8**
6	**Recipe match prediction**: Single constant Kubelka – Munk theory of colourant formulation and recepie prediction; Modern computerised methods of colour matching	**6**
7	**Colour Harmony**: Definition, colour associations, colour harmony theories; colour contrasts-successive and simultaneous contrast, contrast of proportion, intensity, value, hue etc.(Itten's contrasts);colour wheel and various colour schemes, dominant, subdominant and accent colours; visual weight and balance in colour schemes	**8**
List of Text Books/ Reference Books		
1	Colour Physics for Industry, R. McDonald, West Yorkshire, 1997.	
2	Color: A Multidisciplinary Approach; Zollinger Heinrich Zurich, Verlag Helvetica	
3	The Colour Science of Dyes and Pigments, R. McLaren Bristol, Adam Hilger Ltd., 1983	
4	Industrial Colour Technology, Johnson R. M., Sartzman M, American Chemical Society, Washington D.C., 1971.	
5	Coloring of Plastics: Fundamentals by Robert A. Charvat John Wiley & Sons, 11-Mar-2005	

6	Coloring of plastics: theory and practice by M.Ahmad Van Nostrand Reinhold, 1979
Course Outcomes (students will be able to.....)	
1	Understand the colour perception and the effect of various parameters on it. (K1,K2)
2	Understand various visual and colour processes in human beings. (K1,K2)
3	Understand various systems to specify uniquely a colour stimulus and use them to do so.(K1,K2,K3)
4	Use knowledge of such colour systems to predict recipe (K2, K3)
5	Understand colour harmony to study various colour contrasts. (K1, K2)
6	Understand various colour harmony theories and the use of colour wheel. (K1, K2, K3)

	Course Code: CET1105	**Course Title: Transport Phenomena (Marks 100)**	**Credits = 4**		
			L	**T**	**P**
	Semester: IV	**Total contact hours: 60**	**3**	**1**	**0**
List of Prerequisite Courses					
H. S. C. Science					
List ofCourses where this coursewill be prerequisite					
Description of relevance of this course in the B.Tech. Program					

	Course contents	**Required hrs**
1	Fluid Statics and applications to engineering importance.	2
2	Equations of Continuity and motion for Laminar and Turbulent Flows with applications to simple problems	8
3	Bernoulli's Equation and engineering applications, Pressure drop in pipes and Fittings, Piping design and fluid moving machinery such as pumps, blowers, compressors, vacuum systems, etc. Particle Dynamics, Flow through Fixed and Fluidised Beds.	10
4	Gas – liquid Two phase flow: types of flow regimes, Regime maps, estimation of pressure drop and hold-up	2
5	Fundamentals of mass transfer: Molecular diffusion in fluids, mass transfer coefficients, and interface mass transfer, steady state theories of mass transfer, Whitman's two-film theory, and its variations.	10
6	Heat conduction in Cartesian, cylindrical and spherical coordinate systems. Convective heat transfer in laminar and turbulent boundary layers. Theories of heat transfer and analogy between momentum and heat transfer.	8

7	Design aspects of exchangers like: Double pipe heat exchangers: Concurrent, counter-current and cross flows, mean temperature difference. Shell and tube heat exchangers: Basic construction and features. Design methods for shell and tube heat exchangers, Finned tube exchangers.	10
8	Introduction to Compact Exchangers.	2
9	Heat transfer aspects in condensers, reboilers and evaporators.	4
10	Heat transfer in agitated vessels: coils, jackets, limpet coils, calculation of heat transfer coefficients, heating and cooling times, applications to batch reactors and batch processes	4

	List of Text Books/ Reference Books
1	Transport Processes and Separation Process Principles: Geankoplis, C.J.
2	Unit Operations of Chemical Engineering, McCabe W.L., Smith J.C., Harriot P.
3	Coulson and Richardson's CHEMICAL ENGINEERING, Volume 1
4	Heat Transfer: Principles and Applications: Dutta, B.K
5	Principles of Mass Transfer and Separation Processes
6	Transport Phenomena: Brodkey, R.S.
7	Fluid Mechanics: Kundu, P.K.
8	Fluid Mechanics: Subramanya, K
9	Fluid Dynamics and Heat Transfer: Knudsen and Katz
10	Process Heat Transfer: Kern, D.Q.
11	Heat Exchangers: Kakac, S., Bergles, A.E., Mayinger, F.
12	Process Heat Transfer: Hewitt, G.

	Course Outcomes (students will be able to.....)
1	Understand the colour perception and the effect of various parameters on it. (K1,K2)
2	Understand various visual and colour processes in human beings. (K1,K2)
3	Understand various systems to specify uniquely a colour stimulus and use them to do so.(K1,K2,K3)
4	Use knowledge of such colour systems to predict recipe (K2, K3)

5	Understand colour harmony to study various colour contrasts. (K1, K2)
6	Understand various colour harmony theories and the use of colour wheel. (K1, K2, K3)

Course Code: GET1105	**Course Title: Basic Electrical Engineering and Electronics (Marks 50)**	**Credits = 3**		
		L	**T**	**P**
		2	**1**	**0**
Semester: IV	**Total contact hours: 45**			
List of Prerequisite Courses				
H. S. C. Science				
List ofCourses where this coursewill be prerequisite				
Description of relevance of this course in the B.Tech. Program				

S.No.	**Topic**	**Hrs.**
1	Basic Laws: Kirchoff's current and voltage law, Simple series and parallel connections, star and delta transformation. Mesh and nodal analysis, Basic elements R, L and C. Concept of self and mutual inductance.	**6**
2	Network theorems: super position, Thevenin's theorems	**2**
3	A.C. Fundamentals: Equations of alternating voltages and currents, cycle, frequency. Time period, amplitude, peak value average value, R.M.S. value, A.C. through resistance, inductance and capacitance, simple RL, RC and RLC circuits. Resonance in series RLC circuits, Power, power factor, series and parallel circuits.	**5**
4	Three Phase systems: Star and delta connections, relationship between line and phase voltages and currents, Power in three phase circuits	**3**
5	Transformer: Introduction, principle of operation, e.m.f. equation, phasor diagrams. Ideal transformer, transformer on no load, Transformer under load, Transformer losses, efficiency, regulation.	**5**
6	Introduction to dc and ac drives	**3**
7	Diodes and rectifiers: P-N junction diode characteristics, Zener diode, Half wave and full wave rectifiers, their waveforms, brief introduction to filters.	**4**
7	Bi-polar junction transistor: Current components. Modes of operation, Input and output characteristics, Regions of operation, Transistor as an amplifier, classification of amplifiers	**6**
8	Introduction to Uni junction transistor, Characteristics, UJT relaxation oscillator,	**3**

9	Silicon controlled rectifier, controlled rectification, characteristics, methods of turning-on. Applications.	**3**

List of Text Books/ Reference Books
Electrical Engineering Fundamentals by Vincent Deltoro
Electronic devices and circuits by Boylstead, Nashelsky
Electrical Machines by Nagrath, Kothari
Electrical Machines by P.S. Bhimbra
Electrical Technology by B.L.Theraja, A.K.Theraja vol I,II,IV
Thyristors and their applications by M.Ramamurthy
Power Electronics by P.S. Bhimbra
Course Outcomes (students will be able to…..)
1. Understand the basic concepts of D.C circuits. Solve basic electrical circuit problems
2. Understand the basic concepts of single phase and three phase AC supply and circuits.
3. Understand the basic concepts of transformers and motors used as various industrial drives.
4. Understand the basic concepts of electronic devices and their applications

	Course Code: TXT1210	**Course Title: Technology of Textile Dyeing (Marks 100)**	**Credits = 4**		
			L	**T**	**P**
	Semester: IV	**Total contact hours: 60**	**3**	**1**	**0**

List of Prerequisite Courses
Technology of Fibres; Technology of Textile Pretreatment
List ofCourses where this coursewill be prerequisite
Theory of Textile Coloration; Environmental Aspects & Advances in Textile Processing; Technology of Printing;
Description of relevance of this course in the B.Tech. Program
Student will understand the importance and relevance of textile coloration, the problems and remedies to solve them, the developments in machinery with respect to growth of industry, the quality of dyed textiles and environmental relevance of dyeing processes

	Course contents (topics/subtopics)	**Required hrs**
SECTION I		
1	Physical and chemical characteristics of textile fibres in relation to dyeing	2
2	Pretreatments of textiles and quality of water in relation to dyeing	1
3	Colour science, colorants and their classification	2
4	An overview of dyeing technology, the parameters of quality dyeing, types of machines and terms used in dyeing; Performance characteristics of dyed textiles	3
5	Classification of dyes based on application to textiles	1
6	Dyeing with Direct, Azoic, Vat, Solubilized Vat, Sulphur and Oxidation	6
7	Dyeing with Acid, Acid Mordant and Premetallized dyes	2

8	Dyeing of Cationic dyes	2
9	Dyeing of Indigo and Natural dyes	3
10	Dyeing of Disperse dyes	2
11	Dyeing of Reactive dyes	3
12	Dyeing of blends, Mass coloration, Supercritical dyeing, OBAs, etc.	2
13	Advances in dyeing techniques	1
SECTION II		
1	Earlier developments in processes and machinery for dyeing of textiles in various forms such as loose fibres, yarns as well as woven and knitted	3
2	Batch, semi-continuous and continuous type dyeing machinery for all forms	6
3	Dosing systems for dyeing, automatic colour and chemical dispensing systems, automated inventory management systems for dyes and chemicals	3
4	Right First Time approach, Faults in dyed materials and their correction.	4
5	Dyeing of union and blended fibre fabrics; Dyeing of micro fibre fabrics	3
6	Machinery used for washing and soaping of dyed materials	2
7	Application and functions of dyeing assistants	2
8	Recent developments in machinery and dyeing techniques	4
9	Concept of conservation of chemicals and water in dyeing	3

List of Text Books/ Reference Books

1	Textile Chemistry, Peters R.H, Vol-3, Elsevier Publishing Company, London, 1975.
2	Cellulosic Dyeing by John Shore, SDC Publ., 1995
3	Basic Principles of Textile Coloration by A D Broadbent, SDC Publ., 2001
4	Batchwise Dyeing of Woven Cellulose Fabric by John Shore, SDC Publ., 1993
5	Colour for Textiles-User's Handbook, W. Ingamells, SDC Publ., 1993
6	Reactive Dyes for Textile Fibres, A. Hunter and M. Renfrew, SDC Publ., 1999.
7	Technology of Dyeing, Shenai V.A., Vol. 6, Sevak Publication, Bombay, 1994.
8	The Theory and Practice of Wool Dyeing, Bird, C.L., SDC Publ., Bradford, 1972.
9	Wool Dyeing by D M Lewis, SDC Publ., 1992
10	Chemical Processing of Synthetic Fibres & Blends by K V Datye & A A Vaidya, John Wiley and Sons, New York, 1984
11	Chemical Principles of Synthetic Fibre Dyeing, S M Burkinshaw, Blaccie Academic & Professional, 1992.
12	Synthetic Fibre Dyeing by C Hawkyard, SDC Publ., 2004
13	Blends Dyeing by John Shore, 1998
14	A manual of Dyeing : For use of Practical Dyers, Manufactures, Students and all interested in art of dyeing, E. Knecht, C. Rawson, R. Loewenthal, Charles Griffin and Company Ltd., London, Vol.1,1983.
15	Handbook of Synthetic Dyes and Pigments, K.M.Shah, Multitech Publishing Company, Bombay, 2nd edition, 1998.

16	**Few Journals for common reading and research updates** 1) Colourage (Techno-commercial) 2) Asian Dyer (Techno-commercial) 3) Textile Asia (Techno-commercial) 4) Journal of Textile Association (Techno-commercial) 5) Indian Journal of Fibres & Textile Research (Research) 6) Colouration Technology, UK (Research) 7) The Journal of The Textile Institute, UK (Research) 8) AATCC Review, USA (Research) 9) Textile Research Journal, UK (Research)
Course Outcomes (students will be able to.....)	
1	Understand the importance of various textile raw materials and processing inputs for quality dyeing. (K1,K2,K4)
2	Understand the procedures, monitoring of dyeing parameters and functions of additives in dyeing of different fibres with various dyes. (K1,K2,K3,K4)
3	Understand the developments in dyes, machines and procedures of dyeing. (K1,K2,K3,K4)
4	Understand the complexities of dyeing to achieve quality dyeing. (K1, K2, K3,K5)
5	Know about developed techniques for specific purposes. (K1, K2, K3, K4, K5)
6	Understand the types of machinery for each type of fibre form, dyeing parameters, dyeing methods (K2, K3, K4)
7	Understand the importance of machinery controls for quality dyeing (K2, K3, K4)

Course Code: GEP1106	**Course Title: Electrical Engineering and Electronics laboratory**	**Credits = 3**		
		L	**T**	**P**
		2	**1**	**0**
Semester: IV	**Total contact hours: 45**			

Course objectives

1. Students will get an insight to the importance of Electrical Energy in Chemical Plants.
2. The students will understand the basics of electricity.
3. They will understand the working and utility of transformers and electrical drives.
4. They will get basic knowledge as regards to electronic devices and their application in Power supplies, amplifiers and other circuits.

Suitable no of experiments out of the following will be conducted.
1. Superposition Theorem 2. Thevenin's Theorem 3. Series RL circuit 4. Reconance in Series RLC circuit
5. H.W. and F.W. Rectifiers
6. Cathode Ray Oscilloscope
7. Input and output characteristic of npn transistor in CE mode.
8. Load Test on Transformer
9. Three phase star connection

10. Three phase delta connection
11. Study of UJT relaxatation oscillator
12. Design of UJT relaxation oscillator
12. Load Test on 3 phase induction motor
13. Study of Thermo couple **Course Outcomes (students will be able to…..)** 1. Understand concepts of basic working of D.C circuits.
2. Understand the basic applications of single phase and three phase AC supply and circuits.
3. Understand the working and utility of transformers and motors used as various industrial drives.
4. Understand the basic working and applications of electronic devices and circuits

	Course Code: PYP1203	**Course Title: Colour Physics Lab (Marks50) (By Physics)**	**Credits = 2**		
			L	**T**	**P**
	Semester: IV	**Total contact hours: 40**	**0**	**0**	**4**
List of Prerequisite Courses					
H. S. C. Science					
List ofCourses where this coursewill be prerequisite					
Description of relevance of this course in the B.Tech. Program					
This course will help student to study and understand photophysical properties of colorants.					

	Course contents(topics/subtopics)	**Required hrs**
1	Determination of unknown concentration of a dye in solution by Dubosque colorimeter.	4
2	Verification of B-L law (dependence of absorbance on concentration) by spectrophotometer.	4
3	Mixture analysis using spectrophotometer.	4
4	Determination of gloss of various samples using gloss meter	4
5	Determination of color of various textile samples in terms of Lovibond primaries and chromaticity co-ordinates using Lovibond tintometer	4
6	Specification of color of a textile sample in terms of ‘Lab’ at using color computer.	4
7	Finding color differences (ΔE) between set of samples vis a vis dye solution concentration	4
8	Finding color differences (ΔE) between set of samples vis a vis time of exposure.	4
9	Determination of colors of samples in terms of Munsell color system using Munsell Color Tree	4
10	Recipe prediction and matching of colored samples using CCM.	4

List of Text Books/ Reference Books
Colour Physics for Industry, R McDonald, SDC Publ., 1997

Course Outcomes (students will be able.....)	
1	To understand colour specifying systems and schemes of quantification of colour.
2	To measure the intensity of the transmitted light and correlate it with concept of chromophore and colour
3	To use instruments to uniquely specify a colour in terms of nos.
4	To explain various concepts of colour mixing, sources etc.

	CourseCode:CET 1401	Course Title:Chemical Engineering Operations	Credits=3		
			L	T	P
	Semester: V	Total contacthours:45	2	1	0
List of Prerequisite					
	Material&EnergyBalance Calculations,PhysicalChemistry,OrganicChemistry, Transport Phenomena				
List ofCourses where this coursewill be prerequisite					
	ThisisabasicChemEngg.course.Itisrequiredinalmostallthecourses,suchas,ChemicalEngineeringLaboratory, Chemical Technology Projects etc.				
Descriptionof relevanceof this course in the B.Tech.Program					

This is abasicChemicalEngineeringcourse. Theprincipleslearnt in this course are requiredinalmost all the courses and throughouttheprofessional careerof Chemical Technologist.

	CourseContents(Topics and subtopics)	Reqd. hours
1	Introductionto Unit Operations andChemical Engineering Processes	1
2	Single Equilibrium Stage, Flash Calculations and Cascade systems: Binary vapor–liquid systems, bubble-point,anddew-pointcalculations,Cascadeconfigurations,co-current,counter-current,cross- current,andother configurations	2
3	Absorption and Stripping of dilute mixtures: Fundamentals of absorption, equilibrium curves, Operatinglinesfrommaterialbalances,Number ofequilibrium stages,KremserEquation,Stage efficiency and columnperformance,Trayedand packed columns,Ratebasedmethods for packed columns(HTU, NTU), Designconsiderations:loadingandfloodingzones, pressure dropandcolumn diameter	6
4	Distillationofbinarymixtures:Differentialdistillation,Flashorequilibriumdistillation,Fractionating columnandmultistagecolumn,designandanalysisfactors,degreesoffreedom,specifications,reflux,refluxratio,needforreflux,McCabe-Thiele,Lewis-Sorelmethodsofestimationofnumberofplates, Operatingandfeedlines,minimumandoptimumrefluxratio,Trayandcolumnefficiency,Packedcolumndistillation:ratebasedmethods:HETP,HTU,PonchonSavaritmethod,Batch,azeotropic andextractivedistillation.Distillationequipment andsizing	6
5	Methodsformulticomponentseparations:Fenske-Underwood-GillilandMethod,selectionoftwokeycomponents,minimumnumberofstages,minimumrefluxanddistributionofnonkeycomponents, Kremsergroup method	1
6	Particulatesolids:ParticlecharacterizationShape,size,particlesizemeasurement,Particlesizeanalysis	2
7	ParticleSizeReduction:Necessityforsizereductionofsolids,Mechanismforsizereduction, Energy requirementsfor sizereductionandscale-upconsiderations, Operationalconsiderations,Crushingand grindingequipment: impactand	3

8	LiquidFiltration:Filtrationtheory:constantpressure,constantrate,andvariablepressure-variablerate filtration,Incompressibleandcompressiblecakefiltration,Continuousfiltration,filteraids,	4
9	Sedimentation,ClassificationandCentrifugalSeparations:Designandscaleupequations,Performance evaluation,Sedimentationequipment,classifiers,centrifugalequipment,Sievingoperations	2
10	Drying of solids: Mechanism of drying, drying rate curves, Estimation of drying time , Drying Equipment,operation,Processdesignofdryers,materialandenergybalancesindirectdryers,	3
List of Text Books/ Reference		
1	Richardson,J.F.,Coulson,J.M.,Harker,J.H.,Backhurst,J.R.,2002.Chemicalengineering:Particle technology and separation processes. Butterworth-Heinemann,Woburn,MA.	
2	Seader, J.D., Henley,E.J.,2005. SeparationProcess Principles,2 ed.Wiley, Hoboken,N.J.	
3	Svarovsky,L., 2000. Solid-LiquidSeparation.Butterworth-Heinemann, Woburn, MA.	
4	McCabe,W.,Smith,J.,Harriott,P.,2004.UnitOperationsofChemicalEngineering,7ed.McGraw-	
5	Green,D.,Perry,R.,2007.Perry'sChemicalEngineers'Handbook,EighthEdition,8ed.McGraw-Hill	
6	Dutta,B.K.,2007.PrinciplesofMassTransferandSeparationProcess.Prentice-HallofIndiaPvt.Ltd, New Delhi.	
CourseOutcomes(studentswill be able to…..)		
1	Knowthesignificanceandusageofdifferentparticulatecharacterizationparameters,andequipmentto	
2	DescribeSizereductionenergyrequirements,estimateperformanceofequipment,selectionandsizing of equipment	
3	Analyzefiltrationdataandselectsystemsbasedonrequirements,estimatefiltrationareaforgiven	
4	Draw T-y-x diagrams, and y-x diagrams, operating lines, feed line, bubble point, dew point	
5	Describetwocommonmodes of drying,industrial dryingequipment	
6	Calculate mass transfer coefficient in various equipment, Calculate height and diameter required, minimumsolvent required in absorption, calculate height and diameter required,	

	CourseCode:CET 1212	**Course Title:Chemical ReactionEngineering**	**Credits= 3**		
			L	**T**	**P**
	Semester: V	**Total contacthours: 45**	**2**	**1**	**0**
List of Prerequisite					
	Physical Chemistry, Material &Energy Balance Calculations,AppliedMathematics.				
List ofCourses where this coursewill be prerequisite					
	Biochemical Engineering, Environmental Engineering and Process Safety, Proc. Dev and Engg.,				

Descriptionof relevanceof this course in the B.Tech.Program

ChemicalReactionEngineeringisconcernedwiththeutilisationofchemicalreactionsonacommercialscale. Thiscourseis very relevant but notlimitedtothefollowingindustries:Inorganicchemicals,organicchemicals,petroleum&petrochemicals, Pulp &paper, Pigments&paints,rubber,plastics,synthetic fibres,Foods,Dyesandintermediates,Oils,oleochemicals,and surfactants,Minerals,cleansingagents, Polymersandtextiles,Biochemicalsandbiotechnology,pharmaceuticalsand drugs, Microelectronics,energy

	CourseContents(Topics and subtopics)	**Reqd. hours**
1	Batchreactor(BR),continuousstirredtankreactor(CSTR),plugflowreactor(PFR),packed-bed	1

2	DesignequationsforBR,CSTR,PFR,PBR,andapplicationsofdesignequationstovariousseries- and parallel- combinationsof flowreactors	3
3	Rate laws and stoichiometry	2
4	Isothermal reactordesign applied to BR, CSTR, PFR, PBR	3
5	Analysisof rate data: differentialmethod,integral method	2
6	Multiple reactions	2
7	Reactionmechanisms, pathways, bioreactions	3
8	Catalysis andcatalytic reactors, catalystdeactivation, externaldiffusion effectsonheterogeneous	4
9	Introduction to non-isothermal reactor design	3
10	Residence timedistribution in reactors; models fornon-idealreactors	4
11	Masstransferwithchemicalreactioninfluid-fluidandfluid-fluid-solidsystems;Modelcontactors, pilot plants, andcollection ofscale-up data	3
List of Text Books /Reference		
1	Elements of Chemical Reaction Engineering – H.Scott FOGLER	
2	Chemical ReactionEngineering – OctaveLEVENSPIEL	
3	TheEngineering ofChemical Reactions –LannyD.SCHMIDT	
4	An introductionto ChemicalEngineering Kinetics andReactorDesign – CharlesHILL	
5	HeterogeneousReactions, Vol.IandII –L.K. Doraiswamy,M.M.Sharma	
CourseOutcomes(studentswill be able to ...)		
1	design chemical reactorsoptimally, using minimumamountof data	
2	designexperimentsin ajudiciousway to gettherequired data,if not available	
3	fixsome problems relatedtooperability and productivity	
4	maintainandoperate aprocess in asafemanner	
5	increasecapacityand/orselectivityand/orsafetybyimproving/changingthereactortype/sequence	

	Course Code: TXT1211	**Course Title: Technology of Finishing (Marks 100)**	**Credits = 4**		
			L	**T**	**P**
	Semester: V	**Total contact hours: 60**	**3**	**1**	**0**

List of Prerequisite Courses

Technology of Fibres, Technology of Textile Pretreatment

List ofCourses where this coursewill be prerequisite

High-tech and Industrial Fibres

Description of relevance of this course in the B.Tech. Program

This course will help students throughout the B.Tech. with understanding of chemicals required to incorporate various properties into textile depending on the end use.

	Course contents (topics/subtopics)	**Required hrs**
SECTION I		
1	Object of Finishing, Classification of finishes	3
2	Mechanical finishes of cotton and synthetic fabrics like Calendaring, raising, sueding, crabbing, potting, compacting, sanforising, pressing, etc., Decatising of wool	8
3	Heat setting of synthetic fabrics; Machinery used and their principles involved; Techno mechanical features automation of machinery in textile finishing	4

4	Drying equipment; stenters, vertical drying ranges, curing ranges. efficiency of drying , use of process control systems to enhance efficiency of drying	8
5	Finishes of blended fabrics, types of setting , Heat Setting of Polyester and its blends, structural changes brought about by heat setting, Various methods to determine the degree of heat setting; Antifelting, carbonizing and other finishes for wool and silk; Finishing of knitted and texturised fabrics	4
6	Evaluation and durability of finishes	6
SECTION II		
1	Chemical finishing agents like stiffeners, binders, weighting agents, softeners, optical brighteners, etc.	5
2	Chemistry and technology used for improving wrinkle resistance, wash and wear, and durable press properties of fabrics; Non-formaldehyde finishes Technologies for resin finishing- Pad-dry cure and Moist cross linking (batch wise and continuous methods)	3
3	Study of various types of finishes such as creeping, softening, stiffening, wetting, antipilling, laminating, etc.; Organdie finish	4
4	Functional finishes like antibacterial, flame retarding, water/oil repelling, soil release, antistatic finishes, Moisture management, UV Protection, Cellulase Bio Polishing etc.	8
5	Evaluation and durability of above mentioned finishes	5
6	Concept of conservation of chemicals, water, energy through different techniques and machineries; Eco-friendliness of various finishes	5
List of Text Books/ Reference Books		
1.	Encyclopedia of Textile Finishing, Rouette, H.K., Springer Verlag, New York, 2001.	
2.	Handbook of Fibre Finish Technology, Slade, P.E., Marcel, New York, 1998.	
3.	Textile Finishing, Hall A.J., Heywood book, London, 1966.	
4.	An Introduction to Textile Finishing, Marsh J.T., B.I. Publication, Bombay, 1979.	
5.	Technology of Finishing, V.A.Shenai, Vol. 10, Sevak Publication, Bombay, 1990.	
6.	Low liquor Dyeing and Finishing – Textile Institute, Manchester.	
Course Outcomes (students will be able.....)		
1.	Able to **write and comprehend** different methods and machineries available for application of finish and calculation for finish add on onto the fabric (K2,K3, A3, S2)	
2.	Able to **write and describe** different types of softeners, fastness improving agents , antimicrobial, anti static, flame retarding agents , their chemistry, application on fabric and tests to evaluate it. (K1, A1, S1)	
3.	Able to **write and describe** different types of enzymes ,cross linking agents based on formaldehyde or formaldehyde free, their chemistry, application on fabric and tests to evaluate it. (K1, A1, S1)	
4.	Able to **write and describe** machine and process parameters and their effects on textiles. (K1, A1, S1)	
5.	Able to **write and describe** processes and their control systems to enhance efficiency of drying and heat setting for various types of textile material and fabrics. (K1, A1, S1)	

6.	Able to **write and describe** different methods for evaluation and durability of finishes. (K1, A1, S1)

	Course Code: TXT1212	**Course Title: Technology of Textile Printing (Marks 100)**	**Credits = 4**		
			L	**T**	**P**
	Semester: V	**Total contact hours: 60**	**3**	**1**	**0**

List of Prerequisite Courses		
Technology of Fibres		
List ofCourses where this coursewill be prerequisite		
Experiments in Printing		
Description of relevance of this course in the B.Tech. Program		
The course will student to understand choice materials and methods to perform printing on different types of textile substrates.		
	Course contents (topics/subtopics)	**Required hrs**
SECTION I		
1	Preparation of fabrics for printing; Steps in printing of various fabrics; Historical printing techniques	3
2	Selection of thickening agents, chemicals and dyestuffs for printing; Formulation and rheological properties of printing pastes	5
3	Printing of textile materials with different dyes; Printing of blended fibre/fabrics	5
4	Machines used for printing, steaming and other methods of print development; Brief idea about preparation of flat and rotary screens for printing	6
5	Different methods of printing and styles of printing; After treatment of printed materials; Faults in printing, their prevention and correction	4
6	Special printing techniques; Printing of velvet, carpets and knits	3
7	Ecological printing of textiles; Recent developments in printing machinery	4
List of Text Books/ Reference Books		
1	Handbook of Synthetic Dyes and Pigments, K.M.Shah, Multitech Publishing Company, Bombay,2nd edition, 1998.	
2	Technology of Dyeing, Shenai V.A., Vol. 6, Sevak Publication, Bombay, 2nd edition, 1994.	
3	A manual of Dyeing : For use of Practical Dyers, Manufactures, Students and all interested in art of dyeing, E.Knecht, C. Rawson, R.Loewenthal, Charles Griffin and Company Ltd., London, Vol.1,1983.	
4	Dyeing and Printing, Cockett S.R., Hilton K.A., Leonard Hill Books Ltd., London, 1961.	
5	Introduction to Textile Printing, W. Clarke, Newness Butterworths, London, 4th edition, 1977	
6	Guide to Printing Techniques, Naoharu Oyabu, Mahajan Brothers Publish Ltd., Ahmedabad,1978.	

7	Technology of Printing, V.A.Shenai, Sevak Publications, Bombay, Vol. 4, 1990.
Course Outcomes (students will be able.....)	
1	Able to **comprehend** fundamental knowledge on basics of preparation of fabrics for printing; Steps in printing of various fabrics; Historical printing techniques Steps in printing of various fabrics; Historical printing techniques (K2, A2)
2	Able to **describe and use** different type printing, fixation, washing and soaping machinery and automated inventory management systems for dyes and chemicals. (K2, A2, S2)
3	Able to **comprehend** Selection of thickening agents, chemicals and dyestuffs for printing; Formulation and rheological properties of printing pastes(K2, A2)
4	Able to **choose** appropriate method, style and after-treatment for printed materials and remedial action to overcome faults in printing, their prevention and correction(K6, A5, S4)
5	Able to **appraise** the concept of conservation of chemicals and water in printing.(K6, A5, S4)
6	Able to **comprehend and apply** the recent developments in the machinery techniques and special printing techniques. (K2, K3, A2)

	Course Code: TXT1802	**Course Title: Environmental Aspects & Advances in Textile Processing (Marks 100)**	**Credits = 4**		
			L	**T**	**P**
	Semester: V	**Total contact hours: 60**	**3**	**1**	**0**
List of Prerequisite Courses					
Technology of Fibres; Technology of Textile Pretreatment; Theory of Textile Coloration; Technology of Textile Printing; Technology of Textile Finishing					
List ofCourses where this coursewill be prerequisite					
Nil					
Description of relevance of this course in the B.Tech. Program					
To train the students with the basics of environmental issues faced by textile industry and the measures taken for the same. To impart the knowledge of various advanced techniques with immediate and near future application potential in the textile wet processing					
	Course contents (topics/subtopics)		**Required hrs**		
SECTION I					
1.	Introduction to Environmental Management - Definitions of environment, ecology, pollution, Types of pollution and effects of stages of textiles on environment, general waste categorization, effective pollution prevention programme, Testing of Effluents for various characteristics such as BOD, COD, Turbidity, TDS, SS, Grease, Oils; Types of textile effluents and their characteristics.		8		

2.	Introduction to Eco System - changes of eco system like carton cycle, Nitrogen cycle & phosphorus cycle, current eco system problems, Environmental problems and human health, Risk assessment and risk management, ecology and textiles, Toxicological considerations of textile processing.	8
3.	Effluent Treatments - Methods of Treatment of Textile effluents - preliminary treatment - flocculation & coagulation - oxidation by bio-chemical methods, sedimentation - Filtration - Tertiary Treatment , Membrane separation, concept of Zero discharge, Multiple effect Evaopration,sludge disposal - Analysis of effluents - Reuse of water -cost of effluent treatment, design of typical ETP. Current Global Textile Laws for different countries and End uses	8
4.	Tracking through the life cycle of an textile article	2
5.	Water Footprint, Energy Footprint, Chemical Footprint, Carbon Footprint	2
6.	Eco conformance certifications – OekoTex (Confidence in Textiles), GOTS, REACH, etc	2

List of Text Books/ Reference Books

Economy Energy & Environment in textile Wet Processing - ACT, Edited by S.S. Trivedi.

Environmental Issues - Technology option for Textile Industry Edited by R. B. Chavan, Indian Journal of Fibre & Textile Research Special Issue - March, 2001.

Eco-friendly Textiles Challenges to Textile Industry - Textile Committee.

Environmental Success - America Textile Industry, AATCC Symposium - 1996.

The Textile Industry: Achieving Our Environmental Commitment - AATCC Symposium - 1994.

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

1	Able to comprehend fundamental knowledge about environment and its charactertics.
2	Able to describe, define and write various ecosystems and ecolables.
3	Able to understand and describe various effluent treatment procedures and their application to textile processing wastewater.
4	Able to effectively choose the right type of wastewater treatment after each step of

	Course Code: TXP1004	**Course Title: Experimental Dyeing (Marks 100)**	**Credits = 4**		
			L	**T**	**P**

	Semester: V	Total contact hours: 60	0	0	8
List of Prerequisite Courses					
Technology of Textile Dyeing					
List ofCourses where this coursewill be prerequisite					
Description of relevance of this course in the B.Tech. Program					
The course will student to understand choice materials and methods to perform dyeing on different types of textile substrates.					

	Course contents (topics/subtopics)	Required hrs
SECTION I		
1.	To study the effect of liquor ratio and salt concentration on exhaust dyeing of direct dyes on cotton.	4
2.	To study the effect of temperature on exhaust dyeing of direct dyes on cotton	4
3.	To study effect of percentage shade on exhaust dyeing of direct dyes on cotton and determine the absorption of exhausted bath.	4
4.	To study various after treatments of direct dye dyeings	4
5.	To study dyeing of different types of reactive dyes on viscose and cotton	4
6.	To study the effect of pretreatments of cotton on dyeing with direct dye	4
7.	To study dyeing of azoic colors on cotton.	4
8.	To study dyeing azoic colour mixtures on cotton.	4
9.	To study dyeing of solubilised vat dyes on cotton	4
10.	To study dyeing and after treatments of sulphur dyes on cotton	4
11.	To study the dyeing of vat dyes on cotton and viscose	4
12.	To study vat pigmentation and vat acid method dyeing on cotton	4
13.	Dyeing of jute with direct, basic and reactive dyes	4
14.	To study dyeing of acid dyes on wool and silk	4
15.	To study dyeing of cotton, viscose, wool and silk using basic dyes	4
16.	To study dyeing of wool and silk using metal complex dyes	4
17.	To study dyeing of wool and silk using acid mordant dyes	4
18.	To study dyeing of polyesters using different disperse dyes and dyeing techniques and measurement of absorbance of extracted dye.	4

19.	To study comparative dyeing of PET, CDPET, PBT with disperse dyes at boil and 130^0C	4
20.	To study dyeing of Nylon, polypropylene, acrylic with disperse dyes	4
21.	To study dyeing of Nylon with acid, metal complex , reactive and direct dyes	4
22.	To study dyeing of acrylic fabric and CDPET with cationic dyes	4
23.	To study dyeing of Lycra	4
24.	Dyeing of Natural dye on wool and cotton followed by application of mordants	4

List of Text Books/ Reference Books
Gile's Laboratory Course in Dyeing, D G Duff and R S Sinclair, SDC Publ.

Course Outcomes (students will be able to.....)	
1	Able to understand, apply and analyze effect of pretreatments, various parameters after treatment on dyeing of cotton with direct dyes (K4, A3, S2).
2	Able to choose, apply and examine different disperse dyes, dyeing techniques and dyeing of PET, CDPET, PBT (K6, A5, S4).
3	Able to process, apply and evaluate dyeing of vat dyes on cotton by vat pigmentation and vat acid method. (K6, A3, S2).
4	Able to process, apply and analyze dyeing of Nylon with acid, metal complex, disperse, reactive and direct dyes. (K6, A3, S2).
5	Able to process and evaluate dyeing of wool and silk using metal complex dyes and acid mordant dyes (K6, A3,S2).
6	Able to carry out and interpret dyeing of Natural dye on wool and cotton in presence of mordents (K6, A3,S2).
7	Able to perform and develop dyeing of jute with direct, basic and reactive dyes (K3,A2, S3).

	Course Code: TXP1005	**Course Title: Evaluation of Dyes &Specialty Chemicals (Marks 50)**	**Credits = 2**		
			L	**T**	**P**
	Semester: V	**Total contact hours: 45**	**0**	**0**	**4**

List of Prerequisite Courses
Technology of Fibres
List ofCourses where this coursewill be prerequisite
Description of relevance of this course in the B.Tech. Program

Chemistry, Applications and Evaluation of Specialty Chemicals		
	Course contents (topics/subtopics)	**Required hrs**
SECTION I		
1.	Determination of Water Solubility of Direct and Reactive Dyes	4
2.	Determination of Dispersibility of Vat and Disperse Dyes	4
3.	To determine the Solid Content of different auxiliaries	4
4.	Determination of Ionic nature of different auxiliaries	4
5.	To determine the efficiency of Wetting Agents	4
6.	To determine the efficiency of Levelling agent and emulsifier	4
7.	Determination of colour fastness to various agencies like washing, light and rubbing	4
8.	Determination of colour fastness to perspiration and bleaching agents	4
9.	Determination of colour fastness to sublimation and hot pressing.	4
10.	BOD and COD determination of various textile auxiliaries	4
11.	Qualitative and quantitative analysis of printing binders	4
12.	Qualitative and quantitative analysis of dye fixing agent	4
13.	Evaluation of colour fastness to Bleach with hypochlorite and peroxide	4
14.	Qualitative and quantitative analysis of stabilizer in peroxide bleaching	4
15.	To study the effect of metals on dyeing shade	4
16.	Estimation of efficiency of peroxide stabilizer.	4
17.	Determination of Amylase activity	4
Course Outcomes (students will be able to.....)		
1	Able to Analyze various properties of dyes (K4, A3, S1)	
2	Able to Analyze various properties of auxiliaries and specialty chemicals used in textile processing.(K4, A3, S2)	
3	Able to Qualitative and quantitative analysis of auxiliaries and specialty chemicals. (K4, A3, S3)	
4	Able to Evaluate performance properties of processed fabric. (K5, A5, S3)	
5	Able to Analyze the effluents. (K4, A3, S2)	
6	Able to evaluate the effect of metal or other impurities present during processing in the processing liquor. (K5, A5, S3).	

Semester VI

	Course Code: TXT1404	**Course Title: Technology of Garment Manufacturing & Processing (Marks 100)**	**Credits = 4**

			L	T	P
	Semester: VI	**Total contact hours: 60**	**3**	**1**	**0**
List of Prerequisite Courses					
Technology of Textile Dyeing, Technology of Yarn & Fabric Formation					
List ofCourses where this coursewill be prerequisite					
Merchandising & Designing of Textile					
Description of relevance of this course in the B.Tech.					
The course will help student to understand applications of the textile products and requirements of markets.					

	Course contents (topics/subtopics)	**Required hrs**
Manufacturing		
1.	**The Garment Industry:** Structure of the garment Industry, sectors of Industry, product types and organization. Apparel industry in India, Domestic industry: size of the industry, nature of the industry, its developments in recent years. Export industry: Size and nature of the industry.	1
2.	**Manufacturing Technology:** Types of Fabric Packages, Types of Fabrics - One Way - Two Way Fabrics - Their effect on spreading -Methods of Fabric spreading - Spreading equipments - Computerized spreaders - Marker making –Marker efficiency - Factors affecting marker efficiency - Marker duplicating methods-Computer aided marker making.	2
3.	Introduction to cutting machines -Types and functions of cutting machines - straight knife, round knife, band knife, cutting machines - Notches, drills, die cutting machines - Computerized cutting machines -maintenance of cutting machines - common defects in cutting & their remedies.	3
4.	Types of needles - Parts of needles and their function - Needle size -sewing thread - properties of sewing threads - ticket number - fabric sewability. Seam quality - effect of stitch type on seam quality; Selection of seam and stitch	3
5.	Federal classification of seam and stitches - Basic parts of sewing machine	2
a.	Needle - Bobbin case /Bobbin hook, Loopers - Loop spreader - Threading fingers - Throat plate - Tongue chaining plates - Take-up devices	2
b.	Tensioners - Feed dog - Pressure foot for sewing	1
c.	Sewing Technology : feed systems, , machinery and equipment, basic sewing machines, like general sewing, over locking, safety stitching, blind stitching, button holes, bartacking, & button sewing, special sewing machines like three thread over lock with a microprocessor, Sewing	3
d.	Problems, slipped stitches, stay gered stitches, unsalaneed stitching pocker etc.	2
e.	Fusing Technology: Construction of Fusible, Fusing process, Fusing machinery, quality control	1
f.	Application of various components such as buttons, zips, underlining, Hooks and ornamental materials, -fly, kissing, lap; Button and buttonholes, hooks and eye snaps, Velcro and other accessories.	2

g.	Pressing Technology: Classification, components of Pressing, machinery and equipments viz. Hand irons, dry iron, electric steam iron, under pressing, top pressing, scissors press, assept or drower, Carousel machines, Steam dolly, tunnel finishing, controls, handling systems, boiler room.	2
h.	Garment Finishing and lnspection:Attaching buttons, marking, sewing labels, cleaning, final touch, fitting quality, live models, measurements, viewing the garments, quality standards.	2
6.	**Production Technology:** Manual systems, making through, section system, progressive bundle system, straight line system, mechanical transport systems, selective conveyor belt system, unit production system, quick response sewing system. Ware Housing: Handling equipment, storage equipment, packing equipment. Basic Pattern Making: Measurement Taking - Size chart and Measuring of Sizes. Definition of various garments parts & positions. Methods: Bespoke method & Industrial method (Using Blocks) - Basic block construction - Block preparation & correction. Figure analysis: Body ideals, body proportion, height, weight distribution, body parts, individual figure analysis, study of body measurement of all age groups. Preparation of basic blocks, muslin pattern, commercial pattern, sizes and its understanding, fabric preparation for garment construction. CAD/CAM in Garment Manufacturing.	4
Garment Processing		
1.	**Introduction:** Aim and scope of readymade garment field with special reference to textile wet processing. Brief introduction to various departments in a garment export house. General overview of various fabric materials used in garment making.	3
2.	**Garment processing:** Concept of pre garment stage and garment stage processing. Concept of garment finishing, general precaution to be taken during finishing of cotton, wool, silk, rayon, woven and knitted materials. Fabric and sewing thread selection, Process Sequence, Flow Chart.	4
3.	**Garment processing machines-** Pedal dyeing machines, winch dyeing machines, soft overflow dyeing machines, tumble dryers, relax dryers, table printing, garment flat bed printing machines with no. of printing stations, transfer printing, digital printing, washing machines.	4
4.	**Speciality Finishes on Garments** - Finishing of woven / knitted garments - Stoneless stone wash effects - mud wash, Ion wash, chalk wash etc. , various softening treatments, water resistant breathable finish, Bio polishing, Leathery Finish, Protective Finishes -Antimicrobial, Deodorizing etc., Functional Finishes -Cool finish, Thermocat finishes, Wrinkle free finishes,Use of various types of enzymes in garment processing, spray techniques	5
5.	**Wash down effects on Denim** - Stone Wash, Enzyme Wash, Combined enzyme and stone wash, acid wash, antique wash, ball blast, whiskering, Sand blast, Ice wash.	2
6.	**Laundering-** Objective, Laundering procedures for various fibre fabrics i.e. cotton & linen, woolen, silks and synthetics, various laundry equipments used in commercial laundering.	2

7.	**Functional Finishes** -Cool Finish (Snocool), Thermocat Finishing, UV Protective Finish, Peach Skin Effect, AquaTex Finish, Feather touch & ultra soft touch, Rubbery touch, Non-stick Teflon spray **Stain Removal** - Object (with reference to garment processing), general procedure of stain removal. Classification of stains, Principles of stain removing. Classification of stain removers. Application techniques for stain removers, i) Local Application II) Bulk Application	2
8.	**Dry Cleaning** - General introduction, objective and principle of the dry cleaning process, dry cleaning chemicals, detailed description of dry cleaning operations (sequential steps)	2
9.	**Printing** - Special print recipes for fashion & garments; Khadi, Metallic, Floe, Plastizol, Reflective, Pearl, Fluorescent Printing, High Density Printing, Puff Printing, Foil Printing, Plastic Printing.	2
10.	Label Printing Defects -Garment defects, Pressing Defects, Packing Defects	2
11.	Dyeing in Garment form with pigment / reactive / sulphur Colour	2

List of Text Books/ Reference Books

Garment Technology for fashion designers by Gerry Cooklin

Introduction to clothing Manufacturing by Gerry Cooklin

Clothing construction and wardrobe planning by Dora S. Lewin, Mabel Goode Bowers, Manetta Knttunen — The Macmillan co New York

Garment Technology by Dr. V.Subramaniam — Winter School booklets 1990

BIS publications 1989.

Apparel Manufacturing Analysis, Solinger, J., Textile Publisher Inc., New York, 1961.

A Introduction to Quality Control for the Apparel Industry, Mehta, P.V.

Chemical after treatments of textile by Marks, Atlas & Wooding.

Textile finishing by A.J. Hall.

Introduction to textile finishing by J.T. Marsh.

Technology of finishing - Vol. X by Dr. V.A. Shenai.

Chemical processing of polyester/cellulosic blends by R.M. Mittal and S.S. Trivedi.

Silk dyeing, printing and finishing by Prof. M.L. Gulrajani.

Garment Finishing & Care Labelling byS.S.Satsangi, Usha Publishers,53-B/AC-IV, Shalimar Bagh, New Delhi.

Stain Removing Techniques by byS.S.Satsangi, Usha Publishers, 53-B/AC-IV, Shalimar Bagh, New Delhi.

Fabric Care by Noemia D'SOUZA, New Age International Publishers, Daryagang, New Delhi

Garment Processing, Mittal, R.M.

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

1	Able to Understand the Aim and scope of readymade garment field with special reference to textile wet processing. Brief introduction to various departments in a garment export house. General overview of various fabric materials used in garment making.(K2, A2, S1)
2	Able to Understand the concept of various stages of garment processing,(pretreatment dyeing printing finishing)its problems and remedies. general precaution to be taken during finishing of cotton, wool, silk, rayon, woven and knitted materials. Fabric and sewing thread selection, Process Sequence, Flow Chart.(K2, A2)
3	Able to understand Garment, Denim processing, Laundering, dry-cleaning washing off ,stain removal machines, Labelling and embroidering and role of garment accessories in garment processing.(K2 A2)
4	Able to **comprehend** fundamental knowledge of the garment industry and the stages at which garments are manufactured,role of garment manufacturer or an export houseand also to **understand, and analyze** the process of communication between buyers, export housein manufacturing garments. (K4, A3, S2)
5	Able to **understand and describe** different manufacturing processes and various equipments which are related to the fabric cutting, sewing (feed dogs, needles), fusing pressing technology , ware housing and various production systems in the garment manufacturing unit anddevelopments in the technology of garment manufacturing (K2,
6	Able to **list and interpret** different trims and components used in the garment industry, **analyze** the federal classification of seams and stitches which are widely used in the garment industry**. (K4, A3, S2)**

	Course Code: TXT1213	**Course Title: Theory of Textile Coloration(Marks 50)**	**Credits = 2**		
			L	**T**	**P**
	Semester: VI	**Total contact hours: 45**	**2**	**1**	**0**
List of Prerequisite Courses					
Technology of Fibres; Technology of Textile Dyeing					
List ofCourses where this coursewill be prerequisite					
Environmental Aspects & Advances in Textile Processing; Technology of Textile Printing					
Description of relevance of this course in the B.Tech. Program					
To train the students with the in-depth knowledge of the dye-fibre interaction from the point of view of uniform dyeing with desirable depths and tones. Physicochemical aspects of dyeing; the mechanism of coloration of a textile. This theory applies to all the wet processes of textile and also useful in processing of the emerging area of processing of technical textiles.					
	Course contents (topics/subtopics)		**Required hrs**		

Manufacturing		
1.	Classification of colouring matters according to their application to the textile fibres ; Physical and chemical structures of fibres and dyes in relation to dyeing;	4
2.	Interaction between dye molecules and the fibres	2
3.	Dyeing of different dyestuffs onto various natural textile fibres	13
4.	Rapid dyeing concept	8
5.	Dye-fibre bonds and parameters affecting them	3
6.	Thermodynamics of dyeing process; Kinetics of dyeing; Affinity of dyes towards the fibres; Adsorption isotherms; Equilibrium adsorption and factors influencing the same; Saturation value; Diffusion coefficient; Glass transition temperature and its effect on dyeability; Electro-kinetic properties of dye-fibre systems.	10
7.	Compatibility of dyes in mixtures; Dyeing of fibre blends and shade matching.	4
8.	Important properties of dyestuffs and their evaluation; Evaluation of fastness properties of dyed materials and their acceptability limits; Novel dyeing techniques.	10
9.	Theories behind different techniques such as, solvent dyeing, mass colouration, heat transfer coloration, etc; Concept of eco-friendliness in dyestuffs and dyeing techniques.	6

List of Text Books/ Reference Books

Reactive Dyes for Textile Fibres, Renfrew A., A. Hunter M., SDC Publ., Bradford, 1999.

The Theory and Practice of Wool Dyeing, Bird, C.L., SDC Publ., Bradford, 1972.

Theory of Colouration of Textiles, Johnson A.s, SDC Publ., Bradford, 2nd edition, 1989.

Chemical Processing of Synthetic Fibres and Blends, K.V. Datye and A.A. Vaidya, John Wiley and Sons, New York, 1984.

Textile Chemistry, Peters R.H, Vol-3, Elsevier Publishing Company, London, 1975.

Chemical Processing of Synthetic Fibres and Blends, Datye K.V., Vaidya A.A., Wiley-Interscience Publ., New York, 1984.

Course Outcomes (students will be able to.....)	
1	Able to comprehend fundamental knowledge of fibres and colour science in relation to dyeing.
2	Able to describe basic physicochemical aspects of dyeing on fibres.
3	Able to write, compile and elaborate on dyeing procedures.
4	Able to use different dyeing techniques and compare them.
5	Able to correlate the theory and procedures of dyeing.

6	Able to describe the procedures of dyeing with importance of step and chemical additions.

	CourseCode: HUT 1103	**Course Title: Industrial Psychology and Human ResourceManagement**	**Credits=3**		
			L	**T**	**P**
	Semester: VI	**Total contacthours: 45**	**2**	**1**	**0**
List of Prerequisite Courses					

List ofCourses where this coursewill be prerequisite					

Descriptionof relevanceof this course in the B. Tech.Program					
This course equipsstudentswith humanresource management skillsto be able to function effectively intheirprofessional career.					
	CourseContents(Topics and subtopics)		**Reqd. hours**		
1	Introduction &Overview ofthe course,		3		
2	Changes/Challengesin HRM,		3		
3	Management Theories		6		
4	Research Methodology & Statistical Tools		3		
5	Management ofChange		6		
6	OrganizationalCulture&Climate		3		
7	Knowledge Productivity		3		
8	New LeadershipMotivation Theories		3		
9	Talent Management		3		
10	Training & Development		3		
11	PerformanceManagement		3		
12	Selection &Recruitment		3		
13	Compensation, Unions, Entrepreneurship		3		
List of Text Books/ Reference Books					
	Personality and Organization.,Argyris C.				
	The Essenceof Leadership, Locke,EdwinA.				
	OrganisationalBehaviour,RobbinsS				
	Managing HumanResources, Bach, S.2005				
	HumanResourceManagement:				
CourseOutcomes(studentswill be able to…..)					
1	Studentsshould beable to explainthe fundamental concepts ofIPHRM.				
2	Studentsshouldbeable to analyzepractical situations				
3	Studentswill be able to provide applicable solutions.				

	CourseCode:HUT1104	**Course Title:IndustrialManagement– I**	**Credits= 3**		
			L	**T**	**P**
	Semester: VI	**Total contacthours: 45**	**2**	**1**	**0**
List of Prerequisite Courses					
List ofCourses where this coursewill be prerequisite					
	Industrial Management II, Textile Process House Management				

Descriptionof relevanceof this course in the B.Tech.Program		
This course isessential for effective functioning of students intheirprofessional career		
	CourseContents(Topics and subtopics)	**Reqd**

1	Introduction:Principles, thoughts and contributions of FW Taylor, Henry Fayol and Elton Mayo. Responsibilities of management: society and development. Functions of Management:	10
2	Organisational ProcessandBehaviour:IntroductionandMeaningofOrganization,Organizationasa process, Span of Control, Authority, Responsibility and Accountability, Delegation of authority, Decentralizationofauthority.EnhancingManagerialEffectivenessthroughselfandothers,Individual Personality&Behaviour,Perception,Attitudes,	10
3	Technology Management: Strategies &their applications in industry, Business specifications versus	10
4	MarketingManagement:Marketingvssales,advertising,marketingresearch,supplychainmanagement,	10
5	Laws: Company Laws,Factory Laws,LaborLawsandIntellectual Property Rights(IPR)	10
6	CommunicationSkills:Communicationprocess,mediachannels,writtenandverbal/presentationskills,	5
	List of Text Books/	
	Essentials of Management,Koontz	
	Innovationand Entrepreneurship,Peter Drucker	
	Industrial Management–I,JhambL.C.and JhambS.	
	Essentials of Organizational Behavior,S.Robbins	
	OrganizationalBehaviour, LuthansF	
	Principles ofMarketing,Kotler	
	Research andDevelopment Management,BamfieldP	
	Industrial Management, Spriegel U.S.	
	CourseOutcomes(studentswill be able to…..)	
1	Studentsshould beable to explainthe fundamental concepts ofIndustrial Management	
2	Studentsshouldbeable to analyzepractical situationsandbeable to provideapplicablesolutions.	

	Course Code: TXT1501	**Course Title: High-tech & Industrial Fibres (Marks 50)**	**Credits = 3**		
			L	**T**	**P**
	Semester: VI	**Total contact hours: 45**	**2**	**1**	**0**
List of Prerequisite Courses					
Technology of Fibres					
List ofCourses where this coursewill be prerequisite					
Non-woven and Technical Textile					
Description of relevance of this course in the B.Tech. Program					
The course will be helpful to understand the advancements in fields such as polymers, composites, etc and their applications in different fields.					
	Course contents (topics/subtopics)		**Required hrs**		
Manufacturing					
1.	Polymerization, spinning and properties of aromatic polyamides, high molecular weight polyester, rigid rod and ladder polymers such as BBL, PBZT, PBO, PBI.		8		
2.	Manufacturing of carbon fibres from PAN precursors, viscose and pitch fibres.		4		

3.	Glass fibres. Liquid crystal fibres, Gel spinning of polyethylene.	4
4.	Hollow and profile fibres, design of spinneret for such fibres. Blended and bicomponent fibres.	3
5.	Medical textiles, Superabsorbent fibres, etc.	3
6.	Plasma modification, Radiation processing, Industrial tapes.	4
7.	Biaxially oriented films and film fibres, Barrier films and coatings.	4

List of Text Books/ Reference Books

High Performance Fibers, J.W.S. Hearle, Wood head Publishing

New millennium fiber ,Thongu, CRC press,2005

Medical Textiles & biomaterial for healthcare,Anand S.C. Wood head publishing,2006

Kirk-othmer encyclopedia

Isotopes & radiation technology in industry,Rao S.M.

Natural & man-made Textile fibres,G.E Linton, New York duell,sloan and pearce 1966

Advanced fiber spinning Technology,T.Nakajima,Wood head publication,2002

Bicomponent fires. ,Jeffries,Merrow publishing,1996

New millennium fiber ,Thongu,crc press,2005

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

1	Able to **comprehend** the need, technology and difference between conventional and High Tech fibres (K2,A4,S1)
2	Able to **write and describe** manufacturing of Carbon fibres using different precursors, their applications and properties (K3, A4, S1)
3	Able to **write and describe** manufacturing of Glass fibres, their applications in general and as optical fibre and properties (K3, A4, S1)
4	Able to **write and describe** manufacturing of Aramide fibres, their applications and properties (K3, A4, S1)
5	Able to **write and describe** manufacturing of Ultra high molecular weight Polyethylene fibres, their applications and properties (K3, A4, S1)
6	Able to **write and describe** manufacturing of different biodegradable fibres, their applications as medical textiles and properties (K3, A4, S1)

	Course Code: TXP1014	**Course Title: Finishing & Evaluation of Textiles (Marks 100)**	**Credits = 4**		
			L	**T**	**P**
	Semester: VI	**Total contact hours: 60**	**0**	**0**	**8**

List of Prerequisite Courses

Technology of Finishing

List ofCourses where this coursewill be prerequisite

Non-woven and Technical Textile

Description of relevance of this course in the B.Tech. Program		
This will help students to understand the properties of textile substrate used in different applications.		
	Course contents (topics/subtopics)	**Required hrs**
1.	Application of cross linking agent and testing of finished fabric for crease recovery angle, tensile and tear strength.	4
2.	Application of antistatic agent and testing of finished fabric for static charge.	4
3.	Application of flame retarding agent and testing of finished fabric by measurement of char length, rate of burning and Limiting Oxygen Index.	4
4.	Application of softeners and testing of finished fabric for its feel , drapability, effect on absorbency, yellowing, shade change, sewability testing, Handlometer /surface friction assessment.	4
5.	Application of water repellent/waterproof agent and evaluation of fabric for water repellency by spray/shower test and water penetration test.	4
6.	Application of Optical brightening agent and evaluation of fabric for its whiteness.	4
7.	Application of stiffening agent and evaluation of fabric for its feel and bending length	4
8.	Application of antibacterial agents and testing of finished fabric for antibacterial property.	4
9.	Application of soil release agent and testing of finished fabric for anti-soiling property.	4
10.	Application of Water and Oil repellant and its evaluation.	4
Course Outcomes (students will be able to.....)		
1	Able to describe application of different textile finishing agents and their testing procedure for the particular property.(K2, A2, S1).	
2	Able to describe application of flame retarding agent and testing of finished fabric by measurement of char length, rate of burning and Limiting Oxygen Index. (K2, A2, S1).	
3	To carry out application of water repellent/waterproof agent and evaluation of fabric for water repellency by spray/shower test and water penetration test. (K2, A2, S1).	
4	Able to describe application of antibacterial agents and testing of finished fabric for antibacterial property. (K2, A2, S1).	
5	Able to describe application of soil release agent and testing of finished fabric for anti-soiling property. (K2, A2, S1).	
6	Able to describe application of Water and Oil repellant and its evaluation. (K2, A2, S1).	

	Course Code: TXP1015	**Course Title:Analysis of Textile Chemicals & Fibres (Marks 50)**	**Credits = 2**		
			L	**T**	**P**
	Semester: VI	**Total contact hours: 45**	**0**	**0**	**4**
List of Prerequisite Courses					

H. S. C. Science, Chemistry Application of Colorant, Organic Chemistry, Evaluation of Dyes & Specialty Chemicals		
List ofCourses where this coursewill be prerequisite		
Chemistry, Applications and Evaluation of Specialty Chemicals		
Description of relevance of this course in the B.Tech. Program		
It will provide scientific background to students which will help them to understand relation between processing chemicals and fibre substrate.		
Sr. No.	**Course contents (topics/subtopics)**	**Required hrs**
1	Estimation of bleaching powder and sodium chlorite	4
2	Estimation of sodium silicate and sodium carbonate	4
3	Estimation of composition of alkali mixture and barium hydroxide	4
4	Estimation of Glauber's salt and sodium chloride	4
5	Estimation of chrome alum and hardness of water	4
6	Estimation of sodium hydrosulphite and Rangolite C	4
7	Estimation of formaldehyde and oxalic acid	4
8	Estimation of sodium alginate	4
9	Estimation of acid value and Iodine value of fatty acids	4
10	Estimation of efficiency of Sizing chemicals	4
11	Estimation of Chelating agents	4
12	Estimation of bleaching powder and sodium chlorite	4
TXP1003		
13	Identification of fibres by microscopic method	4
14	Identification of fibres by chemical methods	4
15	Identification of fibres from binary blends by chemical methods	4
16	Identification of fibres from tertiary blends by chemical methods	4
17	Quantitative analysis of blends	4
18	Determination of count of yarn	4
19	Fibre maturity measurements	4
20	Fibre fineness by Cut-Weight Method	4
21	Measurement of maturity and fineness by airflow instrument	4
22	Determination of twist in double and single yarn	4
23	To measure Yarn Appearance, Hairiness/yarn imperfections(Zwellager)	4
24	To measure Yarn twist/Count	4
25	To determine Types of weave (Weave Diagram)	4
26	To measure Fabric weight (GSM)	4
27	To measure Fabric Count (Ends/pick, Wales/course)	4
28	Determination of the single yarn strength and elongation at break of the	4
List of Text Books/ Reference Books		

1	Technology of Bleaching and Mercerizing, Shenai V.A., Sevak Publication, Bombay, Vol. - 3, 3rd edition, 2003.
2	Textile Bleaching, Steven A.B., Pitman and Sons, London.
3	Technology of Scouring and Bleaching, Trotman E.R., Griffin, London, 1968.
4	Technology of Bleaching and Dyeing, Chakraverty, R.R., Trivedi S.S., Vol. 1, Mahajan Publishers Private Ltd., Ahmedabad, 1979.
5	Textile Chemistry, Peters R.H, Vol-2, Elsevier Publishing Company, London, 1967.
6	Sizing by D.B.Ajgaonkar, M.K.Talukdar and V.R.Wadekar
7	Mercerizing by J.T.Marsh
8	Chemical Technology in the Pre-treatment Processes of Textiles by S.R.Karmakar
Course Outcomes (students will be able to.....)	
1	Able to estimate the purity of the different acids, alkali, reducing agents, oxidizing agents used in the textile processing. (K4, A3, S2)
2	Able to find the efficiency e.g. of Sizing chemicals, blend analysis, fibre identification by microscopic and by chemical methods . (K5, A3, S3)
3	Able to describe, carry out and use yarn twist/count, Appearance, Hairiness/yarn imperfections, fabric GSM. (K2,A3,S3)
4	Able to describe, interpret, examine and determine twist in double and single yarn, strength and elongation at break.(K3, A3,S3)
5	Able to carry out and use measurement of maturity and fineness of fibres by airflow instrument.(K3,A3,S2)
6	Able to evaluate types of weave using weave diagram. (K5,A3,S3)

	Course Code: TXP1016	**Course Title:Experiments in Printing (Marks 50)**	**Credits = 2**		
			L	**T**	**P**
	Semester: VI	**Total contact hours: 45**	**0**	**0**	**4**
List of Prerequisite Courses					
H. S. C. Science, Theory of Textile Coloration					
List ofCourses where this coursewill be prerequisite					
Nil					
Description of relevance of this course in the B.Tech. Program					
It will provide practical knowledge about one of most important methos of textile coloration using various colorants.					

Sr. No.	**Course contents (topics/subtopics)**	**Required hrs**
1	Direct style of printing of Direct Dyes on cotton	4
2	Direct style of printing of Reactive Dyes on cotton	4
3	Direct style of printing of Reactive Dyes on cotton with various types of thickeners	4
4	Direct style of printing of Vat Dyes cotton	4
5	Direct style of printing of Azoic colors on cotton	4

6	Direct style printing on Polyester with Disperse dyes	4
7	Direct style printing on Nylon with disperse dyes	4
8	Direct style printing on Nylon Acid and Direct dyes	4
9	Direct style printing on Wool with Acid and Direct dyes	4
10	Direct style of printing on Jute, wool and acrylic with Basic Dyes	4
11	Direct style of printing of Pigments on cotton and polyester	4
12	Discharge style of printing – white discharge under direct dyed ground	4
13	Discharge style of printing – white discharge under Reactive dyed ground	4
14	Discharge style of printing – white and yellow discharge under azoic ground	4
15	Discharge style of printing – Vat discharge under direct dyed ground	4
16	Discharge style of printing – pigment under reactive dyed ground	4
17	Resist style of printing – White resist under reactive dyed ground	4
18	Resist style of printing – white resist and colour resist under Phthalogen Blue	4
19	Special print effect – Tie and Dye style of printing	4
20	Special print effect – Batik style of printing	4
21	Special print effect – crimp style of printing	4
22	Special print effect – burnt out/brasso style of printing	4
Course Outcomes (students will be able to.....)		
1.	Able to develop practical skills in preparation of fabric for printing, printing paste and	
2.	Able to select styles and methods of printing	
3.	Able to test performance properties of printed goods	
4.	Able to correlate theoretical aspects with the practice of printing	

Sub Code	SubjectName	TeachingScheme			CreditsAssigned			
		Theory	Pract.	Tut.	Theory	TW/Pract	Tut.	Total
HUT1106	**Environmental Science and Technology**	02	-	01	03	-	-	03

List of Prerequisite Courses
H. S. C. Science
List ofCourses where this coursewill be prerequisite
Value Education, Textile Process House Management
Description of relevance of this course in the B.Tech. Program
This course will be very helpful for environmental awareness in students and ecofriendly ways of production, processing and finishing.

Sr.No.	Details	Hrs
Module 1	**MultidisciplinaryNatureofEnvironmentalStudies:** • ScopeandImportance • NeedforPublicAwareness • DepletingNatureofEnvironmentalresourcessuchasSoil,Water, Minerals,andForests. • GlobalEnvironmentalCrisisrelatedtoPopulation,Water,Sanitation andLand. • Ecosystem:Concept,Classification,StructureofEcosystem,overview ofFoodchain,FoodwebandEcologicalPyramid	04

Module 2	**SustainableDevelopment** • Conceptofsustainabledevelopment • Social,EconomicalandEnvironmentalaspectofsustainable development. • ControlMeasures:3R(Reuse,Recovery,Recycle),Appropriate Technology,Environmentaleducation,Resourceutilizationasperthe carryingcapacity**.**	04
Module 3	**EnvironmentalPollution:** • AirPollution:Sources,Effectsofairpollutionwithrespect toGlobalWarming,OzonelayerDepletion,AcidRain, Photochemicalsmog,TwoControlMeasures-BaghouseFilter, Venturiscrubber. CaseStudy • WaterPollution:SourcesandTreatment,Conceptofwastewaters-Domestic&Industrialandtreatment. CaseStudy • LandPollution:Solidwaste,SolidwasteManagementbyLandfilling, Composting. • NoisePollution;SourcesandEffects • E-Pollution:SourcesandEffects.	07
Module 4	**EnvironmentalLegislation:** • Overview • MinistryofEnvironmentandForests(MoE&F).Organizational structureofMoE&F. • FunctionsandpowersofCentralControlPollutionBoard. • FunctionsandpowersofStateControlPollutionBoard. • EnvironmentalClearance,ConsentandAuthorizationMechanism. • EnvironmentalProtectionAct • AnytwocasestudiespertainingtoEnvironmentalLegislation.	05

Module 5	**RenewablesourcesofEnergy:** • LimitationsofconventionalsourcesofEnergy. • Variousrenewableenergysources. • SolarEnergy:Principle,WorkingofFlatplatecollector&Photovoltaic cell. • WindEnergy:Principle,WindTurbines.	05
	• HydelEnergy:Principle,Hydropowergeneration. • GeothermalEnergy:Introduction,SteamPowerPlant	
Module 6	**EnvironmentandTechnology** • RoleofTechnologyinEnvironmentandhealth • ConceptofGreenBuildings,Indoorairpollution • CarbonCredit:Introduction,Generalconcept. • DisasterManagement:TwoEvents:Tsunami,Earthquakes,Techniques ofDisasterManagement • CaseStudy	05

RecommendedBooks:

1. TextbookofEnvironmentalstudiesbyErachBharucha,UniversityPress.
2. EnvironmentalStudiesby R.Rajagopalan,OxfordUniversityPress.
3. EssentialsofEnvironmentalStudiesby KurianJoseph&Nagendran,PearsonEducation
4. RenewableEnergyby GodfreyBoyle,OxfordPublications.
5. PerspectiveOfEnvironmentalStudies,byKaushikandKaushik,NewAgeInternational
6. EnvironmentalStudiesby.AnanditaBasak,PearsonEducation
7. TextbookofEnvironmentalStudiesbyDaveandKatewa,CengageLearning
8. EnvironmentalStudiesbyBennyJoseph,TataMcGrawHill

Semester VII

	CourseCode:CET 1703	Course Title:Chemical Process Control	Credit		
			L	T	P
	Semester: VII	Total contacthours: 45	2	1	0
List of Prerequisite Courses					
	MaterialandEnergyBalanceCalculations,AppliedMathematics, Chemical Engineering Operation, ChemicalReactionEngineering.				
List ofCourses where this coursewill be prerequisite					
	Chemical Engineering Laboratory, Projects.				
Descriptionof relevanceof this course in the B.Tech.Program					
Processcontrolplaysaverycriticalroleinthecontextofactualoperationofachemicalplant.Mostofthecorechemical engineeringcoursesfocus on thesteadystateoperation. Inthe reallife environment, processiscontinuouslysubjected to various disturbanceswhichdeviatestheoperationfromthedesignedsteadystate.Thiscoursespecificallypreparesstudentstoassessthe impact ofsuch disturbancesand equip themwiththetoolsavailable withthe chemical engineerto tackle these situations.					
	CourseContents(Topics and subtopics)		**Reqd.**		
1	Introductiontoprocesscontrol:Motivation,importance,componentsofcontrolsystem,controlrelevant		2		
2	Dynamicsof first,second andhigher order systems:Examples systems, characterizingparameters,		5		
3	Feedbackcontrol:Motivation,elementsoffeedbackcontrol,servoproblem,regulatoryproblem, effect of proportional,integral and derivative action, responses of P, PIandPID controllers		3		
4	Controller selection and design: Controller selection guidelines, controller design criteria, commoncontrolloops(level,pressure,flow, temperature),reactor control,distillation control		3		
5	Controllertuning:Openlooptuning,closedlooptuning,directsynthesis,commercialcontrollertuning packages		3		
6	Stability analysis: Laplacedomain analysis,frequencydomain analysis		3		
7	Multivariableandadvancedcontrol:Cascadecontrol,dynamicmatrixcontrol,internalmodelcontrol,basicsofratiocontrol,splitrangecontrol,overridecontrol,adaptivecontrol,inferentialcontrol,model predictivecontrol,geometriccontrol		5		
8	Digital control: Discrete time systems, basics of z-transforms, stability analysis		2		
9	Electronicsforcontrolsystems:Distributedcontrolsystem,ProgrammableLogicControllers,SCADA, HMI		2		
10	Instrumentation: Basic measurement devices and working principles for level, flow, pressure andtemperature,typesof controlvalves, etc.		2		
List of Text Books/ Reference Books					
1	Stephanopoulos, G.ChemicalProcess Control: An IntroductiontoTheory and Practice.				
2	Bequette, B.W.Process Control: Modeling,Design, and Simulation.				
3	Seborg, D.E. and Mellichamp, D.A. and Edgar, T.F. and Doyle, F.J.Process Dynamics				
4	Johnson,C.D.Process Control Instrumentation Technology.				

CourseOutcomes(studentswill be able to…..)		
1	Understandtheimportance ofprocessdynamics(unsteady stateoperation)	
2	Design acontrol strategyforkey unit operations (reactor,distillation column, etc)	
3	Tune a controller to rejectdisturbancesor manageoperating point transitions	
4	Understandworkingprinciplesofbasicinstrumentsavailableforflow,pressure,levelandtemperature measurement	
5	Describemodern industrial control systemarchitecture	

	Course Code:TXT 1214	Course Title: Chemistry Application & Evaluation of Specialty Chemicals	Credits = 4

		(Marks 100)	**L**	**T**	**P**
	Semester: VII	**Total contact hours: 60**	**3**	**1**	**0**

List of Prerequisite Courses	
H. S. C. Science, Technology of Textile Dyeing, Technology of Finishing, Technology of	
List ofCourses where this coursewill be prerequisite	
Chemistry of Surfactants, Testing of Textile Materials	
Description of relevance of this course in the B.Tech. Program	
The course will provide student deep understanding about the role of different functional groups on the properties of various specialty chemicals used in different industries.	
Sr. No.	**Course contents (topics/subtopics)** **Required hrs**
1	Nomenclature, functions and classification of textile auxiliaries 3
2	Surfactants and their chemistry and applications. Surface activity 3
3	Anionic Surfactants: Properties & uses of anionics from carboxylic acids, alkylaryl sulphonates, alkyl suphates, alkane sulphonates and phosphate esters, etc. 3
4	Cationic Surfactants: Chemistry, Properties & applications 3
5	Non ionic Surfactants: Chemistry, Properties & applications 3
6	Chemistry and synthesis of important textile auxiliaries 5
7	Qualitative and quantitative evaluation of auxiliaries; Testing of surfactants, detergency, identification of ionic nature. 3
8	Biodegradability of surfactants 2
9	Banned chemicals in pretreatments, Eco friendly textile auxiliaries; 3
10	Recent developments in textile auxiliaries 2
List of Text Books/ Reference Books	
1	Colourants and Auxiliaries: Organic Chemistry and Application Properties, Shore, J., SDC, Bradford, 1990.
2	Laundry Detergents, Smulders, E., Wiley VCH, Weinheim, 2002.
3	Chemistry and Textile Auxiliaries, Shenai V.A., Vol. 65, Sevak Publication, Bombay, 2nd edition, 2002.
4	Textile Auxiliaries, Batty, J.W., Dergamon Press, Oxford, 1967.
5	Textile Chemicals and Auxiliaries, Speel H.C., Reinhold Processing Corporation, New York, 1952
Course Outcomes (students will be able to.....)	
1	Able to understand fundamental knowledge on basics of textile auxiliaries. (K2, A2)
2	Able to describe the role of surfactants in textile and their different types (K2, A2)
3	Able to write synthesis of important textile auxiliaries (K2, A2, S2)
4	Able to understand different tools for testing of surfactants and identify the ionic nature. (K2, A2, S1)
5	Able to explain the biodegradability of surfactants and eco-friendly textile auxiliaries. (K2, A3, S2)
6	Able to describe recent developments in textile auxiliaries. (K2, A3, S2)

	Course Code: TXT 1103	Course Title: Technology of Textile Polymers (Marks 50)	Credits = 3		
			L	T	P
	Semester: VII	Total contact hours: 45	2	1	0

List of Prerequisite Courses
H. S. C. Science
List ofCourses where this coursewill be prerequisite
Non-woven and Technical Textile
Description of relevance of this course in the B.Tech. Program
This course will provide better understanding of fundamental components of textile polymemrs and ability to distinguish various types of polymers.

Sr. No.	Course contents (topics/subtopics)	Required hrs
1	General polymer chemistry; Various synthetic polymers used in textile industry	3
2	Thermosetting and thermoplastic polymers in textile applications; Mechanism of addition and condensation polymerization	3
3	Number average and weight average molecular weights and their measurements	4
4	Swelling and dissolution for polymeric materials; Chemicals used for it, Introduction to electrical properties such as dielectric properties and static charge generation. Thermal properties, heat-setting.	4
5	Determination of crystalline, non-crystalline regions and crystalline orientation in fibre structure; Micro structures of fibre and their theories	3
6	Development and modification of fibre structure through different techniques of spinning, drawing and texurising	4
7	Physical and chemical modifications of fibres and their effect on properties; Graft and block copolymerisation reactions	3
8	Brief idea about characterisation of polymers by different physical techniques such as DTA, DSC, TGA, IR, X-Ray diffraction, birefringence, and sonic modulus. etc.	4
9	Brief idea about polymer composites; Recent developments in synthetic polymers for textiles; Polymer waste and techniques of utilisation	2

List of Text Books/ Reference Books	
1	Synthetic Fibres : Machines and Equipment Manufacture Properties, Fourne, Franz, Munich, Hanser Publications, 1998.
2	Natural Polymer man-made Fibres, Carrol and Porczynski C.Z., National Trade Press Ltd., London,1965.
3	Visco-Elastic Properties of Polymers, Ferry, J.D., John Wiley and Sons, New York, 3rd edition, 1980.

4	Textbook of Polymer Science, Billmeyer F.W., John Wiley and Sons, New York, 3rd edition, 1984.
5	Man-made Fibres, Moncriff, R.W., Newnes Butterworth, London, 6th edition, 1965.
Course Outcomes (students will be able to.....)	
1	Able to **comprehend** fundamental knowledge of polymers, their types, application in textile field and methods of classification (K2, A2).
2	Able to write and compare different techniques used to determine the average molecular weights of the polymers (K4,A5,S2).
3	Able to **write** mechanisms for synthesis of different polymers **and acquire** the knowledge about the role of catalyst and other additives like inhibitor (K3, A3, S2).
4	Able to **describe** and adapt different methods for determining the characteristics or properties of the polymers like crystallinity, microstructure, thermal and chemical properties. (K2, A5, S4)
5	Able to **describe** chemical and physical methods used for fibre modification. (K2,A2)
6	Able to **describe**fibre composites, their fabrication properties and application fields (K1, A1,S1)
7	Able to **comprehend**Polymer waste recycling and their techniques (K2, A1,S1)

	Course Code: TXT 1901	**Course Title: Elective-II: Textile Process House Management (Marks 50)**	**Credits = 3**		
			L	**T**	**P**
	Semester: VII	**Total contact hours: 45**	**2**	**1**	**0**
List of Prerequisite Courses					
Industrial Management, Industrial Psychology and Human Resourse Management					
List ofCourses where this coursewill be prerequisite					
Nil					
Description of relevance of this course in the B.Tech. Program					
This will provide knowledge about management of textile process house with regards to set up of manufacturing, processing and ecofriendly functioning.					
Sr. No.	**Course contents (topics/subtopics)**		**Required hrs**		

1	**Process House Planning** Global textile scenario, textile value chain, position of processing in the textile value chain, feasibility study for setting up process houses (selection of product-mix, process routes adoption, selection of technology, machine balancing, capital and operating costs, margin money and working capital, financial appraisal, calculation of Internal rate of return, payback period, break even, DSCR(debt service coverage ratio), Selection of site for different types of process houses; General layout of building and machinery including pollution control and safety measures; construction of a modern process house; Sourcing of raw materials, handling, infrastructure requirements such as water, steam, electricity, oil, etc. with their costs operating costs incolved in processing ; Human resource requirements; Process controls for quality production in each department, Heat and energy balance – Applications of exhaust humidity controllers, Residual moisture controllers, Fabric GSM control systems). Calculation of heat efficiency of processes.	12
2	**Quality Management and Economics of Textile Processing** Methods of assessment of quality with respect to economy, performance and consumer appeal, Importance of raw materials and machinery in terms of quality of textile goods, ISO 900 series of certification, R and D efforts in monitoring the quality, Economics at different stages of production in textile industry, Factors influencing the cost of production, Methods of reduction in cost of production such as recycling of chemicals, raw materials, energy conservation, substitution by cost effective techniques, right first time approach, Rearranging number of processes, cost of quality.	12
3	Types of pollution in textile industry, Precautions to minimize pollution such as source reduction,; Methods of recovery, reuse and neutralization of various ingredients present in the effluents, cost of effluents treatment, Advantages of pollution control in relation to textile industry, Banned dyes, red listed chemicals and their eco friendly substitutes, ISO 14000 certification.	6
List of Text Books/ Reference Books		
1	Treatment of Textile Processing effluents, Manivasakam, M. Sakthi Publication, Coimbatore, 1995	
2	Water used in Textile Processing : quality, treatment and analysis, Manivasakam, M, Sakthi Publication, Coimbatore, 1995.	
3	Heat Economy in Textile Mills, Prabhu M.R., ATIRA Publ., Ahmedabad, 1981.	
4	Ecology and Textiles, Shenai.V.A. Sevak Publication, Bombay, 1997.	
5	Azo Dyes: facts and figures, Shenai V.A., Sevak Publication, Bombay, 1999.	
6	Management of Textile Industry, Dudeja V.P., Textile Trade Press Ahemadabad, 1981.	
7	An Introduction to Management in the Dyeing Industry, Park J, SDC Bradford, 1984.	
Course Outcomes (students will be able to.....)		
1	Be able to **understand** different aspect of feasibility study for setting up of process house. (K1, A1)	
2	Be able to **comprehend and use** process controls for quality production. (K2, A2)	

3	Able to **understand** the safety and risk assessment of chemicals.(K1, A1)
4	Be able to **understand** different types of pollution in textile Industry and **implement** suitable methods for their control. (K1, A3, S1)
5	Be able to **understand** the economics involved in different stages of processing and **adopt** suitable method for its reduction. (K1, A3, S2)
6	Be able to **comprehend and follow** quality management system standards.(K3, A2, S2)

	CourseCode:HUT1105	**Course Title:IndustrialManagement– II**	**Credits**		
			L	**T**	**P**
	Semester: VII	**Total contacthours: 45**	**2**	**1**	**0**
List of Prerequisite Courses					
	Industrial Management I				
List ofCourses where this coursewill be prerequisite					
	Value Education				
Descriptionof relevanceof this course in the B.Chem. Engg.Program					
This course isessential for effective functioning of students intheirprofessional career					
	CourseContents(Topics and subtopics)		**Reqd.**		
1	Production Operations Management: Production Management – Modern Approach, Manufacturing systems,Interfacemanagement.Manufacturing/ OperationsStrategy – Principles &concept, Operations as competitiveweapon --Investmentstrategy,Capacity strategy,Quality strategy,Technologystrategy, Customerfocusstrategy,Facilitylocationstrategy,Productflexibilitystrategy,Short deliveryprocess strategy,Quick time deliverystrategy, Concepts of Productivity, Measurement &Improvement, Lean Manufacturing, Value Engineering, BusinessProcessRe-engineering. WorldClassManufacturing (WCM) - Principles&concepts,Systems, Processes&toolsinWCM,Kanban,JIT,Wasteidentification&elimination,PokaYokesystem, EHSS managementinWCM,HRDimensions inWCM,WCMinreference to Indian industryand	9		
2	FinancialManagement:Investmentdecisions,LinkinginvestmenttoProductLifeCycle,Investmentrisk analysisandriskcontrol/mitigation,Accountingsystem,Stepcostingdiagram,Balancesheet evaluation, FundFlowanalysis,Financialratios&theirevaluation/ significance,Costcontrolby variableanalysis, Comparable Company evaluation, Budgetingand budgetary control.	9		

3	QualityManagement:Quality–concept/meaning,ModernapproachtoQualityManagement,QAversus QC,Acceptancesamplingandstatisticalqualitycontrol,Deming's14pointsofQM,TQMPrinciples&implementation,ISO 9000–2000, ISO 14000 (Environment) &ISO 50000 (Energy)quality standards.	
4	MaintenanceManagement:Causes,costs,lifeprofiles,Classifications,Organization,Equipment&plant reliability and availability, Management of shutdowns& turnarounds.	
5	MaterialsManagement:Definition,objectives,organization,stages,factorsresponsible,valueanalysis, Managementofprojectmaterialsandmaintenancematerials,Purchasingandvendordevelopment,Spares strategy, Ware-housing, store-keepingandinventory control.	

List of Text Books/ Reference Books	
	Production&OperationsManagement – An Applied Modern Approach,J.S. Martinich
	Industrial Management –I,JhambL.C.and JhambS.
	Industrial Management, Spriegel U.S.
	Operations Management for Competitive Advantage, Richard B. Chase, F. Robert Jacobs, Nicholas
	World ClassManufacturing-AstrategicPerspective, B.S.Sahay,K.B.C.Saxena,A Kumar
	Management Finance, Varanasay Murthy
	Financial Management,R.M.Srivastava
	Quality, John M. Nicholas
	Quality Planning and Analysis, Juranand Gryna
CourseOutcomes(studentswill be able to…..)	
	Studentsshould beable to explainthe fundamental concepts ofIndustrial Management
	Studentsshouldbeable to analyzepractical situationsandbeable to provideapplicablesolutions.

	CourseCode:MAT 1106	CourseTitle:DesignandAnalysisof Experiments	Credits= L	T	P
	Semester: VII	Total contacthours: 45	2	1	0
List of Prerequisite Courses					
	AppliedMathematics I				
List ofCourses where this coursewill be prerequisite					
	Thiscourseisrequiredforgraduatingengineerstofunctioneffectivelyin Industry,Academia andother				

Descriptionof relevanceof this course in the B. Tech.Program

Moderndaymanufacturingactivitiesand R&Dactivitiesneeddecisionstakenwithascientificrigourandshouldbewell- supported by 'statistics'. Chemicalengineering graduates who willserveindustryaswellaspostgraduateresearchstudents whowillserveindustry,R&Dorganisations,oracademicresearchshouldhaveareasonablygoodbackgroundofstatisticaldecision making. Thisalsoinvolvesextractionofmeaningfuldatafromwell-designedminimalnumberofexperimentsatthelowestpossiblematerialcosts. Thiscoursewillalsohelpthestudentsinall domainsoftheirlifebyimpartingthemavisionforcriticalappraisal and analysis ofdata.

	CourseContents(Topics and subtopics)	Reqd.
1	Overview of statistical analysis of data, statistical sampling, statistical inference, tests of significance, regressionanalysis.	8
2	Analysisof variance.	8
3	Statistical design ofexperiments,Factorial design,Response Surface	1
4	Box-Behnkenand Plackett Burmanmethods, Central CompositeDesign (CCD)	1
List of Text Books		
1	Design of ExperimentsinChemical Engineering: Zivorad R.Lazić	
2	Designand Analysis ofExperiments: D.C.Montgomery	
3	Introductionto Statistical Quality Control:D. C. Montgomery	
4	ResponseSurface Methodology: Process and ProductOptimizationusing Designed Experiments: R. H.	

CourseOutcomes(studentswill be able to…..)		
1	Realizeimportanceof statisticalanalysis ofdata	
2	Statisticallycorrelateonesetofdatawithanotherset,andidentifywhetherthecorrelationissignificantor not	
3	Listoutsetofexperimentsneededforaparticularsituation/processconsideringtheinterationbetween parameters/numbersof experimentsneeded	
4	Applythemethodsofexperimentaldesigntooptimisation,andtoidentifyingthoseparametersthatareof highest importance	

Semester VIII

	CourseCode:CET 1504	Course Title:Chemical ProjectEngg andEconomics	Credits		
			L	T	P
	Semester: VIII	Total contacthours: 45	2	1	0
	List of Prerequisite Courses				
	Material and Energy BalanceCalculations, Equip Desand Dwg I, Energy Engineering,				
	List ofCourses where this coursewill be prerequisite				
	Home PaperIand II				
	Descriptionof relevanceof this course in the B Tech.Program				
This course is required for thefutureprofessional career					

	CourseContents(Topics and subtopics)	Reqd.
1	Introductiontogreenfieldprojectsandglobalnatureofprojects;Impactofcurrencyfluctuations onProject justificationandcashflowsandConceptsof"Quality byDesign"includingtypical design deliverablesandunderstandingconstructability,operabilityandmaintainability duringallstages of project execution.Meaning of Project Engineering, variousstages of project implementation	6
2	Relationshipbetweenpriceofaproductandprojectcostandcostofproduction,EVAanalysis.El ements of cost of production, monitoring of the same in a plant, Meaning of Administrative expenses,sales expenses etc. Introductiontovarious components ofprojectcost andtheirestimation. IntroductiontoconceptofInflation,locationindexandtheiruseinestimatingplantandmachiner y cost. Variouscost indices,Relationshipbetweencost andcapacity.	8
4	Projectfinancing: debt:Equityratio,Promoters'contribution,Shareholders'contribution,sourceoffinance, time value of money. Concept of interest, time value of money, selection of various alternativeequipmentorsystem basedonthisconcept. Indiannorms,EMIcalculations.Depreciation concept, Indian normsandtheir utilityinestimateofworkingresultsofproject. Workingcapital concept and its relevance to	7
5	Estimateofworkingresultsofproposedproject. Capacityutilization,Grossprofit,operatingprofit,profit beforetax,Corporate tax, dividend, Netcashaccruals.Projectevaluation: Cumulativecashflow analysis Break-Even analysis, incremental analysis, various ratios analysis, Discounted cash flow analysis	7
6	Process Selection, Site Selection, Feasibility Report	4
7	Project:ConceptiontoCommissioning:milestones,Projectexecutionasconglomerationoftec hnicaland nontechnical activities, contractual details. Contract:Meaning,contents, Types ofcontract. Lump- sum Turnkey (LSTK),Eng,ProcurementandConstruction(EPC),Eng,ProcurementandConstruction Management (EPCM).Mergersand Acquisitions	6
8	ReadingofBalanceSheetsandevaluationof Techno-commercial ProjectReports.	3
9	PERT, CPM,barcharts and network diagrams	4
	List of Text Books/	
	Chemical Project Economics,MahajaniV.V.andMokashi SM.	
	Plant Designand EconomicsforChemical Engineers,Peters M.S.,TimmerhausK.D.	
	ProcessPlant and Equipment Cost Estimation, KharbandaO.P.	
	CourseOutcomes(studentswill be able to…..)	

1	Calculate workingcapital requirementfor agivenproject	
2	Calculate costof equipment usedinaplant total project cost	
3	Calculate cashflow froma given project	
4	Select a site for the projectfromgivenalternatives	
5	List outvarious milestonesrelatedto project concept tocommissioning	

	Course Code: TXT 1301	Course Title: Testing of Textile Materials (Marks 50)	Credits = 3		
			L	T	P
	Semester: VIII	Total contact hours: 45	2	1	0

List of Prerequisite Courses
Technology of Textile Dyeing
List ofCourses where this coursewill be prerequisite
Nil
Description of relevance of this course in the B.Tech. Program
This course will help student to understand and apply different analytical methods for testing textile and assessment of performance properties of textile.

Sr. No.	Course contents (topics/subtopics)	Required hrs
1	Objects of testing; Introduction to textile testing, Selection of samples for testing, Random and biased samples, Testing of raw materials and finished products.	8
2	Process control; Various test specifications such as BIS, AATCC, ISO, etc.	2
3	Tensile testing of fibres, yarns and fabrics. Automation in tensile testers. Tearing, bursting and abrasion resistance tests for fabrics. Pilling resistance of fabrics. Bending, shear and compressional properties of fabrics. Fabric drape and handle. Crease and wrinkle behavior. Air, water and water-vapour transmission through fabrics. Thermal resistance of fabrics. Testing of interlaced and textured yarns.	6
4	Special tests for carpets and nonwoven fabrics.	3
5	Testing in relation to quality control; Eco testing of textiles.	3
6	Norms of global standards for textile production and use, e.g. care lables, eco labels, Lab Accreditation, ISO 17025, etc.	2
7	Testing equipments and their use; Analysis of results.	2
8	Analytical (Advanced) equipments and their role in Textile analysis	4

List of Text Books/ Reference Books	
1	Textile Analysis, Trotman E.R., Trotman S.R., Charles Griffin and Co., London, 1932.
2	Principles of Textile Testing : An introduction to Physical methods and Testing textile fibres, yarn and fabric, Booth J.E., Heywood Books, London, 3rd edition, 1968.
3	Textile Testing and Analysis, Collier, B.J. and Hellen H., Upper Saddle River: Pentice Hall Inc., 1999.
4	Microscopic and Chemical Testing of Textiles, Koch, P.H., Chapman and Hall, London, 1963.
5	Physical Properties of Textile Fibres, Morton, W.E. and Hearle, J.W.S., Textile Institute, Manchester, 2nd edition, 1975.
6	Society of Dyers and Colourists : standard methods for the determination of the colour fastness of Textiles and Leather.

7	Handbook of Textile Testing and Quality Control, Grover, B. and Hemby, P.S., Wiley Eastern Ltd., New Delhi, 2nd edition, 1988.
Course Outcomes (students will be able to.....)	
1	Able to **comprehend** the stages at which testing is to be done (K2,A1,S1)
2	Able to **explain** different physical tastings performed on the fabric. (K2,A1,S2)
3	Able to **list and interpret** different fastness tests(K4,A4,S3)
4	Able to **understand** testing principles and operation of different analytical testing instruments (K3,A1,S1)
5	Able to **identify** different testing standards and their importance (K1,A5,S3)
6	Able to **examine and judge** the fastness properties of the coloured goods (K4, A4, S2)

	Course Code: TXT 1402	**Course Title: Merchandising & Designing of Textiles (Marks 50)**	**Credits = 3**		
			L	**T**	**P**
	Semester: VIII	**Total contact hours: 45**	**2**	**1**	**0**
List of Prerequisite Courses					
Technology of Textile Dyeing, Technology of Garment Manufacturing & Processing					
List ofCourses where this coursewill be prerequisite					
Nil					
Description of relevance of this course in the B.Tech. Program					
This course will help students in product designing, planning and execution based on market research.					
Sr. No.	**Course contents (topics/subtopics)**		**Required hrs**		
1	Sourcing of textiles materials; Inventory planning and marketing of final products; Techniques and principles of merchandising; Merchandising according to domestic and international demand, requirements and supply; Application of information technology in merchandising; Costing with respect to export and domestic market		20		
2	Yarn and fabric textures, colorant types and finishes in relation to design; Concept of need based product development; Application of CAD to product designs; Importance of design in relation to fashion trends		10		
List of Text Books/ Reference Books					
1	Screen Process Printing: For the Serigraphic and Textile Design, Schwalbach M.V., Van Nastrand Reinhold Company, New York, 1970.				
2	Watson's Textile Design & Colour : Elementary Weaves and Figured Fabrics, London : Newness Butterworths, 7th edition, 1975.				
3	World Review of Textile Design, Manchester : Textile Institute and International Textiles, 1993. Textile: A complete solution, Computer Aided textile design creativity and Processing, Kankia				
Course Outcomes (students will be able to.....)					

1	Be able to **acquire** a thorough background in the business aspects of the fashion and textile industry (K1, A1)
2	Be able to **understand the dynamics** of merchandising, its scope and role of merchandisers (K1, A1)
3	Able to **comprehend** visual merchandising as a tool for effective retailing. (K2, A2)
4	Be able to **comprehend and use** various yarn and fabric textures, colorants and finishes in designing of textiles. (K2, A2, S1)
5	Be able to **understand** the significance of the concept of need based product development. (K1, A1)
6	Be able to **comprehend and apply** information technology in merchandising process and product designing. (K3, A2, S2)
7	Be able to **understand** the importance of designing in relation to fashion trends. (K1, A1)

	Course Code: TXT1504	**Course Title: Introduction to Non wovens and Technical Textiles (Marks 100)**	**Credits = 4**		
			L	**T**	**P**
	Semester: VIII	**Total contact hours: 60**	**3**	**1**	**0**

List of Prerequisite Courses

Technology of Textile Dyeing

List ofCourses where this coursewill be prerequisite

Nil

Description of relevance of this course in the B.Tech. Program

Sr. No.	**Course contents (topics/subtopics)**	**Required hrs**
1.	Classification of Technical Textiles & Its Economy	2
2.	Military and Defense textiles.	2
3.	Medical textiles – Introduction – materials used in bio-textiles – classification of medical textiles – textiles for implantation – non-implantable textiles – textiles for extra corporeal (biomedical) – Health care and hygiene products.	3
4.	Geotextiles, Filtration Textile,	2
5.	Sports & creation textiles and water proof breathable fabrics – Sports and creation textiles – Introduction sports uniforms – camping and hiking – base ball – tennis –foot ball – golf & hockey – bikes – marine products – textiles in sports surfaces –hot air ballooning.	3
6.	Water proof breathable fabrics – Introduction – types, assessment techniques and performance of water proof breathable fabrics.	3
7.	Safety protective textiles and transportation textiles. Introduction, high temp. textiles – flame resistant protective clothings, chemical, protective clothing's	3
8.	Mechanical protection, electrical protective clothings-clean room textiles, radiation protection, thermal insulation, high visibility textiles.	3
9.	Transportation textiles : Types – airbags – seat belts – automotive interior and exterior trim – truck and car covers – belts, hoses and filters in cars – textiles for aircrafts – textiles & structural elements in transport vehicles – Inflatable products used in transportation.	3

10.	Colouration and finishing of technical textiles – Introduction – object of colouration colouration of technical textiles – dyestuffs and pigments – mass	3
11.	Smart Textiles – Concept of phase change materials like temperature sensitive, Ph Sensitive, photo sensitive etc., Applications of phase change materials in textiles. Concept of shape memory polymers and their applications in textiles. Use of electronics in clothings.	3
TXT1503		
12.	Definition, Classification according to raw material, Introduction to web forming and bonding methods.	2
13.	Raw material used, process flow for various manufacturing techniques of nonwoven, Methods of production, Comparison of productivity.	4
14.	Dry processes including Carding, Garneting and air laid, Wet process, polymer extrusion	4
15.	Web bonding processes like chemical, thermal and mechanical in detail	8
16.	Classification of Nonwovens	2
17.	Testing of non wovens	4
18.	Application of non wovens in different areas	4
19.	Economics of non wovens	2
List of Text Books/ Reference Books		
1	Hand book of technical textiles, A.R. Horrock and S.C. Anand	
2	Coated textiles Principles and applications by Dr. A.K. Sen	
3	Medical textiles '96 by Subhash Anand	
4	Automotive textiles by Dr. S.K. Mukhopadhyay and J.F. partridge, The Textile Institute.	
5	Wellington sear's hand book of Industrial textiles by Dr. Sabit Adanur.	
6	Nonwoven Fabrics - Wilhelm Albrecht, Hilmar Fuchs, Walter Kittelmann - WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim	
7	Thermal bond of non woven fabrics, textile progress Vol. 26, No.2. The Textile Inst. Publ.	
8	Developments in Non woven fabrics Textile Progress Vol. 12 by A T Purdy, The Textile Inst. Publ.	
9	Non Woven process performance and testing - Turbak	
Course Outcomes (students will be able to.....)		
1	Able to **comprehend** definition and difference between woven/knitted and non woven fabrics along with the economy, areas of application of these nonwovens depending on the properties desired(K1, A1, S1)	
2	Able to **write and describe** web formation technology by air laid, wet laid and by spun laid & melt blown methods and parameters involved therein. (K3, A4, S1)	
3	Able to **write and describe** web bonding technology by chemical, mechanical & thermal method and parameters involved therein. (K3, A4, S1)	
4	Able to define and classify technical textiles (K1, A2, S1)	
5	Able to describe, explain and interpret the properties related to each of the division (or area) of technical textile (K2, A2, S1)	
6	Able to Apply technical textiles in woven, nonwoven knitted form in various areas like transport medical protective etc. (K3, A5, S1)	

	CourseCode:HUT	**Course Title: Value Education**	**Credits=4**

1107		**L**	**T**	**P**
Semester: VIII	**Total contacthours:45**	**2**	1	**0**

List of Prerequisite Courses
List ofCourses where this coursewill be prerequisite
Descriptionof relevanceof this course in the B.Tech.Program

Topics	Hrs.
Unit –I Education and Human values **1.** Education: Etymology, definitions (western, Indian) **2.** Relationship between education and Axiology (Ethics, Logic, aesthetics/Satyam, shivam , Sundaram) **3.** Evaluation of education: Ancient Indian education :Purusharthas **4.** Concept and types of values **5.** Functions of holistic education for the development of Personal/individual growth *****Social, National Global citizenship.	10+5
Unit –II National and International Values for Global Development • Importance for national integration and international understanding. • National values (constitutional Values)- Democracy, socialism ,Secularism ,Equality, Justice, Liberty, freedom and Fraternity • Constitutional provisions for values in Indian constitution –Article 14,15,16,17 & 19 • Social values- Empathy Social responsibility, self- control, Humanity university brotherhood. • Professional values- Religious Tolerance, Wisdom, character formation (Character building) • Aesthetic values- Love and appreciation of literature and fine arts and respect for the same •	10+5
Unit –III Human Rights 1. Right to information 2. Right when arrested 3. Right to compensation in accidents 4. Rights of consumers 5. Constitutional Rights of women 6. Rights of Wife and Children 7. Offenses relating to marriage 8. Women's rights to protect from domestic violence 9. Rights against Dowry 10. Free Legal services to the poor 11. Workman's right to compensation for accidents and Occupational Diseases 12. Working women's right for Maternity benefits 13. Right of women against Sexual Harassment in workplaces	10+5

14. The law on rape	

	Course Code: TXP1019	**Course Title: Shade Matching and Bulk Colouration (Marks 100)**	**Credits = 4**		
			L	**T**	**P**
	Semester: VIII	**Total contact hours: 60**	**0**	**0**	**8**
List of Prerequisite Courses					
Technology of Textile Dyeing, Experimental Dyeing					
List ofCourses where this coursewill be prerequisite					
Description of relevance of this course in the B.Tech. Program					

Sr. No.	**Course contents (topics/subtopics)**	**Required hrs**
1	To study dyeing of cotton with reactive dye on padding mangle	4
2	To study dyeing of cotton with vat dyes by padding technique	4
3	To study dyeing of cotton with azoics on padding mangle	4
4	To study dyeing of cotton with pigments and Phthalogen Blue on padding	4
5	To study dyeing of cotton with solubilised vat on padding mangle	4
6	Stripping of dyed materials and redyeing with Sulphur Black dye.	4
7	To study dyeing of cotton hank by tub liquoring using azoics	4
8	To study dyeing of cotton \ polyester blend by different techniques.	4
9	Beck matching of vat colours on cotton yarns	4
10	Shade matching on Cotton using Vat and Reactive Dyes	4
TXT1008		
11	Dyeing of cotton on jigger	4
12	Dyeing of cotton on continuous dyeing range	4
13	Screen design making and printing	4
14	Dyeing and printing for making an exhibit –Flat bed, rotary and block printing	4
15	Desizing of cotton knit on soft flow machine	4
16	Scouring of cotton knit on soft flow machine	4
17	Bleaching of cotton knit on soft flow machine	4
18	Combined desizing, scouring and bleaching of cotton knit on soft flow machine	4
19	Dyeing of cotton on winch machine	4
20	Dyeing of cotton knit on soft flow machine	4
21	Dyeing of Polyester on soft flow machine	4
22	Dyeing of Polyester/cotton blend on soft flow machine	4

23	Processing of Cotton/Elastane blends in Soft flow	4
24	Processing of Polyester/Viscose, Polyester/Wool blends in Jets	4
25	Dyeing of Polyester on soft flow machine	4
Course Outcomes (students will be able to.....)		
1	Able to carry out dyeing of various types of fabrics and blends using different methods on continuous dyeing range (K4, A3, S4)	
2	Able to carry out screen design and printing using Flat bed, rotary and block printing methods (K4, A3, S4)	
3	Able to carry out combined and separate Desizing, Scouring, Bleaching of cotton knit, processing of Cotton/Elastane blends on soft flow machine (K4, A3, S4)	
4	Able to carry out processing of Polyester/Viscose, Polyester/Wool blends on pilot Jet dyeing machine (K4, A3)	
5	Able to carry out shade matching of cotton fabric using vat and reactive dyes (K5, A5,S4)	
	Able to carry out shade matching of cotton hank by tub liquoring using azoics colours (K5, A5,S4)	

Internship

- Aftertheendofthesixthsemesterexaminationandbeforethestartoftheseventhsemester,everystudentwill haveto undergoaninternship. The Internship would be of 6 credits.
- The internship (preferably Industrial Internship) would be assigned to the student by the Departmental Internship Coordinator, withtheapproval of Head of theDepartment.
- Thetotaldurationoftheinternshipwouldbeforaperiodequivalentto12Calendarweeks. Thisperiodtypicallystartfrom 1st Mayandendbefore30th Julyeveryyear. ThismeanstheendsemesterexaminationofT.Y.Tech(Semester VI)shouldbecompletedby25th Aprileveryyear. TheSemesterVII(4th YearB.Tech.)shouldcommencew.e.f.1st Augevery year. Theinternshipmay becompletedin one ormoreorganizationsasdescribed below.
- Theinternship could be of the following forms: (i)industrialinternshipinacompany(withinIndiaorAbroad)involvedinR&D/design/ manufacturing(QA/QC/Plant Engineering/StoresandPurchase)/ marketing/finance/ consultancy / Technical services/ Engineering/ Projects,etc. (ii) researchinternship in reputedInstitutes(within Indiaor Abroad) like,ICT,IITs,NITs, IISC, NCL, IICT etc.
- Attheendoftheinternship,eachstudentwillsubmitawrittenreportbasedontheworkcarriedoutduringtheInternship. Thereport will be countersigned by theSupervisorfromIndustry /Institute as the case may be.
- Performanceofthestudentwillbeassessedbasedonthewrittenreportandapresentationtoacommitteeconsistingoftwo faculty membersfromthe Department.
- Studentswillbeassignedagradebasedonthewrittenreportandapresentation;evaluatedbyacommitteeoffaculty members.