### ANNA UNIVERSITY, CHENNAI
**AFFILIATED INSTITUTIONS**
**R - 2008**
**B.E. PETROCHEMICAL ENGINEERING**
**II TO VIII SEMESTERS CURRICULUM AND SYLLABI**

#### SEMESTER II

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TOTAL : 28 CREDITS

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* Common to all B.E. / B.Tech. Programmes

+ Offering English Language Laboratory as an additional subject (with no marks) during 2nd semester may be decided by the respective Colleges affiliated to Anna University Chennai.

A. CIRCUIT BRANCHES

I  Faculty of Electrical Engineering
   1. B.E. Electrical and Electronics Engineering
   2. B.E. Electronics and Instrumentation Engineering
   3. B.E. Instrumentation and Control Engineering

II  Faculty of Information and Communication Engineering
   1. B.E. Computer Science and Engineering
   2. B.E. Electronics and Communication Engineering
   3. B.E. Bio Medical Engineering
   4. B.Tech. Information Technology

B. NON – CIRCUIT BRANCHES

I  Faculty of Civil Engineering
   1. B.E. Civil Engineering

II  Faculty of Mechanical Engineering
   1. B.E. Aeronautical Engineering
   2. B.E. Automobile Engineering
   3. B.E. Marine Engineering
   4. B.E. Mechanical Engineering
   5. B.E. Production Engineering
### Faculty of Technology

1. B.Tech. Chemical Engineering  
2. B.Tech. Biotechnology  
3. B.Tech. Polymer Technology  
4. B.Tech. Textile Technology  
5. B.Tech. Textile Technology (Fashion Technology)  

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#### VIII SEMESTER

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<td>Polymer Technology</td>
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AIM:
To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

OBJECTIVES:

- To help students develop listening skills for academic and professional purposes.
- To help students acquire the ability to speak effectively in English in real-life situations.
- To inculcate reading habit and to develop effective reading skills.
- To help students improve their active and passive vocabulary.
- To familiarize students with different rhetorical functions of scientific English.
- To enable students write letters and reports effectively in formal and business situations.

UNIT I
Technical Vocabulary - meanings in context, sequencing words, Articles- Prepositions, intensive reading& predicting content, Reading and interpretation, extended definitions, Process description

Suggested activities:

1. Exercises on word formation using the prefix ‘self’ - Gap filling with preposition.
2. Exercises - Using sequence words.
3. Reading comprehension exercise with questions based on inference – Reading headings
4. and predicting the content – Reading advertisements and interpretation.
5. Writing extended definitions – Writing descriptions of processes – Writing paragraphs based on discussions – Writing paragraphs describing the future.

UNIT II

Suggested activities:

1. Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) - Reading comprehension exercises with texts including graphic communication - Exercises in interpreting non-verbal communication.
2. Listening comprehension exercises to categorise data in tables.
3. Writing formal letters, quotations, clarification, complaint – Letter seeking permission for Industrial visits– Writing analytical paragraphs on different debatable issues.

UNIT III
Cause and effect expressions – Different grammatical forms of the same word - Speaking – stress and intonation, Group Discussions - Reading – Critical reading - Listening, - Writing – using connectives, report writing – types, structure, data collection, content, form, recommendations.
Suggested activities:

1. Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different grammatical forms of the same word. (Eg: object – verb / object – noun)
2. Speaking exercises involving the use of stress and intonation – Group discussions – analysis of problems and offering solutions.
3. Reading comprehension exercises with critical questions, Multiple choice question.
4. Sequencing of jumbled sentences using connectives – Making sentences using different grammatical forms of the same word. (Eg: object – verb / object – noun)

UNIT IV

12

Numerical adjectives – Oral instructions – Descriptive writing – Argumentative paragraphs – Letter of application - content, format (CV / Bio-data) - Instructions, imperative forms - Checklists, Yes/No question form – E-mail communication.

Suggested Activities:

1. Rewriting exercises using numerical adjectives.
2. Reading comprehension exercises with analytical questions on content – Evaluation of content.
3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking - Role play – group discussions – Activities giving oral instructions.

UNIT V

9

Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing an essay, Writing a proposal.

Suggested Activities:

1. Case Studies on problems and solutions
2. Brainstorming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, etc.
5. Writing advertisements.

TOTAL: 60 PERIODS

TEXT BOOK:


REFERENCES:

EXTENSIVE READING:


NOTE:

The book listed under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

<table>
<thead>
<tr>
<th>MA2161</th>
<th>MATHEMATICS – II</th>
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UNIT I  ORDINARY DIFFERENTIAL EQUATIONS 12
Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy’s and Legendre’s linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT II  VECTOR CALCULUS 12

UNIT III  ANALYTIC FUNCTIONS 12
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : \( w = z+c, cz, 1/z \), and bilinear transformation.

UNIT IV  COMPLEX INTEGRATION 12

UNIT V  LAPLACE TRANSFORM 12

Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TOTAL: 60 PERIODS
TEXT BOOKS:

REFERENCES:

PH2161 ENGINEERING PHYSICS – II L T P C
3 0 0 3

UNIT I CONDUCTING MATERIALS

UNIT II SEMICONDUCTING MATERIALS

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS
Superconductivity : properties - Types of super conductors – BCS theory of superconductivity(Quantitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS
UNIT V  MODERN ENGINEERING MATERIALS

Metallic glasses: preparation, properties and applications.
Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, advantages and disadvantages of SMA


TOTAL: 45 PERIODS

TEXT BOOKS:
2. Charles P. Poole and  Frank J.Ownen, 'Introduction to Nanotechnology', Wiley India(2007) (for Unit V)

REFERENCES:

CY2161  ENGINEERING CHEMISTRY – II

AIM
To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

OBJECTIVES
• The student should be conversant with the principles electrochemistry, electrochemical cells, emf and applications of emf measurements.
• Principles of corrosion control
• Chemistry of Fuels and combustion
• Industrial importance of Phase rule and alloys
• Analytical techniques and their importance.
UNIT I ELECTROCHEMISTRY

UNIT II CORROSION AND CORROSION CONTROL

UNIT III FUELS AND COMBUSTION

UNIT IV PHASE RULE AND ALLOYS

UNIT V ANALYTICAL TECHNIQUES

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVE
At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

UNIT I BASICS & STATICS OF PARTICLES 12

UNIT II EQUILIBRIUM OF RIGID BODIES 12

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

UNIT IV DYNAMICS OF PARTICLES 12

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12
TEXT BOOK:

REFERENCES:

EE2151 CIRCUIT THEORY
(Common to EEE, EIE and ICE Branches)

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<tr>
<td>UNIT I</td>
<td>BASIC CIRCUITS ANALYSIS</td>
<td>12</td>
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| UNIT II | NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS: | 12 |
| Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Novton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem. |

| UNIT III | RESONANCE AND COUPLED CIRCUITS | 12 |
| Series and paralled resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits. |

| UNIT IV | TRANSIENT RESPONSE FOR DC CIRCUITS | 12 |
| Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input. |

| UNIT V | ANALYSING THREE PHASE CIRCUITS | 12 |
| Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits. |

TOTAL: 60 PERIODS
TEXT BOOKS:

REFERENCES:

EC2151 ELECTRIC CIRCUITS AND ELECTRON DEVICES L T P C (For ECE, CSE, IT and Biomedical Engg. Branches) 3 1 0 4

UNIT I CIRCUIT ANALYSIS TECHNIQUES 12

UNIT II TRANSIENT RESONANCE IN RLC CIRCUITS 12

UNIT III SEMICONDUCTOR DIODES 12

UNIT IV TRANSISTORS 12
Principle of operation of PNP and NPN transistors – study of CE, CB and CC configurations and comparison of their characteristics – Breakdown in transistors – operation and comparison of N-Channel and P-Channel JFET – drain current equation – MOSFET – Enhancement and depletion types – structure and operation – comparison of BJT with MOSFET – thermal effect on MOSFET.
UNIT V  SPECIAL SEMICONDUCTOR DEVICES (Qualitative Treatment only)  12


TOTAL: 60 PERIODS

TEXT BOOKS:


REFERENCES:


GE2151  BASIC ELECTRICAL AND ELECTRONICS ENGINEERING  L  T  P  C
(Common to branches under Civil, Mechanical and Technology faculty)  4  0  0  4

UNIT I  ELECTRICAL CIRCUITS & MEASURMENTS  12
Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II  ELECTRICAL MECHANICS  12

UNIT III  SEMICONDUCTOR DEVICES AND APPLICATIONS  12

UNIT IV  DIGITAL ELECTRONICS  12
Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V  FUNDAMENTALS OF COMMUNICATION ENGINEERING  12
Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL: 60 PERIODS

TEXT BOOKS:

REFERENCES:

GE2152  BASIC CIVIL & MECHANICAL ENGINEERING  L T P C
(Common to branches under Electrical and I & C Faculty)  4 0 0 4

A – CIVIL ENGINEERING

UNIT I  SURVEYING AND CIVIL ENGINEERING MATERIALS  15


UNIT II  BUILDING COMPONENTS AND STRUCTURES  15
Foundations: Types, Bearing capacity – Requirement of good foundations.


TOTAL: 30 PERIODS
UNIT III  POWER PLANT ENGINEERING  10

UNIT IV  IC ENGINES  10
Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V  REFRIGERATION AND AIR CONDITIONING SYSTEM  10

REFERENCES:

GE2155  COMPUTER PRACTICE LABORATORY – II  L T P C
0 1 2 2

LIST OF EXPERIMENTS

1. UNIX COMMANDS  15
Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING  15
Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX  15
Dynamic Storage Allocation-Pointers-Functions-File Handling

TOTAL: 45 PERIODS
HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

Hardware

- 1 UNIX Clone Server
- 33 Nodes (thin client or PCs)
- Printer – 3 Nos.

Software

- OS – UNIX Clone (33 user license or License free Linux)
  Compiler - C

GS2165  PHYSICS LABORATORY – II  L T P C
                                  0 0 3 2

LIST OF EXPERIMENTS

1. Determination of Young’s modulus of the material – non uniform bending.
2. Determination of Band Gap of a semiconductor material.
3. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.
5. Spectrometer dispersive power of a prism.
6. Determination of Young’s modulus of the material – uniform bending.

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Chemistry.
- The lab examinations will be held only in the second semester.
GS2165  CHEMISTRY LABORATORY – II  L T P C  0 0 3 2

LIST OF EXPERIMENTS

1. Conduct metric titration (Simple acid base)
2. Conduct metric titration (Mixture of weak and strong acids)
3. Conduct metric titration using BaCl₂ vs Na₂SO₄
4. Potentiometric Titration (Fe²⁺ / KMnO₄ or K₂Cr₂O₇)
5. PH titration (acid & base)
6. Determination of water of crystallization of a crystalline salt (Copper sulphate)
7. Estimation of Ferric iron by spectrophotometry.

• A minimum of FIVE experiments shall be offered.

• Laboratory classes on alternate weeks for Physics and Chemistry.
• The lab examinations will be held only in the second semester.

ME2155  COMPUTER AIDED DRAFTING AND MODELING LABORATORY  L T P C  0 1 2 2

List of Exercises using software capable of Drafting and Modeling

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building ( Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.
Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

List of Equipments for a batch of 30 students:

1. Pentium IV computer or better hardware, with suitable graphics facility - 30 No.
2. Licensed software for Drafting and Modeling. – 30 Licenses
3. Laser Printer or Plotter to print / plot drawings – 2 No.

TOTAL: 45 PERIODS

EE2155  ELECTRICAL CIRCUIT LABORATORY
(Common to EEE, EIE and ICE)  L T P C
0 0 3 2

LIST OF EXPERIMENTS

1. Verification of ohm’s laws and kirchoff’s laws.
2. Verification of Threvenin’s and Norton’s Theorem
3. Verification of superposition Theorem
4. Verification of maximum power transfer theorem.
5. Verification of reciprocity theorem
6. Measurement of self inductance of a coil
7. Verification of mesh and nodal analysis.
8. Transient response of RL and RC circuits for DC input.
10. Frequency response of single tuned coupled circuits.

TOTAL: 45 PERIODS
1. Verification of KVL and KCL
2. Verification of Thevenin and Norton Theorems.
3. Verification of superposition Theorem.
4. Verification of Maximum power transfer and reciprocity theorems.
5. Frequency response of series and parallel resonance circuits.
6. Characteristics of PN and Zener diode
7. Characteristics of CE configuration
8. Characteristics of CB configuration
9. Characteristics of UJT and SCR
10. Characteristics of JFET and MOSFET

TOTAL: 45 PERIODS

ENGLISH LANGUAGE LABORATORY (Optional)

1. Listening: 5
Listening & answering questions – gap filling – Listening and Note taking- Listening to telephone conversations

2. Speaking: 5
Pronouncing words & sentences correctly – word stress – Conversation practice.

Classroom Session 20


   Presentations: Body Group Discussions etc

2. Goal setting – interviews – stress time management – situational reasons
Evaluation

(1) Lab Session – 40 marks
   Listening – 10 marks
   Speaking – 10 marks
   Reading – 10 marks
   Writing – 10 marks

(2) Classroom Session – 60 marks
   Role play activities giving real life context – 30 marks
   Presentation – 30 marks

Note on Evaluation

1. Examples for role play situations:
   a. Marketing engineer convincing a customer to buy his product.
   b. Telephone conversation – Fixing an official appointment / Enquiry on availability of flight or train tickets / placing an order. etc.

2. Presentations could be just a Minute (JAM activity) or an Extempore on simple topics or visuals could be provided and students could be asked to talk about it.

REFERENCES:


LAB REQUIREMENTS

1. Teacher – Console and systems for students
2. English Language Lab Software
3. Tape Recorders.
UNIT I  ALIPHATIC HYDROCARBONS AND ALCOHOLS  9

UNIT II  ALDEHYDES, KETONES AND ACIDS  9

UNIT III  CARBOHYDRATES  9

UNIT IV  AROMATIC HYDROCARBON, AMINE AND DIAZONIUM SALT  9

UNIT V  DYES AND DYEING  9

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
UNIT I  CHARACTERISTICS OF PARTICULATE SOLIDS, SIZE REDUCTION AND SCREENING

Properties and characterization of particulate solids – Analysis, technical methods for measurement of size and surface area distribution of powder – Introduction to size reduction equipment – Determination of energy and power requirement in milling operations – Computer simulation techniques for mill performance – Mechanical classifiers – Screening equipment – Capacity and effectiveness.

UNIT II  FILTRATION

Filtration equipments – Filtration media and filter aids – Principles of filtration and clarification – Estimation of filtration parameters for compressible and incompressible cakes and calculations – Centrifugal filtration equipment and principles of operation.

UNIT III  SETTLING AND SEDIMENTATION


UNIT IV  AGITATION AND MIXING


UNIT V  STORAGE AND CONVEYING OF SOLIDS


TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVES
- To understand the basic concepts of different types of electrical machines and their performance.
- To study the different methods of starting D.C motors and induction motors.
- To study the conventional and solid-state drives

UNIT I INTRODUCTION
Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors

UNIT II DRIVE MOTOR CHARACTERISTICS
Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.

UNIT III STARTING METHODS
Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES
Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers –applications.

UNIT V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES
Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVES
The course objective is to develop the skills of the students in the areas of Transforms and Partial Differential Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

UNIT I FOURSIER SERIES 9 + 3

UNIT II FOURSIER TRANSFORMS 9 + 3

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 9 + 3
Formation of partial differential equations – Lagrange’s linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 + 3
Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

UNIT V Z-TRANSFORMS AND DIFFERENCE EQUATIONS 9 + 3

LECTURES: 45 TUTORIALS : 15 TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
UNIT I BASIC CHEMICAL CALCULATIONS 5

Units and Dimensions
Basic and derived units – Use of model units in calculations – Methods of expression – Compositions of mixture and solutions.

Gas Calculations 7

UNIT II MATERIAL BALANCE 12
Stoichiometric principles – Application of material balance to unit operations like distillation – Evaporation, crystallisation, drying etc., – Material balance with chemical reaction – Limiting and excess reactants – Recycle – Bypass and purging – Unsteady state material balances.

UNIT III HUMIDITY AND SATURATION 12
Properties of atmospheric air – Humidity of air – Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity – Use of humidity in condensation and drying – Psychrometric chart, dew point – Wet and dry bulb thermometry.

UNIT IV FUELS AND COMBUSTION 12
Determination of composition by Orsat analysis of products of combustion of solid, liquid and gas fuels – Calculation of excess air from Orsat technique, problems on sulphur and sulphur burning compounds – Theoretical flame temperature.

UNIT V ENERGY BALANCE 6
Thermo Physics

Thermo Chemistry 6

TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES
UNIT I  PROPERTIES OF FLUIDS AND CONCEPT OF PRESSURE  9

UNIT II  MOMENTUM BALANCE AND ITS APPLICATIONS  9

UNIT III  FLOW OF INCOMPRESSIBLE FLUIDS THROUGH DUCTS  9

UNIT IV  FLOW OF FLUIDS THROUGH SOLIDS  9

UNIT V  TRANSPORTATION AND METERING  9

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
CH3207  ORGANIC CHEMISTRY LABORATORY  L T P C  0 0 3 2

1. Estimation of Alcohol
2. Estimation of Aldehydes & Ketenes
3. Estimation of Phenol
4. Pigment Analysis
5. Ore/Alloys analysis
6. Estimation of Amines
7. Estimation of Glucose
8. Preparation of Asprin
9. Preparation of Methyl orange
10. Preparation of Schiff’s base
11. Synthesis of Porphyrin
12. Qualitative analysis of simple Organic compounds.
13. Polymer Analysis
15. Industrial Waste Water analysis

TOTAL: 45 PERIODS

PC3208  ELECTRICAL MACHINES LABORATORY  L T P C  0 0 3 2

1. Open circuit and load characteristics of separately excited and self excited D.C. generator
2. Load test on D.C. shunt motor
3. Load test on D.C. series motor
4. Speed control of D.C. shunt motor
5. Load test on single phase transformer and open circuit and short circuit test on single phase transformer
6. Regulation of three phase alternator by E.M.F. and M.M.F. methods
7. Load test on three phase induction motor
8. No load and blocked rotor tests on three phase induction motor (Determination of equivalent circuit parameters)
9. Load test on single-phase induction motor
10. Study of D.C. motor and induction motor starters

TOTAL: 45 PERIODS
1. One drawing sheet of symbols and basic conventions of machine elements, materials and processes as per Indian and International Standards.
2. One drawing sheet of screw threads, screwed fastenings, cotter pin joints, pipe joints, knuckle joint, riveted and welded joints etc. (minimum two views of each component)
3. One drawing sheet on detail parts and their assembly of valves, couplings, clutches, brakes, pulleys, engine parts etc.
4. One drawing sheet based on AutoCAD with all three views for at least two machine elements / components mentioned above.

TEXT BOOKS

REFERENCES
UNIT I
STRESS, STRAIN AND DEFORMATION OF SOLIDS

UNIT II
TRANSEVERSE LOADING ON BEAMS AND STRESSES IN BEAMS

UNIT III
TORSION
Stresses and deformation in circular and hollows shafts – Stepped shafts – Shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs.

UNIT IV
DEFLECTION OF BEAMS
Double Integration method – Macaulay’s method – Area moment theorems for computation of slopes and deflections in beams – Conjugate beam and energy method – Maxwell’s reciprocal theorems.

UNIT V
THIN CYLINDERS, SPHERES AND THICK CYLINDERS
Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses – deformation in thin cylinders –spherical shells subjected to internal pressure –deformations in spherical shells - Lame’s theory – application of theories of failure

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
UNIT I  GASEOUS STATE

UNIT II  CHEMICAL REACTION EQUILIBRIA
Law of mass action – Van’t Hoff reaction isotherm – Standard free energy change – Le Chatelier’s principle – Application to selected systems – Biological activity – The thermodynamics of ATP.

UNIT III  CHEMICAL KINETICS

UNIT IV  SOLUTIONS

UNIT V  ELECTRICAL CONDUCTANCE

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
UNIT I  CONDUCTION

UNIT II  CONVECTION

UNIT III  RADIATION

UNIT IV  HEAT EXCHANGERS
Heat exchanger types – Parallel and counter flow heat exchangers – Overall heat transfer coefficient – Log mean temperature difference for single pass – Correction factor for multi pass heat exchangers – Heat exchanger effectiveness – Number of transfer units – Chart for different configurations – Dirt factor.

UNIT V  EVAPORATORS

TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES
UNIT I  SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS  (10 +3)

UNIT II  INTERPOLATION AND APPROXIMATION  (8 + 3)
Interpolation with unequal intervals - Lagrange interpolation – Newton’s divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton’s forward and backward difference formulae.

UNIT III  NUMERICAL DIFFERENTIATION AND INTEGRATION  (9 + 3)

UNIT IV  INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS  (9 + 3)

UNIT V  BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS  (9 + 3)
Finite difference methods for solving two-point linear boundary value problems. Finite difference techniques for the solution of two dimensional Laplace’s and Poisson’s equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit (Crank Nicholson) methods - One dimensional wave equation by explicit method.

L: 45  T: 15 TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
UNIT I
ALKALIES
Chloro-alkali industries – Manufacture of soda ash – Caustic soda – Chlorine.

UNIT II
ACIDS
Manufacture of sulphuric acid – Hydrochloric acid – Phosphoric acid – Nitric acid.

UNIT III
GLASSES
Manufacture of glasses – Special glasses – Ceramics and refractories – Paints and pigments.

UNIT IV
INDUSTRIAL GASES

UNIT V
FERTILIZERS

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
UNIT III  ABSORPTION 12

UNIT IV  DRYING 12
Drying – Principle and definitions – Estimation of drying rates, drying rate curve – Critical and equilibrium moisture content – Calculation of drying time under constant drying conditions – Different types of dryers.

UNIT V  HUMIDIFICATION AND CRYSTALLIZATION 12

TOTAL: 60 PERIODS

TEXTBOOKS

REFERENCES

CH3216  PHYSICAL CHEMISTRY LABORATORY  L T P C 0 0 3 2
1. Molecular weight determination of Polymer by using
   a) Rast’s Method b) Viscometer
2. Partition Coefficient Studies for Benzene – Water system
3. Phase rule Studies Simple Eutectic system
4. Conductivity Studies a) Precipitation Titration b) Mixtures of acid – Strong Base Titration
5. EMF Studies Estimation of Fe by Potentiometric Titration
6. Kinetic Studies
   a) Kinetic studies of Persulphate – Iodide reaction
   b) Kinetic studies of Iodination of Acetone.
   c) Determination of Rate constant of Acid catalyst hydrolysis of an Ester.
7. Polarimetry Studies - Kinetic study of Inversion of Cane sugar.
8. Adsorption Studies - Freundlich Adsorption Isotherm
11. Determination of Saponification value of an oil.
12. To determine the moisture & volatile contents in a given coal sample by proximate analysis.
13. pH metric measurements
   (a) To prepare buffer solutions and standardization of pH meter
   (b) Determine the molarity of HCl by pH-metrically, using 0.1 M Sodium Hydroxide.

TOTAL: 45 PERIODS

CH3218  MECHANICAL OPERATIONS LABORATORY  L T P C
0 0 3 2

1. Screen Effectiveness
2. Jaw Crusher and Smooth roll crusher
3. Ball Mill
4. Vacuum Leaf Filter
5. Plate and Frame Filter press
6. Batch Sedimentation
7. Cyclone Separator
8. Terminal settling velocity - Stokes law Verification.
9. Rod mill
10. Hammer Mill
11. Vibrating Screen
12. Continuous Thickener
13. Plate & Frame Filter press
14. Belt conveyor
15. Drop weight crusher
16. Beaker Decantation

TOTAL: 45 PERIODS

PM3205  FLUID MECHANICS LABORATORY  L T P C
0 0 3 2

1. To verify Hagen-Poiseuille Equation.
2. To relate Reynolds Number and Friction factor.
3. To study the effect of coil diameter on Friction factor.
4. To evaluate the performance of Centrifugal pump and Reciprocating Pump
5. To verify Ergun’s equation.
6. To determine the discharge coefficient of Orifice meter, Venturimeter and Rotameter.
7. To evaluate the performance of Weirs and Notches.
8. To characterize the behavior of Fluidized bed.
9. Losses due to friction in pipe lines and fittings
10. Reynold’s Apparatus
11. Bernoulli’s Theorem Apparatus
12. Efflux time Apparatus.
13. Calibration Test Rig for Pitot Tube
14. Flow Through Pipes, Minor Losses due to sudden expansion, Sudden Contraction

TOTAL: 45 PERIODS

GE 2021  ENVIRONMENTAL SCIENCE AND ENGINEERING  L T P C
3 0 0 3

AIM
- The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional Endeavour that they participates.

OBJECTIVE
- At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

UNIT I  ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.
UNIT II  ENVIRONMENTAL POLLUTION  8
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III  NATURAL RESOURCES  10
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV  SOCIAL ISSUES AND THE ENVIRONMENT  7

UNIT V  HUMAN POPULATION AND THE ENVIRONMENT  6

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES BOOKS:
UNIT I  FUNDAMENTAL CONCEPTS AND FIRST LAW OF THERMODYNAMICS  12

UNIT II  ENTROPY AND THE SECOND LAW OF THERMODYNAMICS  12

UNIT III  REFRIGERATION, VAPOR and COMBINED POWER CYCLES  12

UNIT IV  PVT RELATIONS AND THERMODYNAMIC RELATIONS  12

UNIT V  PHASE EQUILIBRIA AND CHEMICAL REACTION EQUILIBRIA  12

TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES
UNIT I  ORIGIN AND OCCURRENCE OF PETROLEUM AND SEDIMENTARY ENVIRONMENT


UNIT II  EXPLORATION METHODS, WELL PROGNOSIS AND ECONOMIC ANALYSIS


UNIT III  GEOLOGICAL STRUCTURE AND GEOLOGGING


UNIT IV  DRILLING FLUIDS AND WORK COMPLETION


UNIT V  OFF-SHORE TECHNOLOGY

Seismic technology – Sniffer survey – Drilling technology – Off-share rigs – Primary and secondary enhanced oil recovery techniques and methods – Major well complication and Remedies.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES
UNIT I  NON – IDEAL REACTORS  9
Residence time distribution function and its measurement – Characteristics of tracer – Mean residence time – Conversion in non-ideal flow reactors.

UNIT II  HETEROGENEOUS PROCESS AND SOLID CATALYSIS  9
Rate equation for heterogeneous reactions – Nature of catalysis – Adsorption isothermal and rates of adsorption – Desorption and surface reaction analysis of rate equation – Rate controlling steps.

UNIT III  GAS – SOLID CATALYTIC REACTORS  9

UNIT IV  GAS – SOLID NON – CATALYTIC REACTORS  9

UNIT V  GAS – LIQUID REACTIONS  9

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES
UNIT I PROPERTIES AND COMPOSITION OF NATURAL GAS

UNIT II ESTIMATION AND PRODUCTION OF NATURAL GAS

UNIT III GAS FROM CONDENSATE OIL FIELDS
Processing of condensate well fluids – Cycling of gas condensate reservoirs – Sweep patterns – Katy cycling plant.

UNIT IV ACID GAS TREATING OF NATURAL GAS
Acid gas removal: Metal oxide process – Slurry process – Amine process – Carbonate washing process – Methanol based process and other process – Sulphur recovery process.

UNIT V DEHYDRATION OF NATURAL GAS AND NGL RECOVERY

TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES
UNIT II
CONTINUOUS FRACTIONATION


UNIT III
LIQUID – LIQUID EXTRACTION

Description of liquid extraction – Terminologies – Application of ternary liquid equilibrium – Representation in equilateral triangular co-ordinate of different type systems – Effect of temperature – Criteria for selection of solvent – Stage wise and continuous contact extractors – Types of extractors and their brief description – Stage wise contact – Cross and counter current extraction – Graphical method of determining number of stages – Composition and minimum solvent requirement.

UNIT IV
 ADSORPTION


UNIT V
 LEACHING

Solid liquid extraction: Description of leaching operations and technologies – Applications of leaching – Preparation of solid – Methods of Operation and classification of equipment – Solid – Liquid Equilibrium in leaching – Multi stage cross and counter current leaching – Calculation of composition and number of stages.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES
1. Determination of heat transfer coefficient using composite wall.
2. Determination of heat transfer coefficient using convection apparatus.
3. Determination of Stefan Boltzmann constant using Stefan Boltzman apparatus.
5. Determination of condensing heat transfer coefficient using horizontal condenser.
6. Study the effect of coil diameter on heat transfer coefficient.
7. Determination of overall heat transfer coefficient using shell and tube heat exchanger.
10. Study the effect of evaporation using jacketed pan evaporator and open pan evaporator.

TOTAL: 45 PERIODS

1. Oil Analysis:
   a) Acid value
   b) Saponification value
   c) Iodine value
2. Soap Analysis:
   a) Moisture and Volatile matter
   b) Fatty acid content of Soap
   c) Total Alkali d) Free alkali or free fatty acid
3. Determination of CaO in the given sample of commercial lime.
4. Analysis of water:
   a) Total solids including suspended matter
   b) pH
   c) Conductivity
   d) Alkalinity
   e) Permanent Harness
   f) Temporary Hardness
5. Cement Analysis
   a) Loss on ignition
   b) Insoluble residue
   c) Estimation of SO3, Silica (SiO2), Lime (CaO), Magnesia (MgO), Iron and Aluminium Oxides (R2O3).
6. Estimation of Nitrogen by Kjeldahl method
8. Effluent water Analysis (COD, BOD, DO, TDS, TSS)
9. Estimation of available chlorine in the given bleaching powder

TOTAL: 45 PERIODS
Globalisation has brought in numerous opportunities for the teeming millions, with more focus on the students’ overall capability apart from academic competence. Many students, particularly those from non-English medium schools, find that they are not preferred due to their inadequacy of communication skills and soft skills, despite possessing sound knowledge in their subject area along with technical capability. Keeping in view their pre-employment needs and career requirements, this course on Communication Skills Laboratory will prepare students to adapt themselves with ease to the industry environment, thus rendering them as prospective assets to industries. The course will equip the students with the necessary communication skills that would go a long way in helping them in their profession.

OBJECTIVES:
- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

<table>
<thead>
<tr>
<th>I. PC based session</th>
<th>(Weightage 40%)</th>
<th>24 periods</th>
</tr>
</thead>
</table>

A. ENGLISH LANGUAGE LAB (18 Periods)

1. LISTENING COMPREHENSION:
   - Listening and typing – Listening and sequencing of sentences – Filling in the blanks -Listening and answering questions.

2. READING COMPREHENSION:
   - Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.

3. SPEAKING:
   - Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)

B. DISCUSSION OF AUDIO-VISUAL MATERIALS (6 PERIODS)

   (Samples are available to learn and practice)

1. RESUME / REPORT PREPARATION / LETTER WRITING
   - Structuring the resume / report - Letter writing / Email Communication - Samples.

2. PRESENTATION SKILLS:
   - Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples
3. **SOFT SKILLS:**
   - Time management – Articulateness – Assertiveness – Psychometrics –
   - Innovation and Creativity - Stress Management & Poise - Video Samples

4. **GROUP DISCUSSION:**
   - Why is GD part of selection process ? - Structure of GD – Moderator – led and other GDs -
   - Strategies in GD – Team work - Body Language - Mock GD -Video samples

5. **INTERVIEW SKILLS:**
   - Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews-Video samples.

<table>
<thead>
<tr>
<th>II. Practice Session</th>
<th>(Weightage – 60%)</th>
<th>24 periods</th>
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</thead>
<tbody>
<tr>
<td>1. Resume / Report Preparation / Letter writing: Students prepare their own resume and report.</td>
<td>2</td>
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<tr>
<td>2. Presentation Skills: Students make presentations on given topics.</td>
<td>8</td>
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<tr>
<td>3. Group Discussion: Students participate in group discussions.</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>4. Interview Skills: Students participate in Mock Interviews</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

**TEXT BOOKS**

**REFERENCES**

**LAB REQUIREMENT**
1. Teacher console and systems for students.
2. English Language Lab Software
3. Career Lab Software
## Requirement for a batch of 60 students

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Description of Equipment</th>
<th>Quantity required</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Server</td>
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<tr>
<td></td>
<td>o PIV system</td>
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<tr>
<td></td>
<td>o 1 GB RAM / 40 GB HDD</td>
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<td></td>
<td>o OS: Win 2000 server</td>
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<td></td>
<td>o Audio card with headphones (with mike)</td>
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<tr>
<td></td>
<td>o JRE 1.3</td>
<td>1 No.</td>
</tr>
<tr>
<td>2.</td>
<td>Client Systems</td>
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<tr>
<td></td>
<td>o PIII or above</td>
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<tr>
<td></td>
<td>o 256 or 512 MB RAM / 40 GB HDD</td>
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<td></td>
<td>o OS: Win 2000</td>
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<tr>
<td></td>
<td>o Audio card with headphones (with mike)</td>
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<td></td>
<td>o JRE 1.3</td>
<td>60 No.</td>
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<tr>
<td>3.</td>
<td>Handicam Video Camera (with video lights and mic input)</td>
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<tr>
<td>4.</td>
<td>Television - 29”</td>
<td>1 No.</td>
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<tr>
<td>5.</td>
<td>Collar mike</td>
<td>1 No.</td>
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<td>6.</td>
<td>Cordless mikes</td>
<td>1 No.</td>
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<tr>
<td>7.</td>
<td>Audio Mixer</td>
<td>1 No.</td>
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<tr>
<td>8.</td>
<td>DVD Recorder / Player</td>
<td>1 No.</td>
</tr>
</tbody>
</table>

### CH3212 MATERIAL TECHNOLOGY LTCP 3003

#### UNIT I NATURE OF MATERIALS

#### UNIT II FERROUS AND NON-FERROUS METALS

#### UNIT III POLYMERIC AND CERAMIC MATERIALS
UNIT IV INORGANIC MATERIALS 9

UNIT V CORROSION AND COATING 9
Basic theories and mechanism of corrosion – Types of corrosion – Application of corrosion theories in equipment design and fabrication – Anti-corrosion methods – Organic paints and coatings – Metal coatings – Ceramic coatings – Lining.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

PC3310 PROCESS DYNAMICS AND CONTROL L T P C
3 1 0 4

UNIT I FIRST ORDER SYSTEMS 12

UNIT II HIGHER ORDER SYSTEMS 12

UNIT III CLOSED LOOP CONTROL SYSTEMS 12

UNIT IV FREQUENCY RESPONSE 12
Introduction to frequency response of closed-loop systems – Routh analysis – Control system design by frequency – Bode diagram – Stability criterion – Tuning of controller settings.

UNIT V SPECIAL CONTROLS 12
Cascade – Feed forward and ratio control – Dead time compensation – Internal model control – Control valves – Process identification.

TOTAL: 60 PERIODS
TEXT BOOKS

REFERENCES

PC3313 EQUIPMENT DESIGN AND DRAWING I
(To Consider as Practical Subject for Examination Purpose)

UNIT I  DESIGN OF PIPE FITTINGS AND JOINTS
Design and schematic of simple bolts and screws – Riveted joints – Design and drawing of shafts and couplings.

UNIT II  DESIGN OF REACTION VESSEL AND STORAGE TANK
Design and schematic of storage tank, (vertical and horizontal) supports, agitated vessel.

UNIT III  DESIGN OF HIGH PRESSURE SYSTEMS
Design of high pressure vessels and reactors.

UNIT IV  DESIGN OF PHASE SEPARATION EQUIPMENT
Design of physical separation equipments such as cyclones, centrifuges, thickeners, filtration equipment

UNIT V  DRAWING OF HEAT EXCHANGERS AND COLUMNS
Drawing of physical process equipments such as double pipe heat exchangers – Shell and tube heat exchangers – Plate and frame heat exchangers – Distillation columns and reactors.

L: 45 P: 15, TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES

Note: Necessary Data Book is to be issued while conducting Practical Examination
UNIT I  GENERAL

UNIT II  TESTING OF PETROLEUM PRODUCTS

UNIT III  CRUDE PROCESSING

UNIT IV  LUBE DISTILLATE TREATMENT TECHNIQUES
Treatment techniques for vacuum distillates with different processes like solvent extraction – Deasphalting, dewaxing, hydrofining, catalytic dewaxing and clay contact process – Production of lubricating oils.

UNIT V  BITUMEN PROCESSING and FINAL TREATMENT TECHNIQUES
Asphalt manufacture, Air blowing technology, Bitumen Types and their properties, Acid gas removal and sulphur removal techniques.

TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES

UNIT I  INTERNAL TREATMENT PROCESS

UNIT II  EXTERNAL TREATMENT PROCESS
UNIT III  
BOILER WATER AND COOLING WATER  
12
Concept – Importance – Location – Commonly used desalination process – Distillation – 
Electrodialysis – Reverse osmosis – Freezing – Solar distillation- Purpose – Problem associated 
with water quality and equipment – Steam system fundamentals – Hot water closed system – 
Measurement and control of pH, corrosion, fouling – Microbial analysis – Ozone control – Study 
of microorganism – Energy efficient operations and maintenance.

UNIT IV  
WASTE WATER TREATMENT  
12
Waste water in Industry- Home and Agriculture – Various waste water treatment processes – 
Optimization – Benefits and costs – Microbial and sanitation water treatment – Biofilm formation 
and removal – Microbial trend analysis – Pretreatment system and equipment.

UNIT V  
WATER MANAGEMENT IN INDIA  
12
Water resources and planning – Water policy – Indian scene – Main aspects of water 
management – Hydrological cycle – Hydrosphere – Water transport – Water exchange – Causes 
and problems in irrigation, rural water, urban water – Water conservation resource management – 
Rain Harvesting.

TEXT BOOKS
1. P.C.Bansil “Water Management in India”, Concept Publishing company, New Delhi, First Edition, 
2004.

REFERENCES

PM3302  
INSTRUMENTATION AND INSTRUMENTAL ANALYSIS  
L T P C  
4 0 0 4

UNIT I  
INTRODUCTION TO INSTRUMENTS, CHARACTERISTICS 
AND SIGNAL CONDITIONING  
12
Introduction to Instruments and Their representation: Introduction, Elements, Classification, 
Standards, Calibration procedures Static and Dynamic Characteristics of Instruments, 
Specification of static characteristics, Selection of instruments, Forcing functions, Formulation of 
First order and second order system equations, Dynamic response Principals of Analog signal 
conditioning, converters, guidelines for analog signal conditioning design, Principles of digital 
signal conditioning, computer interface, DACs, ADCs, DAS hardware, DAS software, 
characteristics of digital data

UNIT II  
TEMPERATURE, PRESSURE, LEVEL MEASUREMENTS  
12
Temperature measurement: Temperature scales, Non electrical methods, Electrical methods, 
Radiation methods
Pressure measurement: Moderate pressure measurement, High pressure measurement, vacuum measurement
Level measurement: measurement techniques for Liquids and slurries, advance measurement techniques
UNIT III  FLOW MEASUREMENTS AND STUDY OF VALVES  12
Flow measurement: Introduction, Review of Venturimeter, orifice meters, rotameters, Pitot tube, working of turbine, vortex shedding, electromagnetic flow meters
Introduction to Advanced flow measurement techniques: Hot Wire anemometer, Laser Doppler anemometer, Ultrasound, Particle image Velocimetry
Study of Valves: Types of Valves, Actuators, Positioners, Valve characteristics, Controllability and Rangeability, Cavitation, Flashing, choking, Valve Sizing for incompressible fluids, compressible fluids, Two phase flows

UNIT IV  INTRODUCTION TO QUALITY CONTROL AND ANALYTICAL TECHNIQUES  12
Miscellaneous measurements and analysis: density, viscosity, Refractometer, pH and redox potential measurements. Thermal conductivity gas analyzers. Oxygen determination. Orsat analysis

UNIT V  WORKING AND INTERPRETATION OF INSTRUMENTAL ANALYTICAL METHODS : I  12
Spectroscopic techniques: Atomic Absorption, X-ray, inductively coupled argon plasma (ICAP), ultraviolet – visible (UV-VIS), fluorescence, infrared (IR), Raman spectroscopy, mass spectrometry (MS), nuclear magnetic resonance (NMR)
Chromatographic Techniques: gas chromatography (GC), high pressure liquid chromatography, gel permeation chromatography (GPC), thin layer chromatography (TLC), super critical fluid chromatography (SFC)
Classification of spectroscopic and chromatographic techniques for Analysis of fuels

Working and Interpretation of Instrumental analytical methods: II
Lubricant Analysis: constituents of lubricants, characterization of lubricants by analytical techniques, importance of elemental analysis in lubricants

TOTAL : 60 PERIODS

TEXT BOOKS:

REFERENCES
CH3318  MASS TRANSFER LABORATORY  L T P C
0 0 3 2

1. Simple distillation
2. Steam distillation
3. Packed column distillation
4. Bubble cap distillation
5. Diffusivity measurements
6. Liquid-liquid extraction
7. Vacuum Dryer
8. Tray dryer
9. Rotary dryer
10. Surface Evaporation
11. Stage wise Leaching
12. Vapor-Liquid Equilibrium
13. Ternary Liquid
14. Sublimation of Naphthalene
15. Wetted Wall Column

* Minimum 10 experiments shall be offered.

TOTAL: 45 PERIODS

PC3317  PETROLEUM PHYSICAL PROPERTIES TESTING LABORATORY  L T P C
0 0 3 2

1. Determination of flash point by Pensky Marten Closed Cup Apparatus
2. Determination of flash point by Abel Open cup Apparatus
3. Determination of Kinematic Viscosity by Redwood viscometer
4. Determination of Kinematic Viscosity by Saybolt viscometer
5. Determination of Kinematic Viscosity by Engler viscometer
6. Determination of Kinematic Viscosity by U tube viscometer
7. API gravity determination
8. Moisture determination by Dean and Stark Method
9. Water estimation by Karl-Fischer conductometer Apparatus
10. ASTM Distillation
11. Vacuum Distillation
12. Determination of Calorific Value by Junker’s Gas Calorific meter.
13. Reid Vapor Pressure Estimation
14. Calorific value by Bomb calorimeter
15. Melting point test

TOTAL: 45 PERIODS
1. Determination of reaction rate constant for a saponification reaction in batch reactor I.
2. Determination of reaction rate constant for a saponification reaction in batch reactor II.
3. Determination of reaction rate constant for a saponification reaction in plug flow reactor.
4. Determination of reaction rate constant for a saponification reaction in packed bed reactor.
5. Determination of reaction rate constant for a saponification reaction in mixed flow reactor.
6. Determination of reaction rate constant for a saponification reaction in semi – batch reactor I.
7. Determination of reaction rate constant for a saponification reaction in isothermal – batch reactor.
8. Determination of the rate frequency factor and activation energy for acetic anhydride hydrolysis using adiabatic reactor.
9. Determination of the mean residence time by RTD studies in plug flow reactor.
10. Determination of the mean residence time by RTD studies in mixed flow reactor.
11. Determination of the mean residence time by RTD studies in packed bed reactor.
12. Determination of the rate constant for a saponification reaction in equal sized CSTR’s in series.

TOTAL: 45 PERIODS
UNIT IV TRANSPORT IN TURBULENT AND BOUNDARY LAYER FLOW 12
Time smoothed equation of change for velocity and temperature distribution – Time smoothed velocity distribution near a wall and circular jet – Time smoothed temperature profile near a wall, turbulent flow in pipes and jets – Time smoothed concentration and equation of continuity with application to turbulent mixing and reaction – Boundary layer theory, thickness, velocity separation and flow around objects, flat plate, application of penetration theory for high mass transfer rate.

UNIT V ANALOGIES BETWEEN TRANSPORT PROCESSES 12
Importance of analogy – Development and applications of analogies between momentum – Heat and mass transfer – Reynolds, Prandtl, Von Karman and Colburn analogies.

TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES

PC3401 EQUIPMENT DESIGN AND DRAWING II L T P C
(To Consider as Practical Subject for Examination Purpose) 2 0 2 4

UNIT I THERMODYNAMIC PROPERTIES EVALUAION FOR DESIGN 9

UNIT II HEAT EXCHANGER DESIGN 9

UNIT III EVAPORATOR DESIGN 9

UNIT IV COLUMN DESIGN 9
Design of distillation columns and Absorption columns.
UNIT V    PUMPS, FANS AND COMPRESSORS

Pumps, fans and compressors – Types and its applications – Characteristics – Piping and pressure drop calculations – Performance analysis of pumps, fans and compressors.

L: 45 P: 15 TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES

Note: Necessary Data Book is to be issued while conducting Practical Examination

PC3404    PETROLEUM SECONDARY PROCESSING TECHNOLOGY     L    T    P    C  
                        4 0 0 4

UNIT I    SECONDARY PROCESSING
12
Need and significance – Types and functions of secondary processing – Visbreaking – Processes, Operating parameters and advantages – Coking – Operating parameters and advantages.

UNIT II    CRACKING
12

UNIT III    HYDROCRACKING AND HYDROTREATING
12
Hydrocracking, principles, process requirements, product yields and qualities and residcracking – Hydrotreating – Sulphur removal, aromatics removal, hydrofinishing.

UNIT IV    REFORMING
12
Reforming – Principles, processes, operating parameters – Catalyst types, performance, effects of operating parameters – Feed quality and regeneration.

UNIT V    OTHER PROCESSES
12
Isomerisation – Processes, operating parameters, advantages – Alkylation – Processes, operating parameters, advantages – Polymerization – Processes, operating parameters, advantages.

TOTAL: 60 PERIODS
TEXT BOOKS

REFERENCES

PM3401 PROCESS ENGINEERING ECONOMICS

UNIT I ENGINEERING FLOW DIAGRAMS AND SAFETY ASPECTS 12
Safety In Process and Plant Design: Intrinsic / extrinsic safety, Safety of personnel, equipment and plant classification of plant areas, Fire protection systems, Flare systems, Safety relief valves, Flame arrestors, rupture disc and explosion venting etc., Health, Safety and Environmental hazards, Loss Prevention: Hazard Assessment Techniques: HAZOP, HAZAN, Fault Tree Analysis, etc

UNIT II PROJECT ENGINEERING 12
Project Management and Statutory Regulations: Site Layout, Plant Layout, Battery Limits and Off Site Facilities, Stages of project, Use of Milestone chart / GANT chart/BAR chart, PERT and CPM techniques for project monitoring and control, Preparation of project reports (Feasibility Reports), Annual report of a company.

UNIT III OVERVIEW OF PROCESS ECONOMICS 12
Economic decision making in the CPI, Process plant components, elements of costing and principles of accounting, Total cost components, Types and methods of cost estimation, Cost estimation for equipment and plant, Direct / indirect manufacturing costs.

UNIT IV MANUFACTURING COST ESTIMATION 12

UNIT V Profitability: Alternative investments and replacements 12
Profitability: Alternative investments and replacements, profitability standards, discounted cash flow, rate of return, capitalized cost, payment period, alternative investments, analysis with small investments, increments and replacements, Break Even Analysis.

TOTAL: 60 PERIODS
TEXT BOOKS:

PM3402               REFINERY PROCESS DESIGN               L T P C
UNIT I               MULTICOMPONENT DISTILLATION               12
Dew point and bubble point for multicomponent mixtures. Design of multicomponent distillation column, Number of variables, Selection of key components, Selection of column pressure, Feed condition, Plate-to-plate calculations, Empirical short cut methods, Introduction to rigorous solution procedures.

UNIT II              PETROLEUM REFINERY DISTILLATION               12
TBP, EFV, ASTM distillation curves and their relevance, Material balance and flash zone calculations for petroleum refinery distillation columns, Pump around and pump back calculations, Overall energy requirements, Estimation of number of equilibrium stages, Design using Packie charts and Watkins method, Introduction to rigorous solution procedure based on pseudo components.

UNIT III             COLUMN DESIGN               12

UNIT IV              FIRED HEATERS               12
Heat load calculations for furnace heaters used in crude refining, Basic constructional features, Different furnace types, Review of factors to be considered in the design of fired heaters, Introduction to manual calculations methods.

UNIT V               PUMPS AND COMPRESSORS               12
Types of pumps and compressors. Selection criteria, Power rating calculations based on process duty, Use of operating curves of centrifugal pump. NPSHR and NPSHA, Pump Cavitation, Surge problem in compressors.

TOTAL: 60 PERIODS
TEXT BOOKS:

PC3316  PROCESS DYNAMICS AND CONTROL LABORATORY       L T P C
         0 0 3 2

1. ON-OFF control of thermal process
2. Flow control loop and Flow Transmitter
3. Level Control loop and Level Transmitter
4. Pressure control loop and Pressure Transmitter
5. Control valve characteristics
6. Verifying the response of Non-Interacting and interacting level System
7. Optimum controller setting using Ziegler’s Nichols Methods
8. Optimum Controller Tuning on Level Process Station
9. pH control system
10. First order and second order system
11. Computer controlled heat exchanger (Shell and tube and Double pipe)
12. Pneumatic control valve positioned trainer
13. Cascade control trainer
14. I/P and P/I converter

*Minimum 10 experiments shall be offered.

TOTAL: 45 PERIODS

PC3406  PETROCHEMICAL ANALYSIS LABORATORY       L T P C
         0 0 3 2

1. Sulphur content determination
2. Flue gas Analysis – Orsat Apparatus
3. Aromatic Content determination
4. Hydrogen sulphide content determination
5. Mercaptan as sulphur estimation apparatus
6. Determination of Lead, Acid and Salt content
7. Oil separation from lubricating Grease (Oil Separation Apparatus)
8. Analysis of petrochemicals using UV spectrophotometer
9. Analysis of petrochemicals using NMR with MS
10. Analysis of petrochemicals using Gas chromatography
11. Biodegradation of petrochemicals
12. Bioremediation of petrochemicals
13. Refractive index of petrochemicals
14. Determination of moisture content – KF titrator
15. Total acidity determination

TOTAL: 45 PERIODS

PC3407 PETROLEUM PRODUCT TESTING LABORATORY L T P C

1. Determination of aniline point and diesel index
2. Softening point of bitumen by ring and ball method
3. Ductility and penetration number of bitumen
4. Rust preventing characteristics of lube oil
5. Drop point of greases
6. Cloud and pour point determination
7. Smoke point determination
8. Copper corrosion testing of petroleum products
9. Sediment content of crude oil and fuel oils
10. Coking tendency of oil
11. Saybolt color of petroleum products / loviband tintometer
12. Water separability of petroleum products
13. Refractive index of petroleum products
14. Hydrocarbon types in petroleum products
15. Carbon residue determination
16. Oxidation stability of gasoline and ATF
17. Bearing and grease noise characteristics

TOTAL: 45 PERIODS
GE2022  TOTAL QUALITY MANAGEMENT  L T P C  3 0 0 3

UNIT I  INTRODUCTION  9


UNIT II  TQM PRINCIPLES  9

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III  TQM TOOLS & TECHNIQUES I  9


UNIT IV  TQM TOOLS & TECHNIQUES II  9


UNIT V  QUALITY SYSTEMS  9


TOTAL: 45 PERIODS

TEXT BOOK:


REFERENCES:

UNIT I  INDUSTRIAL SAFETY
Concepts of safety – Hazard classification chemical, physical, mechanical, ergonomics, biological and noise hazards – Hazards from utilities like air, water, steam.

UNIT II  HAZARD IDENTIFICATION AND CONTROL

UNIT III  RISK MANAGEMENT

UNIT IV  SAFETY PROCEDURES

UNIT V  SAFETY IN HANDLING AND STORAGE OF CHEMICALS
Safety measures in handling and storage of chemicals – Fire chemistry and its control – Personnel protection – Safety color codes of chemicals.

TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES

The project may be considered as the ultimate exercise presented to the final semester student before graduation to measure accumulated engineering knowledge and experience. At the same time, the project itself should provide the students with some new skills, innovation and information, and strengthen the acquired ones.

The project programme consists of different assignment, allotted time, submission of report under internal faculty guidance and evaluation by external member along with internal faculty. The activities performed during a project may cover one or more of the following;
The major project may be assigned to a group of two students. The project topic allotted may be of theoretical, experimental or industrial projects to be carried out under the supervision of internal guide and external guide (in case of industrial projects).

Major projects are to be executed strictly as per the project schedule prepared during VIII semester. A committee of departmental faculty members comprising the project guide, one more faculty member and the head of department will monitor and review the progress achieved by the student at various stages. The internal assessment will be done by the committee based on the progress achieved on completion of the project work.

On completion of the project work, each student has to prepare a project report and submit the same in triplicate to the department. The project work and the report will be evaluated by the internal assessment committee for a total of 100 marks. The external university examination, which carries a total of 100 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.

CH3002 PROCESS MODELLING AND SIMULATION

UNIT I INTRODUCTION ON MODELS

Numerical solutions of model equations – Linear and non linear algebraic 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 multiple reactions – Non-isothermal CSTR – Multiplicity and stability control at the unsteady state – Non- ideal CSTR models – Multi-Parameter models with dead space and bypassing – Staged operation.

UNIT III DISTRIBUTED PARAMETER MODELS(STEADY STATE)

Formulation and solution of split boundary value problems – Shooting technique, quasi – linerization techniques, counter current heat exchanger, tublar 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

UNIT V MODEL PARAMETERS ESTIMATION

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CH2032 FERTILIZER TECHNOLOGY

UNIT I NITROGENOUS FERTILISERS
Methods of production of nitrogenous fertilizer-ammonium sulphate, nitrate, urea and calcium ammonium nitrate; ammonium chloride and their methods of production, characteristics and specifications, storage and handling.

UNIT II PHOSPHATIC FERTILISERS
Raw materials; phosphate rock, sulphur; pyrites etc., processes for the production of sulphuric and phosphoric acids; phosphates fertilizers - ground rock phosphate; bone meal-single superphosphate, triple superphosphate, triple superphosphate, thermal phosphates and their methods of production, characteristics and specifications.

UNIT III POTASSIC FERTILISERS
Methods of production of potassium chloride, potassium schoenite, their characteristics and specifications.

UNIT IV COMPLEX AND NPK FERTILISERS
Methods of production of ammonium phosphate, sulphate diammonium phosphate, nitrophosphates, urea, ammonium phosphate, mono-ammonium phosphate and various grades of NPK fertilizers produced in the country.

UNIT V MISCELLANEOUS FERTILISERS
Mixed fertilizers and granulated mixtures; biofertilisers, nutrients, secondary nutrients and micro nutrients; fluid fertilizers, controlled release fertilizers, controlled release fertilizers.

TOTAL: 45 PERIODS
TEXT BOOKS


REFERENCES


PC3005 PETROLEUM PROCESS EQUIPMENT AUXILIARIES

UNIT I ELECTRICAL MOTORS AND STARTERS

UNIT II ROTARY EQUIPMENT

UNIT III INDUSTRIAL VALVE
Needle valves – Globe, gate and ball valves – Butterfly valves – Check and needle valves – Piping system.

UNIT IV INDUSTRIAL DRYERS
Rotary fluid bed – Spray and freeze dryers – Electrosmotic dryers – Rotary dryer – Case studies.

UNIT V PROCESS UTILITY EQUIPMENTS
Vacuum devices – Filters – Cooling towers – Refrigeration systems – Flare system – Equipments for waste water treatment systems.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

PC3006   INDUSTRIAL MANAGEMENT     L T P C
         3 0 0 3

UNIT I  PERSONNEL MANAGEMENT
Principles and functions – Handling union – Negotiation process – Labour legislation in India – Managerial decision making process, tools and techniques – Role of employee through empowerment – Industrial management program – Public relation.

UNIT II  TQM TOOLS AND TECHNIQUES

UNIT III  QUALITY AND ENVIRONMENTAL MANAGEMENT SYSTEMS

UNIT IV  ENGINEERING ECONOMICS

UNIT V  PROCESS ECONOMICS

TOTAL: 45 PERIODS

TEXT BOOKS
REFERENCES

PM3001 PETROCHEMICAL UNIT PROCESSES

UNIT I FEED STOCK AND SOURCE OF PETROCHEMICALS
Overview of Petrochemical Industry – The key growth area of India, Economics – Feed stock selections for Petrochemicals – Steam cracking of Gas and Naphtha to produce Olefins, Diolefins and Production of Acetylene – Cracker product separation and BTX separation.

UNIT II SYNTHESIS GAS PRODUCTION
Steam reforming of Natural gas – Naphtha and Heavy distillate to produce Hydrogen and Synthesis gas – Production of Methanol – Oxo process.

UNIT III UNIT PROCESSES I
Fundamental and Technological principles involved in Alkylation – Oxidation – Nitration and Hydrolysis.

UNIT IV UNIT PROCESSES II
Fundamental and Technological principles involved in Sulphonation, Sulfation and Isomerisation.

UNIT V UNIT PROCESSES III
Fundamental and Technological principles involved in Halogenation and Esterification

TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES
UNIT I  BASICS OF FLUIDIZATION  9
Packed bed – Velocity – Pressure drop relations – Correlations of Ergun, Kozneykarman – On set of fluidization – Properties of fluidized beds – Development of fluidization from fixed bed.

UNIT II  FLUIDIZED BED TYPES  9

UNIT III  DESIGN ASPECTS  9

UNIT IV  HEAT AND MASS TRANSFER IN FLUIDIZED BEDS  9
Heat and mass transfer in fluidized bed systems – Industrial applications and case studies of fluidized bed systems.

UNIT V  OTHER TYPES OF FLUIDIZATION  9
Single stage and multistage fluidization – Collection of fines – Use of cyclones.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
UNIT II  ENERGY AND ENVIRONMENT  9
chemical cycles – Society and environment population and technology.

UNIT III  MANAGEMENT OF ENERGY CONSERVATION IN CHEMICAL
INDUSTRIES  9
Chemical industries – Classification – Conservation in unit operation such as separation –
Cooling tower – Drying – Conservation applied to refineries, petrochemical, fertilizers, cement,
pulp and paper, food industries – Chloroalkali industries – Conservation using optimization
techniques.

UNIT IV  ENERGY ALTERNATIVES  9
Sources of continuous power – Wind and water – Geothermal – Tidal and solar power – MHD,
fuel cells – Hydrogen as fuel.

UNIT V  ECONOMIC BALANCE IN ENERGY CONSUMPTION  9
Cost analysis – Capacity – Production rate – System rate – System cost analysis – Corporate
models – Production analysis and production using fuel inventories – Input-output analysis –
Economics – Tariffs.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

PC3008  NOVEL SEPARATION PROCESS  9

UNIT I  MEMBRANE SEPARATIONS  9
Types and choice of membranes – Plate and frame membranes, tubular membranes, spiral wound
membranes, hollow fibre membrane and their relative merits, membrane reactors, membrane

UNIT II  SEPARATIONS BY ADSORPTION TECHNIQUES  9
Types of adsorption – Nature of adsorbents – Adsorption equilibria – Adsorption hysterisis
adsorption isotherms – Effect of temperature and pressure – Freundlich equation – Stagewise
adsorption – Single and multistage crosscurrent adsorption – Break through curves and rates of
adsorption.
UNIT III  CHROMATOGRAPHY TECHNIQUES  9

UNIT IV  IONIC SEPARATIONS  9

UNIT V  ZONE MELTING  9
Zone melting – Introduction – Equilibrium Diagram – Apparatus and Applications – Large scale and continuous operations – Limitations.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

PC3010  MULTICOMPONENT DISTILLATION  L T P C
3 0 0 3

UNIT I  THERMODYNAMIC PRINCIPLES  9
General considerations in the design of columns – Column sequencing – Heuristics for column sequencing – Key components – Distributed components – Non-Distributed components – Adjacent keys.

UNIT II  THERMODYNAMIC PROPERTY EVALUATION  9
Fundamental principles involved in the separation of multi component mixtures – Determination of bubble-point and Dew Point Temperatures for multi component mixtures – equilibrium flash distillation calculations for multi component mixtures – separation of multi component mixtures at total reflux.

UNIT III  MINIMUM REFLUX RATIO FOR MCD SYSTEM  9
Definition of minimum reflux ratio – calculation of Rm for multi component distillation – Underwood method – Colburn method.
UNIT IV VARIOUS METHODS OF MCD COLUMN DESIGN 9
Theta method of convergence – Kb method and the constant composition method – Application of the Theta method to complex columns and to system of columns – Lewis Matheson method – Stage and reflux requirements – Short cut methods and Simplified graphical procedures.

UNIT V VARIOUS TYPES OF MCD COLUMNS 9
Design of sieve, bubble cap, valve trays and structured packing columns for multi component distillation – computation of plate efficiencies.

TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES

PC3012 POLYMER TECHNOLOGY L T P C
3 0 0 3

UNIT I CHARACTERISTICS, ANALYSIS OF POLYMERS 9

UNIT II POLYMER MATERIAL STRUCTURE AND PROPERTIES 9
Deformation, flow and melt characteristics – Morphology and order in crystalline polymers – Rheology and the mechanical properties of polymers – Polymer structure and physical properties.

UNIT III POLYMER SYNTHESIS AND REACTION ENGINEERING 9
Condensation polymerization – Addition polymerization – Ionic and coordination polymerization – Copolymerisation – Polymerization conditions and polymer reactions.

UNIT IV INDUSTRIAL POLYMERS: MANUFACTURING PROCESS AND APPLICATIONS 9

UNIT V PROCESSING OF POLYMERS: PLASTICS, FIBRES AND ELASTOMERS 9
Polymers developed for synthetic plastics, fibres and elastomer applications – Plastics technology – Fiber technology – Elastomer technology.

TOTAL: 45 PERIODS
TEXT BOOKS

REFERENCES