ANNA UNIVERSITY
CHENNAI - 600 025

UNIVERSITY DEPARTMENTS
REGULATIONS 2012
CURRICULA AND SYLLABI FOR
I TO VIII SEMESTERS

B.TECH. CHEMICAL ENGINEERING
(FULL TIME)
## SEMESTER I

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<td>Human Rights</td>
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OBJECTIVE

To impart basic communication skills and develop the habit of reading

OUTCOME

- To enable all students of engineering and technology develop their basic communication skills in English.
- To give special emphasis to the development of speaking skills amongst the students of engineering and technology students.
- To ensure that students use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading for pleasure.

UNIT I

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one’s place, important festivals etc. – Introducing oneself, one’s family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one’s leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

UNIT II

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking & answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Lab descriptions (general/specific description of laboratory experiments) - Definitions - Recommendations; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association; E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.
UNIT III
Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation
- Group interaction - Speaking in formal situations (teachers, officials, foreigners);
Reading
- Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause & effect / compare & contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

UNIT IV
Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations & acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

UNIT V
Listening - Listening to different accents, Listening to Speeches / Presentations, Listening to broadcast & telecast from Radio & TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar & Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents, - Interpreting posters

TOTAL : 60 PERIODS

TEXT BOOKS
REFERENCE BOOKS

EXTENSIVE READERS

Website Resources
1. www.uefap.com
2. www.eslcafe.com
3. www.listen-to-english.com
4. www.owl.english.purdue.edu
5. www.chompchomp.com

MA8151 MATHEMATICS – I
(Common to all branches of B.E. / B.Tech. Programmes)
(L T P C) 3 1 0 4
(1 SEMESTER)

OBJECTIVE
To impart the fundamental knowledge about matrices, infinite series, partial derivatives, improper and multiple integrals

OUTCOME
• To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
• To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for
solutions arising in mathematical modeling.

- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

**UNIT I  MATRICES**  
9+3


**UNIT II  INFINITE SERIES**  
9+3


**UNIT III  FUNCTIONS OF SEVERAL VARIABLES**  
9+3


**UNIT IV  IMPROPER INTEGRALS**  
9+3


**UNIT V  MULTIPLE INTEGRALS**  
9+3


**TOTAL : 60 PERIODS**
TEXT BOOKS

REFERENCES

PH8151            ENGINEERING PHYSICS             L T P C
(COMMON TO ALL BRANCHES OF B.E./B.TECH. PROGRAMMES)   3 0 0 3

OBJECTIVE
To introduce the basic physics concepts relevant to different branches of Engineering and Technology.

OUTCOME
On completion of the course the students are expected to have a thorough knowledge on the basic physics concepts relevant to different branches of Engineering and Technology.

UNIT I            PROPERTIES OF MATTER
Elasticity - Poisson’s ratio and relationship between moduli (qualitative) - Stress-strain diagram
UNIT II  ACOUSTICS AND ULTRASONICS


UNIT III  THERMAL PHYSICS


UNIT IV  APPLIED OPTICS


UNIT V  SOLID STATE PHYSICS

Nature of bonding - growth of single crystals (qualitative) - crystal systems - crystal planes and directions - expressions for interplanar distance - coordination number and packing factor for simple structures: SC, BCC, FCC and HCP - structure and significance of NaCl, ZnS, diamond and graphite - crystal imperfections: point defects, dislocations and stacking faults - unit cell, Bravais space lattices - miller indices.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS

CY8151  ENGINEERING CHEMISTRY       LTPC
(Common to all branches of Engineering and Technology)  3 0 0 3

OBJECTIVE
To introduce the basic chemistry concepts relevant to different branches of Engineering and Technology.

OUTCOME
On completion of the course the students are expected to have a thorough knowledge on thermodynamics, polymers, catalysis, spectroscopy and nanochemistry.

UNIT I CHEMICAL THERMODYNAMICS
Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius- Clapeyron equation; Maxwell relations – Van’t Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation – variation of chemical potential with temperature and pressure.

UNIT II POLYMER CHEMISTRY
Introduction: Classification of polymers – Natural and Synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerisation. Types and mechanism of polymerisation: Addition (Free Radical, cationic, anionic and living); condensation and copolymerisation. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerisation: Bulk, emulsion, solution and suspension.

UNIT III KINETICS AND CATALYSIS
UNIT IV PHOTOCHEMISTRY AND SPECTROSCOPY


UNIT V NANO CHEMISTRY


TOTAL : 45 PERIODS

TEXT BOOKS


REFERENCE BOOKS

OBJECTIVE
To introduce the basic knowledge about computers and fundamentals of C programming.

OUTCOME
On completion of the course the students are expected to have a thorough knowledge on computers and C programming.

UNIT I INTRODUCTION
8

UNIT II C PROGRAMMING BASICS
10

UNIT III ARRAYS AND STRINGS
9

UNIT IV FUNCTIONS AND POINTERS
9
Function – definition of function – Declaration of function – Pass by value – Pass by reference– Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays-
Example Problems.

UNIT V STRUCTURES AND UNIONS
9
Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

TOTAL : 45 PERIODS
TEXTBOOKS

REFERENCES

GE8152          ENGINEERING GRAPHICS          LTPC
                        2 0 3 4

OBJECTIVE
To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.

OUTCOME
On completion of the course the students are expected to have a thorough knowledge on design of various engineering products and technical drawings.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.
UNIT I PLANE CURVES AND FREE HAND SKETCHING  
Basic Geometrical constructions, Curves used in engineering practices


Visualization concepts and Free Hand sketching : Visualization principles – Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES  
Orthographic projection- principles-Principal planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS  
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES  
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS  
Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids- Prisms, pyramids and cylinders by visual ray method and vanishing point method.
COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)

Introduction to drafting packages and demonstration of their use.

TOTAL: 75 PERIODS

TEXT BOOKS

REFERENCES

PUBLICATION OF BUREAU OF INDIAN STANDARDS:

SPECIAL POINTS APPLICABLE TO UNIVERSITY EXAMINATIONS ON ENGINEERING GRAPHICS:
1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.
OBJECTIVE
To make the students understand and get hands-on in the basic concepts of practical Physics.

OUTCOME
Familiarizes the basic concept in experiments and provide strong platform to apply hands-on experience gained here for experimenting higher level concepts.

1. Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc
2. Non – uniform bending – Determination of young’s modulus
3. Lee’s disc – Determination of thermal conductivity of a bad conductor
4. Potentiometer – Determination of thermo e.m.f. of thermocouple
5. Air wedge – Determination of thickness of a thin sheet of paper
6. i. Optical fibre – Determination of Numerical Aperture and acceptance angle
    ii. Compact disc – Determination of width of the groove using laser
7. Acoustic grating – Determination of velocity of ultrasonic waves in liquids
8. Post office box – Determination of Band gap of a semiconductor
9. Spectrometer – Determination of wavelength using grating
10. Viscosity of liquids – Determination of co-efficient of viscosity of a liquid by Poiseuille’s flow

TOTAL : 30 PERIODS

OBJECTIVE
To provide hands-on experience in using PH meter, potentiometry, titration methods and estimating the strength of given solutions.

OUTCOME
Ability to perform all kinds of titrations and estimate the unknown chemical samples.

1. Estimation of HCl using Na₂CO₃ as primary standard and Determination of alkalinity in
water sample.

2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1,10-phenanthroline/thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
14. Determination of CMC.
15. Phase change in a solid.

REFERENCES


GE8161 COMPUTER PRACTICES LABORATORY

OBJECTIVE
- To enable the student to learn and use the major components of a computer system
- To make the students write programs and solve problems
- To learn to use office automation tools

OUTCOME
At the end of the lab session student will be able to use MS office and generate data, solve simple problems with C-Programming Language.

LIST OF EXPERIMENTS:
1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

TOTAL : 45 PERIODS

GE8162  ENGINEERING PRACTICES LABORATORY  LTPC
(Common to all Branches of B.E. / B.Tech. Programmes)  0 0 3 2

OBJECTIVE

To provide exposure to the students with hands-on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

OUTCOME:
- ability to fabricate carpentry components and pipe connections including plumbing works.
- ability to use welding equipments to join the structures.
- ability to fabricate electrical and electronics circuits
GROUP – A (CIVIL & ELECTRICAL)

1. CIVIL ENGINEERING PRACTICE

Plumbing
Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.

Laying pipe connection to the suction side of a pump – inlet.

Laying pipe connection to the delivery side of a pump – outlet.

Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.

Wood Work
Sawing, planning and making common joints: T-Joint, Mortise and Tennon joint, Dovetail joint.

Study
Study of joints in door panels, wooden furniture
Study of common industrial trusses using models.

2. ELECTRICAL ENGINEERING PRACTICE

Basic household wiring using switches, fuse, indicator – lamp etc.,
Preparation of wiring diagrams
Stair case light wiring
Tube – light wiring
Study of iron-box, fan with regulator, emergency lamp

GROUP – B (MECHANICAL AND ELECTRONICS)

3. MECHANICAL ENGINEERING PRACTICE

Welding
Arc welding of butt joints, lap joints, tee joints
Gas welding Practice.
Basic Machining
Simple turning, drilling and tapping operations.
Machine assembly Practice.
Study and assembling the following:
Centrifugal pump, mixies and air conditioners. Demonstration on
(a) Smithy operations like the production of hexagonal bolt.
(b) Foundry operation like mould preparation for grooved pulley.

4. **ELECTRONIC ENGINEERING PRACTICE**
Soldering simple electronic circuits and checking continuity.
Assembling electronic components on a small PCB and testing. Study of Telephone, FM radio, low-voltage power supplies.

**TOTAL: 45 PERIODS**

**HS8251**
**TECHNICAL ENGLISH II**
**(For all branches of B.E / B.Tech programmes)**

**OBJECTIVE**
- To make the students acquire listening and speaking skills meant for both formal and informal contexts
- To help them develop their reading skills by exposing them to different types of reading strategies
- To equip them with writing skills needed for academic as well as workplace situations
- To make them acquire language skills at their own pace by using e-materials and language lab component

**OUTCOME**
On completion of the course the students are expected to acquire various linguistics skills required for academic and workplace situations.

**UNIT I**
9+3
Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on something, weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and Inductive reasoning - Extensive reading; Writing
Effective use of SMS for sending short notes and messages - Using 'emoticons' as symbols in email messages; Grammar - Regular & irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

UNIT II

Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his success, thanking one’s friend / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercise on Grammar and vocabulary, Extensive reading activity (reading stories / novels from links), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording student’s dialogues.

UNIT III

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret etc.); Reading - Speed reading – reading passages with the time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading the articles from the journals - Format for the journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar & vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU materials – Attending a meeting and writing minutes.

UNIT IV

Listening - Listening to a telephone conversation, Viewing a model interview (face-to-face, telephonic and video conferencing) and observing the practices; Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping the interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on Grammar & Vocabulary - Different forms of résumés- Filling up a résumé / cover letter;
Language Lab - Telephonic interview – recording the responses - e-résumé writing.

UNIT V 9+3
Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading Writing - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises - Pictures for discussion; Language Lab - Different models of group discussion

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCE BOOKS

Extensive Readers
Web Resources
1. www.esl-lab.com
2. www.englishgrammar.org
3. www.englishclub.com
4. www.mindtools.com
5. www.esl.about.com

MA8251 MATHEMATICS II
(Common to all branches of B.E. / B.Tech. Programmes in II Semester) 3 1 0 4

OBJECTIVE
To impart the fundamental knowledge about differential equations, vector calculus, analytic functions, complex integration and Laplace transforms.

OUTCOME
• To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
• To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
• To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current.
• To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I DIFFERENTIAL EQUATIONS 9+3
Method of variation of parameters – Method of undetermined coefficients – Homogenous equation of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

UNIT II VECTOR CALCULUS 9+3
Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral and volume integral - Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.
UNIT III  ANALYTIC FUNCTION


UNIT IV  COMPLEX INTEGRATION


UNIT V  LAPLACE TRANSFORMS


TOTAL : 60 PERIODS

TEXT BOOKS


REFERENCES

PH8255 PHYSICS OF MATERIALS L T P C
(Common to Chemical, Ceramic, Food, Leather,
Industrial Biotechnology and Pharmaceutical) 3 0 0 3

OBJECTIVE
To introduce the physics of various materials relevant to different branches of technology.

OUTCOME
On completion of the course the students are expected to have a thorough knowledge on the various materials and their physical properties.

UNIT I PREPARATION AND PROCESSING OF MATERIALS 9

UNIT II PROPERTIES OF CONDUCTING AND SUPERCONDUCTING MATERIALS 9

UNIT III ELECTRONIC MATERIALS 9
Elemental and compound semiconductors - Origin of band gap in solids (qualitative) - Concept of effective mass of electron and hole – carrier concentration in an intrinsic semiconductor (derivation) – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – carrier concentration in n-type and p-type semiconductors (derivation) – variation of Fermi level with temperature and impurity concentration – Compound
semiconductors – Hall effect – Determination of Hall coefficient – LED and Solar cells.

UNIT IV INSULATING AND MAGNETIC MATERIALS


UNIT V CERAMIC AND NEW MATERIALS


TOTAL : 45 PERIODS

REFERENCES

OBJECTIVE
To introduce the chemistry involved in various technology.

OUTCOME
On completion of the course the students are expected to have a thorough knowledge on the chemistry of water, interfaces, oils, fats, chemicals and colorants.
UNIT I WATER

UNIT II CHEMISTRY OF INTERFACES

UNIT III OILS, FATS, SOAPS & LUBRICANTS
Chemical constitution, Chemical analysis of oils and fats – acid, saponification and iodine values, Definitions, determinations and significance. Definition, mechanism of lubrication, preparation of petrolubes, desirable characteristics – viscosity, viscosity index, carbon residue, oxidation stability, flash and fire points, cloud and pour points, aniline point. Semisolid lubricant – greases, preparation of sodium, lithium, calcium and axle greases and uses, consistency test and drop point test. Solid lubricants – graphite and molybdenum disulphide

UNIT IV CHEMICALS AND AUXILIARIES

UNIT V COLORANTS
Theory of color and constitution: chromophore and auxochrome, classification of dyes based on application. Chemistry and synthesis of azo dye.

TOTAL : 45 PERIODS

REFERENCES
GE8251 ENGINEERING MECHANICS

OBJECTIVE

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering

OUTCOME

On completion of the course the students are expected to study the effect of force and motion in various design functions of engineering.

UNIT I BASICS AND STATICS OF PARTICLES 9 + 3


UNIT II EQUILIBRIUM OF RIGID BODIES 9 + 3

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Vectorial components of a moment – Varignon’s theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS 9 + 3

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments

UNIT IV DYNAMICS OF PARTICLES 9 + 3

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 9 + 3
Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction –wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
AIM
To introduce and provide an overview of chemical engineering

OBJECTIVE
To enable the students to learn about the fluid flow, heat transfer and mass transfer in engineering applications.

OUTCOMES
On completion of the course, students
- Will attain knowledge in fluid behavior and solid properties
- Will understand conduction of heat and mass
- Will familiarize in equipments for distillation.

UNIT I
Chemistry, Chemical Engineering and Chemical Technology; Chemical process industries: History and their role in Society; Role of Chemical Engineer; History and Personalities of Chemical Engineering; Greatest achievements of Chemical Engineering.

UNIT II
Components of Chemical Engineering: Role of Mathematics, Physics, Chemistry and Biology; Thermodynamics, Transport Phenomena, Chemical Kinetics and Process dynamics, design and control.

UNIT III
Concept of Unit Processes and Unit Operations; Description of different Unit Processes and Unit Operations; Designing of equipments; Flowsheet representation of process plants, Evolution of an Industry – Sulphuric acid and Soda ash manufacture. Demonstration of simple chemical engineering experiments; Plant visit to a chemical industry

UNIT IV
Role of Computer in Chemical Engineering; Chemical Engineering Software; Visit to Process Simulation Lab; Relation between Chemical Engineering and other engineering disciplines; Traditional vs. modern Chemical Engineering; Versatility of Chemical Engineering: Role of Chemical Engineers in the area of Food, Medical, Energy, Environmental, Biochemical, Electronics etc. Plant visit to an allied industry.

UNIT V
Paradigm shifts in Chemical Engineering; Range of scales in Chemical Engineering; Opportunities for Chemical Engineers; Future of Chemical Engineering.
TEXT BOOKS

REFERENCE BOOKS

EE8252 PRINCIPLES OF ELECTRICAL AND ELECTRONICS ENGINEERING

OBJECTIVES:
- To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines.
- To explain the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics
- To impart knowledge of communication

OUTCOMES:
- ability to identify the electrical components explain the characteristics of electrical machines.
- ability to identify electronics components and use of them to design circuits.

UNIT I ELECTRICAL CIRCUITS
Basic principles involved in power generation, transmission and use – Ohms Law Kirchoff’s Law – steady state solution of DC circuits – Theorem: Thevinin’s, Norton’s and Superposition Theorems.

UNIT II AC CIRCUITS
Introduction to AC circuits – waveforms and RMS value – power and power factor, single phase and three-phase balanced circuits, housing wiring, industrial wiring, materials of wiring.
UNIT III    ELECTRICAL MACHINES

UNIT IV    ELECTRONIC DEVICES & CIRCUITS

UNIT V    MEASUREMENTS & INSTRUMENTATION
Introduction to transducers: pressure, temperature, position, electrical measurements - Classification of instruments – moving coil and moving iron ,Ammeter and Voltmeter – multimeters – dynamometer type Wattmeter – three-phase power measurements – energy meter – megger – instrument transformer (CT and PT )

TOTAL : 45 PERIODS

REFERENCES

CY8261    APPLIED CHEMISTRY LAB

OBJECTIVE
- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.
OUTCOMES

- The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

LIST OF EXPERIMENTS

1. Preparation of solutions with various normality and molarity.
2. Determination of Redwood / Saybolt numbers, kinematic viscosity and viscosity index of lubricating oils
3. Determination of flash point, fire point, cloud and pour point of oils
4. Determination of acid value, saponification number and iodine value of oils
5. Determination of total, temporary, permanent, calcium and magnesium hardness of water samples
6. Determination of chloride, sulphate, and COD of water samples
7. Determination of purity of washing soda and strength of a commercial acid
8. Estimation of available chlorine in hypochlorite solution
9. Estimation of strength of hydrogen peroxide
10. Synthesis of a dye, preparation of soap and a defoamer

TOTAL: 45 PERIODS

CH8261 UNIX PROGRAMMING LAB LTPC 0 0 4 2

OBJECTIVE

To introduce working in UNIX environment.

OUTCOME

- To introduce the basic commands in UNIX.
- To teach UNIX shell programming.
- To introduce programming in C with UNIX system calls.

1. Basic Unix commands
   i) Directory Related Commands
   ii) File Related Commands.
   iii) File Compression Related Commands
   iv) Network Communication Commands
   v) Commands for sending messages between the users
vi) Miscellaneous Commands

2. Editors for file operations.
   i) Vi Editor
   ii) Gedit
   iii) Kwrite

3. Filters and Pipes
   i) Concatenating Files
   ii) Display beginning and End of Files
   iii) Cut and Paste
   iv) Sorting
   v) Translating Characters
   vi) Count Characters, words, Lines
   vii) Comparing Files


5. Sed Operations – Sed Scripts, Addresses, Commands

6. Awk

7. Input Redirection and Out Redirection Commands

8. Simple shell programming.

9. Shell programming using complex control structures
   i) if - fi
   ii) if-else-fi
   iii) if-elif
   iv) case-esac
   v) while- do- done
   vi) For-do-done

10. Shell Programming using Arrays & Functions.

11. C Programs using file system related system calls.

12. C Programs using process related system calls.

13. Programs for inter process communication using pipes, FIFOs.

14. Programs using signals.

15. Programs using shared memory.

TOTAL : 60 PERIODS
TEXT BOOK

REFERENCE

MA8356 PROBABILITY AND STATISTICS L T P C
3 1 0 4

OBJECTIVES
• To make the students acquire a sound knowledge in statistical techniques that model engineering problems.
• The Students will have a fundamental knowledge of the concepts of probability.

OUTCOME:
Understand the fundamentals of probability concepts
Apply different probability test to the experiential work and research work
Apply statistical tool to the different real process.

UNIT I RANDOM VARIABLES 9+3
Discrete and Continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 9+3
Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTS OF SIGNIFICANCE 9+3
UNIT IV DESIGN OF EXPERIMENTS

Completely randomized design – Randomized block design – Latin square design - 22 - factorial design - Taguchi’s robust parameter design.

UNIT V STATISTICAL QUALITY CONTROL

Control charts for measurements ( and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL : 60 PERIODS

TEXT BOOKS


REFERENCES


CY8301 ORGANIC CHEMISTRY L T P C 3 0 0 3

OBJECTIVES

- To study the type of components in which organic reactions take place and also to know the preparation of the essential organic compounds.

OUTCOME:

Understand the classification of carbohydrates and preparation of heterocyclic compounds.
Understanding the dye chemistry and synthesis of dyes.
Apply the concept to prepare organic compounds and synthesis the ant malarial and Antibacterial drugs.
UNIT I CARBOHYDRATES
Introduction – various definitions and classifications of carbohydrates – Preparation, Physical & Chemical properties, Structure and Uses of Monosaccharides (Glucose & Fructose) Interconversions – Aldo pentose to aldo hexose–Aldo hexose to aldo pentose- aldose to isomeric Ketose – Ketose to isomeric Aldose – Aldose to epimer

UNIT II HETERO CYCLIC COMPOUNDS
Preparation, Physical & Chemical properties and Uses of Pyrrole, Furan, Furfural, TetrahydroFuran, Thiophene, Indole, Pyridine, Quinoline and Isoquinoline.

UNIT III DYE CHEMISTRY
Witt’s theory and modern theory of colors – Synthesis of Methyl red, Methyl orange, Congo red, Malachite green, para-rosaniline, phenolphthalein, fluorescence, Eosin dyes.

UNIT IV SYNTHETIC ORGANIC CHEMISTRY
Preparation and Synthetic utilities of Grignard reagent, Ethyl aceto acetate and Malonic ester.

UNIT V PHARMACEUTICAL CHEMISTRY

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS
OBJECTIVES

- To make the students acquire a sound knowledge on the principle of spectroscopy, NMR, chromatography and its application

OUTCOME:
Understand the working principle and application of spectroscopy
Understand the NMR principle and its application
Understand the chromatography principle and its application
Understand the fundamentals of electro analysis and surface microscopy

UNIT I INTRODUCTION OF SPECTROMETRY
Properties of electromagnetic radiation - wave properties - components of optical instruments
- Sources of radiation - wavelength selectors - sample containers - radiation transducers
- Signal process and read outs - signal to noise ratio - sources of noise - Enhancement of signal to noise - types of optical instruments - Principle of Fourier Transform optical Measurements.

UNIT II MOLECULAR SPECTROSCOPY

UNIT III MAGNETIC RESONANCE SPECTROSCOPY AND MASS SPECTROMETRY
Theory of NMR - environmental effects on NMR spectra - chemical shift - NMR-spectrometers - applications of 1H and 13C NMR - Molecular mass spectra - ion sources - Mass spectrometer.
Applications of molecular mass - Electron paramagnetic resonance - g values - instrumentation.

UNIT IV SEPARATION METHODS

UNIT V ELECTRO ANALYSIS AND SURFACE MICROSCOPY
Electrochemical cells - Electrode potential cell potentials - potentiometry - reference electrode - Ion selective and molecular selective electrodes - Instrument for potentiometric studies - Voltametry - Cyclic and pulse voltametry - Applications of voltametry. Study of surfaces -
Scanning probe microscopes – AFM and STM.

TOTAL : 45 PERIODS

TEXT BOOK

CH8351            SOLID MECHANICS FOR TECHNOLOGISTS            L T P C
3 0 0 3

AIM
To given them knowledge on structural, Mechanical properties of Beams, columns.

OBJECTIVES
• The students will be able to design the support column, beams, pipelines, storage tanks and reaction columns and tanks after undergoing this course. This is precursor for the study on process equipment design and drawing.

OUTCOMES:
• Solve the problems related to the structural components under various loading conditions

UNIT I      STRESS, STRAIN AND DEFORMATION OF SOLIDS
9

UNIT II   TRANSVERSE LOADING ON BEAMS
9

UNIT III    DEFORMATIONS OF BEAMS
9
Double integration method – Macaulay’s method – Area – moment theorems for computation of slopes and deflections in beams.
UNIT IV  STRESSES IN BEAMS

UNIT V  TORSION AND COLUMNS
Torsion of circular shafts – derivation of torsion equation \(T/J = fs/R = C\theta/L\) – stress and deformation in circular and hollow shafts – stresses and deformation in circular and hollow shafts – stepped shafts – shafts fixed at both ends – stresses in helical springs – deflection of springs – spring constant. Axially loaded short columns – columns of unsymmetrical sections – Euler’s theory of long columns – critical loads for prismatic columns with different end conditions – effect of eccentricity.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE

CH8301  FLUID MECHANICS FOR CHEMICAL ENGINEERS  LTPC 3 0 0 3

OBJECTIVES
- To acquire a sound knowledge on fluid properties, fluid statics, dynamic characteristics for through pipes and porous medium, flow measurement and fluid machineries

OUTCOME
Understand the fundamental properties of fluids and its characteristics under static conditions. Develop empirical correlation using dimensionless analysis.
Analyze flow of fluid through pipe and over the of solid
Understand and select flow meter(s), characteristics of pumps used in Chemical Process Industries

UNIT I
Methods of analysis and description - fluid as a continuum – Velocity and stress field - Newtonian and non-Newtonian fluids – Classification of fluid motion

UNIT II
Fluid statics – basic equation - equilibrium of fluid element – pressure variation in a static fluid - application to manometry – Differential analysis of fluid motion – continuity, equation of motions, Bernoulli equation and Navier-Stokes equation.

UNIT III
The principle of dimensional homogeneity – dimensional analysis, Rayleigh method and the Pi-theorem - non-dimensional action of the basic equations - similitude - relationship between dimensional analysis and similitude - use of dimensional analysis for scale up studies

UNIT IV
Reynolds number regimes, internal flow - flow through pipes – pressure drop under laminar and turbulent flow conditions – major and minor losses; Line sizing; External flows - boundary layer concepts, boundary layer thickness under laminar and turbulent flow conditions- Flow over a sphere – friction and pressure drag - flow through fixed and fluidized beds.

UNIT V
Flow measurement - Constant and variable head meters; Velocity measurement techniques; Types, characteristics and sizing of valves; Classification, performance characteristics and sizing of pumps, compressors and fans

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

CH8302 PROCESS CALCULATIONS

OBJECTIVES

- To acquire a concept of degree of freedom and its application to solution of mass and energy balance equations for single and network of units and introduce to process simulators

OUTCOME

Understand the fundamentals of units and stoichiometric equations.
Write material balance for different chemical process.
Understand the fundamentals of ideal gas behavior and phase equilibria.
Write energy balance for different chemical process.

UNIT I

Units, dimensions and conversion; Process variables and properties; Stoichiometric Equations, Degrees of freedom.

UNIT II

Introduction to material balances. Material balance problems for single units; Stoichiometry and Chemical reaction equations; material balance for processes involving reaction bypass, purging, recycle operations.

UNIT III

Ideal gases, Real gases, Single component two phase systems, Multiple component phase systems, Phase rule, Phase equilibria, Combustion processes.

UNIT IV


UNIT V

47
Application of energy balances. Unsteady state material and energy balances. Solving material and energy balances using process simulators.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

ME8351 BASIC MECHANICAL ENGINEERING

OBJECTIVES
- Students will learn thermodynamics and thermal engineering to understand the principles behind the operation of thermal equipments like IC engines and turbines etc.,
- Students should be able to appreciate the theory behind operation of machinery and be able to design simple mechanisms

OUTCOME
- Apply the law of thermodynamics to the real systems
- Understand and analyse different thermodynamic cycles, calculate their thermal efficiencies and the testing of I.C engines.
- Understand the Steam distribution and utilisation systems and comprehend principles of steam turbines
- Understand the principle of kinematic mechanics, flywheel and belt & rope drives

UNIT I LAWS OF THERMODYNAMICS
Basic concepts and hints; Zeroth law; First Law of Thermodynamics - Statement and application; Steady flow energy equation-problems- Second law of Thermodynamics – Kelvin

UNIT II HEATING AND EXPANSION OF GASES 6
Expressions for work done, Internal energy and heat transfer for Constant Pressure, Constant Volume, Isothermal, Adiabatic and Polytropic processes-Derivations and problems; Free expansion and Throttling process.

UNIT III AIR STANDARD CYCLES 6
Carnot cycle; Stirlings cycle; Joule cycle; Otto cycle; Diesel cycle; Dual combustion Cycle-Derivations and problems.

UNIT IV I.C. ENGINES, STEAM AND ITS PROPERTIES AND STEAM TURBINES 12
Engine nomenclature and classification; SI Engine; CI Engine; Four Stroke cycle, Two stroke cycle; Performance of I.C.Engine; Brake thermal efficiency; Indicated Thermal Efficiency, Specific fuel consumption.

Steam - Properties of steam; Dryness fraction; latent heat; Total heat of wet steam; Dry steam; Superheated steam. Use of steam tables; volume of wet steam, volume of superheated steam; External work of evaporation; Internal energy; Entropy of vapour, Expansion of vapour, Rankine cycle.

Steam turbines – Impulse and Reaction types - Principles of operation.

UNIT V SIMPLE MECHANISM, FLY WHEEL, DRIVES AND BALANCING 11
Definition of Kinematic Links, Pairs and Kinematic Chains;

Flywheel-Turning moment Diagram; Fluctuation of Energy.

Belt and rope drives; Velocity ratio; slip; Creep; Ratio of tensions; Length of belt; Power Transmitted; gear trains-types.

Balancing of rotating masses in same plane; Balancing of masses rotating in different planes.

TOTAL : 45 PERIODS

TEXT BOOKS
REFERENCES


OBJECTIVES
- To provide the practical knowledge and control methods of electrical machines

OUTCOME
Conduct load test as DC Shunt and series motor, evaluate the open circuit and load characteristics of different DC generator and interpret the results. Perform short circuit, open circuit and load test on single phase transformers and interpret the results. Conduct load test on single and three phase induction motor and interpret the results. Ability to conduct regulation of three phase generator test and interpret the results.

1. Study of Starters
2. Power Measurements in Three-Phase Circuits
3. Speed Control of DC Motor
4. Load Test on DC Shunt Motor
5. OCC & Load Test on DC Shunt Generator
7. OC and SC Test on Single-Phase Transformer
8. Load Test on Single-Phase Transformer
9. Load Test on Single-Phase Induction Motor
10. Load Test on Three-Phase Induction Motor
11. Load Characteristics of Alternator.

TOTAL : 60 PERIODS
OBJECTIVES

• To learn basic principles involved in analysis and synthesis of different organic derivatives.

OUTCOME:

Conduct simple experiments to identify the nature (aliphatic/ aromatic), (Saturated/Unsaturated) of organic compounds
Conduct simple experiments to identify the functional groups
Prepare organic compounds like acetanilide, salicylate, m-dinitrobenzene etc.,

1. Quantitative analysis of organic compounds – Identification of aliphatic/aromatic, saturated/unsaturated compounds.
2. Identification and characterization of various functional groups by their characteristic reactions:
   a) alcohol, b) aldehyde, c) ketone, d) carboxylic acid, e) phenol, f) ester, g) primary, secondary and tertiary amines h) imide i) nitro compounds.
5. Analysis of proteins.
6. Methodology of filtration and recrystallization.
7. Introduction to organic synthetic procedures:
   i. Acetylation – Preparation of acetanilide from aniline.
   ii. Hydrolysis – Preparation of salicylic acid from methyl salycilate.
   iii. Substitution – Conversion of acetone to iodoform.
   iv. Nitration – Preparation of m-dinitrobenzene from nitrobenzene.
   v. Oxidation – Preparation of benzoic acid from benzaldehyde/ benzyl alcohol

TOTAL: 60 PERIODS

REFERENCE MANUAL

MA8353 NUMERICAL METHODS  L T P C  3 1 0 4

OBJECTIVES
• To provide the mathematical foundations of numerical techniques for solving linear system, Eigen value problems, interpolation, numerical differentiation and integration and the errors associated with them;
• To demonstrate the utility of numerical techniques of ordinary and partial differential equations in solving engineering problems where analytical solutions are not readily available.

OUTCOME
Solve linear algebraic & transcendental equations and interpolation problems
Understand concepts of numerical differentiations and integration to solve problems using different methods.
Understand and solve boundary value problems in partial, differential equations using Laplace, Poisson method; understand and solve wave equations.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

UNIT II INTERPOLATION AND APPROXIMATION 9+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 – Least square method - Linear curve fitting.

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

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.

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES

OBJECTIVES

- To acquire knowledge in the field of electrochemistry, solubility behaviour, chemical reaction kinetics, photochemical reactions and colloidal chemistry towards different applications.

OUTCOME:

Understand the basic principles of electrochemistry and colloids to apply for their application in Chemical Engineering practice.
Understand kinetics and theory of reaction rates concepts
Understand the fundamentals of photochemistry and the concept of distribution law.

UNIT I ELECTROCHEMISTRY

Electrical Resistance – Specific Resistance – Electrical conductance – Specific conductance – Equivalent conductance – Cell constant – Determination of cell constant – Variation of

UNIT II CHEMICAL KINETICS

UNIT III PHOTOCHEMISTRY

UNIT IV COLLOIDS

UNIT V THE DISTRIBUTION LAW

TOTAL : 45 PERIODS

TEXT BOOKS
REFERENCES

CH8401 CHEMICAL ENGINEERING THERMODYNAMICS- I

OBJECTIVES
• Students will learn PVT behaviour of fluids, laws of thermodynamics, thermodynamic property relations and their application to fluid flow, power generation and refrigeration processes.

OUTCOME:
Understand the fundamental concepts of thermodynamics
Apply second law and analyze the feasibility of systems/devices; understand the real gas behaviour
Understand thermodynamic formulations and the working of compressors and expanders.

UNIT I
Scope of thermodynamics; Definition of system, control volume, state and path function, equilibrium, reversibility, energy, work and heat. zeroth law; temperature scales

UNIT II
PVT behaviour of fluids; Mathematical representation of PVT behaviour; Generalized compressibility factor correlation; Generalized equations of state

UNIT III
Joule’s experiment, internal energy, first law, energy balance for closed systems, mass and energy balance for open systems Statements of the second law of thermodynamics, heat engine and refrigerator, Carnot cycle and Carnot theorems, thermodynamic temperature scale, entropy and its calculation, second law of thermodynamics for a control volume, Third law of thermodynamics, entropy from a microscopic point of view.

UNIT IV
Thermodynamic potentials – internal energy, enthalpy, Helmholtz free energy, Gibbs free energy; thermodynamic property relations – Maxwell relations – partial derivatives and Jacobian method; residual properties; thermodynamic property tables and diagrams
UNIT V
Duct flow of compressible fluids, Compression and expansion processes, steam power plant, internal combustion engines, jet and rocket engines.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

CH8402 HEAT TRANSFER

OBJECTIVES
• To learn heat transfer by conduction, convection and radiation and heat transfer equipments like evaporator and heat exchanger

OUTCOME:
Understand the fundamentals of heat transfer mechanism
Evaluate film coefficients.
Understand the applications of heat transfer equipments and determine the efficiency and effectiveness of evaporators and heat exchangers.

UNIT I
Importance of heat transfer in Chemical Engineering operations - Modes of heat transfer - Fourier’s law of heat conduction - one dimensional steady state heat conduction equation for flat plate, hollow cylinder, - Heat conduction through a series of resistances - Thermal conductivity measurement; effect of temperature on thermal conductivity; Heat transfer in extended surfaces.
UNIT II
Concepts of heat transfer by convection - Natural and forced convection, analogies between transfer of momentum and heat - Reynold's analogy, Prandtl and Coulburn analogy. Dimensional analysis in heat transfer, heat transfer coefficient for flow through a pipe, flow past flat plate, flow through packed beds.

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, Heat transfer to boiling liquids - mechanism of boiling, nucleate boiling and film boiling.

UNIT IV

UNIT V
Log mean temperature difference - Single pass and multipass heat exchangers; plate heat exchangers; use of correction factor charts; heat exchangers effectiveness; number of transfer unit - Chart for different configurations - Fouling factors

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVES

- Students will be able to understand various material and its properties and manufacturing methods

OUTCOME:
Understand basic and the mechanical behavior of the metals
Understand phase diagrams and phase transformations of metals.
Understand the manufacturing process of ferrous, non-ferrous metals and composites.
Understand the basic concepts of nano materials

UNIT I  INTRODUCTION  10

UNIT II  MECHANICAL BEHAVIOUR  8

UNIT III  PHASE DIAGRAMS AND PHASE TRANSFORMATIONS  8
Gibb’s Phase rule : Uniary and Binary phase diagrams , $\text{Al}_2\text{CO}_3$ - $\text{Cr}_2\text{O}_3$, Pb-Sn, Ag-Pt and Iron- Iron Carbide Phase Diagram – Lever rule – Invariant reactions- TTT diagrams – Micro structural changes – Nucleation and growth – Martensitic transformations – Solidification and Crystallization – Glass transition – Recrystallization and Grain growth

UNIT IV  FERROUS, NON-FERROUS METALS AND COMPOSITES  10
Pig iron, Cast iron, Mild Steel-Manufacturing process, properties & Applications Stainless steels, Special Alloy steels-properties and uses; Heat treatment of plain-carbon steels.

Manufacturing methods of Lead, Tin and Magnesium. Properties and applications in process industries.

FRP-Fiber Reinforced Plastics (FRP), manufacturing methods; Asphalt and Asphalt mixtures; Wood.
UNIT V  NANOMATERIALS


TOTAL : 45 PERIODS

TEXT BOOKS
4. Material Science & Engineering, Callister

REFERENCES

CH8404  MECHANICAL OPERATIONS  L T P C
3 0 0 3

OBJECTIVES
• The students will learn characterization of solids, size reduction, techniques of solid - fluid separation and mixing

OUTCOME:
Apply the principles of size analysis and size reduction techniques of solids by selecting proper equipments such as crushers, grinders, etc., Understand the working principles of thickeners, gravity settling tanks, cyclone separators, Filters and other mechanical separation devices Select mixing and agitation equipments, storage and transportation equipments used for handling solids in Chemical process industries.
UNIT I
General characteristics of solids, different techniques of size analysis, shape factor, surface area determination, estimation of particle size. Screening methods and equipment, screen efficiency, ideal and actual screens.

UNIT II
Laws of size reduction, energy relationships in size reduction, methods of size reduction, classification of equipments, crushers, grinders, disintegrators for coarse, intermediate and fine grinding, power requirement, work index; size enlargement - principle of granulation, briquetting, pelletisation, and flocculation.

UNIT III
Gravity settling, sedimentation, thickening, elutriation, double cone classifier, rake classifier, bowl classifier. Centrifugal separation - continuous centrifuges, super centrifuges, design of basket centrifuges; industrial dust removing equipment, cyclones and hydro cyclones, electrostatic and magnetic separators, heavy media separations, floatation, jigging

UNIT IV
Theory of filtration, Batch and continuous filters, 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.

UNIT V
Mixing and agitation - Mixing of liquids (with or without solids), mixing of powders, selection of suitable mixers, power requirement for mixing. Storage and Conveying of solids - Bunkers, silos, bins and hoppers, transportation of solids in bulk, conveyer selection, different types of conveyers and their performance characteristics.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVES

- To learn experimentally to calibrate flow meters, find pressure loss for fluid flows and determine pump characteristics.

OUTCOME:

Use variable area flow meters and variable head flow meters
Analyze the flow of fluids through closed conduits, open channels and flow past immersed bodies
Select pumps for the transportation of fluids based on process conditions/requirements and fluid properties

LIST OF EXPERIMENTS

1. Viscosity measurement of non Newtonian fluids
2. Calibration of constant and variable head meters
3. Calibration of weirs and notches
4. Open drum orifice and draining time
5. Flow through straight pipe
6. Flow through annular pipe
7. Flow through helical coil and spiral coil
8. Losses in pipe fittings and valves
9. Characteristic curves of pumps
10. Pressure drop studies in packed column
11. Hydrodynamics of fluidized bed
12. Drag coefficient of solid particle

EQUIPMENT REQUIRED

1. Viscometer
2. Venturi meter
3. Orifice meter
4. Rotameter
5. Weir
6. Open drum with orifice
7. Pipes and fittings
8. Helical and spiral coils
9. Centrifugal pump
10. Packed column
OBJECTIVE

- To learn basic principles involved in estimation and characterization of industrially important materials.

OUTCOME:

Analyse and determine the various properties of soap, oils, cement, coal and fuels
Able to determine molecular weight of polymers.
Able to determine the properties of substance using calorimetric, conductivity and pH measurement techniques.

I. Soap Analysis
   - Estimation of total fatty acid
   - Estimation of percentage alkali content

II. Oil Analysis
   - Estimation of free acid
   - Determination of Saponification value
   - Determination of iodine value

III. Cement Analysis
   - Estimation of Silica content
   - Estimation of mixed oxide content
   - Estimation of calcium oxide content
   - Estimation of calcium oxide by rapid method

IV. Coal Analysis
   - Estimation of Sulphur present in coal
   - Ultimate analysis of coal
   - Proximate analysis of coal

V. Analysis of Bleaching Powder
   - Estimation of available chlorine

VI. Analysis of Glycerol
a. Estimation of purity of glycerol

VII. Analysis of fuels
a. Flash point b. Fire point c. Cloud point d. Pour point e. Aniline point.

VIII. Determination of the molecular weight of the polymer by viscometry.
IX. Calorimetric measurements

X. Conductivity measurement of an electrolyte solution

XI. pH measurements

TOTAL: 60 PERIODS

REFERENCE MANUAL

OBJECTIVES
• Students will be able to understand Power-generating units such as engines and operate IC engines and conduct tests. They will be able to appreciate the theory behind the functioning of engines. Material properties, their behavior under different kinds of loading and testing can be visualized.

OUTCOME
Able to carry out performance test using Diesel and petrol Engine

LIST OF EXPERIMENTS
1. Port timing diagram
2. Valve timing diagram
3. Study of 2,4 stroke I C Engines
4. Load test on 4-stroke petrol engine
5. Performance test on 4-stroke single cylinder diesel engine
6. Performance test on 4-stroke twin cylinder diesel engine
7. Heat balance test on diesel engines
8. Tension test
9. Compression test
10. Deflection test
11. Hardness test (Rockwell and Brinell)
12. Spring test
13. Torsion test
14. Impact test

TOTAL: 45 PERIODS

* Minimum 10 experiments shall be offered

GE8351  ENVIRONMENTAL SCIENCE AND ENGINEERING  L T P C
3 0 0 3

OBJECTIVES

- Students acquire knowledge about the environment, ecosystems and biodiversity

OUTCOME:

Understand the environment, ecosystems and biodiversity
Understand the natural resources available in the earth and how it get polluted
Understand the influence of social issues and human population on the Environment

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

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 – soil 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

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


UNIT V HUMAN POPULATION AND THE ENVIRONMENT

TEXT BOOKS

REFERENCES
OBJECTIVES

- The Students will be well versed with the behavior of fluids under PVT conditions and also apply them for practical purpose. Main advantage will be to deal with power production and refrigeration processes. The study further provides a comprehensive exposition to theory and application of solution thermodynamics.

OUTCOME:

Understand and evaluate the thermodynamic properties of pure fluids and solutions
Evaluate and analyze the phase equilibrium data
Analyze chemical reaction rates and evaluate the performance of refrigeration cycles

UNIT I  PROPERTIES OF SOLUTIONS

Partial molar properties, ideal and non-ideal solutions, standard states definition and choice, Gibbs-Duhem equation, excess properties of mixtures.

UNIT II  PHASE EQUILIBRIA

Criteria for equilibrium between phases in multi component non-reacting systems in terms of chemical potential and fugacity, application of phase rule, vapour-liquid equilibrium, phase diagrams for homogeneous systems and for systems with a miscibility gap, effect of temperature and pressure on azeotrope composition, liquid-liquid equilibrium, ternary liquid-liquid equilibrium.

UNIT III  CORRELATION AND PREDICTION OF PHASE EQUILIBRIA

Activity coefficient-composition models, thermodynamic consistency of phase equilibria, application of the correlation and prediction of phase equilibria in systems of engineering interest particularly to distillation and liquid extraction processes.

UNIT IV  CHEMICAL REACTION EQUILIBRIA

Definition of standard state, standard free energy change and reaction equilibrium constant, evaluation of reaction equilibrium constant, prediction of free energy data, equilibria in chemical reactors, calculation of equilibrium compositions for homogeneous chemical reactors, thermodynamic analysis of simultaneous reactions.

UNIT V  REFRIGERATION

TEXT BOOKS

REFERENCES

CH8502 CHEMICAL REACTION ENGINEERING - I LTPC
3 1 0 4

OBJECTIVES
- Students gain knowledge on different types of chemical reactors, the design of chemical reactors under isothermal and non-isothermal conditions

OUTCOME:
Apply the principles of reaction kinetics, formulate rate equations and analyse the batch reactor data.
Analyze the experimental kinetic data to select a suitable reactor for a particular application and to workout conversion and space time for different types of reactors.
Evaluate selectivity, reactivity and yield for parallel and mixed reactions.
Examine how far real reactors deviate from the ideal.

UNIT I
12
Rate equation, elementary, non-elementary reactions, theories of reaction rate and Prediction;
Design equation for constant and variable volume batch reactors, analysis of experimental kinetics data, integral and differential analysis.

UNIT II
12
Design of continuous reactors - stirred tank and tubular flow reactor, recycle reactors, combination of reactors, size comparison of reactors.
UNIT III
Design of reactors for multiple reactions - consecutive, parallel and mixed reactions - factors affecting choice, optimum yield and conversion, selectivity, reactivity and yield.

UNIT IV
Non-isothermal homogeneous reactor systems, adiabatic reactors, rates of heat exchanges for different reactors, design for constant rate input and constant heat transfer coefficient, operation of batch and continuous reactors, optimum temperature progression.

UNIT V
The residence time distribution as a factor of performance; residence time functions and relationship between them in reactor; basic models for non-ideal flow; conversion in non-ideal reactors.

TEXT BOOKS

REFERENCE

OBJECTIVES
• To gain knowledge on unit processes and unit operations involved in the manufacture of different chemicals in different industries like chloro-alkali, petroleum, pharmaceutical, fertilizer etc.

OUTCOME:
Understand the role of Chemical Engineers in process industries such as pulp and paper etc., and manufacture of cement, Glass and cements.
Understand manufacturing processes of oil, soap, detergent, petrochemicals, polymers, pharmaceuticals, paints, dyes and intermediates, fertilizer, sugar, food products etc.,
Understand the unit processes involved in petroleum refining etc.,

UNIT I
Introduction to chemical processing; symbolic representation of different unit operations and unit processes to build a flow sheet

UNIT II
Chlor-Alkali- Industries, Cement, Glass and ceramics, Pulp and paper.

UNIT III
Oil, Soap and Detergent, Petroleum Refining, Petrochemicals, Polymers

UNIT IV
Pharmaceuticals, Chemical Explosives, Paints and Pigments.

UNIT V
Dyes and intermediates, Fertilizers, Sugar, Food Products

TOTAL : 45 PERIODS

TEXT BOOKS

OBJECTIVES
• Students will learn to determine mass transfer rates under laminar and turbulent conditions and apply these concepts in the design of humidification columns, dryers and crystallisers.

OUTCOME:
Understand diffusional operations and theories of mass transfer
Understand the concept of interphase mass transfer and gas-liquid mass transfer operations like humidification

Apply the knowledge gained in mass transfer to perform simple calculations in drying and crystallization

UNIT I

Introduction to mass transfer operations; Molecular diffusion in gases, liquids and solids; diffusivity measurement and prediction; multi-component diffusion.

UNIT II

Eddy diffusion, concept of mass transfer coefficients, theories of mass transfer, different transport analogies, application of correlations for mass transfer coefficients, inter phase mass transfer, relationship between individual and overall mass transfer coefficients. NTU and NTP concepts, Stage-wise and differential contractors.

UNIT III

Humidification – Equilibrium, humidity chart, adiabatic and wet bulb temperatures; humidification operations; theory and design of cooling towers, dehumidifiers and humidifiers using enthalpy transfer unit concept.

UNIT IV

Drying – Equilibrium; classification of dryers; batch drying – Mechanism and time of cross through circulation drying, continuous dryers – material and energy balance; determination of length of rotary dryer using rate concept.

UNIT V

Crystallization - Equilibrium, classification of crystallizers, mass and energy balance; kinetics of crystallization – nucleation and growth; design of batch crystallizers; population balance model and design of continuous crystallizers.

TOTAL: 45 PERIODS

TEXT BOOKS


REFERENCES


HS8561 EMPLOYABILITY SKILLS  L T P C
(Lab / Practical Course)  0 0 2 1
(Common to all branches of Fifth or Sixth Semester B.E / B.Tech programmes)

OBJECTIVES
• To enhance the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills
• To help them improve their soft skills, including report writing, necessary for the workplace situations

OUTCOME:
Apply their communicative medium as English to interact with different groups of people, participate in debates and present seminars on technical topics, listen and comprehend technical presentations and speeches
Evaluate them and improve in proper time management and reduce their standing stresses, identify their personal strengths and weaknesses and work out methods (voluntarily) to get rid of the later and apply interview in practice

2. Creating effective PPTs – presenting the visuals effectively
3. Using body language with awareness – gestures, facial expressions, etc.
4. Preparing job applications - writing covering letter and résumé
5. Applying for jobs online - email etiquette
6. Participating in group discussions – understanding group dynamics - brainstorming the topic
7. Training in soft skills - persuasive skills – sociability skills - questioning and clarifying skills – mock GD
8. Writing reports – collecting, analyzing and interpreting data – drafting the report
9. Attending job interviews – answering questions confidently
10. Interview etiquette – dress code – body language – mock interview

TOTAL: 30 PERIODS

Requirements for a class of 30 students
1. A PC or a lap top with one or two speakers
2. A Collar mike and a speaker
3. An LCD projector and a screen
4. CD’s and DVD’s on relevant topics
5. Individual chairs for conducting group discussions

REFERENCE BOOKS

EXTENSIVE READERS

WEB RESOURCES
1. www.humanresources.about.com
2. www.careerride.com

CH8511 HEAT TRANSFER LABORATORY LTPC 0032

OBJECTIVES
- Students develop a sound working knowledge on different types of heat transfer equipments

OUTCOME
Determine Heat transfer co-efficient and evaluate performance of different types of equipments including cooling towers, tray dryers, pan evaporator, packed bed, heat exchangers, condensers, helical coils and agitated vessels
LIST OF EXPERIMENTS
1. Performance studies on Cooling Tower
2. Batch drying kinetics using Tray Dryer
3. Heat transfer in Open Pan Evaporator
4. Boiling Heat Transfer
5. Heat Transfer through Packed Bed
6. Heat Transfer in a Double Pipe Heat Exchanger
7. Heat Transfer in a Bare and Finned Tube Heat Exchanger
8. Heat Transfer in a Condenser
9. Heat Transfer in Helical Coils
10. Heat Transfer in Agitated Vessels

EQUIPMENT REQUIRED
1. Cooling Tower
2. Tray Dryer
3. Open Pan Evaporator
4. Boiler
5. Packed Bed
6. Double Pipe Heat Exchanger
7. Bare and Finned Tube Heat Exchanger
8. Condenser
9. Helical Coil
10. Agitated Vessel

TOTAL : 45 PERIODS

OBJECTIVES
• Students develop a sound working knowledge on different types of crushing equipments and separation characteristics of different mechanical operation separators.

OUTCOME:
Determine work index, average particle size through experiments by crushers, ball mill and conducting sieve analysis.
Design size separation equipments such as cyclone separator, sedimentation, Filters etc.
LIST OF EXPERIMENTS

1. Sieve analysis
2. Batch filtration studies using a Leaf filter
3. Batch filtration studies using a Plate and Frame Filter press
4. Characteristics of batch Sedimentation
5. Reduction ratio in Jaw Crusher
6. Reduction ratio in Ball mill
7. Separation characteristics of Cyclone separator
8. Reduction ratio of Roll Crusher
9. Separation characteristics of Elutriator
10. Reduction ratio of Drop weight crusher
11. Size separation using Sub-Sieving

EQUIPMENT REQUIRED

1. Sieve shaker
2. Leaf filter
3. Plate and Frame Filter Press
4. Sedimentation Jar
5. Jaw Crusher
6. Ball Mill
7. Cyclone Separator
8. Roll Crusher
9. Elutriator
10. Drop Weight Crusher
11. Sieves.

TOTAL : 60 PERIODS

OBJECTIVES

• The objective is to study the non-ideal behavior of homogeneous reactors, gas-solid catalytic and non-catalytic reactors and gas-liquid reactors.

OUTCOME
Understand catalysis and preparation and characterization, Apply adsorption isotherms for analysis of development of rate equations and rate controlling steps. Understand the mechanism of pore diffusion in catalyst to calculate effectiveness factors and to demonstrate the application of volume and surface models and to calculate conversion in non ideal flow reactor. Design the absorption column combined with chemical reactions.

UNIT I CATALYSTS 7
Nature of catalysts, surface area and pore-volume distribution, catalyst preparation.

UNIT II HETEROGENEOUS REACTORS 10
Rate equations for heterogeneous reactions, adsorption isotherms, rates of adsorption and desorption, surface reaction analysis of rate equation and rate controlling steps,

UNIT III GAS-SOLID CATALYTIC REACTORS 10
Diffusion within catalyst particle, effective thermal conductivity, mass and heat transfer within catalyst pellets, effectiveness factor, Thiele Modulus, fixed bed reactors.

UNIT IV GAS-SOLID NON-CATALYTIC REACTORS 9
Models for explaining kinetics; volume and surface models; controlling resistances and rate controlling steps; time for complete conversion for single and mixed sizes, fluidized and static reactors.

UNIT V GAS-LIQUID REACTORS 9
Absorption combined with chemical reactions; mass transfer coefficients and kinetic constants; application of film, penetration and surface renewal theories; Hatta number and enhancement factor for first order reaction, tower reactor design.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE
OBJECTIVES

• Students will learn to design absorber and stripper, distillation column, extraction and leaching equipments and adsorber.

OUTCOME:

Understand absorption and distillation operations and select methods of separation of mixtures based on mass transfer concepts.
Apply the ternary equilibrium diagram concepts to determine the number of stages required for separation of liquid-liquid and solid-liquid mixtures
Design a distillation tower and to perform calculations in adsorption operation

UNIT I  ABSORPTION  12
Gas Absorption and Stripping – Equilibrium; material balance; limiting gas-liquid ratio; tray tower absorber - calculation of number of theoretical stages, tray efficiency, tower diameter; packed tower absorber – rate based approach; determination of height of packing using HTU and NTU calculations.

UNIT II  DISTILLATION  12
Vapour liquid equilibria - Raoult’s law, vapor-liquid equilibrium diagrams for ideal and non-ideal systems, enthalpy concentration diagrams. Principle of distillation - flash distillation, differential distillation, steam distillation, multistage continuous rectification, Number of ideal stages by McCabe - Thiele method and Ponchan - Savarit method, Total reflux, minimum reflux ratio, optimum reflux ratio. Introduction to multi-component distillation, azeotropic and extractive distillation

UNIT III  LIQUID-LIQUID EXTRACTION  12
Liquid - liquid extraction - solvent characteristics-equilibrium stage wise contact calculations for batch and continuous extractors- differential contact equipment-spray, packed and mechanically agitated contactors and their design calculations-packed bed extraction with reflux. Pulsed extractors, centrifugal extractors-Supercritical extraction

UNIT IV  LEACHING  12
Solid-liquid equilibria- leaching equipment for batch and continuous operations- calculation of number of stages - 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.
UNIT V  ADSORPTION AND ION EXCHANGE & MEMBRANE SEPARATION PROCESS

Adsorption - Types of adsorption, nature of adsorbents, adsorption equilibria, effect of pressure and temperature on adsorption isotherms, Adsorption operations - stage wise operations, steady state moving bed and unsteady state fixed bed adsorbers, break through curves. Principle of Ion exchange, techniques and applications. Solid and liquid membranes; concept of osmosis; reverse osmosis; electro dialysis; ultrafiltration.

L : 45 , T : 15 , TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES

UNIT I
Need for safety in industries;  Safety Programmes – components and realization; Potential hazards – extreme operating conditions, toxic chemicals; safe handling
UNIT II
Implementation of safety procedures – periodic inspection and replacement; Accidents – identification and prevention; promotion of industrial safety

UNIT III
Over all risk analysis--emergency planning-on site & off site emergency planning, risk management ISO 14000, EMS models case studies. Quantitative risk assessment - rapid and comprehensive risk analysis; Risk due to Radiation, explosion due to over pressure, jet fire-fire ball.

UNIT IV
Hazard identification safety audits, checklist, what if analysis, vulnerability models event tree analysis fault tree analysis, Hazan past accident analysis Fixborough-Mexico-Madras-Vizag-Bopal analysis

UNIT V
Hazop-guide words, parameters, derivation-causes-consequences-recommendation-coarse Hazop study-case studies-pumping system-reactor-mass transfer system.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVES
• To introduce dynamic response of open and closed loop systems, control loop components and stability of control systems along with instrumentation.

OUTCOME:
Understand the prerequisites of control strategies and design different process control systems
Evaluate the suitable controllers for different chemical process.
Analyse and tune the control systems unto stability
Understand the mechanism of advance control systems

UNIT I INSTRUMENTATION 6
Principles of measurements and classification of process instruments, measurement of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity, pH, concentration, electrical and thermal conductivity, humidity of gases.

UNIT II OPEN LOOP SYSTEMS 11
Laplace transformation, application to solve ODEs. Open-loop systems, first order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics; transportation lag.

UNIT III CLOSED LOOP SYSTEMS 10
Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatory problems, transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transient response of closed-loop control systems and their stability.

UNIT IV FREQUENCY RESPONSE 9
Introduction to frequency response of closed-loop systems, control system design by frequency response techniques, Bode diagram, stability criterion, tuning of controller settings

UNIT V ADVANCED CONTROL SYSTEMS 9
Introduction to advanced control systems, cascade control, feed forward control, Smith predictor controller, control of distillation towers and heat exchangers, introduction to computer control of chemical processes.

TOTAL: 45 PERIODS
TEXT BOOKS

REFERENCES

CH8611 CHEMICAL REACTION ENGINEERING LABORATORY L T P C
0 0 3 2

OBJECTIVES
• Students develop a sound working knowledge on different types of reactors.

OUTCOME:
Understand rate equation for different types of reactors.
Design experiments in kinetics to determine conversion and effect of temperature on rate constant.
Assess the performance of Plug flow Mixed flow and Packed bed by studying the residence time distribution.

LIST OF EXPERIMENTS
1. Kinetic studies in a Batch reactor
2. Kinetic studies in a Plug flow reactor
3. Kinetic studies in a CSTR
4. Kinetic studies in a Packed bed reactor
5. Kinetic studies in a PFR followed by a CSTR
6. RTD studies in a PFR
7. RTD studies in a Packed bed reactor
8. RTD studies in a CSTR
9. Studies on micellar catalysis
10. Study of temperature dependence of rate constant using CSTR.
11. Kinetic studies in Sono chemical reactor
12. Batch reactive distillation
13. Kinetics of photochemical reaction
14. Demonstration of heterogeneous catalytic reaction
15. Demonstration of gas-liquid reaction

**EQUIPMENT REQUIRED**

1. BATCH REACTOR
2. Plug flow reactor
3. CSTR
4. Sono-chemical reactor
5. Photochemical reactor
6. Packed bed reactor

*Minimum 10 experiments shall be offered.

**TOTAL : 45 PERIODS**

**CH8612 COMPUTATIONAL CHEMICAL ENGINEERING LABORATORY**

**OBJECTIVES**

- Students will solve chemical engineering problems from core courses using C and MATLAB programming and also using computational tools like Excel and Aspen.

**OUTCOME:**

Able to solve chemical engineering problems using C and MATLAB programming and Microsoft Excel software.

Analyse and estimate the physical properties of data bank and non data bank components; calculate bubble and dew points and generate T-xy and P-xy diagram by simulating flash drum using ASPEN PLUS Process Simulator.

**Programming in C**

C programs will be written to solve problems from core courses of chemical engineering.

**Microsoft Excel Software**

The computational, plotting and programming abilities in Excel will be used to solve different chemical engineering problems.

**Programming in MATLAB**

Chemical engineering problems will be solved using the powerful computational and graphical capability of MATLAB.
ASPE Software
Individual process equipments and flowsheets will be simulated using Aspen Plus and property analysis and estimation will be done using Aspen Properties.

Evaluation
This lab course will have two or three online assessment tests and an online end semester examination in the Process Simulation Laboratory and assignments in all the above four units.

TOTAL : 60 PERIODS

REFERENCE

CH8701 CHEMICAL PROCESS DESIGN L T P C 3 0 0 3

OBJECTIVES
- Students apply the fundamental knowledge to design the chemical process

OUTCOME:
Understand different codes, standards, design factors and system of units used in design process
Understand the importance of process diagrams, design of reactors
Apply the skill in thermal design of heat transfer equipment and assessing thermal efficiency of the above equipment in practice.
Demonstrate the simulation skills to design process equipments

UNIT I 9
Process Design and Development: General Design Considerations; The Hierarchy of Chemical Process Design; The Nature of Process Synthesis and Analysis;

UNIT II 9
Choice of reactor based on reactor performance, reactor conditions and reactor configuration. Reactor networks in process flow sheets:

UNIT III 9
Choice of separation of heterogeneous and homogeneous mixtures - Attainable region
Separation systems in process flowsheets: multicomponent distillation for ideal and non-ideal systems, distillation column sequences,
UNIT IV
Heat exchange networks synthesis and utilities: Energy targets, Integration in distillation columns

UNIT V
Introduction to optimization approaches to optimal design, role of simulations in process design, Design under uncertainty and failure tolerance, Engineering around variations, Introduction to process integration

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

CH8702 PROCESS ECONOMICS LTPC 3 0 0 3

OBJECTIVES
- Students will acquire the knowledge about the process economics

OUTCOME:
Understand the basic themes of economics
Understand the consumer and producer behavior
Understand the different market structures
Analyse the Economics

UNIT I INTRODUCTION
UNIT II CONSUMER AND PRODUCER BEHAVIOUR 10

UNIT III PRODUCT AND FACTOR MARKET 10

UNIT IV PERFORMANCE OF AN ECONOMY – MACRO ECONOMICS 10

UNIT V AGGREGATE SUPPLY AND THE ROLE OF MONEY 10

TOTAL : 45 PERIODS

TEXT BOOKS
OBJECTIVES

- Students learn to do in detail process and mechanical design and engineering drawing of different chemical engineering equipments

OUTCOME:

Apply the skill in thermal design of heat transfer equipment like shell and tube, double pipe heat exchangers and evaporators, and assessing thermal efficiency of the above equipment in practice.

Demonstrate the skills in basic design and drawing of different dryers, cooling towers and cyclone separators.

Apply the concepts involved in phase separation and design of distillation, Extraction and absorption columns.

Demonstrate the skills in mechanical design of process equipment, design considerations of pressure vessels and its auxiliary devices design the layout of process industries

UNIT I

Heat Exchangers, Condensers, Evaporators

UNIT II

Cooling Tower, Dryers

UNIT III

Absorption column, Distillation Column, Extraction Column, Adsorption column

UNIT IV

Packed bed Reactors, Pressure Vessel, Storage Vessel

UNIT V

Design of Plant Layout, Pipe Lines and Pipe Layouts, Schematics and Presentation, Materials of Construction and Selection of process equipments

TOTAL : 60 PERIODS

REFERENCES

CH8751          TRANSPORT PHENOMENA          L T P C
                      3 1 0 4

OBJECTIVES
• To describe mass, momentum and energy transport at molecular, microscopic and macroscopic level, to determine velocity, temperature and concentration profiles.

OUTCOME:
Understand the principles of momentum, heat and mass transport by developing mathematical models to determine respective fluxes and velocity, temperature and concentration distribution for flow channels, heat sources and systems involving diffusion and reactions.
Apply the equation of change and scale factors for different coordinate systems and solve of momentum, mass and heat transport problems.
Analyze the analogy between the transports and understand the turbulence and boundary layer concept in heat and mass transport.

UNIT I MOMENTUM TRANSPORT
Viscosity, temperature effect on viscosity of gases and liquids, Newton’s law, mechanism of momentum transport, shell balance method, pressure and velocity distributions in falling film, circular tube, annulus, slit.

UNIT II EQUATIONS OF CHANGE AND TURBULENT FLOW
Equation of continuity, motion, mechanical energy, use of equations of change to solve flow problems, dimensional analysis of equations of change, comparison of laminar and turbulent flows, time-smoothed equation of change, empirical expressions.

UNIT III ENERGY TRANSPORT
Thermal conductivity, temperature and pressure effect on thermal conductivity of gases and liquids, Fourier’s law, mechanism of energy transport, shell energy balance, temperature distribution in solids and laminar flow with electrical, nuclear, viscous, chemical heat source, heat conduction through composite walls, cylinders, spheres, fins, slits.

UNIT IV EQUATIONS OF CHANGE FOR NONISOTHERMAL SYSTEM AND TEMPERATURE DISTRIBUTION IN TURBULENT FLOWS
Energy equations, special forms, use of equations of change, dimensional analysis of equations of change, time-smoothed equations of change, empirical expressions, temperature distribution for turbulent flow in tubes, jets.
UNIT V  MASS TRANSPORT, EQUATIONS OF CHANGE FOR
MULTICOMPONENT SYSTEMS AND CONCENTRATION
DISTRIBUTION IN TURBULENT FLOWS

Diffusivity, temperature and pressure effect, Fick’s law, mechanism of mass transport, theory
of diffusion in gases and liquids, shell mass balances, concentration distribution in solids
and in laminar flow: stagnant gas film, heterogeneous and homogeneous chemical reaction
systems, falling film, porous catalyst. The equation of continuity, summary of equations
of change and fluxes, use of equations of change, dimensional analysis, time smoothed
equations of change, empirical expressions for turbulent mass flux.

TOTAL : 60 PERIODS

TEXT BOOKS
   Wiley, 2002

REFERENCES
1. Welty, J. R., Wilson, R. W., and Wicks, C. W., “Fundamentals of Momentum Heat and
   1999.

CH8711  MASS TRANSFER LABORATORY  LTPC
        0 0 4 2

OBJECTIVES
- Students develop a sound working knowledge on different types of mass
  transfer equipments.

OUTCOME:
Determine diffusivity, mass transfer rate and mass transfer co-efficient of given system
using fundamental principles.
Generate VLE data and evaluate the performance calculate the parameters in different
distillation processes
Evaluate the performance calculate the parameters in Leaching extraction and drying
operations

LIST OF EXPERIMENTS
1. Separation of binary mixture using Simple distillation
2. Separation of binary mixture using Steam distillation
3. Separation of binary mixture using Packed column distillation
4. Measurement of diffusivity
5. Liquid-liquid extraction
6. Drying characteristics of Vacuum Dryer
7. Drying characteristics of Tray dryer
8. Drying characteristics of Rotary dryer
9. Water purification using ion exchange columns
10. Mass transfer characteristics of Rotating disc contactor
11. Estimation of mass/heat transfer coefficient for cooling tower
12. Demonstration of Gas – Liquid absorption

EQUIPMENTS REQUIRED
1. Simple distillation setup
2. Steam distillation setup
3. Packed column
4. Liquid-liquid extractor
5. Vacuum Dryer
6. Tray dryer
7. Rotary dryer
8. Ion exchange column
9. Rotating disc contactor
10. Cooling tower
11. Absorption column
Minimum 10 experiments shall be offered.

TOTAL: 60 PERIODS

OBJECTIVES
- Students will gain the hands on training about the control systems

OUTCOME:
Understand the prerequisites of control strategies and design different process control systems
Evaluate the suitable controllers for different chemical process.
Analyse and tune the control systems unto stability
LIST OF EXPERIMENTS
1. Response of first order system
2. Response of second order system
3. Response of Non-Interacting level System
4. Response of Interacting level System
5. Open loop study on a level system
6. Open loop study on a flow system
7. Open loop study on a thermal system
8. Closed loop study on a level system
9. Closed loop study on a flow system
10. Closed loop study on a thermal system
11. Tuning of a level system
12. Tuning of a flow system
13. Tuning of a thermal system
14. Flow co-efficient of control valves
15. Characteristics of different types of control valves

*Minimum 10 experiments shall be offered.

TOTAL : 60 PERIODS

CH8811 PROJECT WORK L T P C 0 0 12 6

OBJECTIVES
• The objective of the project is to make use of the knowledge gained by the student at various stages of the degree course.
• Each student is required to submit a report on the project assigned to him by the department. The report should be based on the information available in the literature or data obtained in the laboratory/industry.
• Students, in addition to the home problem will be permitted to undertake industrial/consultancy project work, outside the department, in industries/Research labs for which proportional weightage will be given in the final assessment.

OUTCOME:
Design a manufacturing chemical process industries
Prepare clear concise project reports with the help of grape, charts and pictorial representation.
OBJECTIVES
• The students will have a fundamental knowledge of the concepts of statistical inference
• Have the knowledge of applying Linear programming tools in management problems.

OUTCOME:
Understand different types of distributions and their uses.
Apply the various methods of testing of hypothesis, analysis of variance and randomized
block design and its applications in engineering.
Design models and optimize their solution by using linear programming models

UNIT I TESTING OF HYPOTHESIS 9 + 3
Sampling distributions - Tests for single mean, proportion and difference of means (large and
small samples) – Tests for single variance and equality of variances – $\chi^2$-test for goodness of
fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 9 + 3
Completely randomized design – Randomized block design – Latin square design - $2^2$ -
factorial design.

UNIT III STATISTICAL QUALITY CONTROL 9 + 3
Control charts for measurements ( and R charts) – Control charts for attributes (p, c and np
charts) – Tolerance limits - Acceptance sampling

UNIT IV LINEAR PROGRAMMING 9 + 3
Formulation of LPP – Graphical methods for two variables – Simplex method - Big M method
– Transportation Problem - Basic feasible solution – North West corner rule – Vogel’s
approximation method (Unit penalty method) – Matrix minima method (Least cost method)
– Optimal solution – Non degeneracy and degeneracy problem – Assignment problem –
Hungarian method – Balanced and unbalanced.

UNIT V ADVANCED LINEAR PROGRAMMING 9 + 3
Dual simplex method – Formation and using simplex method – integer programming – Cutting
plane algorithm.

L: 45, T: 15, TOTAL: 60 PERIODS
TEXT BOOKS

REFERENCES

CH8001 DRUGS AND PHARMACEUTICAL TECHNOLOGY

OBJECTIVES
- Students will gain fundamental knowledge about Drugs and Pharmaceutical and their manufacturing process

OUTCOME:
Understand the Drug Metabolism and pharmaco-kinetics principles
Apply knowledge of unit processes and analytical methods to develop new processes and product formulations.
Demonstrate statistical quality control procedure and quality assurance programmes in various stages of pharmaceutical process.

UNIT I INTRODUCTION
Development of drugs and pharmaceutical industry; organic therapeutic agents uses and economics

UNIT II DRUG METABOLISM AND PHARMACO KINETICS & MICROBIOLOGICAL AND ANIMAL PRODUCTS
Drug metabolism; physico chemical principles; pharma kinetics-action of drugs on human bodies. Antibiotics- gram positive, gram negative and broad spectrum antibiotics; hormones

UNIT III IMPORTANT UNIT PROCESSES AND THEIR APPLICATIONS
Chemical conversion processes; alkylation; carboxylation; condensation and cyclisation; dehydration, esterification, halogenation, oxidation, sulfonation; complex chemical conversions fermentation.
UNIT IV MANUFACTURING PRINCIPLES & PACKING AND QUALITY CONTROL

Compressed tablets; wet granulation; dry granulation or slugging; advancement in granulation; direct compression, tablet presses formulation; coating pills; capsules sustained action dosage forms; parental solutions, oral liquids; injections; ointments; standard of hygiene and manufacturing practice. Packing; packing techniques; quality control.

UNIT V PHARMACEUTICAL PRODUCTS & PHARMACEUTICAL ANALYSIS

Vitamins; cold remedies; laxatives; analgesics; nonsteroidal contraceptives; external antiseptics; antacids and others. Analytical methods and tests for various drugs and pharmaceuticals – spectroscopy, chromatography, fluorimetry, polarimetry, refractometry, pHmetry.

TEXT BOOK


REFERENCES


CH8002 ELECTROCHEMICAL ENGINEERING

OBJECTIVES

- Students will gain knowledge about electrochemical process and its application

OUTCOME:

Understand the principles of electrochemistry and mechanism involved in electrochemical systems
Understand the mechanism of corrosion.
Apply the concepts involved in electro process and design of batteries, fuel cell and electrochemical reactors

UNIT I

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. over potential, primary-secondary current distribution –rotating disc electrode.

UNIT III

UNIT IV

UNIT V
Electrodes used in different electrochemical industries: Metals-Graphite –Lead dioxide –Titanium substrate insoluble electrodes –Iron oxide –semi conducting type etc. Metal finishing-cell design. types of electrochemical reactors, batch cell, fluidized bed electrochemical reactor, filter press cell, Swiss roll cell, plug flow cell, design equation, figures of merits of different type of electrochemical reactors.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVES

- Students will gain knowledge about different energy sources

OUTCOME:

Understand conventional Energy sources, Non-conventional Energy sources, biomass sources and develop design parameters for equipment to be used in Chemical process industries.

Understand energy conservation in process industries

UNIT I  ENERGY  8
Introduction to energy – Global energy scene – Indian energy scene - Units of energy, conversion factors, general classification of energy, energy crisis, energy alternatives.

UNIT II  CONVENTIONAL ENERGY  8
Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants, efficiency, merits and demerits of the above power plants, combustion processes, fluidized bed combustion.

UNIT III  NON-CONVENTIONAL ENERGY  10
Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, energy plantations. Wind energy, types of windmills, types of wind rotors, Darrieus rotor and Gravian rotor, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy.

UNIT IV  BIOMASS ENERGY  10
Biomass origin - Resources – Biomass estimation. Thermochemical conversion – Biological conversion, Chemical conversion – Hydrolysis & hydrogenation, solvolysis, biocrude, biodiesel power generation gasifier, biogas, integrated gasification.

UNIT V  ENERGY CONSERVATION  9
Energy conservation - Act; Energy management importance, duties and responsibilities; Energy audit – Types methodology, reports, instruments. Benchmalcing and energy performance, material and energy balance, thermal energy management.

TOTAL : 45 PERIODS
TEXTBOOKS

REFERENCES

CH8004 FRONTIERS OF CHEMICAL ENGINEERING L T P C 3 0 0 3

OBJECTIVES
- Students will know the latest trends to be followed in the process industries

OUTCOME:
Understand the new process and reactor configuration used in industries
Know the new sources of renewable energy and new material & its application

UNIT I PROCESS INTENSIFICATION
Novel reactor configurations; combination of reaction and separation; use of different energy fields, lab on a chip.

UNIT II CHEMICAL PRODUCT DESIGN
Scope and importance; identification of needs and specifications; sources of ideas and screening ideas; selection of product idea; process development for product manufacture; specialty chemical manufacture; economic aspects.

UNIT III RENEWABLE ENERGY
Hydrogen production, Hydrogen economy, Fuel Cell Technology, biofuel cells and bio-hydrogen, solar energy
UNIT IV  MATERIALS ENGINEERING

Polymers and composites, ceramics and glasses, colloidal dispersions and nanoparticles, thin films and electronic materials

UNIT V  BIOENGINEERING

Biomechanics, biotransport and biomaterials, biomolecular and cellular engineering, drug discovery and development.

TOTAL : 45 PERIODS

REFERENCES

CH8005  MODERN SEPARATION TECHNIQUES

OBJECTIVES
- Students will gain knowledge about recent separation methods

OUTCOME:
Create the understanding of separation processes for selecting optimal process for new and innovative applications. Ability to exhibit the skill to develop membrane processes, adsorption process and inorganic separation process. Apply the latest concepts like super critical fluid extraction, pervaporation, lyophilisation etc., in Chemical process industries. Understand Innovative techniques of controlling and managing oil spills.

UNIT I  BASICS OF SEPARATION PROCESS

Review of Conventional Processes, Recent advances in Separation Techniques based on size, surface properties, ionic properties and other special characteristics of substances, Process concept, Theory and Equipment used in cross flow Filtration, cross flow Electro Filtration, Surface based solid – liquid separations involving a second liquid.
UNIT II   MEMBRANE SEPARATIONS
Types and choice of Membranes, Plate and Frame, tubular, spiral wound and hollow fiber Membrane Reactors and their relative merits, commercial, Pilot Plant and Laboratory Membrane permeators involving Dialysis, Reverse Osmosis, Nanofiltration, Ultra filtration and Micro filtration, Ceramic- Hybrid process and Biological Membranes.

UNIT III  SEPARATION BY ADSORPTION
Types and choice of Adsorbents, Adsorption Techniques, Dehumidification Techniques, Affinity Chromatography and Immuno Chromatography, Recent Trends in Adsorption.

UNIT IV  INORGANIC SEPARATIONS
Controlling factors, Applications, Types of Equipment employed for Electrophoresis, Dielectrophoresis, Ion Exchange Chromatography and Eletrodialysis, EDR, Bipolar Membranes.

UNIT V  OTHER TECHNIQUES
Separation involving Lyophilisation, Pervaporation and Permeation Techniques for solids, liquids and gases, zone melting, Adductive Crystallization, other Separation Processes, Supercritical fluid Extraction, Oil spill Management, Industrial Effluent Treatment by Modern Techniques.

TOTAL : 45 PERIODS

REFERENCES
OBJECTIVES
- Students will gain knowledge about process modeling and optimization

OUTCOME:
Design experiments and formulate models of chemical processes/equipment.
Understand different search methods and linear programming methods for solution of chemical process problems like optimization of process variables to get maximum yield/conversion, product mix pattern product distribution etc.,
Understand the non-linear programming methods for application in R & D work.

UNIT I  INTRODUCTION 5
Introduction to optimization; applications of optimization in chemical engineering; classification of optimization problems.

UNIT II  SINGLE VARIABLE OPTIMIZATION 9
Necessary and sufficient conditions for optimum; region elimination methods; interpolation methods; direct root methods.

UNIT III  MULTIVARIABLE OPTIMIZATION WITHOUT AND WITH CONSTRAINTS 9
Necessary and sufficient conditions for optimum; direct search methods; indirect search methods.

UNIT IV  OTHER OPTIMIZATION METHODS 9
Introduction to geometric, dynamic and integer programming and genetic algorithms.

UNIT V  APPLICATIONS OF OPTIMIZATION 13
Formulation of objective functions; fitting models to data; applications in fluid mechanics, heat transfer, mass transfer, reaction engineering, equipment design, resource allocation and inventory control.

TOTAL : 45 PERIODS

TEXT BOOKS
OBJECTIVES
- Students will gain knowledge about petroleum refining process and production of petrochemical products

OUTCOME:
Understand the classification, composition and testing methods of crude petroleum / product to develop innovative refining process and develop quality control and assurance techniques.
Apply the knowledge of treatment processes to develop the manufacture of petroleum products.

UNIT I

UNIT II
Cracking, Thermal Cracking, Vis-breaking, Catalytic Cracking (FCC), Hydro Cracking, Coking and Air Blowing of Bitumen.

UNIT III
Treatment Techniques: Removal of Sulphur Compounds in all Petroleum Fractions to improve performance, Solvent Treatment Processes, Dewaxing, Clay Treatment and Hydrofining.

UNIT IV
Cracking of Naphtha and Feed stock gas for the production of Ethylene, Propylene, Isobutylene and Butadiene. Production of Acetylene from Methane, Catalytic Reforming of Petroleum Feed Stocks and Extraction of Aromatics.

UNIT V
Production of Petrochemicals like Dimethyl Terephthalate (DMT), Ethylene Glycol, Synthetic Glycerine, Linear Alkyl Benzene (LAB), Acrylonitrile, Methyl Methacrylate (MMA), Vinyl Acetate Monomer, Phthalic Anhydride, Maleic Anhydride, Phenol and Acetone, Methanol, Formaldehyde, Acetaldehyde, Pentaerythritol and Production of Carbon Black.

TOTAL: 45 PERIODS
TEXT BOOKS

CH8008 POLYMER TECHNOLOGY  L T P C  3 0 0 3

OBJECTIVES
• Students will gain knowledge about mechanism of polymer process and its application

OUTCOME:
Understand the fundamental of mechanism of polymerization
Apply the mechanism and effectiveness of polymerization in designing reactor systems.
Understand the knowledge of polymer stability for developing new formulations and products
Acquire knowledge on different test for characterization of polymer for applications in R & D work; understand the manufacture and properties of industrial polymers.

UNIT I GENERAL ASPECTS OF POLYMERS 9
Classification, mechanisms and methods of polymerization, Properties-Molecular weight, Glass transition temperature, Crystallinity, thermal, Electrical and Mechanical properties

UNIT II APPLICATION ORIENTED POLYMERS 9
Resins – PVC, Silicon Oil and resins, fibrous Polymers – Nylon 66, Polyacrylonitrile, adhesives- Epoxides, Phenol formaldehyde, Urea formaldehyde

UNIT III ELASTOMERS 9
Natural Rubber, Styrrene – butadiene, Polyisopropylene – Neoprene, Silicone rubber, Thermoplastic elastomers

UNIT IV PROCESSING OF POLYMERS 9
Processing additives, plasticizers, Antiaging additives, surface and optical properties, modifiers, fire retardants, additives for rubber and elastomers, various molding techniques
UNIT V  PHYSICAL AND CHEMICAL TESTING OF PLASTICS

Mechanical properties, tensile strength and hardness, electrical properties, volume resistivity, dielectric strength, optical properties—glass, light transmission and refractive index, chemical analysis—elemental and functional analysis.

TOTAL : 45 PERIODS

REFERENCES

CH8009  PROCESS MODELLING AND SIMULATION

OBJECTIVES
- Students will develop suitable chemical process model to get process output

OUTCOME:
Understand the fundamentals of modelling and their applications to transport/energy equations, chemical and phase equilibria kinetics etc.,
Create the mathematical models for different unit operations equipments such as stirred tank heaters, Heat exchangers, Evaporators, Reactors, distillation columns etc.,
Analyze the principles of steady state/unsteady state lumped systems and steady state/ unsteady state distributed systems and can select proper equation of state for estimating component properties and process flow sheeting.

UNIT I  INTRODUCTION
Introduction to modeling and simulation, classification of mathematical models, conservation equations and auxiliary relations.

UNIT II  STEADY STATE LUMPED SYSTEMS
Degree of freedom analysis, single and network of process units, systems yielding linear and non-linear algebraic equations, flow sheeting—sequential modular and equation oriented approach, tearing, partitioning and precedence ordering, solution of linear and non-linear
algebraic equations.

UNIT III   UNSTEADY STATE LUMPED SYSTEMS  
Analysis of liquid level tank, gravity flow tank, jacketed stirred tank heater, reactors, flash and distillation column, solution of ODE initial value problems, matrix differential equations, simulation of closed loop systems.

UNIT IV   STEADY STATE DISTRIBUTED SYSTEM  
Analysis of compressible flow, heat exchanger, packed columns, plug flow reactor, solution of ODE boundary value problems.

UNIT V   UNSTEADY STATE DISTRIBUTED SYSTEM & OTHER MODELLING APPROACHES  

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVES

- Students will gain knowledge about auxiliary equipments used in chemical process plants

OUTCOME:

Comprehend the principles of water treatment, and methods of treating cooling water; understand the principles of efficient steam generation and utilisation. Understand methods of compression of air, air drying system and different types refrigeration and humidification systems used in process industries; simple calculations of compressors Understand the types of fuels and its disposal methods.

UNIT I IMPORTANT OF UTILITIES

Hard and Soft water, Requisites of Industrial Water and its uses. Methods of water Treatment such as Chemical Softening and Demineralization, Resins used for Water Softening and Reverse Osmosis. Effects of impure Boiler Feed Water.

UNIT II STEAM AND STEAM GENERATION

Properties of Steam, problems based on Steam, Types of Steam Generator such as Solid Fuel Fired Boiler, Waste Gas Fired Boiler and Fluidized Bed Boiler. Scaling and Trouble Shooting. Steam Traps and Accessories.

UNIT III REFRIGERATION

Refrigeration Cycles, Methods of Refrigeration used in Industry and Different Types of Refrigerants such as Monochlorodifluoro Methane, Chlorofluoro Carbons and Brins. Refrigerating Effects and Liquefaction Processes.

UNIT IV COMPRESSED AIR


UNIT V FUEL AND WASTE DISPOSAL

REFERENCES

GE8751 ENGINEERING ETHICS AND HUMAN VALUES  L T P C
3 0 0 3

OBJECTIVES
- Students will gain knowledge about ethics to be followed in industries and outside

OUTCOME:
Demonstrate their understanding of their professional and ethical responsibilities, moral issues and how the engineering designs affect the society.
Understand the concept of engineering experimentation to incorporate safety, environment and health factors in to the design of chemical process equipment.
Demonstrate the application of environmental and global ethics in the design of Chemical process systems.

UNIT I  HUMAN VALUES

UNIT II  ENGINEERING ETHICS
UNIT III  ENGINEERING AS SOCIAL EXPERIMENTATION  9
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law – The Challenger Case Study

UNIT IV  SAFETY, RESPONSIBILITIES AND RIGHTS  9

UNIT V  GLOBAL ISSUES  8

TOTAL : 45 PERIODS

TEXTBOOK

REFERENCES

WEB SOURCES:
1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org
OBJECTIVES
- Students will gain knowledge about practices followed in supply chain management

OUTCOME:
Understand the logistics management and supply chain network design
Apply latest technology used in supply chain management.

UNIT I  INTRODUCTION  6
Definition of Logistics and SCM: Evolution, Scope, Importance & Decision Phases – Drivers of SC Performance and Obstacles.

UNIT II  LOGISTICS MANAGEMENT  10

UNIT III  SUPPLY CHAIN NETWORK DESIGN  10

UNIT IV  SOURCING, AND PRICING IN SUPPLY CHAIN  9
Supplier selection and Contracts - Design collaboration - Procurement process. Revenue management in supply chain

UNIT V  COORDINATION AND TECHNOLOGY IN SUPPLY CHAIN  10
Supply chain coordination - Bullwhip effect – Effect of lack of co-ordination and obstacles – IT and SCM - supply chain IT frame work. E Business & SCM. Metrics for SC performance – Case Analysis

TOTAL : 45 PERIODS

REFERENCES
2. Logistics, David J. Bloomberg, Stephen Lemay and Joe B. Hanna, PHI 2002
4. Modeling the supply chain, Jeremy F. Shapiro, Thomson Duxbury, 2002

FT8551 BIOCHEMICAL ENGINEERING

OBJECTIVES
- Students will gain fundamental knowledge about biochemical reactions and its application to the reactor design

OUTCOME:
- Apply the knowledge of microorganisms and enzymes to study different biochemical reactions and rate equations.
- Understand transport mechanisms and sterilization concepts to design and analyze bioreactors.
- Understand the downstream processing and industrial bioreactors

UNIT I INTRODUCTION
Industrial biochemical processes with typical examples, comparing chemical and biochemical processes, development and scope of biochemical engineering as a discipline. Industrially important microbial strains; their classification; structure; cellular genetics.

UNIT II KINETICS OF ENZYME ACTION
Kinetics of enzyme catalyzed reaction: the enzyme substrate complex and enzyme action, modulation and regulation of enzyme activity, types of inhibition. Immobilized enzyme technology: enzyme immobilization, Immobilized enzyme kinetics: effect of external mass transfer resistance.

UNIT III KINETICS OF MICROBIAL GROWTH
Kinetics of cellular growth in batch and continuous culture, models for cellular growth unstructured, structured and cybernetic models, medium formulation. Thermal death kinetics of cells and spores, stoichiometry of cell growth and product formation, Design and analysis of biological reactors

UNIT IV TRANSPORT PHENOMENA
Transport phenomena in bioprocess systems, Gas-liquid mass transfer in cellular systems,
determination of oxygen transfer rates, power requirements for sparged and agitated vessels, scaling of mass transfer equipment, heat transfer.

UNIT V DOWN STREAM PROCESSING

Down stream processing: Strategies to recover and purify products; separation of insoluble products, filtration and centrifugation; cell disruption-mechanical and non-mechanical methods; separation of soluble products: liquid-liquid extractions, membrane separation (dialysis, ultra filtration and reverse osmosis), chromatographic separation-gel permeation chromatography, electrophoresis, final steps in purification – crystallization and drying.

TOTAL : 45 PERIODS

TEXT BOOKS


REFERENCES


GE8072 DISASTER MANAGEMENT

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR).
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.
OUTCOMES:
The students will be able to
- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context,
- Disaster damage assessment and management.

UNIT I INTRODUCTION TO DISASTERS
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.– Differential impacts in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don’ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.
TEXTBOOKS:

REFERENCES
1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005

GE8073 HUMAN RIGHTS L T P C 3 0 0 3

OBJECTIVES
- To sensitize the Engineering students to various aspects of Human Rights.

OUTCOME
- Engineering students will acquire the basic knowledge of human rights.

UNIT I

UNIT II

UNIT III
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V
MEDIA, EDUCATIONAL INSTITUTIONS, SOCIAL MOVEMENTS.

TOTAL: 45 PERIODS

REFERENCES: