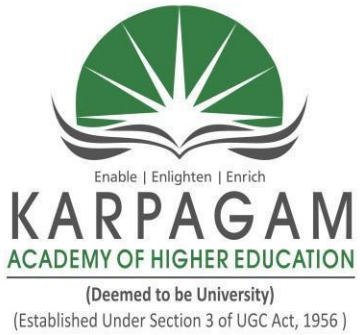
Chemical Engineering (B. Tech)

CHOICE BASED CREDIT SYSTEM (CBCS)

Syllabus 2017-2018



DEPARTMENT CHEMICAL ENGINEERING

ENGINEERING

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)
(Establishedundersection3 of UGC Act,1956)
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SEMESTER I

17BTCC101 ENGLISH FOR ENGINEERS 3 0 0 3

COURSE OBJECTIVES

1. To enable students to attain fluency and accuracy to inculcate proficiency in professional communication to meet the growing demand in the field of Global communication.
2. To help students acquire their ability to speak effectively in real life situations.
3. To inculcate the habit of reading and to develop their effective reading skills.
4. To ensure that students use dictionary to improve their active and passive vocabulary.
5. To enable students to improve their lexical, grammatical and communicative competence.

To enable for reading and listening skills

COURSE COURSE OUTCOMES::

1. Use English language for communication: verbal & non –verbal.
2. Enrich comprehension and acquisition of speaking & writing ability.
3. Gain confidence in using English language in real life situations.
4. Improve word power: lexical, grammatical and communication competence.
5. Ability to reading and listening skills
6. Interpreting visual materials, Abbreviations & Acronyms.

Unit- I LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking andRepresenting) (9)

Listening–Types of listening- Listening to class reading - Video tapes/ Audio tapes. **Speaking** – Introduction on self. **Reading** - Reading for comprehension – Reading different kind of passages like descriptive, narrative, COURSE OBJECTIVES, conversational and argumentative.**Writing** – Formal and Informal letters- Letters to the Editor.

Grammar&Vocabulary (Function Grammar & Technical Vocabulary)Tenses - Articles.**Vocabulary** - Word Formation – Word expansion (Root word) - Prefix and Suffix.

Unit – II LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (8)

Listening –Understanding the passage in English–Pronunciation practice. **Speaking** –Asking andanswering questions. **Reading** – Critical reading – Finding key information in a given text (Skimming - Scanning). **Writing**– Coherence and cohesion in writing – Short paragraph writing – Writing short messages.

Grammar&Vocabulary (Function Grammar & Technical Vocabulary)

WH questions –Yes/No Question - Subject Verb agreement. **Vocabulary**– Compound Nouns/Adjectives – Irregular verbs.

Unit - III LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (8)

Listening –Listening for specific task–fill in the gaps.**Speaking**–Phonemes–Syllables–Roleplay – Conversation Practice.**Reading** –comprehension passages based on general topics or matters of current affairs. **Writing -** Autobiographical writing & Biographical writing.

Grammar&Vocabulary (Function Grammar & Technical Vocabulary)

Preposition – Infinitive &Gerund. – Foreign words used in English – British and American usage.

Unit- IV LSRW SKILLS & GRAMMAR, CAREER ORIENTED

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking andRepresenting)

Listening –Responding to questions–Reading in class for complete understanding and for betterpronunciation. **Speaking** – Debate- Presentations in seminars.**Reading** – Making inference from the reading passage – Predicting the content of reading passages. **Writing -** Interpreting visual materials (tables, graphs, charts, etc) & Instruction writing.

Grammar&Vocabulary (Function Grammar & Technical Vocabulary)

Parts of Speech, Sentence pattern – Voice (active and passive voice). **Vocabulary** – One word substitution.

Unit-VLSRW SKILLS & GRAMMAR, FIELD WORK

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (10)

Listening –Distinction between native and Indian English (Speeches by TED and Kalam). **Speaking**-Extempore talk –Just-a-minute talk.**Reading**-Reading strategies–Intensive reading – Text analysis.**Writing -** Creative writing – Writing circulars and notices – Writing proposal.

Grammar&Vocabulary (Function Grammar & Technical Vocabulary)

Direct and Indirect speech – Conditional sentences - Auxiliary verbs.**Vocabulary** – Abbreviations & Acronyms.

Note: Students shall have hands on training in improving listening skill in the language laboratory @2 periods per each unit.

Total-45

TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Sangeeta Sharma , Meenakshi Raman	Technical Communication: Principles And Practice 2nd Edition	OUP, New Delhi.	2015

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Lakshminarayanan, K.R. &Murugavel, T.	Communication Skills for Engineers	SCITECH Publications, Chennai	2009
2	Rizvi Ashraf, M	Effective Technical Communication	Tata McGraw-Hill, New Delhi.	2007
3	Rutherford Andrea, J.	Basic Communication Skills for Technology	Pearson Education	2006

WEBSITES:

www.learnerstv.com– Listening/ Speaking/ Presentation
www.usingenglish.com–Writing/ Grammar
www.englishclub.com–Vocabulary Enrichment/ Speaking
www.ispeakyouspeak.blogspot.com–Vocabulary Enrichment/ Speakingwww.teachertube.com–Writing
Technicallywww.Dictionary.com – Semantic / Grammar

17BTCE102 ENGINEERING MATHEMATICS I 3 2 0 4

COURSE OBJECTIVES

1. To develop analytical skills for solving different engineering problems.
2. To understand the concepts of Matrices and vector differentiation.
3. To solve problems by applying Differential Calculus and Differential equations.
4. To solve problems of implicit functions and successive differentiation.
5. To understand Reduction to canonical form through orthogonal reduction.
6. To solve vector operator applied to vector point functions

COURSE COURSE OUTCOMES::

1. Apply advanced matrix knowledge to Engineering problems.
2. Improve their ability in solving geometrical applications of differential calculus problems
3. Improve their ability in vector differentiation.
4. Apply knowledge for chain rule and successive differentiation
5. Apply engineering problems -Partial differential equations
6. Improve their ability for vector operator applied to scalar point functions.

UNIT I MATRICES (12)

Review of Matrix Algebra - Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic forms – Reduction to canonical form through orthogonal reduction.

UNIT II DIFFERENTIAL CALCULUS (12)

Limits, Continuity (Concepts only)- Differentiation- Differentiation Techniques: standard formulae, product rule, quotient rule, chain rule, method of substitution, implicit functions and successive differentiation.

UNIT III GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS (12)

Curvature – centre, radius and circle of curvature in Cartesian co- ordinates – Evolutes - Envelope – Evolute as envelope of normals.

UNIT IV DIFFERENTIAL EQUATIONS (12)

Introduction to Ordinary differential equations: Linear ordinary differential equations of second and higher order with constant coefficients.

Introduction to Partial differential equations: Linear Partial differential equations of second and higher order with constant coefficients.

UNIT V VECTOR DIFFERENTIATION (12)

Vectors-Differentiation of vectors – scalar and vector point functions –vector operator – vector operator applied to scalar point functions: Gradient; vector operator applied to vector point functions: Divergence and curl; Physical interpretation of divergence and curl, Directional derivative, solenoidal and irrotational vectors.

Total: 60

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Hemamalini. P.T	Engineering Mathematics	McGraw Hill Education (India) Private Limited, New Delhi	2014
2	Sundaram, V. Lakhminarayan,K.A. &Balasubramanian,R.	Engineering Mathematics for first year.	Vikas Publishing Home, New Delhi.	2006
3	Bali, N.P. & Manish Goyal	A Text Book of Engineering Mathematics	Laxmi Publications Pvt. Ltd., New Delhi.	2014

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Grewel . B. S.	Higher Engineering Mathematics	Khanna Publications, New Delhi.	2014
2	BhaskarRao. P. B, Sri Ramachary SKVS, BhujangaRao. M	Engineering Mathematics I	BS Publications, India.	2010
3	Ramana. B.V	Higher Engineering Mathematics	Tata McGraw Hill Publishing Company, New Delhi.	2007
5	Michael D. Greenberg	Advanced Engineering Mathematics	Pearson Education, India	2009

WEBSITES:

1. www.efunda.com
2. www.mathcentre.ac.uk
3. www.intmath.com/matrices-determinants
4. www. Intmath.com/calculus/calculus-intro.php

17BTPH103/17BTPH203 ENGINEERING PHYSICS 3 0 0 3

COURSE OBJECTIVES:

1. To enhance the fundamental knowledge in Physics and its applications relevant to various branches of Engineering and Technology
2. For checking, judging and critiquing the applications of Electrodynamics, Optics and Relativity
3. Explain Quantum Mechanics to understand wave particle dualism. Necessity of quantum mechanics to explore the behavior of sub atomic particles. Evaluate the Eigen values and Eigen functions of a particle
4. To understand the basic elastic and dielectric properties of materials. To demonstrate the success of quantum free electron theory over classical free electron theory
5. To classify the type of the defect present in the crystal. To find out the particle size of a crystal by XRD technique
6. To know the significance of Maxwell's equations in the Engineering applications of electromagnetic waves

COURSE COURSE OUTCOMES:::

1. The students will have the knowledge on the basics of physics related to properties of matter, fiber optics, quantum, crystal physics and that knowledge will be used by them in different engineering and technological applications
2. Check, judge and critique the applications of Electrodynamics, Optics and Relativity
3. understand applications of optics using basic fundamentals of Physics
4. Explain the Modern Physics Concepts
5. familiar with Basic Elements of Quantum Theory
6. knowledge about dual nature of wave function, Applications of Schrodinger wave equation Fermi-Dirac probability function, Position of Fermi level in intrinsic and extrinsic semiconductors, Semiconductor conductivity

UNIT I PROPERTIES OF MATTER AND THERMODYNAMICS (9)

Threetypes of modulus of elasticity – basic definitions, relation connecting themodulii (Derivation), Poisson‟s ratio- Torsional pendulum- bending of beams - bending moment – uniform and non uniform bending

Thermodynamics – laws of thermodynamics- concept of entropy- change of entropy in reversible and irreversible processes – refrigeration.

UNIT II LASER AND FIBER OPTICS (9)

Introduction – emission and absorption process- Einstein‟s coefficients derivation. Types of LASER - CO_2, Semiconductor LASER- Applications of LASER in industry and medicine.Total internal reflection – modes of propagation of light in optical fibers – numerical aperture andacceptance angle – derivations, types of optical fibers (Material, refractive index and mode) – fiber optical communication system (block diagram)

UNIT III QUANTUM PHYSICS (9) Introduction to quantum theory – Black body radiation - dual nature of matter and radiation –de Broglie wavelength, uncertainty principle –Schrödinger‟s wave equation – time dependent and time independent equations – particle in one dimensional box- physical significance of wave function, scanning electron microscope

UNIT IV CRYSTAL PHYSICS (9)

Lattice – unit cell – Bravais lattice – calculation of number of atoms per unit cell, atomic radius, coordination number, packing factor for SC, BCC, FCC and HCP structures, crystal defects – point, line and surface defects

UNIT V ULTRASONICS AND NUCLEAR PHYSICS (9)

Production of ultrasonics by piezoelectric method –Non Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays, Medical applications – Sonogram. Introduction – basics about nuclear fission and fusion, Radiation detectors – semi conductor detector. Reactors – essentials of nuclear reactor- power reactor.

Total- 45

TEXT BOOK:

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Ganesan.S and Baskar.T	Engineering Physics I	GEMS Publisher, Coimbatore-641 001	2015

REFERENCES:

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Serway and Jewett	Physics for Scientists and Engineers with Modern Physics	Thomson Brooks/Cole, Indian reprint, New Delhi	2010
2	Gaur, R.K. and Gupta, S.C	Engineering Physics	Dhanpat Rai Publications,New Delhi.	2011
3	M.N. Avadhanulu and PG Kshirsagar	A Text book of Engineering Physics	S.Chand and company, Ltd., New Delhi	2011
4	D.C. Ghosh, N.C. Ghosh, P.K. Haldar	Engineering Physics	University Science, New Delhi	2011
5	P. Khare, A. Swarup	Engineering Physics: Fundamentals and Modern Applications	Jones & Bartlett Learning	2009

WEBSITES:

1. www.nptel.ac.in
2. www.physicsclassroom.com
3. www. oyc.yale.edu
4. www.physics.org

17BTCH103/17BTCH203 ENGINEERING CHEMISTRY 3 0 0 3

COURSE OBJECTIVES

1. To understand about the water technology.
2. To get the information on electrochemical cells, batteries, fuels and combustion.
3. To study about the corrosion and protective coatings.
4. To gain knowledge on adsorption phenomena.
5. To make the student conversant with basic water technology
6. To acquaint the students with the basic of engineering materials

COURSE COURSE OUTCOMES::

1. This course will create an impact on the students and make them to realize the modern utility on electrochemical cells, batteries, fuels and combustion process, corrosion and adsorption methods.
2. Outline the basic principles of chemistry for water treatment
3. Identify the concept of corrosion and its protection in the engineering field
4. Apply the concepts combustion of different fuels
5. Apply the concepts of surface chemistry in the field of engineering
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology

UNIT I WATER TECHNOLOGY (9)

Sources-Characteristics – Specification for drinking water, BIS &WHO-Alkalinity – Types of alkalinity and determination (No problems) – Hardness – Types and estimation by EDTA method (No problems) - Domestic water treatment – Disinfection methods (Chlorination, Ozonation. UV treatment) – Boiler feed water – Requirements – Disadvantages of using hard water in boilers – Internal conditioning (Phosphate, Calgon and Carbonate conditioning methods) – External conditioning – Demineralization process – Desalination - Reverse osmosis.

UNIT II ELECTROCHEMISTRY AND STORAGE DEVICES (9)

Electrolytic conductance-application (conductometric titration)- Electrochemical cells – EMF – Measurement of emf – Single electrode potential – Nernst equation – Reference electrodes –Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – Glass electrode and measurement of pH – Electrochemical series – Significance – Potentiometric titrations (Redox - Fe^{2+} vs dichromate) –-Batteries- Primary batteries-Leclanche cell- Secondary batteries- Lead acid battery. An introduction to Fuel Cell- H_2-O_2 Fuel Cell.

UNIT III FUELS AND COMBUSTION (9)

Coal - Proximate and Ultimate analysis - Metallurgical coke - Manufacture by Otto-Hoffman method - Petroleum processing and fractions - Synthetic petrol - Bergius and Fischer-Tropsch method - Knocking - Octane number and Cetane number - Gaseous fuels - Water gas, Producer gas, Combustion of fuel-Introduction-GCV-NCV- Problems on Calculation of GCV & NCV - Flue gas analysis.

UNIT IV CORROSION SCIENCE (9)

Chemical and Electrochemical corrosion - Galvanic corrosion - Differential aeration corrosion - Corrosion control - Sacrificial anode and Impressed current cathodic methods - Corrosion inhibitors - Protective coatings – Organic coatings-Paints - Constituents and functions –Inorganic coatings-Metallic coatings - Electroplating of Cu over Fe and Electro less plating (Ni) - Surface conversion coating - Hot dipping.- Anodizing of Al

UNIT V SURFACE CHEMISTRY AND PHASE RULE (9)

Introduction-Adsorption-Types, adsorption of gases on solids, adsorption of solutes from solutions, Adsorption isotherms-Freundlich adsorption isotherm-Langmuir adsorption isotherm- Role of adsorbents in industries (catalysis and water softening).

Phase Rule: Definition -Phase diagrams – one component water system, two component Ag-Pb system.

Total: 45

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Dr. Vairam.S	Engineering Chemistry	Gems Publishers, Coimbatore.	2014
2.	Dr.Ravikrishnan.A	Engineering Chemistry I & II	Sri Krishna Hi tech Publishing Company (P) Ltd., Chennai.	2012

REFERENCE BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Raman Sivakumar	Engineering Chemistry I &II	McGraw-Hill Publishing Co.Ltd., 3rd Reprint NewDelhi.	2013
2.	Kuriakose. J.C. and Rajaram	Chemistry in Engineering and Technology. Vol. I & II 5th edition.	Tata McGraw Hill Publishing Company, New Delhi.	2010
3.	Jain, P.C. and Monika Jain	Engineering Chemistry.	Dhanpat Rai Publishing Company (P) Ltd., New Delhi.	2009
4.	Dara.S.S	Text book of Engineering Chemistry.	S.Chand&Co.Ltd., New Delhi	2008
5.	Sharma.B. K	Engineering Chemistry	Krishna Prakasam Media (P) Ltd., Meerut	2001

WEBSITES:

1.http://www.studynotes.ie/leaving-cert/chemistry/
2. http://www.rejinpaul.com/2011/04/engineering-chemistry-ii-second.html
3.http://www.learnerstv.com/Free-chemistry-Video-lectures-ltv044-Page1.htm
4. http://ocw.mit.edu/courses/#chemistry
5. http://www.chem.qmul.ac.uk/surfaces/sec

COURSE OBJECTIVES

1. To study the basic unit operations and unit processes in Chemical industry
2. To study the Process instrumentation and safety
3. To introduce the student with basic concepts of Chemical Engineering
4. To introduce the moles and pressure concept
5. To introduce the chemical process and basic concepts
6. Recognition of and commitment to the importance of continued self-improvement and the ability to engage in lifelong learning

COURSE COURSE OUTCOMES::

1. Students will be able to convert units of simple quantities from one set of units to another set of units
2. Students will be able to calculate quantities and /or compositions, energy usages, etc. in variousprocesses and process equipment such as reactors, filters, dryers, etc.
3. Gain knowledge of chemical processes and the need of safety in industries.
4. student will able to know the knowledge of basic of chemical operation
5. Students will be able to know basic principles of chemical operation
6. Students will be able to know chemical process

INTRODUCTION (Not included for examination) **3**

Introduction to chemical engineering; history of chemical engineering and chemical technology; Scope of Chemical Engineering, Nature of Industries.

UNIT IBASIC CHEMICAL CALCULATIONS **8**

Basic Concepts: concept of mole, weight percent, mole percent, normality, molarity, molality, vapor pressure, partial pressure.

UNIT IIUNIT PROCESSES **8**

Introduction to unit processes with simple examples like sulphonation, polymerization, oxidation, hydrogenation, saponifoication, etherification, nitration, chlorination.

UNIT III UNIT OPERATIONS-I **8**

Introduction, Definition, examples like Size reduction, sedimentation, filtration, Distillation, evaporation, absorption, extraction, fluid handling, mixing, solid handling, fluid-solid contacting, fluid-solid separation, fluid storage, crystallization, drying, leaching.

UNIT IV UNIT OPERATIONS-II **8**

Heat Transfer- Conduction, Convection, Radiation concepts and Heat Exchangers.Principle of Ion exchange, techniques and applications. Solid and liquid membranes; concept of osmosis; reverse osmosis; electro dialysis; ultrafiltration Fluid properties, fluid flows, flow measurement devices.

Conversion, Yield, efficiency, flow diagram, flow sheets, & block diagram, with examples

TOTAL **45**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	W.L. McCabe and J.C. Smith and Peter Harriott,	Unit operations in chemical engineering	Mc Graw Hill	1993
2	Coulson J M and Richardson J F	Chemical Engineering, Vol. I and II	Pergamon Press, NY	1990

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Himmelblau, D.H	Basic Principles and Calculations in Chemical Engineering	Prentice Hall, New York	1990
2	Badger and Banchero	Introduction to Chemical Engineering	McGraw Hill,	1954

WEBSITES

http://biochemie.lf2.cuni.cz/anglicky/biox2zimni/seminare/Chemistry%20calculations%20I.pdf

http://www.docbrown.info/page04/4_73calcs07mam.htm

https://docs.google.com/file/d/0B6mmcxyrKnEhdEY0ZTMzeHNVSHM/edit

17BTBT105 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING 3 0 0 3

COURSE OBJECTIVES

1. To impart the basic knowledge about the Electric circuits.
2. To understand the working of various Electrical Machines.
3. To know about various measuring instruments.
4. To understand the basic concepts in semiconductor devices and digital electronics.
5. To know Dynamometer type Watt meters and Energy meters
6. To understand the Boolean expressions using logic gates

COURSE OUTCOMES:

1. The students shall develop an intuitive understanding of the circuit analysis,
2. Basic concepts of electrical machines,
3. Basics of electronics and be able to apply them in practical situation.
4. Fundamentals of Voltage Regulation. Bipolar Junction Transistor
5. Implementation of Boolean expressions using logic gates
6. Basics of Dynamometer type Watt meters and Energy meters

UNIT IELECTRIC CIRCUITS & MEASUREMENTS 9

Ohm‟s Law – Kirchoff‟s Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase balanced Circuits.

UNIT II ELECTRICAL MACHINES 9

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III MEASURING INSTRUMENTS 9

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT IV SEMICONDUCTOR DEVICES AND APPLICATIONS 9

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics

UNIT V DIGITAL ELECTRONICS 9

Number systems – binary codes - logic gates - Boolean algebra, laws & theorems- simplification of Boolean expression - implementation of Boolean expressions using logic gates - standard forms of Boolean expression.

TOTAL 45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Mittle, V.M	Basic Electrical Engineering	Tata McGraw Hill Edition, New Delhi	2004
2	SedhaR.S	Applied Electronics	S. Chand & Co	2006

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Muthusubramanian R, and Muraleedharan K A	Basic Electrical, Electronics and Computer Engineering	Tata McGraw Hill, Second Edition	2006
2	Nagsarkar T K and Sukhija M S	Basics of Electrical Engineering	Oxford press	2005
3	Mahmood Nahvi and Joseph A. Edminister	Electric Circuits	Schaum‟ Outline Series, McGraw Hill	2002
4	Premkumar N	Basic Electrical Engineering	Anuradha Publishers	2003

17BTPH111/17BTPH211 ENGINEERING PHYSICS LABORATORY 0 0 4 2

COURSE OBJECTIVES:

1. To develop basic laboratory skills
2. Demonstrating the application of physical principles.
3. Application of Young‟s modulus of the material – Non uniform bending (or) Uniform bending.
4. Application of of Band Gap of a semiconductor material
5. To develop basic knowledge about acceptance angle in an optical fiber
6. To know the wavelength of mercury spectrum, Viscosity of liquid

COURSE COURSE OUTCOMES:::

1. The students will have the knowledge on Physics practical experiments
2. Knowledge will be used by them in different engineering and technological applications.
3. Spectrometer Dispersive power of a prism
4. Student will be able to Determination of thickness of a thin wire – Air wedge method
5. Student will able to Determination of Band Gap of a semiconductor material
6. Student will able to Young‟s modulus of the material – Non uniform bending (or) Uniform bending.

LIST OF EXPERIMENTS – PHYSICS

1. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
2. Determination of wavelength of mercury spectrum – spectrometer grating.
3. Determination of Young‟s modulus of the material – Non uniform bending (or) Uniform bending.
4. Determination of Viscosity of liquid – Poiseuille‟s method.
5. Spectrometer Dispersive power of a prism.
6. Torsional pendulum – Determination of Rigidity modulus.
7. Particle size determination using Diode Laser
8. Determination of Laser parameters – Wavelength, and angle of divergence.
9. Determination of acceptance angle in an optical fiber.
10. Determination of thickness of a thin wire – Air wedge method
11. Determination of Band Gap of a semiconductor material.
12. Determination of Specific resistance of a given coil of wire – Wheatstone Bridge

17BTCH111/17BTCH211 ENGINEERING CHEMISTRY LABORATORY 0 0 4 2

COURSE OBJECTIVES:

1. To provide students with practical knowledge of quantitative analysis of materials byclassical
2. To provide students with instrumental methods for developing experimental skills in building technical competence.
3. To know practical knowledge Ferric ion by Spectrophotometry
4. To know Practical knowledge of molecular weight and degree of polymerization using Viscometers.
5. To know practical knowledge of pH Titration
6. To know of molecular weight and degree of polymerization using Viscometers

COURSE COURSE OUTCOMES:::

1. The students will be outfitted with hands-on knowledge in quantitative chemical analysis of water quality parameters
2. The students will be corrosion measurement.
3. students will be able to know the Ferric ion by Spectrophotometry
4. Students will be able to know the of molecular weight and degree of polymerization using Viscometers.
5. students will be able to know the pH Titration
6. students will be able to know the chemical oxygen demand

LIST OF EXPERIMENTS – CHEMISTRY

1. Estimation of alkalinity of Water sample.
2. Estimation of hardness of Water by EDTA
3. Estimation of chloride in Water sample (Argentometric method)
4. Determination of corrosion rate by weight loss method.
5. Conductometric Titration (Simple acid base).
6. Conductometric Titration (Mixture of weak and strong acids).
7. Conduct metric Titration using $BaCl_2$ vs Na_2 SO_4.
8. pH Titration (acid & base).
9. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$).
10. Estimation of Ferric ion by Spectrophotometry.
11. Determination of water of crystallization of a crystalline salt (Copper sulphate).
12. Determination of molecular weight and degree of polymerization using Viscometers.
13. Determination of chemical oxygen demand.

17BTCE112 ENGINEERING WORKSHOP PRACTICE 0 0 4 2

COURSE OBJECTIVES

1. To provide exposure to the students with hands on experience on various basic engineering practices in Mechanical, Electrical and Electronics Engineering.
2. Students able to understand different tool &equipment for work shop practice.
3. Students acquire skills for the preparation of different Carpentry/fitting/welding models.
4. Students able to understand the safety precaution in the workshop
5. Student acquires skills of Application orientated tasks.
6. Prepare the student for future Engineering positions

COURSE OUTCOMES:

1. To provide exposure to the students with hands on experience on various basic Engineering practices in Civil and Mechanical Engineering
2. To provide exposure to the students with hands on experience on various basic Engineering practices in Electrical and Electronics Engineering.
3. To develop general machining skills in the students.
4. To develop a skill in dignity of labour, precision, safety at work place, team working and development of right attitude
5. Prepare the simple job as per specification using tin smithy tools
6. Select appropriate pipe fitting tool for the required application

PART – A (MECHANICAL)

i. WELDING

i. Preparation of arc welding of butt joints, lap joints and tee joints.

ii. BASIC MACHINING

i. Simple Turning and Taper turning
ii. Drilling and Tapping
iii. Sheet Metal Work
iv. Model making – Trays, funnels, etc.

iii. DEMONSTRATION ON

i. Smithy operations
ii. Foundry operations
iii. Plumbing Works
iv. Carpentary Works

PART –B (ELECTRICAL & ELECTRONICS)

iv. ELECTRICAL ENGINEERING

i. Study of electrical symbols and electrical equipments.
ii. Construct the wiring diagram for Stair case wiring.
iii. Construct the wiring diagram for Residential house wiring using switches, fuse, indicator, lamp and energy meter.
iv. Measurement of electrical quantities – voltage, current, power & power factor in R load.
v. Measurement of energy using single phase energy meter.

v. ELECTRONICS ENGINEERING

i. Study of Electronic components– Resistor (color coding), capacitors and inductors.
ii. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
iii. Study of logic gates AND, OR, NOT, NOR and NAND.

REFERENCES

S. No.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	Jeyachandran, K., Natarajan, S. and Balasubramanian, S	A Premier on Engineering Practices Laboratory	Anuradha Publishers, Kumbakonam	2007
2	Jeyapoovan, T., Saravanapandian, M	Engineering Practices LabManual	Vikas Puplishing House Pvt. Ltd, Chennai	2006
3	Bawa, H.S	Workshop Practice	Tata McGraw – Hill Publishing Company Limited, New Delhi	2007

17BTBT113 ENGINEERING GRAPHICS 1 0 3 3 100

COURSE OBJECTIVES

1. To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
2. To expose them to existing national standards related to technical drawings.
3. Employ freehand 3D pictorial sketching to aid in the visualization process and to efficiently communicate ideas graphically
4. The course is aimed at developing Basic Graphic skills.
5. Develop Skills In Preparation Of Basic Drawings.
6. Skills in Reading and Interpretation of Engineering Drawings

COURSE COURSE OUTCOMES::

1. Perform free hand sketching of basic geometrical constructions and multiple views of objects.
2. Do orthographic projection of lines and plane surfaces.
3. Draw projections and solids and development of surfaces.
4. Prepare isometric and perspective sections of simple solids.
5. Demonstrate computer aided drafting.
6. Appreciate the usage of engineering curves in tracing the paths of simple machine components

UNIT I INTRODUCTION 9

Introduction to Engineering Drawing, Bureau of Indian Standards (BIS), Layout of drawing sheets, sizes of drawing sheets, different types of lines used in drawing practice geometric constructions, principles of dimensioning– linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension.

UNIT II SCALES AND PLANE CURVES 8

SCALES:Reducing Scale, Enlarging Scale, Plain Scale, Diagonal Scale and Vernier Scale. Conics – Construction of Ellipse, Parabola and Hyperbola by eccentricity method

UNIT III FREE HAND SKETCHING 9

Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT IV PROJECTION OF POINTS, LINES AND PLANE SURFACES 8

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Traces–Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT VPROJECTION OF SOLIDS 8

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

Introduction to Drafting Software/Package (Not for Exam) 3

Basic operation of drafting packages, use of various commands for drawing, dimensioning, editing, modifying, saving and printing/plotting the drawings.Introduction to 3D primitives.

TOTAL 45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Venugopal K and Prabhu Raja V	Engineering Graphics	New Age International Publishers	2007
2	VTU	A Primer on Computer Aided Engineering Drawing	Belgaum	2006

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Kumar M S	Engineering Graphics	D D Publications, Chennai	2007
2	Bureau of Indian Standards	Engineering Drawing Practices for Schools and Colleges SP 46-2003	BIS, New Delhi	2003
3	Luzadder W J	Fundamentals of Engineering Drawing	Prentice Hall Book Co., New York	1998

WEB REFERENCES

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

17BTCC151 **YOGA** **1 0 0**

COURSE OBJECTIVES:

1.Yoga Education Helps To Develop The Self Discipline, Self Control, Awareness, Concentration And Higher Level Of Consciousness.

2. To give them a basic understanding of Definition of psychology, Methods of psychological sciences like Introspection method, Observation method, Case study method and Observation method.

3.To awre of Scope and substance of Indian Psychology, Cognitive process like Sensation, Perception, Attention, Memory, Language, Thinking, Concept formation and creativity, Extra sensory perception,

4. Fundamentals of Attitudes, learning, motivation and emotion.

5. awere of Yoga Psychology and Definition& characteristics of Personality and Indian approaches to Personalit

6. To provide the necessary knowledge of Kriyas, Asanas, Mudras, Bandas, Pranayama and meditative postures

COURSE COURSE OUTCOMES::

1. Demonstrate basic skills associated with yoga and Pilates.
2. Demonstrate the ability to perform yoga movements in various combination and forms.
3. Understand and apply the knowledge of basic choreography, and effective group management.
4. Demonstrate the ability to create and present various yoga activities. Identify opportunities for participation in yoga activities in the community.
5. Demonstrate an understanding of health-related fitness components: muscular strength, muscular endurance, and stress management.
6. Understand and correctly apply biomechanical and physiological principles elated to exercise and training.

UNIT- I

Introduction To Yoga- Meaning Of Yoga – Concept Of Yoga- Aim And COURSE OBJECTIVES Of Yoga – History Of Yoga - Systems Of Yoga.- Stages (Or) Limbs Of Yoga

UNIT- II

Asanas-Surya Namashkar- Thdasana- Veerabadhra Asana- Trikonasana- Utkatasana- ArdhaChakrasana- Ardha Kati Chakrasana- Thandasana- Gomugasana- Padmasana- Vajrasana- Paschimottasana- Matsyendrasana-BavanaMukthasana- SuptaPadhangusthasana-Sethubhandhasana- Navasana- ArdhaBavanamukthasana- Mathasyasana- Naukasana- Bujangasana- Salabasana- Makkarasana-Dhanurasana.

UNIT- III

Advance Asanas- Sirasasana- Garudasana- Natrajasana- Rajakoptasana- Chakrasana- Kukutasana- Virikshasana- Sarvagasana- Halasana-. Mayurasana.

UNIT- IV

Pranayama- Meaning- Types Of Pranayama- Bhastrika- Bhramari- Udgeeth- Kabalbhati- Bahya- AnulomVilom- Pranay Pranayama- Benefits Of Pranayama. Neti - JalaNeti , Sutra Neti, Nouli-Three Types, Douthy-Three Types

UNIT- V

Mudras- Uses Of Mudras- Gyan- Shoonya- Apaan- Prana- Vayu- Prithvi- Linga- Apana- Adi Mudra-- Agni Mudra- Surya Mudra- Varuna- Hakini Mudra.

REFERENCES:

S. No.	Author Name	Title Of Book	Publisher	Year of Publication
1.	Dr.K.Chandrasekaran	Sound Health Through Yoga	Prem Kalyan	2009
2.	B.K.S.Iyangar	Light On Pranayama	Crossroad Centuary	2013
3.	Thirumular	Thirumandhiram	Sriramakrishna Math	2016

SEMESTER II

17BTCC201ABUSINESS COMMUNICATION 3 0 0 3

COURSE OBJECTIVES

1. To help students comprehend the role of listening skills in effective communication.
2. To familiarize students with verbal and non-verbal communication.
3. To expose students to neutral accent.
4. To develop emotional intelligence skills in them for enhancing their self-esteem.
5. To assist them in setting goals and developing positive attitude.
6. To enable students to acquire decision making skills, problem solving skills and assertive skills.

COURSE COURSE OUTCOMES::

1. Design and deliver a persuasive presentation that convinces the audience of the topic's relevance and overcomes resistance, using appropriate visual support and adhering to a specified time limit.
2. Use a strategic communication model and critical thinking to identify COURSE OBJECTIVES, analyze audiences, and choose the most effective structure and style for delivering strategically sound written and spoken messages.
3. Practice principles of effective business writing and document design in all written documents.
4. Build an understanding of different organizational cultures, business practices, and social norms to communicate more effectively in domestic and cross-cultural business contexts.
5. Develop their soft skills and inter personal skills, which will make the transition from college to workplace smoother and help them excel in their job.
6. To demonstrate his verbal and non-verbal communication ability through presentations

UNIT I

What is Business Communication? - Types of Communication – Formal and informal communication – Process of Communication- modes of Communication – Barriers to communication.

UNIT II

Written Business Communication – Style- word-usage- organisation of Ideas – mechanics of writing and fill up of forms - Cover Letter- Letter for Job Application- Letter of Complaint - Memos - Resumes - Email- Reports Revising and proofreading- Advertising slogans- jargons- interpretation of graphs using expressions of comparison and contrast .

UNIT III

Reading and Understanding the news articles - Oral Business Communication - First Impressions - Attire – Effective Presentation strategies- Nuances of delivery – Controlling nervousness and stage fright- Visual aids Presentations- Capturing Audience - Tone - Behavior - Telephone Etiquette- Non - verbal communication - Eye contact - Facial expressions - Posture - Gestures - Body langage – Etiquette- Organization of presentation – brain storming- Negotiations.

UNIT - IV

Difference between goals and dreams - SMART goal setting - 3 Ds of goal setting- Determination, Discipline and Direction - Developing the right attitude - Motivation - Intrinsic and Extrinsic motivation - Dealing with change - Dedication - Taking responsibilities - Decision making.

UNIT - V

Intrapersonal skills - Self-analysis - Thought process – Interpersonal skills - Confidence building - Resolving conflicts- Analytical skills - Team Building - Leadership skills - Planning/organizing - Ability to work independently - Professional ethics - Communicating via e-mail. Ethical perspectives and their implications for responsible communication - Proposal Presentation

TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Meenakshi Raman ; Prakash Singh	1. Business Communication	Oxford University Press	2012

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Murthy, G .R. K.	Soft Skills for Success**.**	The ICFAI University Press, Hyderabad.	2008
2	Jagadeesan, G & Santanakrishnan,R.	Soft Skills Development:Training and Evaluation.	The ICFAI University Press, Hyderabad.	2008
3	Sherfield, Robert M., Rhonda J. Montgomery, & Patricia G. Moody	Developing Soft Skills.	Pearson Education, New Delhi.	2005

WEBSITES

http://tribehr.com/social-hr-software/talent-management/skills-trackingwww.ispeakyouspeak.blogspot.comhttps://alison.com/subjects/6/Personal-Development-Soft-Skills www.learning-development.hr.toolbox.comhttp://www.niit.com/solution/soft-skill-training

17BTCC201B TECHNICAL ENGLISH 3 0 0 3

COURSE OBJECTIVES

1. To motivate learners to acquire listening & speaking skills in both formal and informal context.
2. To focus on question forms & to make them understand the importance of using question tags and also the functional use of transformation of sentences.
3. To improve their reading habit and to train them in critical and analytical reading.
4. To equip them to write for academic as well as work place context.
5. To enable students to face interviews.
6. To allow students to gain key strategies and expressions for communicating with professionals and non-specialists

COURSE COURSE OUTCOMES::

1. Acquire second language: speaking convincingly, expressing their opinions clearly, negotiating and arguing using appropriate communicative strategies.
2. Enhance them reading texts critically and analytically.
3. Develop writing effectively, persuasively and producing different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
4. Enrich the ability to face interviews with confidence.
5. Understand how to critically analyze data from research; incorporate it into assigned writing clearly, concisely, and logically; and attribute the source with proper citation.
6. Practice the unique qualities of professional rhetoric and writing style, such as sentence conciseness, clarity, accuracy, honesty, avoiding wordiness or ambiguity, using direct order organization, readability, coherence and transitional devices

UNIT-1 LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and

Representing) (9)

Listening - Difference between Hearing & Listening–Listening to informal conversation. **Speaking** -Spoken structures on different situations - Introduction, Greeting, Comments on topics like Films, Games etc, Excuse, Request, Agreement, Disagreement, etc., **Reading** – Extensive and Intensive reading. **Writing** – Report writing - Writing a covering letter.

Grammar&Vocabulary (Function Grammar & Technical Vocabulary)

Regular & Irregular verbs - Kinds of sentences - Question tags. Homonyms and Homophones.

UNIT-II LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and

Representing) (9)

Listening –Note Taking- Improving grasping ability.**Speaking**–Welcome address - Vote of thanks

- Master of ceremony.**Reading** – Active and Passive reading - Reading for vocabulary- Reading for a purpose. **Writing** - Writing a review (Film review) - Summary of a story.**Grammar&Vocabulary(Function Grammar & Technical Vocabulary**)

Modal verbs – Conjunction - Expression of cause and effect.Phrasal verbs - Idioms.

UNIT – III LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and

Representing) (9)

Listening - Barriers to listening (Physical, Psychological, Linguistic & Cultural). **Speaking** – Stress,Pause and Intonation. **Reading** – Rapid reading – Skimming, Scanning and Surveying. (SQ3R)**Writing** - Essay writing -Minutes of meeting - Agenda

Grammar&Vocabulary (Function Grammar & Technical Vocabulary)

Active and Passive voice - Purpose expression. Same words used as noun and verb - Often misspelt and confused words.

UNIT-IV LSRW SKILLS & GRAMMAR, CAREER ORIENTED

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and

Representing) (9)

Listening –Listening to telephone conversation - Viewing model interviews. **Speaking** – GroupDiscussion - Correlation between verbal & non - verbal communication.**Reading** – Reading comprehension (short & long text) - Reading job advertisements and profile of a company.**Writing** – Checklist preparation.

Grammar&Vocabulary (Function Grammar & Technical Vocabulary)

Grammar - Numerical expressions–Collocations. Singular and Plural (Nouns)

UNIT- V LSRW SKILLS & GRAMMAR, FIELD WORK

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and

Representing) (9)

Listening –Types of listening- Improving listening comprehension**. Speaking** - Oral presentation -

Vocal communication techniques - Voice, quality, volume, pitch etc., **Reading** -Note making - Making notes from books/ any forms of writing materials. **Writing** - Describing process & products -

Recommendation writing – Short essays writing-

Grammar&Vocabulary (Function Grammar & Technical Vocabulary)

Transformation of sentences (Simple, Compound & Complex).Collection of Technical Vocabularies with their meanings.

Note: Students shall have hands on training in improving listening skill in the language laboratory @2 periods per each unit.

Total-45

TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Sangeeta Sharma , Meenakshi Raman	Technical Communication: Principles And Practice 2nd Edition	OUP, New Delhi.	2015

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Lakshminarayanan, K.R. &Murugavel, T.	Communication Skills for Engineers	SCITECH Publications, Chennai	2008
2	Rizvi Ashraf, M	Effective Technical Communication	Tata McGraw-Hill, New Delhi.	2007
3	Rutherford Andrea, J.	Basic Communication Skills for Technology	Pearson Education, New Delhi.	2006

WEBSITES :

www.learnerstv.com– Listening/ Speaking/ Presentation
www.usingenglish.com– Writing/ Grammar www.englishclub.com– Vocabulary Enrichment/ Speaking www.ispeakyouspeak.blogspot.com– Vocabulary Enrichment/ Speaking www.teachertube.com– Writing Technically
www.Dictionary.com–Semantic / Grammar

17BTCE202 ENGINEERING MATHEMATICS II 3 2 0 4

COURSE OBJECTIVES

1. To have knowledge in integral calculus and Vector calculus
2. To expose the concept of Analytical function and Complex integration.
3. To be able to find time responses of linear systems using Laplace transforms.
4. To impart conceptual knowledge of Mathematical Sciences for formulating and analyzing the real world problems with futuristic approach.
5. To equip the students sufficiently in both analytical and computational skills in Mathematical Sciences.
6. To develop a competitive attitude for building a strong academic - industrial collaboration, with focus on continuous learning skills

COURSE COURSE OUTCOMES::

1. Solve problems in Fluid Dynamics, Theory of Elasticity, Heat and Mass Transfer etc.
2. Find the areas and volumes using Multiple Integrals
3. Improve their ability in Vector calculus
4. Expose to the concept of Analytical function.
5. Apply Complex integration in their Engineering problems
6. Students will be able to remember terminologies and formulae in differential equations, multiple integration, integral calculus

UNIT I INTEGRAL CALCULUS (12)

Definite and indefinite integrals – Techniques of integration – Substitution rule, Trigonometric integrals, Integration by parts , Integration of rational functions by partial fraction, Integration of irrational functions – Improper Integrals.

UNIT II MULTIPLE INTEGRALS (12)

Double integral – Cartesian coordinates – Polar coordinates – Area as double integrals- Change the order of integration – Triple integration in Cartesian co-ordinates.

UNITIII VECTOR INTEGRATION (12)

Integration of vectors – line integral- surface integral- volume integral- Green‟s theorem - Gauss divergence theorem and Stoke‟s theorems (Statement Only), hemisphere and rectangular parallelopipeds problems.

UNIT IV ANALYTIC FUNCTIONS (12)

Analytic functions - Cauchy-Riemann equations in Cartesian and polar forms – Sufficient condition for an analytic function (Statement Only) - Properties of analytic functions – Constructions of an analytic function - Conformal mapping: w = z+a, az, 1/z and bilinear transformation.

UNIT V COMPLEX INTEGRATION (12)

Complex Integration - Cauchy‟s integral theorem and integral formula (Statement Only) – Taylor series and Laurent series - Residues – Cauchy‟s residue theorem (Statement Only) - Applications of Residue theorem to evaluate real integrals around unit circle and semi-circle (excluding poles on the real axis).

Total: 60

TEXT BOOKS:

S.NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Hemamalini. P.T	Engineering Mathematics I & II	McGraw-Hill Education Pvt.Ltd, New Delhi	2014
2	Grewal, B.S.	Higher Engineering Mathematics	Khanna Publishers, Delhi.	2014

REFERENCE BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Erwin Kreyszig	Advanced Engineering Mathematics.	John Wiley & Sons. Singapore	2011
2	Venkataraman, M. K.	Engineering Mathematics.	The National Publishing Company, Chennai	2005
3	Narayanan. S, Manicavachagam pillay.T.K and Ramaniah.G	Advanced Mathematics for Engineering Students.	Viswanathan S.(Printers and Publishers) Pvt. Ltd. Chennai.	2002
4	Michael D. Greenberg	Advanced Engineering Mathematics	Pearson Education, India	2009

WEBSITES:

1.www.efunda.com
2. www.mathcentre.ac.uk
3. www.sosmath.com/diffeq/laplace/basic/basic.html
4. www.mathworld.wolframe.com

17BTCC204 ENVIRONMENTAL SCIENCES 3 0 0 3

COURSE OBJECTIVES

1. To give a comprehensive insight into natural resources, ecosystem and biodiversity.
2. To educate the ways and means of the environment
3. To protect the environment from various types of pollution.
4. To impart some fundamental knowledge on human welfare measures.
5. To nurture knowledge, respect, and love for the natural and human communities of central Maine, the place where they spend four formative years of their lives.
6. To develop skills of analysis and communication, bearing in mind disciplinary traditions and diverse publics

COURSE COURSE OUTCOMES:::

1. Students will prepare themselves to go ecofriendly and help preserving the nature and environment.
2. Reflecting upon their internalized values system, students will continue to evolve an individual vision of harmonious and sustainable interaction among humans as well as between humans and the rest of the natural world.
3. Sudents will have mastered foundational knowledge enabling them to make sound life decisions as well as enter a career in an environmental profession or graduate school
4. Students will be able to apply specific models of social system processes derived from various social science theories to explain environmental issues (including current and past conditions), and to propose future solutions to environmental problems
5. Students will be able to identify, interpret, and apply basic measures (metrics and formulae) of social system variables to assess socio-environmental conditions.
6. Students will be able to articulate basic understanding of various social science theories/frameworks and how they apply to environmental issues

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES (9)

Definition, Scope and Importance – Need for public awareness -Forestresources: Useandover-exploitation, deforestation- Water resources-Use and over-utilization of surface and ground water, floods, drought, conflicts over water- Land resources-Land as a resource, land degradation, man induced landslides, soil erosion and desertification –Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources- Food resources-World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture- Energy resources-Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources-role of an individual in conservation of natural resources.

UNIT II ECOSYSTEM (9)

Chemistry and Environment- Environmental segments, Composition and Structure of atmosphere-Concept of an ecosystem- Structure, components and function of an ecosystem Energy flow in the

ecosystem – Food chain, Food web and Ecological pyramids, Structure and function of Terrestrial ecosystem (Forest, Desert and Grassland ecosystem) and Aquatic ecosystem (Fresh water and Marine ecosystem)

UNIT III BIODIVERSITY (9) Introduction to biodiversity, Definition- Genetic diversity, Species diversity and
Ecosystem diversity, Biogeographical classification of India, Importance of biodiversity-Value of biodiversity - Hot Spots of biodiversity-Threats to biodiversity - Endangered and Endemic Species of India– Conservation of biodiversity- In-Situ and Ex-Situ conservation of biodiversity.

UNIT IV ENVIRONMENTAL POLLUTION (9)
Definition – causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution and Thermal pollution. Solid waste management-causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution– Disaster management-earthquake, tsunami, cyclone and landslides.

UNIT V SOCIAL ISSUES AND ENVIRONMENT (9) From Unsustainable to Sustainable development, Urban problems related to energy sources, Water conservation, Rain water harvesting and Watershed management, Resettlement and
rehabilitation of people, its problems and concerns, Environmental ethics- Issues and possible solutions- Climate change- Green house effect and Global warming, Acid rain, Ozone layer depletion, Wasteland reclamation- Environment Protection Act- Human Rights-Value education, Role of Information Technology in Environment and Human health-Population growth, Variation of population among nations-Population explosion.

Total: 45

TEXT BOOKS:

S.No.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Dr. Ravikrishnan, A	Environmental Science	Sri Krishna Hi tech Publishing Company Private Ltd., Chennai	2012
2.	Anubhakaushik C.P. Kaushik	Environmental Science and Engineering	New Age International (P) Ltd., New Delhi.	2010

REFERENCES:

S.No.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	William P.Cunningham	Principles of Environmental Science	Tata Mc Graw -Hill Publishing Company, New Delhi.	2008
2.	Linda D. Williams	Environmental Science Demystified	Tata Mc Graw -Hill Publishing Company Ltd., New Delhi.	2005
3.	BharuchaErach	Environmental Science Demystified	Mapin Publishing (P) Ltd., Ahmedabad.	2005
4.	Tyler Miller G. Jr	Environmental Science	Thomson & Thomson Publishers, New Delhi.	2004
5.	Trivedi, R.K. and Goel, P.K	Introduction to Air Pollution	Techno-Science Publications, Jaipur.	2003

WEBSITES:

1. http://people.eku.edu/ritchisong/envscinotes1.html
2.http://nptel.ac.in/courses.php?disciplineId=120
3.www.unesco.org/ext/field/beijing/scienceb.htm,www.infinitepower.org/education.htm
4. http://www.sciencedaily.com/news/top/environment/

17BTCE205 ENGINEERING MECHANICS 3 0 0 3 100

COURSE OBJECTIVES

1. To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.
2. To learn the effect of friction on equilibrium. To learn kinematics, kinetics of particle and rigid body, related principles.¬
3. To implement the above know how to solve practical problems.
4. The tools learned in this course will provide the basis for later courses and a career in engineering
5. To give students practice in applying their knowledge of mathematics, science, and engineering and to expand this knowledge into the vast area of "rigid body Mechanics".
6. To prepare the students for higher level courses such as courses in Mechanics of Solids, Mechanical Design and Structural Analysis.

COURSE COURSE OUTCOMES::

1. Ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
2. Ability to analyse the forces in any structures.
3. Ability to solve rigid body subjected to dynamic forces.
4. Use scalar and vector analytical techniques for analyzing forces in statically determinate structures. Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple,Practical problems.
5. Apply basic knowledge of mathematics and physics to solve real-world problems
6. Define, identify, and carry out equilibrium analysis of frames, machines, trusses, beams and cables.

UNIT I STATICS OF PARTICLES 9

Forces – system of forces – concurrent forces in plane and space– resultant – problems involving the equilibrium of a particle–free body diagram–equilibrium of particle in space.

UNIT IISTATICS OF RIGID BODIES IN TWO DIMENSIONS 9

Rigid bodies–moment of force about an axis–moments and couples–equivalent system of coplanar forces–Rigid body in equilibrium–problems involving equilibrium of rigid body–types of supports–reactions of beams.

UNIT III CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA 9

Centroids of areas, composite areas, determination of moment of inertia of plane figures, polar moment of inertia – radius of gyration – mass moment of inertia of simple solids.

UNIT IV KINEMATICS OF PARTICLES 9

Introduction – plane, rectilinear motion – time dependent motion – rectangular coordinates – projectile motion.

IMPULSE AND MOMENTUM: Concept of conservation of momentum – Impulse–Momentum principle– Impact – Direct central impact – Oblique central impact – Impact of elastic bodies.

UNIT VKINETICS OF PARTICLES AND FRICTION **9**

KINETICS OF PARTICLES: Equations of motion–rectilinear motion–Newton‟s II law – D‟Alembert‟s principle – Energy – potential energy–kinetic energy–conservation of energy–work done by a force – work energy method.

Laws of friction – coefficient of friction–problems involving dry friction – wedge and ladder friction.

TOTAL **45**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Beer F P and Johnson E.R	Vector Mechanics for Engineers–Statics and Dynamics	Tata Mc–Graw Hill Publishing Co. Ltd., New Delhi	2012
2	Rajasekaran.S and Sankarasubramanian G	Engineering Mechanics–Statics and Dynamics	Vikas Publishing House Pvt. Ltd., New Delhi	2009

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Bansal R K	Engineering Mechanics	Laxmi Publications Pvt. Ltd., New Delhi	2006
2	Young D H and Timashenko S	Engineering Mechanics	Tata McGraw–Hill, New Delhi	2006
3	JivanKhachane and Ruchi Shrivastava	Engineering Mechanics: Statics and Dynamics	ANE Books, New Delhi	2006

WEB REFERENCES

1. http://nptel.iitm.ac.in/courses/Webcourse–contents/IIT%20Guwahati/engg_mechanics/index.htm
2. http://nptel.iitm.ac.in/video.php?subjectId=112103108
3. http://web.mit.edu/emech/dontindex–build/index.html
4. http://www.indiabix.com/engineering–mechanics/questions–and–answers/

17BTCE112 COMPUTER PRACTICE AND PROGRAMMING LABORATORY 1 0 4 3

COURSE OBJECTIVES:

1. To write programs for Understand the basic concept of C Programming, and its different modules that includes conditional and looping expressions, Arrays, Strings and Functions.
2. The students will learn to interact properly with their peers in other disciplines in industry and society to establish compatibility as well as inter-industrial relationship which would help to contribute to the economic growth of the country
3. Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
4. Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
5. Be aware of the important topics and principles of software development
6. To create programs for solving problems

COURSE COURSE OUTCOMES::

1	Study, analyze and understand logical structure of a computer program, and different construct to develop a program in „C" language
2	Apply knowledge of mathematics, science and algorithm in solving complex Computer engineering problems.
3	Generate solutions by conducting experiments and applying techniques to analyze and interpret data
4	Design component, or processes to meet the needs within realistic constraints.
5	Identify, formulate, and solve Software Engineering, Networking and Data Mining problems.
6	Comprehend professional and ethical responsibility in computing profession

THEORY:

What is computer- Computer Components- What is C- C Character set- Constants, Variables and Keywords-General form of C Program - Relational and Logical Operators - Selection Structures- If and nested if - Switch Case - Loops-Definition and types- Functions- Arrays- Introduction to Strings- Pointers.

PRACTICALS:

1. Working with word Processing, Spreadsheet and presentation software in Linux

2. Programming in Scratch:
   Practicing fundamental concepts of programming like sequence, selection decision statements, working of loops and event driven programming

3. C Programming:
   Practicing programs to get exposure to basic data types, algebraic expressions, Conditional statements, Input and Output Formatting, Decision Statements, Switch Case, Control structures, arrays, Strings and function, implementation of pointers.

Total Hours: 45

REFERENCES:

1. E. Balagurusamy, " Computing Fundamentals and C Programming", TMH Education, 5th Edition, 2014
2. YashavantKanetkar, " Let us C", BPB Publications, 13th Edition, 2013

17BTCE213 PHYSICAL CHEMISTRY LAB 2 0 2 3 100

COURSE OBJECTIVES

1. To Learn the chemical process kinetics and the distribution laws
2. To gain practical knowledge of rate constant and activation energy
3. Investigate and understand the physical models underlying our current perception of atomic and molecular behavior at the most basic, fundamental level. Understand basic terminology of quantum chemistry and spectroscopy in context of these models.
4. Develop an ability to use conceptual and mathematical tools to express and predict atomic and molecular behavior
5. Analyze and interpret experimental data using quantum mechanical models.
6. Nurture a basic understanding of how computational chemistry can be used to determine atomic and molecular properties

COURSE COURSE OUTCOMES::

1	The student is able to determine the properties and characteristics of solvents and mixtures
2	Experience in some scientific methods employed in basic and applied physical chemistry
3	Developed skills in procedures and instrumental methods applied in analytical and practical tasks of physical chemistry
4	Developed skills in the scientific method of planning, developing, conducting, reviewing and reporting experiments
5	Developed some understanding of the professional and safety responsibilities residing in working with chemical systems.
6	Developed expertise relevant to the professional practice of chemistry

UNIT I CHEMICAL KINETICS

Rate of a reaction-Order of a reaction – Examples and rate equations for Zero order, First order, Second order and Third order reactions –Molecularity of a reaction – Unimolecular and Bimolecular reactions – Half-life period– Kinetics of parallel and opposing reactions – Activation energy – Arrhenius equation – Collision theory of reaction rates – Theory of absolute reaction rates – Michalis Menton kinetics of enzyme catalyzed reactions.

UNIT II COLLOIDS

Introduction to colloids – properties of colloids – coagulation of solutions – Origin of charge on colloidal particles – Determination of size of colloidal particles – Donnan Membrane equilibrium – Emulsions – Gels – Applications of colloids – Nanoparticles (Au, Ag, Pt)– Preparation – Characterization – Properties – Application in catalysis and drug delivery systems.

UNIT III THE DISTRIBUTION LAW

Distribution co-efficient - Distribution Law — Conditions for the validity of the Distribution law – I2–CCl4–H2O System – Nature of interaction of the solute with one of the solvents Dissociation-Association

Experiments

1. Determination of partition co-efficient of iodine between two immiscible solvents
2. Determination of partition co-efficient of benzoic acid between two immiscible solvents
3. Determination of Ka of the weak acid
4. Conductometric experiments- Verification of Oswald's Dilution Law
5. Determination of Rate Constant (K)
6. Determination of Activation Energy (ΔE)
7. Determination of standard electrode potential (Zn, Cu, Ag)
8. To study the adsorption of Acetic acid on charcoal and construct the Isotherm.
9. Application of Phase Rule to Phenol-Water system
10. To study the inversion of cane sugar by polarimeter.
    a. Polarimeter-Inversion of cane sugar
    b. Refractometer

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Kund and Jain	Physical Chemistry	S.Chand and Company, New Delhi	1996
2	Puri B.H. Sharma L.R. and M.S.Prathama	Principles of Physical Chemistry	S.Chand and Company, New Delhi	2001

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Gordon M. Barrow	Physical Chemistry	Sixth Edition, Tata McGraw Hill	1998
2	Peter Atkins & Julio de Paula Atkins	Physical Chemistry	7th Edition, Oxford university press	2002
3	B.S.Bahl, Arun Bahl and G.D.Tuli	Essentials of Physical Chemistry	S.Chand and Company, New Delhi	2005

17BTCC251 BUSINESS PLAN 1 0 0 _

COURSE OBJECTIVES:

1. To explain relevance of Ethics while taking business decisions.
2. Basic operations management Basic Corporate and Intellectual Property Law
3. Research and analyze the individual components needed for a business plan
4. Apply skills to create a business plan for different audiences, including investors, banks, and other stakeholders
5. Explain the purpose and future of your business in easy to understand terms
6. Use accounting terms to describe the future for your business

COURSE COURSE OUTCOMES::

1. Acquiring Conceptual Clarity of Various Functional Areas Ability to analyze various functional issues affecting the organization
2. Demonstrating ability to evolve strategies for organizational benefits
3. Analysis and interpretation of the data which is used in Decision Making
4. Demonstrate the ability to develop models / frameworks to reflect critically on
5 specific business contexts Demonstrate Effectively Oral and Written Communication
6. Demonstrate Ability to work in Groups

Unit I

Entrepreneurship – Types- Entrepreneurial Competencies -Business Plan – Meaning - Basic parameters - Project parameters - Factors of successful business - Term Loans and Working Capital Management.

Unit II

Business Plan Process - Sources of Information – Online Resources - Offline Resources - Sources of Market Research - Benefits of market study - Coverage of market study.

Unit III

Business Plan components - Company description - Industry Analysis - Target Market - Competition - Strategic position - Risk assessment - Technology plan - Management and Organization – Government policy

Reference books:

1. Rhonda Abrams " The Successful business Plan Secret $ Strategies " Prentice Hall
2. Rhonda Abrams “The business plan in a day" Prentice Hall.
3. Business plan preparation - Entrepreneurship Development Institute of India

SEMESTER III

17BTCE301 PROBABILITY AND STATISTICS 3 2 0 4

COURSE OBJECTIVES

1. To introduce the concept of probability and Sampling techniques.
2. To understand the fundamentals of Experimental Designs and Quality Control.
3. Apply graphical methods of displaying data.
4. Construct frequency distributions, histograms, frequency polygons, pareto charts, ogives, pie charts, and box-and-whisker plots.
5. Read and analyze frequency distributions, histograms, frequency polygons, pie charts, and box-and-whisker plots.
6. Calculate combinations and permutations.

COURSE OUTCOMES::

1. The students would be exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.
2. Organize, manage and present data.
3. Analyze statistical data graphically using frequency distributions and cummulative frequency distributions. Analyze statistical data using measures of central tendency, dispersion and location.
4. Use the basic probability rules, including additive and multiplicative laws, using the terms, independent and mutually exclusive events.
5. Translate real-world problems into probability models.
6. Derive the probability density function of transformation of random variables

UNIT- I PROBABILITY (11)

Probability – Definition – Law - conditional probability-Bayes theorem- Probability mass function - Probability density functions.

UNIT- IIRANDOM VARIABLES (13)

Introduction to one dimensional random variables – Discrete – Continuous - Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Regression.

UNIT- IIITESTING OF HYPOTHESIS (12)

Sampling distributions – Testing of hypothesis for mean, variance, proportions and differences using Normal, t, Chi-square and F distributions – Tests for independence of attributes and Goodness of fit.

UNIT – IV DESIGN OF EXPERIMENTS (12)

Analysis of variance – one way classification – CRD – Two-way classification – RBD – Latin square.

UNIT – VRELIABILITY AND QUALITY CONTROL (12)

Concepts of reliability – hazard functions – Reliability of series and parallel systems – control charts for measurement (h) - Control charts for attributes (p, c and np charts).

TOTAL: 60

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	P.S.S.Sundar Rao and J.Richard	Introduction to Biostatistics and Research Methods	Prentice Hall of India, New Delhi.	2012
2	R.A.Johnson and C.B.Gupta	Miller and Freund‟s Probability and Statistics for Engineers	Pearson Education Asia, New Delhi.	2007
3	S.C.Gupta and V.K.Kapoor	Fundamentals of Applied Statistics	Sultan Chand & Sons, New Delhi	2007

WEBSITES

1. www.cut-theknot.org/probability.shtml
2. www.mathcentre.ac.uk
3. www.mathworld. Wolfram.com

COURSE OBJECTIVES

1. To enable the students to learn the type of components in which organic reactions take place and also to know the preparation of the essential organic compounds.
2. Deduce the structural formula of an unknown organic compound from spectroscopic or chemical data.
3. Predict very roughly the physical properties of an organic compound given its structural formula.
4. Demonstrate some knowledge of the sources of and uses for organic compounds in the practical world.
5. Design reactions paths by which a great variety of moderately complex organic compounds could be prepared from simple, readily available compounds.
6. Be able to account for how reactions occur at the molecular level

COURSE OUTCOMES:

1. At the end of the course students will be in a position to have knowledge on various reaction mechanisms, preparation of organic compounds and their properties.
2. This will be a precursor for the study on Chemical Reaction Engineering.
3. Identify, properly use, and care for equipment and supplies used in analytical laboratory
4. Identify the requirements for adequate protection of personnel form solvents and materials used in the analysis
5. Identify, properly use, and care for equipment and supplies used in analytical laboratory
6. Identify the requirements for adequate protection of personnel formsolvents and materials used in the analysis

UNIT I CARBOHYDRATES 9

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 HETEROCYCLIC COMPOUNDS 9

Preparation, Physical & Chemical properties and Uses of Pyrrole, Furan, Furfural, TetrahydroFuran, Thiophene, Indole, Pyridine, Quinoline and Isoquinoline.

UNIT III DYE CHEMISTRY 9

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 9

Preparation and Synthetic utilities of Grignard reagent, Ethyl aceto acetate and Malonic ester.

UNIT V PHARMACEUTICAL CHEMISTRY 9

Synthesis of Antimalarial drugs – isopentaquine and chloroquine Synthesis of Antibacterial drugs – Sulphaniliamide and Sulphapyridine.

TOTAL : 45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	R.T. Morrison and R.N. Boyd	Organic Chemistry	VI Edition Prentice Hall Inc USA.	1996
2	K.S. Tiwari, N.K. Vishnoi and S.N. Malhotra	A text book of Organic Chemistry	Second Edition, Vikas Publishing House Pvt. Ltd New Delhi	1998

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Bahl B.S. and Arun Bahl	Advanced Organic Chemistry	3rd Edition, S. Chand & Co, New Delhi	2005
2	Felix A. Carroll	Perspectives on Structure and Mechanism in Organic Chemistry	John Wiley & Sons	2011

COURSE OBJECTIVES

1.To teach 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.

2.Toperform stoichiometric calculations for chemical and non-chemical systems and to understand quantitative relationships between matter and energy involved in physiochemical processes

3. Successfully practice or apply the principles of Chemical Engineering in a variety of employment areas.

4.Achieve professional success with an understanding and appreciation of ethical behaviour, social responsibility, and diversity, both as individuals and in team environments.

5. Pursue continued life-long learning through professional practice, further graduate education or other training programs in engineering science or other professional fields.

6. To know and understand the units of different parameters that will be used in the chemical processes and their conversions

COURSE COURSE OUTCOMES:

1. understand and apply different systems of units and dimensions, calculate compositions of mixtures/solutions and determine pressure, volume and temperature of gases using equations of state
2. apply the law of conservation of mass for different batch and continuous unit operations
3. apply the law of conservation of mass for unit processes and evaluate yield, conversion, recycle ratio /purge /bypass of chemical reactors
4. apply energy balances for reacting systems and understand the effect of temperature and pressure on heat of reaction
5. identify practical problems that involve technology where equations were used
6. define molar mass and perform mole-mass inter-conversions for pure substances

UNIT IUNITS AND DIMENSIONS **9**

Conversion of Equations, Systems of Units,Fundamental Concepts: Basic and derived units, use of different system of units in process calculations. Introduction to Chemical Engineering Calculations:

Basis, Mole Fraction and Mole Percent, Mass Fraction and Mass Percent, Concentration of different forms, Conversion from one form to another, Roult‟s Law, Henry‟s law, Antoine‟s Equation. Clausius Clapeyron Equation.

UNIT IIMATERIAL BALANCE WITHOUT CHEMICAL REACTION 9

Material Balance during Mixing, Humidity and Application of Psychrometric Chart, Solubility and Crystallization, Evaporator, Distillation Column, Absorption Column, Drier, Liquid - Liquid and Solid - Liquid Extraction Units.

UNIT III MATERIAL BALANCE WITH CHEMICAL REACTION 9

Single Reaction, Multiple Reactions, Reactions with Recycle, Purge and By-pass, Combustion Reaction, Calculation of Excess Air, Material Balance of Unsteady State Reaction systems.

UNIT IV ENERGY BALANCE 9

Enthalpy calculation for systems (single component and multi components) without Chemical Reaction with Mean and Temperature dependent Heat Capacity, Enthalpy calculation for systems with Chemical Reactions.Heat of Reaction from Heat of Formation and Heat of Combustion Data, Effect of Temperature and Pressure on Heat of Reaction, Hess‟s Law, Adiabatic Flame Temperature, Theoretical Flame Temperature.

UNIT – V COMBUSTION 9

Fuels and combustion; Calculation of theoretical and excess air from combustion of solid, liquid and gaseous fuels.Composition of flue gases by Orsat analyzer.

Lecture:45, Tutorial:15, TOTAL:60

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Himmelblau D.M	Basic Principles and Calculations in Chemical Engineering	8 th Edition, Prentice Hall of India, New Delhi	2013
2	Venkataramani V. and Anantharaman N. and Meera SheriffaBegam K.M.	Process Calculations	2nd Edition, Prentice Hall of India, New Delhi	2011

REFERENCES:

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	HougenO.A.,Watson K. M. and Ragatz R. A.,	Chemical Process Principles. Part I. Material and Energy Balances	2 nd Edition, John Wiley & Sons, New York	1956
2	Bhatt B.L and Vora S.M	Stoichiometry	4^{th} Edition, Tata McGraw Hill Publishing Company, New Delhi	2004

WEBSITES

http://www.msubbu.in/sp/pc/

http://che31.weebly.com/uploads/3/7/4/3/3743741/lect12-recycle-bypass-purge.pdf

http://facstaff.cbu.edu/rprice/lectures/

http://che31.weebly.com/course-materials.html

COURSE OBJECTIVES

1. To impart to the students the knowledge on fluid properties, fluid statics, dynamic characteristics for through pipes and porous medium, flow measurement and fluid machineries.
2. to solve simplified examples of fluid mechanics - theoretical and practical preparation enabling students to apply the acquired knowledge and skills in professional and specialist courses.
3. concept of fluid flow and its application to chemical process industries including pipe flow, fluid machinery and agitation & mixing
4. understand the dynamics of fluid flows and the governing non-dimensional parameters,
5. apply concepts of mass, momentum and energy conservation to flows,
6. grasp the basic ideas of turbulence

COURSE COURSE OUTCOMES:

1. comprehend the principles of fluid properties, fluid statics and fluid flow problems and apply the same in chemical process industries
2. analyze flow behavior of solid and liquid and to demonstrate the understanding of packed and fluidized bed
3. understand and select fluid moving machinery for different applications in process industries
4. understand and select characteristics of pumps, flow meters and valves for different applications in process industries.
5. Define the relationship between pressure and elevation as it relates to manometers, barometers and other pressure measuring devices
6. Use the general energy equation to calculate changes in fluid flow for circular and non-circular pipes for in-compressible fluids

UNIT I FLUID PROPERTIES 9

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

UNIT IIFLUID STATICS 9

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 IIIPRINCIPLES OF FLUID FLOW **9**

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 IVFLUID FLOWS **9**

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 VFLOW MEASUREMENT **9**

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**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	McCabe W.L., Smith J.C. and Harriot P	Unit Operations in Chemical Engineering	7 th Edition, McGraw Hill International Edition, New York	2006.
2	Noel de Nevers	Fluid Mechanics for Chemical Engineers	3rdEdition, McGrawHill, New York	2004.

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Cengel, Yunus and CimbalaJohn M	Fluid Mechanics Fundamentals and Applications	2 nd Edition, Tata McGraw Hill Publishing Company, New Delhi	2006
2	Munson B.R., Young D.F., Okiishi T.H. and HuebschW.W	Fundamentals of Fluid Mechanics	6thEdition, Wiley India, New Delhi,	2010

3	James O Wilkes and Stacy G Bike,	Fluid Mechanics for Chemical Engineers	Prentice Hall PTR (International series in Chemical Engineering)	2013
4	John F. Douglas	Fluid Mechanics	Pearson/Prentice Hall	2005

WEBSITES

http://eprints.staffs.ac.uk/222/1/engineering-fluid-mechanics%5B1%5D.pdfhttp://nptel.ac.in/downloads/103104043/http://chemical.eng.usm.my/notes/HEKARL/notes/ekc212_notes.pdf

17BTCE305 MECHANICAL OPERATIONS 3 0 0 3 100

COURSE OBJECTIVES

1. In this course, the students will learn characterization of solids, size reduction techniques of solid – fluid separation and mixing.
2. Understand mechanical separation aspect such as screening, filtration, sedimentation, transportation of solids etc.
3. Understand energy requirements in solids handling, agitation and mixing, solid conveying and storage.
4. Hands on experience of working by conducting experiments on some of the basic unit operations such as separation and size reduction.
5. Present seminar on current separation techniques and submit the report on the samples
6. identify the important physical mechanisms occurring in processes involving particles

COURSE COURSE OUTCOMES:

1. Apply the principles of size analysis, handling, storage and transportation for handling solids in chemical process industries
2. Analyze the size reduction techniques of solids by selecting proper equipments such as crushers, grinders, etc.
3. Understand the working principles of gravity settling tank, cyclone separators, Filters and other mechanical separation devices
4. Recognize mixing and agitation equipment, power calculation and selection of mixing
5. Knowledge of filtration equipment for different chemical industries, and designing of filtration process
6. Knowledge of solid-solid and gas-solid separation techniques for various applications including coal, mineral beneficiation environmental pollution control

UNIT I CHARACTERISTICS AND SCREENING 9

Characteristics and 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 SIZE REDUCTION 9

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 IIIMECHANICAL SEPARATIONS **9**

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 FILTRATION **9**

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 **9**

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

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	McCabe, W.L., Smith, J.C., and Harriot, P	Unit Operations in Chemical Engineering	7th Edn., McGraw-Hill	2005
2	Badger W.L. and BancheroJ.T	Introduction to Chemical Engineering	Tata McGraw Hill	1997

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Coulson, J.M. and Richardson, J.F	Chemical Engineering	Vol. I, 4th Edn., Asian Books Pvt. Ltd., India	1998
2	Badger Walter L. and Banchero Julius T	Introduction to Chemical Engineering	Tata McGraw Hill Publishing Company, New Delhi	Reprint 2008.
3	Dr. CM Narayan and Dr. B.C. Bhattacharya	Mechanical Operation for Chemical Engineers.	CBS Publishers & Distributors Pvt. Ltd	2010

17BTCE311 ORGANIC CHEMISTRY LABORATORY 0 0 3 2 100

COURSE OBJECTIVES

1. To learn basic principles involved in analysis and synthesis of different organic derivatives
2. To understand how to draw energy diagrams.
3. To understand how to calculate bond order.
4. To understand how to calculate lattice energy through Born Haber Cycle.
5. The students will learn the laboratory skills needed to design, safely conduct and interpret chemical research.
6. The primary aim of a qualitative research is to provide a complete detailed description of the research topic. Quantitative research focuses more in counting and classifying features and constructing statistical models and figures to explain what is observed

COURSE COURSE OUTCOMES:

1. The student is able to identify what distinguishes a strong and weak nucleophile and recall the rules of reactions.
2. The student shows their mastery of nomenclature since ethyl bromide is not drawn out.
3. The student analyzes a list of compounds and determines their reactivity.
4. Able to recognize the symmetry elements and their associated operations as required to specify molecular symmetry
5. Gain knowledge about types of reactions and their reaction mechanism
6. Acquire knowledge about the formation of complexes in solutions and their stability, factors effecting the stability & HSAB principle

LIST OF EXPERIMENTS

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.
3. Analysis of an unknown organic compound and preparation of suitable solid derivatives
4. Analysis of carbohydrates.
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 salycilic acid from methyl salyciliate.
    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: 45

17BTCE312 FLUID MECHANICS LABORATORY 0 0 3 2 100

COURSE OBJECTIVES

1. To learn experimentally to calibrate flow meters, find pressure loss for fluid flows and determine pump characteristics.
2. The students will learn to conduct experiments to verify fundamental principles of fluid mechanics, calibrate measuring devices, analyze experimental data and develop empirical relations when appropriate.
3. Calibration of flow measuring devices Determination of friction factor for pipes
4. Determination of minor losses in pipes
5. Verification of Bernoulli's theorem.
6. Studying the performance of hydraulic turbines and pumps

COURSE OUTCOMES:

1. Determine the coefficient of discharge for venturi / orificemeter, open drum orifice and v-notchvalidate the Moody's diagram for flow through straight pipe / concentric pipes and helical coilassess the frictional loss coefficient for different valves and pipe fittingsappraise pressure drop through packed bed
2. Impact of jet on vanes 8. Performance test on Pelton wheel turbine
3. Performance test on Francis turbines
4. Performance characteristics of a single stage Centrifugal pump
5. Performance characteristics of multi- stage Centrifugal pump
6. Performance characteristics of a Reciprocating pump and Study of hydraulic jump

LIST OF EXPERIMENTS

1. Viscosity measurement of non Newtonian
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. Hydrodynamics of fluidized bed
11. Drag coefficient of solid particle

TOTAL: 45

17BTCE313 STRENGTH OF MATERIALS AND METALLURGY LABORATORY 0 0 3 2 100

COURSE OBJECTIVES

1. To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads.
2. This would enable the student to have a clear understanding of the design for strength and stiffness.
3. This would enable the student to have a clear understanding of the design for strength, stiffness, Analyze the beam of different cross sections for shear force, bending moment, slope and deflection.
4. To understand the concept of microscopic examination of various materials.
5. To provide basic knowledge in mechanics of materials so that the students can solve real engineering problems and design engineering systems.
6. Define direct normal stress and direct shear stress and compute their values and normal strain and shearing strain.

COURSE OUTCOMES:

1. Analyze how different types of forces are to be considered and how to quantify them.
2. Design. Study of different types of stresses and strains occurring in various components of the structure.
3. Know the advantages and disadvantages of various geometric sections available for engineering design.
4. Determine the stresses and strains in members subjected to combined loading and apply the theories of failure for static loading.
5. 5. Determine and illustrate principal stresses, maximum shearing stress, and the stresses acting on a structural member.
6. 6. Determine the deflections and rotations produced by the three fundamental types of loads: axial, torsional, and flexural

LIST OF EXPERIMENTS

1. Tensile test on metals–stress strain characteristics
2. Cupping test on metal sheets–load deformation characteristics, cupping load, cupping number.
3. Hardness test on metals–Brinell and Rockwell Hardness tests.

4. Impact test on metals–Charpy, Izod impact tests.
5. Shear test on metals–direct shear strength, single shear, double shear.
6. Tests on helical springs–compression, tension springs–load deformation characteristics, stiffness, shear stress, modulus of rigidity, energy.
7. Torsion test on beams–torque and angle of twist characteristics, shear stress, modulus of rigidity, energy.
8. Microscopic examination of i) Hardened samples ii) Hardened and tempered samples.
9. Tempering – Improvement of Mechanical properties –Comparison for i) Unhardened specimen ii) Quenched specimen iii) Quenched and tempered specimen.
10. Study of low carbon steel and medium carbon steel.

TOTAL 45

17BTCE314 COURSE ORIENTED PROJECT I 0 0 2 1 100

17BTCE351 SOFT SKILLS1 0 0 - 100

COURSE OBJECTIVES

- To help the students understand interpersonal skills.
- To support them in building interpersonal skills.
- To better the ability to work with others.

COURSE OUTCOMES:

- ability to communicate smartly and effectively with co-workers,:relationship enhancement
- Improvement of time management and organizational skill.
- development of leadership teamwork, creativity, efficiency & productivity
- development of presentation skills
- ability to recognize stress symptom & develop stress deflecting strategies
- brain storming &problem solving strategies to increase creativity and collaborative COURSE OUTCOMES:

UNIT I **4**

Overview to communication, self-Introduction, Presentation on their own topic, Extempore, Group Activity

UNIT II **3**

Group Discussion, Do's and Don‟ts of Group Discussion, Body language, Grooming and Resume, Resume correction

UNIT III **4**

Introduction to HRM – Questions - Do's and Don‟t's - Interview - Mock GD - Stress Management

UNIT IV **4**

Personality Development - Presentation skills, Interpersonal skills, Critical thinking, Confidence building and Stress management.

TOTAL 15

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Barun K Mitra	Personality Development and Soft Skills	Oxford University Press-New Delhi	2012
2	Rajiv K. Mishra	Personality Development	Rupa & Co	2012

SEMESTER IV

17BTCE401 CHEMICAL TECHNOLOGY 3 0 0 3 100

COURSE OBJECTIVES

1. To impart the basic concepts of chemical technology.
2. To develop understanding about unit process and operations in various chemical industries.
3. To learn manufacturing processes of organic and Inorganic Chemicals and its applications.
4. Introduce the basic information and the systematic diagrams of Unit operations involved in chemical industries.
5. Familiarize the concepts of design, operation details and schematic of industrial equipment.
6. Ascertain the right separation technology for easy separation of chemical components

COURSE OUTCOMES:

1. Understand the role of chemical engineers in process industries and develop block diagrams and flow charts for manufacture of different chemicals
2. Comprehend the unit operations/ processes in chloralkalies, nitrogen and sulphur industries
3. To gain knowledge in the manufacture of plant nutrients, agrichemicals and fertilizers
4. Apply principles of chemical engineering in wood chemicals, oils, fats/ soap manufacturing Units.
5. The student had a brief introduction of chemical process equipment
6. Application of thermodynamics, the chemical process principles, the equipment design and so on. Provided the basic inorganic chemistry background required for the undergraduate students of engineering

UNIT I PRODUCTION PROCESSES

Production of pulp, paper and rayon, Manufacture of sugar, starch and starch derivatives, Gasification of coal and chemicals from coal.

UNIT IIIINDUSTRIAL MICROBIAL PROCESSES AND EDIBLE OILS 9

Fermentation processes for the production of ethyl alcohol, citric acid and antibiotics, Refining of edible oils and fats, fatty acids, Soaps and detergents.

UNIT III ALKALIES AND ACIDS 9

Chlor - alkali Industries: Manufacture of Soda ash, Manufacture of caustic soda and chlorine - common salt. Sulphur and Sulphuric acid: Mining of sulphur and manufacture of sulphuric acid. Manufacture of hydrochloric acid.

UNIT IV CEMENT GASES, WATER AND PAINTS 9

Types and Manufacture of Portland cement, Glass: Industrial Gases: Carbon dioxide, Nitrogen, Hydrogen, Oxygen and Acetylene - Manufacture of paints – Pigments

UNIT VFERTILISERS **9**

Nitrogen Fertilisers; Synthetic ammonia, nitric acid, Urea, Phosphorous Fertilisers: Phosphate rock, phosphoric acid, super phosphate and Triple Super phosphate.

TOTAL :45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	George T Austin	Shreve's Chemical Process Industries - International Student Edition	McGraw Hill Inc	2015
2	Sittig M. and Gopala Rao M	Dryden's Outlines of Chemical Technology for the 21st Century	WEP East West Press	2010

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	SrikumarKoyikkal	Chemical Process Technology and Simulation	PHI Learning Ltd	2013
2	Shukla and G.N. Pandey	Text book on Chemical Technology	Vikas publishing company	2009

17BTCE402 CHEMICAL ENGINEERING THERMODYNAMICS 3 1 0 4 100

COURSE OBJECTIVES

1. Students will learn PVT behavior of fluids, laws of thermodynamics, thermodynamic property relations and their application to fluid flow, power generation and refrigeration processes.
2. To evaluate thermodynamic properties of pure substances with special emphasis on fluids. Be able to use various PVT equations-of-state and heat capacities to evaluate thermodynamic properties (U, H, P, V, T, etc.)
3. To be able to calculate heat transfer rates associated with processes involving phase changes and reactions. To be able to calculate standard heats of reaction.
4. To understand the interrelationships between different thermodynamic properties and become familiar with the calculus that establishes these interrelationships.
5. To be able to use various sources of thermodynamic data and properties, including graphs and tables. To use graphs of thermodynamic properties to develop an intuition for the variation of these properties during various processes.
6. To apply the laws of thermodynamics and various methods of evaluating state properties to equipment commonly encountered in chemical engineering processes, such as turbines, pumps, engines, and refrigeration units.

COURSE OUTCOMES:

1. Apply thermodynamic concepts and the laws of thermodynamics to various systems and processes
2. Understand the properties of solution and determine the partial molar properties from mixture properties and vice- versa
3. Apply the criterion for equilibrium between phases to engineering systems with two or more co-existing phases
4. Apply chemical reaction equilibrium for thermodynamic analysis of homogeneous reactions
5. The student will describe salient features of liquid-liquid and liquid-solid phase equilibrium plots.
6. The student will compute bubble and flash point for a given data

UNIT – I LAWS OF THERMODYNAMICS 12

Laws of Thermodynamics Laws of Thermodynamics: Basic concepts; Zeroth l aw; First Law - applications to non-flow and flow processes; Second Law - heat engines, Carnot cycle and theorem, Entropy calculations; Third Law of thermodynamics.

UNIT – II PROPERTIES OF REAL GASES AND THERMODYNAMICS

FORMULATIONS

Properties of Real Gases and Thermodynamics Formulations: PVT behaviour of fluids - compressibility factor, two- and three-parameter theorems of corresponding states; Equation of states- Virial, VanderWaals, Redlich-Kwong and Peng-Robinson equations; Basic energy relations; Maxwell relations.

UNIT – IIIPROPERTIES OF SOLUTIONS 12

Partial molar properties; chemical potential; fugacity and activity coefficients; Gibbs - Duhem equation; enthalpy , entropy and Gibbs free energy changes in mixing of ideal solution.

UNIT – IV PHASE EQUILIBRIA 12

Phase equilibrium and stability; criteria for equilibrium between phases in single and multi - component non-reacting systems; vapor-liquid equilibrium of binary ideal and non-ideal solutions; azeotropes; Raoult„s l aw and Henry„s law; P-x- y and T-x- y diagrams using Antoine equations.

UNIT – V CHEMICAL REACTION EQUILIBRIA 12

Criteria of equilibrium; standard free energy change and react ion equilibrium constant; effect of temperature and pressure on reaction equilibrium constant; homogeneous chemical reactions - thermodynamic analysis and prediction of equilibrium compositions.

TOTAL: 60

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Smith, J.M., Van Ness, H.C and Abbot M.M	Introduction to Chemical Engineering Thermodynamics	McGraw Hill Publishers, VI edition	2003
2	Narayanan, K.V	A Textbook of Chemical Engineering Thermodynamics	Prentice Hall India	2004

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Kyle, B.G.	Chemical and Process Thermodynamics III Edition	Prentice Hall of India Pvt. Ltd	2005

2	Elliott J.R, Lira, C.T.	Introductory chemical engineering thermodynamics	Prentice Hall	2003
3.	Rao, Y.V.C	Chemical Engineering Thermodynamics	Universities Press	2005
4	Pradeep ahuja	Chemical Engineering Thermodynamics	PHI Learning Ltd	2009
5	Gopinath Halder	Introduction to Chemical Engineering Thermodynamics	PHI Learning Ltd	2009

17BTCE403 HEAT TRANSFER 3 0 0 3 100

.COURSE OBJECTIVES

1. To enable the students to learn heat transfer by conduction, convection and radiation and
2. Heat transfer equipments like evaporator and heat exchanger
   Solve one-dimensional, steady conduction heat transfer problems in various geometries with heat sources
3. Solve multi-dimensional, steady heat transfer problems using shape factors
4. To be familiar with the partial differential equations used for transient and steady heat transfer in one or more dimensions and be able to apply solutions to these equations to find temperatures
5. Solve transient heat transfer problems known as "lumped capacity" problems where the main heat transfer resistance is from external convection
6. To apply the concepts in application.

COURSE OUTCOMES:

1. Understand the fundamental principles of conduction
2. acquire knowledge in convection and radiation heat transfer
3. familiarize with the fundamentals of boiling and condensation
4. apply the knowledge of heat transfer in the design of evaporators
5. design and analyze the performance of heat exchangers
6. Students will be able to analyze results of numerical simulation of thermal and fluid flow problems

UNIT I CONDUCTION 9

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 CONVECTION 9

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 IIIBOILING AND CONDENSATION 9

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 RADIATION AND EVAPORATION 9

Theory and design procedure of evaporation. Concept and nature of thermal radiations - Concept

of Black and grey bodies; Stefan Boltzmann, Kirchhoff,,s, Planck,,s and Wien laws; Radiation between surfaces – configuration factor; radiation shield.

UNIT V HEAT EXCHANGERS 9

Types of heat exchangers Log mean temperature difference - use of correction factor charts; ssurface area calculations for double pipe and shell and tube heat exchangers ,heat exchangers effectiveness and number of transfer units - Chart for different configurations - Fouling factors.

TOTAL 45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Holman, J. P.	Heat Transfer	10 thEdn., McGraw Hill	2009
2	Ozisik, M. N.	Heat Transfer: A Basic Approach	McGraw-Hill	1984
3	Kern, D.Q	Process Heat Transfer	McGraw-Hill	2012
4	B. K. Dutta	Heat Transfer: Principles And Applications	PHI Learning Pvt. Ltd., New Delhi	2006

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	McCabe, W.L., Smith, J.C., and Harriot, P.	Unit Operations in Chemical Engineering	6th Edn., McGraw-Hill	2013
2	Coulson, J.M. and Richardson, J.F	Chemical Engineering	Vol. I, 4th Edn., Asian Books Pvt. Ltd, India	2013

17BTCE404 PROCESS ORGANIC SYNTHESIS 3 0 0 3 100

COURSE OBJECTIVES

1.To impart knowledge on various aspects of production engineering and enable the students to understand the practical methods of production process in a chemical industry.
2. To learn about optical activity of asymmetric and dissymmetric molecules. Basic idea about aliphatic nucleophilic substitution reactions, aromaticity, aromatic nucleophilic and electrophilic substitution reactions
3. To learn about bonding in polyacids, inorganic polymers, formation, factors that affect stability of complexing stereo isomerism of inorganic complexes and crystal field theory and its limitations.
4. To learn the techniques of separation of organic mixture. To apply the skill in two stage preparation, purification and recrystallisation.
5. To learn the mechanism of addition and elimination reaction, oxidation of methylene to carbonyl, oxidation of aryl methanes, allylic oxidation of olefins, reduction and coupling reaction
6. To learn the basic concept of electro chemistry mechanism of electrode reaction. Symmentry elements points and material representation. Selection rules of Raman spectra

COURSE OUTCOMES:

1 understand the various unit processes in synthesis of organic compounds
2 understand the application of organic compounds in various industries
3 analyze chemical reactions and reaction conditions
4 identify reaction schemes and mechanisms for a number of important reactions used in organic synthesis
5 To learn the concept stereochemistry and its importance
6 To know what is aliphatic nucleophilic substitution

UNIT – I NITRATION AND AMINATION9

Principle of Nitration-N-Nitro compounds and Nitration esters, industrial equipment and processes. Amination; methods – reduction and Ammonolysis. Catalytic reaction and manufacture of amino compounds.

UNIT – II HYDROGENATION AND ALKYLATION9

Production and Properties of Hydrogen, Catalytic hydrogenation and Hydrogenolysis; Methanation and Fischer-Tropsch reactions. Types and Factors affecting alkylation, Industrial alkylation process**.**

UNIT – IIIOXIDATION, HYDROLYSIS AND ESTERFICATION 9

Types of Oxidation reaction-Liquid-phase and Vapor-phase; Hydrolysis-processes and equipment. Esterification of organic and inorganic acids-applications in chemical industries.

UNIT – IV HALOGENATION, SULFONATION AND SULFATION9

Halogenation- Chlorination reaction; Sulfonation and sulfation; Desulfonation reactions.

UNIT – V DYE AND DRUG SYNTHESIS9

Synthesis of Dyes - Congo red. Triphenylmethane dyes -Malachite green, Para Rosaniline, Alizarin, Eosin; Drug Synthesis - Sulphanilamide, Sulphapyrindine, Chloroquinine, penicillin, erythromycin.

TOTAL: 45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Groggins P.H	Unit Processes in Organic Synthesis	5th Edition (Reprint), McGraw Hill International Co	2007
2	Austin G.T	Shreve's Chemical Process Industries	5th Edition (Special Reprint Edition), McGraw Hill International Co	2005

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1.	Tiwari K.S. and Vishnoi N.K	A Textbook of Organic Chemistry	3rd Edition, Vikas Publishing House, New Delhi	2007.
2.	Graham Solomons T.W., Craig B. Fryhle and Scott A. Student Snyder	Organic Chemistry	11th Edition, International Version, John Wiley & Sons Inc., New York	2013.

17BTCE405 MATERIAL SCIENCE AND ENGINEERING 3 0 0 3 100

COURSE OBJECTIVES

1. To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.
2. To introduce the physical origin of and demonstrate the correlation between structure and properties of materials. To introduce common crystal defects and to understand their role in materials behavior.
3. To provide overview of mechanical behavior of ceramics, metals, and polymers
4. To introduce students to the concept of phases and phase diagrams, including T-c behavior leads to different microstructures and, hence, varying mechanical behavior due to heat treatment. To understand effects of composition on structural and mechanical behavior, as well as how process history effects materials properties.
5. To introduce and utilize simple concepts of crack propagation, fast-fracture, and failure.
6. To provide failure examples and motivate importance of materials properties in design

COURSE OUTCOMES:

1 Comprehend the criterion for selection of materials for chemical process industries.
2 outline the properties and applications of smart materials and nano and bio materials
3 apply the knowledge about various materials used in chemical process industries
4 select materials for high temperature and Sour service and gain knowledge of modern engineering materials.
5 an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
6 an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet COURSE OBJECTIVES

UNIT I NATURE OF MATERIALS 9

Selection process of engineering materials (General aspects), Chemical and physical properties of materials, chemical structure, Micro and macro structure, corrosion resistance, chemical reactivity.Mechanical properties, stress, strain, strength, hardness, malleability, ductility, elasticity, plasticity, toughness, thermal stability. Types of deformation: Plastic, viscous; plastic deformation of single crystal, poly crystalline metals, slip, twinning, dislocations, viscoelasticity, creeps in metals, amorphous materials.

UNIT II METALLURGY 9

Extractive Metallurgy: Hydro, pyro and electro metallurgy, refining of metals. Powder Metallurgy: methods of production of metal powder, mixing of metal powders, compaction of powders -

applications. Extraction process of Iron: manufacture of pig iron, blast furnace operations, chemistry of reactions. Manufacture of cast iron, varieties of cast iron, effect of impurities. Production of steel , Bessemer process ,open-hearth process ,L D methods. Classification of steel, effect of impurities.
Heat treatment process: annealing, hardening, tempering, normalizing and gas carburizing. Fe-Carbon phase diagram.

UNIT III COMPOSITES AND ADHESIVES 9

Polymer composites: Introduction, Types of composites, particle reinforced, fiber reinforced, structural composites, examples. Matrix materials, reinforcement materials-, Kevlar, Polyamides, fibers, glass, carbon fibers, ceramics and metals. Techniques for producing FRP, applications.

UNIT IV BIOMATERIALS 9

Classification of bio-materials (based on tissue response) ,Comparison of properties of some common biomaterials , Metallic implant materials (stainless steel, cobalt-based and titanium-based alloys) , Polymeric implant materials (Polyamides, polypropylene, Acrylic resins and Hydro gels) ,Tissue replacement implants , Soft and hard tissue replacements ,Skin implants, Tissue engineering, Biomaterials for organ replacement (Bone substitutes), Biosensor.

UNIT V MODERN ENGINEERING MATERIALS 9

Smart materials , Shape memory alloys, Electrostatics, Irreversible Marten sites, Domain Walls, Nature of Shape Memory, Shape Memory Alloy Materials, Ferromagnetic Shape Memory Alloys, Relation to Shape Memory Alloys, Actuator and Sensor Materials Chromic materials (Thermo, Photo and Electro) ,Rheological fluids , Metallic glasses.

TOTAL :45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Thiruvadigal. J. D, Ponnusamy. ,Sudha.D, and Krishnamohan. M.	Materials Sciences	2nd Edition, Vibrant Publication,Chennai	2013
2	Rajendran. V	Materials Science	3rdEdition, Tata McGraw-Hill,New Delhi,	2011

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Khanna. O.P	A Text book of Material science and Metallurgy	4th Edition, Danpat Rai Publications	1999
2	Rajput. R.K.	A Text book of Material Science and Engineering	3rd Edition, S.K Kataria & sons, Delhi	2003
3	Agarwal. C.V	Chemistry of Engineering materials	4th Edition, Tata McCraws Hill	1997 .
4	William F.Smith.	Foundation of Materials Science and Engineering	2ndEdition, Tata McCraw Hill	1998

COURSE OBJECTIVES

- To introduce the scientific computing, covering some important aspects of solving algebraic equations, IVP, BVP.
- To implement the methods using the spread sheet in Excel
- To provide an overview of some of the issues and problems that arise in scientific computation, such as (non-)linear systems, numerical and symbolic integration, differential equations and simulation.
- To develop good programming skills and to develop problem solving skills via C-programming language.
- To provide an overview of some of the issues and problems that arise in scientific computation, such as (non-)linear systems, numerical and symbolic integration, differential equations and simulation

to provide students with up-to-date knowledge on some methods and techniques…

LIST OF EXPERIMENTS

1. Finding solution of Transcendental equation
    i) Newton – Raphson Method
    ii) Bisection method
    iii) Iterative method by reducing the equation to the form x= f(x)
2. Finding the dominant eigenvalue and eigenvector by power method
3. Numerical integration
    i) Gauss 2 point and 3 point formulae
    ii) Trapezoidal method
    iii) Simpson‟s 1/3 rule
4. Solution of initial value problems governed by ODE
    i) Runge - Kutta 4^{th} order method
    ii) Modified Euler‟s method
    iii) Milne‟s method
    iv) Adam – Bashforth method
5. Solution of BVP governed by PDE
    i) Laplace Equation
    ii) One – dimensional heat equation
        a) Explicit method : Bender – Schmidt‟s method
        b) Implicit method : Crank - Nicolson‟s method
    iii) One dimensional wave equation Implicit method

TOTAL 60 PERIODS

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Curtis F. Gerald and Patrick O. Wheatley	Applied Numerical Analysis	Pearson Education, South Asia	2009
2	Steven C. Chapra, Raymond P. Canale	Numerical Methods for Engineers	McGraw - Hill Pub. Co. Ltd	2014

17BTCE412 TECHNICAL ANALYSIS LABORATORY 0 0 3 2 100

COURSE OBJECTIVES

1	To provide experience on preparation, analysis and testing of chemicals used for industrial raw materials and end uses.
2	Interpret the characteristics of semiconductor devices.
3	Apply the basic knowledge semiconductor devices for basic switching applications.
4	Select a right semiconductor device for a given application.
5	Observe and validate the functioning under simulated environment.

COURSE OUTCOMES:

1. At the end of this practical course, the student would have a thoroughunderstanding on the estimation and analysis of chemical compounds.
2. Familiarization with equipment like viscometers, flash and fire point apparatus etc.
3. Familiarization of methods for determining TDS
4. Familiarization of a few simple synthetic techniques for soap
5. Perform routine tasks and assigned procedures to support the purification, analysis and synthesis of chemical compounds and samples.
6. Use prescribed laboratory procedures to conduct basic manual and instrumental quantitative analysis and report results

LIST OF EXPERIMENTS (ANY 10 EXPERIMENTS)

1. Soap Analysis
   a. Estimation of total fatty acid
   b. Estimation of percentage alkali content
2. Oil Analysis
   a. Estimation of free acid
   b. Determination of Saponification value
   c. Determination of iodine value
3. Cement Analysis
   a. Estimation of Silica content
   b. Estimation of mixed oxide content
   c. Estimation of calcium oxide content
   d. Estimation of calcium oxide by rapid method
4. Coal Analysis
   a. Estimation of Sulphur present in coal
   b. Ultimate analysis of coal

c. Proximate analysis of coal

5. Analysis of Bleaching Powder

   a. Estimation of available chlorine

6. Analysis of Glycerol

   a. Estimation of purity of glycerol

7. Analysis of fuels

   a. Flash point b. Fire point c. Cloud point d. Pour point e. Aniline point.

8. Determination of the molecular weight of the polymer by viscometry.
9. Calorimetric measurements
10. Conductivity measurement of an electrolyte solution
11. pH Measurements
12. Determination of sucrose content in sugar
13. Determination of dissolved oxygen in water
14. Determination of total nitrogen and ammoniacal nitrogen
15. Determination of SS, TDS, and VSS of a wastewater sample
16. Analysis of oil & grease in wastewater sample.
17. Study of analytical instruments: Spectrophotometer, pH meter, Gas Chromatograph, High Performance Liquid Chromatograph (HPLC), FTIR,Total Organic Carbon Analyser (TOC).

TOTAL: 45

17BTCE413 MECHANICAL OPERATIONS LABORATORY 0 0 3 2 100

COURSE OBJECTIVES

1. To enable the students to develop a sound working knowledge on different types of crushing equipments and separation characteristics of different mechanical operation separators.
2. Basic understanding of concepts and principles related to applied sciences as a foundation for further studies.
3. Development of communication and interpersonal skills for effective functioning in the world of work.
4. Understanding of basic concepts and principles of mechanical, electrical and civil engineering so as to enable the students to apply the knowledge of these principles to the field of chemical engineering.
5. Ability to read and interpret drawings related to plant layout, process equipment and components.
6. Knowledge of various materials used in chemical processes, their properties and specifications

COURSE OUTCOMES:

1	Estimate crushing characteristics, power requirements and constants ofcrushing lawsusing Jaw and Roll Crusher
2	Determine the critical speed and work index by using Ball mill
3	Determine average particle size and specific surface area by conducting Sieve analysis, Beaker Decantation and Air permeability experiments
4	Estimate specific cake and filter medium resistance using Filter press and Leaf filter
5	Design a thickener using batch sedimentation data and assess the efficiency of Cyclone separator
6	Apply separation techniques like forth floatation, sedimentation to separate a mixture.

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

TOTAL: 45

17BTCE413	**COURSE ORIENTED PROJECT 2**	**002 1**	**100**

17BTCE451 PRODUCTION OF COMMERCIALLY VALUABLE COMPOUNDS **1 0 0 - 100**

COURSE OBJECTIVES:

- To give hands on training on the development of industrially important biotechnology products

COURSE OUTCOMES::

At the end of the course,

- The students will be able to get exposure on small scale development of biotechnology products

1. Production of ethanol from molasses and grapes
2. Production of Biofertilizers
3. Production of Single cell protein (Spirullina)
4. Mushroom cultivation
5. Production of jam from mixed fruits

SEMESTER V

17BTCE501 CHEMICAL REACTION ENGINEERING - I 3 1 0 4 100

COURSE OBJECTIVES

1. To impart knowledge on different types of chemical reactors, the design of chemical reactors under isothermal and non-isothermal conditions
2. to increase the student's ability to do chemical reactor design by providing the knowledge and tools required to obtain, evaluate, and improve rate equations for use in design, operation and optimization of chemical reactors
3. To train students how to analyze chemical reactors and reaction systems
4. To provide practice at developing critical and creative thinking skills related to reaction engineering.
5. To provide experience for students to solve open-ended reaction engineering problems in teams. .
6. To provide practice with computer software and simulation relating to chemical reaction engineering

COURSE OUTCOMES:

1. To gain knowledge on the selection of the reactor for the reaction and its design
2. To apply the principles of reaction kinetics and formulate rate equations and analyze the batch reactor data
3. Understand the ideal reactor concepts and to develop the performance equation to workout conversion and space time
4. Perform RTD analysis in non-ideal flow reactors and calculation of conversion
5. Evaluating the selection process of the reactor for the reaction and its design
6. Applying the principles of reaction kinetics and formulate rate equations and analyze the batch reactor data.

UNIT IRATE EQUATIONS 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 I1DESIGN OF REACTORS 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 12

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 REACTOR SYSTEMS 12

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 VNON IDEAL FLOW REACTORS **12**

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

TOTAL:60

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Levenspiel O	Chemical Reaction Engineering	Wiley Eastern Ltd., II Edition	2000
2	Smith, J.M	Chemical Engineering Kinetics	McGraw Hill, III Edition	1981
3	Fogler.H.S	Elements of Chemical Reaction Engineering	Prentice Hall of India Ltd IIIrd Edition	2000

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Froment. G.F. & K.B.Bischoff	Chemical Reactor Analysis and Design	John Wiley and Sons	1979
2	Smith, J.M., VanNess, H.C., & Abbot M.C	Introduction to Chemical Engineering Thermodynamics	McGraw Hill VII Edition	2004
3	Narayanan K.V	A Text Book of Chemical Engineering Thermodynamics	Prentice Hall of India Pvt. Ltd	2001

COURSE OBJECTIVES

1. Students will learn to determine mass transfer rates under laminar and turbulent conditions.
2. course adheres to advanced solution methods, each solution beginning with differential forms of the equations of change
3. To teach the fundamental principles of mass transfer and separation processes including unit operations for chemical and biological engineering systems;
4. To introduce the mass transfer principles and basic concepts of mass transport
5. To analyze and solve mass transfer problems involving molecular diffusion;
6. To study the vapor liquid equilibrium and the basic concepts of mass transfer in distillation, extraction, leaching operation

COURSE OUTCOMES:

On completion of the course the students will be able to

- understand diffusional operations and theories of mass transfer
- understand the concept of interphase mass transfer
- understand the concept gas-liquid mass transfer operations like humidification
- apply the knowledge gained in mass transfer to perform simple calculations in drying
- apply the knowledge gained in mass transfer to perform simple calculations in crystallization process
- Calculate tower height and number of transfer units for absorption process

UNIT I DIFFUSION **9**

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

UNIT IIINTERPHASE MASS TRANSFER **9**

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 **9**

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 **9**

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 VCRYSTALLIZATION **9**

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**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Treybal, R.E	Mass Transfer Operations	3rd Edn, McGraw-Hill	1981
2	Geankoplis, C.J	Transport Processes and Unit Operations	4th Edition, Prentice Hall Inc., New Jersey	2003

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	McCabe, W.L., Smith, J.C., and Harriot, P	Unit Operations in Chemical Engineering	7th Edn., McGraw-Hill	2005
2	Coulson, J.M. and Richardson, J.F	Chemical Engineering" Vol. I and II	4th Edition,Asian Books Pvt. Ltd., India	1998
3.	J.D. Seader and E.J. Henley	Separation Process Principles	2nd Ed., John Wiley	2006
4	BinayK.Dutta	Principles of Mass Transfer and Seperation Processes	PHI Learning Ltd	2013

17BTCE503CHEMICAL PROCESS PLANT SAFETY AND HAZARD ANALYSIS **3 0 0 3 100**

COURSE OBJECTIVES

1. To impart the importance of safety in industries and the various methods of safety measures and risk analysis in the industry
2. To provide future perspective of inherently safer processes and designs for making safe chemical plants
3. All process safety fundamentals are covered and participants will emerge with a better understanding of the key principles of process safety and its management
4. To gain knowledge about different process utilities used in the chemical process industry and issues related to hazards & safety
5. Understand the common definitions used for process safety Explore myths about process safety.
6. Identify components of a safety culture. Discuss individual risk, societal risk, and risk populations.

COURSE OUTCOMES:

On completion of the course the students will be able to

- demonstrate the awareness of plant safety standards, codes and MSDS in handling and storage of chemicals
- exhibit the skill in classifying chemical, fire, explosion hazards and to understand the occupational diseases
- investigate safety in operations and process by undergoing HAZOP and HAZAN studies
- analyze the accident causes, costs, prevention techniques, accident proneness and case studies
- examine the legal aspects related to safety and emergency studies to know the basic rules and requirements which govern the chemical industries
- Remembering safety operations and process by undergoing HAZOP and HAZAN studies

UNIT – I SAFETY PRINCIPLES **9**

Need for safety, Safety programs, Training & Education, Design for ventilation; Personal protective Equipments. Safety codes: NFPA, IS and OSHA standards; colour codes for pipe lines. Materials Safety Data sheets; safety in storage and handling of chemicals.

UNIT – IIHAZARDS **9**

Hazards- fire, explosion and radiation; Designs to prevent fires and explosions; relief and relief sizing. Occupational diseases - effects.

UNIT – III SAFETY IN OPERATIONS AND PROCESSES **9**

Safety in operations and processes. Runaway reactions, unstable products; Safety Studies – HAZOPS, HAZANS, Fault tree, Event tree and risk analysis.

UINT IVINDUSTRIAL ACCIDENTS **9**

Industrial accidents –types, nature/effects, causes, costs, prevention, investigation and analysis, accident proneness, case studies.

UNIT V LEGAL ASPECTS **9**

Factories act, ESI act and Workmen,,s compensation act, Role of Government, safety organizations, management and trade unions in promoting industrial safety. Emergency response systems for hazardous goods basic rules and requirements which govern the chemical industries.

TOTAL: 45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Fawcett H.H. and Wood W.S	Safety and Accident Prevention in Chemical Operation‖	2nd Edition, Interscience,	1982.
2	Gupta A.K	Industrial Safety and Environment	2nd Edition Reprint	2009

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	William H.	Industrial Safety Handbook‖,	2nd Edition, McGraw Hill,	1968.
2	Loss Prevention and Safety Promotion in Chemical Process Industries		Vol. I, II, III Published by Institution of Chemical Engineers U.K	1983.

17BTCE504 INSTRUMENTAL METHODS OF ANALYSIS 3 0 0 3 100

COURSE OBJECTIVES

1. To make the students understand the working principles of different types of instruments and their applications.
2. instrumental methods of chemical analysis and train students to perform practical work on real samples to get acquainted with instrumentation and equipment which is needed in monitoring of environmental pollution and in investigating current environmental processes.
3. Integrate a fundamental understanding of the underlining physics principles as they relate to specific instrumentation used for atomic, molecular, and mass spectrometry, magnetic resonance spectrometry and chromatography.
4. Understand and be able to apply the theory and operational principles of analytical instruments
5. Distinguish between qualitative and quantitative measurements and be able to effectively compare and critically select methods for elemental and molecular analyses.
6. Gaining factual knowledge (terminology, classifications, methods, trends and Learning fundamental principles, generalizations, or theories

COURSE OUTCOMES:

On completion of the course the students will be able to

- comprehend the principles of electromagnetic radiation and classification of instrumental methods
- grasp the principles and applications of UV, Visible, IR Spectroscopy and Photometric titrations
- appreciate the importance of AAS and NMR spectroscopy in chemical analysis
- gain knowledge about thermo gravimetric instruments and their applications
- understand the principles and applications of chromatographic methods.

- Evaluating the working principles of different types of instruments and their applications

UNIT I ELECTROMAGNETIC RADIATION 9

Various ranges, Dual properties, Various levels, Interaction of photons matter, energy with

absorbance& transmittance and their relationship, Permitted energy levels for the electrons of an atom and simple molecules, classification of instrumental methods based on physical properties.

UNIT II MOLECULAR SPECTROSCOPY 9

Various electronic transitions in organic and inorganic compounds effected by UV, visible and infra-red radiations, various energy level diagrams of saturated, unsaturated andcarbonyl compounds, excitation by UV and Visible radiations, Woodward-Fischer rules for thecalculation of absorption maxima (dienes and carbonyl compounds), Effects of auxochromesandeffects of conjugation on the absorption maxima; Instrumentation for UV, VISIBLE and IRspectroscopies (source, Optical parts and Detectors), Photometric titration (Experimental set-up andvarious types of titrations), Applications of UV, VISIBLE and IR spectroscopies.

UNIT III AAS, NMR SPECTROSCOPY 9

Atomic Absorption Spectrophotometry: Principle instrumentation andapplications. Nuclear Magnetic Resonance: Introduction to NMR, principle and instrumentation (Proton NMR only). Relaxation, Chemical shift and its causes, reference compounds.

UNIT IV THERMAL METHODS 9

Thermogravimetry: Instrumentation, factors affecting shapes of thermo grams, and applications. Thermogram of important compounds (CaSO4.5H2O; CaC2O4.2H2O) DifferentialThermal Analysis: Principle, instrumentation and applications. Differences between DSC &DTA.Application of DSC (Inorganic & Polymer samples). TGA - Principle, instrumentation andapplications.

UNIT V CHROMATOGRAPHIC METHODS9

Classification of chromatographic methods; Column, Thin layer, Paper, Gas, High Performance Liquid Chromatography (principle, mode of separation and technique).Separation of organic compounds by Column and Thin Layer, Mixture of Cu, Co and Ni by PaperChromatography. Separation of amino acids by Paper Chromatography. Estimation of organiccompounds by GC and HPLC.

TOTAL: 45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
	Willard H.H., Merritt I.,	Instrumental Methods	7th Edition, CBS	

1	Dean J.A. and Settle F.A	of Analysis	Publishers, New Delhi,	1986
2	Ewing, Galen W	Instrumental Methods of Chemical Analysis	7th Edition, McGraw-Hill Company, New Delhi,	1985

REFERENCES

S. No.	**Author(s) Name**	**Title of the book**	**Publisher**	**Year of Publication**
1	Skoog D.A. and West D.M	Fundamentals of Analytical Chemistry	7th Edition, Saunders College Publishing, New York	1996.
2	Banwell. G. C	Fundamentals of Molecular Spectroscopy	Tata McGraw-Hill, New Delhi	2006

17BTCE511 HEAT TRANSFER LABORATORY 0 0 3 2 100

COURSE OBJECTIVES

1. To enable the students to develop a sound working knowledge on different types of heat transfer equipments
2. Understand the various forms of heat transfer and their applications in real life problems.
3. Analyze different methods to calculate the heat transfer coefficient in various heat transfer problems.
4. Analyze the theoretical knowledge and apply it in conducting experiments in the forms of heat transfer
5. A knowledge-based design problem requiring the formulations of solid conduction and fluid convection and the technique of numerical computation progressively
6. To gain experience in designing experiments for thermal systems, the design, fabrication, and experimentation of a thin film heat flux gage will be attempted as part of laboratory requirement

COURSE COURSE OUTCOMES:

On completion of the Lab course the student will be able to

- determine Stefan Boltzmann constant at different temperatures
- assess the heat transfer coefficient for natural and forced convection systems, double pipe heat
- exchanger / shell and tube heat exchanger and condensers
- develop temperature profile in unsteady state heat transfer system
- evaluate the convective and radiative heat transfer coefficients using radiation experiment
- appraise the fin efficiency and estimate the steam economy in an evaporator

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

TOTAL:45

17BTCE512 PROCESS EQUIPMENT DESIGN AND DRAWING I 0 0 3 2 100

COURSE OBJECTIVES

1. To develop skill to design and install process equipments used widely in the chemical industry
2. Learn basic symbols used instrumentation diagrams
3. Impart the knowledge mechanical aspects of pressure vessel design
4. Translatemechanical design specifications in to fabrication drawings for plant erection.
5. Draw detailed dimensional drawingsshall include sectional front view, Full Top/side view depending on equipment.
6. It introduces the symbols of chemical engineering equipment and plants.

COURSE OUTCOMES:

On successful completion of the course the students will be able to

1. design machine elements and Piping system/presentation of PFD and PID
2. apply the skill in thermal design of heat transfer equipments like shell and tube and double pipe heat exchangers
3. perform the process design of evaporators
4. apply the skill in design of equipments like crystallizer and centrifuge
5. understand the concepts involved in design of pressure vessel, storage vessel and tall columns
6. to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

LIST OF EXPERIMENTTS:

- Basic design and drawing considerations of machine elements
- Design of Heat Exchangers
- Design of Evaporators
- Design of Crystallizers
- Design of Pressure vessel

TOTAL: 45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Towler C. Gavin and Sinnott Ray	Chemical Engineering Design: Principles, Practice and Economics of Plant and Process Design	2nd Edition, Elsevier	, 2008
2	Thakore S.B. and Bhatt B.I	Introduction to Process Engineering and Design‖,	Reprint, Tata McGraw-Hill	2009

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	SinnotR.K	Chemical Equipment Design: Chemical Engineering	Volume – 6,4thEdition, Elsevier- Butterworth	2005
2	Joshi M.V. and Mahajan V.V	Process Equipment Design	3rd Edition, Macmillan India Ltd	1996.

17BTCE513 CHEMICAL REACTION ENGINEERING 0 0 4 2 100

LABORATORY

COURSE OBJECTIVES

1. To impart knowledge on design of reactors
2. This laboratory course mainly deals with the understanding of the basic concepts pertaining to analyze kinetics for complex reactions by performing different experiments
3. To examine reaction rate data to determine rate laws, and to use them to design chemical reactors, to simulate several types of reactors in order to choose the most appropriate reactor for a given need, To design chemical reactors with associated cooling/heating equipment.
4. Determination of rate kinetics
5. To provide in-depth of heterogeneous reaction systems.
6. learn to design experiments and interpret data to find reaction kinetics

INTENEDED COURSE OUTCOMES:

On completion of the Lab course the students will be able to

1. determine the order and rate constant of the rate equations for Batch/ Mixed / Plug flow reactor
2. estimate the conversion in Batch/Semi-batch/Mixed/Plug flow reactors
3. determine the effect of temperature on rate of reaction to validate Arrhenius equation
4. evaluate the performance of combined Mixed and Plug flow reactor system
5. conduct residence time distribution studies to develop C, E & F- curve for Mixed/Plug flow reactor/Packed-bed reactor
6. Develop mathematical expressions (models) to describe the behaviour of reactors and analyse how kinetics, mass- and heat transfer affect the performance of reactors.

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

TOTAL 45

17BTCE514 COURSE ORIENTED PROJECT 3002 1 100

17BTCE551 PIPE STRESS ANALYSIS(CAEAR-II) 1 0 0 - 100

COURSE OBJECTIVES

1. To understand the engineering principles in a pipe stress analysis
2. To study Nozzle loading and flexibility
3. Limiting the sagging of the piping system within allowable limits
4. Directing the line movements so as protect sensitive equipment against overloading
5. Resisting pipe system to collapse in case of earthquake, wind or shock loadings.
6. Providing pre-spring, cold spring, clearance required for line expansion, and additional line flexibility.

COURSE COURSE OUTCOMES:::

1. Students will be able to identify and analyze practical problems.
2. Students will be able to model the given problem and use experimentation tools required for the same.
3. That the use of codes, regulations and standards are the basics for safety and practical engineering of piping systems in process plants.
4. Piping terminology and how codes, regulations and standards are used in drafting and design of piping systems.
5. Handover and finalization process of a piping installation.
6. Commonly used components in piping systems.

1. **UNIT I**

Introduction to CAESAR II, General modeling in CAESAR II, Pipe stress theory, Stress analysis according to a design codes

UNIT II **3**

Load-based piping design (e.g. earthquake and wind), Flange and nozzle analysis, Structural steel, Expansion joints

UNIT III **4**

Hanger sizing, Fiberglass piping, Buried piping, Generation of isometric drawings

TOTAL 15

17BTCE552 **IN–PLANT TRAINING** **- - - - 100**

COURSE OBJECTIVES

- To know the basic knowledge on industry and its environment.
- To understand the psychology of the workers, their habits, attitudes and approach to problems along with the practices followed either at factory or site.

Students will undergo industrial training for four weeks during the vacation at the end of IV semester and a report with the training completion certificate from the industry will be subsequently submitted to the department within a week after completion. Viva – Voce exam will be conducted at the end of V semester and 100 marks will be awarded.

SEMESTER VI

17BTCE601 CHEMICAL REACTION ENGINEERING - II 3 1 0 4 100

COURSE OBJECTIVES

1. To enable the students to learn the gas-solid catalytic and non-catalytic reactors and gas-liquid reactors
2. the general mole balance, reactor types, conversion and reactor sizing, rate laws and stoichiometry and isothermal reactor design
3. To provide experience for students to solve open-ended reaction engineering problems in teams.
4. To provide practice with computer software and simulation relating to chemical reaction engineering.
5. Use matrix algebra to analyze large systems of reactions
6. Use knowledge of reaction rate theories and/or reaction mechanisms to derive expressions for rate of reaction

COURSE OUTCOMES:

On completion of the course the students will be able to

1. understand the ideal reactor concepts and heterogeneous reactors. .
2. understand the basics of catalysis and industrial catalytic reactors such as gas-solid reactors
3. Identify reaction rate parameters 2 List simple methods of chemical analysis 3 Determination of physic chemical parameters using simple laboratory tools
4. Design and conduct experiments on process equipment to achieve desired COURSE OUTCOMES:
5. Apply engineering analysis to experimental data
6. Identify safety concerns related to the experimental processes

UNIT ICATALYSTS 12

Nature of catalysts, surface area and pore-volume distribution, catalyst preparation.

UNIT II HETEROGENEOUS REACTORS 12

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 12

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 12

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 12

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: 60

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Levenspiel, O	Chemical Reaction Engineering	III Edition, John Wiley	1999
2	Fogler. H. S	Elements of Chemical Reaction Engineering	III Edition, Prentice Hall of India	1999

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Smith J.M.	Chemical Engineering Kinetics	III Edition, McGraw-Hill, New York	1981
2	Froment G.F & K.B. Bischoff	Chemical Reaction Analysis and Design	John Wiley and Sons	1979

COURSE OBJECTIVES

1. To provide introduction to physical and thermodynamic principles of mass transfer with an emphasis on how these principles affect the design of equipment and result in specific requirements for quality and capacity
2. To learn the fundamental concepts of mass transfer principles and to apply those concepts to real engineering problems.
3. To be familiar with equations describing molecular diffusion through gases, liquids, and solids.
4. To be familiar with techniques used to estimate mass transfer coefficients in laminar and turbulent flows.
5. To get acquainted with the general approach for the design of continuous contact and stage wise operations
6. Be familiar with principles underlying and the derivation of the design equations for basic mass transfer operations.

COURSE OUTCOMES:

On completion of the course the students will be able to

1. understand absorption and distillation operations and select methods of separation of mixtures based on mass transfer concepts
2. design a distillation tower
3. perform calculations in adsorption operation
4. apply the ternary equilibrium diagram concepts to determine the number of stages required for separation of liquid-liquid and solid -liquid mixtures
5. Ability to construct and analyze the simultaneous phase equilibrium and mass balances in continuous separation processes (absorbers, strippers, and distillation columns).
6. Ability to develops understanding of implications of factors affecting column operation, and design: effect of reflux ratio, feed conditions.

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 IIDISTILLATION 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 Mc.Cabe - 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 VADSORPTION **12**

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.

TOTAL:60

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Wankat, P.	Equilibrium Stage Separations	Prentice Hall	1993
2	Treybal, R.E	Mass Transfer Operations	3rd Edn., McGraw-Hill	1981
3	Geankoplis, C.J	Transport Processes and Unit Operations	4th Edition, Prentice Hall Inc., New Jersey	2003

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Seader, J.D. and E.J. Henley	Separation Process Principles	2nd Ed., John Wiley	2006
2	McCabe, W.L., Smith, J.C., and Harriot, P	Unit Operations in Chemical Engineering	7th Edn., McGraw-Hill	2005
3	King, C. J	Separation Processes	2nd Edn.,Tata McGraw-Hill	1980

17BTCE603 PROCESS DYNAMICS CONTROL AND INSTRUMENTATION **3 0 0 3 100**

COURSE OBJECTIVES

1. To impart knowledge about the elements and techniques involved in process dynamics and control
2. characterize the dynamics and stability of processes based on mathematical analysis
3. understand the principles of feedback and feedforward controllers
4. design PID controllers using different tuning rules
5. carry out a frequency-domain analysis of control loop systems
6. understand the philosophy of and design model-predictive controllers and

COURSE OUTCOMES:

On completion of the course the students will be able to

1. understand the prerequisites of control strategies to design different process control systems
2. evaluate the suitable controllers for different chemical process
3. familiarize the closed loop response of control loops and characteristics of control valves
4. analyze and assess the control systems unto stability
5. know the tuning procedures and advanced control techniques
6. demonstrate fundamental understanding of process control. develop the mathematical model of various chemical processes.

UNIT IINSTRUMENTATION **9**

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

UNIT II OPEN LOOP SYSTEMS **9**

Laplace transformation and its application in process control. 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 **9**

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 controllers Z-N tuning rules, C-C

tuning rules.

UNIT V ADVANCED CONTROL SYSTEMS 9

Introduction to advanced control systems, cascade control, feed forward control, Smith predictor, control of distillation towers and heat exchangers, introductionto computer control of chemical processes.

TOTAL 45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	D.R. Coughanour	Process Systems analysis and Control	Mc.Graw Hill	1991
2	Stephanopoulous	Chemical Process Control – Theory and Practice	Prentice Hall of India Ltd	1984

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	C.A.Smith and A.B.Corripio	Principle and Practice of Automatic Process Control	John Wiley and Sons	1985
2	W.L.Luyben	Process Modelling Simulation and Control for Chemical Engineers"	Mc.Graw Hill	1990
3	D.W.Seborg, T.F.Edger, and D.A.Millichamp	Process Dynamics and Control	John Wiley and Sons	1994
4	Peter Harriott	Process Control	Tata McGraw Hill Publishing Co	1964

17BTCE604 PROCESS ECONOMICS FOR CHEMICAL ENGINEERING 3 0 0 3 100

COURSE OBJECTIVES

1. To enable students to understand the fundamental economic concepts applicable to engineering and
2. To learn the techniques of incorporating inflation factor in economic decision making, sensitivity and risk analysis.
3. the program COURSE OBJECTIVES that are most relevant are the ability to apply knowledge of chemical engineering fundamentals to identify and solve chemical engineering problems
4. a broad knowledge necessary to understand the impact of engineering solutions in a global and societal context
5. an ability to perform step-by-step design of engineered systems and chemical processes
6. an awareness of safety and environmental issues as an integral part of the chemical engineering profession

COURSE COURSE OUTCOMES::

1. Gain knowledge on cost and asset accounting, time value of money, profitability, alternative investments, and minimum attractive rate of return, sensitivity and risk analysis.
2. Practice various depreciation methods and its uses in industries for the recovery of plant cost
3. Assess the various financial ratios by taking the real time data's of the industries and comment the stability of the financial statements
4. Specify the economic balance in batch, cyclic and continuous operations and study the optimum conditions of operating variables.
5. Outline the various management principles and organization types practiced in the organization
6. Discuss the production planning control methods in industries and also role of control charts in production for the quality control.

UNIT IPRINCIPLES OF MANAGEMENT AND ORGANISATION 12

Planning, organization, staffing, coordination, directing, controlling, communicating, organization as a process and a structure; types of organizations. Method study; work measurement techniques; basic procedure; motion study; motion economy; principles of time study; elements of production control; forecasting; planning; routing; scheduling; dispatching; costs and costs control, inventory and inventory control.

UNIT IIINVESTMENT COSTS AND COST ESTIMATION 8

Time Value of money; capital costs and depreciation, estimation of capital cost, manufacturing costs and working capital, capital budgeting and project feasibility.

UNIT III PROFITABILITY, INVESTMENT ALTERNATIVE ANDREPLACEMENT 9

Estimation of project profitability, sensitivity analysis; investment alternatives; replacement policy; forecasting sales; inflation and its impact.

UNIT IV ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE 8

Principles of accounting; balance sheet; income statement; financial ratios; analysis of performance and growth.

UNIT VECONOMIC BALANCE 8

Economic decisions in Chemical Plant - Economics of size - Essentials of economic balance – Economic balance approach, economic balance for insulation, evaporation, heat transfer.

TOTAL : 45 PERIODS

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Peters, M. S. and Timmerhaus,	, “Plant Design and Economics for Chemical Engineers”	III Edn, McGraw Hill,	2003
2	Holand, F.A., Watson, F.A. and Wilkinson, J.K	., "Introduction to process Economics",	2nd Edn, John Wiley	2007

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	M.L.Jhingan	Principles of Economics	Konark Publications	2010
2	Prasanna Chandra	Fundamentals of Financial Management	Tata McGraw Hill, New Delhi.	2007
3	D.M.Mithani	Money, Banking, International Trade & Public Finance	Himalaya Publishing House	2004

COURSE OBJECTIVES

1. To train the students to develop sound working knowledge on different types of mass transfer equipment
2. the students will get the experimental exposure of different mass transfer operations such as diffusion, extraction, drying,
3. the students learn to record and present the observations made through experiments.
4. to provide students with the theoretical/analytical background to understand mass transfer operations and to tackle the sort of complex problems.
5. students the first-hand experience of verifying various theoretical concepts learnt in theory course that includes Diffusion, Equilibria, Gas Absorption, Cooling tower
6. Analyse one dimensional steady state mass transfer rate for different situations

COURSE OUTCOMES:

On completion

1. Determine diffusivity and mass transfer co-efficient of a given system
2. Generate vapour liquid equilibrium data and liquid equilibrium data for different systems
3. Evaluate the performance and determine the design Parameters of Simple /Packed / Steam distillation
4. Appraise the performance of a simple leaching process
5. Conduct experiments to solve complex engineering problems effectively as an individual or team work,
6. Perform as a leader with good ethical principles to meet societal needs in the field of chemical engineering.

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

TOTAL 45

17BTCE612 PROCESS EQUIPMENT DESIGN AND DRAWING-II 0 0 3 2 100

COURSE OBJECTIVES

1. To enable the students to learn the methods and practices followed in the design of process equipments and to draw the designed equipments to scale.

2. The designing of process equipment such as condensers and evaporators will be learned.

3. The knowledge of fundamentals in momentum, heat and mass transfer will be utilized to design chemical process equipment.

4. The optimization of design parameters for the processes to make more economical.

5. To apply the basics of calculations related to material and energy balances in the processes.

6. Able to appreciate the importance of chemical process design in the process industries

COURSE OUTCOMES:

1. apply the skill in thermal design of heat transfer equipments like condensers and reboilers
2. estimate the design parameters of reactors
3. perform the process design of distillation column
4. apply the skill in design of absorption column
5. Compute the design parameters of distillation columns, absorption towers and rotary drier for the given duty according to standards codes.
6. Conduct experiments to solve complex engineering problems effectively as an individual or team work.

LIST OF EXPERIMENTS

- Design of Condensers
- Design of reactors
- .Design of distillation Column
- Design of Absorption Column
- Design of Dryers

TOTAL: 45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1.	Walas, Stanley M	Chemical Process Equipment Selection and Design	3rd Edition,Butterworth - Heinemann, Boston	2012.
2	Lloyd E.Brownell and Edwin H. Young	Process Equipment Design	John Wiley and Sons	2010

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Nicholas P. Cherimisinoff.	Handbook of Chemical Processing Equipment	Butterworth	2000
2	Uzimann	Principles of Chemical Reactor Analysis and Design	2nd Edition, John Wiley andSons	2009

17BTCE651	MINI PROJECT	0 0 1 - 100

COURSE OBJECTIVES

1. The main COURSE OBJECTIVES is to give an opportunity to the student to get hands on training of a complete working model, which is designed by them.

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be set as a model may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

17BTCE652	TECHNICAL PRESENTATION	1 0 0 - 100

COURSE OBJECTIVES

- To equip the students with effective technical presentation
- To understand the barriers and bridges to communication
- To improve the public speaking capabilities, body language and posture

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.

TOTAL 15

SEMESTER VII

17BTCE701 PROFESSIONAL ETHICS, PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT **3 0 0 3 100**

COURSE OBJECTIVES

- To enable the students to create an awareness on Engineering Ethics, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

COURSE OUTCOMES:

1. Develop managerial skills
2. Cultivate engineering ethics with oneself
3. Develop .stress managing attitude and entrepreneurship.
4. Evaluate theories of the firm, and explain how they are relevant to the diverse range of ownership structures that exist in reality
5. Discuss the moral and social responsibility dimensions of corporate governance
6. Describe why systematic way failure of corporate governance can lead to failure of confidence that could spread from individual firms to entire markets or economies

UNIT I HISTORICAL DEVELOPMENT, PLANNING, ORGANISING 9

Definition of Management – Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Steps involved in Planning – COURSE OBJECTIVES – Setting COURSE OBJECTIVES – Process of Managing by COURSE OBJECTIVES – Strategies, Policies and Planning Premises– Forecasting – Decision–making – Formal and informal organization

– Organization Chart –.

UNIT IIDIRECTING AND CONTROLLING 9

Human Factors – Creativity and Innovation – Harmonizing COURSE OBJECTIVES – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment –Process of Communication – System and process of Controlling – Requirements for effective control – Control of Overall Performance – Direct and Preventive Control – Reporting

UNIT III ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – variety of moral issued – types of inquiry – moral dilemmas – moral autonomy – Kohlberg's theory – Gilligan's theory – consensus and controversy – Models of

Professional Roles – theories about right action – Self–interest – customs and religion – uses of ethical theories.

UNIT IV FACTORS OF CHANGES **9**

Forces that shape culture, social control – Meaning, Agencies, Institution, Customs, Values, Folkways, Norms and Laws. Social changes – Meaning and nature – Theories.

UNIT VENTREPRENEURSHIP AND MOTIVATION **9**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth– Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, COURSE OBJECTIVES.

TOTAL 45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Harold Kooritz and Heinz Weihrich	Essentials of Management	Tata McGraw Hill, New Delhi	2010
2	Khanka S.S	Entrepreneurial Development	S.Chand and Co. Ltd., NewDelhi	2006
3	Mike Martin and Roland Schinzinger	Ethics in Engineering	McGraw–Hill, NewYork	2005

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Tripathy P.C and Reddy P.N	Principles of Management	Tata McGraw Hill, New Delhi	2008
2	Rabindra N Kanungo	Entrepreneurship and innovation	Sage Publications, New Delhi	1998

WEB REFERENCES

1. http://www.managementst udyguide.com/taylor_fayol.htm

2. http://tutor2u.net/business/gcse/people_motivation_theories.htm
3. http://lfkkb.tripod.com/eng24/gilliganstheory.html
4. http://www.developingeyes.com/five–types–of–entrepreneurs/

COURSE OBJECTIVES

To enable the students to understand

- Different types of fluids, their flow characteristics and different mathematical models applied to actual situations
- Mechanism of fluids in motion under different conditions.

COURSE OUTCOMES:

1. Apply the shell momentum balances and velocity distribution in laminar flow and understand
2. Equation of continuity and motion
3. Establish the shell energy balances and temperature distributions in solids and apply the equations of change to solve heat transfer problems
4. Determine the shell mass balance and concentration distributions in systems involving diffusion and reactions
5. Analyze the analogy between the transports processes of heat, momentum and mass transfer
6. Critically apply understanding of ethics of real–world contexts and gather and analyse information by way of undertaking a research project on a topic relevant to business ethics.

UNIT IFUNDAMENTALS OF TRANSPORT PHENOMENAAND VELOCITY DISTRIBUTION IN LAMINAR FLOW **9**

Importance of transport phenomena: analogous nature of transport process, basic concepts, conservation laws. Phenomenological laws of transport properties Newtonian and Non-Newtonian fluids, Rheological models, Theories of transport properties of gases and liquids, effects of pressure and temperature.Shell Momentum Balances and Boundary conditions- Flow of a Falling Film- Flow Through a Circular Tube- Flow through an Annulus- Flow of Two Adjacent Immiscible Fluids- Creeping Flow around a Sphere.

UNIT IIEQUATION OF CHANGE FOR ISOTHERMAL PROCESS **9**

The Equations of Change in Terms of the Substantial Derivative-The Equation of Continuity- The Equation of Motion- Use of the Equations of Change to Solve Flow Problems- Dimensional Analysis of the Equations of Change.

UNIT III VELOCITY DISTRIBUTION IN TURBULENT FLOW **9**

Comparisons of Laminar and Turbulent Flows- Time-Smoothed Equations of Change for incompressible Fluids- The Time-Smoothed Velocity Profile near a Wall- Empirical Expressions for the Turbulent Momentum Flux- interphase transport in isothermal system- Definition of Friction Factors- Friction Factors for Flow in Tubes- Friction Factors for Flow around Spheres -

Friction Factors for Packed Columns-Ergun equation.

UNIT IV SHELL ENERGY BALANCES AND TEMPERATURE DISTRIBUTIONS IN SOLIDS AND LAMINAR FLOW **9**

Shell Energy Balances; Boundary Conditions-Heat Conduction with an Electrical Heat Source-Heat Conduction with a Nuclear Heat Source- Heat Conduction with a Viscous Heat Source- Heat Conduction through Composite Walls- Heat Conduction in a Cooling Fin- Forced Convection-Free Convection-Use of equations of change to setup steady state heat transfer problems.

UNIT VCONCENTRATION DISTRIBUTIONS IN SOLIDS AND LAMINAR FLOW **9**

Shell Mass Balances; Boundary Conditions- Diffusion through a Stagnant Gas Film- Diffusion with a Heterogeneous Chemical Reaction- Diffusion with a Homogeneous Chemical Reaction-Diffusion into a Falling Liquid Film (Gas Absorption)- Diffusion into a Falling Liquid Film (Solid Dissolution)- Diffusion and Chemical Reaction inside a Porous Catalyst- Diffusion in a Three-Component Gas System- equations for change for Multi Component Systems- The Equations of Continuity for a Multicomponent Mixture.

TOTAL :45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Byron R.Bird, Warren E. Stewart	Transport Phenomena	John Wiley & Sons, New York	2002
2	Sissom L.E., and Pitts D.R	Elements of Transport Phenomena	McGraw Hill	1972

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Brodkey R.S. and Hershey H.C	Transport Phenomena - A United Approach	McGraw Hill,	1988
2	R.W.Fahien.	Elementary Transport Phenomena	McGraw Hill,	1983
3	Welty J.R.,Wicks C.E., Wilson R.E	Fundamentals of momentum, heat and mass transfer	John Wiley & sons	2007

17BTCE711 COMPUTATIONAL METHODS IN CHEMICAL ENGINEERING LABORATORY **0 0 3 2 100**

COURSE OBJECTIVES

1. To impart computational techniques for chemical engineering calculations
2. Classification of chemical engineering process simulation models based on mathematical approaches.
3. To handle Software Packages such as EXCEL, MATLAB, FEM LAB to solve chemical engineering problems.
4. How to analyse and interpret results provided by SOFTWARE modeling approaches.
5. Solution dependence and sensitivity on process parameter specifications
6. The students are exposed to learn the basic principles, and logical skills in solving the problems using computational methods.

COURSE OUTCOMES:

1. The current rapid development of these combinatorial methods promises solutions to more complex problems, including the creation of new biosynthetic pathways.
2. Computational methods are also developing quickly.
3. The approaches will allow us to generate the efficient, effective catalysts needed by the pharmaceutical, food and chemicals industries and should open up new opportunities for producing energy and chemicals from renewable resources.
4. Apply the process simulation software like MATLAB /C Programming in the design of single and multiple effect evaporator
5. Interpret the issues, modeling and computational models in Embedded design
6. Explain the basic concepts and compare the features of real time operating systems

LIST OF EXPERIMENTS

Writing Programs and Sub Programs using C/C++and MATLAB/SCILAB for Solving

1. Jacobi Methods, Cramer‟s Rule- "Multiple Effect Evaporator and Similar Problems."
2. "Phase Equilibrium Problems, Equation of State Determination of Bubble and Dew Poin"t Differential Distillation- Minimum Reflux Ratio Calculations.
3. "Mass Transfer Problems- Rayleigh‟s Equation", NTU in Absorption, Determination of Drying time from batch drying data- Determination of reactor size.
4. "Milne‟s Method, Laplace Equation, Predictor-Corrector Methods".
5. "Heat conduction problems and chemical reaction" Engineering problems

COMPUTER AIDED DESIGN

Design, Rating and Simulation of Chemical Engineering Equipment Using Aspen Plus / ChemcadSoftware:Mixer, Flow splitter; Flash column; pipe line and pipe pressure drop; Pump; Single and multistage compressors; Heat Exchangers; Distillation Columns; Reactors etc.

COMPUTER AIDED SIMULATION

Simulation Exercises Using Aspen Plus /Chemcad: Physical property estimations; Simulation of a flow sheet:Mass and Energy balances; Handling user specifications on output streams.**4**

Introduction to HYSYS Software, HYSYS User Interface, Defining the Simulation Basis, Selecting a Unit Set, Adding a Stream, Flash Calculations **3**

- Adding Utilities, The Stream Property Value, Flash Calculations of a Ethanol-Water Mixture, Gas Plant Example **4**

- Optimization in HYSYS, Set and Adjust Logic Operations, Flash Calculation, PFD Preparation, Sizing of Columns, Oil Manager / Characterization, Pipe Sizing and Pressure Drop in HYSYS, Simulation of live Project

TOTAL 45

COURSE OBJECTIVES

1. To determine experimentally the methods of controlling the processes including measurements using process simulation techniques.
2. To control temperature, pressure, flow, level using PC with the help of different control modes.
3. To verify the operation of control valves.
4. To verify the operation of I/P & P/I converters.
5. To control the speed of DC motor.
6. To obtain the time domain specification for a second order system using PID controller.

COURSE COURSE OUTCOMES::

1. Students would have knowledge on the development and use of right type of control dynamics for process control under different operative conditions.
2. Develop the skills required for automation, control and monitoring of industrial processes in high level with automation and control systems
3. Employ high-level PLC control systems in the computer integration of manufacturing processes.
4. Integrate the industrial processes, control of sequences for automation and monitoring through distributed control systems.
5. Practice the manufacturing and inventory management systems currently used in the process industries.
6. Explain the different computer process control systems and its application.

LIST OF EXPERIMENTS

1. Single capacity liquid level process
2. Time constant of a thermocouple
3. Calibration of resistance thermometer
4. Response of a dial thermometer
5. Two capacity liquid level process without interaction
6. Two capacity liquid level process with interaction
7. Heat transfer dynamics of stirred tank
8. Computer controlled level process analyser
9. Computer controlled flow process analyser
10. Computer controlled pressure process analyser
11. Computer controlled temperature process analyser
12. Computer controlled heat exchanger system
13. Triangle simulator trainer.

TOTAL 45

17BTCE791 PROJECT WORK PHASE I 0 0 8 4 100

COURSE OBJECTIVES

1. To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

17BTCE891 PROJECT WORK - PHASE II & VIVA-VOCE 0 0 32 16 300

COURSE OBJECTIVES

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

PROFESSIONAL ELECTIVES

17BTCE5E01 FOOD TECHNOLOGY 3 0 0 3 100

COURSE OBJECTIVES:

1. To enable the students to learn to design processing equipments for Food Industries
2. To acquaint with different groups of micro-organisms associated with food, their activities, destruction and detection in food
3. To acquaint with different groups of micro-organisms associated with food, their activities, destruction and detection in food
4. To acquaint with basic principle of Food Engineering and its Processes, with importance of various foods process and their evaluation.
5. To make students understand the need, importance and process of developing healthy and nutritious foods for special category of population groups
6. To acquaint the students about importance of nutrition, balanced diets, therapeutic diets for health and role of food and nutraceuticals in health.

COURSE COURSE OUTCOMES::

1. The students will able to describe DNA based biosensors to study the presence of heavy metals in the food products
2. The students will have knowledge about different processing and preservation methods and principle involved
3. The students will gain information about various food constituents, and changes that occur in them during food processing.
4. Students will get acquainted with analytical methods used for quality control analysis of raw material and processed food commodities
5. The students are expected to have learnt statistical tools for analyzing data
6. students will have knowledge about different groups of micro-organisms and their beneficial as well as harmful effects related to food

UNIT I AN OVERVIEW 9

General aspects of food industry; world food needs and Indian situation.

UNIT II FOOD CONSTITUENTS, QUALITY AND DERIVATIVE FACTORS 9

Constituents of food; quality and nutritive aspects; food additives; standards; deteriorative factors and their control

UNIT III GENERAL ENGINEERING ASPECTS AND PROCESSING METHODS 9

Preliminary processing methods; conversion and preservation operations.

UNIT IV FOOD PRESERVATION METHODS 9

Preservation by heat and cold; dehydration; concentration; drying irradiation; microwave heating; sterilization and pasteurization; fermentation and pickling; packing methods.

UNIT VPRODUCTION AND UTILISATION OF FOOD PRODUCTS **9**

Cereal grains; pulses; vegetables; fruits; spices; fats and oils; bakery; confectionery and chocolate products; soft and alcoholic beverages; dairy products; meat; poultry and fish products.

TOTAL **45**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Heid J.L. Joslyn M.A.,	Fundamentals of Food Processing Operation	The AVI publishing Co., West port	1967
2	Potter N.N	Food Science	The AVI publishing Co., Westport	1963

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Heldman D.R.,	Food Process Engineering	The AVI publishing co	1975
2	Charm S.E	The Fundamentals of Foods Engineering	The AVI Publishing Co., Westport	1963

COURSE OBJECTIVES

1. To motivate the students by highlighting the importance of Energy technology and various energy management concepts
2. To facilitate the students to achieve a clear conceptual understanding of technical and commercial aspects of energy conservation and energy auditing.
3. To enable the students to develop managerial skills to assess feasibility of alternative approaches and drive strategies regarding energy conservation and energy auditing
4. To impart knowledge in the domain of energy conservation
5. To bring out Energy Conservation Potential and Business opportunities across different user segments under innovative business models
6. To inculcate knowledge and skills about assessing the energy efficiency of an entity/ establishment

COURSE OUTCOMES: :

1. Explain the formation of coal and its classification, ranking, analysis, testing, carbonization, gasification, liquefication and and manufacture of coke.
2. Create the knowledge about occurrence of crude oil, its composition, classification and production of petroleum products, properties and testing, handling and storage of petroleum, refining and other conversion processes.
3. State the occurrence, properties, production and storage of gaseous fuels, combustion, furnaces for different gaseous fuels and waste heat recovery.
4. Understand the concept of nuclear reactions and to infer the fuel materials, moderators and structural materials for construction of various types of nuclear reactors for contribution to the energy needs.
5. Analyze the utilization of solar energy for room and water heating, to derive energy from biomass using different biogas plants and to study application of other energy resources such as wind energy, tidal and ocean energy.
6. Students will be able to work effectively in teams and demonstrate team-working capabilities.

Unit I FUELS
TECHNOLOGY

Introduction – Solid fuels – Coal origin, analysis and properties, efficient utilisation, storage and applications, Liquid fuels – Petroleum- Production and consumption, refining, properties and petroleum products, Gaseous fuels – natural gas, producer gas, water gas, gasification of coal; gases from biomass

UNIT II **9**

Distinct features of combustion of solid, liquid and gaseous fuels - determination of gross and net calorific values - combustion of solid fuels including pulverized fuels, stoking and ash removal - fluidized bed combustion of solid fuels - combustion of liquid fuels - burners and nozzles - combustion of gaseous fuels - types of combustion: surface combustion, submerged combustion and pulsating combustion

UNIT III HYBRID SYSTEMS **9**

Wind-PV systems, Wind-DG systems, Wind-Hydel systems, Gasifier DG- Wind systems and Application areas, Hybrid conventional and geothermal power plants, Integrated coal gasifier and fuel cell power plant

UNIT IV ENERGY AUDIT **9**

Energy Audit: Types and Methodology; Energy Audit Reporting Format; Understanding.Energy Costs; Benchmarking and Energy Performance; Matching Energy Usage to Requirement; Maximising System Efficiency; Fuel and Energy Substitution; Energy Audit Instruments; Duties and responsibilities of energy auditors

UNIT VENERGY MANAGEMENT **9**

Definition and COURSE OBJECTIVES of Energy Management; Importance; Indian need of Energy Management; Energy action planning, Energy Organization, energy costing, budgeting,
Equipment professionals, staffing, Monitoring and targeting – Data and Information Analysis; Relating Energy Consumption and Production, Design of energy management programs

TOTAL **45**

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Gupta	Elements of fuels, furnaces and refractories	Khanna Publishers	2010
2	Rao S.& Dr. Parulakar B.B	Energy Technology	Khanna Publishers	1994
3	Samir Sarkar,	Fuels and Combustion	University Press	2009

17BTCE5E03 BIOCHEMICAL ENGINEERING 3 0 0 3 100

COURSE OBJECTIVES:

1. This course mainly discusses the role of enzymes and microbes in biotechnology sectors
2. foster a unique and personalized undergraduate experience by leveraging the advantages of a small college atmosphere within a comprehensive liberal arts and research university;
3. Provide a diverse, inclusive, and equitable environment for all students
4. Enrich the undergraduate experience through cultural diversity, international opportunities, and/or experiential learning
5. Provide a solid foundation and understanding of the fundamental principles of mathematics, science, and engineering;
6. Provide students with experience in learning and applying tools, and analyzing and interpreting data to solve theoretical and open-ended chemical engineering problems

COURSE COURSE OUTCOMES:::

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. Communicate effectively and Function on multidisciplinary teams
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
6. Acquire and apply new knowledge as needed, using appropriate learning strategies.

UNIT I INTRODUCTION 9

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 IIKINETICS OF ENZYME ACTION 9

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 9

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 **9**

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 VDOWN STREAM PROCESSING **9**

Downstream 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**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	J.E.Bailey and D.F.Ollis	Biochemical engineering fundamentals	McGraw Hill	1986
2	Michael L. Shuler and FikretKargi	Bioprocess Engineering	Pearson education	2000

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	James M.Lee	Biochemical engineering	Prentice-Hall	1992
2	Pauline M. Doran	Bioprocess engineering principles	Academic Press	1997
3	H.W. Blanch and D.S. Clark	Biochemical Engineering	Marcel Dekker	1997

17BTCE5E04 FERTILIZER TECHNOLOGY 3 0 0 3 100

COURSE OBJECTIVES

1. To enable the students to learn the fertilizer manufacturing including new or modified fertilizer products and new techniques.
2. Understand the various unit operation and unit processes and their application in different chemical industries like fertilizer, process industry, sugar and plastic etc
3. . Understand various instruments used in process control of chemical industry including use of computer.
4. Understand the organisation and his place in it. Understanding the general procedures of stores, purchase and inventory etc.
5. Understand the techniques of installation, erection and commissioning of equipments/instruments in chemical plants.
6. Understand, interpret and prepare plant layout and flow diagrams.

COURSE COURSE OUTCOMES:::

1. Understand the basic concepts of fertilizer industries.
2. Identify engineering problems in fertilizer manufacturing
3. Handle the fertilizers.
4. Select appropriate synthesis fertilizer.
5. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
6. an ability to design and conduct experiments, as well as to analyze and interpret data

UNIT INITROGENOUS FERTILISERS 9

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

UNIT IIPHOSPHATIC FERTILISERS 9

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

UNIT III POTASSIC FERTILISERS 9

Methods of production of potassium chloride, potassium schoenite, their characteristics and specifications.

UNIT IV COMPLEX AND NPK FERTILISERS 9

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

UNIT VMISCELLANEOUS FERTILISERS **9**

Mixed fertilizers and granulated mixtures; biofertilisers, nutrients, secondary nutrients and micro nutrients; fluid fertilizers, controlled release fertilizers, controlled release fertilizers.

TOTAL **45**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Handbook of fertilizer technology		Association of India, New Delhi	1977
2	Menno, M.G	Fertilizer Industry - An Introductory Survey	Higginbothams Pvt. Ltd	1973

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Sauchelli, V.	The Chemistry and Technology of Fertilizers	ACS MONOGRAPH No. 148, Reinhold Publishing Cor. NewYork	1980
2	Fertiliser Manual	United Nations Industrial Development Organisation	United Nations, New York	1967
3	Slack, A.V.;	Chemistry and Technology of Fertilisers,	Interscience, New York	1966

COURSE OBJECTIVES:

1. To enable the students to learn the design aspects of fluidized beds.
2. Fluidization phenomena, fluidized bed regimes and models
3. Understand the fundamental of fluidization.
4. Acquainted with the fundamentals of fluidization engineering, different regimes,classification of particles.
5. Realize themovement of bubbles mixing in bed.
6. Know the mathematical models of Fluidized Bed

COURSE OUTCOMES:

1. Remembering the fluidization behavior
2. Evaluating pressure drop, bubble size, void age, heat and mass transfer rates for the fluidized beds ·
3. Applying the model equations for fluidized beds. ·
4. Creating the gas-solid fluidized bed reactors
5. Understanding the fundamental of fluidization.
6. Analyzing the fundamentals of fluidization engineering, different regimes, classification of particles.

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UNIT IBASICS OF FLUIDIZATION 9

Packed bed – Velocity – Pressure drop relations – Correlations of Ergun, Kozneykarman – On set of fluidization – Properties of fluidized beds – Development of fluidization from fixed bed.

UNIT II FLUIDIZED BED TYPES 9

Minimum fluidization conditions – Expanded bed – Elutriation – Moving solids and dilute phase – spouted bed.

UNIT III DESIGN ASPECTS 9

Channeling – Bed expansion in liquid – Solid and gas – Solid fluidizations. Design aspects of fluidized bed systems.

UNIT IV HEAT AND MASS TRANSFER IN FLUIDIZED BEDS 9

Heat and mass transfer in fluidized bed systems – Industrial applications and case studies of fluidized bed systems.

UNIT V OTHER TYPES OF FLUIDIZATION 9

Single stage and multistage fluidization – Collection of fines – Use of cyclones.

TOTAL : 45 PERIODS

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Levenspiel	Fluidization Engineering	2nd Edition, Butterworth–Heinmann,	1991
2	Robert H. Perry and Don W. Green	Perry‟s Chemical Engineer‟sHandBook	7th Edition, Mc Graw Hill – International	1997

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Rowe and Davidson	Fluidization	Academic Press	1971
2	Leva, M	Fluidization	McGraw Hill Book Co	1959
3	Wen-Ching Yang.,	Handbook of Fluidization and Fluid-Particle Systems	Marcel Dekker Inc	2003

COURSE OBJECTIVES

1. To understand the formation and composition of petroleum
2. To understand the various treatment techniques of petroleum
3. Making students familiarize with upgrading process of petroleum products
4. Relate upon his/her skills in chemicalprocess design with the elements of refinery process
5. Get acquainted with the various refinery processes and the products.
6. Understand the safety and environmental issues in designing relevant equipments.

COURSE COURSE OUTCOMES::

1. Get conversant the basic separation and conversion processes used in refining crude oil
2. Apply chemical engineering principles to the analysis of safe and efficient refinery operations
3. Use the Fenske Underwood and Gilliand method in designing oil-water separators, Design of light end units.
4. Design ADU/VDU and absorbers
5. Examine how each refinery process works and how physical and chemical principles are applied to achieve the COURSE OBJECTIVES of each refinery process
6. Assess implications of changing crude oil feedstocks on refinery configuration and propose strategies to resolve conflicts with degrading crude oil quality and increasingly stringent environmental regulations on petroleum fuels

UNIT – I FORMATION AND COMPOSITION OF PETROLEUM 9

Origin and formation of petroleum; composition; types and classification; Petroleum reserves.

UNIT – II PROPERTIES AND TESTING METHODS9

Physical properties and testing methods – crude and petroleum products;

UNIT– III TREATMENT TECHNIQUES9

Desalting of crudes, dehydration and fractionation methods; Thermal and catalytic cracking processes – vis-breaking, Dubbs two coil process, coking, FCC, Hydro cracking processes.

UNIT– IV UPGRADING PROCESSES 9

Solvent extraction; hydro treatment processes; Reforming and Alkylation; Isomerization; polymerization; finishing and purification processes.

UNIT – V MATERIAL AND ENERGY BALANCES 9

Material and Energy balances calculation; controlling hydrocarbon losses in refinery; application of pollution control techniques.

TOTAL: 45

TEXT BOOKS:

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	BhaskaraRao B.K	Modern Petroleum Refining Processes	5th Edition, Oxford and IBH Publishing Company, New Delhi	2008
2	Nelson W.L	Petroleum Refinery Engineering	4th Edition, McGraw Hill Publishing Company Limited	1958

REFERENCE BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Watkins R.N	Petroleum Refinery Distillation	2nd Edition, Gulf Publishing Company, Texas	1979
2	Hobson G. D	Modern Petroleum Technology	Part 1&2, 5th Edition, Wiley Publishers	1984

COURSE OBJECTIVES

1. Focused on papermaking science and technology and is to be especially valuable to students majoring in programs leading to careers in corporate or government positions which would interface with the paper related industries
2. Provide fundamental knowledge necessary to maximize bleach plant performance while extending the life span of pulp/bleaching equipment.
3. Optimize pulping operations to achieve maximum pulp bleachability and strength properties
4. Apply the fundamental chemical principles of making pulp and paper in the industry.
5. Advise pulp and paper makers on how to control environmental pollution.
6. Focused on papermaking science and technology and is to be especially valuable to students majoring in programs leading to careers in corporate or government positions which would interface with the paper related industries.

COURSE OUTCOMES:

1. Introduction to Basic Pulp and Paper Technology, Wood Harvesting, Wood as a Raw Material Wood-yard Operations.
2. Mechanical and Chemical Pulping processes, Stock Preparation Paper Machine Wet End Additives
3. Paper Machine Wet and Dry End Operations, Other Paper and Paperboard Formers and Products
4. Surface Treatments; Finishing Operations
5. Paper End Uses. Process Control Properties and Testing of Pulp and Paper
6. An Introduction to Quality; Mill Services; Water Pollution Control; Air Pollution Control.

UNIT I INTRODUCTION **9**

Introduction Basic pulp and paper technology – Wood haves dry – Wood as a raw material

UNIT II WOODYARD OPERATION **9**

Woodyard operation - Mechanical pulping – Chemical pulping – Secondary fibre pulp processing

UNIT III PAPER MACHINE **9**

Paper Machine wet and addition paper machine dry and operation – Paper machine - Wet and operation

UNIT IV PAPER AND PAPERBOARD **9**

Paper and paperboard frames and products – Surface treatments – Finishing operation– End uses

UNIT V PROPERTIES AND TESTING OF PULP AND PAPER **9**

Properties and Testing of pulp and paper Process control – Quality assurance – Water and air pollution control

TOTAL **45**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Kenneth W. Brittt	Handbook of Pulp and Paper Technology	2nd Revised Edition, John Wiley & Sons	1971
2	SmookG.A	Handbook for Pulp & Paper Technologists	3 rd Edition, Angus Wilde Publications, Incorporation	2003

REFERENCE BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Austin, G.T	Shreve's Chemical Process Industries	5 th Edition, McGraw-Hill International Book Company, Singapore	1984
2	Kent J.A	Riggel's Hand Book of Industrial Chemistry	Van Nostrant Reinhold	1974

17BTCE6E04 POLYMER TECHNOLOGY 3 0 0 3 100

COURSE OBJECTIVES

1. To enable the students to compute molecular weight averages from the molecular weight distribution, Condensation polymerization and transition in polymers.
2. To provide the students with overall knowledge on the manufacturing of plastic materials, their properties, applications, processing, product design, mold design, testing & quality control, and recycling through theory as well as practical training.
3. To make the students competent to take up the challenging positions in Plastics material manufacturing industries, compounding industries, processing machinery manufacturing industries through offering specialized elective subjects and industry exposure.
4. Apart from technical oriented subjects the students are also offered management subjects like TQM, Industrial costing and management, statistical quality control, and general subjects like professional ethics, environmental science to impart leadership qualities in the students.
5. To meet the man power requirements of plastics and allied industries in India and overseas.
6. To provide the students with basic knowledge of the morphology of polymers in the solid state, amorphous and crystalline. Particular emphasis will be on the interplay between morphology and physico-chemical properties

COURSE COURSE OUTCOMES:::

1. Students will be able to understand the relationships between polymer molecular weight, molecular weight distribution, and the properties of polymeric materials.
2. Students will demonstrate an ability to distinguish different polymerization reactions and their mechanisms/kinetics, and learn how actual polymerization is performed in the laboratory. Students will also be able to analyze polymerization data and predict the conversion and molecular weight, which will lead to critical thinking about how to improve the setup for better polymerization.
3. Students will be able to determine polymer molecular weights and molecular weight distributions from different types of experiments. Students will learn about polymer solvent interaction and the effect of the solvents on the dimensions of the polymers in solution.
4. Students will improve and expand their skills in performing and analyzing the thermal and mechanical properties of polymers, and demonstrate an ability to predict how the molecular weight will affect these properties.
5. Students will be able to describe the viscoelastic behavior of polymers with respect to their chemical structures and molecular weights, and to construct a corresponding master curve from the experimental data.
6. Students will be able to run extrusion and injection molding machines, and to collect and analyze data. This will help them to make connections between the polymer molecular weight, viscoelastic properties, and processing conditions.

UNIT I INTRODUCTION **9**

History of Macromolecules – structure of natural products like cellulose, rubber,proteins – concepts of macro molecules – Staudinger‟s theory of macromolecules – difference between simple organic molecules and macromolecules

UNIT IIADDITION POLYMERIZATION **9**

Chemistry of Olefins and Dienes – double bonds – Chemistry of free radicals – monomers – functionality – Polymerization: Initiation – types of initiation – free radical polymerization – cationic polymerization – anionic polymerization – coordination polymerization – industrial polymerization – bulk, emulsion, suspension and solution polymerization techniques – Kinetics – Copolymerization concepts

UNIT III CONDENSATION POLYMERIZATION **9**

Simple condensation reactions – Extension of condensation reactions to polymer synthesis – functional group reactivity – polycondensation – kinetics of polycondensation- Carother‟s equation – Linear polymers by polycondensation – Interfacial polymerization – crosslinked polymers by condensation – gel point.

UNIT IV MOLECULAR WEIGHTS OF POLYMERS **9**

Difference in molecular weights between simple molecules and polymers – number average and weight average molecular weights – Degree of polymerization and molecular weight – molecular weight distribution – Polydispersity – molecular weight determination. Different methods – Gel Permeation Chromatography – Osmometry, Light Scattering.

UNIT VTRANSITIONS IN POLYMERS **9**

First and second order transitions – Glass transition, Tg – multiple transitions in polymers – experimental study – significance of transition temperatures – crystallinity in polymers – effect of crystallization – in polymers – factors affecting crystallization crystal nucleation and growth – relationship between Tg and Tm – Relationship between properties and crystalline structure

TOTAL **45**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Billmeyer.F.W.,Jr	Text Book of Polymer Science	Ed. Wiley-Interscience	1984
2	Seymour.R.B., and Carraher.C.E., Jr.,	Polymer Chemistry	2nd Ed., Marcel Dekker	1988
3	Gowariker.V.T., Viswanathan.N.V., and Sreedar.J.	Polymer Science	Wiley Eastern Ltd.	1988

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Joel,R.F	Polymer Science and Technology	Eastern Economy Edition	1999
2	Rodriguez, F., Cohen.C., Oberic.K and Arches, L.A.	Principles of Polymer Systems	5th edition, Taylor an	2000

COURSE OBJECTIVES:

1. To give the students an understanding of the polytechnical nature of engineering and drug discovery in the pharmaceutical industry involving Chemical Engineering.
2. The students shall apply the principles of physical and chemical properties of particle science, polymer science and their use in pharmaceutical dosage forms.
3. They also learn the compression and consolidation parameters for powders and granules. Students also learn about the rheology, disperse systems, dissolution and solubility related parameters for dosage form
4. Students will know the preformulation studies, methodology, different excipients used in solid dosage forms and their evaluation with references to production technologies. The students also know the optimization techniques and their applications in pharmaceutical industries
5. They also learn the pharmacokinetic parameter like drug disposition, absorption, nonlinear and time dependant pharmacokinetics.
6. They also understand about the drug interactions & problems, practice associated in pharmacokinetic parameters calculations

COURSE OUTCOMES::

1. Students would have studied about the gross morphology, structure and functions of nervous, respiratory, urinary and reproductive systems in the human body.
2. They would have studied in detailed about energy and metabolism.
3. Students would able to identify the various organs of different systems of human body.They would have perform
4. med and learnt about the experiments like neurological reflex, body temperature measurement
5. They would have studied elaborate on interlinked mechanisms in the maintenance of normal functioning of human body
6. 6. They would have learnt and performed the experiments like Olfaction, gustation reflex and eye sight

UNIT I INTRODUCTION 9

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

UNIT II DRUG METABOLISM AND PHARMACO KINETICS MICROBIOLOGICAL AND ANIMAL PRODUCTS 9

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 APPLICATION 9

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 9

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

UNIT V PHARMACEUTICAL PRODUCTS & PHARMACEUTICAL ANALYSIS 9

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

TOTAL : 45 PERIODS

TEXT BOOK

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	RawlinesE.A	Bentleys Text book of Pharmaceutics	III Edition Bailliere Tindall, London	1977

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Yalkonsky, S.H.; Swarbick. J	Drug and Pharamaceutical	Vol.I, II, III, IV, V, VI and VII, Marcel Dekkar Inc.,	1975
		Sciences	New York	
2	“Remingtons Pharmaceutical Sciences		Mack Publishing Co	1975

COURSE OBJECTIVES

1. This course will give an appreciation of the fundamental principles on corrosion engineering.
2. To understand the electrochemical nature of corrosion of metals and alloys.
3. To become familiar, in a general way, with the properties and behavior of different classes of materials, particularly, strength, ductility, and densities.
4. To become familiar with the basic methods of polymer synthesis and how these affect microstructure and morphology.
5. To understand that polymers can be amorphous (glassy or rubbery) or semi-crystalline and how this affects thermal and mechanical properties.
6. To become familiar with the basic mechanical properties of polymers (strength, stiffness, toughness) and how these properties compare to other materials.

COURSE OUTCOMES:

1. Students know basic elements of chain microstructure (branching, tacticity, networks, etc).
2. Students understand how microstructure affects the ability to crystallize.
3. Students know the basic elements of the morphology effect of structure on the melting and glass transition temperature.
4. Students know the effect of structure on the melting and glass transition temperature.
5. Students know how the general mechanical properties of materials depend on structure.
6. Students obtain a basic understanding of the viscoelastic nature of polymer materials

UNIT I **9**

Electrochemical and thermodynamic principles, Nernst equation and electrode potentials of metals, EMF and galvanic series, merits and demerits; origin of Pourbaix diagram and its importance to iron, aluminium and magnesium metals.

UNIT II **9**

Exchange current density, polarization - concentration, activation and resistance, Tafel equation; passivity, electrochemical behaviour of active/passive metals, Flade potential, theories of passivity.

UNIT III **9**

Atmospheric, pitting, dealloying, stress corrosion cracking, intergranular corrosion, corrosion fatigue, fretting corrosion and high temperature oxidation; causes and remedial measures.

UNIT IV **9**

Purpose of testing, laboratory, semi-plant and field tests, susceptibility tests for IGC, stress corrosion cracking and pitting, sequential procedure for laboratory and on-site corrosion investigations, corrosion auditing and corrosion map of India.

UNIT V **9**

Corrosion prevention by design improvements, anodic and cathodic protection, metallic, non-metallic and inorganic coatings, mechanical and chemical methods and various corrosion inhibitors.

TOTAL **45**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Raj Narayan	An Introduction to Metallic Corrosion and its Prevention	Oxford and IBH	1983
2	Fontana M. G., Greene N. D	Corrosion Engineering	McGraw Hill	1985

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Denny Jones	Principles and Prevention of Corrosion	Prentice Hall	1996

17BTCE6E07 PIPING ENGINEERING 3 0 0 3 100

COURSE OBJECTIVES

1. To understand the construction and working principle of various piping design.
2. To understand basics of Piping Engineering.
3. To understand the purpose of Piping Engineering
4. Responsibilities of piping engineer in a project.
5. To understand project requirements & Methodology.
6. To learn types of calculations involved in piping engineering project.

COURSE COURSE OUTCOMES::

1.That the use of codes, regulations and standards are the basics for safety and practical engineering of piping systems in process plants.
2.Piping terminology and how codes, regulations and standards are used in drafting and design of piping systems Ways of controlling and reducing forces acting on a pipe system in operating conditions.piping relevant Norsok standards
3.Commonly used metallic piping materials and their serviceability 6. Insulation and surface treatment of piping components and systems
4. Fabrication and control of prefabricated pipe spools.
5. Installation challenges and safety issues related to pipe spools.
6. Relevant inspection, examination and testing issues related to prefabrication of pipe spools.

UNIT I INTRODUCTION TO PIPING ENGINEERING 9

Fluid flow, types of fluids and examples, different pipe fittings. Friction factor, pressure drop for flow Newtonian and non-Newtonian fluids, pipe sizing, economic velocity.Pipe line networks and their analysis for flow in branches, restriction orifice sizing.Pressure drop calculations for non-Newtonian fluids.two phase flow, types of two phase flow, two phase flow as encountered in piping for steam, distillation column, pressure drop, vibrations in two phase flow.

UNIT IIMATERIALS FOR PIPING 9

Selection of material for piping, desirable properties of piping materials, materials for various temperature and pressure conditions, materials for corrosion resistance. Common ASTM and IS specifications for: Seamless / ERW pipes, pipe fittings, flanges, and fasteners, materials for valves. Gaskets: Functions and properties, types of gaskets and their selection.

UNIT III CONTROL & SAFETY IN PIPING 9

Types of valves, control valves, safety valves, constructional features, criteria for selection.Piping components, pressure relieving devices, constructional features, selection criteria and application, safety features. Calculations for line sizing, steam traps, P.R.V. &condensive systems.

UNIT IV PIPING SYSTEM DESIGN **9**

Design principles, calculation of pipe diameter, thickness, important system characteristics and design principles related to steam flow at high and low pressures. Design principles and line sizing for vacuum pipelines, slurry pipelines, surge drums and flare stacks, vacuum devices including ejector system. Considerations governing pump selection, analysis of system and pump characteristics in connection with series, parallel flow, and minimum flow and equalizing lines, NPSH, allowable nozzle loads in various codes. Design principles and line sizing of pneumatic conveying of solids, components of conveying systems, dust and fume extraction systems principles.

UNIT VPIPING LAYOUTS **9**

Introduction to P & I Diagrams, Process flow diagrams, standard symbols and notations. Introduction to various facilities required guidelines for Plot Plan / Plant Layout. Introduction to equipment layout, piping layout, piping isometrics and bill of material. Typical piping system layout considerations for following systems: (i) Distillation columns and heat exchangers, (ii) Reactors, (iii) Pipe racks, (iv) Storage tanks, (v) Pumps.

TOTAL **45**

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	McAllister E.W.	Pipeline Rules of Thumb Handbook	Gulf Publication	2009
2	Kellogg	Design of Piping System	M.W. Kellogg Co	2009
3.	Weaver R	Process Piping Design	Gulf Publication	1989

COURSE OBJECTIVES

1. To understand the functions and design principles of nanotechnology
2. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional scientific practice.
3. will be able to characterize major top-down and bottom-up strategies;
4. will be able to understand the physical laws active in the nano-range and as they differ from those in the micro-range;
5. will know the basics of the electronic structure of atoms, molecules, and nano-particles.
6. Also, the student will know what forces act between atoms and/or molecules when nanoparticles are generated;

COURSE COURSE OUTCOMES:

1. Understand and apply mathematical techniques for describing and deeper understanding of nano systems.
2. Understand and apply quantum mechanical methods for particles in various physical systems and processes.
3. Understand and apply inter-disciplinary concepts and computational simulation for understanding and describing the natural phenomenon.
4. Understand and apply principles of quantum mechanics for understanding the nano systems in quantum realm.
5. Provide exposure in various specialization of Nanotechnology
6. Provide exposure to advanced experimental/theoretical methods for measurement, observation, and fundamental understanding of phenomenon at nano scale and nano systems

UNIT I

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

UNIT II **9**

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

UNIT III **9**

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

UNIT IV **9**

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

UNIT V **9**

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

TOTAL **45**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	B. Bhushan	Springer handbook of nanotechnology	Springer – Verlag	2004
2	Charles P. Poole; Frank K. J Owens	Introduction to Nanotechnology	A John Wiley and Sons	2000

COURSE OBJECTIVES:

1. To solve problems related to the production, storage, distribution and utilization of electrochemical energy and the associated environmental issues.
2. To promote students with interest in research and learning, as well as continuously striving for the forefront of technology.
3. To encourage them to set up models for an electrochemical system, based on continuity equations and transport equations for relevant variables, and with necessary boundary conditions.\
4. To train students to implement equations for production and transport of heat in electrochemical systems, and explain the temperature dependence of electrode potentials, electrode kinetics and mass transport properties.
5. Gain a basic understanding of the fundamental concepts of electrochemical science and engineering such as electrolyte solution, electrochemical cell, electric conductivity, equilibrium electrochemistry, electrochemical kinetics, and current-potential relationship.
6. Understand fundamental principles of the electrochemical energy conversion systems such as fuel cells and electrolyzers or electrochemical phenomena such as corrosion.

COURSE OUTCOMES:

1. Differentiate between galvanic and electrolytic reactions.
2. Work out / Determine limiting electrochemical thermodynamic efficiency and voltage of a device.
3. Derive key kinetic models used to characterize electrochemical devices. Identify limiting bottleneck(s) of a technology based on its current-potential behavior.
4. Compare activation, concentration, and ohmic overpotential losses of a device.
5. Propose approaches to improving device performance, Design electrodes and operating conditions with favorable performance for specific applications.
6. Critique performance of new electrochemical technologies

UNIT I **9**

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

UNIT II **9**

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 **10**

Introduction to corrosion, series, corrosion theories derivation of potentialcurrent relations of activities controlled and diffusion controlled corrosion process. Potential-pH diagram, Forms of

corrosion- definition, factors and control methods of various forms of corrosion-corrosion control measures industrial boiler water corrosion control –protective coatings –Vapor phase inhibitors – cathodic protection, sacrificial anodes –Paint removers.

UNIT IV **8**

Electro deposition –electro refining –electroforming –electro polishing – anodizing –Selective solar coatings, Primary and secondary batteries –types of batteries, Fuel cells.

UNIT V **9**

Electrodes used in different electrochemical industries: Metals-Graphite –Leaddioxide –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

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Picket	Electrochemical Engineering	Prentice Hall	1977
2	J. S	Electrochemical systems	Prentice Hall	1973

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Barak, M. and	Electrochemical Power Sources	McGraw Hill	1980
	Stevenge U. K	- Primary and Secondary Batteries	McGraw Hill	1990
2	Mantell, C	Electrochemical Engineering	McGraw Hill	1972

COURSE OBJECTIVES:

1. To make the students to demonstrate competence in setting up computational fluid dynamics models for some industrially important applications. This technical competence in building and conducting CFD simulations is a skill which enhances employability.
2. To develop an understanding for the major theories, approaches and methodologies used in CFD
3. To build up the skills in the actual implementation of CFD methods (e.g. boundary conditions, turbulence modelling etc.) in using commercial CFD codes
4. To gain experience in the application of CFD analysis to real engineering designs,to introduce numerical modeling and its role in the field of heat transfer and fluid flow.
5. To enable the students to understand the various discretization methods and solving methodologies.
6. To create confidence to solve complex problems in the field of heat transfer and fluid dynamics by using high speed computers

COURSE OUTCOMES:

1. The student will demonstrate the ability to simplify a real fluid-flow system into a simplified model problem, to select the proper governing equations for the physics involved in the system, to solve for the flow, to investigate the fluid-flow behavior, and to understand the results.
2. The student will demonstrate the ability to communicate the results of this detailed fluid-flow study in a written format.
3. The student will demonstrate an ability to describe various flow features in terms of appropriate fluid mechanical principles and force balances.
4. Understand and be able to numerically solve the governing equations for fluid flow and apply finite difference, finite volume and finite element methods to fluid flow problems
5. Understand how grids are generated and Understand how to assess stability and conduct a grid-convergence assessment
6. Understand and apply turbulence models to engineering fluid flow problems 6. Understand and apply compressible flow solvers

UNIT I CONSERVATION LAWSAND TURBULENCE MODELS 9

Governing equations of fluid flow and heat transfer –mass conservation, momentum and energy equation, differential and integral forms, conservation and non-conservation form. Characteristics of

turbulent flows, time averaged Navier Strokes equations, turbulence models-one and two equation, Reynolds stress, LES and DNS.

UNIT II FINITE DIFFERNCE APPROXIMATION **9**

Mathematical behaviour of PDE, finite difference operators, basic aspects of discretization by FDM, explicit and implicit methods, error and stability analysis

UNIT III FINITE VOLUME METHOD **15**

Diffusion problems – explicit and implicit time integration; Convection-diffusion problems properties of discretisation schemes, central, upwind, hybrid, QUICK schemes; Solution of discretized equations.

UNIT IV FLOW FIELD COMPUTATION **6**

Pressure velocity coupling, staggered grid, SIMPLE algorithm, PISO algorithm for steady and unsteady flows

UNIT V GRID GENERATION **6**

Physical aspects, simple and multiple connected regions, grid generation by PDE solution, grid generation by algebraic mapping.

TOTAL : 45 PERIODS

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Anderson, J. D	Computational Fluid Dynamics: The Basics with Applications	McGraw-Hill	1995
2	Fletcher, C. A. J	Computational Techniques for Fluid Dynamics	Springer Verlag	1997
3	Versteeg, H.K. and	An Introduction to	Pearson	2007
	Malalasekera, W	Computational Fluid Dynamics: The Finite Volume Method	Education Ltd	

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Chung T.J	Computational Fluid Dynamics	Cambridge University Press	2003
2	Muralidhar, K., and Sundararajan, T	Computational Fluid Flow and Heat Transfer	NarosaPublishing House, New Delhi	2001
3	Ghoshdastidar, P.S	Computer Simulation of flow and heat transfer	Tata McGraw – Hill Publishing Company Ltd	1998
4	Subas, V. Patankar	Numerical heat transfer fluid flow	Hemisphere Publishing Corporation	1980
5	Taylor, C and Hughes, J.B	Finite Element Programming of the Navier Stock Equation	Pineridge Press Limited, U.K	1981

COURSE OBJECTIVES:

1. To focus on the wastewater transport system and the theory and design technique for the wastewater treatment process.
2. Describe the way organic wastes pollute water Identify elements of wastewater collection systems.
3. Outline the stages of wastewater treatment at the typical treatment facility. wastewater during preliminary, primary, secondary, and tertiary treatment.
4. Describe methods of solids handling, Identify and describe the different types of bar and woven screens used for screening.
5. Identify and describe common types of grit-removal equipment.List factors affecting settling rates.Figure the length of detention time needed to settle out settleable particles.Describe the three principal methods of land disposal
6. Describe what colloidal particles are and outline the problems associated with removing themfrom wastewater.List chemicals used as coagulants.Explain how the flocculation process works

COURSE COURSE OUTCOMES::

1. Learn how to characterize source water, and the best Department Syllabus CE – 46500 Page | 2 available technologies (BAT) for physical and chemical treatment of drinking water.
2. Name and distinguish a variety of chemical reactions and their importance. Review equilibrium chemistry and perform dimensional analysis. List and describe types of electrodes and electrode potential. Measure pH, emf and other related parameters
3. Classify colloids, discuss their properties and their environmental significance. Reproduce the two-film theory and identify the salient features. Perform different analytical techniques for measuring water quality parameters and wastewater characteristics. Apply the knowledge of instrumental analytical techniques for measuring different types of environmental pollutants.
4. Discuss the need for microbiology and identify different flora and fauna of importance in water, air and soil media. Describe bacterial cell structure, function, microbial growth and metabolism. Apply various growth models and determine biokinetic coefficients.
5. Draw and identify bacterial cell structure and morphological features. Solve numerical problems on generation time, specific growth rarte and decay rate. Analyze single & multiple substrate utilization rate.
6. Distinguish between algae, fungi and virus. Classify and characterize using different methods. Formulate enzymatic relationships using kinetics. Apply the knowledge of using microbes in pollution control activities. Review emerging microbial contaminants.

UNIT I WASTE WATER TREATMENT AN OVERVIEW 9

Terminology – Regulatios – Health and Environment Concerns in waste water management –

Constituents in waste water inorganic – Organic and metallic constituents.

UNIT II PROCESS ANALYSIS AND SELECTION 9

Components of waste water flows – Analysis of Data – Reactors used in waste water treatment –
Mass Balance Analysis – Modeling of ideal and non-ideal flow in Reactors – Process Selection.

UNIT III CHEMICAL UNIT PROCESSES 9

Role of unit processes in waste water treatment chemical coagulation – Chemical precipitation for improved plant performance chemical oxidation – Neutralization – Chemical Storage.

UNIT IV BIOLOGICAL TREATMENT 9

Overview of biological Treatment – Microbial metabolism – Bacterial growth and energatus Aerobic biological oxidation – Anaerobic fermentation and oxidation – Trickling filters – Rotating biological contractors – Combined aerobic processes – Activated sludge film packing.

UNIT V ADVANCED WASTE WATER TREATMENT 9

Technologies used in advanced treatment – Classification of technologies Removal of Colloids and suspended particles – Depth Filtration – Surface Filtration – Membrane Filtration Absorption – Ion Exchange – Advanced oxidation process.

TOTAL : 45 PERIODS

TEXT BOOKS

S. No	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Metcalf, Eddy and Tchobanoglous G	Waste Water Engineering Treatment and Reuse	2nd Edition, Tata McGraw Hill Company, NewYork	2002
2	Industrial Waste Water Management, Treatment and Disposal-		3rd Edition, Tata McGraw Hill Professional Publishing Company, New York	2008

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Eckenfelder W.W	Industrial Water Pollution Control	2nd Edition, McGraw-Hill	1999
2	ArceivalaS.J	Wastewater Treatment for Pollution Control	3rd Edition, McGraw-Hill	2006

COURSE OBJECTIVES

- To facilitate the understanding of Quality Management principles and process.

1. The student manager will be able to differentiate between common anspecial cause of variation and/ or differentiate between attributes and variables and/ or construct and write formulae for control charts for variables and attributes.

2. Given the phase of manufacturing (design/ manufacturing/ assembly/ finished product/ service), the student manager will be able to identify potential failure modes and justify the calculation of RPN through 15 steps of FMEA procedure.

3. The student manager will be able to explain the concept of Six Sigma its DMAIC process

4. To realize the importance of significance of quality, Manage quality improvement teams
5. Identify requirements of quality improvement program, Evaluate the principles of quality management and to explain how these principles can be applied within quality management systems.
6. Identify the key aspects of the quality improvement cycle and to select and use appropriate tools and techniques for controlling, improving and measuring quality.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM – TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

UNIT II TQM PRINCIPLES 9

Leadership - Strategic quality planning, Quality Councils – Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership- Partnering,Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA -Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II 9

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY SYSTEMS **9**

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors..

TOTAL: 45 PERIODS

TEXT BOOKS

S. No	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Dale H. Besterfiled, et at	Total quality Management	Pearson Education Asia, Third Edition, Indian Reprint	2006

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	James R. Evans and William M. Lindsay	The Management and Control of Quality	8th Edition, First Indian Edition, Cengage Learning	2012
2	Suganthi.L and Anand Samuel	Total Quality Management	Prentice Hall (India) Pvt. Ltd	2006
3	Janakiraman. B and Gopal .R.K	Total Quality Management - Text and Cases	Prentice Hall(India) Pvt. Ltd	2006

17BTCE8E01 PROCESS OPTIMIZATION 3 0 0 3 100

COURSE OBJECTIVES

1. To know the design experiments and formulate optimization models of chemical processes/equipments.
2. Enumerate the fundamental knowledge of Linear Programming and Dynamic Programming problems.
3. Learn classical optimization techniques and numerical methods of optimization.
4. Know the basics of different evolutionary algorithms.
5. Explain Integer programming techniques and apply different optimization techniques to solve various models arising from engineering areas
6. To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems

COURSE OUTCOMES::

1. Enumerate fundamentals of Integer programming technique and apply different techniques to solve various optimization problems arising from engineering areas.
2. Apply knowledge of optimization to formulate and solve engineering problems.
3. Understand the different methods of optimization and be able to suggest a technique for a specific problem.
4. Understand how optimization can be used to solve industrial problems of relevance to the chemical and oil industries.
5. The students will also be able to learn different techniques to solve Non- Linear Programming Problems
6. They will be able to understand the major limitations and capabilities of deterministic operations research modeling as applied to problems.

UNIT – I DEVELOPING MODELS FOR OPTIMIZATION 9

Scope and hierarchy of optimization, Essential features of Optimization problems, Classification of Models, Building a model, Factorial experimental designs, Degree of freedom

UNIT – II BASIC CONCEPTS 9

Formation of COURSE OBJECTIVES function, continuity of functions, NLP problem statement, convexity and applications, Interpretation of COURSE OBJECTIVES function based on its Quadratic approximation

UNIT – III OPTIMIZATION OF UNCONSTRAINED FUNCTIONS 9

Methods for one dimensional search, Newton,,s method and Quasi – Newton methods for uni dimensional search. Polynomial approximation methods

UNIT – IV UNCONSTRAINED MULTIVARIABLE OPTIMIZATION 9

Methods using function value only, methods using first derivative, Newton,,s method, Quasi – Newton methods.

UNIT – V LINEAR PROGRAMMING 9

Simple method, Barrier method, sensitivity analysis, Linear mixed integer programs, Examples

TOTAL: 45

TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Edgar T.F., Himmelblau D.M., and Ladson L.S	Optimization of Chemical Practice	2nd Edition, McGraw Hill International Company, New York,	2003
2	Kalyanmoy Deb	Optimization for Engineering Design: Algorithms and Examples	Prentice Hall of India, New Delhi	2005

REFERENCES:

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Joshi M.C., and Kannan M. Moudgalya	Optimization, Theory and Practice	Narsoa Publication, New Delhi	2004
2	Urmila M. Diwaker	Introduction to Applied Optimization	Kluwer Academic Publication	2003

COURSE OBJECTIVES

1. To understand about the pilot plants, models, similarity and scale up methods
2. To understand the scale-up of reactors, columns and dryers, unit operations equipment and its limitations
3. The effectiveness of Pilot plant is determined by the ease with which the new product or process is brought into routine production.
4. This could be possible if a good relationship exists between the pilot plant group with other groups (Research & Development, Processing, Packaging, Engineering, Quality Assurance, Quality Control, Regulatory and Packaging) of the company.
5. The formulator who developed the product can take the product into the production.
6. The formulator continues to provide the support to the other departments even after the transition into the production has been completed.

COURSE OUTCOMES::

1. Differentiate between pilot plant and model.
2. Able to develop a prototype (Large scale plant) based on pilot plant studies.
3. Correlate the performance of geometrically similar paddle, propeller and turbine mixers.
4. Advantages and disadvantages of dimensional analysis technique over differential equation technique.
5. Designing a piece of equipment by successive approximation method (Extrapolation).
6. Able to eliminate boundary effects in various chemical systems.

UNIT – I FUNDAMENTALS OF SCALE UP, DIMENSIONAL ANALYSIS AND SCALE-UP CRITERION 9 Principles of Similarity, Pilot Plants and Models, Introduction to Scale-up Methods, Dimensional Analysis, Regime Concept, Similarity Criterion and Scale up Methods used in Chemical Engineering.

UNIT – II SCALE-UP OF HEAT TRANSFER EQUIPMENT 9
Typical Problems in Scale-up of Mixing Equipment and Heat Transfer Equipment.

UNIT – III SCALING UP OF REACTORS 9
Scale-up Techniques available for Tubular Reactor, CSTR and Catalytic Reactors.

UNIT – IV SCALE-UP OF MASS TRANSFER EQUIPMENT 9
Distillation Column and Packed Towers: Scale-up of Distillation Columns and Packed Towers for Continuous and Batch Processes and Dryers

UNIT – V SCALE UP OF MISCELLANEOUS EQUIPMENT AND LIMITATIONS 9
Scaling up of Ball Mill, Pressure Jet Nozzle and Centrifugal Disk Atomizers and Screw Extruders, Furnaces and Kilns, Analogue Models, Limitations of Scale up Techniques.

TOTAL : 45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Johnstone R.E. and Thring M.W	Pilot Plants Models and Scale-up methods in Chemical Engineering	McGraw Hill, New York	1962
2	Marko Zlokarnik	Scale-up in Chemical Engineering	Wiley-VCH, Germany	2002

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Marko Zlokarnik	Dimensional Analysis and Scale-up in Chemical Engineering	Springer - Verlag, Berlin, Germany	1986
2	Donald G. Jordan	Chemical Process Development, Part-1 and 2	Intersciences Publishers	1988

17BTCE8E03POLLUTION CONTROL IN PROCESS INDUSTRIES 3 0 0 3 100

COURSE OBJECTIVES

1. To impart the basic concepts of industrial pollution control
2. To develop understanding about water, air, light pollution control
3. To train the students on developing practical, efficient and cost effective solutions on problems and challenges on environmental sciences and engineering.
4. To inculcate among student's sensitivity towards social and corporate responsibilities.
5. Understanding of basic concepts of air pollution.
6. Study of air pollution episodes. Reasoning of the entire episode, identification of the parameters, conditions, mechanisms.

COURSE OUTCOMES:

1. To identify environmental problems and solutions through organized research.
2. To improve the communication and writing skill so as to face the competitive world
3. Ability to identify air pollution problems and interpret criteria air quality data
4. Ability to recognize various environmental transformation processes of pollutants under extreme weather condition.
5. Ability to interpret meteorological data and develop capability to assessment of project proposal, air quality pollution index for any region
6. Ability to justify the use of pollution control equipment and their design

UNIT I INTRODUCTION 9

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

UNIT IIWATER POLLUTION 9

Types of water pollution, sources, water pollution control. Waste water treatment technologies and Recycle.

UNIT III SOLID WASTE MANAGEMENT 9

Sources, processing methods, waste disposal methods, energy recovery from solid waste

UNIT IV NOISE POLLUTION 9

Hazardous noise exposure, noise measuring instruments and noise pollution control technology. Regulations: ISO 14000, 9000, pollution Acts and Regulations.

UNIT VCASE STUDY 9

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

TOTAL 45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	S.C. Bhatia	Environmental Pollution and control in chemical process industries	Khanna Publishers	2001
2	C.S.Rao	Environmental Pollution Control Engineering	Wiley Eastern	1992

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	S.P.Mahajan	Pollution control in Process Industries	Pollution control in Process Industries	1990
2	F. P. Lees	Loss prevention in process industries	Butter worth- Heinemann	1996

17BTCE8E04 STATISTICAL THERMODYNAMICS 3 0 0 3 100

COURSE OBJECTIVES

1. The student will acquire an introduction to concepts that link classical and statistical thermodynamics.
2. The course will also provide the student with the basic knowledge of statistical thermodynamics and its applications in chemistry and chemical engineering
3. understand the essence of the renormalization group theory
4. students a deep understanding of the fundamental principles of thermal physics. Topics include probability, ensembles, equilibrium, entropy, laws of thermodynamics, heat engines, magnetism, chemical equilibria and quantum statistics.
5. Thermal Physics forms one of the core foundations of modern natural science and plays a significant role in cutting edge research in a variety of fields ranging from condensed matter physics and materials science and engineering to molecular biology and biophysics to chemical structure and dynamics and even to high energy physics and astrophysics.
6. This course aims to introduce students to state-of-the art theoretical techniques and to communicate the excitement of cutting-edge research in a variety of fields where thermal physics plays a critical role.

COURSE OUTCOMES:::

1. Student uses the appropriate normalization for the Boltzmann factor and the appropriate degeneracies and densities of states
2. Can apply the theory on different types of gasses: ideal classic, diatomic, quantum Fermi gasses such as quarks, electrons or baryons, quantum Bose gases such as photons, gluons or mesons.
3. Can analyze phase diagrams, phase transitions and explain the concept of latent heat
4. Has thorough knowledge on different classical and quantum mechanical distribution functions
5. Can explain the procedures for deriving the relation between thermodynamic parameters such as pressure, temperature, entropy and heat capacity from the distribution functions.
6. Can explain phase transitions and magnetization in magnetic system

UNIT ISTATISTICAL-MECHANICAL ENSEMBLES AND THERMODYNAMICS

Ensembles and Postulates, Canonical Ensemble and Thermodynamics, Grand Canonical Ensemble, Microcanonical Ensemble, Entropy, Other ensembles, characteristic equations, Fluctuations

UNIT II GENERAL RELATIONS FOR INDEPENDENT MOLECULES 9

Thermodynamic equivalence of ensembles, Second law, Criteria for spontaneous change, Systems of distinguishable and indistinguishable particles, Boltzmann Statistics, Translational Partition Function.

UNIT III IDEAL MONOATOMIC AND DIATOMIC GAS **9**

Ideal Monatomic Gas, Density of States, Thermodynamic Functions, Internal Degrees of Feedom, Homonuclear Diatomics, Molecular Partition Functions, Ideal Diatomic Gas, Vibrational, Rotational, Gas of Homonuclear Diatomics at Low Temperature, Quantum Statistics, Polyatomic Molecules

UNIT IV CHEMICAL EQUILIBRIUM IN IDEAL MIXTURES **9**

Chemical Equilibrium, General Relations, Statistical Derivation in a Special Case, Fluctuations in a Simple Chemical Equilibrium, Examples of Chemical Equilibriua.

UNIT V RATES OF CHEMICAL REACTIONS IN IDEAL MIXTURES **9**

Potential Surfaces, Absolute Rate Theory, A Non-Chemical Application of the Eyering Theory

TOTAL **45**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Terrell. L, Hill	An Introduction to Statistical Thermodynamics	Dover Publications	1987

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Donald. A, McQuarrie	Statistical Mechanics	University Science Books Publishers	2000

17BTCE8E05 **PLANT UTILITIES** **3 0 0 3 100**

COURSE OBJECTIVES

1. Equipping the students with knowledge on the various process utilities and their importance in chemical process plants.
2. Equip the students with the basic understanding and effective utilization of utilities viz. water, steam, compressor, vacuum pumps, refrigeration and cooling units, insulator, inert gases in process industries and allied operations
3. Impart insights in relation to the different types of fuels and boilers used in process industries for the generation of steam, types of compressors and blowers for handling air and inert gases
4. Expose students to different methods of treatment of wastewater and drinking water
5. Problem representation, temperature enthalpy diagram, simple match matrix
6. Role & scope of piping, line diagram, Process flow diagram

COURSE OUTCOMES::

1. Describe the system layout, component parts and online instrumentation for typical systems for water, gas, steam, compressed air, HVAC refrigeration and electrical generation and distribution
2. Examine the hazards and risks associated with the operation of a range of utility systems
3. Explain the mechanisms for system control such as lock out, tag out and emergency shutdown
4. Describe routine systems monitoring activities for a range of utility systems
5. Explain the design, and operation principles of a range of pumps, valves and piping systems to include their application in the life sciences industries
6. Interpret the control and operational requirements of a range of pumps, valves and piping systems utilised in a process plant

UNIT I STEAM, COMPRESSORS AND VACUUM PUMPS 9

Steam generation and its application in chemical process plants, steam distribution including appropriate mechanical valves and instrumentation, steam utilization, design of efficient steam heating systems, steam nozzles. Compressed air, process pumps, compressors, vacuum pumps, pressurized air distribution systems. Types of compressors and vacuum pumps.

UNIT II REFRIGERATION SYSTEMS AND INSULATION 9 Refrigeration system and their characteristics, load calculation and load calculation and humidification and de humidification equipments, drying and cooling tower, air blending, exhaust, ventilation, cryogenics, their characteristics and production of liquid N2 and O2Importance of insulation for meeting for the process equipment, insulation material and their effect on various materials of equipment piping, fitting and valves, insulation for high, intermediate, low and subzero temperatures including cryogenic insulation, determination of optimum insulation thickness.

UNIT III WATER **9**

Water Resources, process water, boiler feed water, storage and distribution of water, reuse and conservation of water.

UNIT IV PIPING **9**

Piping: Role & scope of piping, line diagram, Process flow diagram and piping and instrumentation diagram.

UNIT VPINCH ANALYSIS **9**

Pinch Analysis: Problem representation, temperature enthalpy diagram, simple match matrix. Heat content diagram, Temperature interval diagram. Heat Exchanger Network Synthesis using Pinch technology

TOTAL **45**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Jack Broughton	Process Utility Systems: Introduction to Design, Operation and Maintenance	IChemE	1994

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Mahesh Rathore	Thermal Engineering	Tata McGraw Hill India	2010
2	Robin M. Smith	Chemical Process: Design and Integration	John Wiley & Sons Ltd., 2005.	2005

17BTCE8E06 INDUSTRIAL MANAGEMENT 3 0 0 3 100

COURSE OBJECTIVES

1. To provide an opportunity to learn basic management concepts essential for business
2. Contribute to the success of companies through effective problem solving
3. Design, develop, implement, and improve integrated systems that include people, materials, information, equipment, and environments
4. Effectively manage business operations and project management teamsContinue to develop holistically, including the personal and professional skills
5. necessary to adapt to our changing societal, technological, and global environments
6. expected to meet the challenges for contemporary professional practice; be able to adapt and solve the increasingly complex problems faced by industry

COURSE OUTCOMES:::

1. An ability to apply knowledge of mathematics, science, and engineering.
2. An ability to design and conduct experiments, as well as to analyze and interpret data.
3. An ability design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. An ability to function on a multidisciplinary team.
5. An ability to identify, formulate, and solve engineering problems.
6. An understanding of professional and ethical responsibility and communicate effectively.

UNIT I INTRODUCTION 9

Management - Definition – Functions – Evolution of Modern Management – Scientific Management Development of Management Thought. Approaches to the study of Management, Forms of Organization – Individual Ownership – Partnership – Joint Stock Companies – Co-operative Enterprises – Public Sector Undertakings, Corporate Frame Work – Share Holders – Board of Directors – Committees – Chief Executive –Trade Union

UNIT IIFUNCTIONS OF MANAGEMENT 9

Planning – Nature and Purpose – COURSE OBJECTIVES – Strategies – Policies and Planning Premises – Decision Making – Organizing – Nature and Process – Premises – Departmentalization – Line and staff – Decentralization – Organizational culture, Staffing - selection and training – Placement – Performance appraisal – Career Strategy – Organizational Development. Leading – Managing human factor – Leadership – Communication, Controlling - Process of Controlling – Controlling techniques, productivity and operations management – Preventive control, Industrial Safety.

UNIT III ORGANIZATIONAL BEHAVIOUR 9

Definition – Organization – Managerial Role and functions – Organizational approaches, Individual behaviour – causes – Environmental Effect – Behavior and Performance, Perception – Organizational Implications. Personality – Contributing factors - Dimension – Need Theories –

Process Theories – Job Satisfaction, Learning and Behavior – Learning Curves, Work Design and approaches.

UNIT IV GROUP DYNAMICS **9**

Group Behavior – Groups – Contributing factors – Group Norms, Communication – Process – Barriers to communication – Effective communication, leadership – formal and informal characteristics – Managerial Grid – Leadership styles – Group Decision Making – Leadership Role in Group Decision, Group Conflicts – Types – Causes – Conflict Resolution – Inter group relations and conflict, Organization centralization and decentralization – Formal and informal – Organizational Structures – Organizational Change and Development – Change Process – Resistance to Change – Culture and Ethics.

UNIT VMODERN CONCEPTS **9**

Management by COURSE OBJECTIVES (MBO), Management by Exception (MBE), Strategic Management - Planning for Future direction – SWOT Analysis – Information technology in management – Decisions support system – Business Process Re-engineering (BPR) – Enterprises Resource Planning (ERP) – Supply Chain Management (SCM) – Activity Based Management (ABM).

TOTAL **45**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Herald Knottz and Heinz Weihrich	Essentials of Management	Tata McGraw Hill Education Pvt. Ltd.,	2010
2	Stephen P. Robbins	Organization Behaviour	Pearson Education Inc., 13 edition	2010

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Ties, AF, Stoner and R.Edward Freeman	Management	Prentice Hall of India Pvt. Ltd. New Delhi	1992
2	Joseph J, Massie	Essentials of Management	Prentice Hall of India Pvt. Ltd	1985
3	P.C. Tripathi & P.N. Reddy	Principles of Management	Tata McGraw Hill	2006

17BTCE8E07 MODERN SEPARATION PROCESSES 3 0 0 3 100

COURSE OBJECTIVES

1. To enable the students to learn the principle and technical concept of advanced separation processes.
2. To understand the governing mechanisms and driving forces of various advanced separation processes and to perform process and design calculations for advanced separation process
3. Understand basic principles of membrane separation and characterization methods available for membranes
4. Derive various transport mechanism involved in MF, UF, NF, RO and gas separation membranes
5. Select membranes for different industrial separation and purification application
6. To be able to design distillation columns having multiple feed streams. And understand the operating principles behind the various types of modern separation methods and to be able to select appropriate method for a particular application.

COURSE OUTCOMES:

1. Knowledge of various chemical engineering separation processes
2. Ability to Select appropriate separation technique for problem
3. Ability to analyze the separation system for multi-component mixtures
4. Ability to design separation system for the effective solution of problem
5. Understanding of modern separation technique in various applications
6. Ability to analyze and design novel membranes for application

UNIT I BASICS OF SEPARATION PROCESS 9

Review of Conventional Processes,Recentadvances in SeparationTechniques 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 9

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, Ultrafiltration andMicro filtration, Ceramic- Hybrid process and Biological Membranes.

UNIT III SEPARATION BY ADSORPTION 9

Types and choice of Adsorbents, Adsorption Techniques, Dehumidification Techniques, Affinity Chromatography and Immuno Chromatography, Recent Trends in Adsorption.

UNIT IV INORGANIC SEPARATIONS 9

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

UNIT V OTHER TECHNIQUES **9**

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

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	King., C. J	Separation Processes	Tata McGraw Hill	1982
2	Roussel, R. W	Handbook of Separation Process Technology	John Wiley, New York	1987
3	Nakagawal.O. V	Membrane Science and Technology	Marcel Dekkar	1992

3 0 0 3

17BTCE8E08 PROCESS MODELING AND SIMULATION 100

COURSE OBJECTIVES

1. To give an overview of various methods of process modeling, different computational techniques for simulation.
2. Summarizing the core concepts learned in the various chemical engineering ourses and using them to build predictive and control models of chemical processes that reveal interesting underlying physics of the processes.
3. A systematic approach will be developed for modeling and simulation, involving the following aspects:
4. Choosing model parameters that best capture the physics of the process, and estimating their sensitivity on the model behavior.
5. Developing methods of validating the model against appropriately designed experiments.

Developing simple mathematical models of chemical systems and analyzing them, gradually leading to more complex models.

COURSE OUTCOMES:

1. Understand the important physical phenomena from the problem statement
2. Develop model equations for the given system, demonstrate the model solving ability for various processes/unit operations
3. Demonstrate the ability to use a process simulation
4. For a given chemical system, recognize the various processes taking place whose relative rates will influence system performance. Identify the characteristic scales appropriate to the system and processes and derive dimensionless groups.
5. For a given chemical system, write the appropriate conservation and constitutive equations that determine the rates of the processes or specify the equilibrium conditions for reversible processes taking place.
6. Determine appropriate specifications of model parameters for a chemical system - lumped, distributed or staged system, to solve simple design and rating problems involving the system

UNIT I INTRODUCTION

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

UNIT II STEADY STATE LUMPED SYSTEMS 9

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 9

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 7

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 13 Analysis laminar flow in pipe, sedimentation, boundary layer flow, conduction, heat exchanger, heat transfer in packed bed, diffusion, packed bed adsorption, plug flow reactor, hierarchy in model development, classification and solution of partial differential equations. Empirical modeling, parameter estimation, population balance and stochastic modeling.

TOTAL: 45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Ramirez. W	Computational Methods in Process Simulation	2nd Edn,Butterworths Publishers, New York	2000
2	Luyben, W.L	Process Modelling Simulation and Control	2nd Edn, McGraw-Hill Book Co	1990

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Felder, R. M. and Rousseau, R. W	Elementary Principles of Chemical Processes	John Wiley	2000
2	Franks, R. G. E	Mathematical Modelling in Chemical Engineering	John Wiley	1967
3	Amiya K. Jana	Process Simulation and Control Using ASPEN	2nd Edn,PHI Learning Ltd	2012
4	Amiya K. Jana	ChemicalProcess Modelling and Computer Simulation	2nd Edn,PHI Learning Ltd	2012

COURSES OFFERED BY OTHER DEPARTMENTS

OPEN ELECTIVES OFFERED BY
DEPARTMENT OF SCIENCE AND HUMANITIES

17BTSHOE01 PROBABILITY AND RANDOM PROCESS 3 0 0 3

COURSE OBJECTIVES

1. To gain knowledge in measures of central tendency.
2. To provide necessary basic concepts in probability and random processes.
3. To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
4. To understand the basic concepts of probability, one- and two-dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
5. To understand the basic concepts of random processes which are widely used in IT fields.
6. To understand the concept of correlation and spectral densities.

COURSE OUTCOMES::

1. Learners acquire skills in handling situations involving more than one random variable and functions of random variables.
2. The students will have an exposure of various distribution functions, correlation and spectral densities
3. To understand the basic concepts of one- and two-dimensional random variables and apply in engineering applications
4. To apply the concept random processes in engineering disciplines.
5. The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable.
6. The students will have an exposure of various distribution functions, correlation and spectral densities.

UNIT- I MEASURES OF CENTRAL TENDENCY AND PROBABILITY (9)

Measures of central tendency – Mean, Median, Mode - Standard Deviation Probability - Random variable - Axioms of probability - Conditional probability - Total probability – Baye‟s theorem.

UNIT- II STANDARD DISTRIBUTIONS (9)

Functions of a random variable - Binomial, Poisson, Uniform, Exponential, Gamma(one Parameter only) and Normal distributions - Moment generating functions, Characteristic function and their properties – Chebyshev's inequality.

UNIT -IIITWO DIMENSIONAL RANDOM VARIABLES (9)

Joint distributions - Marginal and conditional distributions - Probability mass function - Probability density functions – Covariance - Correlation and regression

UNIT- IVCLASSIFICATION OF RANDOM PROCESS (9)

Definition and examples - first order, second order, strictly stationary, wide – sense stationary and Ergodic processes - Markov process - Binomial, Poisson and Normal processes - Sine wave process.

UNIT -VCORRELATION AND SPECTRAL DENSITIES (9)

Auto correlation - Cross correlation - Properties – Power spectral density – Cross spectral density - Properties – Wiener-Khintchine relation – Relationship between cross power spectrum and cross correlation function - Linear time invariant system - System transfer function –Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

Total : 45

TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Peebles Jr, P.Z	Probability Random Variables and Random Signal Principles	Tata McGraw-Hill Pubishers, New Delhi.	2002

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Ross, S	A first Course in Probability	Pearson Education, New Delhi (Chap 2 to 8)	2012
2	Gupta, S.C. and Kapoor, V.K	Fundamentals of Mathematical Statistics	Sultan Chand and Sons, New Delhi.	2014
3	Veerarajan,T.	Probabilitiy, Statistics and Random process	Tata McGraw-Hill Education pvt. Ltd., New Delhi	2008
4	Henry Stark and John W. Woods	Probability and Random Processes with Applications to Signal Processing	Pearson Education, Third edition, Delhi	2002

WEBSITES:

1. www.cut-theknot.org/probability.shtml
2. www.mathcentre.ac.uk
3. www.mathworld. Wolfram.com

17BTSHOE02 FUZZY MATHEMATICS 3 0 0 3

COURSE OBJECTIVES

1. To know the fundamentals of fuzzy Algebra.
2. To know the basic definitions of fuzzy theory
3. To know the applications of fuzzy Technology.
4. To know the basic definitions of fuzzy relations
5. Be able to apply basic fuzzy inference and approximate reasoning
6. To know the applications of fuzzy Technology.

COURSE OUTCOMES:

1. The Engineers will have an exposure on various topics such as fuzzy algebra, fuzzy theory and fuzzy technology.
2. To understand the concept of fuzziness involved in various systems and fuzzy set theory.
3. To gain the methods of fuzzy logic.
4. To comprehend the concepts of fuzzy relations.
5. To analyze the application of fuzzy logic control to real time systems.
6. The Engineers will have an exposure on various topics such as fuzzy algebra, fuzzy theory and fuzzy technology.

UNIT I FUZZY SETS (9)

Fuzzy Sets : Basics Classical sets vs Fuzzy Sets – Need for fuzzy sets – Definition and Mathematical representations – Level Sets – Fuzzy functions - Zadeh‟s Extension Principle

UNIT II OPERATIONS ON FUZZY SETS (9)

Operations on Fuzzy Sets Operations on [0,1] – Fuzzy negation, triangular norms, tconorms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations

UNIT III FUZZY RELATIONS (9)

Fuzzy Relations Fuzzy Binary and n-ary relations – composition of fuzzy relations – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Relational Equations

UNIT IV FUZZY MEASURES (9)

Possibility Theory Fuzzy Measures – Evidence Theory – Necessity and Belief Measures – Probability Measures vs Possibility Measures

UNIT V FUZZY INFERENCE (9)

Approximate Reasoning Fuzzy Decision Making - Fuzzy Relational Inference – Compositional rule of Inference - Efficiency of Inference - Hierarchical

Total : 45

TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	George J Klir and Bo Yuan	Fuzzy Sets and Fuzzy Logic : Theory and	Prentice Hall of India, New Delhi.	2003

		Applications		

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Zimmermann H.J.	Fuzzy Set Theory and its Applications	Kluwer Academic publishers, USA.	2001
2	Michal Baczynski and Balasubramaniam Jayaram	Fuzzy Implications	Springer-Verlag publishers, Heidelberg	2008
3	Kevin M Passino and Stephen Yurkovich	Fuzzy Control	Addison Wesley Longman publishers, USA	1998

WEBSITES:

1. www.mathcentre.ac.uk
2. www.mathworld. Wolfram.com
3. www.calvin.edu/~pribeiro/othrlnks/Fuzzy/fuzzysets.htm

17BTSHOE03 LINEAR ALGEBRA 3 0 0 3

COURSE OBJECTIVES

1. To know the fundamentals of linear Algebra.
2. To study about the linear transformations
3. To introduce the concepts of inner product spaces
4. To know the basic definitions of fuzzy relations
5. Be able to apply basic fuzzy inference and approximate reasoning
6. To know the applications of fuzzy Technology.

COURSE OUTCOMES:

The student will be able to

1. Recognize the underlying theory of vector spaces over a field and inner product spaces over real or complex numbers
2. Visualize linear transformations as matrix form
3. Articulate the importance of Linear Algebra and its applications in branches of Mathematics
4. To comprehend the concepts of fuzzy relations.
5. To analyze the application of fuzzy logic control to real time systems.
6. The Engineers will have an exposure on various topics such as fuzzy algebra, fuzzy theory and fuzzy technology

UNIT I VECTOR SPACES (9)

General vector spaces, real vector spaces, Euclidean n-space, subspaces, linear independence, basis and dimension, row space, column space and null space,

UNIT II EIGEN VALUES AND EIGEN VECTORS (9)

Eigen values and Eigen vectors - Diagonalization - Power method - QR decomposition

UNIT III SYSTEM OF LINEAR EQUATIONS (9)

Direct methods, Gauss elimination method, Gauss Jordan method, Crout‟s method, iterative methods, Gauss-Jacobi method, Gauss–Seidel method, convergence criteria.

UNIT IV LINEAR TRANSFORMATIONS (9)

Linear Transformations - The Null Space and Range - Isomorphisms - Matrix Representation of Linear Transformations – Similarity - Eigenvalues and Eigenvectors Eigen values and Eigen vectors - Diagonalization

UNIT V INNER PRODUCT SPACES (9)

The Dot Product on R^n and Inner Product Spaces - Orthonormal Bases - Orthogonal Complements - Application : Least Squares Approximation - Diagonalization of Symmetric M - Application: Quadratic Forms

Total : 45

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Kreyszig,E	Advanced Engineering Mathematics	John Wiley & Sons, New Delhi.	2014
2	Shahnaz Bathul	Text book of Engineering Mathematics(Special Functions and Complex Variables)	PHI Publications, New Delhi.	2009

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Kreyszig,E	Advanced Engineering Mathematics	John Wiley & Sons, New Delhi.	2014
2	Anton and Rorres	Elementary Linear Algebra, Applications version	Wiley India Edition, New Delhi.	2012
3	Jim Defranza, Daniel Gagliardi	Introduction to Linear Algebra with Application	Tata McGraw-Hill, New Delhi.	2008

WEBSITES:

1. www.sosmath.com
2. www.nptel.ac.in
3. www.mathworld.wolfram.com

17BTSHOE04 ENGINEERING ACOUSTICS3 0 0 3

COURSE OBJECTIVES

1. To provide mathematical basis for acoustics waves and the characteristic behaviour of sound in pipes, resonators and filters.
2. To introduce the properties of hearing and speech
3. To inculcate the characteristics of radiation and reception of acoustic waves.
4. To divulge knowledge on the basics of pipe resonators and filters.
5. To introduce the features of architectural acoustics.
6. To impart the basic knowledge of transducers and receivers.

COURSE OUTCOMES:::

1. The students will have the knowledge on acoustics waves , the characteristic behaviour of sound in pipes, resonators and filters and that knowledge will be used by them in different engineering and technology applications
2. Apply the concepts of radiation and reception of acoustic waves.
3. Explain the basic ideas of pipe resonators and filters.
4. Illusrate the basics of architectural acoustics.
5. Illustrate the transducers and receivers and its applications in various electronic devices.
6. Apply the knowledge inputs of the course for engineering applications.

UNIT I INTRODUCTION (9)

Acoustics waves – Linear wave equation – sound in fluids – Harmonic plane waves - Acoustics intensity – Specific acoustic impedance – spherical waves – Describer scales.Reflection and Transmission:Transmission from one fluid to another normal and oblique incidence –method of images.

UNIT II RADIATION AND RECEPTION OF ACOUSTIC WAVES (9)

Radiation from a pulsating sphere – Acoustic reciprocity – continuous line source radiation impedance

- Fundamental properties of transducers.Absorption and attenuation of sound. Absorption from viscosity – complex sound speed and absorption – classical absorption coefficient

UNIT III PIPES RESONATORS AND FILTERS (9)

Resonance in pipes - standing wave pattern absorption of sound in pipes – long wavelength limit – Helmoltz resonator - acoustic impedance - reflection and transmission of waves in pipe - acoustic filters

– low pass, high pass and band pass. Noise, Signal detection, Hearing and speech. Noise, spectrum level and band level – combing band levels and tones – detecting signals in noise – fundamental properties of hearing – loudness level and loudness – pitch and frequency – voice.

UNIT IV ARCHITECTURAL ACOUSTICS (9)

Sound in endosure – A simple model for the growth of sound in a room – reverberation time - Sabine,

sound absorption materials – measurement of the acoustic output of sound sources in live rooms – acoustics factor in architectural design.

Environmental Acoustics: Highway noise – noise induced hearing loss – noise and architectural design specification and measurement of some isolation design of portions.

UNIT V TRANSDUCTION (9)

Transducer as an electives network – canonical equation for the two simple transducers transmitters – moving coil loud speaker– horn loud speaker, receivers – condenser – microphone – moving coil electrodynamics microphone piezoelectric microphone – calibration of receivers

Total: 45

TEXT BOOK:

S.No.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Lawerence E.Kinsler, Austin R.Frey,	Fundamentals of Acoustics	John Wiley & Sons	2000

REFERENCE:

S.No.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	F. AltonEverest& Ken Pohlmann	Master Handbook of Acoustics	McGraw Hill Professional	2014

WEBSITES:

1. www. acousticalsociety.org
2. www.acoustics-engineering.com
3. www.nptel.ac.in
4. www. ocw.mit.edu

17BTSHOE05 SOLID WASTE MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

1. To understand about the solid waste
2. To study about the waste treatment
3. To gain knowledge on the disposal of waste and waste management.
4. To get the information on energy conservation.
5. To develop an understanding of the basic concepts of Hazardous waste managements.
6. To acquaint the students with the basics of energy generation from waste materials.

COURSE OUTCOMES:::

1. The students will know solid waste and energy conservation. They will understand the methodologies to disposal of solid waste and its management.
2. Identify the concepts of treatment of solid wastes (S).
3. Identify the methods of wastes disposals. (S)
4. Examine the level of Hazardousness and its management. (S)
5. Examine the possible of the energy production using waste materials. (S)
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A).

UNIT I SOLID WASTE (9)

Definitions – Sources, Types, Compositions, Properties of Solid Waste – Municipal Solid Waste – Physical, Chemical and Biological Property – Collection – Transfer Stations – Waste Minimization and Recycling of Municipal Waste

UNIT II WASTE TREATMENT (9)

Size Reduction – Aerobic Composting – Incineration – batch type and continuous flow type, Medical/ Pharmaceutical Waste Incineration – Environmental Impacts – Measures of Mitigate Environmental Effects due to Incineration

UNIT IIIWASTE DISPOSAL (9)

Sanitary Land Fill Method of Solid Waste Disposal – Land Fill Classficaition, Types, Methods &Siting Consideration – Layout & Preliminary Design of Land Fills – Composition, Characteristics generation, Movement and Control of Landfill Leachate & Gases – Environmental Monitoring System for Land Fill Gases, Waste landfill Remediation

UNIT IV HAZARDOUS WASTE MANAGEMENT (9)

Definition & Identification of Hazardous Waste – Sources and Nature of Hazardous Waste – Impact on Environment – Hazardous Waste Control – Minimization and Recycling -Assessment of Hazardous Waste Sites – Disposal of Hazardous Waste, Underground Storage Tanks Construction, Installation & Closure, Remediaiton, risk assessment.

UNIT V ENERGY GENERATION FROM WASTE (9)

Thermal conversion Technologies – Pyrolysis systems, Combustion systems, Gasification systems, Environment control systems, Energy recovery systems. Biological & Chemical conversion technologies – Aerobic composting, low solids.Anaerobic digestion, high solids anaerobic digestion, Energy production from biological conversion products, other biological transformation processes. Chemical transformation processes.

Total: 45

TEXT BOOK:

S. No.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Dara.S.S,Mishra.D.D	A Text book of Environmental Chemistry and Pollution Control	S.Chand and Company Ltd., New Delhi.	2011

REFERENCES:

S. No.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Naomi B. Klinghoffer and Marco J. Castaldi	Waste to Energy Conversion Technology (Woodhead Publishing Series in Energy)	Woodhead Publishing Ltd., Cambridge, UK	2013
2.	Frank Kreith, George Tchobanoglous	Hand Book of Solid Waste Management- 2nd edition	McGraw Hill Publishing Ltd., Newyork	2002
3.	Shah, L Kanti	Basics of Solid & Hazardous Waste Management Technology	Prentice Hall (P) Ltd., New Delhi.	1999

WEBSITES:

1.www.iitk.ac.in/3inetwork/html/reports/IIR2006/Solid_Waste.

2.http://www.unep.or.jp/ietc/ESTdir/Pub/MSW/

3.www.alternative-energy-news.info/technology/garbage-energy/

17BTSHOE06 GREEN CHEMISTRY 3 0 0 3

COURSE OBJECTIVES

1. To understand about the green chemistry
2. To study the atom efficient process and synthesis elaborately.
3. To gain knowledge on the green technology and renewable energy resources.
4. To get the information on catalysis
5. To develop an understanding of the basic concepts of renewable energy resources.
6. To acquaint the students with the basic's information on catalysis.

COURSE OUTCOMES:::

1. Students will know the chemistry and application of green technology for energy sources. They will understand the role of green catalyst in industries.
2. Examine the different atom efficient process and synthesis elaborately (S).
3. Apply the concepts combustion of green technology (S).
4. Identify and apply the concepts of renewable energy (S).
5. Apply the concepts of green catalysts in the synthesis (S).
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

UNIT I INTRODUCTION TO GREEN CHEMICAL PRINCIPLES (9)

Definition, tools, and twelve principles of green chemistry, solvent-less reactions and reactions in water, microwaves and fluorous solvents, green resolution of racemic mixtures, materials for a sustainable economy, chemistry of longer wear, agrochemicals: problems and green alternate solutions.

UNIT II ATOM EFFICIENT PROCESSES (9)

Atom efficient processes, evaluating chemical reagents according to their yield and atom efficiency, examples of efficient stoichiometric and catalytic processes, atom economy and homogeneous catalysis, halide-free synthesis and alternatives to Strecker synthesis.

UNIT III BIOTECHNOLOGY AND GREEN CHEMISTRY (9)

Bio technology and its applications in environmental protection-Bio informatics-Bio remediation, biological purification of contaminated air.Green chemistry for clean technology-Significance of green chemistry-Basic components of green chemistry, Industrial applications of green chemistry, green fuels-e-green propellants and bio catalysts.

UNIT IV RENEWABLE RESOURCES (9)

Use of renewable materials, evaluating feedstock and starting materials and their origins, toxicity, sustainability and the downstream implications of the choice of feedstock, commodity chemicals from glucose and biomass conversion.

UNIT V CATALYSIS IN GREEN CHEMISTRY (9)

Catalysis, energy requirements and usage, optimization of the reaction by minimizing the energy requirements, examples of efficient catalytic reactions including the use of heterogeneous catalysis, zeolites, oxidation using molecular oxygen.

Total: 45

TEXT BOOKS:

S. No.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Sanjay K. Sharma, AckmezMudhoo	Green Chemistry for Environmental Sustainability	CRC Press , London	2010
2.	Ahluwalia V. K. and M.Kidwai	New Trends in Green Chemistry 2nd edition	Anamaya publishers., New Delhi.	2007

REFERENCES:

S. No.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Dr. Sunita Ratan	A Textbook of Engineering Chemistry	S.K. Kataria and Sons., New Delhi.	2012
2.	Mukesh Doble. Ken Rollins, Anil Kumar	Green Chemistry and Engineering, 1st edition	Academic Press, Elesevier., New Delhi.	2007
3.	Desai K. R.	Green Chemistry	Himalaya Publishing House, Mumbai.	2005
4.	Matlack A. S.	Introduction to Green Chemistry	Marcel Dekker: New York	2001

WEBSITES:

1.http://www.organic-chemistry.org/topics/green-chemistry.shtm

2.http://www.essentialchemicalindustry.org/processes/green-chemistry.html

3. http://www.chm.bris.ac.uk/webprojects2004/vickery/green_solvents.htm

4. http://www.epa.gov/research/greenchemistry/

17BTSHOE07 APPLIED ELECTROCHEMISTRY 3 0 0 3

COURSE OBJECTIVES

1. To get the information on electrochemical material.
2. To study about the conducting polymers
3. To understand about the fuel
4. To gain knowledge on the batteries and power sources.

COURSE OUTCOMES:::

1. Students will understand about the fuel. They will get knowledge on the batteries and power sources.
2. Identify the usage of the **agriculture** chemicals (S).
3. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A).
4. Recognize writing as a constructive, meaningful process.
5. Practice using reading strategies for effective writing
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

UNIT I METAL FINISHING (9)

Fundamental principles, surface preparation-Electroplating of copper, nickel, chromium, zinc and precious metals (gold & silver)- Electroplating for electronic industry- Alloy plating, brass plating- Electro less plating of nickel- anodizing – Electroforming – Electro winning.

UNIT II CONDUCTING POLYMERS AND ELECTROCHEMICALS (9)

lectropolymerisation- anodic and cathodic polymerization-effect of reaction parameters on the course of the reaction- Electrochemical preparation of conducting polymers- poly acetylene- Electrolytic production of perchlorates and manganese dioxide- Electro organic chemicals- constant current electrolysis.

UNIT IIIBATTERIES AND POWER SOURCES-I (9)

Principles of energy conservation- electrochemical energy conservation- thermodynamic reversibility, Gibbs equation. EMF- battery terminology, energy and power density- Properties of anodes, cathodes, electrolytes and separators- Types of electrolytes.

UNIT IVBATTERIES AND POWER SOURCES-II (9)

Primary batteries- Dry Leclanche cells, alkaline primary batteries, Lithium batteries, Lithium ion batteries- construction, characteristics, problems associated with system- Secondary batteries- Lead acid, nickel cadmium- Fuel cells- Introduction, types of fuel cells, advantages.

UNIT V ELECTROCHEMICAL MATERIAL SCIENCE (9)

Solar cells- Preparation of CdS/Cu_2S solar cells by screen printing techniques and their characteristics - Amorphous silicon solar cells - Photo electrochemical cells(PEC) for conversion of light energy to electrical energy - PEC cells based on Cd/Se and Ga/As characteristics.

Total: 45

TEXT BOOKS:

S. No.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Cynthia G. Zoski	Hand Book of Electrochemistry	Academic Press, Elesevier., UK	2007
2.	D.Pletcher and F.C.Walsh	Industrial Electrochemistry	Chapman and Hall, London	1990

REFERENCES:

S. No.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	M. Barak	Electrochemical Power Sources	I.EEE series, Peter Peregrinius Ltd, Steverage, U.K.	1997
2.	Bruno Scrosati	Applications of Electroactive Polymers	Chapman & Hall, London	1993
3.	K.L. Chopra and I. Kaur	Thin Film Devices and their Application	Plenum Press, New York.	1983
4.	M.M.Baizer	Organic Electrochemistry	Dekker Inc. New York	1983

WEBSITES:

1. http://www.anoplate.com/finishes/
2. http://hyperphysics.phy-astr.gsu.edu/hbase/electric/battery.html
3. http://inventors.about.com/od/sstartinventions/a/solar_cell.htm

17BTSHOE08 INDUSTRIAL CHEMISTRY 3 0 0 3

COURSE OBJECTIVES

1. To understand about the fuel
2. To study about the abrasives and lubricants.
3. To gain knowledge on inorganic chemicals and explosive materials.
4. To get the information on agriculture chemicals.
5. To develop an understanding of the basic concepts**explosives**.
6. To acquaint the students with the basics of **agriculture chemicals**.

COURSE OUTCOMES:::

1. The student will acquire basic knowledge on cement. The student will understand the interaction of engineering materials and their utilization in industries.
2. Examine the uses of abrasives and refractories (S).
3. Identify the usage of the inorganic chemicals. (S)
4. Identify the concepts of explosives and smoke screens (S).
5. Identify the usage of the **agriculture** chemicals (S).
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A).

UNIT ICEMENT AND LIME (9)

Manufacture of Portland cement – settling of hardening of portland cement – regauging cement – effect of fineness on setting and hardening – freezing – high early strength cement – high alumina cement Lime – raw materials- manufacture – slaking – lime mortar – types of lime – high – calcium or fat lime – calcium lime or lean lime – magnesian lime – dolomitic lime – hydraulic lime.

UNIT II ABRASIVES AND REFRACTORIES (9)

Abrasives – hard abrasives – siliceous abrasives – soft abrasives – artificial abrasives – uses. Refractories – definition – classification – acid refractories – basic refractories – neutral refractories – properties – uses.

UNIT IIIINORGANIC CHEMICALS (9)

Common salt and soda ash – manufacture – different grades – products – alkalis – Na_2CO_3, caustic soda and chlor-alkali industry – manufacture principles of electrolytic process – chlorine – storage. Hydrochloric acid – manufacture – absorption – uses, sulphur and sulphuric acid – extraction of sulphur – manufacture of H_2SO_4 – chamber – contact processes – industrial uses.

UNIT IV EXPLOSIVES (9)

Explosives – uses – properties and tests – explosives for war – nitrocellulose – picric acid and T.N.T. – industrial explosives – nitroglycerin and dynamites – black powder – smoke screens – incendiaries – gas mask.

UNIT V AGRICULTURE CHEMICALS (9)

Fertilizers – organic and inorganic – ammoniated superphosphates, sodium nitrate, solid pellets – potassium salts – pesticides – fungicides – herbicides – their preparations and characteristics – environmental impacts.

Total: 45

TEXT BOOKS:

S. No.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Harikrishan	Industrial Chemistry	Goel Publishing House, Meerut.	2014
2.	B.K. Sharma	Industrial Chemistry	Goel Publishing House, Meerut.	2000

REFERENCES:

S. No.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	B.N.Chakrabarty	Industrial Chemistry	Oxford and IBH Publishing CO. New Delhi.	1998
2.	James A. Kent	Hand Book of Industrial Chemistry, 9^{th} edition	Van Nostrand Reinhold, New York.	1992
3.	R.N. Sherve	Chemical Process Industries	McGraw-Hill, Kugakuisha Ltd., Tokyo.	1984
4.	S.D. Shukla and G.N. Pandy	A Text book of Chemical Technology	Vikas Publishing House (P) Ltd, New Delhi.	1979

WEBSITES:

1.http://en.wikipedia.org/wiki/Cement

2. http://www.hon.ch/HONselect/Selection/D01.html

3. http://fas.org/man/dod-101/navy/docs/fun/part12.htm

4. http://toxics.usgs.gov/topics/agchemicals.html

17BTSHOE09 ENGLISH FOR TECHNOCRATS 1 4 0 3

COURSE OBJECTIVES:

1. Develop abilities to write technically and expressively.
2. Recognize writing as a constructive, meaningful process.
3. Practise using reading strategies for effective writing.Design effective technical documents for both print and digital media.
4. Identify the qualities of good technical writing.
5. Recognize writing as a constructive, meaningful process.
6. Practice using reading strategies for effective writing

COURSE OUTCOMES::

Students undergoing this course are able to

1. Construct simple sentences, correct common grammatical errors in written English.
2. Build confidence in English language by imbibing lexical and syntax rules.
3. Enrich their reading ability for effective writing.
4. Elevate them to minimize word, sentence, and paragraph length without sacrificing clarity or substance
5. Familiarize with basic technical writing concepts and terms, such as audience analysis, jargon, format, visuals, and presentation.
6. Demonstrate the basic components of definitions, descriptions, process explanations, and other common forms of technical writing.

UNIT – I BASICS OF WRITING

Introduction to Technical Writing – Importance of Writing – Characteristics of Writing– Audience Recognition/ Analysis – Appropriateness of language — Conciseness and Flow– Bias free and plain writing – Impersonal and Formal Language -Techniques of Technical Writing– Overcoming writer‟s block – Prioritizing for effective writing– Avoiding plagiarism.

UNIT – 2 PARAGRAPHS AND ESSAYS

Expressing Ideas – Paragraph construction – Cohesion and Coherence – Adequate development – Kinds of paragraphs – Writing drafts – Paragraph length and pattern – Types of Essays – Characteristics of Essays – Salient point of sentence constructions.

UNIT – 3 LETTERS, MEMOS AND EMAIL

Formal written correspondence – Types of messages – Business letters – Structure of letters – Language in letters – Tense in letters – Cover letters – Resumes – Curriculum vitae – Memos – Emails – Email Etiquette – Effectiveness and purpose.

UNIT – 4 THE ART OF CONDENSATION AND TECHNICAL PROPOSALS

Steps to Effective précis writing – Guidelines – Technical Proposals – Types of Proposals – Characteristics – Body of the Proposals – Style and appearance – Evaluation of proposals – Proof Reading – Book /Film Review – Travelogue – Dialogue Writing.

UNIT – 5 REPORTS AND RESEARCH ARTICLES

Discussion of newspaper articles -COURSE OBJECTIVES of Reports – Characteristics of Reports – Structure of Reports – Types of Reports – Writing an article – Writing research articles – Essential features of Dissertation – Organizing the structure of thesis and articles – Writing technical description.

TEXT BOOKS:

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	V.N. Arora & Lakshmi Chandra	Improve Your Writing: Revised First Edition	OUP	2014

REFERENCES:

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Crème, P. and M. Lea.	Writing at University: A guide for students.	OUP	2003
2	Graham King	Collins Improve Your Writing	Collins; First edition	2009
3	David Morley	The Cambridge Intro. To Creative Writing	Cambridge	2008

WEBSITES:

http://www.stevepavlina.com/blog/2006/08/10-ways-to-improve-your-technical-skills/http://www.nyu.edu/classes/keefer/brain/net2.htmlhttps://www.udemy.com/technical-writing-and-editing/http://techwhirl.com/what-is-technical-writing/

OPEN ELECTIVES OFFERED BY DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

17BECSOE01 INTERNET PROGRAMMING L T P C
3 0 0 3

COURSE OBJECTIVES

- To introduce the Java programming language and explore its current strengths and Weaknesses
- To study the way that object-oriented concepts are implemented in the Java programming language
- To write working Java code to demonstrate the use of applets for client side programming
- To study the way that exceptions are detected and handled in the Java programming language
- To write working Java code that demonstrates multiple threads of execution
- To understand about various Internet applications

COURSE OUTCOMES:

1. Know Java programming language and explore its current strengths and Weaknesses
2. Learn about object-oriented concepts
3. Learn Java code to demonstrate the use of applets for client side programming
4. To study the way that exceptions are detected and handled in the Java programming language
5. know Java code that demonstrates multiple threads of execution
6. To understand about various Internet applications

UNIT I INTRODUCTION 9

Introduction - Network of Networks, Intranet, Extranet and Internet.World Wide Web- Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. TCP/IP- Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. IP Sub netting and addressing- Classful and Classless Addressing, Sub netting

UNIT II HTML 9

Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Color name, Color value. Image Maps- map, area, attributes of image area- Extensible Markup Language (XML)- Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief.CGI Scripts- Introduction-Environment Variable, GET and POST Methods.

UNIT III PERL 9

Introduction, Variable, Condition, Loop, Array, implementing data structure, Hash, String, Regular Expression, File handling, I/O handling- JavaScript- Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation. Cookies- Definition of cookies, Create and Store a cookie with example. Java Applets-Container Class, Components, Applet Life Cycle, Update method, Applications.

UNIT IV CLIENT-SERVER PROGRAMMING 9

Client-Server programming in Java - Java Socket, Java RMI. Threats - Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks- Network security techniques- Password and Authentication- VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH). Firewall- Introduction, Packet filtering, Stateful, Application layer, Proxy.

UNIT V INTERNET TELEPHONY 9

Introduction, VoIP- Multimedia Applications- Multimedia over IP: RSVP, RTP, RTCP and RTSP- Streaming media, Codec and Plugins, IPTV- Search Engine and Web Crawler- Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.

Total: 45

TEXTBOOKS:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1.	Paul Deitel, Harvey Deitel and Abby Deitel	Internet and World Wide Web-How to Program 5thEdition	Dorling Kindersley pvt Ltd	2011
2.	N.P. Gopalan and J. Akilandeswari	Web Technology: A Developer's Perspective	PHI Learning	2013

REFERENCES:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1.	Rahul Banerjee	Internetworking Technologies, An Engineering Perspective	PHI Learning, Delhi	2011
2.	Robert W. Sebesta	Programming the World Wide Web	Pearson Education	2016

17BECSOE02 MULTIMEDIA AND ANIMATIONL T P C 3 0 0 3

COURSE OBJECTIVES:

study the graphics techniques and algorithms

1. To study the multimedia concepts and various I/O technologies. □□□
2. To enable the students to develop their creativity □□□
3. To impart the fundamental concepts of Computer Animation and Multimedia.
4. To understand Techniques of Animation
5. To Learn about different 3D Animation

COURSE OUTCOMES::

After the course the student will be able to:

1. Get Familiarised With Animation
2. Types Of 3D Animation
3. Know about motion caption
4. Work With The Timeline And Tween-Based Animation
5. Learn about 3D Animation
6. Master the techniques of computer animation and multimedia

UNIT I INTRODUCTION 9

What is mean by Animation – Why we need Animation – History of Animation– Uses of Animation – Types of Animation – Principles of Animation – Some Techniques of Animation – Animation on the WEB – 3D Animation – Special Effects -Creating Animation.

UNIT II CREATING ANIMATION IN FLASH 9

Introduction to Flash Animation – Introduction to Flash – Working with the Timeline and Frame-based Animation - Working with the Timeline and Tween-based Animation – Understanding Layers - Action script.

UNIT III 3D ANIMATION & ITS CONCEPTS 9

Types of 3D Animation – Skeleton & Kinetic 3D Animation – Texturing & Lighting of 3D Animation – 3D Camera Tracking – Applications & Software of 3D Animation.

UNIT IV MOTION CAPTION 9

Formats – Methods – Usages – Expression – Motion Capture Software's – Script Animation Usage – Different Language of Script Animation Among the Software**.**

UNIT V CONCEPT DEVELOPMENT 9

Story Developing – Audio & Video – Color Model – Device Independent Color Model – Gamma and Gamma Correction - Production Budgets- 3D Animated Movies**.**

Total: 45

TEXTBOOK:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1.	Malay K. Pakhira	Computer Graphics, Multimedia and Animation	PHI Learning PVT Ltd	2010

REFERENCES:

S.NO	Author(s) Name	Title of The Book	Publisher	Year of Publication
1.	Ranjan Parekh	Principles of Multimedia	TMH	2007
2.	Ashok Banerji, Ananda Mohan Ghosh	Multimedia Technologies	McGraw Hill Publication	2010
3.	Pankaj Dhaka	Encyclopedia of Multimedia and Animations	Anmol Publications	2011

17BECSOE03 PC HARDWARE AND TROUBLE SHOOTING L T P C

3 0 0 3

COURSE COURSE OBJECTIVES

1. Assemble/setup and upgrade personal computer systems
2. Perform installation, configuration, and upgrading of microcomputer hardware and software.
3. Install/connect associated peripherals.
4. Diagnose and troubleshoot microcomputer systems hardware and software, peripheral
5. equipment.
6. Know Multitasking and Multiprogramming
7. Familiarise Various Types of faults

COURSE COURSE OUTCOMES:

After the course student will be able to:

1. Familiarise Special Peripherals.
2. Know Computer Organization
3. Know about Memory Space
4. Familiarise Motherboard Logic
5. Know Programmable LSI's
6. Know about Data Recovery

UNIT I INTRODUCTION 9

Introduction - Computer Organization – Number Systems and Codes – Memory – ALU – CU – Instruction prefetch – Interrupts – I/O Techniques – Device Controllers – Error Detection Techniques – Microprocessor – Personal Computer Concepts – Advanced System Concepts – Microcomputer Concepts – OS – Multitasking and Multiprogramming – Virtual Memory – Cache Memory – Modern PC and User.

UNIT II PERIPHERAL DEVICES 9

Introduction – Keyboard – CRT Display Monitor – Printer – Magnetic Storage Devices – FDD – HDD – Special Types of Disk Drives – Mouse and Trackball – Modem – Fax-Modem – CD ROM Drive – Scanner – Digital Camera – DVD – Special Peripherals.

UNIT III PC HARDWARE OVERVIEW 9

Introduction – Hardware BIOS DOS Interaction – The PC family – PC hardware – Inside the System Box – Motherboard Logic – Memory Space – Peripheral Interfaces and Controllers – Keyboard Interface – CRT Display interface – FDC – HDC.

UNIT IV INSTALLATION AND PREVENTIVE MAINTENANCE 9

Introduction – system configuration – pre installation planning – Installation practice – routine checks – PC Assembling and integration – BIOS setup – Engineering versions and compatibility – preventive maintenance – DOS – Virus – Data Recovery.

UNIT V TROUBLESHOOTING 9

Introduction – computer faults – Nature of faults – Types of faults – Diagnostic programs and tools – Microprocessor and Firmware – Programmable LSI's – Bus Faults – Faults Elimination process – Systematic Troubleshooting – Symptoms observation and analysis – fault diagnosis – fault rectification – Troubleshooting levels – FDD, HDD, CD ROM Problems.

Total: 45

TEXTBOOK:

S.NO.	Author(s) Name	Title of The Book	Publisher	Year of Publication
1.	B. Govindarajalu	IBM PC Clones Hardware, Troubleshooting and Maintenance	TMH	2002

REFERENCES:

S.NO.	Author(s) Name	Title of The Book	Publisher	Year of Publication
1.	Peter Abel, NiyazNizamuddin	IMB PC Assembly Language and Programming	Pearson Education	2007
2.	Scott Mueller	Repairing PC'sPHI		1992

17BECSOE04 JAVA PROGRAMMING L T P C3 0 0 3

COURSE OBJECTIVES

Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.

1. Understand fundamentals of object-oriented programming in Java, including defining classes,
2. invoking methods, using class libraries, etc.
3. Be aware of the important topics and principles of software development.
4. Have the ability to write a computer program to solve specified problems.
5. Be able to use the Java SDK environment to create, debug and run simple Java programs
6. To understand Object oriented programming concepts

COURSE OUTCOMES::

After the course student will be able to:

1. Familiar with programming such as variables, conditional and iterative execution, methods, etc
2. Understand fundamentals of object-oriented programming in Java and work with 2D shapes
3. Be familiar with Arrays – Strings - Packages
4. Have the ability to write a computer program to solve specified problems.
5. Work on Java SDK environment to create, debug and run simple Java programs
6. To understand abstract classes

UNIT I INTRODUCTION TO JAVA 9

Object oriented programming concepts – objects – classes – methods and messages –abstraction and encapsulation – inheritance – abstract classes – polymorphism.- Objects and classes in Java – defining classes – methods - access specifiers – static members –constructors – finalize method

UNIT II PACKAGES 9

Arrays – Strings - Packages – Java-Doc comments –- Inheritance – class hierarchy –polymorphism – dynamic binding – final keyword – abstract classes

UNIT III I/O STREAMS 9

The Object class – Reflection – interfaces – object cloning – inner classes – proxies - I/O Streams - Graphics programming – Frame – Components – working with 2D shapes.

UNIT IV EXCEPTION HANDLING 9

Exceptions – Syntax of exception handling code – Multiple catch statements – Using finally statements – Throwing our own exceptions – Using exceptions for debugging

UNIT V THREADS 9

Introduction, Creating Threads, The Life Cycle of a Thread, Thread Methods, Using Threads, Synchronization of Threads, Summary

Total: 45

TEXTBOOK:

S.NO.	Author(s) Name	Title of The Book	Publisher	Year of Publication
1.	Cay S. Horstmann and Gary Cornell	Core Java: Volume I -Fundamentals	Sun Microsystems Press	2008

REFERENCES:

S.NO.	Author(s) Name	Title of The Book	Publisher	Year of Publication
1.	K. Arnold and J. Gosling	The JAVA programming language Third edition	Pearson Education	2009
2.	Timothy Budd	Understanding Object-oriented programming with Java Updated Edition	Pearson Education	2002
3.	C. Thomas Wu	An introduction to Object-oriented programming with Java Fourth Edition	Tata McGraw-Hill Publishing company Ltd	2008

WEBSITES:

http://elvis.rowan.edu/~kay/cpp/vc6_tutorial/

http://www.winprog.org/tutorial/msvc.html
http://www.tutorialized.com/tutorials/Visual-C/1

http://www.freeprogrammingresources.com/visualcpp.html

LIST OF OPEN ELECTIVES OFFERED BY
ELECTRICAL AND ELECTRONICS ENGINEERING DEPARTMENT

17BEEEOE01 ELECTRIC HYBRID VEHICLES L T P C3 0 0 3

COURSE OBJECTIVES

- To understand the basic concepts of electric hybrid vehicle.
- To gain the knowledge about electric propulsion unit.
- To understand and gain the knowledge about various energy storage devices.
- To know the concept of electric hybrid vehicle
- Understand the various energy storage schemes
- Know about the various fuel efficiency schemes

COURSE OUTCOMES::

- At the end of the course the student will be understand the concept of electric hybrid vehicle and its energy storage schemes.
- Battery based energy storage and its analysis,
- Familiarise Fuel Cell based energy storage and its analysis
- Super Capacitor based energy storage and its analysis,
- Understand Flywheel based energy storage and its analysis,
- Know Hybridization of different energy storage devices.

UNIT I INTRODUCTION 9

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

UNIT II HYBRID ELECTRIC DRIVE-TRAINS 9

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

UNIT III ELECTRIC PROPULSION UNIT 9

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motr drives, drive system efficiency.

UNIT IV ENERGY STORAGE 9

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

UNIT V ENERGY MANAGEMENT STRATEGIES 9

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Total: 45

TEXTBOOK:

S. NO.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	Iqbal Hussein	Electric and Hybrid Vehicles: Design Fundamentals	CRC Press – 2nd edition	2010

REFERENCES:

S. NO.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi	Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design	Standardsmedia – 2nd edition	2009
2	James Larminie, John Lowry	Electric Vehicle Technology Explained	Wiley – 2nd edition	2012

17BEEEOE02 ENERGY MANAGEMENT AND ENERGY AUDITING L T P C
3 0 0 3

COURSE OBJECTIVES

- To gain the knowledge about energy management.
- To understand the basic concepts in economic analysis in energy management.
- To understand the basic principles of energy audit.
- To gain the knowledge about the basic concept of types of Energy Audit
- To gain and Evaluate the different energy efficient motors
- Understand the concept of Energy conservation.
- To study about the behaviour changes of PF requirement in motor currents

COURSE OUTCOMES::

At the end of this course, students will demonstrate the ability to

- Understand the concept of Energy Management.
- Analyze the different methods for economic analysis
- Knowledge about the basic concept of Energy Audit and types.
- Evaluate the different energy efficient motors
- Understand the concept of Energy conservation.
- Investigate the different methods to improve power factor.

UNIT I ENERGY MANAGEMENT 9

Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting –Energy Auditor and Energy Manager – Eligibility, Qualification and functions - Questionnaire and check list for top management.

UNIT II ECONOMIC ASPECTS AND ANALYSIS 9

Economics analysis – Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis - Calculation of simple payback method, net present worth method.

UNIT III BASIC PRINCIPLES OF ENERGY AUDIT 9

Energy audit – definition, concept, type of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes – Energy audit of industries – energy saving potential, energy audit of process industry, thermal power station, building energy audit.

UNIT IV ENERGY EFFICIENT MOTORS 9

Electric Motors: Factors affecting efficiency - Energy efficient motors - constructional details, characteristics - voltage variation –over motoring – motor energy audit-

Energy conservation: Importance-energy saving measures in DG set-fans and blowers pumps- air conditioning system- energy efficient transformers.

UNIT V POWER FACTOR IMPROVEMENT, LIGHTING AND ENERGY INSTRUMENTS 9

Power factor - methods of improvement, location of capacitors, p.f with non linear loads, effect of harmonics on p.f,- p.f motor controllers –Energy efficient lighting system design and practice-lighting control– Measuring Instruments – wattmeter, data loggers, thermocouples, pyrometers, lux meters, tong testers, application of PLCs.

Total: 45

TEXTBOOK:

S. NO.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	Murphy W.R. and G.Mckay Butter worth	Energy Management	Heinemann Publications	2007

REFERENCES:

S. NO.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	John.C.Andreas	Energy Efficient Electric Motors	Marcel Dekker Inc Ltd – 3rd edition	2005
2	W.C.Turner Steve Doty	Energy Management Handbook	**Lulu Enterprises, Inc. - 8th Edition Volume II**	2013

17BEEEOE03 PROGRAMMABLE LOGIC CONTROLLER L T P C
3 0 0 3

COURSE OBJECTIVES

- To understand the basic principles of PLC systems.
- To gain the knowledge about data handling functions.
- To gain the knowledge of storage techniques in PLC
- To acquire the knowledge about how to handle the data and functions
- To study about flow charts of ladder and spray process system
- To understand the principles of PID.

COURSE OUTCOMES::

- At the end of the course the student will be able to understand the registers and functions in PLC and they are able to do the program.
- To acquire the knowledge of storage techniques in PLC
- Students know how to handle the data and functions
- Students known about advanced controller in PLC applications
- Students gather real time industrial application of PLC
- Students gathered and evaluate the flow charts of ladder and spray process system

UNIT I INTRODUCTION 9

PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment Programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

UNIT II PLC PROGRAMMING 9

PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT III REGISTERS AND PLC FUNCTIONS 9

PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

UNIT IV DATA HANDLING FUNCTIONS 9

Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

UNIT V PID PRINCIPLES 9

Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing , analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions

Total: 45

TEXTBOOK:

S. NO.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	JR Hackworth and F.D Hackworth – Jr	Programmable Logic Controllers – Programming Method and Applications	Pearson	2006

REFERENCES:

S. NO.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	John Webb and Ronald A Reiss	Programmable Logic Controllers – Principle and Applications	Fifth edition, PHI	2004
2	W.Bolton	Programmable Logic controller	Elsevier Newnes Publications, 5th Edition	2009

WEBSITE:

1. http://www.mikroe.com/old/books/plcbook/chapter1/chapter1.htm,- Introduction to programmable Logic controller.

17BEEEOE04 RENEWABLE ENERGY RESOURCES L T P C

3 0 0 3

COURSE OBJECTIVES

- To gain the knowledge about environmental aspects of energy utilization.
- To understand the basic principles of wind energy conversion, solar cells, photovoltaic conversion.
- To study about solar energy collectors and its storages
- To study about the inter connected system in wind power
- To understand the basic principles fuel cell, Geo thermal power plants.
- To gain the knowledge about hydro energy.

Course COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

- Analyze the Energy Scenario in india
- Understand the concept of Solar Energy
- Understand the concept of Wind Energy
- Understand the concept of Hydro Energy
- Analyze the different energy sources
- Students gathered the real time inter connected system modelling in wind power

UNIT I INTRODUCTION 9

Energy scenario - Different types of Renewable Energy Sources - Environmental aspects of energy utilization - Energy Conservation and Energy Efficiency - Needs and Advantages, Energy Conservation Act 2003.

UNIT II SOLAR ENERGY 9

Introduction to solar energy: solar radiation, availability, measurement and estimation– Solar thermal conversion devices and storage – solar cells and photovoltaic conversion – PV systems – MPPT. Applications of PV Systems – solar energy collectors and storage.

UNIT III WIND ENERGY 9

Introduction – Basic principles of wind energy conversion- components of wind energy conversion system - site selection consideration – basic–Types of wind machines. Schemes for electric generation – generator control, load control, energy storage – applications of wind energy – Inter connected systems.

UNIT IV HYDRO ENERGY 9

Hydropower, classification of hydro power, Turbine selection, Ocean energy resources, ocean energy routes.Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean wave energy conversion and tidal energy conversion.

UNIT V OTHER SOURCES 9

Bio energy and types –Fuel cell, Geo-thermal power plants; Magneto-hydro-dynamic (MHD) energy conversion.

Total: 45

TEXTBOOKS:

S. NO.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	Rai.G.D	Non-conventional sources of energy	Khanna publishers	2011

2	Khan.B.H	Non-Conventional Energy Resources	The McGraw Hills, Second edition	2009

REFERENCES:

S. NO.	Author(s) Name	Title of the Book	Publisher	Year of Publication
1	Rao.S. &Parulekar	Energy Technology	Khanna publishers, Eleventh Reprint	2013
2	Godfrey Boyl	Renewable Energy: Power sustainable future	Oxford University Press, Third edition	2012
3	John W Twidell and Anthony D Weir	Renewable Energy Resources	Taylor and Francis – 3rd edition	2015

WEBSITES:

1. www.energycentral.com
2. www.catelelectricpowerinfo.com

LIST OF OPEN ELECTIVES OFFERED BY ELECTRONICS AND COMMUNICATION ENGINEERING

17BEECOE01 REAL TIME EMBEDDED SYSTEMS L T P C 100
3 0 0 3

COURSE OBJECTIVES

- To introduce students to the embedded systems, its hardware and software.
- To introduce devices and buses used for embedded networking.
- To study about task management
- To learn about semaphore management and message passing
- To study about memory management
- To imparts knowledge on

Course COURSE OUTCOMES:

At the end of the course the students will be able to

- Understand overview of embedded systems architecture
- Acquire knowledge on embedded system, its hardware and software.
- Gain knowledge on overview of Operating system
- Discuss about task Management
- Gain knowledge about semaphore management and message passing.
- Gain knowledge about memory management.

UNIT-I INTRODUCTION TO EMBEDDED SYSTEM 9

Introduction- Embedded systems description, definition, design considerations &requirements-Overview of Embedded SystemArchitecture (CISC and RISC)-Categories of Embedded Systems-embedded processor selection &tradeoffs- Embedded design life cycle -Product specifications-hardware / software partitioning- iterations and implementation- hardware software integration – product testing techniques–ARM7.

UNIT-II OPERATING SYSTEM OVERVIEW 9

Introduction–AdvantageandDisadvantageofUsingRTOS–Multitasking–Tasks-RealTimeKernels – Scheduler- Non-Preemptive Kernels – Preemptive Kernels – Reentrancy- ReentrantFunctions– Round Robin Scheduling- Task Priorities- Static Priorities– Mutual Exclusion–Deadlock– Inter task Communication–Message Mailboxes–Message Queues- Interrupts- TaskManagement– Memory Management-Time Management–Clock Ticks.

UNIT-III TASK MANAGEMENT 9

Introduction-µ C/OS-II Features-Goals ofµ C/OS-II-Hardware and Software Architecture–Kernel Structures: Tasks–Task States–Task Scheduling–Idle Task–Statistics Task–Interrupts Under µC/OS-II –Clock Tick-µ C/OS- II Initialization. Task Management: Creating Tasks–Task Stacks–StackChecking–Task'sPriority–SuspendingTask–ResumingTask.TimeManagement: Delaying aTask–Resuming a Delayed Task–System Time. Event Control Blocks-Placing a Task in the ECB Wait List–Removing a Task from an ECB wait List.

UNIT-IV SEMAPHORE MANAGEMENT AND MESSAGE PASSING 9

Semaphore Management: Semaphore Management Overview– Signaling a Semaphore. MessageMailbox Management: Creating a Mailbox –Deleting Mailbox–Waiting for a Message box–Sending Message to a Mailbox- Status of Mailbox. Message Queue Management: Creating Message Queue– Deleting a Message Queue–Waiting for a Message Queue–Sending Message to a Queue– Flushing a Queue.

UNIT-V MEMORY MANAGEMENT 9

Memory Management: Memory Control Blocks–Creating Partition-Obtaining a Memory Block–Returning a Memory Block. Getting Started withµ C/OS-II–Installingµ C/OS-II–Portingµ C/OS-II:Development Tools–Directories and Files– Testing a Port -IAR Workbench withµ C/OS-II-µ C/OS- II Porting on a 8051CPU– Implementation of Multitasking- Implementation of Scheduling andRescheduling –Analyze the Multichannel ADC with help ofµ C/OS-II.

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	JeanJ. Labrosse	Micro C/OS–II The Real Time Kernel	CMPBOOKS	2009
2	David Seal	ARM Architecture Reference Manual.	Addison-Wesley	2008
3	Steve Furbe,	ARM System-on-Chip Architecture,	Addison-Wesley Professional, California	2000

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	K.V.K.K.Prasad	Embedded Real-Time Systems: Concepts, Design & Programming	Dream Tech Press	2005
2	Sriram V Iyer, Pankaj Gupta	Embedded Real Time Systems Programming	Tata McGraw Hill	2004

17BEECOE02 CONSUMER ELECTRONICS L T P C 100

3 0 0 3

COURSE OBJECTIVES

- To study about various speakers and microphone
- To learn the fundamental of television systems and standards
- To learn the process of audio recording and reproduction
- To study various telephone networks
- To discuss about the working of home appliances
- To familiarize with TV services like ISDN.

COURSE OUTCOMES:

At the end of the course the students will be able to

- Understand working of various type of loud speakers
- Acquire knowledge on various types of picture tubes
- Demonstrate the working of various optical recording systems
- Distinguish various standards for color TV system
- Acquire knowledge on various telecommunication networks
- Demonstrate the working of various home appliances

UNIT I LOUDSPEAKERS AND MICROPHONES 9

Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters – Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones.

UNITII TELEVISION STANDARDS AND SYSTEMS 9

Components of a TV system–interlacing–composite video signal.Colour TV– Luminance and Chrominance signal; Monochrome and Colour Picture Tubes- Color TV systems– NTSC, PAL, SECAM-Components of a Remote Control.

UNITIII OPTICAL RECORDING AND REPRODUCTION 9

Audio Disc– Processing of the Audio signal–readout from the Disc –Reconstruction of the audio signal–Video Disc–Video disc formats- recording systems–Playback Systems.

UNITIV TELECOMMUNICATION SYSTEMS 9

Telephone services-telephone networks–switching system principles–PAPX switching–Circuit, packet and message switching, LAN, MAN and WAN, Integrated Services Digital Network.Wireless Local Loop.VHF/UHF radio systems, Limited range Cordless Phones; cellular modems.

UNITV HOME APPLIANCES 9

Basic principle and block diagram of microwave oven; washing machine hardware and software; Components of air conditioning and refrigeration systems.

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	S.P. Bali	Consumer Electronics	PearsonEducation	2007

2	J.S.Chitode	Consumer Electronics	Technical Publications	2007

REFERENCE:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Philip Hoff,Philip Herbert Hoff.	Consumer Electronics for Engineers.	Cambridge University Press	1998

17BEECOE03 NEURAL NETWORKS AND ITS APPLICATIONS L T P C
1003 0 0 3

COURSE OBJECTIVES

- To introduce the basic concepts of neural networks and its applications in various domain
- To educate how to use Soft Computing to solve real-world problems
- To have a solid understanding of Basic Neural Network.
- To provide students with a sound and comprehensive understanding of artificial neural networks and machine learning.
- To gain exposure in the field of neural networks and relate the human neural system into the digital world
- To provide knowledge of computation and dynamical systems using neural networks

COURSE OUTCOMES:

At the end of the course the students will be able to

- Understand the basic concepts of neural networks and its applications in various domains
- Gain knowledge about learning process in Neural Networks
- Apply perception concept in design
- Design using ART phenomena
- Gain knowledge on SOM concepts
- Ability to develop the use of Soft Computing to solve

UNIT I INTRODUCTION TONEURAL NETWORKS 9

Introduction-biological neurons and their artificial models-learning, adaptation and neural network's learning rules-types of neural networks-single layer, multiple layer-feed forward, feedback networks

UNIT II LEARNING PROCESS 9

Error– correction learning– memory based learning- hebbian learning-competitive learning-Boltzmann learning-supervised and unsupervised learning-adaptation-statistical learning theory.

UNIT III PERCEPTION 9

Single layer Perception-Adaptive filtering-unconstrained Optimization-Least-mean square algorithm- Leaning Curve-Annealing Technique-perception convergence Theorem-Relationship between perception and Baye’s Classifier-Back propagation algorithm

UNIT IV ATTRACT OR NEURAL NETWORK AND ART 9

Hopfield model-BAM model -BAM Stability-Adaptive BAM -Lyapunov function-effect of gain- Hopfield Design-Application to TSP problem-ART-layer 1-layer 2-orienting subsystem- ART algorithm-ARTMAP.

UNIT V SELF ORGANIZATION 9

Self-organizing map-SOM Algorithm-properties of the feature map-LVQ-Hierarchical Vector Quantization. Applications of self-organizing maps: The Neural Phonetic Type Writer Learning Ballistic Arm Movements.

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	SimonHaykin	Neural Networks and Learning Machines	Pearson/Prentice Hall 3rd Edition	2009
2	SatishKumar	Neural Networks: A Classroom Approach	TMH	2008

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Rajasekaran.S, VijayalakshmiPai. G.A	Neural Networks, Fuzzy Logic and Genetic Algorithms,	PHI, New Delhi.	2003
2	LaureneFausett	Fundamentals of Neural Networks: Architectures, Algorithms, and Applications	Pearson/PrenticeHall	1994
3	Wasserman P.D	Neural Computing Theory & Practice	Van Nortrand Reinhold	1989
4	Freeman J.A., S kapura D.M	Neuralnetworks, algorithms, applications, and programming techniques.	AdditionWesley	2005

17BEECOE04 FUZZY LOGIC AND ITS APPLICATIONS L T P C 100
3 0 0 3

COURSE OBJECTIVES

- To introduce the basic concepts of Fuzzy logic and its applications in various domain
- To educate how to use Fuzzy computation to solve real-world problems
- To have a solid understanding of Basic fuzzy models.
- Provide an understanding of the basic mathematical elements of the theory of fuzzy sets.
- To learn about applications on Fuzzy based systems
- To familiarize with fuzzy fiction and de fuzzy fiction procedures

COURSE OUTCOMES:

At the end of the course the students will be able to

- Understand the basic concepts of Fuzzy logic and its applications in various domain
- Gain knowledge on theory of Reasoning
- Develop fuzzy controllers
- Understand concepts of adaptive fuzzy control
- Ability to develop how to use Fuzzy computation to solve real- world problems
- Design fuzzy based model for any application

UNITI **9**

Basics of Fuzzy Logic: Fuzzy sets, Properties of fuzzy sets, operation in fuzzy sets, fuzzy relations, the extension principle

UNIT II **9**

Theory of Approximate Reasoning: Linguistic variables, Fuzzy proportions, Fuzzy if-then statements, inference rules, compositional rule of inference-fuzzy models

UNIT III **9**

Fuzzy Knowledge Based Controllers (Fkbc): Basic concept structure of FKBC, choice of membership functions, scaling factors, rules, fuzzy fiction and de fuzzy fiction procedures–Design of Fuzzy
Logic Controller

UNIT IV **9**

Adaptive Fuzzy Control: Process performance monitoring, adaption mechanisms, membership functions, tuning using gradient descent and performance criteria. Set organizing controller model based controller.

UNIT V **9**

Fuzzy based systems: Simple applications of FKBC-washing machines-traffic regulations-lift control-fuzzy in medical Applications-Introduction to ANFIS.

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	D .Diankar ,H. Hellendoom and M .Rein frank	An Introduction to Fuzzy Control	Narosa Publishers India	1996
2	G.J. KlirandT.A. Folger	Fuzzy Sets Uncertainty and Information	PHI IEEE	1995

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Timothy J. Ross	Fuzzy Logic with Engineering Applications	McGraw Hill	1997
2	George. J Klir and Bo Yuan	Fuzzy Sets and Fuzzy Logic	Prentice Hall, USA	1995

LIST OF OPEN ELECTIVES OFFERED BY
MECHANICAL ENGINEERING DEPARTMENT

17BEMEOE01 COMPUTER AIDED DESIGN L T P 3 0 0 3

COURSE OBJECTIVES

- To apply basic concepts to develop construction (drawing) techniques.
- To ability to manipulate drawings through editing and plotting techniques.
- To understand geometric construction and Produce template drawings.
- To understand and demonstrate dimensioning concepts and techniques.
- To understand Section and Auxiliary Views.
- To become familiar with Solid Modelling concepts and techniques.

COURSE OUTCOMES::

1. Apply basic concepts to develop construction (drawing) techniques.
2. Ability to manipulate drawings through editing and plotting techniques.
3. Understand geometric construction and Produce template drawings.
4. Understand and demonstrate dimensioning concepts and techniques
5. Understand Section and Auxiliary Views
6. Become familiar with Solid Modelling concepts and techniques.

UNIT I OVERVIEW OF CAD SYSTEMS 9

Conventional and computer aided design processes-advantages and disadvantages. Subsystems of CAD-CAD hardware and software, analytical and graphics packages, CAD workstations. Networking of CAD systems.

UNIT III NTERACTIVE COMPUTER GRAPHICS AND GRAPHICSTRANSFORMATIONS 9

Generative, cognitive and image processing graphics. Static and dynamic data graphics. Transport of graphics data. Graphic standards. Generation of graphic primitives - display transformation in Two- and Three – Dimensional graphics concepts, Graphical input technique, Geometric transpformations, Visual Realism, Computer animation, customizing graphics software.

UNIT III GEOMETRIC MODELING 9

Wireframe, surface, NURBS and solid modeling-applications and advantages. Creating primitive solids, sweeping solids, boolean operations. Extracting entities from a solid. Filleting of edges of solids. Boundary representation (B-rep) Constructive Solid Geometry(CSG) and Analytical Solid Modeling(ASM)

UNIT IV PARAMETRIC DESIGN AND OBJECT REPRESENTATION 9

Types of co-ordinate systems. Parametric design - definition and advantages. Parametric representation of analytic and synthetic curves. Parametric representation of surfaces and solids - manipulations.

UNIT V PRODUCT DESIGN AND DEVELOPMENT **9**

Automated 2D drafting - basics, mechanical assembly - bill of materials generation. Mass property calculations.

Total: 45

TEXTBOOKS:

S. NO.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Vera B Anand	Computer Graphics and Geometric Modeling for Engineers	John Wiley & Sons, New York	2000
2	Radhakrishnan P and			
Subramanyan S	CAD/CAM/CIM	New Age International Pvt. Ltd	2004	

REFERENCES:

S. NO.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Radhakrishnan P and Kothandaraman C P	Computer Graphics and Design	DhanpatRai& Sons, New Delhi	2002
2	Ibrahim Zeid	CAD/CAM Theory and Practice	McGraw Hill Inc., New York	2003
3	Barry Hawhes	The CAD/CAM Process	Pitman Publishing, London	1998
4	William M Newman and Robert Sproul	Principles of Interactive Computer Graphics	McGraw Hill Inc., New York	1994
5	Sadhu Singh	Computer-Aided Design and Manufacturing	Khanna Publishers, New Delhi	1998
6	Rao S S	Optimisaiton Techniques	Wiley Eastern, New Delhi	2003

17BEMEOE02 INDUSTRIAL SAFETY AND ENVIRONMENT **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To recognize and evaluate occupational safety and health hazards in the workplace.
- To determine appropriate hazard controls following the hierarchy of controls.
- To analyse the effects of workplace exposures, injuries and illnesses, fatalities.
- To prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
- To teach student the concept of Industrial Safety & provide useful practical knowledge for workplace safety.
- To prevent or mitigate harm or damage to people, property, or the environment.

COURSE OUTCOMES::

- Recognize and evaluate occupational safety and health hazards in the workplace.
- Determine appropriate hazard controls following the hierarchy of controls.
- Analyse the effects of workplace exposures, injuries and illnesses, fatalities.
- Prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
- Understand the concept of Industrial Safety & provide useful practical knowledge for workplace safety.
- Prevent or mitigate harm or damage to people, property, or the environment

UNIT I INTRODUCTION TO LOGISTICS **9**

Logistics - concepts, definitions and approaches, factors influencing logistics - Supply chain: basic tasks, definitions and approaches, influencing supply chain - a new corporate model.

UNIT II PHASES OF SUPPLY CHAIN **9**

The new paradigm shift - The modular company - The network relations - Supply processes - Procurement processes - Distribution management.

UNIT III EVOLUTION OF SUPPLY CHAIN MODELS **9**

Strategy and structure - Factors of supply chain - Manufacturing strategy stages - Supply chain progress - Model for competing through supply chain management - PLC grid, supply chain redesign - Linking supply chain with customer.

UNIT IV SUPPLY CHAIN ACTIVITIES **9**

Structuring the SC, SC and new products, functional roles in SC - SC design frame- work - Collaborative product commerce (CPC).

UNIT V SCM ORGANISATION AND INFORMATION SYSTEM **9**

The management task - Logistics organization - The logistics information systems - Topology of SC application - Product Data Management - Warehouse management system MRP- I, MRP - II, ERP,. - Case study, ERP Software's

Total: 45

TEXTBOOKS:

S. NO.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Shari.P.B and Lassen.T.S	Managing the global supply chain	Viva books, New Delhi	2000
2	Ayers.J.B	Hand book of supply chain management	The St. Lencie press	2000

REFERENCES:

S. NO.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Nicolas.J.N	Competitive manufacturing management - continuous improvement, Lean production, customer focused quality	McGrawHill, New York	1998
2	Steudel.H.J and Desruelle.P	Manufacturing in the nineteen - How to become a mean, lean and world class competitor	Van No strand Reinhold, New York	1992

17BEMEOE03 TRANSPORT PHENOME L T P C
3 0 0 3

COURSE OBJECTIVES

- To generalized equations for mass, momentum and heat.
- To understand the concepts of Reynolds and Gauss theorems.
- To learn combined diffusive and convective transport.
- To apply Film- and penetration models for mass and heat transfer.
- To apply Stefan-Maxwells equations for multi-component diffusion.
- To Solve the given set of equations either analytically or numerically.

COURSE OUTCOMES::

- Generalized equations for mass, momentum and heat.
- Understand the concepts of Reynolds and Gauss theorems.
- Learn combined diffusive and convective transport.
- Apply Film- and penetration models for mass and heat transfer.
- Apply Stefan-Maxwells equations for multi-component diffusion.
- Solve the given set of equations either analytically or numerically.

UNIT IINTRODUCTION AND BASIC CONCEPTS 9

General overview of transport phenomena including various applications, Transport of momentum, heat and mass , Transport mechanism, Level of transport, Driving forces, Molecular transport (diffusion), convective transport (microscopic)

UNIT II PROPERTIES, UNITS AND OTHER PHYSICAL PARAMETERS 9

Unit systems, temperature, mole, concentration, pressure, Gas laws, laws of conservation, energy and heat units

UNIT III MOMENTUM TRANSPORT 9

Basic concepts in fluid mechanics, Force, unit and dimensions, pressure in fluid, head of fluid, Molecular transport for momentum, heat and mass transfer, Viscosity of fluids, Newton's law, Momentum transfer, Newtonian and non- Newtonian fluids, Fluid flow and Reynolds number, Overall mass balance, Control volume and Continuity equation, Overall energy balance, Bernoulli's equation, Overall momentum balance, Drag coefficient, Stokes law, Flow in packed beds, Flow in fluidized bed

UNIT IV ENERGY TRANSPORT 9

Basic concepts in heat transfer, Heat transfer mechanisms, Fourier's law of heat conduction, thermal conductivity, convective heat transfer coefficient, Conduction heat transfer - through flat slab/wall and through hollow cylinder, Conduction through solids in series, Forced convection heat transfer inside pipes, Heat transfer outside various geometrics in forced convection, General discussion on natural convection heat transfer, Heat exchangers, General discussion on radiation heat transfer

UNIT V MASS TRANSPORT 9

Basic concepts in mass transport, Some application examples, Modes of mass transfer, Molecular diffusion- Fick's law, Analogy between mass, heat and momentum transfer, Dispersion, Hydraulic or Darcy's flow in porous media, Chemical kinetics and activation energy, Film theory, Convective

mass transfer, Liquid-solid mass transfer, Liquid-liquid mass transport, Gas-liquid mass transfer, Aeration and oxygen transport, Air stripping
Total: 45

REFERENCE:

S. NO	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Geankoplis, C. J	Transport Processes and Separation Processes Principles	Prentice Hall	2003

WEB REFERENCE:

- https://laulima.hawaii.edu/portal

17BEMEOE04 INTRODUCTION TO BIOMECHANICS L T P C

3 0 0 3

COURSE OBJECTIVES

- To describe the principles of the study of human movement.
- To describe the range of factors that influence the initiation, production and control of human movement.
- To identify the body's lever systems and their relationship to basic joint movement and classification.
- To distinguish between biomechanical principles of kinetics and kinematics when applied to the analysis of human movement.
- To explain joint and muscle function and the forces acting upon the human body during various sporting activities.
- To relate the different body systems necessary for human movement to occur.

COURSE OUTCOMES::

- Describe the principles of the study of human movement.
- Describe the range of factors that influence the initiation, production and control of human movement.
- Identify the body's lever systems and their relationship to basic joint movement and classification.
- Distinguish between biomechanical principles of kinetics and kinematics when applied to the analysis of human movement.
- Explain joint and muscle function and the forces acting upon the human body during various sporting activities.
- Relate the different body systems necessary for human movement to occur.

UNIT I INTRODUCTION 9

Biomechanics - Improving Performance – Applications - Preventing And Treating Injury - Qualitative And Quantitative Analysis - Scholarly Societies - Computer Searches – Biomechanical Knowledge versus Information - Kinds of Sources - Evaluating Sources

UNIT II KEY MECHANICAL CONCEPTS 9

Mechanics - Basic Units - Nine Fundamentals of Biomechanics - Principles and Laws - Nine Principles for Application ofBiomechanics

UNIT III HUMAN ANATOMY AND SOME BASIC TERMINOLOGY 9

Gross (Whole-Body) Modeling - Position and Direction Terminology - Terminology for Common Movements - Skeletal Anatomy - Major Joints - Major Muscle Groups - Anthropometric Data

UNIT IV ANATOMICAL DESCRIPTION 9

Key Anatomical Concepts - Directional Terms - Joint Motions - Muscle Actions - Active and Passive Tension of Muscle - Limitations of Functional Anatomical Analysis - Mechanical Method of Muscle Action Analysis - The Need for Biomechanics to Understand Muscle Actions - Sports Medicine and Rehabilitation Applications

UNIT V MECHANICS OF THE MUSCULOSKELETAL SYSTEM **9**

Tissue Loads - Response of Tissues To Forces - Biomechanics of The Passive Muscle–Tendon Unit - Biomechanics of Bone - Biomechanics of Ligaments - Three Mechanical Characteristics of Muscle - Stretch-Shortening Cycle (SSC) - Force–Time Principle - Neuromuscular Control

Total: 45

REFERENCES:

S. NO	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Duane Knudson	Fundamentals of Biomechanics	Springer Science+ Business Media, LLC	2007
2	C. Ross Ethier Craig A. Simmons	Introductory Biomechanics	Cambridge University Press	2007

LIST OF OPEN ELECTIVES OFFERED BY AUTOMOBILE ENGINEERING DEPARTMENT

17BEAEOE01 AUTOMOBILE ENGINEERING L T P C 3 0 0 3

COURSE OBJECTIVES

To impart knowledge on the constructional details and principle of operation of various automobile components.
To learn the function and working of various components in transmission and drive lines.
To study the concept and working of steering and suspension systems in an automobile.
To give knowledge on the wheels, tyres and brakes of automobiles.
To provide information on the current and future trends in automobiles.
Identify and explain the types of steering system..

COURSE COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

Demonstrate the operating principles and constructional details of various automobile components.
Explain the function and working of components in transmission and drive lines.
Identify and explain the types of steering system.
Identify and explain the types of suspension system.
Classify and describe the types of wheels, tyres and brakes of automobiles.
Discuss the current and future trends in the automobiles

UNIT I ENGINE AND FUEL FEED SYSTEMS 9

Classification of Engine, construction and working of four stroke petrol and diesel engine, firing order and its significance. Carburetor working principle, requirements of an automotive carburetor, Petrol injection Systems (MPFI, TBI), Diesel fuel injection systems (CRDI)

UNIT II TRANSMISSION SYSTEMS 9

Requirements of transmission system.Flywheel. Different types of clutches, principle, Construction, torque capacity and design aspects. COURSE OBJECTIVES of the gearbox - Determination of gear ratios for vehicles.Performance characteristics at different speeds. Different types of gearboxes - operation. Function of Propeller Shaft Construction details of multi drive axle vehicles. Different types of final drive. Differential principles. Constructional details of differential unit. Non-slip differential. Differential lock

UNIT III SUSPENSION SYSTEM 9

Need of suspension system - Types of suspension - Suspension springs - Constructional details and characteristics of leaf, coil and torsion bar springs - Independent suspension - Rubber suspension – Pneumatic suspension – Hydro Elastic suspension - Shock absorbers. Vibration and driving comfort.

UNIT IV BRAKES

9

Necessity of brake, stopping distance and time, brake efficiency, weight transfer, shoe brake and disc brake theory, Brake actuating systems - Mechanical, Hydraulic and Pneumatic. Parking and engine exhaust brakes. Power and power assisted brakes. Antilock Braking System (ABS).

UNITV ELECTRICAL SYSTEM **9**

Principle and construction of lead acid battery. Lighting system: details of head light and side light, LED lighting system, head light dazzling and preventive methods – Horn, wiper system and trafficator. Starting System and charging system.
Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Young U.P and Griffiths L	Automotive Electrical Equipment	ELBS & New Press	1999
2.	Ganesan.V	Internal Combustion Engines	Tata McGraw-Hill Publishing Co., New Delhi	2003
3.	Dr.Kirpal Singh	Automobile Engineering	Standard Publishes	2011

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Heldt .P.M	The Automotive Chassis	Literary Licensing,LLC	2012
2.	Crouse.W.H	Automobile Electrical Equipment", 3rd Edition	McGraw-Hill Book Co., Inc., New York.	1986
3.	N.Newton, W. Steeds and T.K.Garrett	The Motor vehicle, 13th edition	SAEInc	2001

17BEAEOE02 BASICS OF TWO AND THREE WHEELERS L T P C

3 0 0 3

COURSE OBJECTIVES

- The COURSE OBJECTIVES of this course is to make the students to know and understand the constructional details, operating characteristics and design aspects of Two and Three wheelers.
- Construct the frames of two and three wheelers of different layouts.
- Demonstrate the constructional details and principle of operation of various engine components.
- Identify and explain the types of transmission systems.
- Identify and explain the types of steering and suspension systems.
- Classify and describe the types of wheels, tyres and brakes for two and three wheelers.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

1. Construct the frames of two and three wheelers of different layouts.
2. Demonstrate the constructional details and principle of operation of various engine components.
3. Identify and explain the types of transmission systems.
4. Identify and explain the types of steering and suspension systems.
5. Classify and describe the types of wheels, tyres and brakes for two and three wheelers.
6. Explain the servicing of two and three wheelers.

UNIT I INTRODUCTION 9

Classifications- design considerations –weight and dimension limitations – requirements stability problems, gyroscopic effect- pendulum effect of two and three wheelers.

UNIT II POWER UNITS, IGNITION SYSTEMS AND OTHER ELECTRICAL SYSTEMS 9

2 stoke and 4 stoke SI engines and CI engines design criteria– design of cylinders, cylinder head, cooling fins, crank case, connecting rod and crank shaft. Carburetor types and design. Battery coil ignition, magneto ignition and electronic ignition. Lighting and other electrical system.

UNIT III CLUTCHES AND TRANSMISSION 9

Types of clutches for 2 and 3 wheelers.Design of clutch system.Gears for two and three wheelers.Design of gear box and gear change mechanism. Belt, chain and shaft drive. Freewheeling devices, starting systems.

UNIT IV FRAMES, SUSPENSION, WHEELS AND TYRES 9

Types of frames used for two wheelers and three wheelers. Wheel frames- construction design of frames for fatigue strength torsional stiffness and lateral stability. Front and rear forks. Springs for suspension, Dampers, constructional details of wheel and tyres.

UNIT V THREE WHEELERS **9**

Auto rickshaws, different types, Pick-Ups and delivery type vehicle, frames and transmission for 3 wheelers wheel types, wheel attachment tyre types. Brakes and their operating mechanism.

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Irving P.E.	Motor Cycle Engineering.	Temple Press Book, London.	1992
2.	Srinivasan.S.	Motor cycle, Scooter, Mobeds.	New century book house.	1988.

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	M.M.Griffin.	Motor cycles from inside and outside.	Prentice Hall Inc, New Jersey.	1978
2.	Bruce A. Johns, David D.Edmundson and Robert Scharff	Motorcycles: Fundamentals, Service, Repair	Goodheart-Willcox	1999

17BEAEOE03 AUTOMOBILE MAINTENANCE L T P C

3 0 0 3

COURSE OBJECTIVES

- The COURSE OBJECTIVES of this course is to make the students to know and understand the maintenance and fault diagnosis of basic systems in Automobile.
- Describe and differentiate the types of maintenance.
- List the procedure for dismantling, servicing and assembling of engine components.
- Demonstrate the servicing of transmission and driveline components.
- Discuss the procedure for steering and suspension
- Discuss the procedure for wheel and brake maintenance.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

1. Describe and differentiate the types of maintenance.
2. List the procedure for dismantling, servicing and assembling of engine components.
3. Demonstrate the servicing of transmission and driveline components.
4. Discuss the procedure for steering and suspension
5. Discuss the procedure for wheel and brake maintenance.
6. Explain the fault diagnosis in the electrical and air conditioner systems

UNIT I MAINTENANCE OF RECORDS AND SCHEDULES 9

Importance of maintenance, preventive (scheduled) and breakdown (unscheduled) maintenance, requirements of maintenance, preparation of check lists, Inspection schedule, maintenance of records, log sheets and other forms, safety precautions in maintenance.

UNIT II ENGINE MAINTENANCE 9

Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up.

UNIT III CHASSIS MAINTENANCE 9

Mechanical and automobile clutch and gear box, servicing and maintenance, maintenance servicing of propeller shaft and differential system, Maintenance servicing of suspension systems. Brake systems, types and servicing techniques, Steering systems, overhauling and maintenance. Wheel alignment, computerized alignment and wheel balancing.

UNIT IV ELECTRICAL SYSTEM MAINTENANCE 9

Testing methods for checking electrical components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems, Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instruments.

UNIT V MAINTENANCE OF FUEL SYSTEM, COOLING SYSTEMS, LUBRICATION SYSTEM AND VEHICLE BODY 9

Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply, Cooling systems, water pump, radiator, thermostat, anticorrosion and antifreeze additives, Lubrication maintenance, lubricating oil changing, greasing of parts,

Vehicle body maintenance, minor and major repairs. Door locks and window glass actuating system maintenance.
Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	John Doke	Fleet Management	McGraw Hill Co	1984
2.	James D Halderman	Advanced Engine Performance Diagnosis	Prentice Hall Publications	2011

17BEAEOE04 INTRODUCTION TO MODERN VEHICLE TECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on trends in the vehicle power plants.
- To learn the various advanced driver assistance systems.
- To study the working of advanced suspension and braking systems in an automobile.
- To give information about motor vehicle emission and noise pollution control.
- To provide knowledge of the vehicle telematics.
- To give information about the noise control techniques.

COURSE COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

1. Distinguish and describe the various modern vehicle power plant systems.
2. List and explain the various driver assistant mechanisms.
3. Identify and describe the working of advanced suspension and braking systems.
4. Apply the knowledge of motor vehicle emission and noise pollution control.
5. Describe the noise control techniques
6. Describe the vehicle telematics and its applications

UNIT I TRENDS IN POWER PLANTS **9**

Hybrid vehicles - Stratified charged / learn burn engines - Hydrogen engines - battery vehicles – Electric propulsion with cables - Magnetic track vehicles**.**

UNIT II DRIVER ASSISTANCE SYSTEMS **9**

Collision Avoidance Systems, Adaptive cruise control, adaptive noise control, anti-spin regulation, traction control systems, cylinder cut- off technology, ABS, Driver Drowsiness Detection system

UNIT III SUSPENSION BRAKES AND SAFETY 9

Air suspension - Closed loop suspension - antiskid braking system, Retarders, Regenerative braking safety cage - air bags - crash resistance - passenger comfort.

UNIT IV NOISE & POLLUTION 9

Reduction of noise - Internal & external pollution control through alternate fuels/power plants – Catalytic converters and filters for particulate emission.

UNIT V TELEMATICS 9

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition

Total: 45

TEXT BOOKS

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	LjuboVlacic, Michael Saren and Fumio Harashima	Intelligent Vehicle Technologies	Butterworth-Heinemann publications, Oxford	2001
2.	Ronald K.Jurgen	Navigation and Intelligent Transportation Systems –Progress in Technology	Automotive Electronics Series,SAE, USA.	1998

REFERENCES

S.NO.	**Author(s) Name**	**Title of the book**	Publisher	Year of publication
1.	William B Riddens	"Understanding Automotive Electronics", 5th Edition	Butterworth Heinemann Woburn.	1998
2.	Bechhold,	"Understanding Automotive Electronics"	SAE	1998
3.	Robert Bosch,	"Automotive HandBook", 5th Edition	SAE	**2000**

LIST OF OPEN ELECTIVES OFFERED BY CIVIL ENGINEERING DEPARTMENT

17BECEOE0 HOUSING, PLAN AND MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- Teach them introduction to housing
- Make them aware of Formulation of Housing Projects
- Impart knowledge about construction techniques and cost-effective materials
- Learn about Formulation of Housing Projects
- Understand Site analysis
- Learn about Layout design

COURSE COURSE OUTCOMES::

At the end of the this course the students should have learnt

- the basic terms of housing programmes,
- planning and designing of housing projects,
- Know construction techniques and
- Understand cost effective materials and
- familiarise housing finance
- Know Project appraisal techniques.

UNIT I INTRODUCTION TO HOUSING 9

Definition of Basic Terms – House, Home, Household, Apartments, Multi storeyed Buildings, Special Buildings, COURSE OBJECTIVES and Strategies of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Bye-laws at Urban and Rural Local Bodies – levels - Development Control Regulations, Institutions for Housing at National, State and Local levels

UNIT II HOUSING PROGRAMMES 9

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighbourhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organisations**.**

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS 9

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems)

UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS 9

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL 9

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing o f Housing Units, Rents, Recovery Pattern (Problems).

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Meera Mehta and Dinesh Mehta	Metropolitan Housing Markets	Sage Publications Pvt. Ltd., New Delhi	2002
2.	Francis Cherunilam and Odeyar D Heggade	Housing in India	Himalaya Publishing House, Bombay	2001

REFERENCES:

S.NO.	Title of the book	Year of publication
1.	Development Control Rules for Chennai Metropolitan Area,CMAM Chennai	2002
2.	UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS (Habitat), Nairobi	2000

17BECEOE02 BUILDING SERVICES L T P C
3 0 0 3

COURSE OBJECTIVES

- Defining and identifying of eng. services systems in buildings.
- The role of eng. services systems in providing comfort and facilitating life of users of the building.
- The basic principles of asset management in a building & facilities maintenance environment
- Importance of Fire safety and its installation techniques
- To Know the principle of Refrigeration and application
- To Understand Electrical system and its selection criteria

COURSE OUTCOMES::

The students will be able to

- Machineries involved in building construction
- Understand Electrical system and its selection criteria
- Use the Principles of illumination & design
- Know the principle of Refrigeration and application
- Importance of Fire safety and its installation techniques
- Know the principle behind the installation of building services and to ensure safety in buildings

UNIT I MACHINERIES 9

Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity

UNIT II ELECTRICAL SYSTEMS IN BUILDINGS 9

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations

UNIT III PRINCIPLES OF ILLUMINATION & DESIGN 9

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilisation factor – Depreciation factor – MSCP – MHCP – Lans of illumination – Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.

UNIT IV REFRIGERATION PRINCIPLES & APPLICATIONS 9

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Subcooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners –

Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems

UNIT V FIRE SAFETY INSTALLATION 9

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	E.R.Ambrose	Heat Pumps and Electric Heating	John and Wiley and Sons, Inc., NewYork	2002
2.	Handbook for Building Engineers in Metric systems	NBC, New Delhi	**2005**	

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Philips Lighting in Architectural Design	McGraw-Hill, New York	2000	
2.	A.F.C. Sherratt	Air-conditioning and Energy Conservation	The Architectural Press London	2005
3.	National Building Code			

17BECEOE03 MANAGEMENT OF IRRIGATION SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVES

- To enable the students for a successful career as water management professionals.
- To create a potential among students in the area of irrigation management with specific enrichment to synthesis of data and their analysis.
- To expose the students the need for an interdisciplinary approach in irrigation water management
- To providing a platform to work in an interdisciplinary team.
- To provide students an ability to understand the applications of mathematical and scientific concepts to analyse intricate technical, social and environmental problems in irrigation water management and finding solutions for them.
- To promote student awareness for a life-long learning process and inculcate professional ethics and codes of professional practice in water management.

COURSE COURSE OUTCOMES::

At the end of this the students will be in a capacity to

1. Understand the concepts of soil-water-plant relationship as well as to expose them to the principles and practices of crop production.
2. Exposure to ground water, hydraulics of ground water related to drainage, drainage concepts, planning, design and management of drainage related irrigation system management
3. Understand the various principles of irrigation management and to analyse the different types of irrigation systems and their performances based on service oriented approach.
4. Gain insight on local and global perceptions and approaches to participatory water resource management
5. Learn from successes and failures in the context of both rural and urban communities of water management.
6. Exposure on the use of economic concepts in irrigation development and to impart knowledge on economic planning so as to enable viable allocation of resources in the irrigation sector**.**

UNIT I IRRIGATION SYSTEM REQUIREMENTS 9

Irrigation systems – Supply and demand of water – Cropping pattern – Crop rotation – Crop diversification – Estimation of total and peak crop water requirements – Effective and dependable rainfall – Irrigation efficiencies.

UNIT II IRRIGATION SCHEDULING 9

Time of irrigation – Critical stages of water need of crops – Criteria for scheduling irrigation – Frequency and interval of irrigation**.**

UNIT III MANAGEMENT 9

Structural and non-structural strategies in water use and management – Conjunctive use of surface and ground waters – Quality of irrigation water**.**

UNIT IV OPERATION 9

Operational plans – Main canals, laterals and field channels – Water control and regulating structures – Performance indicators – Case study**.**

UNIT V INVOLVEMENT OF STAKE HOLDERS 9

Farmer's participation in System operation – Water user's associations – Farmer councils – Changing paradigms on irrigation management – Participatory irrigation management

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Dilip Kumar Majumdar	Irrigation Water Management – Principles and Practice	Prentice Hall of India Pvt. Ltd., New Delhi	2000
2.	Hand book on Irrigation Water Requirement R.T. Gandhi, et. al., Water Management Division, Department of Agriculture, Ministry of Agriculture, New Delhi			

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Maloney, C. and Raju, K.V	Managing Irrigation TogetherPractice	Stage Publication, New Delhi, India	2000

17BECEOE04 ADVANCED CONSTRUCTION TECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVES:

- To give an experience in the implementation of new technology concepts which are applied in field of Advanced construction.
- To study different methods of construction to successfully achieve the structural design with recommended specifications.
- To involve the application of scientific and technological principles of planning, analysis, design and management to construction technology.
- To study of construction equipment's, and temporary works required to facilitate the construction process
- To provide a coherent development to the students for the courses in sector of Advanced construction technology.
- To present the new technology of civil Engineering and concepts related Advanced construction technology**.**

COURSE OUTCOMES::

1. Implementation of new technology concepts which are applied in field of Advanced construction.
2. Different methods of construction to successfully achieve the structural design with recommended specifications.
3. Application of scientific and technological principles of planning, analysis, design and management to construction technology.
4. Will gain the Knowledge of construction equipment's, and temporary works required to facilitate the construction process
5. Development to the students for the courses in sector of Advanced construction technology.
6. The new technology of civil Engineering and concepts related Advanced construction technology.

UNIT - I MODERN CONSTRUCTION METHODS 9

Open Excavation, Shafts and Tunnels- Preparation of foundation, Cofferdams, Caisson, Piled Foundation, Prestressed Concrete Construction, Pre-cast Concrete Construction**.**

UNIT - II CONSTRUCTION METHODS FOR SPECIAL STRUCTURES 9

Construction Methods For Bridges, Construction Methods for Roads, Construction Methods For Special Structures for Railways, Construction Methods for Dams, Construction Methods for Harbour, Construction Methods for River Works Pipelines.

UNIT - III MODERN CONSTRUCTION EQUIPEMENTS -I 9

Construction Equipment used for Earth Moving, Excavating, Drilling, Blasting, Tunneling and hoisting.

UNIT - IV MODERN CONSTRUCTION EQUIPEMENTS-II 9

Construction Equipment used for Conveying, Hoisting, Dredging, Dewatering Systems, Paving and concreting Plant**.**

UNIT - V PRINCIPLES AND PRACTICES OF TEMPORARY STRUCTURES 9

Principles and Practices of Temporary structures, Shoring, and Strutting,Underpinning, Principles and Design of Formwork, Scaffolding, Operation and maintenance of construction equipments

Total: 45

TEXTBOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Peurifoyu , R. L., , Ledbette, W.B	Construction Planning , Equipment and Methods	McGraw Hill Co.	2000
2.	Antill J.M	PWD, Civil Engineering Construction	McGraw Hill Book Co	2005

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1.	Varma, M	Construction Equipment and its Planning & Applications	Metropoltian Book Co	2000
2.	Nunnaly, S.W	Construction Methods and Management	Prentice – Hall	2000
3.	Ataev, S.S	Construction Technology	MIR , Pub	2000