REGULATIONS, CURRICULUM AND SYLLABUS

for

B. TECH

CHEMICAL ENGINEERING

PONDICHERRY UNIVERSITY
PONDICHERRY-605 014

PONDICHERRY UNIVERSITY
BACHELOR OF TECHNOLOGY PROGRAMMES
(EIGHT SEMESTERS)

REGULATIONS

1. Conditions for Admission:

(a)Candidates for admission to the first semester of the 8 semester B.Tech Degree programme should be required to have passed :

The Higher Secondary Examination of the (10+2) curriculum (Academic Stream) prescribed by the Government of Tamil Nadu or any other examination equivalent there to with minimum of 45% marks (a mere pass for OBC and SC/ST candidates) in aggregate of subjects – Mathematics, Physics and any one of the following optional subjects: Chemistry / Biotechnology/ Computer Science / Biology (Botany & Zoology) or an Examination of any University or Authority recognized by the Executive Council of the Pondicherry University as equivalent thereto.

(b) For Lateral entry in to third semester of the eight semester B.Tech programme :

The minimum qualification for admission is a pass in three year diploma or four year sandwich diploma course in engineering / technology with a minimum of 60 % marks (50% marks for OBC and a mere pass for SC/ST candidates) in aggregate in the subjects covered from 3rd to final semester or a pass in any B.Sc. course with mathematics as one of the subjects of study with a minimum of 60 % marks (50% marks for OBC and a mere pass for SC/ST candidates) in aggregate in main and ancillary subjects excluding language subjects. The list of diploma programs approved for admission for each of the degree programs is given in **Annexure A**.

2. Age Limit :

The candidate should not have completed 21 years of age as on 1st July of the academic year under consideration. For Lateral Entry admission to second year of degree programme , candidates should not have completed 24 years as on 1st July of the academic year under consideration. In the case of SC/ST candidates, the age limit is relaxable by 3 years for both the cases.

3. Duration of Programme :

The Bachelor of Technology degree programme shall extend over a period of 8 consecutive semesters spread over 4 academic years – two semesters constituting one academic year. The duration of each semester shall normally be 15 weeks excluding examinations.

4. Eligibility for the award of Degree:

No candidate shall be eligible for the award of the degree of Bachelor of Technology, unless he/she has undergone the course for a period of 8 semesters (4 academic years) / 6 semesters (3 academic years for Lateral Entry candidates) in the faculty of Engineering and has passed the prescribed examinations in all the semesters.

5. Branches of Study:

Branch I - Civil Engineering
Branch II - Mechanical Engineering
Branch III - Electronics & Communication Engineering
Branch IV - Computer Science & Engineering
Branch V - Electrical & Electronics Engineering
Branch VI - Chemical Engineering
Branch VII - Electronics & Instrumentation Engineering
Branch VIII - Information Technology
Branch IX - Instrumentation & Control Engineering
Branch X - Biomedical Engineering

or any other branches of study as and when offered. The branch allocation shall be ordinarily done at the time of admission of the candidate to the first semester.

6. Subjects of Study:

The subjects of study shall include theory and practical courses as given in the curriculum and shall be in accordance with the prescribed syllabus. The subjects of study for the first two semesters shall be common for all branches of study.

7. Examinations:

The theory and practical examinations shall comprise continuous assessment throughout the semester in all subjects as well as university examinations conducted by Pondicherry University at the end of the semester (November / December or April / May).

(a) Theory courses for which there is a written paper of 75 marks in the university examination**.**

The Internal Assessment marks of 25 has to be distributed as 10 marks each for two class tests and 5 marks for class attendance in the particular subject. The distribution of marks for attendance is as follows.

5 marks for 95% and above
4 marks for 90% and above but below 95%
3 marks for 85% and above but below 90%
2 marks for 80% and above but below 85%
1 mark for 75% and above but below 80%

In total, three tests are to be conducted and the better two are to be considered for assessment.

(b) Practical courses for which there is a university practical examination of 50 marks**:**

The internal assessment marks of 50 has to be distributed as 20 marks for the periodic practical works and records submitted thereof, 15 marks for an internal practical examination, 5 marks for an internal viva voce, and 10 marks for class attendance in the particular subject. The distribution of marks is as given below.

10 marks for 95% and above
8 marks for 90% and above but below 95%
6 marks for 85% and above but below 90%
4 marks for 80% and above but below 85%
2 marks for 75% and above but below 80%

8. Requirement for appearing for University Examination:

A candidate shall be permitted to appear for university examinations at the end of any semester only if:

(i) He / She secures not less than 75% overall attendance arrived at by taking into account the total number of periods in all subjects put together offered by the institution for the semester under consideration.

(Candidates who secure overall attendance greater than 60% and less than 75% have to pay a condonation fee as prescribed by University along with a medical certificate obtained from a medical officer not below the rank of Asst. Director)

(ii) He / She earns a progress certificate from the Head of the institution for having satisfactorily completed the course of study in all the subjects pertaining to that semester.

(iii) His / Her conduct is found to be satisfactory as certified by the Head of the institution.

A candidate who has satisfied the requirement (i) to (iii) shall be deemed to have satisfied the course requirements for the semester.

9. Procedure for completing the course:

A candidate can join the course of study of any semester only at the time of its normal commencement and only if he/she has satisfied the course requirements for the previous semester and further has registered for the university examinations of the previous semester in all the subjects as well as all arrear subjects if any.

However, the entire course should be completed within 14 consecutive semesters (12 consecutive semesters for students admitted under lateral entry).

10. Passing Minimum:

(i) A candidate shall be declared to have passed the examination in a subject of study only if he/she secures not less than 50% of the total marks (Internal Assessment plus University examination marks) and not less than 40% of the marks in University examination.

(ii) A candidate who has been declared "Failed" in a particular subject may reappear for that subject during the subsequent semesters and secure a pass. However, there is a provision for revaluation of failed or passed subjects provided he/she fulfills the following norms for revaluation.

(a) Applications for revaluation should be filed within 4 weeks from the date of declaration of results or 15 days from the date of receipt of marks card whichever is earlier.

(b) The candidate should have attended all the college examinations as well as university examinations.

(c) If a candidate has failed in more than two papers in the current university examination, his/her representation for revaluation will not be considered.

(d) The request for revaluation must be made in the format prescribed duly recommended by the Head of the Institution along with the revaluation fee prescribed by the University.

The internal assessment marks obtained by the candidate shall be considered only in the first attempt for theory subjects alone. For the subsequent attempts, University examination marks will be made up to the total marks. Further the University examination marks obtained in the latest attempt shall alone remain valid in total suppression of the University examination marks obtained by the candidate in earlier attempts.

11 Award of Letter Grades:

The assessment of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain points, will be awarded as per the range of total marks (out of 100) obtained by the candidate, as detailed below:

Range of Total	Letter	Grade
90 to 100	S	10
80 to 89	A	9
70 to 79	B	8
60 to 69	C	7
55 to 59	D	6
50 to 54	E	5
0 to 49	F	0
Incomplete	FA	

'F' denotes failure in the course. 'FA' denotes absent / detained as per clause 8.

After results are declared, grade sheets will be issued to the students. The grade sheets will contain the following details:

(a) The college in which the candidate has studied.

(b) The list of courses enrolled during the semester and the grades scored.

(c) The Grade Point Average (GPA) for the semester and The Cumulative Grade Point Average (CGPA) of all enrolled subjects from first semester onwards.

(d) GPA is the ratio of sum of the products of the number of credits (C) of courses registered and the corresponding grades points (GP) scored in those courses, taken for all the courses and sum of the number of credits of all the courses

$$GPA = \left(Sum\ of\ \ (C \times GP) / Sum\ of\ \ C \right)$$

CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester. FA grades are to be excluded for calculating GPA and CGPA.

The conversion of CGPA into percentage marks is as given below

$$\%\, Marks = (CGPA - 0.5) \times 10$$

12 Award of Class and Rank:

(i) A candidate who satisfies the course requirements for all semesters and who passes all the examinations prescribed for all the eight semesters (six semesters for lateral entry candidates) within a maximum period of 7 years (6 years for lateral entry candidates) reckoned from the commencement of the first semester to which the candidate was admitted shall be declared to have qualified for the award of degree.

(ii) A candidate who qualifies for the award of the degree passing in all subjects pertaining to semesters 3 to 8 in his/her first appearance within 6 consecutive semesters (3 academic years) and in addition secures a CGPA of 8.50 and above for the semesters 3 to 8 shall be declared to have passed the examination in **FIRST CLASS** with **DISTINCTION**.

(iii) A candidate who qualifies for the award of the degree by passing in all subjects relating to semesters 3 to 8 within a maximum period of eight semesters after his/her commencement of study in the third semester and in addition secures CGPA not less than 6.5 shall declared to have passed the examination in **FIRST CLASS**.

(iv) All other candidates who qualify for the award of degree shall be declared to have passed the examination in **SECOND CLASS**.

(v) For the Award of University ranks and Gold Medal for each branch of study, the CGPA secured from 1st to 8th semester alone should be considered and it is mandatory that the candidate should have passed all the subjects from 1st to 8th semester in the first attempt. Rank certificates would be issued to the first ten candidates in each branch of study.

13. Provision for withdrawal:

A candidate may, for valid reasons, and on the recommendation of the Head of the Institution be granted permission by the University to withdraw from writing the entire semester examination as one Unit. The withdrawal application shall be valid only if it is made earlier than the commencement of the last theory examination pertaining to that semester. Withdrawal shall be permitted only once during the entire course. Other conditions being satisfactory, candidates who withdraw are also eligible to be awarded DISTINCTION whereas they are not eligible to be awarded a rank.

14. Discontinuation of Course:

If a candidate wishes to temporarily discontinue the course for valid reasons, he/she shall apply through the Head of the Institution in advance and obtain a written order from the University permitting discontinuance. A candidate after temporary discontinuance may rejoin the course only at the commencement of the semester at which he/she discontinued, provided he/she pays the prescribed fees to the University. The total period of completion of the course reckoned from the commencement of the first semester to which the candidate was admitted shall not in any case exceed 7 years, including of the period of discontinuance.

15. Revision of Regulations and Curriculum:

The University may from time to time revise, amend or change the regulations of curriculum and syllabus as and when found necessary.

ANNEXURE – A

B.Tech courses in which admission is sought	Diploma courses eligible for admission
Civil Engineering	Civil Engineering Civil and Rural Engineering Architectural Assistantship Architecture Agricultural Engineering
Mechanical Engineering	Mechanical Engineering Automobile Engineering Agricultural Engineering Mechanical and Rural Engineering Refrigeration and Air-conditioning Agricultural Engineering & Farm Equipment Technology Metallurgy Production Engineering Machine Design & Drafting Machine tool maintenance and Repairs Printing Technology / Engineering Textile Engineering / Technology Tool Engineering
Electrical and Electronics Engineering Electronics & Communication Engineering Electronic and Instrumentation Engineering Instrumentation and Control Engineering Bio Medical Engineering	Electrical Engineering Electrical and Electronics Engineering Electronics and Instrumentation Engineering Instrumentation Engineering / Technology Electronics and Communication Engg. Electronics Engineering Medical Electronics Instrumentation and Control Engineering Applied Electronics
Chemical Engineering	Chemical Engineering Chemical Technology Petrochemical Technology Petroleum Engineering Ceramic Technology Plastic Engineering Paper & Pulp Technology Polymer Technology
Information Technology Computer Science & Engineering	Computer Science and Engineering Computer Technology Electrical and Electronics Engineering Electronics & Communication Engineering Electronics & Instrumentation Engineering Instrumentation Engineering / Technology

CURRICULUM
B.TECH (CHEMICAL ENGINEERING)
(With effect from Academic year 2009 – 10)

I Semester

Sl. No	Sub. Code	Subjects	Periods			Cr	Marks		
			L	T	P		IA	UE	TM
Theory									
1	T101	Mathematics I	3	1	-	4	25	75	100
2	T102	Physics	4	-	-	4	25	75	100
3	T103	Chemistry	4	-	-	4	25	75	100
4	T110	Basic Civil & Mechanical Engineering	4	-	-	4	25	75	100
5	T111	Engineering Mechanics	3	1	-	4	25	75	100
6	T112	Communicative English	4	-	-	3	25	75	100
Practicals									
1	P104	Physics Lab	-	-	3	2	50	50	100
2	P105	Chemisry Lab	-	-	3	2	50	50	100
3	P106	Workshop Practice	-	-	3	2	50	50	100
		Total	22	2	9	29	300	600	900

II Semester

Sl. No	Sub. Code	Subjects	Periods			Cr	Marks		
			L	T	P		IA	UE	TM
Theory									
1	T107	Mathematics II	3	1	-	4	25	75	100
2	T108	Material Science	4	-	-	3	25	75	100
3	T109	Environmental Science	4	-	-	3	25	75	100
4	T104	Basic Electrical and Electronics Engineering	3	1	-	4	25	75	100
5	T105	Engineering Thermodynamics	3	1	-	4	25	75	100
6	T106	Computer Programming	3	1	-	3	25	75	100
Practicals									
1	P101	Computer Programming Lab	-	-	3	2	50	50	100
2	P102	Engineering Graphics	2	-	3	2	50	50	100
3	P103	Basic Electrical and Electronics Lab	-	-	3	2	50	50	100
4	P107	NSS/ NCC *	-	-	-	-	-	-	-
		Total	22	4	9	27	300	600	900

* To be completed in I and II semesters, under Pass/Fail option only and not counted for CGPA calculation.

III Semester

Sl. No	Sub Code	Subjects	Peroids			Cr	Marks		
			L	T	P		IA	UE	TM
Theory									
1	MA T31	Mathematics III	3	1	-	4	25	75	100
2	CH T32	Physical Chemistry	4	-	-	3	25	75	100
3	CH T33	Strength of Materials	4	-	-	3	25	75	100
4	CH T34	Electrical and Electronics Engineering	4	-	-	3	25	75	100
5	CH T35	Process Calculations	3	1	-	4	25	75	100
6	CH T36	Momentum Transfer	3	1	-	4	25	75	100
Practicals									
1	CH P31	Physical Chemisry Lab	-	-	3	2	50	50	100
2	CH P32	Strength of Materials Lab	-	-	3	2	50	50	100
3	CH P33	Electrical and Electronics Engg. Lab	-	-	3	2	50	50	100
		Total	21	3	9	27	300	600	900

IV Semester

Sl. No	Sub Code	Subjects	Periods			Cr	Marks		
			L	T	P		IA	UE	TM
Theory									
1	MA T41	Mathematics IV	3	1	-	4	25	75	100
2	CH T42	Organic Chemistry	4	-	-	3	25	75	100
3	CH T43	Chemical Engineering Thermodynamics	3	1	-	4	25	75	100
4	CH T44	Process Heat Transfer	3	1	-	4	25	75	100
5	CH T45	Mass Transfer I	3	1	-	4	25	75	100
6	CH T46	Mechanical Operations	3	1	-	4	25	75	100
Practicals									
1	CH P41	Organic Chemistry lab	-	-	3	2	50	50	100
2	CH P42	Momentum Transfer lab	-	-	3	2	50	50	100
3	CH P43	Chemical Engineering Drawing	-	-	3	2	50	50	100
4	SP P44	Physical Education*	-	-	-	-	-		-
		Total	19	5	9	29	300	600	900

* Pass/ Fail option only and not counted for CGPA calculation

V Semester

Sl. No	Sub. Code	Subjects	Periods			Cr	Marks		
			L	T	P		IA	UE	TM
Theory									
1	CH T51	Process Instrumentation	4		-	3	25	75	100
2	CH T52	Mass Transfer II	3	1	-	4	25	75	100
3	CH T53	Chemical Reaction Engineering - I	3	1	-	4	25	75	100
4	CH T54	Energy Technology and Management	4		-	3	25	75	100
5	CH T55	Chemical Process Industries	4		-	3	25	75	100
6	CH T56	Chemical Engineering Practice	4		-	3	25	75	100
Practicals									
1	CH P51	Mass Transfer Lab I	-		3	2	50	50	100
2	CH P52	Heat Transfer Lab	-		3	2	50	50	100
3	CH P53	Mechanical Operations Lab	-		3	2	50	50	100
4	HS P54	General Proficiency I	-		3	2	100	-	100
		Total	22	2	12	28	400	600	1000

VI Semester

Sl. No	Sub. Code	Subjects	Periods			Cr	Marks		
			L	T	P		IA	UE	TM
Theory									
1	MA T61	Numerical Methods and Special Functions	3	1	-	4	25	75	100
2	CH T62	Mass Transfer III	3	1	-	4	25	75	100
3	CH T63	Chemical Reaction Engineering - II	3	1	-	4	25	75	100
4	CH T64	Process Design of Chemical Equipments	2	2	-	4	25	75	100
5	----------	Elective I	4	-	-	3	25	75	100
6	---------	Elective II	4	-	-	3	25	75	100
Practicals									
1	CH P61	Mass Transfer Lab II	-	-	3	2	50	50	100
2	CH P62	Chemical Reaction Engg. Lab	-	-	3	2	50	50	100
3	CH P63	Technical Analysis Lab	-	-	3	2	50	50	100
4	HS P64	General Proficiency II	-	-	3	2	100	-	100
		Total	19	5	12	30	400	600	1000

VII Semester

Sl. No	Sub. Code	Subjects	Periods			Cr	Marks		
			L	T	P		IA	UE	TM
Theory									
1	CH T71	Process Dynamics and Control	3	1	-	4	25	75	100
2	CH T72	Mechanical Design of Chemical Equipments	2	2	-	4	25	75	100
3	CH T73	Industrial Management	4	-	-	3	25	75	100
4	---------	Elective III	4	-	-	3	25	75	100
5	---------	Elective IV	4	-	-	3	25	75	100
Practicals									
1	CH P71	Computer aided design lab	-	-	3	2	50	50	100
2	CH PW7	Project Work (Phase I)	-	-	3	2	100	-	100
3	CH P72	Seminar	-	-	3	1	100	-	100
4	CH P73	Industrial Visit / Training	-	-	-	1	100	-	100
		Total	17	3	9	23	475	425	900

VIII Semester

Sl. No	Sub. Code	Subjects	Periods			Cr	Marks		
			L	T	P		IA	UE	TM
Theory									
1	CH T81	Transport Phenomena	2	2	-	4	25	75	100
2	CH T82	Process Engineering Economics	3	1	-	3	25	75	100
3	CH T83	Pollution Control in Process Industries	4	-	-	3	25	75	100
4	---	Elective V	4	-	-	3	25	75	100
5	---	Elective VI	4	-	-	3	25	75	100
Practicals					-				
1	CH P81	Process Dynamics and Control Lab	-	-	3	2	50	50	100
2	CH PW8	Project Work (Phase II)	-	-	12	6	50	50	100
3	CH P82	Comprehensive Viva Voce	-	-	-	2	50	50	100
4	CH P83	Professional Ethical Practice	-	-	1	1	100		100
		Total	17	3	10	27	375	525	900

Total : 220 credits

List of Electives

Sl. No	Sub. Code	**A.Electives I & II (VI Semester)**
1	CH E61	Petroleum Refinery Engineering
2	CH E62	Bio Chemical Engineering
3	CH E63	Nano Technology
4	CH E64	Drugs and Pharmaceutical Technology
5	CH E65	Nuclear Engineering
B. Elective III & IV (VII Semester)		
6	CH E71	Polymer Science and Technology
7	CH E72	Petrochemical Technology
8	CH E73	Electrochemical Engineering
9	CH E74	Risk and Safety Management in Process Industries
10	CH E75	Industrial Biotechnology
C. Electives V & VI (VIII Semester)		
11	CH E81	Process Flow Sheeting,Design and Synthesis
12	CH E82	Process Modelling and Simulation
13	CH E83	Environmental Impact Assessment and Clean Technology
14	CH E84	New Separation Techniques
15	CH E85	Optimization of chemical Processes

T101 MATHEMATICS – I

UNIT I

Calculus: Curvature, radius of curvature, evolutes and involutes. Beta and Gamma functions and their properties.

UNIT II

Multiple Integrals and Applications: Multiple integrals – change of order of integration. Applications: Areas (double integration) and volumes by triple integration (Cartesian and polar) – mass and center of mass (constant and variable densities).

UNIT III

Analytical Solid Geometry: Directional cosines and ratios – angle between two lines – the equation of plane - equations to a straight line and shortest distance between two skew lines.

UNIT IV

Differential Equations: Exact equations, First order linear equations, Bernoulli's equation, orthogonal trajectories, growth and decay, geometrical applications and electric circuits. Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

UNIT V

Differential Equations (Higher order): Linear differential equations of higher order – with constant coefficients, the operator D - Euler's linear equation of higher order with variable coefficients - simultaneous linear differential equations – solution by variation of parameters method – simple applications to electric circuits.

Text Book

1. M.K.Venkataraman, Engineering Mathematics (First Year), Second Edition, The National Publishing Company, Madras, 2001.

Reference Book

1. N.P. Bali and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications, New Delhi , 2007.

T102 PHYSICS

UNIT I

Acoustics and NDT: *Ultrasonics* - *U*ltrasonic Waves Productions (Piezoelectric and Magnetostriction method) – Detections (Acoustic Grating)
Acoustics - Factors affecting Acoustic of Buildings (Reverberation, Loudness, Focusing, Echo, Echelon Effect and Resonance) and their Remedies - Sabine's formula for Reverberation Time . *NDT applications* - Pulse Echo Method - Liquid Penetrant Method

UNIT II

Optics: *Interference* - Air Wedge – Michelson's Interferometer – Wavelength Determination– Interference Filter – Antireflection Coatings. *Diffraction* - Diffraction Grating – Dispersive power of grating - Resolving Power of Grating and Prism. *Polarisation* - Huygens Theory of Double Refraction – Quarter and Half Wave Plates – Specific Rotary Power – Laurent Half Shade Polarimeter

UNIT III

Lasers and Fiber Optics: *Lasers* - Principles of Laser – Spontaneous and Stimulated Emissions - Einstein's Coefficients – Population Inversion and Laser Action – Optical resonators – Types of Lasers - NdYAG, CO_2 laser, GaAs Laser
Fiber Optics - Principle and Propagation of light in optical fiber – Numerical aperture and acceptance angle – Types of optical fibers (material, refractive index, mode)

UNIT IV

Wave Mechanics: Matter Waves – de Broglie Wavelength – Uncertainty Principle – Schrödinger Wave Equation – Time Dependent – Time Independent – Application to Particle in a One Dimensional Box – Quantum Mechanical Tunneling – Tunnel Diode.

UNIT V

Nuclear Energy Source: General Properties of Nucleus (Size, Mass, Density, Charge) – Mass Defect – Binding Energy - Disintegration in fission – Nuclear Fusion (p-p and C-N cycle) – *Nuclear Reactor:* Materials Used in Nuclear Reactors. – PWR – BWR - FBTR

Text Books

1. A S Vasudeva, Modern Engineering Physics, S. Chand & Co, New Delhi, 2006.
2. V Rajendran, Engineering Physics, TMH, New Delhi 2008.

Reference Books

1. Richtmyer, Kennard and cooper , Introduction to Modern Physics, TMH, New Delhi 2005.
2. Ajay Ghatak, Optics, TMH, New Delhi, 2007.
3. Thiagarajan and Ghatak, Laser and Application, TMH, New Delhi, 2008.
4. Arthur Beiser, Concept of Modern Physics, TMH, New Delhi, 2008.
5. Avadhanulu M N and Kshir Sagar , A Text Book of Engineering Physics, S. Chand & Co, New Delhi, 2007.
6. R. Murugeshan, Modern Physics, S. Chand & Co, New Delhi, 2006.
7. K.R.Nambiar, Lasers, New Age International, New Delhi, 2008.

T103 CHEMISTRY

UNIT I

Water: Hardness of water – units and calcium carbonate equivalent. Determination of hardness of water- EDTA method. Disadvantages of hardwater-boiler scale and sludge, caustic embrittlement, priming and foaming and boiler corrosion. Water softening method – internal and external conditioning – lime-soda process, zeolite process and ion exchange process. Desalination – reverse osmosis and electrodialysis.

UNIT II

Polymers : Classification, types of polymerization reactions - mechanism of radical, ionic and Ziegler-Natta polymerizations. Polymer properties - chemical resistance, crystallinity and effect of temperature. Thermoplastics and thermosets. Polymerization techniques - bulk, suspension, emulsion, solution and gas phase polymerization. Preparation, properties and uses of PVC, TEFLON, Nylons, Bakelite, polyurethane, Mn and Mw. Rubbers - vulcanization, synthetic rubber, buna S, buna N, silicone and butyl rubber. Conducting polymers - classification and applications. Polymer composites – FRP - laminar composites.

UNIT III

Electrochemical Cells: Galvanic cells, single electrode potential, standard electrode potential, electromotive series. EMF of a cell and its measurement. Nernst equation. Electrolyte concentration cell. Reference electrodes-hydrogen calomel, Ag /AgCl and glass electrodes. Batteries - primary and secondary cells, laclanche cell, lead acid storage cell, Ni-Cd battery and alkaline battery. Fuel cells - H_2-O_2 fuel cell.

UNIT IV

Corrosion And Its Control: Chemical and electrochemical corrosion-Galvanic series-galvanic, pitting, stress and concentration cell corrosion. Factors influencing corrosion-corrosion control methods - cathodic protection and corrosion inhibitors. Protective coating - types of protective coatings-metallic coating-tinning and galvanizing, cladding, electroplating and anodizing.

UNIT V

Phase Rule: Definition and derivation of phase rule. Application to one component system - water and sulphur systems. Thermal analysis, condensed phase rule. Two component alloy systems - Pb-Ag, Cu-Ni and Mg-Zn systems.

Text books

1. P.C. Jain and Monika Jain, Engineering Chemistry, Dhanpat Rai and Sons, New Delhi 2004.
2. N. Krishnamurthy, P. Vallinayagam and D. Madhavan, Engineering Chemistry, 2nd edition. PHI Learning PVT., LTD, New Delhi, 2008.

Reference Books

1. S. S. Dara, A Textbook of Engineering Chemistry, S. Chand & Co., Ltd. New Delhi.
2. B. K. Sharma, Engineering Chemistry, 3rd edition Krishna Prakashan Media (P) Ltd., Meerut, 2001.

T 110 BASIC CIVIL AND MECHANICAL ENGINEERING

PART-A CIVIL ENGINEERING

UNIT I

Buildings, Building Materials: Buildings-Definition-Classification according to NBC-plinth area, Floor area, carpet area, floor space index-construction materials-stone, brick, cement, cement-mortar, concrete, steel- their properties and uses.

UNIT II

Buildings and their Components: Buildings- Various Components and their functions. Soils and their classification Foundations-Functions and types of foundations, Masonry, Floors-functions and types of floors, Roofs and types of roofs.

UNIT III

Basic Infrastructure: Surveying-classification, general principles of surveying – Basic terms and definitions of chain, compass and leveling surveying , uses of surveying , contours, their characteristics and uses. Roads-types, Water bound macadam road, cement concrete road, bituminous road. Bridges-components and types of bridges. Dams-Purpose, selection of site, types of dams and components. Water supply-sources and quality requirements. Rainwater harvesting.

PART - B MECHANICAL ENGINEERING

UNIT IV

Internal and External Combustion Systems: Working principles of IC engines – Classification – Diesel and petrol engines: two stroke and four stroke engines. Steam generators(Boilers) – Classification – Constructional features (of only low pressure boilers) – Boiler mountings and accessories.

Conventional Power Generation Systems: Hydraulic, steam and gas turbines power plants – Schemes and layouts – Selection criteria of above power plants.

UNIT V

Non-Conventional Energy Systems (Description Only): Solar thermal systems – Solar photovoltaic – Solar pond – wind, wave, tidal, geothermal and ocean thermal energy conversion systems.

Casting : Green and dry sand moulding processes for ferrous and non-ferrous metals – applications.

UNIT VI

Metal Joining: Elements of arc and gas welding, brazing and soldering – Bolted joint types – Adhesive Bonding; classification of adhesives – applications. Sheet Metal Processing- Punching, blanking, shearing, bending, and deep drawing processes; descriptions and applications .

Text Books:

1. Purushothama Raj.P., Basic civil engineering, 3rd Edn., Dhanam Publications, Chennai, 2001.
2. Natarajan, K V, Basic Civil Engineering, 11th Edition, Dhanalakshmi Publications Chennai, 2001.
3. Lindberg, R.A.Process and Materials of Manufacture, PHI, 1999.
4. Nagpal, Power Plant Engineering, Khanna Publishers, Delhi, 1998.

Reference Books

1. Rajput, R K, Engineering Materials, S Chand & Co. Ltd., New Delhi, 2002.
2. Punmia, B.C., et. al., Surveying , Vol-I, Laxmi Publishers, New Delhi, 2002.
3. Punmia, B.C., et.al Building Construction, Laxmi Publishers, New Delhi ,2002.
4. El.Wakil, M.M., Power Plant Technology, Mc Graw Hill Book Co.,1985.
5. Hajra Choudhry, et. al., Workshop Technology Vol I and II, Media Promoters Publishers Pvt. Ltd., Bombay, 2004.

T111 ENGINEERING MECHANICS

UNIT I

Fundamental of Mechanics: Basic Concepts Force System and Equilibrium, Definition of Force, Moment and Couple, Principle of Transmissibility, Varignon's theorem, Resultant of force system – Concurrent and non concurrent coplanar forces, Condition of static equilibrium for coplanar force system, stability of equilibrium, concept of free body diagrams, applications in solving the problems on static equilibrium of bodies.

UNIT II

Plane Trusses: Degrees of freedom, Types of supports and reactions, Types of loads, Analysis of Trusses-method of joints, method of sections

Friction: Introduction, Static dry friction, simple contact friction problems, ladders, wedges, screws and belt friction.

UNIT III

Properties of Surfaces: Properties of sections – area, centroids of lines, areas and volumes, moment of inertia first moment of inertia, second moment of inertia and product moment of inertia, polar moment of inertia, radius of gyration, mass moment of inertia.

UNIT IV

Kinematics and Kinetics of Particles: Equations of motion - Rectilinear motion, curvelinear motion, Relative motion, D'Alembert's principle, work- Energy equation – Conservative forces and principle of conservation of energy, Impulse – momentum, Impact – Direct central impact and oblique central impact.

UNIT V

Kinematics and Kinetics of Rigid bodies: Plane motion, Absolute motion, Relative motion, translating axes and rotating axes, work and energy, impulse and momentum

Text Books

1. Bhavikatti,S.S and K.G.Rajashekarappa, Engineering Mechanics, New Age International (p) Ltd, New Delhi,2008.
2. Rajesekaran, S and Sankara Subramanian., G., Engineering Mechanics, Vikas Publishing House Private Ltd., 2002.

Reference Books

1. Palanichamy, M.S. Nagan, S., Engineering Mechanics – Statics & Dynamics, Tata McGraw-Hill,2001.
2. Beer, F.P and Johnson Jr. E.R, Vector Mechanics for Engineers, Vol. 1 Statics and Vol.2 Dynamics, McGraw – Hill International Edition, 1997.

T112 COMMUNICATIVE ENGLISH

UNIT I

Basic Communication Theory: Importance of Communication – stages of communication, modes of communication – barriers to communication – strategies for effective communication – Listening: Importance, types, barriers – Developing effective listening skills.

UNIT II

Comprehension and Analysis: Comprehension of technical and non-technical material – Skimming, scanning, inferring-Note making and extension of vocabulary, predicting and responding to context- Intensive Reading and Reviewing

UNIT III

Writing: Effective sentences, cohesive writing, clarity and conciseness in writing – Introduction to Technical Writing – Better paragraphs, Definitions, Practice in Summary Writing – Four modes of writing – Use of dictionaries, indices, library references – making bibliographical entries with regard to sources from books, journals, internet etc.

UNIT IV

Business Writing / Correspondence: Report writing – Memoranda – Notice – Instruction – Letters – Resumes – Job applications

UNIT V

Oral Communication: Basics of phonetics – Presentation skills – Group Discussions – Dialogue writing – Short Extempore – Debates-Role Plays-Conversation Practice

Reference Books:

1. Ashraf M.Rizvi., Effective Technical Communication. Tata-McGraw, 2005.
2. Boove, Courtland R et al., Business Communication Today, Pearson Education, New Delhi, 2002.
3. Meenakshi Raman and Sangeeta Sharma., Technical Communication Principles and Practice,OUP, 2007.
4. Robert J.Dixson. ,Complete Course in English, Prentice-Hall of India Pvt. Ltd., New Delhi,2006.
5. Robert J.Dixson., Everyday Dialogues in English, Prentice-Hall of India Pvt. Ltd., New Delhi,2007.
6. Sethi,J and Kamalesh Sadanand., A Practical Course in English Pronunciation, Prentice- Hall of India Pvt. Ltd, New Delhi,2007.

P104 PHYSICS LABORATORY

List of experiments (Any 10 Experiments)

1. Thermal conductivity – Lee's DISC
2. Thermal conductivity - Radial flow
3. Spectrometer – Prism or Hollow prism
4. Spectrometer – Transmission grating
5. Spectrometer - Ordinary & Extraordinary rays
6. Newton's rings
7. Air – wedge
8. Half shade polarimeter – Determination of specific rotatory power
9. Jolly's experiment – determination of α
10. Magnetism: i – h curve
11. Field along the axis of coil carrying current
12. Vibration magnetometer – calculation of magnetic moment & pole strength
13. Laser experiment: wavelength determination using transmission grating, reflection grating (vernier calipers) & particle size determination
14. Determination of optical absorption coefficient of materials using laser
15. Determination of numerical aperture of an optical fiber

P105 CHEMISTRY LABORATORY

List of experiments (Any 10 Experiments)

1. Determination of dissolved oxygen in water.
2. Determination of total hardness of water by EDTA method.
3. Determination of carbonate and bicarbonate in water.
4. Estimation of chloride content in water.
5. Estimation of magnesium by EDTA.
6. Estimation of vinegar.
7. Estimation of ferrous by permanganometry.
8. Estimation of ferrous and ferric iron in a solution mixture by dichrometry.
9. Estimation of available chlorine in bleaching powder.
10. Estimation of copper in copper sulphate solution.
11. Estimation of calcium by permanganometry.
12. Estimation of iron by colorimetry.

Demonstration Experiments(Any two of the following)

1. Determination of COD of water sample.
2. Determination of lead by conductometry.
3. Percentage composition of sugar solution by viscometry.

P106 WORKSHOP PRACTICE

Sl.No.	Trade	List of Exercises
1.	Fitting	Study of tools and Machineries. Exercises on symmetric joints and joints with acute angle.
2.	Welding	Study of arc and gas welding equipment and tools – Edge preparation – Exercises on lap joint and V Butt joints – Demonstration of gas welding
3	Sheet metal work	Study of tools and Machineries – exercises on simple products like Office tray and waste collection tray.
4.	Carpentry	Study of tools and Machineries – Exercises on Lap joints and Mortise joints

LIST OF EXERCISES

I Fitting

1.Study of tools and Machineries
2.Symmetric fitting
3.Acute angle fitting

II Welding

1.Study of arc and gas welding equipment and tools
2.Simple lap welding (Arc)
3.Single V butt welding (Arc)

III Sheet metal work

1.Study of tools and machineries
2.Funnel
3.Waste collection tray

IV Carpentry

1.Study of tools and machineries
2.Half lap joint
3.Corner mortise joint.

T107 MATHEMATICS – II

UNIT I

Algebra: Binomial, exponential and logarithmic series (without proof) – problems on summation, approximation and coefficients.

UNIT II

Matrices: Inverse of matrix by row transformation – Eigen values and Eigen vectors - Cayley-Hamilton theorem (without proof) – Diagonalisation – rank of matrix – solution of a general system of m linear algebraic equations in n unknown ($m \leq n$).

UNIT III

Trigonometry: Expansions for $\sin^n \theta$, $\cos^n \theta$, $\tan^n \theta$, $\sin(n\theta)$, $\cos(n\theta)$, $\tan(n\theta)$. Exponential, circular, hyperbolic, inverse hyperbolic and logarithmic functions of a complex variable – separation of real and imaginary parts.

UNIT IV

Vector Analysis: Scalar fields and Vector fields – Gradient, Divergence and Curl – their properties and relations – Gauss and Stokes theorems (without proof), simple problems for their verification.

UNIT V

Statistics: Moments, kurtosis and skewness based on moments only. Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions. Correlation and regression – rank correlation.

Text Books:

1. M.K. Venkataraman, Engineering Mathematics (First Year), Second Edition, The National Publishing Company, Madras, 2001.
2. M.K. Venkataraman, Engineering Mathematics (Third Year-Part A), The National Publishing Company, Madras, 2001.

Reference Book:

1. N.P. Bali and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications, New Delhi, 2007.

T108 MATERIAL SCIENCE

UNIT I

Crystal Structure and Defects: Crystal Systems – Bravais Lattices – Coordination Number, Atomic Radius, Packing Factor for FCC & HCP structures – Miller Indices for a cubic crystal– Powder X Ray Diffraction Method - Lattice defects – Qualitative ideas of point, line, surface and volume defects

UNIT II

Dielectric Properties: Dielectric Polarization and Mechanism – Internal or local Field - Clausius-Mossotti relation – Dielectric loss - Temperature and frequency dependence of dielectric constant – Measurement of Dielectric constant and loss using Scherring bridge – Elementary ideas of Piezoelectrics, Ferroelectrics and Pyroelectric materials and its Applications

UNIT III

Magnetic Properties: Elementary Ideas of classification of magnetic materials (Dia, Para, Ferro & Ferri) – Quantum theory of Para & Ferro Magnetism – Domain Theory of Hysteresis – Heisenberg Theory of Exchange Interaction (without derivation) – Qualitative ideas of Anti ferromagnetic Ordering – Structure and Properties of Ferrites – Properties of Soft & Hard Magnetic Materials – Applications: floppy disks, CD ROM, Magneto optical recording

UNIT IV

Semiconductors and Superconductors: Derivation of Carrier concentration in intrinsic Semiconductor – Hall effect in Semiconductors -- Application of Hall Effect - Basic Ideas of Compound Semiconductors (II-VI & III-V) - Basic concepts of superconductivity – transition temperature – Meissener effect – Type I and II superconductors – high temperature superconductors – 123 superconductor.

UNIT V

Advanced Materials: Liquid Crystals – Types – Application as Display Devices – Metallic Glasses – Nanomaterials (one, Two & three Dimensional) – Physical Properties and Applications of Carbon Nano Tubes

Text books:

1. V Raghavan , Materials Science and Engineering- A First Course, PHI Learning, 2008.
2. M Arumugam , Materials Science, Anuratha Printers, 2004.

Reference Books:

1. M Ali Omar, Elementary Solid State Physics, Addison Wesley Publishing Co., 2000.
2. William D Callister Jr., Material Science and Engineering, John Wiley and sons, 2006.
3. Srivatsava J P, Elements of Solid State Physics, PHI Learning, 2001.
4. Charles Kittel, Introduction to Solid State Physics, John Wiley & sons, Singapore ,2007.
5. S.O Pillai , Solid State Physics– New Age International,2005.
6. Charles P Poole and Frank J Owens, Introduction to Nanotechnology, Wiley Interscience, 2003.

T109 ENVIRONMENTAL SCIENCE

UNIT I

Environmental Segments and Natural Resources: Environmental segments-lithosphere, hydrosphere, biosphere and atmosphere-layers of atmosphere. Pollution-definition and classification. Pollutants-classification.Forest resources-use and overexploitation, deforestation, forest management. Water resources-sources, use and conflicts over water, dams-benefits and problems. Mineral resources-mineral wealth of India, environmental effects of extracting and using mineral resources. Food resources-world food problems, environmental impact of modern agriculture-fertilizer and pesticides, overgrazing and land resources-land degradation- land slides, soil erosion and desertification. Energy resources-growing energy needs renewable and non-renewable energy resources and use of alternate-energy sources.

UNIT II

Ecosystem and Biodiversity: Concept of an ecosystem-structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of forest, grass land, desert and aquatic (fresh water, estuarine and marine) ecosystem. Biodiversity-definition-genetic species and ecosystem diversity. Value of biodiversity – consumptive use, productive use, social, ethical, aesthetic and option values. Hot spots of biodiversity. Threats to biodiversity-habitat loss, poaching of wild life, human-wildlife conflicts. Endangered and endemic species. Conservation of biodiversity-in situ and ex-situ conservation of biodiversity.

UNIT III

Air Pollution: Air pollution-sources of air pollution. Sources, effects and control measures of oxides of nitrogen, oxides of sulphur, oxides of carbon, hydrocarbon, chlorofluro carbons and particulates. Green house effect-causes and effects on global climate and consequences. Ozone depletion-causes, mechanism and effect on the environment. Smog-sulfurous and photochemical smog-effect on the environment. Acid rain-theory of acid rain and effects.

UNIT IV

Water Pollution and Solid Waste Management Sources: effects and control measures of –water pollution, soil pollution, marine pollution, noise pollution, thermal pollution and radioactive pollution. Solid waste management – causes, effect and control measures of urban and industrial wastes.

UNIT V

Social Issues and the Environment: From unsustainable to sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, water shed management. Resettlement and rehabilitation of people. Environmental ethics. Consumerism and waste products. Environmental protection act-air (prevention and control of pollution) act, water (prevention and control of pollution) act, wildlife protection act, forest conservation act. Role of an individual in prevention of pollution.

Human population and the environment-population growth, variation among nations, population explosion, role of information technology in environment and human health.

Text Books:

1. K. Raghavan Nambiar, "Text Book of Environmental Studies" 2nd edition, Scitech Publications, India, Pvt. Ltd, Chennai, 2008.
2. A. K. De, "Environmental chemistry" 6rd edn; New age international (P) Ltd, New Delhi, 2006.

Reference Books:

1. B.K. Sharma, "Environmental chemistry" goel publishing house, Meerut, 2001.
2. G. S. Sodhi, Fundamental concepts of environmental chemistry, Narosa publishing house, New Delhi
3. S .S.Dara, " A text book of environmental chemistry and pollution control, S. Chand and Company Ltd, New Delhi, 2002.
4. Richard T. Wright, environmental science, 9th edition, Pearson education inc, New Delhi, 2007
5. P. Meenakshi, "Elements of environmental science and engineering" PHI Learning, New Delhi, 2006.

T104 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

PART A – ELECTRICAL

UNIT – I

Review of Kirchoff's laws - series and parallel circuits, equivalent resistance, star/delta conversion. Concepts of AC circuits – rms value, average value, form and peak factors – real and reactive power – power factor.

UNIT – II

Node and mesh methods of analysis of DC circuits and simple AC circuits - Introduction to three phase circuits, Introduction to three phase system - phase and line parameters – relations, power measurement – voltmeter and ammeter method, two and three wattmeter methods.

UNIT – III

Principle of DC generator and motor - Transformer, synchronous generator, induction motor (single phase). Sources for electrical energy conversion-thermal and hydraulic plant (Block diagram approach only). Components of AC transmission and distributions systems – line diagram.

PART B – ELECTRONICS

UNIT – IV

Half-wave rectifier and Full-wave rectifier- filters - Amplifiers-common emitter and common collector amplifiers- Hartley oscillator and RC phase shift oscillator.

Transducers – Resistance temperature detector (RTD) – Linear variable differential transformer (LVDT) - Strain gauge – Piezo electric transducer.

UNIT - V

Boolean algebra – Reduction of Boolean expressions – De-Morgan's theorem – Logic gates – Implementation of Boolean expressions – Flip flops – RS, JK, T and D. Combinational logic – Half adder, Full adder and Subtractors. Sequential logic – Ripple counters and shift registers.

UNIT - VI

Model of communication system – Analog and digital – Wired and wireless channel. Block diagram of various communication systems – Microwave, satellite, optical fiber and cellular mobile system. Network model – LAN, MAN and WAN – Circuit and packet switching – Overview of ISDN.

Text Books

1. Hughes revised by John Hiley, Keith Brown, Ian McKenzie Smith, Electrical and Electronics Technology, Pearson Education Limited, New Delhi, 2007.
2. Smarajit Ghosh, Fundamentals of Electrical and Electronics Engineering, Second Edition, PHI Learning, 2007.
3. George Kennedy and Bernard Davis, Electronics communication Systems, Tata McGraw-Hill Ltd, New Delhi, 2007.

Reference Books

1. D.P.Kothari and I.J.Nagrath, Theory and Problems of Basic Electrical Engineering,
PHI Learning., New Delhi.
2. J.B.Gupta, A Course in Electrical Power, Katson Publishing House, New Delhi,

T105 THERMODYNAMICS

UNIT I

Basic Concepts and Definitions: Energy conversion and efficiencies - System, property and state - Thermal equilibrium - Temperature - Zeroth law of Thermodynamics.

UNIT II

First Law of Thermodynamics: The concept of work and adiabatic process - First law of thermodynamics - Conservation of Energy principle for closed and open systems - Calculation of work for different processes of expansion of gases

UNIT III

Second Law of Thermodynamics: Equilibrium and the second law - Heat engines - Kelvin-Planck statement of second law of thermodynamics - Reversible and irreversible processes - Carnot principle - Clausius inequality- Entropy

UNIT IV

Gas Power Cycles: Air standard cycles: The air standard Carnot cycle - Air standard Otto cycle, diesel cycle, dual cycle and Bryton cycles and their efficiencies

UNIT V

Refrigeration Cycles and Systems: Reverse Carnot cycle - COP - Vapor compression refrigeration cycle and systems (only theory) - Gas refrigeration cycle - Absorption refrigeration system (only theory)- Liquifaction and solidification of gases

Text Books:

1. Nag, P. K., "Engineering Thermodynamics", 4th edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi,1995.
2. Wark, K., "Thermodynamics", 4th edition, McGraw Hill, N.Y.,1985

Reference Books :

1. Arora, C.P., "Thermodynamics" , Tata McGraw Hill Publishing Co. Ltd., New Delhi,1998.
2. Burghardt, M.D., "Engineering Thermodynamics with Applications", 4th edition, Harper and Row, N.Y., 1986.
3. Huang, F.F., "Engineering Thermodynamics" 2nd edition , Macmillan Publishing Co. Ltd., N.Y.,1989.
4. Cengel, Y.A. and Boles, M.A., "Thermodynamics - An Engineering Approach", 5th edition, McGraw Hill, 2006

T106 COMPUTER PROGRAMMING

UNIT – I

History of Computers – Block diagram of a Computer – Components of a Computer system – Classification of computers - Hardware – Software – categories of Software – Operating System – Applications of Computers - Role of Information Technology – Internet and its services – Intranet – Study of word processor – Preparation of worksheets

UNIT – II

Problem solving techniques – Program – Program development cycle – Algorithm design – Flowchart - Pseudo code.

Introduction to C – C tokens – data types – Operators and expressions – I/O functions

UNIT – III

Decision making statements – branching and looping – arrays – multidimensional arrays – Functions – Recursion – Passing array to functions

Storage classes – Strings – String library functions

UNIT – IV

Structures – Arrays and Structures – nested structures – passing structures to functions – user defined data types– Union

Pointers – pointers and arrays – pointers and functions - pointers and strings - pointers and structures

UNIT – V

Files – operations on a file – Random access to files – command line arguments

Introduction to preprocessor – Macro substitution directives – File inclusion directives – conditional compilation directives – Miscellaneous directives

Text Books

1. Ashok N Kamthane, "Computer Programming", Pearson education, Second Impression, 2008.
2. K. Venugopal and C.Kavichithra, "Computer Programming", New Age International Publishers, First Edition, 2007.

Reference Books

1. Balagurusamy. E, "Programming in ANSI C", Tata McGraw Hill, Third edition, 2006.

P101 COMPUTER PROGRAMMING LAB

List of Exercises

OS Commands, Word Processor and Spreadsheets

1. Study of OS commands-Compilation and execution of simple C programs
2. Use of mail merge in word processor
3. Use of spreadsheet to create Charts(XY, Bar, Pie) and apply the formulae wherever necessary C Programming (Flowcharts and algorithms are essential for the programming exercises)
4. Greatest of three numbers using conditional operator and if statement
5. Read two numbers and swap those two numbers using temporary variable and without using temporary variable.
6. Solve quadratic equation for different sets of inputs.
7. Use of Switch….Case statements
8. Generation of prime and Fibonacci series
9. Evaluate the COSINE series using for, while and do..while loops
10. Matrix operations

1. Addition
2. Transpose
3. Multiplication

11. Evaluate the sin(x) series using functions and recursive functions
12. Read a string and find solution to remove the duplicates of a given string from the given sentence

Create an array of structures for a list of items with the following details

Item_Code	Item_ Name
102	Paste – Colgate
102	Paste –Pepsodent
102	Paste –Close-up
101	Soap-Cinthol
101	Soap-Lux
101	Soap-Hamam
101	Soap-Dove

Arrange the set of items in ascending order of its Item_Code and descending order of its Item_ name as given below

Item_Code	Item_ Name
101	Soap-Lux
101	Soap-Hamam
101	Soap-Dove
101	Soap-Cinthol
102	Paste –Pepsodent
102	Paste –Colgate
102	Paste – Close-up

14.Use of Structure to define a user defined data types, input the data and write the data into the file

15.Use of pointers and array of pointers

16.Functions with static data types

17.Write command line program to implement the following DOS commands using files

- Del
- Copy

P102 ENGINEERING GRAPHICS

Unit 0

Introduction to Standards for Engineering Drawing practice, Lettering, Line work and Dimensioning

Unit I

Conic sections, Involutes, Spirals, Helix. Projection of Points, Lines and Planes

Unit II

Projection of Solids and Sections of Solids.

Unit III

Development of surfaces - Intersection of surfaces (cylinder-cylinder, cylinder-cone)

Unit IV

Isometric projections and Orthographic projections

Unit V

Computer Aided Drafting: Introduction to Computer Aided Drafting hardware - Overview of application software - 2D drafting commands (Auto CAD) for simple shapes - Dimensioning.

Text Books

1. K.R. Gopalakrishna and Sudhir Gopalakrishna, Engineering Graphics, Inzinc Publishers, 2007.
2. K.V. Natarajan, A Text Book of Engineering Drawing, Dhanalakshmi Publishers, 2006.
3. BIS, Engineering Drawing practice for Schools & College, 1992.

Reference Books

1. N.D. Bhatt, Engineering Drawing, 49th edition, Chorotar Publishing House, 2006.
2. K. Venugopal, Engineering Drawing and Grahics + Auto CAD, 4th edition, New Age
International Publication Ltd., 2004 .
3. David I cook and Robert N Mc Dougal, Engineering Graphics and Design with computer
applications, Holt – Sounders Int. Edn. 1985.
4. James D Bethune and et. al., Modern Drafting, Prentice Hall Int., 1989.

P103 BASIC ELECTRICAL AND ELECTRONICS LAB

ELECTRICAL LAB

1. Study of tools and accessories
2. Study of joints
3. Staircase wiring
4. Doctor's room wiring
5. Godown wiring
6. Tube Light and Fan connection
7. Lamp controlled from three different places-wiring

ELECTRONICS LAB

1. Rectifiers

Construction of half wave and full wave rectifiers with and without filters – Calculation of ripple factors.

2. Frequency Response of RC Coupled Amplifiers

Determination of frequency response of given RC coupled amplifier - Calculation of bandwidth.

3. Verification of Kirchoff's Voltage and Current Laws

Determine the voltage and current in given circuits using Kirchoff"s laws theoretically and verify the laws experimentally.

4. Study of Logic Gates
    1. Verification of Demorgan's theorems
    2. Verification of truth tables of OR, AND, NOT, NAND, NOR, EX-OR, EX-NOR gates and Flipflops - JK, RS, T and D
    3. Implementation of digital functions using logic gates

5.Study of CRO
    1. Measurement of AC and DC voltages
    2. Frequency and phase measurements (using Lissajou's figures)

6.Study of Transducers
    1. Displacement and load measurements with transducers
    2. Temperature measurement with thermocouple

P107 NCC / NSS

NCC/NSS training is compulsory for all the Undergraduate students

1. The above activities will include Practical/field activities/Extension lectures.
2. The above activities shall be carried out outside class hours.
3. In the above activities, the student participation shall be for a minimum period of 45 hours.
4. The above activities will be monitored by the respective faculty incharge and the First Year Coordinator.
5. Pass /Fail will be determined on the basis of participation, attendance, performance and behaviour. If a candidate Fails, he/she has to repeat the course in the subsequent years
6. Pass in this course is mandatory for the award of degree.

MA T31 MATHEMATICS III

(Offered by the Department of Mathematics)

UNIT-I:
Laplace Transform: Definitions, Laplace Transform functions, Impulse and Step functions. Laplace Transform of periodic functions. Exponential shift formula, Initial and Final value theorems, Laplace Transform of derivatives and integrals. Convolution theorems, inverse Laplace Transform, methods of determining inverse Laplace Transform, Solutions of Linear differential equations using Laplace Transform.

UNIT-II:
Function of a complex variable: Functions of complex variable - continuity, derivatives and analytical function, Cauchy - Riemann equations sufficient conditions for analytically - Harmonic and Orthogonal properties of the real and imaginary parts – conformal mapping - Bilinear transformations.

UNIT-III:
Complex Integration: Cauchy's integral formula - Taylor's and Laurent series. Residue theorem, contour integration rounds the unit circle and semi circle.

UNIT-IV:
Fourier series: Dirichlet's conditions. Expansion of periodic functions into Fourier series, change of interval. Half - range and complex Fourier series. Numerical method of finding Fourier coefficient - Harmonic analysis.

UNIT-V:
Fourier Transform: Definition and properties. Fourier Integral, the limit of Fourier series, Inverse Fourier Transform.

Text Books:

1. Venkataraman.M.K. , "Engineering Mathematics", Vol. II, National Publishing company,
Madras, 2009 (for units I, II & III).
2. Venkataraman.M.K. , "Engineering Mathematics", Vol. III, National Publishing company,
Madras, 2009 (for units IV & V).

Reference Books:

1. N.P.Bali & Manish Goyal, "A Text book of Engineering Mathematics",Laxmi Publications,
New-Delhi, 2008.
2. Erwin Kreyszig, "Advanced Engineering Mathematics",John-Wiley Sons, New-York,
2005.
3. B.S.Grewal, "Higher Engineering Mathematics", Khanna Publishers, Delhi, 2008.

CH T32 PHYSICAL CHEMISTRY

(Offered by Department of Chemistry)

UNIT-I:

Gaseous State – Ideal gases, equation of state, Boyle's law, Charles law, Avagadro's law, Daltons law, kinetic molecular theory of gases, deduction of gas laws from kinetic gas equation. Maxwell's distribution of molecular velocities. Collision properties – mean free path. Deviation from ideal behaviour – van der Waals equation of state.

Liquid state – Equation of state of liquids, structure of liquids – vacancy model, vapour pressure, heat of vapourisation, Trouton's rule.

UNIT-II:

Free energy – variation of free energy with temperature and pressure. Maxwell's relationships. Gibbs-Helmholtz equation. Concept of chemical potential – Gibbs-Duhem equation. Variation of chemical potential with temperature and pressure. Clapeyron – Clausius equation. Fugacity – determination of fugacity of a gas and concept of activity.

UNIT – III:

Solutions – Solutions of liquid in liquids, ideal solutions, Raoult's law, Non- ideal solutions vapour presure- composition and temperature- Composition diagrams. Fractional distillation. Partially miscible liquids – critical solution temperature. Immiscible liquids – steam distillation. Colligative properties – Lowering of vapour pressure, elevation of boiling point, depression of freezing point, molecular weight determination, osmotic pressure.

UNIT – IV:

Chemical kinetics – effect of temperature on reaction rates, Arrhenius equaton, Energy of activation theories of reaction rates- Collision theory, absolute reaction rate theory and Lindemann theory of unimolecular reaction.

Catalysis- Characteristics of catalysts, homogeneous catalysis – kinetics of acid base catalysis, and enzyme catalysis. Heterogeneous catalysis – kinetics of unimolecular and bimolecular surface reactions- Langmuir-Rideal – Hinshelwood mechanism.

UNIT- V:

Adsorption – Physical and chemical adsorption. Adsorption of gases by solids, Langmuir and BET Theories. Freundlich adsorption isotherm.

Analytical instruments- electromagnetic radiations, properties , emission and absorption of radiation, radiation sources, wavelength selectors, transducers. Principle and Instrumentation of atomic absorption and emission spectrometry. ICP source. UV – visible spectrophotometry-Principle and instrumentation. Beer-Lamberts law. Chromatography – Introduction, Principle and Instrumentation of HPLC and gas chromatography.

Text books:

1. A.S. Negi and S.C.Anand, "A Textbook of Physical Chemistry", New Age International (P)
Ltd., 2nd edition, New Delhi, 2007.
2. B.R.Puri Sharma and Pathania, "Principles of Physical Chemistry", Vishal Publishing Co.,
New Delhi, 2007.

Reference Books:

1. Peter Atkins and Julio de Paula, "Elements of Physical Chemistry", 4th edition, Oxford
University Press, New Delhi, 2007.
2. K.J.Laidler and J.H.Meiser, "Physical Chemistry", 2nd edition, CBS Publishers and
Distributers, New Delhi, 1999.
3. Samuel Glasstone, "A Textbook of Physical Chemistry", Macmillan India Ltd, New Delhi,
1976.

CH T33 STRENGTH OF MATERIALS

(Offered by the Department of Civil Engineering)

UNIT- I:

Concept of mechanics of deformable bodies-Behaviour of mild steel under tension-stress and strain – elastic constants and their relationships-equivalent modulus-factor of safety-Principal planes and principal stresses (two dimensional) – Mohr's circle representation.

UNIT-II:

Bending moment and shear force diagrams for cantilever, simply supported and over hanging beams-Bending of beams: theory of simple bending-neutral axis-stress distribution across a section due to bending moment and shear force-thin cylindrical shells.

UNIT-III:

Deflection of beams:Equation of deflection curve-slope and deflection by double integration method-Moment area method –conjugate beam method.

UNIT-IV:

Torsion: Torsion of solid and hollow circular shafts-combined beind and torsion-springs:Leaf springs-closed and open coiled helical springs.

UNIT-V:

Columns:Thoery of columns-combined beinding and direct stresses-concept of structural stability-long columns:Euler's theory of buckling load-Rankine-Gardon formula-Jhonson's formula-column with initial curvature.

Text Books:

1. Rajput.R.K, "Strength of Materials", S.Chand and Company Ltd., New Delhi, 2002.

Reference Books:

1. Bhavikatti.S.S, "Strength of Materials", Vikas Publishing House (P) Ltd., 2002.

CH T34 ELECTRICAL AND ELECTRONICS ENGINEERING

(Offered by the Department of Electrical And Electronics Engineering)

UNIT-I:

Transformer-construction –EMF equation –Transformer on No load –Transformer on Load –Equivalent Circuit –Efficiency –OC abd Sc Test –Regulation –All day efficiency-Auto trans former –Introduction to 3-phaes transformer.

UNIT-II:

Induction motor –principle of action –Construction –starting methods-starting torque-3phase IM –Introduction – efficiency-speed control methods-capacitor run Induction motor –Stepper motor –Hysterisis motor –its applications,AC/DC generators.

UNIT- III:

Thevenin , Norton ,Maximum power transfer ,Super position theorems for DC circuitsonly.Resonance –Parallel resonance-Introduction to 3-phase system –Two watt meter method of power meaurement.

UNIT-IV:

Analog Electronics:Operational Amplifiers-Idael Characteristics-741 IC details-Inverting and non-Inverting amplifier –scale changers-Inverter –Instrumentation amplifier-CMRR-Block diagram of 555 ic-Astable,monostable multivibraytors using 555IC-Different types of ADC.

UNIT-V:

Introduction to Boolean Algebra-combination circuits-Simplification –Karnaugh map-NAND-NOR implementation –counters –UPDOWN counters-Ring counters-Multiplexes –De multiplexes-Digital to Analog convention Technique

Text Books:

1. Hughes, "Electrical and Electronics Technology", Pearson education(Singapore)Pvt Ltd., New Delhi, 2003.
2. B.L.Theraja, "Fundamental of Electrical engineering & eletronics", S.Chand &company, New Delhi, 1996.

Reference Books:

1. A.P.Malvino, "Electronic Principles", Tata Mc GrawHill, New Delhi, 1994.
2. U.K. Metha , "Principles of Eletronics", S.Chand &company, New Delhi, 1996.

CH T35 PROCESS CALCULATIONS

UNIT-I :
Introduction to Chemical engineering calculations, units and dimensions, mole and molecular weight, properties of gases, vapors, liquids, solutions and solids, gas laws, partial pressures, vapor pressures, saturation and equilibria, Raoults law, partial saturation and humidity.

UNIT-II :
Material balances without chemical reactions, stoichiometry and unit operations-distillation, absorption, stripping, extraction, leaching, crystallization, drying, and psychrometry. Recycle, purge and bypass calculations.

UNIT-III :
Material balances involving chemical reactions, simple oxidation reaction, calculations involving combustion of gaseous, liquid and solid fuels. Recycle, purge and bypass calculations.
Introduction to unsteady state material balances.

UNIT-IV:
Energy balance - heat capacity and calculation of enthalpy changes, Enthalpy changes for phase transitions, evaporation, clausius - clapeyron equation,

UNIT-V:
Energy balances with chemical reaction - heat of reaction and adiabatic flame temperature calculations.

Text Books:

1. B.I.Bhatt and S.M.Vora, "Stoichiometry", Tata McGraw Hill, 3rd Edition, 2004.

Reference Books:

1. David.M.Himmelblau, "Basic principles and calculations in chemical engineering",
Prentice Hall of India Ltd., 6th Edition, 1998.
2. A.Hougen, K.M. Watson and K.A.Ragatz, "Chemical Process Principles", Vol 1, John
Wiley, 1960.
3. Richard M. Felder, Ronald W.Rousseau, "Elementry Principles of Chemical Processes",
Wiley Publications, 3rd Edition, 2007.

CH T36 MOMENTUM TRANSFER

UNIT-I:
Fluid Statics - Pressure concept, Hydrostatic equilibrium, measurement of fluid pressure, manometers, buoyancy.
Fluid Dynamics - shear rate, shear stress, viscosity, newtonian and non-newtonian fluids, laminar and turbulent flow, Reynolds number and transition from laminar to turbulent flow.
Dimensional Analysis

UNIT-II:
Basic equations of fluid flow, mass and momentum balance equations, Bernoulli's equation, Laminar flow of incompressible fluids in pipes, couette flow, flow through parallel plates, flow through noncircular conduits, Hagen - Poiseulle equation, Correction of Bernoulli's equation for fluid friction, friction factor, friction loss from sudden expansion or contraction of cross section.
Transportation and metering of fluid flow - Orificemeter, venturimeter, Rotameter, Wiers and notches, pumps and compressors, performance and characteristics of reciprocating, centrifugal and airlift pumps.

UNIT-III:
Turbulent flow - Velocity fluctuations in turbulent flow, statistical nature of turbulence, Reynold's stresses, empirical theories, eddy viscosity, Prandtl's mixing length, Velocity distribution for turbulent flow, relationship between friction factor and reynold's number, Reynold's number and friction factor for non-newtonian fluids.

UNIT-IV:
Flow past immersed bodies - Boundary layer, laminar and turbulent boundary layer, drag and drag coefficient, Stokes law and terminal settling velocity.
Flow of fluids through a bed of solids - Darcy's law, Ergun's equation, Fluidisation, Slurry and pneumatic transport.

UNIT-V:
Flow of Compressible fluids - sonic velocity, mach number, flow through variable area conduits, equations for isentropic flow, equations for adiabatic frictional flow, equations for isothermal frictional flow.

Text Books:

1. W.L.Mc.Cabe, J.C.Smith and P.Harriot, "Unit operations of chemical engineers", McGraw
   Hill International edition, V edition, 1995.
2 Noel de.Nevers, "Fluid mechanics for Chemical Engineers", Mc.Graw Hill International
   edition, 2005.

Reference Books:

1. Paul.A.Longwell, "Mechanics of Fluid Flow", Mc.Graw Hill, 1966.
2. Coulson J.M and Richerdson J.F., "Chemical Engineering - Volume 1", Elsevier Press,
   VI Edition, 2006..
3. White, "Fluid mechanics", Mc.Graw Hill, II edition, 1986.

CH P31 PHYSICAL CHEMISTRY LABORATORY

(Offered by Department of Chemistry)

List of Exprements:

1. Study of simple eutectic formed by naphthalene-biphenyl system.
2. Rate constant of hydrolysis of ethyl acetate by an acid.
3. Partition coefficient of iodine between carbon tetra chloride and water.
4. Partition coefficient of benzoic acid between benzene and water.
5. Determination of molecular weight from depression of freezing point.
6. Adsorption of acetic acid in charcoal – Freundlich adsorption isotherm.
7. Critical solution temperature of phenol – water system.
8. Conductometry titration – mixture of hydrochloric acid and acetic acid vs sodium hydroxide.
9. Acetic acid – chloroform – water three component system.
10. Determination of lead by conductometry titration.

CH P32 STRENGTH OF MATERIALS LAB

(Offered by Department of Civil Engineering)

List of Experiments:

I Test on Metals (Ferrous and Non-ferrous)

1. Tension tests: To find Yield stress, Ultimate stress, Percentage elongation and reduction
   of area of cross-section, Young's Modulus and Barba's constants

2. Double shear test: 180˚ bend test

3. Hardness test: Vickesrs, Brinell and Rockwell

4. Torsion test: Wires and Rods

5. Impact test: Charpy and Izo

6. Ductility test: Erichsen cupping test

7. Fatigue test(Demonstration)

II Test on Plastics

III Test on Springs

CH P33 ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

(Offered by Department of Electrical And Electronics Engineering)

List of Experiments:

1. Performance characteristics of transformers through OC and SC test.
2. Load test on single-phase transformer.
3. Load test on DC shunt motor.
4. Load test on single phase IM.
5. OCC of DC generator.
6. Swinbarn's test.
7. Verification of logic gates.
8. Verification of Thevinin and Norton theorem.
9. Verification of superposition theorem.
10. Series and parallel resonance.

MA T41 MATHEMATICS IV

(Offered by Department of Mathematics)

UNIT-I:

Partial Differential Equations**:** Formation of PDE by elimination of arbitrary constants and arbitrary functions – General, singular, particular and complete integrals – Lagrange's linear first order equation – Higher order differential equations with constant coefficients.

UNIT-II:

Solution of partial differential equation by the method of separation of variables – Boundary value problems – Fourier series solutions – Transverse vibration of an elastic string.

UNIT-III:

Fourier series solution for one dimensional heat flow equation – Fourier series solutions for two dimensional heat flow equations under steady state conditions (Cartesians and polar forms)

UNIT-IV:

Applied Statistics**:** Curve fitting by the method of least squares-fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

UNIT-V:

Small Samples: Test for single mean, difference of means and correlation coefficients, test for ratio of variances – Chi-square test for goodness of fit and independence of attributes.

Text Books:

1. M.K.Venkataraman,"Engineering Mathematics", Vol.II&III, National Publishing Company, Madras, 2005.
2. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematics Statistics", Sultan Chand and Sons, New Delhi, 2008.

Reference Books:

1. N.P.Bali &bManish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications, 2008.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley Sons, Newyork, 2005.
3. B.S.Grewal, "Higher Engineering Mathematics", Khanna Publishers, Delhi, 2008.

CH T42 ORGANIC CHEMISTRY

(Offered by Department of Chemistry)

UNIT-I:

Classification of organic compounds. Concept of hybridization – sp^3, sp^2, sp. Factors affecting a covalent bond – inductive effect, mesomeric effect, electromeric effect and hyperconjugation. Free radicals, carbocation – stability, carbenes, electrophiles and nucleophiles. General methods of preparation, physical and chemical properties of alkanes and alkenes – Markownikoff rule, peroxide effect, Bayer's test. Preparation and properties of alkynes. Monohydric alcohols – general methods of preparation, general properties – Saytzeff rule, methods of distinguishing the three classes of alcohols – Lucas test, Dichromate test.

UNIT-II:

Aldehydes and ketones – General methods of preparation, physical and chemical properties – aldol condensation, Clemmensen reduction, Wolf-Kishner reduction, Haloform reaction, Cannizzaro reaction, Reformatsky reaction, Wittig reaction. Saturated monocarboxylic acids- Preparation, phsical and chemical properties- Hell-Volhard- Zelinsky reaction. Amino acids- methods of preparation, physical and chemical properties. Protiens – classification, structure,
properties and tests.

UNIT- III:

Benzene – Aromaticcity- Huckel rule, general methods of preparation of benzene, electrophilic substitution reactioins of benzene, directive effects of substituents. Aromatic amino compounds – general methods of preparation and properties – carbyl amine reaction. Monohydric phenols – general methods of preparation and properties – Reimer – Tiemann reaction, Kolbe reaction, Fries rearrangement. Aryl diazonium salts – preparation and synthetic applications .

UNIT- IV:

Carbohydrates – classification. Monosaccharides- reaction of Glucose and fructose, open chain and cyclic structures of glucose and fructose, mutarotation, epimerzation, Killiani- Fisher synthesis, Ruff degradation, conversion of aldoses to ketoses and Ketoses to aldoses. Disaccharides – properties and structure of sucrose. Polysaccharides – properties and structure of starch and cellulose.

UNIT – V:

Heterocyclic compounds- Preparation and properties of furan, thiophene, pyrrole and pyridine.Dyes – colour and constitution, Classification of dyes by structure, preparation of azo dyes – methyl orange, congo red, triaryl amine dyes – malachite green, phenolphthalein, fluorescein, Anthraquinone dyes – alizarin and indigo dye. Classification of dyes based on application.

Text Books:

1. Arun Bhal and B.S. Bhal, "A text book of Organic chemistry", S.Chand & Co., New Delhi, 2008.

Reference Books:

1. K.S. Tewari and N.K. Vishnoi, "A textbook of organic chemistry", 3rd edition, Vikash
   Publishing house Pvt. Ltd., New Delhi, 2007.
2. R.T.Morrison and R.N. Boyd, "Organic chemistry", 6th Edition, Pearson Education,
   New Delhi, 2004.
3. I.L. Finar, "Organic chemistry (Vol.1)", 6th Edition, Pearson Education, New Delhi, 2006.
4. I.L. Finar, "Organic Chemistry (Vol.2)", 5th edition, Pearson Education, New Delhi, 2006.

CH T43 CHEMICAL ENGINEERING THERMODYNAMICS

UNIT-I :
The behavior of fluids - PVT properties of fluids, equations of state, ideal and nonideal gas, the and compressibility factor, critical properties, generalised equations of state.

UNIT-II:
First law of thermodynamics - Types of energy, work, heat and energy changes, application of first law to different processes.
Second law of thermodynamics and its applications - Entropy, reversible and irreversible processes, Carnot cycle, T-S diagrams, enthalpy of mixing and disorder. refrigeration and liquefaction .

UNIT-III:
Thermodynamic properties and relations among them, mathematical relationships among basic properties, Maxwell relations, changes in properties, temperature and pressure effects, thermodynamic diagrams, construction of thermodynamic diagrams.

UNIT-IV:
Solution properties - Partial molal properties and chemical potential, concept of fugacity and activity and their calculations, ideal and nonideal solutions, Gibbs - Duhem equations, property change of mixing and excess properties.

UNIT-V :
Phase equilibria - Phase rule, fundamentals of vapour - liquid equilibria , Vanlaar, Margules and Wilson equations for binary mixture, liquid - liquid, solid - liquid and solid - vapour equilibria, Introduction to group contribution methods (UNIFAC).

Text Books:

1. J.M. Smith and H.C. Van Ness, "Introduction to Chemical Engineering Thermodynamics",
Mc.Graw Hill, 1998.
2. K.V.Narayanan, ."A textbook of Chemical Engineering Thermodynamics", Prentice Hall
of India Ltd., 2001.

Reference Books:

1 T.E. Daubert, "Chemical Engineering Thermodynamics ", Mc.Graw Hill, 1985.
2. B.G.Kyle, "Chemical and Process Thermodynamics", Prentice Hall of India Ltd., 1992.
3. Stanley.M. Walas, "Phase Equilibria in Chemical Engineering", Butterworth Publishers, 1985.
4. R.C.Reid, J.M. Prausnitz and B.E. Poling, "The Properties of Gases and Liquids", Mc.Graw Hill, IV Edition, 1988.
5. Y.V.C.Rao, "An Introduction to Thermodynamics", Wiley Eastern, 1994.

CH T44 PROCESS HEAT TRANSFER

UNIT-I:

Steady state conduction - Fouriers law, thermal conductivity, conduction through composite multilayer plane walls, spherical walls and cylindrical walls, insulation and critical thickness of insulation, heat conduction in rods with heat generation. Heat transfer in extended surfaces - equation for heat transfer in rectangular and cylindrical fins, fin effectiveness and fin efficiency.

Unsteady state heat conduction – lumped parameter model, Derivation of unsteady state equation with boundary condition (Solution not included)

UNIT-II:

Principles of heat transfer in fluids - laminar flow and boundary layer theory in heat transfer, heat transfer in turbulent flow, eddy thermal diffusivity, prandtl mixing length theory, analogies between transfer of momentum and heat - Reynold's analogy, Prandtl and Coulburn analogy. Dimensional analysis in heat transfer, Correlations for the calculation of heat transfer coefficients, heat transfer coefficient for flow through a pipe, flow through a non circular conduit, flow past flat plate, flow through packed beds. Heat transfer by natural convection.

UNIT-III:

Heat transfer to fluids with phase change - heat transfer from condensing vapours, drop wise and film wise condensation, Nusselt equation for vertical and horizontal tubes, condensation of superheated vapours, effect of non-condensable gasses on rate of condensation. Heat transfer to boiling liquids - mechanism of boiling, nucleate boiling and film boiling.

UNIT-IV:

Radiation heat transfer - Emissive power, Black body radiation, Emissivity, Stefen - Boltzman law, Plank's law, radiation between surfaces, View factor calculations - view factor for infinitely parallel grey planes, view factor from a plane to a hemisphere, Radiation in absorbing gases.

UNIT-V:

Heat exchange equipments - Double pipe and shell and tube heat exchangers, concept of log mean temperature difference (LMTD), LMTD correction factor, overall heat transfer coefficient, dirt factor, heat exchanger effectiveness.

Evaporators - single effect and multiple effect evaporators, boiling point rise, capacity and economy of multiple effect evaporators, evaporation equipments.

Text Books:

1. Binay K.Dutta , "Heat Transfer", Prentice Hall Publications, 2006.
2. W.L.Mc.Cabe, J.C.Smith and P.Harriot, "Unit operations of chemical engineers", McGraw Hill International edition, V edition, 1995.

Reference Books:

1. Holman.J.P, "Heat Transfer", 9 th Edition, McGraw Hill International, 2004.
2. Kern D.Q, "Process Heat Transfer", Mc.Graw Hill, 1950.
3. Krieth, " Fundamentals of Heat Transfer", Harper and Row Publishers, IV Edition, 1986.
4. C.J.Geankoplis, "Transport Processes and Unit Operations", Prentice Hall, III Edition, 1993.
5. Coulson J.M and Richerdson J.F, "Chemical Engineering - Volume 1", Elsevier Press, V Edition, 2006.

CH T45 MASS TRANSFER I

UNIT I:

Molecular diffusion in gases and liquids, measurement and calculation of diffusivities, steady state diffusion in multicomponent mixtures.

Diffusion in solids, molecular and Knudsen diffusion in porous solids, unsteady state diffusion in solids.

UNIT II:

Mass transfer in turbulent flow, eddy diffusion, mass transfer coefficients, film theory, penetration theory and surface renewal theories of mass transfer, analogies of mass, heat and momentum transfer - Reynolds, Prandtl and Chilton - Coulburn analogies, estimation of mass transfer coefficient in wetted wall coloumn, correlations for the calculation of mass transfer coefficients.

UNIT III:

Theory of interface mass transfer, Individual and overall mass transfer coefficients, steady state cocurrent and countercurrent mass transfer processes, stages and stage efficiencies, cross flow and counter current cascades of stages, Kremser equations for the calculation of number of theoretical stages.

UNIT IV:

Equipments for gas-liquid contact operations – Gas dispersed – Sparged vessels, Mechanically agitated vessels, Tray towers; Liquid Dispersed – Venturi Scrubber, Wetted Wall Tower, Spray Tower, packed Towers; Correlations for Mass Transfer Coefficients.

UNIT V:

Gas Absorption - Tray tower absorber, absorption factor, calculation number of theoretical stages, Murphree efficiency - point efficiency, tray efficiency and overall tray efficiency, calculation of actual number of trays.

Packed tower absorber - HETP, HTU and NTU calculations

Non-isothermal absorber, absorption with chemical reaction.

Text Books:

1. R.E. Treybol, "Mass Transfer Operations", McGraw Hill, II Edition, 1981.
2. W.L.Mc.Cabe, J.C.Smith and P.Harriot, "Unit operations of chemical engineers", McGraw Hill International edition, V edition, 1995.

Reference Books :

1. C.J.Geankoplis, "Transport Processes and Unit Operations", Prentice Hall, III Edition, 1993.
2. Badger and Banchero, "Introduction to Chemical Engineering", Tata Mc.Graw Hill, 2006.
3. Coulson J.M and Richerdson J.F, "Chemical Engineering - Volume 2", Elsevier Press, V Edition, 2006.
4 T.K.Sherwood, R.L.Pigford and C.R.Wilke, "Mass Transfer", McGraw Hill, 1975.

CH T46 MECHANICAL OPERATIONS

UNIT-I:
Particle Size Analysis - Methods of representation of size analysis, shape factor, subsieve methods of analysis, surface area determination. Industrial screening - Theory of screening, screen efficiency, types of screening equipments and their performances. Storage and Conveyance of solids - Bunkers, silos, bins and hoppers, transportation of solids in bulk, conveyer selection, different types of conveyers and their performance characteristics.

UNIT-II:
Size reduction - Energy relationships in size reduction, size reduction equipment and selection, closed circuit and open circuit operation. Size enlargement - Principle of granulation, briquetting, pelletisation, flocculation, typical equipments used.

UNIT-III:
Classification - Application of Stoke's equation, types of classifiers - gravity settling, settling tanks, elutriation, double cone classifier, rake classifier, bowl classifier. Centrifugal separation - Principles, separation of solids from fluids, separation of immiscible liquids, continuous centrifuges, super centrifuges, design of basket centrifuges, cyclones and hydro cyclones. Gas cleaning - Gravity and momentum separators, cyclone separators, design of cyclones, liquid washing, electrostatic precipitators.

UNIT-IV:
Solid - Liquid separation-Filtration, flow through filter cake and filter media, compressible and incompressible filter cakes, filtration equipments - selection, operation and design of filters and optimum cycle of operation, filter aids. Thickening - Batch and continuous thickeners, design of continuous thickeners.

UNIT-V:
Froth flotation - Principles and theories of collection, flotation cell and typical circuit.
Magnetic separation, Electrical separation. Sorting (separation of solids) - principles of jiggers, types of jiggers, performance characteristics, principles of flowing film concentrators, tabling, heavy liquid and heavy media separation. Mixing and agitation - Mixing of liquids (with or with out solids) which are viscous but are pourable after mixing, mixing of liquids (with solids) which form stiff pastes, mixing of powders, selection of suitable mixers, power requirement for mixing.

Text Books:

1.. Badger and Banchero, "Introduction to Chemical Engineering", Tata Mc.Graw Hill, 2006.
2. W.L.Mc.Cabe, J.C.Smith and P.Harriot, "Unit operations of chemical engineers", McGraw Hill International edition, V edition, 1995.

Reference Books:

1. Coulson J.M and Richerdson J.F, "Chemical Engineering - Volume 2", Elsevier Press, V
Edition, 2006.
2. Foust Wenzel, "Principle of Unit Operations", John Wiley and sons, II Edition, 1980.

CH P41 ORGANIC CHEMISTRY LABORATORY

(Offered by Department of Chemistry)

1. Organic preparations:

   Preparations of compounds involving the following reactions

   (a) Oxidation (b) Reduction (c) Bromination

   (d) Nitration (e) Acetylation (f) Hydrolysis

2. Organic qualitative analysis:

The following classes of compounds are to be analysed

(a) Aldehydes (b) Ketones (c) Acids

(d) Amides (e) Esters (f) Amines

(g) Ethers (h) Alcohols (i) Hydrocarbons

(j) Sugar (k) Phenols

3. Determination of physical constants:

   Boiling point and melting point determination.

CH P42 MOMENTUM TRANSFER LAB

List of Experiments :

1. Laminar flow of Newtonian and non Newtonian fluids
2. Flow through pipes and fittings
3. Flow through annulus
4. Orifice meter
5. Venturi meter
6. Rotameter
7. Weirs and notches
8. Packed bed
9. Fluidized bed
10. Centrifugal pump characteristics

CH P43 CHEMICAL ENGINEERING DRAWING

Assembly drawing of the following :

1. Globe valve
2. Ball Valve
3. Spring Loaded Safety valve
4. Gate valve
5. Non-return valve
6. Centrifugal Pump
7. Gear Pump
8. Stuffing Box
9. Rivetted joints and Flanges
10. P & ID symbols – Line numbering – line scheduling – Typical P & ID diagrams

SP P44 PHYSICAL EDUCATION

Physical education is compulsory for all the undergraduate students:

1. The above activities will include games and sports / extension lectures.
2. Two hours / week will be allocated for physical education in the 3rd and 4th semesters. The student participation shall be for a minimum period of 45 hours in both the semesters put together.
3. The above activities will be monitored by the Director of Physical Education.
4. Pass / Fail will be determined on the basis of Participation, Attendance, Performance and

Behaviour. If a candidate Fails, he /she has to Repeat the course in Subsequent years.

5. Pass in this course is mandatory for the award of degree.

CH T51 PROCESS INSTRUMENTATION

(Offered by Department of Electronics and Instrumentation)

UNIT-I:

Generalized scheme of measurement systems – Basic method of measurements – Errors in measurements – Types of Errors. Transducers – definition – classification – Static characterisitics of instruments – Dynamic characteristic. Transmitter – definition – different types.

UNIT-II:

Temperature measurements: Introduction – Temperature scale – Conventional methods of temperature sensing. Resistance Thermometer Detector (RTD) – Unbalanced Wheatstone Bridge – Direct conversion. Thermistors – Temperature sensing using thermistor – Semiconductor temperature sensor. Thermocouple – Basics of thermocouple – Thermocouple types – Cold junction compensation. Infrared thermometry – Basics of radiation – Emissivity – Methods of sensing – Direct detection – Indirect detection.

UNIT-III:

Pressure measurements: Introduction – Units of pressure – Types of pressure measurement – Bourdon tube and bellows – SG based pressure sensors – Capacitance type pressure transducers. Low pressure measurements – pirani gauge – Thermocouple gauge – Ionization gauge.

UNIT-IV:

Basics of fluid flow – Flow meters – Quantum flow measurements, Differential pressure measurement – Principle of the differential pressure flowmeter, Orifice plate, Venturimeter, Flow nozzle, Dall tube, Pitot tube. Variable area flow meter, Magnet Flowmeters – DC Magnetic Flowmeter, Pulsed Magnetic Flowmeter, Permanent Magnet Type Magnetic Flowmeter, AC Magnetic Flowmeter. Positive displacement Flowmeters – Different type of ultrasonic Flowmeter.

UNIT-V:

Level Measurements – Level transducer with differential pressure sensing – Capacitance based level sensors – Capacitance sensors for conducting liquids – Capacitance sensors for Non – conducting liquids, other liquid sensors – Displacement type level sensor – Ultrasonic type level sensor – Gamma ray level sensor. pH measurements – Basic ideas of pH value – Measurement of electrode potentials – Glass electrode – Reference electrode – Calomel eletrode – Silver-Silver chloride electrode, Humidity Sensing – Basic ideas of humidity sensing – Humidity measurement by dew point sensing – Humidity measurement using Lithium Chloride.

Text Books:

1. Tattamangalam R. Padmanaban "Industrial Instrumentation Principles and Design"
Springer, 2000.

Reference Books:

1 .Donald P. Eckman, " Industrial Instrumentation", CBS Publishers, New Delhi, 2002.
2 .R.K.Jain, "Mechanical and Industrial Measurements" , Khanna Publishers, New Delhi,
1999.
3. D.Patranabis, "Principles of Industrial Instrumentation", Tata McGraw Hill Publishing
Ltd, New Delhi,1999.
4. C.D. Johnsons, " Process Control Instrumentation Technology", Prentice Hall Inc, 1998.
5. A.K.Sawhney, " A Course In Electrical And Electronics Measurement And
Instrumentation", Dhanpat Rai And Sons, New Delhi, 1999.

CH T52 MASS TRANSFER II

UNIT-I:

Vapour liquid equilibria - Raoult's law, relative volatility, vapour liquid equilibrium diagrams for ideal and non-ideal systems, enthalpy concentration diagrams.

Principle of distillation - flash distillation, differential or simple distillation, steam distillation, multistage continuous rectification, calculation of number of ideal stages by Ponchan - Savarit method, Total reflux, minimum reflux ratio, optimum reflux ratio.

UNIT-II:

Number of ideal stages by Mc.Cabe - Thiele method, effect of operating conditions on the number of ideal stages, Murphree stage and overall efficiency, calculation of actual number of stages, batch distillation with reflux, packed bed distillation, NTU and HTU calculations.

UNIT-III:

Introduction to Multicomponent distillation - bubble point and dew point calculations, flash distillation, continuous rectification, key components, minimum number of plates, minimum reflux ratio, Azeotropic and Extractive distillation.

UNIT-IV:

Liquid - liquid extraction - ternary liquid liquid equilibrium, solvent characteristics, equipments for liquid liquid extraction, stage wise contact - cross current and counter current extraction, continuous contact extraction, packed bed extraction with reflux .

UNIT-V:

Leaching - Leaching by percolation through stationary solid beds, moving bed leaching, counter current multiple contact (shank's system), equipments for leaching operation, multi stage continuous cross current and counter current leaching, stage calculations, stage efficiency.

Text Books:

1. R.E. Treybol, "Mass Transfer Operations", McGraw Hill, II Edition, 1981.
2. C.J.Geankoplis, "Transport Processes and Unit Operations", Prentice Hall, III Edition, 1993.

Reference Books :

.

1.. Badger and Banchero, "Introduction to Chemical Engineering", Tata Mc.Graw Hill, 2006.

2. W.L.Mc.Cabe, J.C.Smith and P.Harriot, "Unit operations of chemical engineers", McGraw Hill International edition, V edition, 1995.

3.. Coulson J.M and Richerdson J.F, "Chemical Engineering - Volume 2", Elsevier Press, V Edition, 2006.

CH T53 CHEMICAL REACTION ENGINEERING I

UNIT-I:

Chemical equilibria - Free energy and chemical reactions, feasibility of chemical reaction, calculation of free energy of homogeneous reactions, equilibrium constants and evaluation from thermodynamic data, effect of different variables on reaction equilibria, calculation of equilibrium composition for single and multiple reactions, equilibria of heterogeneous reactions.

UNIT-II:

Kinetics of homogeneous reactions - introduction, single and multiple reactions, elementary and nonelementary reactions, rate equations, kinetic models for nonelementary reactions, testing kinetic models, temperature dependence of rate - Arrhenius, collision and activated complex theories, Interpretation of batch reactor data for single and complex reactions under constant volume and variable volume conditions, differential and integral analysis, half life period.

UNIT-III:

Design of single homogeneous reactors - ideal reactors, design equations for ideal batch reactor, PFR and CSTR, size comparison of single reactors, optimum reactor size problems.

UNIT-IV:

Multiple reactor systems - plug flow reactors in series and / or parallel, CSTRs in series, reactors of different types in series, recycle reactor, auto catalytic reactions, optimum recycle ratio for an auto catalytic reaction.

UNIT-V :
Multiple reaction systems - series and parallel reactions in CSTRs and PFRs, product distribution, fractional yields, maximization of fractional yield in multiple reactions, series - parallel reactions

Text Books:

1. Octave Levenspiel, "Chemical Reaction Engineering", Wiley Eastern Publications Ltd., 3rd Edition, 2007.
2. J.M.Smith, "Chemical Engineering Kinetics", McGraw Hill, III Edition, 1981.

Reference Books:

1. H.S.Fogler, "Elements of Chemical Reaction Engineering", Prentice Hall of India Ltd., III Edition, 2001.
2. G.F.Froment and K.B.Bischoff, "Chemical Reactor Analysis and Design", John Wiley and Sons, 1979.

CH T54 ENERGY TECHNOLOGY AND MANAGEMENT

UNIT-I:
Fuels - Classification, Properties, tests and analysis.
Solid Fuels - Coal, origin, classification, storage and handling, carbonization, gasification and briquetting - gasification of biomass.

UNIT-II:
Liquid fuels - Petroleum based fuels, synthetic fuels, alcohol and blended fuels, storage and handling.
Gaseous fuels - Water gas, carbureted water gas, producer gas, coal gas and natural gas.

UNIT-III:
Combustion - Air requirement for solid, liquid and gaseous fuels, Combustion equipment
Solar energy, Wind energy, Tidal energy

UNIT-IV:
Geothermal energy, Magneto hydrodynamics, Nuclear energy.
Energy Management-Principles need, initiating and managing an energy management program.

UNIT-V:
Energy audit – elements, and concepts, types of energy audits, energy audit with respect to industries like sugar, paper etc.,
Energy Conservation-Thermodynamics of energy conservation, cogeneration, waste heat recovery technologies. Industrial insulation - material selection, economical thickness

Text Books:
1. S.Sarcar, "Fuels and combustion", Orient Longman, 1990.
2. G.D.Rai, "Non conventional energy sources", Khanna Publishers, IV edition, New Delhi, 2004.

Reference Books:

1. S.P.Sharma and ChanderMohan, "Fuels and Combustion", Tata McGraw Hill, 2004.
2. J.K.Harker and J.R.Backhurst, "Fuel and energy", Academic Press, 1981.
3. D.A.Raey, "Industrial Energy Conservation", Pergomon Press, 1980.
4. J.D.Gilchrist, "Fuels, Furnaces and Refractories", Pergamon Press, 1977.

CH T55 CHEMICAL PROCESS INDUSTRIES

UNIT-I:

Water Conditioning methods, Demineralisation, Precipitation Process.
Industrial Gases: Carbondioxide, Nitrogen, Hydrogen, Oxygen and Acetylene

UNIT-II:

ALKALIES:
Chlor-alkali Industries: Manufacture of Soda ash, Manufacture of Caustic Soda and chlorine-common salt.

ACIDS:
Sulphur and Sulphuric acid: Mining of Sulphur and manufacture of Sulphuric acid. Manufacture of hydrochloric acid and Nitric Acid

UNIT-III:

CEMENT, GLASS AND PAPER
Cement: Types and Manufacture of Portland cement, Glass: Manufacture of Glasses and

Special Glasses, Ceramics: Refractories, Production of pulp, paper and Rayon

UNIT-IV:

SUGARS AND PAINTS:
Manufacture of sugar, starch and starch derivatives-Manufacture of paints – Pigments.
Vegetable oil, Cottonseed Oil and Soybean Oil by Solvent Extraction.

UNIT-V:

FERTILISERS:
Nitrogen Fertilisers: Synthetic Ammonia, Urea, Ammonium chloride,
CAN, Ammonium Phosphate- Phosphorus fertilizers: Phosphate rock,
Phosphoric, Acid, Super Phosphate and Triple Super phosphate –MAP, DAP.

Text Books:

1. N.Shreve, "Chemical Process Industries ", 5th Edition, McGraw Hill, New York, 1984.
2. R.Gopal and M.Sittig, "Dryden's outlines of Chemical Technology", 2nd Edition, 1965.

Reference Books:

1. S.D.Shukla and G.N.Pandey, " Textbook of Chemical Technology ", Volume I, 1977.

CH T56 CHEMICAL ENGINEERING PRACTICE

UNIT-I:
Role of a process Engineer, Process documentation, flow sheets – types, preparation, flow sheet presentation, symbols, line and equipment symbols, Piping and Equipment identification, Standards and codes, time planning and Scheduling.

UNIT-II:
Materials selection: mechanical properties, materials- metals, polymeric materials, ceramic materials, graphite, glasses, Corrosion, Factors affecting corrosion, Causes and cures, types, material selection for corrosion resistances, novel engineering materials.

UNIT-III:
Pumps classification and types, Pump performance characteristics and selection of pumps, packing and mechanical seals, pumping systems design, pump priming. Fans, blowers, compressor, ejectors and mechanical vaccum systems

UNIT-IV:
Piping calculations, available piping, tubing and other flow conduits, economical sizing of pipe, Valves: types, sizing and selection.
Thermal insulation, usages for thermal insulation, types of insulation, recommended thickness of insulation, Tracing- steam tracing, electric tracing, jacketing,.

UNIT-V:
Utilities of a chemical plant, Boilers, Cooling tower, DM water plants, Industrial water Treatment, Turbines, Chillers, Process Safety and Pressure relieving devices, Storage tanks.

Text Books:
1. Henry J. Sandler, Edward T. Luckiewicz, "Practical process engineering – A working approach to plant design", McGraw Hill Book Company,1987

Reference Books:
1. Ernest E. Ludwig, "Applied Process Design, Vol I, II & III", 3rd Edition, Gulf Professional Publishing, 1999.

CH P51 MASS TRANSFER LABORATORY -I

List of Experiments:

1. Stefan's tube experiment-diffusivity of vapour in air
2. Liquid liquid diffusion-diffusivity of salt in water
3. Surface Evaporation
4. Sublimation of naphthalene ball
5. Packed bed absorber
6. Hydrodyanmic /flooding characterization of packed tower
7. Hydrodynamic /flooding characterization of tray tower
8. Adsorption isotherm
9. Multistage adsorption
10. Vapour liquid equilibrium

CH P52 HEAT TRANSFER LABORATORY

List of Experiments :

1. Heat Transfer through Composite Wall
2. Transient Heat Conduction
3. Heat Transfer in a Shell and Tube Heat Exchanger
4. Heat Transfer through Packed Bed
5. Heat Transfer in a Double Pipe Heat Exchanger
6. Heat Transfer in a Vertical Condenser
7. Heat Transfer in a Horizontal Condenser
8. Heat Transfer in Helical Coils
9. Heat Transfer with Natural Convection
10. Heat Transfer by Radiation

CH P53 MECHANICAL OPERATIONS LABORATORY

List of Experiments :

1. Screen effectiveness
2. Jaw crusher
3. Ball mill
4. Drop weight crusher
5. Beaker decantation
6. Air elutriation
7. Vacuum leaf filter
8. Plate and frame filter press
9. Batch sedimentation
10. Terminal settling velocity-Stokes law

HS P54 GENERAL PROFICIENCY I

UNIT – I:
ART OF COMMUNICATION
Verbal and non-verbal commuynication – Barriers to communication – Importance of Body language – Effective listening – Feedback

UNIT – II:
INTRODUCTION TO SOFT SKILLS
Attitide - self confidence – Leadership qualities – Emotional Quotient – Effective time management skills – surviving stress – Overcoming failure – professional ethics – interpersonal skills

UNIT –III:
WRITING
Importance of writing – Written Vs spoken language – Formal and Informal styles of writing – Resources for improving writing – Grammar and usage – Vocabulary building – SWOT analysis

UNIT – IV:
SPEAKING PRACTICE
Dialogue – Telephone Etiquette – Public Speaking – Debate – Informal Discussions – Presentations

UNIT – V:
APTITUDE
Verbal and numerical aptitude.

Reference Books:

1. Nicholls, Anne, "Mastering public speaking",. Jaico publishing House, 2003.
2. Aggarwal, R.S,. "Quantitative aptitude".
3. Leigh, Andrew and Michael Maynard, "The Perfect Leader", Random House Business Books, 1999.
4. Whetton.A.David and Kim S.Cameron, "Developing Management Skills", .Pearson Education, 2007.
5. K.R.Lakshminarayanan., "Developing Soft Skills", Scitech, 2009.
6. Sherfield M Robert, "Developing Soft Skills", Pearson Education, 2005.
7. Hair O' Dan, Friedrich W. Gustav and Lynda Dee Dixon, " Strategic Communication in Business and the Professions", Pearson Education, 2008.
8. Chaney Lilian and Jeanette Martin, "Intercultural Business Communication", Fourth Edition, Pearson Education, 2008.

MA T61 NUMERICAL METHODS AND SPECIAL FUNCTIONS

UNIT I:

Gamma And Beta Functions: Bessel functions and legendre polynomials –Series solutions – Generating functions – Recurrence relations and orthogonal property.

UNIT II:

Solution of algebraic and transcendental equations simultaneous linear algebraic equations and matrix inversion:
Method of bisection, method of false position and Newton-Raphson method for single nonlinear equation, Gauss Elimination and Gauss-Jordan elimination methods-Crout's reduction method. Gauss-Seidel interative method. Matrix inversion by Gauss elimination and Crout's methods.

UNIT III:

Eigen Value Problem, Interpolation And Numerical Differentiation: Finding Eigen value and Eigen vector by power method. Finite differences Polynomial interpolation: Newton's forward and backward difference formulae for equal intervals. Lagrange's and Newton's divided difference method for unequal intervals. Numerical differentiation: Formulae to find first and second order derivatives.

UNIT IV:

Numerical Intergration And Solution Of Ordinary Differential Equations: Integration by Trapezoidal and Simpson's rule with respect to one variable. Solution of ordinary differential equations by Taylar series method, Euler and Improved Euler methods only and Runge-Kutta method of fourth order. Multistep methods: Milne and Adams-Bashforth method.

UNIT V:

Solution Of Partial Differential Equations: Solution of Laplace and Poission equations: Leibmann's interative method. Diffusion equation: Bender-Schmitt metho and Crank-Nicholson implicit difference method. Wave equation: Explicit difference method.

Text Books:

1. M.K. Venkataraman, "Higher Engineering Mathematics for Science and Engineering", National Publishing Co., Madras, 2007.

Reference Books:

1. N.P.Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications, 2008.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley Sons, Newyork, 2005.
3. B.S.Grewal, "Higher Engineering Mathematics", Khanna Publishers, Delhi, 2008.

CH T62 MASS TRANSFER III

UNIT-I:

Adsorption – Types of adsorption, nature of adsorbents, adsorption equilibria, effect of pressure and temperature on adsorption isotherms, Freundlich equation.

Adsorption operation – stage wise operations, steady state moving bed adsorbers, unsteady state fixed bed adsorbers, break through curves, rate of adsorption in fixed beds, design of fixed bed adsorbers, fundamentals of chromatographic separations. Ion exchange – Principle of Ion exchange, techniques and applications.

UNIT-II:

Humidification operations - humidity chart, adiabatic saturation curves, wet bulb temperature and measurement of humidity, Lewis relation, equipments for humidification operations, water cooling towers and spray chambers.

Theory and calculation of humidification processes - gas liquid interaction, conditions in the top and bottom of cooling towers, design of cooling towers and dehumidifiers.

UNIT –II:

Drying - equipments for batch and continuous drying of solids, principles and theories of drying - drying rate curve, critical and equilibrium moisture content, calculation of drying time under constant drying conditions.

Mechanism of batch drying - cross-circulation drying, through circulation drying.

Continuous drying - material and energy balances in continuous dryers, rotary dryer - design of rotary dryer.

UNIT-IV:

Crystallization - principles of crystallization, types of crystals, nucleation theories, crystal growth and □□L law, particle size distribution of crystals, Yields, heat and material balances in crystallization, equipments for crystallization.

UNIT-V:

Membrane separation processes - classification of membrane separation processes, separation of gasses by membrane processes, flow patterns in membrane separators - cross flow and counter current flow models for gas separation by membranes, effect of processing variables on gas separation by membranes, separation of multi-component gas mixtures by membranes.

Separation of liquids by membrane processes - dialysis, pervaporation, reverse osmosis, ultrafiltration.

Text Books:

1. R.E. Treybol, "Mass Transfer Operations", McGraw Hill, II Edition, 1981.
2. C.J.Geankoplis, "Transport Processes and Unit Operations", Prentice Hall, III Edition, 1993.

Reference Books :

.

1. Badger and Banchero, "Introduction to Chemical Engineering", Tata Mc.Graw Hill, 2006.
2. W.L.Mc.Cabe, J.C.Smith and P.Harriot, "Unit operations of chemical engineers", McGraw Hill International edition, V edition, 1995.
3. Coulson J.M and Richerdson J.F, "Chemical Engineering - Volume 2", Elsevier Press, V Edition, 2006.
4. P.C. Wankat, " Rate Controlled Seperation", Springer Publications, 2005.

CH T63 CHEMICAL REACTION ENGINEERING - II

UNIT-I:

Non-isothermal reactions - temperature effects on chemical reaction rates, design procedures for adiabatic and non-isothermal operation of batch and flow reactors, optimum temperature progression, operating temperature for favorable product distribution in multiple reactions, reactor stability.

UNIT-II:

Non-ideal reactors - Reasons for non-ideal flow behaviours, concept of mixing - micro and macro mixing, residence time distribution (RTD) functions, C, E and F curves, calculation of mean residence time from E and F curves, Tanks in series models, Axial dispersion model, segregated flow model, conversion in non-ideal reactors, introduction to multi-parameter models.

UNIT-III:

Fluid-solid noncatalytic reactions - shrinking core model, determination of the rate controlling step, conversion in reactors with constant fluid composition, conversion in reactors with variable fluid composition - fixed bed reactor, moving bed reactor.
Gas-liquid non-catalytic reactions - models for transfer at gas-liquid interface, enhancement factor, Hatta number, Derivation of overall rate equation for first order irreversible reaction and instantaneous reaction, design of packed bed reactors for gas-liquid non-catalytic reactions (simple cases).

UNIT-IV:

Solid catalysts - characteristics, classification of catalysts, selection and preparation of industrial catalysts, promoters and inhibitors, catalyst deactivation.
Kinetics of solid catalysed reactions - Langmuir-Hinshelwood-Hougen-Watson mechanism, interpretation of kinetic data, redox rate equation, kinetics of catalyst deactivation.

UNIT-V:

Reaction and diffusion in porous catalysts - effectiveness factor, Thiele modulus, non-isothermal effectiveness factor, Global rate equations.
Heterogeneous catalytic reactors - Fixed bed reactors, fluidized bed reactors, slurry reactors, Trickle bed reactors, design aspects with some simple examples.

Text Books :

1. Octave Levenspiel, "Chemical Reaction Engineering", Wiley Publications Ltd., 3rd Edition, 2007.
2. J.M.Smith, "Chemical Engineering Kinetics", McGraw Hill, III Edition, 1981.

Reference Books:

1. H.S.Fogler, "Elements of Chemical Reaction Engineering", Prentice Hall of India Ltd., III Edition, 2001.
2. G.F.Froment and K.B.Bischoff, "Chemical Reactor Analysis and Design", John Wiley and Sons, 1979.

CH T64 PROCESS DESIGN OF CHEMICAL EQUIPMENTS

In the university examination, the students are required to answer one out of two questions from each one of the two units. Use of 'Chemical Engineering Handbook', R.H. Perry and Don Green, Mc.Graw Hill is permitted in the examination.

UNIT-I:

Detailed process design of the following heat transfer equipments :
Heat exchangers - Double pipe heat exchangers, Shell and Tube heat exchangers.
Condensers - Horizontal condenser, Vertical condenser.
Evaporators - Multiple effect evaporators with forward feed and backward feed arrangements (calculations involving boiling point rise) .

UNIT-II:

Detailed Process design of the following mass transfer equipments :
Absorption towers - plate tower and packed tower absorption columns.
Distillation towers - plate tower and packed tower distillation columns.
Humidification towers - Humidifiers, Dehumidifiers, cooling towers.
Drying – Rotary dryers.

Text Books :

1. J.M.Coulson and J.F.Richardson, "Chemical Engineering - Volume VI", Elsevier Press, VI Edition, 2006..

Reference Books :

1. R.E. Treybol, "Mass Transfer Operations", McGraw Hill, II Edition, 1981.
2. Kern D.Q, "Process Heat Transfer", Mc.Graw Hill, 1950
3. R.H.Perry and Don Green, "Chemical Engineer's Handbook", Mc.Graw Hill, VI Edition, 1984.

CH P61 MASS TRANSFER LABORATORY -II

List of Experiments :

1. Simple distillation
2. Steam distillation
3. Packed bed distillation
4 Ternary liquid euilibria
5. Liquid- Liquid equilibrium-immiscible phases
6. Liquid- Liquid extraction
7. Cross current leaching
8. Counter current leaching
9. Tray dryer
10. Cooling tower

CH P62 CHEMICAL REACTION ENGINEERING LABORATORY

List of Experiments :

1. Isothermal Batch reactor – Determination of order and reaction rate constant
2. Semibatch reactor- Determination of conversion and reaction rate constant
3. Determination of activation energy
4. CSTR- Determination of conversion and reaction rate constant
5. PFR- Determination of conversion and reaction rate constant
6. PFR and CSTR in series- Comparision of conversion
7. Three CSTRs in series- Comparision of conversion
8. Residence Time Distribution in CSTR
9. Residence Time Distribution in packed bed reactor
10. Heterogeneous catalytic reaction

CH P63 TECHNICAL ANALYSIS LABORATORY

List of Experiments

1. Analysis of Oils and Fats
2. Analysis of Metals
3. Silica content in cement
4. Analysis of Fertiliser
5. Pigment analysis
6. Flame Photometer
7. Characterization of liquid fuel Diesel and Kerosene
   (Smoke point, Flash point, Cloud point, Aniline point, Pour point, Viscosity)
8. Viscometer
9. Colorimeter
10. Proximate analysis of solid fuels

HS P64 GENERAL PROFICIENCY II

UNIT-I:
Composition Analysis :
Technical and Non-technical Passages (GRE Based); Differences in American and British English; Analyzing Contemporary Issues; Expanding Terminology

UNIT-II:
Writing
Job Application Letter Writing – Resume Writing

UNIT-III:
Oral Skills
Group Discussion – Introduction and Practice – Team Work – Negotiation Skills – Organizing and Attending Meetings – Facing Interviews.

UNIT-IV:
Adapting to Corporate Life
Corporate Etiquette – Grooming and Dressing.

UNIT-V:
Aptitude
Verbal and Numerical aptitude.
Reference Books:

1. Pushplata and Sanjay Kumar, "Communicate or Collapse : A Handbook of Effective Public Speaking, Group Discussions and Interviews", Prentice Hall, Delhi, 2007.
2. Thorpe, Edgar, "Course in Mental Abilty and Quantitative Aptitude", Tata McGraw Hill, 2003.
3. Prasad, H.M, "How to prepare for Group Discussion and Interview", Tata McGraw Hill, 2001.
4. Thorpe, Edgar, " Test of Reasoning", Tata McGraw Hill, 2003.
5. Career Press Editors, "101 Great Resumes", Jaico Publishing House, 2003.
6. Aggarwal, R.S, "A Modern Approach to Verbal and Non-Verbal Reasoning", S. Chand and Co., 2004.
7. Mishra Sunita and Muralikrishna, "Communication Skills for Engineers", First Edition. Pearson Education , 2004.

CH T71 PROCESS DYNAMICS AND CONTROL

UNIT- I :

Introduction - Control system, components of a feed back control system, Lags in the control system – transfer lag, transportation lag, Pneumatic PID controller , control valve – valve characteristics

Laplace transforms - properties of laplace transform, solution of linear differential equations using laplace transform techniques, piecewise continuous functions

UNIT- II :

Dynamic behaviour of systems - derivation of transfer functions for first and second order systems, liquid level, temperature, pressure, flow and concentration control processes, linearisation of nonlinear systems, interacting and non-interacting systems.

Transient response of first and second order systems, natural frequency, damping factor, overshoot, decay ratio, rise time and settling time.

UNIT- III:

Transient analysis of control systems - block diagram algebra, overall transfer function of closed loop control systems, regulator and servo problems, transient response of first and second order systems with P, PI and PID controller.

Definition of stability of control systems, Routh test , limitations of Routh test, Pade's approximation of time delay systems.

UNIT- IV:

Root-locus technique - rules for plotting the root locus diagram, application of root locus to control systems.

Introduction to frequency response - Bode diagrams, Bode diagrams for first and second order systems, P, PI, PID controllers, transportation lag. Bode stability criteria, phase margin and gain margin, Nichols chart, Ziegler - Nichols Optimum controller settings.

UNIT- V:

Nyquist stability criteria, calculation of phase margin, gain margin, peak gain and resonant frequency using nyquist plot.

Introduction to advanced control techniques - feed forward control, cascade control, ratio control, adaptive control, inferential control, selective control .

Text Books:

1. D.R. Coughanour, "Process Systems analysis and Control", Mc.Graw Hill, II Edition, 1991.
2. Stephanopoulous, "Chemical Process Control – Theory and Practice", Prentice Hall of India Ltd., 1984.

Reference Books:

1. C.A.Smith and A.B.Corripio, "Principle and Practice of Automatic Process Control", John
   Wiley and Sons, 1985.
2. W.L.Luyben, "Process Modelling Simulation and Control for Chemical Engineers",
   Mc.Graw Hill, II Edition, 1990.
3. D.W.Seborg, T.F.Edger, and D.A.Millichamp, "Process Dynamics and Control", John
   Wiley and Sons,II Edition, 2004.
4. Peter Harriott, "Process Control", Tata McGraw Hill Publishing Co., 1964.

CH T72 MECHANICAL DESIGN OF CHEMICAL EQUIPMENTS

In the university examination students are required to answer one out of two questions. Use of the following books is permitted in the examination .

1. Unified Pressure Vessel Code IS-2825, IS 803.
2. IS specification for shell and tube heat exchanger - IS 4503.
3. 'Chemical Engineer's Handbook', R.H.Perry and Don Green, Mc.Graw Hill.

Mechanical design of cylindrical vessels and closures for internal and external pressure, design of tall vertical vessels, design of horizontal vessels.
Mechanical design and drawing of the following chemical equipments :

1. Shell and Tube heat exchangers
2. Evaporators and crystallizers
3. Distillation and absorption columns
4. Reactors
5. Storage tanks - horizontal, vertical and spherical

Text Books :

1. I.E. Brownwell and E.H. Young, "Process Equipment Design", John Wiley and Sons, 1958.
2. M.V.Joshi, "Process Equipment Design", Mc.Millan Company, 1976.

Reference Books:

1. B.C.Bhattacharyya, "Introduction to Chemical Engineering Design - Mechanical Design", CBS Publishers, 1985.
2. Kern D.Q, "Process Heat Transfer", Mc.Graw Hill, 1950.
3. R.H.Perry and Don Green, "Chemical Engineer's Handbook", Mc.Graw Hill, VI Edition,

CH T73 INDUSTRIAL MANAGEMENT

(Offered by Department of Mechanical Engineering)

UNIT-I:

Plant location layout and Material Handling;

Plant Location: Influencing factors – evaluation of location alternatives (Simple problems) – Plant layout: Classification of production systems – principles of layout – basic types of layout -line balancing – Material Handling: functions – principles – Classification of material handling equipments (only classification and no description) – factors to be considered in selection of material handling equipments.

UNIT-II:

Production, Planning and Control:

Production, Planning and control: functions – qualitative and quantitative techniques of forecasting – simple problems in forecasting using moving average, weighted moving average, simple exponential smoothing and regressing methods – routing – loading and scheduling – different methods of scheduling – product sequencing – expediting – dispatching.

UNIT-III:

Material and Human Resource Management:

Functions and objectives of materials management – Introduction to inventory control – types -ABC analysis – JIT concepts, Human Resource Management – individual and group behavior – motivation and morale - fatigue – accidents: causes and remedies - manpower planning – Job evaluation and merit rating.

UNIT-IV:

Total quality Management (TQM) :

Introduction to TQM – Strategies – Concepts and objectives – Total quality model – TQM as applied to Indian Industries – Quality circle: concepts, objectives and functions - Training of quality circle members – implementation.

UNIT-V:

Statistical Process Control – Types of control charts – Simple problems – Quality Design for reliability – Maintainability concepts – Quality Function Development (QFD) - Principles, concepts and case studies – Introduction to 6-Sigma Concept.

Text Books:

1. R.Panner Selvam, " Production/Operations Management", Prentice Hall of India, 1992.
2. R.B.Kanna, "Production and Operations Management", Prentice Hall of India, 2007.

Reference Books:

1. Martand Telsang, " Industrial Engineering and Production Management", S.Chand & Co., 1998.
2. John Bank, " The Essence of Total Quality Management", Prentice Hall of India, 1998.
3. Joseph Monks, "Operations Management", McGraw Hill, New York, 1986.
4. James.I. Bossert, "Quality Function Development", ASQC Quality Press, Wisconsin, 994.

CH P71 COMPUTER AIDED PROCESS DESIGN LABORATORY

Detailed Process Design (Computer Aided Approach) of the following equipments:

1. Double Pipe Heat Exchanger
2. Shell and Tube Heat Exchanger
3. Horizontal Condenser
4. Vertical Condenser
5. Multiple Effect Evaporator with forward feed and Bacward feed
6. Plate type absorption Tower
7. Packed type absorption Tower
8. Plate type Distillation column
9. Packed type Distillation column
10. Cooling Tower

CH PW7 PROJECT WORK (PHASE I)

The objective of the project is to enable the students to work in groups of not more than four members in each group on a project involving analytical, experimental , design or combination of these in the area of Electronics and Instrumentation Engineering. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. The evaluation is based on continuous internal assessment by an internal assessment committee for 100 marks.

CH P72 SEMINAR

Each one of the students will be assigned a Seminar Topic in the current and frontier areas. The student has to conduct a detailed study/survey on the assigned topic and prepare a report. The student will make an oral presentation followed by a brief question and answer session. The Seminar (presentation and report) will be evaluated by an internal assessment committee for a total of 100 marks.

CH P73 INDUSTRIAL VISITS / TRAINING

During the course of study from 3rd to 7th semester each student is expected to undertake a minimum of four industrial visits or undertake a minimum of two weeks of industry/field training. The students are expected to submit a report, which shall be evaluated by an internal assessment committee at the end of seventh semester for 100 marks.

CH T81 TRANSPORT PHENOMENA

(*In the university examination, the students are required to answer two out of three questions from each one of the units I and II, one out of two questions from unit III. Table containing the Transport Phenomena equations is permitted in the examination.)*

UNIT- I:
Transport in laminar flow or in solids in one dimension - Shell balances for momentum, energy and mass transfer, unidimensional velocity, temperature and concentration profiles.

UNIT- II:
Transport in an arbitrary continuum - equations of change for momentum, energy and mass transfer in Cartesian, cylindrical and spherical coordinates, simple solutions in one dimension.

UNIT- III:
Transport in laminar flow or in solids with two independent variables - unsteady state viscous flow, heat conduction and diffusion, two dimensional viscous flow, heat conduction and diffusion, simple solutions.

Text Books:

1. R.B.Bird, W.E.Stewart and E.N.Lightfoot, "Transport Phenomena", John Wiley and Sons,
   II edition,2001.

Reference Books:

1. Willim Thomas, "Introduction to Transport phenomena", Perason Education ,2000.
2. R.S.Brodkey and H.C. Herskey, "Transport Phenomena", Mc.Graw Hill, 1988.
3. J.R.Welty, C.E.Wicks and R.E.Wilson, "Fundamentals of Momentum, Heat and Mass
   transfer", John Wiley and Sons, IV Edition, 2007.
4. C.J. Geankoplis, "Transport Processes and Unit Operations", Prentice Hall, III Edition,
   1993.

CH T82 PROCESS ENGINEERING ECONOMICS

UNIT- I:
Time value of money - simple and compound interest - discrete, nominal and continuous rate of return and their relationships, issue and evaluation of bonds, concept of equivalence.

UNIT- II:
Depreciation and Amortization - classification of depreciation and methods of uniform, rapid and slow write off techniques and their comparison, depreciation accounting procedures, taxes and insurance, implication of taxes in selecting alternates.

UNIT- III:
Economics of selection of alternates - criteria, annual cost, present worth, rate of return, capitalized cost methods, extra investment analysis, mutually exclusive basis, replacement economy.

UNIT- IV:
Cost estimation - equipment costs, cost indices, William's point sixth rule, methods of estimation of fixed capital, product cost estimation.
Bookkeeping - ledgers and journals, financial statements, balance sheet, principles and application of project execution techniques, PERT and CPM, preparation of project feasibility reports, selection of plant location and layout.

UNIT- V:
Optimization - procedure involving single and two variables, optimum number of units required for maximum profit and minimum cost, determination of optimum parameters in selected unit operations - fluid flow (optimum pipe diameter), heat transfer (optimum thickness of insulation), evaporation, filtration, break-even analysis.

Text Books:

1. Peters and Timmerhaus, "Plant Design and Economics for Chemical Engineers", McGraw Hill, 2003.

Reference Books:
1. Jelen and Black, "Cost and Optimization Engineering", McGraw Hill.

CH T83 POLLUTION CONTROL IN PROCESS INDUSTRIES

UNIT- I:
Man and Environment, Types of pollution, Pollution control aspects, Pollution monitoring and analysis of pollutant.
Air pollution: Sources and effects, particulate control, control of gaseous pollutants (SO_x, NO_x, oxides of carbon, hydrocarbon pollutants), Air Quality Management.

UNIT- II :
Water Pollution:
Types of water pollution, sources, water pollution control.
Waste water treatment technologies and Recycle.

UNIT- III:
Solid waste management: Sources, processing methods, waste disposal methods, energy recovery from solid waste.

UNIT- IV:
Noise Pollution: Hazardous noise exposure, noise measuring instruments and noise pollution control technology.
Regulations: ISO 14000, 9000, pollution Acts and Regulations.

UNIT- V:
Case Study:
Pollution (Air, Water & Solid) control in the following process industries - Fertilizers, Petroleum Refinery and Petrochemical, Pulp and Paper, Cane Sugar, Tannery, Distilleries and Pharmaceutical Industry .

Text Books:

1. S.C. Bhatia, "Environmental Pollution and control in chemical process industries", Khanna Publishers, 1st edition, 2001.
2. C.S.Rao, "Environmental Pollution Control Engineering", Wiley Eastern, 1992.

Reference Books:

1. S.P.Mahajan, "Pollution control in Process Industries", Tata McGraw Hill, 1990.
2. F. P. Lees, "Loss prevention in process industries", 2nd edition., Butter worth- Heinemann, 1996.
3. Martin Crawford, "Pollution Control Theory", McGraw Hill, 1976.
4. Marell, "Solid Wastes", John Wiley, 1975.

CH P81 PROCESS DYNAMICS AND CONTROL LAB

List of Experiments :

1. Time constant of a thermometer
2. Transient response of a mercury manometer
3. Transient response of a pressure vessel system
4. Transient response of a mixing vessel
5. Transient response of an interacting liquid level system
6. Transient response of a non-interacting liquid level system
7. Control valve characteristics
8. On –Off Control system behaviour
9. Closed loop behaviour of control system(Level/ Temperature control loop)
10. Simulation of closed loop control systems

CH PW8 PROJECT WORK (PHASE II)

Project work phase II will be an extension of the project work started in the seventh semester. On completion of the work, a project report should be prepared and submitted to the department. The project work and the report will be evaluated by an internal assessment committee for 50 marks. The external university examination, which carries a total of 50 marks, will have report evaluation and viva voce examination conducted by a committee of one external examiner and one internal examiner appointed by the University.

CH P82 COMPREHENSIVE VIVA

The student will be tested for his understanding of the basic principles of the core chemical engineering subjects. The internal assessment for a total of 50 marks will be made by an internal assessment committee. The committee will conduct two written examinations of objective type or short questions type from all the core subjects. The external university examination , which carries a total of 50 marks, will be a viva voce examination conducted by a committee of one external examiner and one internal examiner appointed by the university.

CH P83 PROFESSIONAL ETHICAL PRACTICE

The course should cover the following topics by way of Seminars, Expert Lecturers and Assignments.

1. Engineering Ethics – Moral Issues, Ethical theories and their uses
2. Engineering as Experimentation – Code of Ethics
3. Engineer's Responsibilty for Safety
4. Responsibilities in Rights
5. Global issues of engineering ethics

Reference Books:

1. Charles D.Fleddermann, " Engineering Ethics" , Prentice Hall, New Mexico, 1999.

CH E61 PETROLEUM REFINERY ENGINEERING

UNIT- I:
Introduction – genesis, occurrence, exploration, drilling of crude oil. Composition and Evaluation of crude oil and testing of petroleum products.
Refining of petroleum – Atmospheric and vacuum distillation.

UNIT- II:
Refining of petroleum – Atmospheric and vacuum distillation.
Pretreatment of crude oil and transportation.

UNIT- III:
Cracking processes - Thermal cracking, Vis-breaking, Coking.
Catalytic cracking (FCC), Hydro cracking, Rebuilding processes, bitumen blowing.

UNIT- IV:
Treatment techniques for removal of sulphur compounds to improve performance, Storage and stability.
Product treatment processes - various solvent treatment processes, Dewaxing ,Clay treatment and Hydro fining.

UNIT- V:
Cracking of naphtha and gas for the production of ethylene, propylene isobutylene and butadiene. Production of acetylene from methane
Catalytic Reforming of petroleum feed stocks. Extraction of Aromatics.

Text Books :

1. B.K.Bhaskara Rao, "Modern Petroleum Refining Processes", 2nd Edn., Oxford and IBH
Publishing Company, New Delhi, 1990.

Reference Books:

1 W.L.Nelson, ." Petroleum Refinery Engineering", 4th Edn., McGraw Hill, New York, 1985
2. Robert. A. Meyers, "Handbook of Petroleum Refining Processes", Mc Graw Hill, 1986.
3. G.D.Hobson and W.Phol, "Modern Petroleum Technology", Applied science Publishers,
IV Edition, 1975.

CH E62 BIOCHEMICAL ENGINEERING

UNIT I:

Introduction - principles of microbiology, structure of cells, microbes, bacteria, fungi, algae, chemicals of life - lipids, sugars and polysaccharides, amino acids, proteins, nucleotides, RNA and DNA, hierarchy of cellular organisation, , Principles of genetic Engineering, Recombinant DNA technology, mutation.

UNIT II:

The kinetics of enzyme catalyzed reactions - the enzyme substrate complex and enzyme action, simple enzyme kinetics with one and two substrates, determination of elementary step rate constants. Isolation and utilisation of Enzymes - production of crude enzyme extracts, enzyme purification, applications of hydrolytic enzymes, other enzyme applications, Enzyme production - intercellular and extra cellular enzymes.

UNIT III:

Metabolic pathways and energetics of the cell, concept of energy coupling, ATP and NAD, Photosynthesis, Carbon metabolism, EMP pathway, Tricabocyclic cycle and electron transport chain, aerobic and anaerobic metabolic pathways, transport across cell membranes, Synthesis and regulation of biomolecules.

UNIT IV:

Typical growth characteristics of microbial cells, Factors affecting growth, Batch and Continuous cell growth , nutrient media, enrichment culture, culture production and preservation

Immobilisation Technology – Techniques of immobilisation, Characteristics and applications, Reactors for immobilized enzyme systems

UNIT V:

Introduction to bio reactors, types, Continuously Stirred aerated tank bioreactors, Determination of volumetric mass transfer rate of oxygen from air bubbles and effect of mechanical mixing and aeration on oxygen transfer rate, heat transfer and power consumption, Fermentation-methods and applications, Downstream processiong and product recovery in bio processes

Text Books:

1. M.L.Shuler and F.Kargi, "BioProcess Engineering : Basic concepts", 1st Edition , Prentice Hall, New Jersey, 1992
2. Mukesh Doble, Sathyanarayana N, Gummai, "Biochemical Engineering", Prentice Hall, 2007.

Reference Books:

1. Trevan, Boffey, Goulding and Stanbury, "Biotechnology", Tata Mcgraw Hill Publishing Co.,NewDelhi, 1987
2. S.Aaiba, "Biochemical Engineering", Academic Press, 1965.
3. D.G. Rao, "Introduction to Biochemical Engineering", Tata McGraw Hill, 2005.

4. J.E.Bailey and D.F.Ollis, "Biochemical Engineering Fundamentals", Mc.Graw Hill, 1986.

CH E63 NANO TECHNOLOGY

(Offered by Department of Physics)

UNIT-I:

Background and Definition of Nanotechnology. Why Nano? Applications in Different Fields, Chemical Approaches to Nanostructured Materials, Molecular Switches and Logic Gates, Solid State Devices.

UNIT-II:

Carbon Nanotubes - Structure of Carbon Nanotubes, Synthesis of Carbon Nanotubes, Growth Mechanisms of Carbon Nanotubes, Properties of Carbon Nanotubes, Carbon Nanotube-Based Nano-Objects, Applications of Carbon Nanotubes, Nano wires – Synthesis, Characterization and Physical Properties of Nanowires, Applications.

UNIT-III:

Basic Microfabrication Techniques, MEMS Fabrication Techniques, Nanofabrication Techniques, Stamping techniques - High Resolution Stamps, Microcontact Printing, Nanotransfer Printing, Applications.

UNIT–VI:

Material aspects of NEMS and MEMS – Silicon, Germanium-Based Materials, Metals, GaAs, InP, and Related III-V Materials, MEMS Devices and Applications - Pressure Sensor, Inertial Sensor, Optical MEMS, RF MEMS, NEMS Devices and Applications, Current Challenges and Future Trends.

UNIT-V:

Microscopy - Scanning Tunneling Microscope, Atomic Force Microscope, Scanning Electron Microscopy, Principles of Noncontact Atomic Force Microscope (NC-AFM).

Text Books:

1. B. Bhushan, (in Eds.) "Springer handbook of nanotechnology", Springer – Verlag, 2004.

Reference Books:

1. Charles P. Poole; Frank K. J Owens, "Introduction to Nanotechnology", A John Wiley and Sons , Inc, Publication.

CH E64 DRUGS AND PHARMACEUTICAL TECHNOLOGY

UNIT- I:

Development of drugs and pharmaceutical industry – organic therapeutic agents uses and economics. Drug metabolism physio chemical principles – radio activity-pharma kinetics –action of drugs of human bodies.

UNIT- II:

Chemical conversion processes – Alkylation – carboxylation – condensation and cyclisation –dehydration, esterfication (alcohoysis) halogenation – oxidation sulforation – complex chemical conversion – fermentation.

UNIT- III:

Compressed tablets – wet granulation – dry granulation – direct compression – tablet presses formulation – coating – pills – capsules sustained action dosage forms – parenter solutions –oral liquids – injections – cirtmerts – standard of hygienes and good manufacturing practice.

UNIT- IV:

Vitamins – cold remedies – laxatives – analgesic – non steroical contraceptives – external antiseptics – antacids and others.

UNIT- V:

Antibiotics – biologicals – harmones – vitamins – preservations – analytical methods or test for various drugs and pharmaceuticals packing – packing techniques – quality control.

Text Books:

1. E.A. Rawlines Bertleys,"Text books of pharmaceuticals" III Edition, billlieere Tincall, London, 1977.

Reference Books:

1. S.H. Yalkorsky and J. Swarbrick, "Drug and pharmaceutical Science" Volume I, II, III, IV, V, VI, and VII Marcel Dekar Inc. New York 1975.
2. Remingtons," Pharmaceutical Science", Mack Publishing Co, 1975.

CH E65 NUCLEAR ENGINEERING

UNIT- I:

Nuclear energy fundamentals: Atomic structure, and radio isotopes, radio activity, nuclear fission, nuclear fission reactors. History of reactor development, reactors for power production.

UNIT- II:

Nuclear reactions and radiations:

Radio activity, interaction of alpha and beta particles, with matter, interaction of beta particles with matter, interaction of neutrons with matter, neutron cross section.

UNIT- III:

Nuclear reactor theory:

The neutron cycle, critical mass, neutron diffusion, the diffusion equation, flux distribution in a spherical and rectangular core, slowing down of neutrons, reactor period, transient conditions and reflectors.

UNIT- IV:

Engineering Considerations of Nuclear Power:

Extension of theory to design, design criteria, selection of materials, reactor fuel, moderator materials, coolant system, reactor control and operation, fuel preparation, reprocessing of spent fuel.

UNIT- V:

Environmental effects and safety:

Radiation hazards, radiation monitoring, radio waste treatment systems, reactor shielding.

General principles of reactor safety, reactor protection system, reliability and risk assessment.

Text Books:

1. Samuel Glasstone and Alexander Seasonske, "Nuclear reactor engineering ", 3rd edn, CBS Publishers, USA.
2. Glenn Murphy, "Elements of Nuclear Engineering", John Wiley and sons Inc.

Reference Books:

1. K.Sriram, "Basic Nuclear Engineering", Wiley eastern Ltd., 1990.
2. W.Marshall, "Nuclear Power Technology", Vol 1,2 & 3, Oxford University Press, New York, 1983.

CH E71 POLYMER SCIENCE AND TECHNOLOGY

UNIT- I:
Introduction - Definitions and concepts, polymerisation reactions, polymer structure, functionality and degradation, Characterisation of polymers.

UNIT- II:
Different types of polymers - natural and modified natural products, synthetic polymers, addition and condensation products and their preparations.

UNIT- III:
Methods of polymerisation - mass, solution, emulsion and suspension polymerisation processes, reactions and equipments used.

UNIT- IV:
Polymer processing - Molding, cold and hot compression molding, injection and jet type molding, extruding, calendering and skiving.

UNIT- V:
Polymer processing - sheet forming, atmospheric and fluid pressure forming, lamination and impregnating, coating, expanding, casting, embedding, spinning and finishing.

Text Books:

1. Fred.W.Billmeyer, "Text Book of Polymer Science", John Wiley and sons, 1980.
2. V.R.Gowarikar, "Polymer Science", New Age International, Second Edition,2006.

.

Reference Books:

1. David J. Williams, "Polymer Science and Engineering", Prentice Hall, 1971.
2. Stanley Middleman, "Fundamentals of Polymer Processing", McGraw Hill, 1977.
3. Herman S. Kaufman and Joseph J Falcetta, "Introduction to Polymer Science and Technology", JohnWiley and sons, 1977.
4. Rakesh K.Gupta and Anil Kumar, "Fundamentals of Polymers", International edition, 1998

CH E72 PETROCHEMICAL TECHNOLOGY

UNIT- I:
General Introduction - History, economics and future of petrochemicals, energy crisis and petrochemical industry, sources and classification of petrochemicals.

UNIT- II:
First generation petrochemicals - alkanes - C1, C2, C3, C4 petrochemicals, alkenes - C2,C3,C4 petrochemicals, alkynes - C2,C3,C4 petrochemicals, B-T-X auromatics, diene based petrochemicals.

UNIT- III:
Second generation petrochemicals - synthesis gas, methanol, formaldehyde chloromethanes, ethanol, acetaldehyde, acetic acid, acetic anhydride, isopropyl alcohol, ethylene oxide, propylene oxide, acetone, vinyl chloride, phenol, aniline and styrene.

UNIT- IV:
Third generation petrochemicals - plastics, rubbers and fibres, olefinic polymers, polyethylene, polypropylene, polyisobutylene, diene polymers - polybutadiene, neoprene, polyisoprene, SBR, synthetic fibres.

UNIT- V:
Miscellaneous petrochemicals - petroleum proteins, synthetic detergents, resin and rubber chemicals, explosives - TNT and RDX.

Text Books:

1. S.Maiti, "Introduction to petrochemicals", Oxford and IBH publishing Co., 1992.

Reference Books:

1. H.Steines, "Introduction to petrochemical Industry", Pergamon, 1961.
2. G.D.Hobson and W.Pohl, "Modern Petroleum Technology", Applied Science Publishers, IV Edition, 1975.
3. Richard frank Goldsten and A.Lawrence Waddams, "The Petroleum Chemical Industry", E&FN Spon Ltd., 1967.
4. G.T.Austin, "Shreves Chemical Process Industries", McGraw Hill, V Edition, 1986.

CH E73 ELECTROCHEMICAL ENGINEERING

UNIT- I:

Review basics of electrochemistry: Faraday's law - Nernst potential – Galvanic cells –Polarography
The electrical double layer: It's role in electrochemical processes – Electro capillary curve –Helmoltz layer – Guoy – Steven's layer – fields at the interface.

UNIT- II:

Mass transfer in electrochemical systems: diffusion controlled electrochemical reaction – the importance of convention and the concept of limiting current. Mass transfer over potential or concentration polarization. Secondary current distribution – the rotating disc electrode.

UNIT- III:

Corrosion:
Introduction – Metallic surface preparation – Phosphating – Inhibitors in acid media – in engine cooling systems. Control measures, industrial boiler water corrosion control –protective coatings – vapor phase inhibitors – cathodic protection, sacrificial anodes – Paint removers.

UNIT- IV:

Batteries:

Primary and secondary batteries – Lechlanche dry cell – alkaline manganese cell – Mercury cell – Reverse electrolyte cells like Mg-$CuCl_2$, Zn-PbO_2, Secondary cells like lead acid, Ni-Cd, Ni-Fe, Ago-Zn, Ago-cd, sodium-sulphur, Li-S, Fuel cells.

UNIT- V:

Electrodes used in different electrochemical industries: Metals- Graphite – Lead dioxide –Titanium substrate insoluble electrodes – Iron oxide – semi conducting type etc. Metal finishing: Electro deposition – electro refining – electroforming – electro polishing –anodizing – Selective solar coatings. Cell design.

Text Books:

1. Picket, "Electrochemical Engineering", Prentice Hall,1977.
2. J.S. Newman, "Electrochemical systems", Prentice Hall,1973.

Reference Books:

1. C. Mantell, "Electrochemical engineering", McGraw Hill, 1972.

CH E74 RISK AND SAFETY MANAGEMENT IN PROCESS INDUSTRIES

UNIT- I:
Hazard identification methodologies, risk assessment methods - PHA, HAZOP, MCA, ETA, FTA, consequence analysis, probit analysis.

UNIT- II:
Hazards in work places - nature and type of work places, types of hazards, hazards due to improper house-keeping, hazards due to fire in multi-floor industries and buildings, guidelines and safe methods in the above situations.

UNIT- III:
Workers' exposures to hazardous chemicals, TLVs of chemicals, physical and chemical properties of chemicals leading to accidents like fire explosions, ingestion and inhalation, pollution in work places due to dangerous dusts, fumes and vapours, guidelines and safe methods in chemicals handling, storage and entry into confined spaces.

UNIT- IV:
Hazards peculiar to industries like fertilizer, heavy chemicals, petroleum, pulp and paper, tanneries, dyes, paints, pesticides, glass and ceramics, dairy and sugar industries, guidelines for safeguarding personnel and safeguarding against water, land and air pollution in the above industries.

UNIT- V:
Safety education and training - safety management, fundamentals of safety tenets, measuring safety performance, motivating safety performance, legal aspects of industrial safety, safety audit.

Text Books:

1. F. P. Lees, "Loss prevention in process industries", 2nd ed, Butterworth-Heinemann, 1996.

Reference Books :

1. W. Handley, "Industrial safety handbook", 2nd ed., McGraw-Hill, 1977.
2. S. P. Levine, 1985, "Protecting personnel at hazardous waste sites", Martin-Butterworth, 1971.
3. R. P. Blake, "Industrial safety", Prentice Hall, 1953.
4. D. Patterson, "Techniques of safety management", McGraw-Hill, 1978.

CH E75 INDUSTRIAL BIOTECHNOLOGY

UNIT I:
Introduction: Basic concepts in biotechnology and historical development - Biotechnology an interdisciplinary pursuit – public perception of biotechnology – Biotechnology and developing world – Ethics of biotechnology – future and scope of biotechnology.

UNIT II:
General requirements of Fermentation Process: An overview of aerobic and anaerobic fermentation processes and their apllication in industry; basic design and construction of fermentor and its auxillaries, sensors and monitoring instruments, media design and sterlization for fermentation processes.

UNIT III:
Solid and liquid substrate fermentation – cheese production – single cell protein (SCP) – mushroom production – soya sauce production – leaching of metals – vitamin C and vitamin B12 production – sewage treatment – biogas production – ethanol from molasses.

UNIT IV:
Genetics and biotechnology: The role of genes within cells, elucidation of the genetic code, genetic elements that control gene expression, methods of creating recombinantDNA molecules, safety guidelines of recombinantDNA research, plasmid and phage vectors.

UNIT V:
Food and Medicine biotechnology: Biotechnology in relation to the food industry, types of micro-organisms Brewing and alcoholic brewerages – wine production – beer production. Antibiotics – pencillin production, vaccines and monoclonal antibodies, human insulin production.

Text Books:

1. John E.Smith, "Biotechnology", 3rd edition, Cambridge University Press.

Reference Books:

1. Atkinson.B and Mavituna.F, "Biochemical Engineering and Biotechnology Handbook", McGraw HillMillan,1993.
2. J.E.Bailey and D.F.Ollis, "Biochemical Engineering Fundamentals", Mc.Graw Hill, 1986.

CH E81 PROCESS FLOWSHEETING, DESIGN AND SYNTHESIS

UNIT I:
Overview of flowsheet synthesis, decomposition strategies for process flowsheet synthesis, precedence ordering, recycle partitioning, tearing, process flow sheet optimization.

UNIT II:
Basic concepts in process synthesis, heat exchanger network synthesis, Grand composition curves, pinch design approach to a network, stream splitting at the pinch, using grand composition curves to design refrigration cycles.

UNIT III:
Heat integrated distillation processes, synthesis of distillation sequences.

UNIT IV:
Reactor network synthesis - geometric techniques for the synthesis of reactor networks, multiple reactions, recycle reactors, reactor network synthesis with target formulations, heat integration of reactors.

UNIT V:
Optimal design and scheduling of batch plants, characteristics of batch processes, scheduling of products and operations, multiproduct batch plants, multipurpose batch plants.

Text Books:

1. L.T.Biegler, "Systematic methods of chemical process design", I.E.Grossmann and Westerberg, Prentice Hall, 1997.
2. J.M.Douglus, "Conceptual Design of Chemical Processes", Mc.Graw Hill, 1998.

Reference Books :

1. Robin Smith, "Chemical Process Design", Mc.Graw Hill, 1995.
2. Richard S.H.Mah, "Chemical Process Structures and information flows", Butterworth, 1990.
3. Smith, "Chemical Process Design and Integration", Wiley Publication,2007.

CH E82 PROCESS MODELLING AND SIMULATION

UNIT I:

Introduction - models and model building, principles of model formulation, fundamental laws - continuity equation, energy equation, equations of motion, transport equations, equations of state, equilibrium and kinetics, classification of mathematical models.

Numerical solutions of model equations – Linear and non linear algebraic equations in one and more than one variables, ordinary differential equations in one and more than one variables.

UNIT II:

Lumped Parameter Models:

Formulation and solution techniques to be discussed for Vapour liquid equilibrium models, dew point and flash calculations for multicomponent systems, boiling operations, batch and continuous distillation models, tank models, mixing tank, stirred tank with heating, CSTR with mutiple reactions. Non-isothermal CSTR - mutiplicity and stability, control at the unsteady state. Non-ideal CSTR models - multi-parameter models with dead space and bypassing, staged operations.

UNIT III:

Distributed Parameter Models (Steady State):

Formulation and solution of split boundary value problems - shooting technique, quasi-linearization techniques, counter current heat exchanger, tubular reactor with axial dispersion, counter current gas absorber, pipe line gas flow, tubular permeation process, pipe line flasher.

UNIT IV:

Unsteady State Distributed Parameter Models:

Solution of partial differential equations using finite difference method, convective problems, diffusive problems, combined convective and diffusive problems. Unsteady state conduction and diffusion, unsteady state heat exchangers, dynamics of tubular reactor with dispersion. Transfer function models for distributed parameter systems.

UNIT V:

Model Parameters Estimation :

Introduction, method of least squares, curve fitting, parameter estimation of dynamic transfer function models – step and impulse response models, Auto regressive Moving Average models, least square and recursive least square methods, parameter estimation of RTD models - moments method.

Text Books:

1. W.F. Ramirez, "Computational Methods in Process Simulation", Butterworth Publishers, 1989.
2. Roger E. Franks, "Modelling and Simulation in Chemical Engineering", John Wiley and Sons, 1972.

Reference Books:

1. Seinfeld and Lapidus, "Mathematical Methods in Chemical Engineering", Prentice Hall, 1974.
2. W.L.Luyben," Process Modelling, simulation and Control for Chemical Engineers", 1990.
3. Santosh Kumar Gupta, "Numerical Methods for Engineers", Tata Mc.Graw Hill, 1995.

CH E83 ENVIRONMENTAL IMPACT ASSESSMENT AND CLEAN TECHNOLOGY

UNIT I:
Introduction and need for impact assessment. Legislation and pollution control acts and Regulations.
Methodologies – collection of data and analysis, cost benefit analysis.

UNIT II:
Application of Impact assessment methods in specific developmental projects, advantages, disadvantages of different methods, applicability of specific methods with examples.

UNIT III:
Impact assessment report contents for developmental projects like thermal power projects, refinery process and chemical process industries.

UNIT IV:
Ranking of impacts, concepts and contents of environmental management plan.
Environmental audits, waste audit, life cycle assessment, industrial symbiosis.

UNIT V:

Clean Technology Options: Clean technology and Clean up technology, materials reuse, waste reduction at source and clean synthesis.

Text Books:

1. Larry W. Carter , "EIA", 1997, McGraw Hill book Co.
2. R.C.Kirkwood and A.J.Longley, "Clean Technology and Environment", Chapman & Hall, 1995.

Reference Books:

1. "EIA, theory and practice" Unwin Hyman Ltd., 1988.
2. "Environmental Health and Safety Auditing Handbook", McGraw Hill, Inc., New York, 1994.

CH E84 NEW SEPARATION TECHNIQUES

UNIT I:
Adsorption separations - Review of fundamentals, mathematical modeling of column contactors, pressure swing adsorption, ion chromatography, affinity chromatography, gradient chromatography, parametric pumping, counter-current, simulated counter-current and multidimensional chromatography.

UNIT II:
Membrane separation processes – basic concepts, membrane modules, structure and characteristics of membranes, design considerations of Reverse Osmosis, Ultra Filtration, Electro Dialysis, Gas permeation membranes, Pervaporation,Nano filtration and micro filtration.

UNIT III:
Detailed theories for membrane separations – concentration polarization, gel formation and fouling, mathematical models for membrane systems with and with out concentration polarization, Transport inside the membranes, solution diffusion membranes, porous membranes.

UNIT IV:
Surfactant based separations - fundamentals of surfactants at surfaces and in solution, liquid membrane permeation, and foam separations, micellar separations.

UNIT V:
Supercritical fluid extraction - Physicochemical principles, thermodynamic modeling, process synthesis and energy analysis.

Text Books:
1. P. C. Wankat, "Large scale adsorption and chromatography", CRC Press, 1986.
2. R.T. Yang, "Gas Separation by Adsorption Processes", Imperial College Press, 1997.
3. P.C. Wankat, "Rate Controlled Processes", Springer Publications, 2005.
4. Seader, "Separation Process Principles", Wiley Publication, Second Edition, 2008.

Reference Books:
1. R. W. Rousseau, "Handbook of separation process technology", John Wiley and Sons, 1987.
2.. M. C. Porter, "Handbook of industrial membrane technology", Noyes publication, Park Ridge, New Jersey, 1990.
3. J. F. Scamehorn and J. H. Harwell, "Surfactant based separation processes, T. A. Hatton in Vol. 23 of Surfactant science series", Marcel-Dekker., 1989.
4 M. A. McHugh and V. J. Krukonis, "Supercritical fluid extraction", Butterworth, 1985.

CH E85 OPTIMIZATION OF CHEMICAL PROCESSES

UNIT I:
Nature and organization of optimization problems, fitting models to data, method of least squares, factorial experimental designs, formulation of objective functions.

UNIT II:
Optimization theory and methods - basic concepts of optimization, optimization of unconstrained functions, one dimensional search, mutivariable optimization.

UNIT III:
Linear programming and applications, nonlinear programming with constraints, optimization of staged and discrete processes.

UNIT IV:
Optimum recovery of waste heat, optimum shell and tube heat exchanger design, optimization of heat exchanger networks, optimization of multistage evaporators , optimization of liquid liquid extraction processes, optimal design and operation of staged distillation columns.

UNIT V:
Optimal pipe diameter, minimum work of gas compression, economic operation of fixed bed filter, optimal design of gas transmission network, optimal design and operation of chemical reactors.

Text Books:

1. T.F.Edger and D.M.Himmelblau, "Optimization of Chemical Processes", Mc.Graw Hill, 2001.

Reference Books:

1. G.S.Beveridge and R.S.Schechter, "Optimization Theory and Practice", Mc.Graw Hill, 1970.
2. Kalyanmoy Deb, "Optimization for Engineering Design", John Wiley, 1995.
3. V.Kafarov, "Cybernetic Methods in Chemistry and Chemical Engineering", MIR Publishers, 1976.