Bharath Postgraduate College
In collaboration with

KARANATAKA STATE OPEN UNIVERSITY

Manasagangotri, Mysore – 570006,

B.TECH CHEMICAL ENGINEERING

SEMESTER SYSTEM

SYLLABUS

I YEAR SYLLABUS

(Basic Engineering)
(Common to all Branches)

Subject Code	Subject Title	Max marks	Max Credits
Semester-I			
BE1001	English-I	100	**2**
BE1002	Mathematics-I	100	**2**
BE1003	Engineering Physics-I	100	**2**
BE1004	Engineering Chemistry-I	100	**2**
BE1005	Fundamentals of Computing and Programming	100	**3**
BE1006	Physics & Chemistry Laboratory – I	100	**2**
BE1007	Computer Application Lab– I	100	**2**
Semester -II			
BE2001	Technical English	100	**2**
BE2002	Mathematics-II	100	**2**
BE2003	Engineering Physics-II	100	**2**
BE2004	Engineering Chemistry-II	100	**2**
BE2005	Engineering Graphics	100	**3**
BE2006	Computer Application Lab –II	100	**2**
BE2007	Engineering Practices Laboratory	100	**2**

Chemical Engineering- III Semester

Subject Code	Subject Title	Max Marks	Max Credits
CH3001	Engineering Mathematics	100	**2**
CH3002	Organic Chemistry	100	**3**
CH3003	Basics of Mechanical Engineering	100	**3**
CH3004	Instrumental Method of Analysis	100	**3**
CH3005	Physical Chemistry	100	**3**
CHP001	Organic Chemistry Lab	100	**2**
CHP002	Instrumental Method of Analysis Lab	100	**2**

Chemical Engineering-IV Semester

Subject Code	Subject Title	Max Marks	Max Credits
CH4001	Basics of Electrical Engineering	100	**3**
CH4002	Numerical Methods	100	**3**
CH4003	Material Science and Technology	100	**3**
CH4004	Environmental science	100	**3**
CH4005	Chemical Engineering-Thermodynamics-I	100	**2**
CHP003	Electrical Engineering Lab	100	**2**
CHP004	Technical Analysis Lab	100	**2**

Chemical Engineering-V Semester

Subject Code	Subject Title	Max Marks	Max Credits
CH5001	Heat Transfer	100	**3**
CH5002	Mass Transfer – I	100	**3**
CH5003	Chemical Process Industries	100	**3**
CH5004	Professional Ethics and Human Values	100	**3**
CH5005	Total Quality Management	100	**2**
CHP005	Communication Skills Lab	100	**2**
CHP006	Heat Transfer Lab	100	**2**

Chemical Engineering-VI Semester

Subject Code	Subject Title	Max Marks	Max Credits
CH6001	Chemical Engineering-Thermodynamics-II	100	**3**
CH6002	Mass Transfer – II	100	**3**
CH6003	Process Instrumentation and Control	100	**3**
CH6004	Chemical Reaction Engineering – I	100	**3**
CH6005	Petroleum Refinery Engineering	100	**3**
CHP007	Process Instrumentation and Control Lab	100	**2**
CHP008	Mass Transfer Lab	100	**2**

Chemical Engineering-VII Semester

Subject Code	Subject Title	Max Marks	Max Credits
CH7001	Chemical Reaction Engineering – II	100	**3**
CH7002	Process Plant Utilities	100	**3**
CH7003	Transport Phenomena	100	**3**
	Elective-I	100	**3**
	Elective-II	100	**3**
CHP009	Chemical Reaction Engineering Lab	100	**2**

Chemical Engineering-VIII Semester

Subject Code	Subject Title	Max Marks	Max Credits
CH8001	Petrochemicals Engineering	100	**3**
	Elective-III	100	**3**
	Elective-IV	100	**3**
CHP010	Petro Products Testing Lab	100	**2**
CHP011	Project	300	**6**

Total Marks = 5500
Total Credits = 136

List of Electives

Subject Code	Subject Title
CHE001	Project Engineering and Process Plant
CHE002	Fluidization Engineering
CHE003	Safety and Hazard Control
CHE004	Food Technology
CHE005	Process Optimization
CHE006	Fertilizer Technology
CHE007	Polymer Technology
CHE008	Computer Technology For Chemical Engineering

SEMESTER : I
Subject Code : BE 1001
Subject Title : English - I
Structure of the Course Content

BLOCK 1 Focus on Language (Grammar)

Unit 1: Prefixes, Suffixes and Synonyms & Antonyms
Unit 2: Framing of Questions and Subject Verb and Agreement
Unit 3: Five Major Pattern and Voice
Unit 4: Preposition, Phrasal Verbs and Use of Conditionals

BLOCK 2 Reading

Unit 1: Skimming the Text
Unit 2: Scanning the Text
Unit 3: Note Making
Unit 4: Comprehension

BLOCK 3 Writing

Unit 1: Definition
Unit 2: Description
Unit 3: Process Description
Unit 4: Formal and Informal Letter Writing

BLOCK 4 Listening

Unit 1: Extensive Listening
Unit 2: Intensive Listening
Unit 3: Note Making
Unit 4: Inferential Comprehension

BLOCK 5 Speaking

Unit 1: Developing Confidence & Introducing One self
Unit 2: Describing Objectives
Unit 3: Analysing Problem & Providing Solutions
Unit 4: Expressing Opinions and giving instruction

Books:

1. A.S.Hornby, 'The advanced learners Dictionary of current English', Oxford university
2. Longman Basic English dictionary Ist Edition Pearson Longman
3. Department of Humanities and Social Sciences, Anna University, English for Engineers and Technologists, Vol.1, 2nd Edition, Orient Longman Ltd., 2002.
4. Chellammal, V., Learning to Communicate: A Resource Book for Scientists and Technologists, Allied Pub. Pvt. Ltd., Chennai, 2003.
5. Sharon J. Gerson, Steven M. Gerson, Technical Writing – Process and Product, 3rd Edition, Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2004.
6. Vocabulary in Practice - Part 1 to 4 by Glennis Pye, Cambridge University Press,
7. Learn Correct English by Shiv K. Kumar & Hemalatha Nagarajan, Pearson Longman,
8. Essential English Grammar by Raymond Murphy, Cambridge University Press.
9. Common Errors in English by M.Thomas, Lotus Press, New Delhi, 2006
10. Basic English Usage by Michael Swan, ELBS/OUP, 1989

SEMESTER : I
Subject Code : BE 1002
Subject Title : Mathematics - I

Structure of the Course Content

BLOCK 1 Matrices

Unit 1: Rank of a matrix – Consistency of linear system of equations
Unit 2: Eigen value problem
Unit 3: Cayley –Hamilton theorem
Unit 4: Orthogonal matrices – Orthogonal transformation of a symmetric Matrix

BLOCK 2 Three Dimensional Analytical Geometry

Unit 1: Direction cosines and ratios – Angle between two lines
Unit 2: Equations of a plane – Equations of a straight line – Coplanar lines
Unit 3: Shortest distance between skew lines – Sphere – Tangent plane
Unit 4: Plane section of a sphere – Orthogonal spheres

BLOCK 3 Geometrical Applications Of Differential Calculus

Unit 1: Curvature – Cartesian and polar co-ordinates
Unit 2: Centre and radius of curvature
Unit 3: Circle of curvature
Unit 4: Involutes and evolutes – Envelopes

BLOCK 4 Functions Of Several Variables

Unit 1: Functions of two variables – Partial derivatives – Total differential
Unit 2: Taylor's expansion, Maxima and minima
Unit 3: Lagrange's Multiplier method – Jacobians
Unit 4: Differentiation under integral sign.

BLOCK 5 Ordinary Differential Equations

Unit 1: Simultaneous first order linear equations with constant coefficients
Unit 2: Linear equations of second order with constant and variable coefficients
Unit 3: Homogeneous equations of Euler type
Unit 4: Equations reducible to homogeneous form, Method of variation of Parameters

Books:

1. Veerarajan,T., "Engineering Mathematics," Second Edition , Tata McGraw–Hill Pub. Co.
2. Venkataraman, M.K., "Engineering Mathematics, Volume I," Fourth Edition, The National Pub. Co., Chennai, 2003.
3. Kreyszig, E., "Advanced Engineering Mathematics", Eighth Edition, John Wiley and Sons (Asia) Ltd., Singapore, 2001.
4. Grewal, B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Publish.
5. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics" Volume I, Fourth Revised Edition, S. Chand & Co., New Delhi, 2000.
6. Widder, D.V. "Advanced Calculus", Second Edition, Prentice Hall of India, New Delhi,
7. Engineering Mathematics Vol-III by Dr. B. Krishna Gandhi , Dr. T.K.V Iyengar, S.Ranganatham, , S.Chand & Co, New Delhi
8. Introduction to Engineering Mathematics by H.K. Dass, Dr.Rama Verma, S.Chand & Co,
9. Applied Engineering Mathematics Vol-II by H.K.Dass, S.Chand & Co.
10. Advanced Engineering Mathematics by N.Bali,M.Goyal,C.Watkins, Lakshmi

SEMESTER : I
Subject Code : BE 1003
Subject Title : Engineering Physics - I

Structure of the Course Content

BLOCK 1 Acoustics and Ultrasonic

Unit 1: Sound and Weber Fechner law
Unit 2: Factors affecting acoustics of buildings
Unit 3: Ultrasonic production
Unit 4: SONAR, Measurement of velocity of blood flow & movement of heart

BLOCK 2 Crystallography & Non-Destructive Testing

Unit 1: Space lattice, unit cell, Bravais space lattices, Lattice planes
Unit 2: Miller indices Calculation of number of atoms per unit cell, Atomic Radius
Unit 3: coordination number & packing factor for simple cubic
Unit 4: NDT methods

BLOCK 3 Wave Optics

Unit 1: Air wedge and testing of flat surfaces
Unit 2: Michelson interferometer, Types of fringes
Unit 3: Theory of plane and Photo elasticity
Unit 4: Isoclinic and iso-chromatic fringes – Photo elastic bench

BLOCK 4 Quantum Physics

Unit 1: Planck's quantum theory of black body radiation, Photo electric effect
Unit 2: Compton effect
Unit 3: Schrödinger wave equation
Unit 4: Physical significance of wave function & electrons in a metal

BLOCK 5 Laser & Fibre Optics

Unit 1: Einstein's coefficients and Laser
Unit 2: Material processing, CD-ROM & Holography
Unit 3: Optical fibre
Unit 4: Fibre optics communication system

Books:

1. Rajendran V. and Marikani A., Applied Physics for Engineers, 3rd Edition, Tata McGraw–Hill Publishing Company Limited, New Delhi, 2003.
2. Arumugam M., Engineering Physics, 5th Edition, Anuradha Agencies, Kumbakonam,
3. Palanisamy P.K., Physics for Engineers, Vol.1 & Vol.2, 2nd Edition, Scitech Publications,
4. Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications
5. Uma Mukherji, Engineering Physics, Narosa Publishing House, New Delhi, 2003.
6. Modern Engineering Physics by A.S.Vasudeva, S. Chand Publishers, New Delhi
7. Engineering Physics Fundamentals & Modern Applications by P.Khare and A.Swarup, Lakshmi Publications (Pvt) Ltd, New Delhi
8. Engineering Physics by Dipak Chandra Ghosh,Nipesh Chandra chosh,Prabir Kumar Haldar, Lakshmi Publications (Pvt) Ltd, New Delhi
9. Engineering Physics by Vikram Yadav, Tata McGraw Hill, New Delhi
10. Schaum's Outline of Physics for Engineering and Science by Michael Browne, Tata

SEMESTER : I
Subject Code : BE 1004
Subject Title : Engineering Chemistry - I
Structure of the Course Content

BLOCK 1 Electro Chemistry

Unit 1: Galvanic cells – reversible and irreversible cells
Unit 2: Single electrode potential, standard electrodes, electrochemical series
Unit 3: Nernst equation and Metal
Unit 4: Glass electrode, concentration cells and Kohlrausch law

BLOCK 2 Thermodynamics

Unit 1: Thermodynamic terms – definition of system
Unit 2: Thermodynamic equilibrium
Unit 3: Law of thermodynamics
Unit 4: Entropy of phase transitions, Gibbs Helmholtz equation

BLOCK 3 Chemical Kinetics

Unit 1: Kinetics of second order reaction
Unit 2: Kinetics of opposing, parallel and consecutive reactions
Unit 3: Decomposition of diethyl ether in gaseous phase – radioactive decay of polonium
Unit 4: Effect of temperature on reaction rate – theory of absolute reaction rate

BLOCK 4 Surface Chemistry And Catalysis

Unit 1: Adsorption
Unit 2: Freundlich, Langmuir isotherms
Unit 3: Catalysis
Unit 4: Michaelis – Menton equation – acid base catalysis

BLOCK 5 Spectroscopy

Unit 1: Electromagnetic spectrum
Unit 2: Electronic transition, Vibrational transition and rotational transition
Unit 3: Lambert's Law –colorimetric analysis – estimation of concentration of a solution by colorimetry
Unit 4: Visible & UV spectroscopy, IR spectroscopy

Books:

1. Puri B.R., Sharma L.R. and Madan S. Pathania, Principles of Physical Chemistry, Shoban Lal Nagin Chand & Co., Jalandhar, 2000.
2. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai & Sons, Delhi
3. Bahl B.S., Tuli G.D., and Arun Bahl, Essentials of Physical Chemistry, S.Chand& Co.
4. Kuriacose J.C. & Rajaram J, Chemistry in Engineering & Technology, Vol. 1, Tata McGraw
5. Introduction to Engineering Chemistry by Minaxi B Lohani, Upma Misra, S.Chand &Co
6. Engineering Chemistry by Dr.A.K.Pahari,Dr.B.S.Chauhan, Lakshmi Publicationsvt) Ltd,
7. Advanced Engineering Chemistry by M.Senapati, Lakshmi Publications (Pvt) Ltd, Delhi
8. Engineering chemistry by Uppal , Khanna publishers
9. Environmental chemistry &Pollution control by Dara .SS, S. Chand&co
10. Environmental Pollution by, Tripathy .SN , Sunakar panda - Vrinda publication

SEMESTER : I
Subject Code : BE 1005
Subject Title : Fundamentals of Computing and Programming
Structure of the Course Content

BLOCK 1 Introduction to Computer

Unit 1: Introduction, Evaluation and generation of Computer
Unit 2: Classification of Computers
Unit 3: Basic Computer organization
Unit 4: Number Systems

BLOCK 2 COMPUTER ARITHMETIC AND SOFTWARE

Unit 1: Computer Codes
Unit 2: Computer Arithmetic
Unit 3: Computer Software
Unit 4: Logical System Architecture – Software Development Steps

BLOCK 3 PROBLEM SOLVING AND OFFICE AUTOMATION

Unit 1: Planning the Computer Program – Purpose
Unit 2: Algorithm – Flow Charts – Pseudocode
Unit 3: Application Software Packages- Word Processing – Spreadsheet
Unit 4: Graphics – Personal Assistance.

BLOCK 4 INTRODUCTION TO C

Unit 1: Overview of C – Constants, Variables and Data Types
Unit 2: Operators and Expression – Managing Input and Output Operators
Unit 3: Decision Making and Branching
Unit 4: Decision Making and Looping

BLOCK 5 FUNCTIONS AND POINTERS

Unit 1: Arrays – Handling of Character Strings
Unit 2: User-Defined Functions- Structures and Unions
Unit 3: Pointers
Unit 4: Developing a C Programs

Books:

1. Pradeep K.Sinha and Priti Sinha, “Computer Fundamentals: Concepts, Systems and Applications”, BPB Publications, 2003.
2. E.Balagurusamy, “Programming in ANSI C”, TMH, New Delhi, 2002.
3. Allen B.Tucker et.al, “Fundamentals of Computing I”, TMH New Delhi, 1998.
4. V.Rajaraman, “Fundamentals of Computers”, Prentice-Hall of India, 2002.
5. Herbert Schidt, “C Made Easy”, McGraw-Hill.

SEMESTER : I
Subject Code : BE 1006
Subject Title : Physics & Chemistry Laboratory
Structure of the Course Content

Practical

List of Experiments for Physics

1. Torsional Pendulum – determination of rigidity modulus of wire and moment of inertia of disc.
2. Non Uniform Bending - Young modulus determination
3. Viscosity –Determination of co-efficient of Viscosity of liquid by Poiseuilles flow
4. Lee's disc – Determination of thermal conductivity of a bad conductor
5. Air wedge – Determination of thickness of a thin wire
6. Newton rings – Determination of Focal length of a lens
7. Spectrometer – Dispersive power of a prism
8. Determination of wavelength of Laser using Grating and Particle size determination.

List of Experiments Chemistry

I. Weighing and preparation of standard solutions

1. Preparation of molar and normal solutions of the following substances - oxalic acid, sodium carbonate, sodium hydroxide, hydrochloric acid.
2. Preparation of buffer solutions: borate buffer, phosphate buffer using Henderson equation.

II. Water Analysis

1. Determination of total hardness, temporary & permanent hardness of water by EDTA method.
2. Determination of DO content by Winkler's method.
3. Determination of alkalinity in a water sample.
4. Determination of chloride content of water sample by argentometric method.

III. Conductometry

1. Conduct metric titration of mixture of acids.
2. Conduct metric precipitation titration using $BaCl_2$ – Na_2SO_4.

SEMESTER : I
Subject Code : BE 1007
Subject Title : Computer Application Lab - I
Structure of the Course Content

Practical

MS-OFFICE

a) Word Processing

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
3. Mail merge and Letter preparation.
4. Drawing - flow Chart

b) Spread Sheet

1. Chart - Line, XY, Bar and Pie.
2. Formula - formula editor.
3. Spread sheet - inclusion of object, Picture and graphics, protecting the document and sheet.
4. Sorting and Import / Export features.

C Programming

1. Data types, Expression Evaluation, Condition Statements.
2. Functions, Recursion and parameter passing mechanisms.
3. Arrays
4. Structures and Unions
5. Pointers and Functions
6. File Processing
7. Dynamic allocation & Linked List

SEMESTER : II
Subject Code : BE 2001
Subject Title : Technical English
Structure of the Course Content

BLOCK 1 Focus on Language

Unit 1: Cause and Effect Expression
Unit 2: Connectives & Imperative and Modal Verbs
Unit 3: Infinitives, Gerunds and Reporting Verbs
Unit 4: Varied Grammatical Functions of the same word

BLOCK 2 Reading

Unit 1: Reading Comprehension
Unit 2: Guided note Making
Unit 3: Evaluating the style
Unit 4: Cloze Reading

BLOCK 3 Writing

Unit 1: Formal Letter Writing
Unit 2: Technical Report
Unit 3: Industrial Report
Unit 4: Project Proposal

BLOCK 4 Listening

Unit 1: Listening for global Comprehension and Specification information
Unit 2: Listening to speech Segments
Unit 3: Listening to recorded telephonic conversation
Unit 4: Listening to Short and Long conversion

BLOCK 5 Speaking

Unit 1: Activities related to professional skills
Unit 2: Role plays activities and Conversational etiquette
Unit 3: Group discussion & Mock interview
Unit 4: Academic skills

Books:

1. A.S.Hornby, 'The advanced learners Dictionary of current English', Oxford university press.
2. Longman Basic English dictionary Ist Edition Pearson Longman
3. Department of Humanities and Social Sciences, Anna University, English for Engineers and Technologists, Vol.2, Orient Longman Ltd., 2002, 2nd Edition.
4. T M Farhathullah, Communication Skills for Technical Students, Orient Longman Ltd., 2002.
5. Andrea J. Rutherford, Basic Communication Skills for Technology, 1st Edn., Pearson Education Asia (Singapore) Pvt. Ltd., Bangalore, 2001.
6. Vocabulary in Practice - Part 1 to 4 by Glennis Pye, Cambridge University Press,
7. Learn Correct English by Shiv K. Kumar & Hemalatha Nagarajan, Pearson Longman,
8. Essential English Grammar by Raymond Murphy, Cambridge University Press.
9. Common Errors in English by M.Thomas, Lotus Press, New Delhi, 2006
10. Basic English Usage by Michael Swan, ELBS/OUP, 1989

SEMESTER : II
Subject Code : BE 2002
Subject Title : Mathematics - II
Structure of the Course Content

BLOCK 1 Multiple Integrals

Unit 1: Double integration – Cartesian and polar coordinates
Unit 2: Change of order of integration – Area as a double integral
Unit 3: Triple integration in Cartesian coordinates
Unit 4: Change of variables between Cartesian and polar coordinates

BLOCK 2 Vector Calculus

Unit 1: Gradient, divergence and curl
Unit 2: Line, surface and volume integrals
Unit 3: Green's, Gauss divergence
Unit 4: Stoke's theorems

BLOCK 3 Analytic Functions

Unit 1: Function of a complex variable – Analytic function
Unit 2: Cauchy, Riemann equations in Cartesian coordinates
Unit 3: Determination of harmonic conjugate by Milne – Thomson method
Unit 4: Conformal mapping and bilinear transformation.

BLOCK 4 Complex Integration

Unit 1: Cauchy's theorem and Cauchy's integral formula
Unit 2: Taylor and Laurent expansion – Singularities
Unit 3: Residues – Cauchy's residue theorem
Unit 4: Contour integration – Unit circle and semi-circular contours

BLOCK 5 Laplace Transform

Unit 1: Transforms of elementary functions – Basic properties
Unit 2: Inverse transforms
Unit 3: Derivatives and integrals of transforms
Unit 4: Convolution theorem – Transform of periodic functions

Books:

1. Grewal, B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Delhi,
2. Kreyzig, E., "Advanced Engineering Mathematics", Eighth Edition, John Wiley & Sons
3. Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students", Volumes I and III, S. Viswanathan (Printers and Publishers)
4. Grewal, B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna, Delhi,
5. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics" Volume II, Fourth Revised Edition, S. Chand & Co., New Delhi, 2000.
6. Widder, D.V. "Advanced Calculus", Second Edition, Prentice Hall of India, New Delhi,
7. Engineering Mathematics Vol-III by Dr. B. Krishna Gandhi , Dr. T.K.V Iyengar, S.Ranganatham, , S.Chand & Co, New Delhi
8. Veerarajan,T., "Engineering Mathematics (for First Year)," Second Edition ,Tata Mc Hill
9. Venkataraman, M.K., "Engineering Mathematics, Volume II," Fourth Edition, The National Pub. Co., Chennai, 2003.
10. Kreyszig, E., "Advanced Engineering Mathematics", Eighth Edition, John Wiley and

SEMESTER : II
Subject Code : BE 2003
Subject Title : Engineering Physics - II

Structure of the Course Content

BLOCK 1 Crystal Defects

Unit 1: Crystal imperfection – point defects-line defects
Unit 2: Dislocations
Unit 3: Burger Vector – Dislocation climb
Unit 4: Strengthening mechanisms for the improvement of mechanical Properties

BLOCK 2 Conducting and Semi conducting Materials

Unit 1: Drawbacks of classical theory- Fermi distribution function
Unit 2: Origin of band gap in solids, Concept of effective mass of electron and hole
Unit 3: Types of Semiconductor
Unit 4: Hall effect

BLOCK 3 Magnetic and Dielectric Materials

Unit 1: Origin of magnetic moment – Bohr magneton
Unit 2: Weiss theory of Para magnetism, Determination of paramagnetic Substance
Unit 3: Ferromagnetism, Anti-ferromagnetic materials and Ferrites magnetic
Unit 4: Storage of magnetic data

BLOCK 4 Nuclear Physics

Unit 1: Nuclear forces – Einstein's mass energy relation– binding energy
Unit 2: Nuclear fission
Unit 3: Nuclear reactor
Unit 4: Nuclear power station

BLOCK 5 New Engineering Materials

Unit 1: Superconducting
Unit 2: Meissner effect, Isotope effect
Unit 3: Magnetic levitation and SQUIDS - Metallic glasses
Unit 4: Nano phase materials

Books:

1. Arumugam M, Materials Science, 3rd Edition, Anuradha Agencies, Kumbakonam, 2003.
2. Srivastava C.M. and Srinivsan C, Science of Engineering Materials, 2nd Edition, New Age International (P) Ltd, Publications, New Delhi, 1997.
3. Rajendran V. and Marikani A., Applied Physics for Engineers, 3rd Edition, Tata McGraw.
4. Palanisamy, P.K., Materials Science, 2nd Edition, Scitech Publications (India), Pvt. Ltd.,
5. Murthy V.S.R., Jena AK, Gupta K.P. and Murthy G.S., Structure and Properties of Engineering Materials, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2003.
6. Kenneth G. Budinski, Michel K. Budinski, Engineering Materials Properties and Selection, 7th Edition, Pearson, Singapore (Prentice Hall), 2002.
7. Vasudeva A.S., Modern Engineering Physics, 2nd Edition, S.Chand & Co. Ltd., Delhi.
8. Modern Engineering Physics by A.S.Vasudeva, S. Chand Publishers, New Delhi
9. Engineering Physics Fundamentals & Modern Applications by P.Khare and A.Swarup, Lakshmi Publications (Pvt) Ltd, New Delhi
10. Engineering Physics by Dipak Chandra Ghosh,Nipesh Chandra chosh, Prabir Kumar

SEMESTER : II
Subject Code : BE 2004
Subject Title : Engineering Chemistry - II

Structure of the Course Content

BLOCK 1 Fuels And Combustion

Unit 1: Classification of fuels
Unit 2: Coal varieties, coke and cracking
Unit 3: Synthetic petrol and Fischer
Unit 4: Gaseous fuels

BLOCK 2 Mechanical Engineering Materials

Unit 1: Abrasives
Unit 2: Refractories
Unit 3: Lubricants
Unit 4: Polymer blends and alloys

BLOCK 3 Water Technology And Corrosion

Unit 1: Corrosion
Unit 2: Sacrificial anode - boiler feed water
Unit 3: Boiler compounds – caustic embrittlement – boiler corrosion
Unit 4: Priming and foaming – desalination by reverse osmosis

BLOCK 4 Phase Rule And Physical Metallurgy

Unit 1: Phase rule
Unit 2: Thermal analysis
Unit 3: Physical metallurgy - powder metallurgy
Unit 4: Mixing and blending – compacting – sintering

BLOCK 5 Analytical Techniques

Unit 1: Gravimetry analysis of Pb, Fe, Al, and Ni - complex metric titrations
Unit 2: Estimation of Ni, Zn, and Mg - redox titrations
Unit 3: Estimation of iron by dichrometry and copper by iodometry
Unit 4: Atomic absorption spectroscopy, quantitative estimation of Ni and Cr.

Books:

1. Jain P.C. and Monika Jain, Engineering Chemistry, Dhanpat Rai Pub. Co. (P) Ltd., New Delhi, Edition 2002.
2. Dara S.S., A text book of Engineering Chemistry, S. Chand Co. (P) Ltd., New Delhi, 2003.
3. Vogel A.I., A text book Quantitative Inorganic Analysis, ELBS, London, 2000.
4. Engineering chemistry by Uppal , Khanna publishers
5. Environmental chemistry &Pollution control by Dara .SS, S. Chand&co.
6. Environmental Pollution by . Tripathy .SN , Sunakar panda - Vrinda publication
7. Rain water Harvesting-hand book by Chennai Metro Water
8. Introduction to Engineering Chemistry by Minaxi B Lohani, Upma Misra, S.Chand & Co, New Delhi
9. Engineering Chemistry by Dr.A.K.Pahari,Dr.B.S.Chauhan, Lakshmi Publications (Pvt) Ltd, New Delhi
10. Advanced Engineering Chemistry by M.Senapati, Lakshmi Publications (Pvt) Ltd, New Delhi

SEMESTER : II
Subject Code : BE 2005
Subject Title : Engineering Graphics
Structure of the Course Content

BLOCK 1 Projection of Points, Lines And Surfaces

Unit 1: General principles of presentation of technical drawings as per BIS
Unit 2: First angle projection. And Orthographic projection of points
Unit 3: Projections of straight lines located in first quadrant only
Unit 4: Projections of plane surfaces like polygonal lamina and circular lamina

BLOCK 2 Projections of Solids

Unit 1: Projection of simple prism
Unit 2: Projection of simple pyramid
Unit 3: Projection of simple cylinder
Unit 4: Projection of simple cone

BLOCK 3 Sections of Solids and Development

Unit 1: Sectioning of simple prisms
Unit 2: Sectioning of simple pyramids
Unit 3: Sectioning of simple cylinder
Unit 4: Sectioning of simple cone and sphere

BLOCK 4 Pictorial Projections

Unit 1: Isometric views of simple truncated prisms
Unit 2: Isometric views of pyramids
Unit 3: Isometric views of cylinders
Unit 4: Isometric views of cones

BLOCK 5 Free-Hand Sketching

Unit 1: Free hand sketching techniques
Unit 2: sketching of orthographic views
Unit 3: Hand dimensioning.
Unit 4: Sketching pictorial views from given orthographic views.

Books:

1. Nataraajan K.V, "Engineering Drawing and Graphics ", Private Publisher, Chennai.
2. Venugopal K., "Engineering Graphics", New Age International (P) Limited, 2002.
3. Bertoline and Wiebe, Fundamentals of Graphics Communication, Third edition, McGraw-
4. Warren J. Luzadder and Jon. M.Duff, "Fundamentals of Engineering Drawing", Prentice Hall of India Pvt. Ltd., Eleventh Edition, 2001.
5. Gopalakirishna K.R., "Engineering Drawing (Vol. I & II)", Subhas Publications, 1998.
6. Engineering Drawing by Shah/Rana,Ist Edition Pearson Longman
7. Machine Drawing with AutoCAD by Pohit/Ghosh, Ist Edition Pearson Longman
8. Engineering Graphics by Prof.P.J.Shah, S.Chand & Co, New Delhi

Standards :

1. IS 10711 - 2001 Technical Product Documentation - Sizes of drawing sheets
2. IS 9609 - 1983 Lettering on technical drawings
3. IS 10714 - 1983 General Principles of presentation of technical drawings
4. IS 11669 - 1986 General Principles of dimensioning of technical drawings

SEMESTER : II
Subject Code : BE 2006
Subject Title : Computer Application Lab - II
Structure of the Course Content

Practical

1. UNIX COMMANDS

(i) Study of Unix OS - Basic Commands - Process Management Commands - Unix Editor

2. SHELL PROGRAMMING

(i) Simple Shell program - Conditional Statements - Testing and Loops

(ii) Commands line substitution

3. C PROGRAMMING AND FILE MANAGEMENT

(i) C Program to implement Unix Commands

4. PROCESS MANAGEMENT AND SIGNAL HANDLING

(i) Programs in C for signal handling and Process management

SEMESTER : II
Subject Code : BE 2007
Subject Title : Engineering Practices Laboratory
Structure of the Course Content

Practical

1. CIVIL ENGINEERING PRACTICE

Plumbing

Basic pipe connections involving the fittings like valves, taps

Wood Work

Sawing, planing, making common joints: T-Joint, Dovetail joint.

2. ELECTRICAL ENGINEERING PRACTICE

Basic household wiring using switches, fuse, indicator-lamp, Tube Light

3. MECHANICAL ENGINEERING PRACTICE

Welding

Arc welding of butt joints, lap joints, tee joints.

Basic Machining

Simple turning, and drilling operations

4. ELECTRONIC ENGINEERING PRACTICE

Soldering simple electronic circuits and checking continuity **SEMESTER : III**

Subject Code : CH3001
Subject Title : Engineering Mathematics
Structure of the Course Content

BLOCK 1 PARTIAL DIFFERENTIAL EQUATIONS

Unit 1: Formation of partial differential equations
Unit 2: Solution of standard types of first order partial differential equations
Unit 3: Lagrange's linear equation
Unit 4: Linear partial differential equations of second and higher order

BLOCK 2 Fourier Series

Unit 1: General Fourier series – Odd and even functions
Unit 2: Half range Sine and Cosine series
Unit 3: Complex form of Fourier series
Unit 4: Parseval's identify and Harmonic Analysis

BLOCK 3 Boundary value problems

Unit 1: Second order quasi linear partial differential equations
Unit 2: One dimensional wave and heat equation
Unit 3: Steady state solution of two-dimensional heat equation
Unit 4: Fourier series solutions in Cartesian coordinates

BLOCK 4 Fourier Transform

Unit 1: Fourier integral theorem (without proof) and Fourier transform pair
Unit 2: Sine and Cosine transforms – Properties
Unit 3: Transforms of simple functions
Unit 4: Convolution theorem and Parseval's identity

BLOCK 5 Z -Transform and Difference Equations

Unit 1: Z-transform - Elementary properties
Unit 2: Inverse Z – transform
Unit 3: Convolution theorem
Unit 4: Formation of difference equations

Books:

1. Grewal, B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Publishers, Delhi, 2001.
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics Volume III", S. Chand & Company ltd., New Delhi, 1996.
3. Wylie C. Ray and Barrett Louis, C., "Advanced Engineering Mathematics", Sixth Edition, McGraw-Hill, Inc., New York, 1995
4. Andrews, L.A., and Shivamoggi B.K., "Integral Transforms for Engineers and Applied Mathematicians," Macmillen , New York ,1988.
5. Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.
6. Churchill, R.V. and Brown, J.W., "Fourier Series and Boundary Value Problems", Fourth Edition, McGraw-Hill Book Co., Singapore, 1987

SEMESTER : III
Subject Code : CH3002
Subject Title : Organic Chemistry
Structure of the Course Content

BLOCK 1 Carbohydrates

Unit 1: Mono and Disaccharides – Important reactions
Unit 2: Polysaccarides – Starch and Cellulose – Derivaters of Cellulose
Unit 3: Carboxy Methyl Cellulose and gun cotton
Unit 4: Structural aspects of cellulose

BLOCK 2 Organic Reactions

Unit 1: Electrophilic reaction
Unit 2: Nucleophilic reactions
Unit 3: Free radical reaction
Unit 4: Alylic halogination

BLOCK 3 Heterocyclic Compounds

Unit 1: Furan
Unit 2: Thiophone
Unit 3: Pyrrole, Pyridine
Unit 4: Indole – Quinoline

BLOCK 4 Dyes and Dyeing

Unit 1: Synthesis of some important azodyes
Unit 2: Synthesis of Triphenylmethane dyes
Unit 3: Phthalein dyes-Eosin preparation
Unit 4: Introduction to Natural and Reactive dyes

BLOCK 5 Amino Acids and Properties

Unit 1: Classification and properties of Amino acids
Unit 2: Ccomposition and classification of proteins
Unit 3: Amino acids in Proteins
Unit 4: Hydrolysis of proteins - polypeptides

Books:

1. Organic Chemistry – VI Edition – R.T. Morrison and R.N.Boyd Prentice Hall Inc. (1996) USA
2. A text book of Organic Chemistry – K.S.Tiwari, N.K.Vishnoi and S.N.Malhotra Second Edition – Vikas Publishing House Pvt. Ltd. (1998) – New Delhi
3. Chemistry in Engineering and Technology, Vol.2, TMH Publishing Co Ltd., New Delhi, 1994

SEMESTER : III
Subject Code : CH3003
Subject Title : Basics of Mechanical Engineering
Structure of the Course Content

BLOCK 1 Laws of Thermodynamics

Unit 1: Basic concepts and hints; Zeroth law; First Law of Thermodynamics
Unit 2: Steady flow energy equation-problems
Unit 3: Kelvin - Plank statement and Clausius statement
Unit 4: Heat Engine, Refrigerator and Heat Pump, Available energy

BLOCK 2 HEATING AND EXPANSION OF GASES

Unit 1: Expressions for work done, Internal energy
Unit 2: Heat transfer for Constant Pressure, Constant Volume
Unit 3: Isothermal, Adiabatic and Polytropic processes
Unit 4: Derivations and problems; Free expansion and Throttling process

BLOCK 3 AIR STANDARD CYCLES

Unit 1: Carnot cycle; Stirlings cycle
Unit 2: Joule cycle; Otto cycle
Unit 3: Diesel cycle
Unit 4: Dual combustion Cycle

BLOCK 4 I.C. ENGINES, STEAM TURBINES

Unit 1: Engine nomenclature and classification
Unit 2: Performance of I.C.Engine
Unit 3: Steam - Properties of steam
Unit 4: Steam turbines – Impulse and Reaction types - Principles of operation

BLOCK 5 SIMPLE MECHANISM, FLY WHEEL, DRIVES AND BALANCING

Unit 1: Definition of Kinematic Links, Pairs and Kinematic Chains
Unit 2: Flywheel-Turning moment Diagram; Fluctuation of Energy
Unit 3: Belt and rope drives; Velocity ratio; slip; Creep
Unit 4: Balancing of rotating masses in same plane

Books:

1. Bhaskaran, K.A., and Venkatesh, A., " Engineering Thermodynamics ", Tata McGraw Hill, 1973.
2. Pandya A. and Shah, " Theory of Machines ", Charatakar Publishers, 1975.
3. Khurmi R.S., and Gupta J.K, “Thermal Engineering”, S.Chand & Company (P) Ltd.,2001.
4. Kothandaraman and Dhomkundwar,”: A course in Thermal Engineering (SI Units)”, Dhanpat Rai and Sons, Delhi (2001)
5. Nag, P.K., " Engineering Thermodynamics ", II Edition, Tata McGraw Hill Publishing Co., Ltd., 1995.
6. Rajput, R .K, “Thermal Engineering”, Laxmi publications (P) Ltd, 2001.
7. Khurmi R.S., and Gupta J.K, “Theory of Machines”, Eurasia Publishing House (P) Ltd., 2004

SEMESTER : III
Subject Code : CH3004
Subject Title : Instrumental Method of Analysis
Structure of the Course Content

BLOCK 1 INTRODUCTION TO SPECTROSCOPICAL METHODS OF ANALYSIS

Unit 1: Electromagnetic radiation
Unit 2: Classification of instrumental methods based on physical properties
Unit 3: Beer -Lambert's law, Limitations, Deviations
Unit 4: Estimation of inorganic ions such as Fe, Ni and estimation of Nitrite

BLOCK 2 UV AND VISIBLE SPECTROCOPY

Unit 1: Various electronic transitions in organic and inorganic compounds
Unit 2: Effects of auxochromes and efffects of conjugation on the absorption maxima
Unit 3: Multicomponent analysis
Unit 4: Applications of UV and VISIBLE spectroscopies

BLOCK 3 IR , RAMAN AND ATOMIC SPECTROSCOPY

Unit 1: Theory of IR spectroscopy, Various stretching and vibration modes
Unit 2: various ranges of IR
Unit 3: sample preparation techniques
Unit 4: Types of burners, Types of fuels, Hollow cathode lamp

BLOCK 4 Thermal Methods

Unit 1: Thermogravimetry
Unit 2: Thermograms of some important compounds
Unit 3: Differential thermal analysis
Unit 4: Applications of DSC

BLOCK 5 CHROMATOGRAPHIC METHODS

Unit 1: Classification of chromatographic methods
Unit 2: Performance Liquid Chromatographical methods
Unit 3: Separation of organic compounds
Unit 4: Estimation of organic compounds by GC and HPLC

Books:

1. Willard, H.H., Merritt.l.l., Dean J.a., and Settle,F.A., Instrumental methods of analysis, Sixth edition, CBS publishers,1986
2. Skoog D.A and West D.M, Fundamentals of Analytical Chemistry, Saunders -college Publishing, 1982.
3. Banwell, G.C., Fundamentals of molecular spectroscopy, TMH,1992.
4. A.I. Vogel's Quantitative Inorganic analysis . V Edition
5. Day R.A Underwood A.L Qualitative Inorganic analysis (A. I. Vogel).
V Edition, Prentice-Hall of India (P) Ltd, NewDelhi
6. Sharma, B.K., Instrumental Methods of Analysis, Goel publishing House,1995
7. Kalsi .P.S. Spectroscopy of organic compounds, 6th Edition, New Age International Publishers,2006
8. William Kemp, Organic Spectroscopy, 3rd Edition, Palgrave publishers, 2007
9. Sathya Narayana. D. N. Vibrational Spectroscopy, First Edition 2004 and Reprint 2005, New Age International publishers

SEMESTER : III
Subject Code : CH3005
Subject Title : Physical Chemistry
Structure of the Course Content

BLOCK 1 Electrochemistry

Unit 1: Electrical conductance – Specific conductance
Unit 2: Kohlrausch's law – Transport number – Galvanic cells
Unit 3: Reference electrode – Standard Hydrogen electrode
Unit 4: Chemical and electrochemical corrosion

BLOCK 2 IONIC EQUILIBRIA

Unit 1: Acids and bases – Arrhenius concept – Lewis concept
Unit 2: Buffer solutions – calculation of pH – Henderson's equation
Unit 3: Hydrolysis of salts – Degree of hydrolysis
Unit 4: acid-base indicators – their applications – solubility product principle

BLOCK 3 CHEMICAL KINETICS

Unit 1: Zero order, First order, Second order and Third order reactions
Unit 2: Molecualrity of a reaction – Unimolecular and Bimolecular reactions
Unit 3: Kinetics of parallel and opposing reactions
Unit 4: Theory of absolute reaction rates – Kinetics of enzyme catalyzed reactions

BLOCK 4 PHOTOCHEMISTRY

Unit 1: Laws of Photochemistry, Quantum efficiency, Photochemical reactions
Unit 2: Kinetics and mechanism of Hydrogen
Unit 3: Bromine reaction, Hydrogen – Chlorine reaction
Unit 4: Photosensitization, Chemiluminscence

BLOCK 5 COLLOIDS

Unit 1: Introduction to colloids – properties of colloids – coagulation of solutions
Unit 2: Origin of charge on colloidal particles – Determination of size of colloidal particles
Unit 3: Donnan Membrane equilibrium – Emulsions – Gels – Applications of colloids
Unit 4: Application in catalysis and drug delivery systems.

Books:

1. Gordon M. Barrow, Physical Chemistry, Sixth Edition, Tata McGraw Hill (1998).
2. Peter Atkins & Julio de Paula, Atkins' Physical Chemistry, 7th Edition, Offord university press. (2002).
3. Kund and Jain, Physical Chemistry, S.Chand and Company, New Delhi (1996).
4. Puri B.H. Sharma L.R. and M.S.Prathama, "Principles of Physical Chemisry", S.Chand and Company, New Delhi (2001).
5. B.S.Bahl, Arun Bahl and G.D.Tuli, "Essentials of Physical Chemistry", S.Chand and Company, New Delhi (2005).

SEMESTER : III
Subject Code : CHP001
Subject Title : Organic Chemistry Lab
Structure of the Course Content

1. Analysis of nature of organic compounds – To identify 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) amide 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

SEMESTER : III
Subject Code : CHP002
Subject Title : Instrumental Method of Analysis Lab
Structure of the Course Content

List of Experiments

1. UV-Visible spectrophotometer
2. Infrared spectrophotometer
3. Gas chromatograph.
4. High performance liquid chromatograph
5. Atomic absorption spectrophotometer.
6. Flame photometer
7. Thermo gravimetric analyzer
8. Differential scanning calorimeter
9. Differential thermal analyzer

SEMESTER : IV
Subject Code : CH4001
Subject Title : Basics of Electrical Engineering
Structure of the Course Content

BLOCK 1 ELECTRIC CIRCUITS

Unit 1: Definition – ohm's law – series parallel circuit – parallel circuit
Unit 2: Division of current – Kirchoffs law
Unit 3: Superposition and Thevenin's Theorem
Unit 4: Star-delta transformation; Simplification of networks

BLOCK 2 A.C. CIRCUITS

Unit 1: Alternating Voltage; Need for A.C. Voltage; Sinusoidal A.C. Voltage
Unit 2: R,RL and RLC networks
Unit 3: Resonance in A.C. Circuits; Series, Parallel and series-parallel resonance
Unit 4: Three phase circuits

BLOCK 3 D.C. MACHINES

Unit 1: Lenz's law of electromagnetic induction; Fleming's rule
Unit 2: Principle of operation of D.C. Machines
Unit 3: Emf equation of D.C. generators
Unit 4: Speed control of D.C. motor; Starters

BLOCK 4 AC Machines

Unit 1: Principle of operation of A.C. Machines
Unit 2: Single and three phase induction motors
Unit 3: Alternators; Synchronous motors; Equivalent circuit
Unit 4: Starting of induction motors

BLOCK 5 Transformers

Unit 1: Principle of operation of Transformer
Unit 2: Single and three phase Transformer
Unit 3: Losses of Transformers
Unit 4: Regulation and efficiency of single phase transformer

Books:

1. Cotton, H., Electrical Technology, Pitman Publishers, (1975)
2. Uppal, S.L., Text Book of Electrical Engineering, Khanna Publishers, (1975)
3. Theraja, D.L. Text Book of Electrical Technology, Nirja publishers (1995)

SEMESTER : IV
Subject Code : CH4002
Subject Title : Numerical Methods

Structure of the Course Content

BLOCK 1 Solution of Equations and Eigen Value Problems

Unit 1: Solution of equation –Fixed point iteration: x=g(x) method - Newton's method
Unit 2: Solution of linear system by Gaussian elimination and Gauss-Jordon method
Unit 3: Gauss-Seidel method - Inverse of a matrix by Gauss Jordon method
Unit 4: Eigen value of a matrix by power method

BLOCK 2 Interpolations and Approximation

Unit 1: Lagrangian Polynomials
Unit 2: Divided differences
Unit 3: Interpolating with a cubic spline
Unit 4: Newton's forward and backward difference formulas

BLOCK 3 Numerical Differentiations and Integration

Unit 1: Differentiation using interpolation formulae
Unit 2: Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules
Unit 3: Romberg's method – Two and Three point Gaussian quadrature formulae
Unit 4: Double integrals using trapezoidal and Simpsons's rules

BLOCK 4 Initial Value Problems for Ordinary Differential Equation

Unit 1: Single step methods: Taylor series method
Unit 2: Euler method for first order equation
Unit 3: Fourth order Runge – Kutta method
Unit 4: Multistep methods: Milne's and Adam's predictor and corrector methods

BLOCK 5 Boundary Value Problems in Ordinary and Partial Differential Equations

Unit 1: Finite difference solution of second order ordinary differential equation
Unit 2: Finite difference solution of one dimensional heat equation
Unit 3: One dimensional wave equation
Unit 4: Two dimensional Laplace and Poisson equations

Books:

1. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, 2007.
2. Gerald, C. F. and Wheatley, P.O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, 2006.
3. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004
4. Veerarajan, T and Ramachandran, T. 'Numerical methods with programming in 'C' Second Editiion, Tata McGraw-Hill Publishing.Co.Ltd. (2007).
5. Sankara Rao K, 'Numerical Methods for Scientisits and Engineers' – 3rd editiion Printice Hall of India Private Ltd, New Delhi, (2007).

SEMESTER : IV
Subject Code : CH4003
Subject Title : Material Science and Technology

Structure of the Course Content

BLOCK 1 Introduction to Materials

Unit 1: Selection criteria and processes: General criteria of selection of materials
Unit 2: Properties: Mechanical, Thermal, Chemical, Electrical, Magnetic
Unit 3: Technological properties. Processing of metals and alloys
Unit 4: Casting-hot and cold rolling forging- extrusion-deep drawing

BLOCK 2 Ferrous and Non Ferrous Metals

Unit 1: Pure iron, cast iron, mild steel, stainless steels, special alloy steels
Unit 2: Iron and iron carbide phase diagram
Unit 3: Heat treatment of plain-carbon steels
Unit 4: Manufacturing methods of Lead, Tin and Magnesium

BLOCK 3 Polymers, Composites, Ceramics and Inorganic Materials

Unit 1: Industrial polymerization methods, crystallinity and stereo isomers
Unit 2: FRP-Fiber Reinforced Plastics
Unit 3: Ceramic crystal and silicate structures-processing of ceramics
Unit 4: Cement and its properties-manufacturing of cement

BLOCK 4 Advanced Materials

Unit 1: Single crystals-production-properties-applications
Unit 2: Memory metals
Unit 3: Intelligent materials
Unit 4: Some important metallic and non-metallic single crystals

BLOCK 5 Corrosion and Prevention

Unit 1: Basic theories and mechanism of corrosion
Unit 2: Types of corrosion
Unit 3: Anti-Corrosion methods
Unit 4: Organic paints and coatings metal, ceramic coatings

Books:

1. Budinsky K G and Budinsky K M " Engineering materials- Properties and Selection" Prentice Hall of India (2002).
2. Khanna O P, "Material Science and metallurgy" Dhnapat Rai Publications (1995).
1. Henry R Clauster, "Industrial and Engineering materials" McGraw Hill Book Co. (1975).

SEMESTER : IV
Subject Code : CH4004
Subject Title : Environmental Science
Structure of the Course Content

BLOCK 1 Water

Unit 1: Water Supply
Unit 2: Quantity of water
Unit 3: Collections and conveyance of water
Unit 4: Quality of water

BLOCK 2 Water Treatments

Unit 1: Layout of treatment plants
Unit 2: Filtration
Unit 3: Treatment processes
Unit 4: Distribution system

BLOCK 3 Collections and conveyance of sewage

Unit 1: Definition of terms
Unit 2: physical and chemical bacteriological BOD, COD
Unit 3: Estimation of quantity of sewage – problems
Unit 4: Laying of sewers lines & Sewage pumps

BLOCK 4 Treatments and disposal

Unit 1: Treatment of sewage
Unit 2: Sedimentation
Unit 3: Septic tanks
Unit 4: Disposal of Septic Tank effluent

BLOCK 5 Environmental pollution and control

Unit 1: Industrial waste
Unit 2: Treatment Processes
Unit 3: Water pollution
Unit 4: Land Pollution
Unit 5: Control of Air Pollution

Books:

1. Water supply and Sanitary Engineering by S.K. Garg, Kanna publishers, Delhi
2. Water supply and Sanitary Engineering by K.S. Rangwala
3. Water supply and Sanitary Engineering by G.S. Birdie and JS. Birdie, Dhanpat rai Publishers
4.Environmental Studies by Suresh K.Dhamija, S.K.Katarial Sons Delhi
5. Industrial waste water treatment by Rao & Dutta
6. Air pollution by M.N. Rao & H.V. Rao, Tata Mcgrawhill Publishing Company
7. Environmental Engineering by Basak, TMH
8. Principle of Environmental Science by Cunningham, Tata Mcgrawhill Publishing Company
9. Introduction to Environmental Engineering by Davis, TMH
10. Environmental Engineering –I: Water supply Engineering by Dr.B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain

SEMESTER : IV
Subject Code : CH4005
Subject Title : Chemical Engineering- Thermodynamics-I

Structure of the Course Content

BLOCK 1 Basic Concept

Unit 1: The terminologies of thermodynamics
Unit 2: Energy classifications, point and path properties
Unit 3: Energy in transition, heat and work
Unit 4: Reversible and irreversible processes, phase rule

BLOCK 2 Laws of Thermodynamics

Unit 1: The first law and internal energy
Unit 2: Enthalpy and heat capacity limitations of the first law
Unit 3: Statements of the second law of thermodynamics
Unit 4: Entropy function, applications of the second law

BLOCK 3 Thermodynamics Properties of Real Gases

Unit 1: The PVT behaviour of fluids, laws of corresponding states
Unit 2: PVT relationships of non ideal gas, problems
Unit 3: Compressibility factors, generalized equations of state
Unit 4: Fugacity and fugacity coefficients of real gases

BLOCK 4 Thermodynamic Formulations

Unit 1: Measurable quantities, basic energy relations, Maxwell relations
Unit 2: Thermodynamic formulations to calculate enthalpy
Unit 3: Thermodynamic properties of an ideal gas
Unit 4: Entropy change in reversible and irreversible process

BLOCK 5 Compressions of Fluids

Unit 1: Thermodynamic aspects of compression process
Unit 2: Classification of compression processes
Unit 3: The effect of clearance volume, multistage compression
Unit 4: Convergent divergent flow, Ejectors

Books:

1. Hougen, O.A., Watson, K.M., and Ragatz, R.A., "Chemical Process Principles Part II, Thermodynamics", John Wiley 1970.
2. Dodge, B.F., "Chemical Engineering Thermodynamics", McGraw-Hill, 1960.
3. Sandler, S.I., "Chemical and Engineering Thermodynamics 2nd edn.", Wiley, 1989.
4. Kyle, B.G., "Chemical and Process Thermodynamics 2nd edn.", Prentice Hall of India Pvt. Ltd., 1990
5. Smith, J.M., VanNess, H.C., & Abbot M.C, "Introduction to Chemical Engineering Thermodynamics", McGraw Hill VII Edition 2004.
6. Narayanan K.V "A Text Book of Chemical Engineering Thermodynamics" Prentice Hall of India Pvt. Ltd. 2001

SEMESTER : IV
Subject Code : CHP003
Subject Title : Electrical Engineering Lab
Structure of the Course Content

1. Open circuit characteristics of D.C. shunt generator
2. Load characteristics of D.C. shunt generator
3. Load characteristics of D.C. compound generator
4. Load test on D.C. shunt motor
5. Study of D.C. motor starters
6. O.C. and S.C. tests on single phase transformer
7. Load test on single phase transformer
8. Load test on 3 – phase squirrel cage induction motor
9. Study of 3 – phase induction motor starters
10. Load test on 3 – phase slip ring induction motor
11. O.C. and S.C. tests on 3 – phase alternator
12. Synchronization and V – curves of alternator

SEMESTER : IV
Subject Code : CHP004
Subject Title : Technical Analysis Lab
Structure of the Course Content

1. Ore Analysis
   (i) Estimation of manganese in pyrolusite ore.
   (ii) Estimation of magnesium in dolomite.

2. Analysis of alloys .

3. Analysis of fertilizer.
   (i) Estimation of nitrogen in urea by kjeldal method.

4. Sugar Analysis .

5. Estimation of phenol by Iodimetry / UV-Vis Spectrometer.

6. Water Analysis
   (i) Determination of total residual chlorine in water.
   (ii) Determination of chemical oxygen demand.
   (iii) Determination of dissolved oxygen.

7. Polymer analysis .

8. Conductometric Titration.

9. Potentiometry.
   (i) Estimation of iron.
   (ii) Determination of standard – electrode potential of Zn , Fe , Copper.

10. Estimation of sodium and potassium by flame photometry.

11. Gravimetric analysis
   (i) Estimation of barium in barium sulphate.
   (ii) Estimation of nickel as DMG.

12. pH metry (acid – basic titration) – not basic.

SEMESTER : V
Subject Code : CH5001
Subject Title : Heat Transfer
Structure of the Course Content

BLOCK 1 Heat Transfer by Conduction

Unit 1: Importance of heat transfer in Chemical Engineering operations
Unit 2: Concept of heat conduction - Fourier's law of heat conduction
Unit 3: Heat conduction through a series of resistances
Unit 4: Thermal conductivity measurement; effect of temperature

BLOCK 2 Film Coefficients and Their Application

Unit 1: Individual and overall heat transfer coefficients
Unit 2: Two dimensional steady state conduction
Unit 3: Analytical and graphical methods
Unit 4: Transient heat conduction

BLOCK 3 Convection

Unit 1: Concept of heat transfer by convection - Natural and forced convection
Unit 2: Equations for forced convection
Unit 3: Equations for natural convection
Unit 4: Heat transfer to molten metals

BLOCK 4 Heat Exchangers

Unit 1: Parallel and counter flow heat exchangers
Unit 2: Single pass and multipass heat exchangers; plate heat exchangers
Unit 3: Design of various types of heat exchangers
Unit 4: Design of furnaces - Design of condensers

BLOCK 5 Radiation and Evapration

Unit 1: Concept of thermal radiations - Black body concept
Unit 2: Stefan Boltzmann's law -concept of grey body – radiation between surfaces
Unit 3: Types of evaporation
Unit 4: Design calculation for single and multiple effect evaporation

Books:

1. Harker J Coulson, J.M., Richardson, J.F., Backhurst J "Chemical Engineering", Vol. I., Butterworth Heinman 1996.
2. Kern, D.Q., "Process Heat Transfer", McGraw-Hill - Revised adition - 1999
3. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", McGraw-Hill VII Edition 2004.
4. Binay K.Dutta "Heat Transfer Principles and Applications", Prentice Hall of India, 2001

SEMESTER : V
Subject Code : CH5002
Subject Title : Mass Transfer - I
Structure of the Course Content

BLOCK 1 Diffusion

Unit 1: Molecular and eddy diffusion in gases and liquids
Unit 2: Steady state diffusion
Unit 3: Diffusivity measurement and prediction
Unit 4: Multi component diffusion, diffusion in solids and its applications

BLOCK 2 Mass Transfer Coefficients

Unit 1: Concept of mass transfer coefficients
Unit 2: JD, HTU, and NTU concepts
Unit 3: Interphase mass transfer and over all mass transfer coefficients
Unit 4: Application to gas-liquid and liquid-liquid systems

BLOCK 3 Humidification's and Air Conditioning

Unit 1: Basic concepts, psychrometric chart construction
Unit 2: Humidification and dehumidification operations
Unit 3: Cooling tower principle and operation
Unit 4: Types of equipment, design calculation

BLOCK 4 Drying

Unit 1: Theory and mechanism of drying, drying characteristics of materials
Unit 2: Batch and continuous drying
Unit 3: Calculation for continuous drying, drying equipment
Unit 4: Design and performance of various drying equipments

BLOCK 5 Crystallisation

Unit 1: Nuclei formation and crystal growth, theory of crystallization
Unit 2: Growth coefficients and the factors affecting these in crystallization
Unit 3: Batch and continuous industrial crystallizers
Unit 4: Principle of design of equipment

Books:

1. Harker J Coulson, J.M., Richardson, J.F., Backhurst J "Chemical Engineering", Vol. I., Butterworth Heinman 1996.
2. Foust, A.S.Wenzel, L.A., Clump, C.W., Naus, L., and Anderson, L.B., "Principles of Unit Operations", Second Edition, Wiley, 1980.
3. Roman Zarzytci, Andrzai Chacuk, "Absorption: Fundamentals and Application", Pergamon Press, 1993.
4. Skelland, A.H.P., "Diffusional Mass Transfer", Krieger, Malabar FL (1985).
5. R.E.Treybal, "Mass Transfer Operations", McGraw-Hill III Edition, 1980.
6. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", McGraw-Hill VII Edn., 2004

SEMESTER : V
Subject Code : CH5003
Subject Title : Chemical Process Industries
Structure of the Course Content

BLOCK 1 Introduction to Chemical Industries

Unit 1: Chemical processing, the role of a chemical engineers in process industries
Unit 2: Importance of block diagrams and flow charts, unit operations
Unit 3: Unit processes, process utilities and economics
Unit 4: Industrial safety and pollution, outline of plant and equipment design

BLOCK 2 MARINE CHEMICALS, CHOLORO-ALKALI INDUSTRIES

Unit 1: Sodium chloride, By-products of common salt industry
Unit 2: Value added product
Unit 3: Soda ash and sodium bicarbonate, chlorine and caustic soda
Unit 4: Bleaching powder and related bleaching agents, hydrochloric acid

BLOCK 3 SULPHUR AND SULPHURIC ACID INDUSTRIES , PHOSPHORUS INDUSTRIES

Unit 1: Mining and manufacture of sulphur
Unit 2: Recovery of sulphur from polluting gases
Unit 3: Sulphur trioxide and sulphuric acid
Unit 4: Posphate rock, benefication, phosphoric acid-phosphate

BLOCK 4 NITROGEN INDUSTRIES, AGRICHEMICAL INDUSTRIES

Unit 1: Synthesis ammonia and nitric acid
Unit 2: Insecticides, pesticides
Unit 3: Herbicides
Unit 4: Plant nutrients and regulators

BLOCK 5 FERTILISER INDUSTRIES

Unit 1: Growth elements, functions, nitrogenous fertilizers ammonium sulphate
Unit 2: Ammonium nitrate and urea phosphotic fertilizers
Unit 3: Single and triple super phosphate, ammonium phosphate
Unit 4: Potassium chloride, potassium nitrate and phosphate

Books:

1. Hougen, O.A., Watson, K.M., and Ragatz, R.A., "Chemical Process Principles Part II, Thermodynamics", John Wiley 1970.
2. Kent, J.A., (ed), Riggel's Hand book of Industrial Chemistry, Van Nostrant Reinhold, 1974.
3. CHEMTECH 1-4, Chemical Engineering Education Development Centre, I.I.T., Madras 1975-78.
4. Dodge, B.F., "Chemical Engineering Thermodynamics", McGraw-Hill, 1960.
5. Sandler, S.I., "Chemical and Engineering Thermodynamics 2nd edn.", Wiley, 1989.
6. Kyle, B.G., "Chemical and Process Thermodynamics 2nd edn.", Prentice Hall of India Pvt. Ltd., 1990
7. Austin, G.T., Shreve's Chemical Process Industries, Fifth Edition, McGraw-Hill International Book Co, Singapore, 1984
8. Dryden, C.E., Outlines of Chemicals Technology, Edited and Revised by Gopala Rao, M. and M.Sittig., Second Edition, Affiliated East-West press, 1993

SEMESTER : V
Subject Code : CH5004
Subject Title : Professional Ethics and Human Values
Structure of the Course Content

BLOCK 1 Human Values

Unit 1: Morals, Values and Ethics – Integrity – Work Ethic
Unit 2: Service Learning – Civic Virtue – Respect for Others – Living Peacefully
Unit 3: Caring – Sharing – Honesty – Courage – Valuing Time
Unit 4: Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality

BLOCK 2 Engineering Ethics

Unit 1: Senses of 'Engineering Ethics' - variety of moral issued
Unit 2: Types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory
Unit 3: Gilligan's theory - consensus and controversy – Models of Professional Roles
Unit 4: Theories about right action - Self-interest - customs and religion

BLOCK 3 Engineering as Social Experimentation

Unit 1: Engineering as experimentation
Unit 2: Engineers as responsible experimenters
Unit 3: Codes of ethics - a balanced outlook on law
Unit 4: The challenger case study

BLOCK 4 Safety, Responsibilities and Rights

Unit 1: Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk
Unit 2: The three mile island and chernobyl case studies
Unit 3: Collegiality and loyalty - respect for authority - collective bargaining
Unit 4: Confidentiality - conflicts of interest - occupational crime - professional rights

BLOCK 5 Global Issues

Unit 1: Multinational corporations - Environmental ethics
Unit 2: Computer ethics - weapons development
Unit 3: Engineers as managers-consulting engineers
Unit 4: Engineers as expert witnesses and advisors -moral leadership

Books:

1. Charles D. Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint now available)
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001
5. Mike Martin and Roland Schinzinger, “Ethics in engineering”, McGraw-Hill, New York 1996.
6. Govindarajan M, Natarajan S, Senthil Kumar V. S, “ Engineering Ethics”, Prentice Hall of India, New Delhi, 2004

SEMESTER : V
Subject Code : CH5005
Subject Title : Total Quality Management
Structure of the Course Content

BLOCK 1 Concepts of TQM

Unit 1: Philosophy of TQM, Customer focus
Unit 2: Organization, top management commitment
Unit 3: Team work
Unit 4: Quality philosophies of Deming, Crosby and Muller

BLOCK 2 TQM Process

Unit 1: QC Tools, Problem solving methodologies
Unit 2: New management tools
Unit 3: Work habits, quality circles
Unit 4: Bench marking, strategic quality planning

BLOCK 3 TQM Systems

Unit 1: Quality policy deployment
Unit 2: Quality function deployment
Unit 3: Standardization
Unit 4: Designing for quality, manufacturing for quality

BLOCK 4 Quality Systems

Unit 1: Need for ISO 9000 system
Unit 2: Advantages, clauses of ISO 9000
Unit 3: Implementation of ISO 9000
Unit 4: Quality costs, quality, auditing, case studies

BLOCK 5 Implementation of TQM

Unit 1: Steps, KAIZEN
Unit 2: 5s, JIT
Unit 3: POKAYOKE, Taguchi methods
Unit 4: Case studies

Books:

1. Rose J. E., “Total quality Management”, Kogan Page Ltd
2. Bank, J., “The essence of Total Quality Management”, Prentice Hall of India
3. Bonds, G., “Beyond Total Quality Management”, McGraw Hill

SEMESTER : V
Subject Code : CHP005
Subject Title : Communication Skills Lab
Structure of the Course Content

I. PC based session (weightage-40%)

A. English Language Lab

1. Listening Comprehension

Listening and typing – Listening and sequencing of sentences – Filling in the blanks – Listening and answering the questions

2. Reading Comprehension and Vocabulary

Filling in the blanks - Cloze Exercises – Vocabulary building – Reading and answering questions.

3. Speaking:

Phonetics: Intonation – Ear Training – Correct Pronunciation – Sound recognition exercises -Common Errors in English

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

B. Career Lab

(Samples are available to learn and practice in the class room session)

1. Resume / Report Preparation / Letter Writing

Structuring the resume / report – Letter writing / E-mail communication – Samples

2. Presentation Skills

Elements of an effective presentation – Structure of a presentation – Presentation tools – Voice Modulation – Audience analysis – Body Language – Video Samples

3. Soft Skills

Time Management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity – Stress Management & Poise – Video Samples

4. Group Discussion

Why is GD part of selection process? – Structure of a GD – Moderator-led and other GDs – Strategies in GD – Team work – Body Language – Mock GD – Video Samples

5. Interview Skills

Kinds of Interviews – Required Key Skills – Corporate culture – Mock Interviews – Video Samples

II. Class Room Session (weightage-60%)

1. Resume / Report Preparation /Letter writing : Students prepare their own resume and report.

2. Presentation Skills: Students make presentations on given topics.

3. Group Discussion: Students participate in group discussions.

4. Interview Skills: Students participate in Mock interviews.

SEMESTER : V
Subject Code : CHP006
Subject Title : Heat Transfer Lab
Structure of the Course Content

1. Laminar Flow
2. Condenser (Vertical)
3. Condenser (Horizontal)
4. Convective Heat Transfer
5. Transient Heat Conduction
6. Agitated vessel
7. Natural Convection
8. Jacketed Kettle
9. Sreafan Boltzman experiment – Radiation.
10. Open Pan Evaporator
11. Characteristics of Temperature Measuring Device:

SEMESTER : VI
Subject Code : CH6001
Subject Title : Chemical Engineering- Thermodynamics-II
Structure of the Course Content

BLOCK 1 PROPERTIES OF SOLUTIONS

Unit 1: Partial molar properties
Unit 2: Ideal and non-ideal solutions
Unit 3: Standard states definition and choice
Unit 4: Gibbs-Duhem equation, excess properties of mixtures

BLOCK 2 PHASE EQUILIBRIA

Unit 1: Criteria for equilibrium between phases in multi component
Unit 2: Application of phase rule, vapour-liquid equilibrium
Unit 3: Phase diagrams for homogeneous systems
Unit 4: Effect of temperature and pressure on azeotrope composition

BLOCK 3 CORRELATION AND PREDICTION OF PHASE EQUILIBRIA

Unit 1: Activity coefficient-composition models
Unit 2: Thermodynamic consistency of phase equilibria
Unit 3: Application of the correlation and prediction of phase equilibria
Unit 4: Liquid extraction processes

BLOCK 4 CHEMICAL REACTION EQUILIBRIA

Unit 1: Definition of standard state, standard free energy change
Unit 2: Evaluation of reaction equilibrium constant, prediction of free energy data
Unit 3: Equilibria in chemical reactors
Unit 4: Thermodynamic analysis of simultaneous reactions

BLOCK 5 REFRIGERATION

Unit 1: Principles of refrigeration, methods of producing refrigeration
Unit 2: Liquefaction process, coefficient of performance
Unit 3: Evaluation of the performance of vapour compression
Unit 4: Gas refrigeration cycles

Books:

1. Hougen, O.A., Watson, K.M., and Ragatz, R.A., "Chemical Process Principles Part II", Thermodynamics, John Wiley, 1970.
2. Dodge, B.F., "Chemical Engineering Thermodynamics", McGraw-Hill, 1960.
3. Sandler, S.I., "Chemical and Engineering Thermodynamics", 2nd Edition, Wiley, 1989
4. Smith, J.M., VanNess, H.C., & Abbot M.C, "Introduction to Chemical Engineering Thermodynamics", McGraw Hill VII Edition 2004.
5. Narayanan K.V "A Text Book of Chemical Engineering Thermodynamics" Prentice Hall of India Pvt. Ltd. 2001

SEMESTER : VI
Subject Code : CH6002
Subject Title : Mass Transfer - II
Structure of the Course Content

BLOCK 1 ABSORPTION

Unit 1: Equilibrium and operating line concept in absorption calculations
Unit 2: Operating characteristics of stage wise and differential contactors
Unit 3: Volumetric mass transfer coefficients; multicomponent absorption
Unit 4: Mechanism and model of absorption with chemical reaction

BLOCK 2 DISTILLATION

Unit 1: Vapour-liquid equilibria, Raoult's law and deviations from ideality
Unit 2: Design calculations by McCabe- Thiele and ponchon-Savarit, methods
Unit 3: Continuous contact distillation tower (packed tower) design
Unit 4: Distillation low pressure distillation; steam distillation

BLOCK 3 LIQUID-LIQUID EXTRACTION

Unit 1: Equilibrium in ternary systems;
Unit 2: Differential contact extraction equipment
Unit 3: Pulsed extractors
Unit 4: Centrifugal extractors

BLOCK 4 SOLID-LIQUID EXTRACTION (LEACHING)

Unit 1: Solid-liquid equilibria
Unit 2: Leaching equipment
Unit 3: Batch and continuous types
Unit 4: Calculation of number of stages

BLOCK 5 ADSORPTION, ION EXCHANGE SEPARATION PROCESSES

Unit 1: Theories of adsorption of gases and liquids
Unit 2: Design calculation of ion-exchange resins
Unit 3: Membrane separation process
Unit 4: Foam separation process; Thermal and sweep diffusion process

Books:

1 . C.Judson King “Separation Processes”, McGraw-Hill II Edition 1980.
2. A.H.P.Skelland, “Diffusional Mass Transfer”, Krieger, Malapur, FL (1985).
3. Roman Zarfyki and Andrzej Chacuk, “Absorption Fundamentals and Applications", Pergamon Press, 1993.
4. P.Wankat “Separation Process Engineering ”, Prentice Hall, II Edition 2006.
5. R.F.Strigle (jr), Packed Tower Design and Application, 2nd Edn. Gulf Publishing Company U.S.A. 1994
6. R.E.Treybal, “Mass Transfer Operations”, McGraw-Hill, III Edition 1980.
7. W.L McCabe J.C.Smith, and Harriot. P., “Unit Operations of Chemical Engineering”, VI edition McGraw-Hill, International Edition, 2001

SEMESTER : VI
Subject Code : CH6003
Subject Title : Process Instrumentation and Control

Structure of the Course Content

BLOCK 1 Open Loop Systems

Unit 1: Laplace transformation, transform of standard functions
Unit 2: Open-loop systems, first order systems
Unit 3: Linearization and its application in process control
Unit 4: Transfer function for chemical reactors and dynamics

BLOCK 2 Closed Loop Systems

Unit 1: Block diagram for feed-back control systems
Unit 2: Servo and regulator problems
Unit 3: Transfer function for controllers and final control element
Unit 4: Principles of pneumatic and electronic controllers

BLOCK 3 Frequency Responses

Unit 1: Introduction to frequency response of closed-loop systems
Unit 2: Bode diagram, stability criterion
Unit 3: Nyquist diagram
Unit 4: Tuning of controller settings

BLOCK 4 Advanced Control Systems

Unit 1: Introduction to advanced control systems
Unit 2: Cascade control, feed forward control
Unit 3: Control of distillation towers and heat exchangers
Unit 4: Introduction to microprocessors and computer control of chemical processes

BLOCK 5 Process Control Instruments

Unit 1: Classification of process control instruments
Unit 2: Measurements of temperature, pressure, fluid flow
Unit 3: Viscosity and consistency, pH, concentration
Unit 4: Electrical and thermal conductivity, humidity of gases

Books:

1. Thomas, E.Marlin, Process Control, 2nd Edn, McGraw-Hills International Edn. 2000.
2. George Stephanopoulos, Chemical Process Control, Prentice Hall of India 2003.
3. Norman H.CEAGLSKE, Automatic process control for chemical engineers, John Wiley & Sons, Japan.
4. Emenule, S.Savas, "Computer Control of Industrial Processes", McGraw-Hill, London, 1965.
5. Eckman, D.P., "Industrial Instrumentation", Wiley, 1978
6. D. SCoughnowr and Koppel, "Process Systems Analysis and Control", McGraw-Hill, New York, 1991.
7. George Stephanopoulos, "Chemical Process Control", Prentice-Hall of India Pvt. Ltd., New Delhi, 1990.
8. Patranabis.D, Principles of Process control, II edition, Tata McGraw-Hill Publishing Co. Ltd., 1981.
9. Peter Harriott, Process control, Tata McGraw-Hill Publishing Co., Reprint 2004

SEMESTER : VI
Subject Code : CH6004
Subject Title : Chemical Reaction Engineering - I

Structure of the Course Content

BLOCK 1 REACTION KINETICS

Unit 1: Law of mass action, rate equation, elementary, non-elementary reactions
Unit 2: Theories of reaction rate and temperature dependency
Unit 3: Analysis of experimental reactor data
Unit 4: Integral and differential analysis for constant variable volume system

BLOCK 2 IDEAL REACTORS

Unit 1: Design for homogeneous systems
Unit 2: Stirred tank and tubular flow reactor
Unit 3: Design of reactors for multiple reactions
Unit 4: Combination reactor system, size comparison of reactors

BLOCK 3 CHOICE OF REACTORS

Unit 1: Factors affecting choice, optimum yield and conversion
Unit 2: Selectivity, reactivity and yield problems
Unit 3: Consecutive, parallel and mixed reactions
Unit 4: Recycle

BLOCK 4 HEAT EFFECTS IN REACTORS

Unit 1: Isothermal and non isothermal homogeneous reactor systems
Unit 2: Adiabatic reactors, rates of heat exchanges for different reactors
Unit 3: Design for constant rate heat input and constant heat transfer coefficient
Unit 4: Batch and continuous reactors, optimum temperature progression

BLOCK 5 REACTOR STABILITY AND REACTION EQUILIBRIA

Unit 1: Equilibrium in chemically reactive systems
Unit 2: Evaluation of reaction equilibrium constant
Unit 3: Effect of temperature on equilibrium
Unit 4: Computation of equilibrium composition

Books:

1. Levenspiel.O, “Chemical Reaction Engineering”, John Wiley, III Ediition, 1998.
2. Smith.J.M., “Chemical Engineering Kinetics”, McGraw-Hill Third Edition, 1981.
3. Fogler .S “Fundamental Chemical Reaction Engg”, Prentice Hall of India

SEMESTER : VI
Subject Code : CH6005
Subject Title : Petroleum Refinery Engineering
Structure of the Course Content

BLOCK 1 Introduction to Petroleum

Unit 1: Origin, Exploration and production of petroleum
Unit 2: Types of crudes, Composition, characteristics
Unit 3: Products pattern and characteristics, indigenous and imported crudes
Unit 4: Availability Vs Demands, Future outlook

BLOCK 2 Refining

Unit 1: Engineering aspects of refining, Reaction stoichiometry
Unit 2: Chemical kinetics; Thermo chemistry and chemical equilibrium
Unit 3: Mixuing in flow systems; Reactor design. Crude heating,
Unit 4: Energy input and recovery, Vacuum distillation, Types of trays

BLOCK 3 Solvent Extractions

Unit 1: Lube oil and wax processing, Solvent extraction, Dewaxing, Deciling,
Unit 2: Clay contacting, principles, technologies, operating parameters
Unit 3: Product qualities, Air blowing technology
Unit 4: Storage and handling of crude products

BLOCK 4 Catalysts

Unit 1: Fluid catalytic cracking, principles, recent developments
Unit 2: Feedstocks and product yields and qualities,
Unit 3: Catalysts and operating parameters
Unit 4: Hydrocracking, principles, process requirements

BLOCK 5 Catalytic Reforming

Unit 1: Catalytic reforming and Isomerisation, Reforming, Principles
Unit 2: Developments in technology, Catalyst types and their performance
Unit 3: Effects of operating parameters, Feed quality, Product improvement
Unit 4: Sulphur removal, Aromatics removal, Hydrofinishing

Books:

1. Nelson, W.L "Petroleum Refinery Engineering" McGraw Hill Publishing Company Limited
2. Smalheer, C.V and R.Kennedy Smith Lubricant Additives. The Lezius – Hill Company, Cleveland, Ohio. USA
3. Hobson, G.D. – Modern petroleum Refining Technology, 4th Edition, Institute of Petroleum U.K

SEMESTER : VI
Subject Code : CHP007
Subject Title : Process Instrumentation and Control Lab
Structure of the Course Content

1. ON-OFF control of thermal process
2. Simulation of Proportional Controller
3. Flow control loop and Flow Transmitter
4. Level Control loop and Level Transmitter
5. Pressure control loop and Pressure Transmitter
6. Control valve characteristics
7. Verifying the inherent characteristics of control valve
8. Flow co-efficient of control valve
9. Range ability of control valve
10. Verifying the response of Non-Interacting level System
11. Verifying the response of Interacting level System
12. Effect of PI controller on flow control System
13. The effect of a P controller on level process for set point and load changes
14. Effect of P, PI, PID Controller on Pressure Control Loop
15. Optimum controller setting using Zigler's Nichols Methods
16. Optimum Controller Tuning on Level Process Station

SEMESTER : VI
Subject Code : CHP008
Subject Title : Mass Transfer Lab
Structure of the Course Content

1. Simple distillation.
2. Steam distillation.
3. Packed column distillation.
4. Bubble cap distillation.
5. Diffusivity measurements.
6. Liquid-liquid extraction.
7. Vacuum Dryer.
8. Tray dryer.
9. Rotary dryer.
10. Surface Evaporation.
11. Adsorption.
12. Leaching.

SEMESTER : VII
Subject Code : CH7001
Subject Title : Chemical Reaction Engineering - II

Structure of the Course Content

BLOCK 1 NON-IDEAL REACTORS

Unit 1: The residence time distribution as a factor performance
Unit 2: Residence time functions and relationship between them in reactor;
Unit 3: Basic models for non-ideal flow
Unit 4: Conversion in non ideal reactors

BLOCK 2 HETEROGENEOUS PROCESS AND SOLID CATALYSIS

Unit 1: Rate equations for heterogeneous reactions nature of catalysis
Unit 2: Adsorption isothermal and rates of adsorption
Unit 3: Desorption and surface reaction analysis of rate equation
Unit 4: Surface area and pore-volume distribution, catalyst preparation

BLOCK 3 GAS-SOLID CATALYTIC REACTORS

Unit 1: Diffusion within catalyst particle effective thermal conductivity
Unit 2: Mass and heat transfer within catalyst pellets
Unit 3: Effective factors
Unit 4: Thiele Modulus, fixed bed reactors

BLOCK 4 GAS-SOLID NON-CATALYTIC REACTORS

Unit 1: Models for explaining the kinetics
Unit 2: Volume and surface models; controlling resistances and rate controlling steps
Unit 3: Time for complete conversion for single and mixed sizes
Unit 4: Fluidized and static reactors

BLOCK 5 GAS-LIQUID REACTIONS

Unit 1: Absorption combined with chemical reactions
Unit 2: Mass transfer coefficients and kinetic constants
Unit 3: Application of film penetration and surface renewal theories
Unit 4: Hatta number and enhancement factor for first order reaction

Books:

1. Smith J.M., “Chemical Engineering Kinetics”, 3rd edition, McGraw-Hill, New York, 1981
2. Fogler. H.S., “Elements of Chemical reaction engineering III edition, Prentice Hall of India Pvt. Ltd., 1998 (Indians Reprint 2003)
3. Levenspiel, O; “Chemical Reaction Engineering”, III Edition, John Wiley, 1998

SEMESTER : VII
Subject Code : CH7002
Subject Title : Process Plant Utilities
Structure of the Course Content

BLOCK 1 STEAM

Unit 1: Steam generation and its application in chemical process plants
Unit 2: Design of efficient steam heating systems
Unit 3: Steam economy, condensate utilization, steam traps
Unit 4: Selection and application, waste heat utilization

BLOCK 2 COMPRESSORS AND VACUUM PUMPS

Unit 1: Types of compressors and vacuum pumps
Unit 2: Methods of vacuum development and their limitations
Unit 3: Materials handling under vacuum, piping systems
Unit 4: Lubrication and oil removal in compressors in pumps

BLOCK 3 REFRIGERATION SYSTEMS

Unit 1: Refrigeration system and their characteristics
Unit 2: Load calculation and humidification and de humidification equipments
Unit 3: Drying and cooling tower, air blending
Unit 4: Exhaust, ventilation,cryogenics,

BLOCK 4 INSULATION

Unit 1: Importance of insulation for meeting for the process equipment
Unit 2: Fitting and valves
Unit 3: Insulation for high, intermediate, low temperatures
Unit 4: Determination of optimum insulation thickness

BLOCK 5 INERT GASES

Unit 1: Properties of inert gases & their use
Unit 2: Sources and methods of generation
Unit 3: Comparison of nitro generation routes
Unit 4: Operational, maintenance and safety aspects

Books:

1. Jack Broughton; Process utility systems; Institution of Chem. Engineers U.K.
2. Reid, Prausnitz poling; The properties of gases & liquids, IV ed. McGraw Hill international ed.
3. S.C.Arora & S.Domkumdwar; A course in refrigeration and air conditioning; Dhanpat Rai & Co.(P) ltd.

SEMESTER : VII
Subject Code : CH7003
Subject Title : Transport Phenomena
Structure of the Course Content

BLOCK 1 Basic Concept of Transport Properties

Unit 1: Phenomenological Equations and Transport properties
Unit 2: Rheological behaviour of fluids
Unit 3: Balance Equations
Unit 4: Differential and Integral equations

BLOCK 2 Applications of Differential Equations of Change

Unit 1: Applications in laminar transport in compressible fluids
Unit 2: Applications in Turbulent transport in compressible fluids
Unit 3: Applications in laminar and turbulent transport in incompressible fluids
Unit 4: Boundary layer theory

BLOCK 3 Applications of Integral Equations of Change

Unit 1: Macroscopic balance for isothemal and nonisothermal systems
Unit 2: Macroscopic balance for isothemal systems and their applications
Unit 3: Macroscopic balance for nonisothemal systems and their applications
Unit 4: Heat and Mass transport problems

BLOCK 4 Interphase and Multiphase momentum Transfer

Unit 1: Friction factor, Fluid –Fluid systems
Unit 2: Flow patterns in vertical and horizontal pipes
Unit 3: Formulation of bubbles and drops and their size distribution
Unit 4: Solid – fluid systems, Forces acting on stagnant and moving solids,

BLOCK 5 Interphase Transport in Non-isothermal

Unit 1: Heat Transfer coefficient, Forced convection in tubes
Unit 2: Around submerged objects, Heat Transfer by free convection
Unit 3: Film type and dropwise condensation and equations for heat transfer
Unit 4: Heat transfer in boiling liquids

Books:

1. Brodkey, R. S. and Hershey, H. C., "Transport Phenomena – A Unified Approach", Brodkey Publishing
2.Welty, J.R., Wicks, C. E. and Wilson, R. E., "Fundamentals of Momentum, Heat Mass Transfer", 5th Edn., John Wiley and Sons
3.Bird R.B., Stewart, W. E. and Lightfoot, E. N., "Transport Phenomena", 2nd Edn., John Wiley and Sons

SEMESTER : VII
Subject Code : CHP009
Subject Title : Chemical Reaction Engineering Lab
Structure of the Course Content

1. Kinetic studies in a batch reactor
2. Kinetics in a plug flow reactor
3. Kinetics in a PFR followed by a CSTR
4. RTD in a PFR
5. RTD in a packed bed
6. RTD in CSTRs in series

SEMESTER : VIII
Subject Code : CH8001
Subject Title : Petrochemicals Engineering
Structure of the Course Content

BLOCK 1 Introduction to Petrochemicals

Unit 1: Overview of petrochemical
Unit 2: Overview of petrochemical industrial Growth in India
Unit 3: Economics in Petrochemicals
Unit 4: Feedstock Selection for Petrochemicals

BLOCK 2 Accessories in Petrochemicals-I

Unit 1: Steam reforming, Hydrogen
Unit 2: Synthesis gas, cracking of gaseous and liquid for stocks
Unit 3: Olefins, Diolifins
Unit 4: Acetylene and Aromatics and their separation

BLOCK 3 Accessories in Petrochemicals-II

Unit 1: Alkylation, Oxidation
Unit 2: Dehydrogenation, Nitration
Unit 3: Chlorination
Unit 4: Sulphonation and Isomerization

BLOCK 4 Chemicals

Unit 1: Chemicals from synthesis gas
Unit 2: Olefins
Unit 3: Diolefins
Unit 4: Acetylene and Aromatics

BLOCK 5 Production Techniques

Unit 1: Modes and techniques
Unit 2: Production of Polyethylene, PVC
Unit 3: Polypropylene, SAN, ABS, SBR, Polyacrylonitrile
Unit 4: Polycarbonates, Polyurethane, Nylon, PET

Books:

1.Sitting M., Aromatics Hydrocarbons, Manufacture and Technology, Noyes Data Corporation
2. Brownstein A.M. Trends in Petrochemical Technology, Petroleum Publishing Company
3. Stevens P.M. Polymer Chemistry, Addison Wesley Publishing Company

SEMESTER : VIII
Subject Code : CHP010
Subject Title : Petro Products Testing Lab
Structure of the Course Content

List of Experiments

1. Determination of flash point
2. Viscosity Determination
3. Aniline point determination
4. API gravity determination
5. Determination of aromatic content
6. Hydrogen sulphide content determination
7. Sulphur content determination
8. Determination of calorific value
9. Bitumen testing
10. Carbon residue determination (Conradson apparatus)
11. Cloud point and pour point estimation
12. Cgealing point of wax
13. Foaming characteristics of lube oil
14. Smoke point estimation
15. Corrosion testing of petroleum oil
16. API distillation apparatus
17. Moisture determination other than Karl-Fischer method

SEMESTER : VIII
Subject Code : CHP011
Subject Title : Project
Structure of the Course Content

Practical

The objective of the project work is to enable the students to work in convenient groups of not more than four members in a group on a project involving theoretical and experimental studies related to Chemical Engineering. Every Project Work shall have a Guide who is a member of the faculty of Chemical Engineering of the college where the student is registered. The hours allotted for this course shall be utilized by the students to receive directions from the Guide, on library reading, laboratory work, computer analysis or field work and also to present in periodical seminars the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature Survey, problem statement, Project work details and conclusions. This experience of project work shall help the student in expanding his / her knowledge base and also provide opportunity to utilise the creative ability and inference capability

ELECTIVE
Subject Code : CHE001
Subject Title : Project Engineering and Process Plant
Structure of the Course Content

BLOCK 1 Introduction to Project Engineering

Unit 1: Project definition, Project Profile and standards
Unit 2: Feedback information (MIS)
Unit 3: Evaluation and Modification
Unit 4: Selection, Criteria

BLOCK 2 Process Planning

Unit 1: Planning the process, Strategic and Managerial Planning
Unit 2: Organising the process planning, cost and costing, Cost Control systems
Unit 3: Methods (PERT/CPM), Engineering Flow Diagrams, Cost requirements
Unit 4: Analysis and Estimation of Process Feasibilities

BLOCK 3 Plant Engineering Management

Unit 1: Objectives, Programme, Control, Plant Location and Site Selection
Unit 2: Layout diagrams, Selection and procurement of equipments
Unit 3: Installation, Recommission, Commissioning and performance appraisal
Unit 4: Strategies choice and Influence, Product planning and development

BLOCK 4 Safety Standards

Unit 1: Process safety, Materials safety and Handling regulations
Unit 2: Safety in equipment and machinery operations
Unit 3: Design considerations of safety organization and control
Unit 4: Pollution, Pollution control and Abatement, Industrial Safety Standard

BLOCK 5 Pollution Control

Unit 1: Government regulations on procurement of raw materials
Unit 2: Export – Import regulations, Pricing policy, Industrial licensing procedure
Unit 3: Excise and commercial taxes, Policies on depreciation and corporate tax
Unit 4: Factory act, Regulations of Pollution Control Board.

Books:

1. Cheremisinoff, N. P., Practical Guide to Industrial Safety: Methods for Process Safety Professionals, CRC Press
2. Couper, J. R., Process Engineering Economics, CRC Press
3. Perry, J. H. "Chemical Engineer's Hand Book", 8th Ed., McGraw Hill, New York

ELECTIVE
Subject Code : CHE002
Subject Title : Fluidization Engineering
Structure of the Course Content

BLOCK 1 Introduction to Fluidization

Unit 1: The Fluidized state, Nature of hydrodynamic suspension
Unit 2: Particle forces, species of Fluidization, Regimization of the fluidized state
Unit 3: Operating models for fluidization systems
Unit 4: Applications of fluidization systems

BLOCK 2 Hydrodynamics of Fluidization Systems

Unit 1: General bed behaviour, pressure drop, Flow regimes, Incipient Fluidization
Unit 2: Pressure fluctuations, Phase Holdups, Measurements Techniques
Unit 3: Empirical Correlations for Solids holdup, liquid holdup and gas holdup
Unit 4: Flow models – generalized wake model, structural wake model

BLOCK 3 Solids Mixing and Segregation

Unit 1: Phase juxtapositions operation shifts, Reversal points
Unit 2: Degree of segregation, Mixing Segregation equilibrium
Unit 3: Generalised fluidization of poly disperse systems
Unit 4: Liquid phase Mixing and gas phase mixing

BLOCK 4 Heats and Mass Transfer in Fluidization System

Unit 1: Mass transfer – Gas Liquid mass transfer
Unit 2: Liquid Solid mass transfer and wall to bed mass transfer, Heat transfer
Unit 3: Bed heat transfer, Immersed vertical cylinder to bed heat transfer
Unit 4: Immersed horizontal cylinder to bed heat transfer

BLOCK 5 Special Systems

Unit 1: Conical Fluidized bed, Moving bed, Slurry bubble columns
Unit 2: Turbulent bed contactor, Two phase and Three phase inverse fluidized bed
Unit 3: Semi fluidized bed systems, Annular systems, Typical applications
Unit 4: Powder characterization and modeling by bed collapsing

Books:

1. Kunii, D. and Levenspiel, O., "Fluidization Engineering", 2nd Edn., Butterworth-Heinemann, London
2. Kwauk, M., "Fluidization - Idealized and Bubbleless, with applications", Science Press
3. Fan, L. S., "Gas- liquid Solid Fluidization Engineering", Butterworths

ELECTIVE
Subject Code : CHE003
Subject Title : Safety and Hazard Control
Structure of the Course Content

BLOCK 1 Basic Concept of Safety

Unit 1: Conventional and modern concepts of safety
Unit 2: Basic Principles and concepts in hazard identification, Chemical hazards
Unit 3: Process and operation hazard, Hazards from utilities like air, water, steam
Unit 4: Occupational health hazards, Hazard and operability Studies, Safety Audits

BLOCK 2 Accident Analysis

Unit 1: Past Accident Analysis
Unit 2: Consequence Analysis of fire, gas/vapour
Unit 3: Dispersions and explosion, Vulnerability models
Unit 4: Fault and Event Tree Analysis

BLOCK 3 Risk Assessments

Unit 1: Introduction to Risk Assessment
Unit 2: Safety in plant design and layout
Unit 3: Risk Assessment
Unit 4: Case Studies

BLOCK 4 Safety Measures

Unit 1: Safety measures in handling and storage of chemicals
Unit 2: Process plant
Unit 3: Personnel Protection
Unit 4: First Aid

BLOCK 5 Emergency Plans

Unit 1: Need of Emergency Plans
Unit 2: Disaster mitigation
Unit 3: Emergency Preparedness plans
Unit 4: Case Studies

Books:

1.Well, G.S Safety Process Plants Design, George Godwin Ltd., London, John Wilelys and Sons, New York
2. Safety in Chemical and Petrochemical Industries, Report of the Inter Ministry Group, Dept. of Chemicals and Petrochemicals, Govt.of India, ICMA Publications.
3. Major Hazard Control, Manual by International Labour Organization, Geneva

ELECTIVE
Subject Code : CHE004
Subject Title : Food Technology
Structure of the Course Content

BLOCK 1 Basics of Food Technology

Unit 1: General aspects of food industry
Unit 2: World food needs
Unit 3: Indian food needs
Unit 4: Recent Trends in Food Technology

BLOCK 2 FOOD CONSTITUENTS, QUALITY AND DERIVATIVE FACTORS

Unit 1: Constituents of food
Unit 2: Quality and nutritive aspects
Unit 3: Food additives; standards
Unit 4: Deteriorative factors and their control

BLOCK 3 GENERAL ENGINEERING ASPECTS AND PROCESSING METHODS

Unit 1: Need For Storage of Foods
Unit 2: Preliminary processing methods
Unit 3: Conversion of Foods
Unit 4: Preservation operations in Foods

BLOCK 4 FOOD PRESERVATION METHODS

Unit 1: Preservation by heat and cold
Unit 2: Dehydration; concentration; drying irradiation
Unit 3: Microwave heating; sterilization and pasteurization
Unit 4: Fermentation and pickling; packing methods

BLOCK 5 PRODUCTION AND UTILISATION OF FOOD PRODUCTS

Unit 1: Cereal grains; pulses; vegetables; fruits; spices; fats and oils
Unit 2: Bakery; confectionery and chocolate products
Unit 3: Soft and alcoholic beverages; dairy products
Unit 4: Meat; poultry and fish products

Books:

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
3. Heid J.L. Joslyn M.A., Fundamentals of Food Processing Operation, The AVI publishing Co., West port 1967.
4. Potter N.N., Food Science, The AVI publishing Co., Westport, 1963

ELECTIVE
Subject Code : CHE005
Subject Title : Process Optimization
Structure of the Course Content

BLOCK 1 OPTIMISATION

Unit 1: Introduction; formulation of objective functions
Unit 2: Fitting models to data; classification of functions
Unit 3: Analytical methods Lagrange multiplier methods
Unit 4: Necessary and sufficient conditions for stationary points

BLOCK 2 NUMERICAL METHODS

Unit 1: Unimodal functions; Newton's quasi Newton, secant methods
Unit 2: Region elimination methods, polynomial approximation
Unit 3: Multimodal functions; direct methods; random, grid
Unit 4: Powell's technique; indirect methods; gradient and conjugate gradient

BLOCK 3 MULTIVARIABLE OPTIMIZATION

Unit 1: Unconstrained Multivariable Optimization Algorithms
Unit 2: Optimality criteria, Unidirectional search, direct search methods
Unit 3: Evolutionary optimization method, simplex search method
Unit 4: Powell's conjugate direction method. Gradient-based methods

BLOCK 4 LINEAR AND NON-LINEAR PROGRAMMING

Unit 1: Review on basic concepts of LP formulations
Unit 2: Simplex methods
Unit 3: Integer, quadratic programming
Unit 4: Geometric and dynamic programming

BLOCK 5 APPLICATIONS

Unit 1: Heat transfer and energy conservation
Unit 2: Separation processes
Unit 3: Fluid flow systems
Unit 4: Reactor design and operation; large scale systems

Books:

1. Biles, W.E., Swain, J.J.; "Optimisation and Industrial Experimentation ", Inter Science, New York, 1980.
2. Seinfeld, J.H.; Lapidus, L; "Process Modelling, Estimation and Identification ", Prentice Hall, Englewood Cliffs, New Jersey, 1974
3. Edgar, T.F., Himmelblau, D.M., " Optimisation of Chemical Processes ", McGraw-Hill Book Co., New York, 1985.
4. Reklaitis, G.V., Ravindran, A., Ragsdell, K.M. " Engineering Optimisation ", John Wiley, New York, 1980

ELECTIVE
Subject Code : CHE006
Subject Title : Fertilizer Technology
Structure of the Course Content

BLOCK 1 NITROGENOUS FERTILISERS

Unit 1: Methods of production of nitrogenous fertilizer
Unit 2: Ammonium sulphate, nitrate, urea and calcium ammonium nitrate
Unit 3: Ammonium chloride and their methods of production
Unit 4: Characteristics and specifications, storage and handling

BLOCK 2 PHOSPHATIC FERTILISERS

Unit 1: Raw materials; phosphate rock, sulphur; pyrites
Unit 2: Processes for the production of sulphuric and phosphoric acids
Unit 3: Phosphates fertilizers - ground rock phosphate
Unit 4: Thermal phosphates and their methods of production

BLOCK 3 POTASSIC FERTILISERS

Unit 1: Methods of production of potassium chloride
Unit 2: Methods of production of potassium schoenite
Unit 3: Characteristics and specifications of potassium chloride
Unit 4: Characteristics and specifications of potassium schoenite

BLOCK 4 COMPLEX AND NPK FERTILISERS

Unit 1: Methods of production of ammonium phosphate
Unit 2: Sulphate diammonium phosphate, nitrophosphates, urea
Unit 3: Ammonium phosphate, mono-ammonium phosphate
Unit 4: Various grades of NPK fertilizers produced in the country

BLOCK 5 MISCELLANEOUS FERTILISERS

Unit 1: Mixed fertilizers and granulated mixtures
Unit 2: Biofertilisers, nutrients, secondary nutrients and micro nutrients
Unit 3: Fluid fertilizers, controlled release fertilizers
Unit 4: Controlled release fertilizers

Books:

1. Sauchelli, V.; "The Chemistry and Technology of Fertilizers", ACS MONOGRAPH No. 148, Reinhold Publishing Cor. New York, 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
4. "Handbook of fertilizer technology", Association of India, New Delhi, 1977.
5. Menno, M.G.; "Fertilizer Industry - An Introductory Survey", Higginbothams Pvt. Ltd., 1973.

ELECTIVE
Subject Code : CHE007
Subject Title : Polymer Technology
Structure of the Course Content

BLOCK 1 Introduction to Polymer Processing Methods

Unit 1: Introduction to Polymer Technology
Unit 2: Introduction to various Polymer Processing methods
Unit 3: Machinery Morphology
Unit 4: Structure of Polymers

BLOCK 2 Channel Models

Unit 1: Screw Extrusion – Geometry of screw – Simplified Flat plate Model
Unit 2: Rectangular channel model; cylindrical Channel Model
Unit 3: Helical Channel Model; Newtonian and Non-Newtonian flows
Unit 4: Isothermal, non-isothermal and adiabatic Models

BLOCK 3 Moulding Process

Unit 1: Injection Moulding
Unit 2: Various parts of the moulds
Unit 3: Analysis of flow through mould Cavity
Unit 4: Various Models; Balancing of runners

BLOCK 4 Mixing Operations

Unit 1: Newtonian and non-Newtonian models
Unit 2: Calendar fed with finite sheet
Unit 3: Normal stress and viscosity effects
Unit 4: oating – Mixing operations

BLOCK 5 Expert Systems

Unit 1: Modelling of Polymer Process
Unit 2: Advanced Process in Polymer Technology
Unit 3: Knowledge based expert systems for modeling of polymer processing
Unit 4: Case Studies

Books:

1. Agassant, J.F. Avenas, P, Sergant, J,Ph., and Correon, P.J. “Polymer Porcessing” Carl Hamsen Verlag Munich
2.Tucker C.L, “Fundamentals of Computer Modelling for Polymer Processing”, Carl Hamsen Verlag, Munich

ELECTIVE
Subject Code : CHE008
Subject Title : Computer Technology For Chemical Engineering
Structure of the Course Content

BLOCK 1 Introduction to Computer Languages

Unit 1: Review on Programming languages
Unit 2: BASIC
Unit 3: FORTRAN
Unit 4: Review on operating system commands

BLOCK 2 SPREAD SHEETS

Unit 1: Application in Density, molecular weight, mole and percentage compositions
Unit 2: Empirical and Molecular formula calculations
Unit 3: Heat of mixing, Gas laws
Unit 4: Vapour pressure, Chemical Kinetics calculations

BLOCK 3 SPREAD SHEETS (DATA ANALYSIS)

Unit 1: Application in data processing, Statistical analysis of data
Unit 2: Regression. Analysis of variance, Interpolation
Unit 3: Graphical representations of various Chemical Engineering problem
Unit 4: Mechanical operation, Reaction Engineering, Distillation

BLOCK 4 DATABASE

Unit 1: Design and developments of simple databases on Chemical
Unit 2: Retrieval and Database in report, query and other formats
Unit 3: Interfacing with other softwares
Unit 4: Preparation of Material and energy Balances preparation of plant layout

BLOCK 5 MATHEMATICAL PROGRAMMING

Unit 1: Linear Programming
Unit 2: Transportation, Assignment
Unit 3: Dynamic Programming in Chemical Engineering
Unit 4: Formulation and solution through PC based programes

Books:

1. Jerry, O., Breneman, G.L. Spreadsheet Chemistry, Prentice Hall, Englewood Cliffs, 1991.
2. Myers, A.L. Seider W.D. Introduction to Chemical engineering and Computer Calculations
3. Hanna, O.T. Scandell, O.C. Computational Methods in Chemical Engineering, Prentice Hall, 1995.
4. R.K. Taxali, T.K. dBase IV made simple, Tata McGraw-Hill 1991