



**B.TECH PETROCHEMICAL TECHNOLOGY
 (FOUR YEAR FULL TIME)
 CURRICULUM-2008
 SEMESTER I**

Code No.	Course Title	L	T	P	C
THEORY					
XPC101	Technical English	3	1	0	4
XPC102	Mathematics- I	3	1	0	4
XPC103	Applied Physics	3	1	0	4
XPC104	Applied Chemistry	3	1	0	4
XPC105	Engineering Graphics	2	0	3	4
XPC106	Basic Engineering I	3	0	0	3
PRACTICAL					
XPC107	Applied Physics Lab	0	0	3	2
XPC108	Applied Chemistry Lab	0	0	3	2
XPC109	Basic Workshop Practice	0	0	3	2

Total Hours:33

Total Credits:29

SEMESTER II

Code No.	Course Title	L	T	P	C
THEORY					
XPC201	Mathematics – II	3	1	0	4
XPC202	Computer Programming	3	0	0	3
XPC203	Mechanical operations	3	1	0	4
XPC204	Basic Engineering II	3	0	0	3
XPC205	Organic Chemistry	3	0	0	3
XPC206	Fluid Mechanics	3	1	0	4
PRACTICAL					
XPC207	Computer Programming Lab	0	0	3	2
XPC208	Communication Skills Enhancement	2	0	2	3
XPC209	Basic Engineering Lab	0	0	4	2

Total Hours:32

Total Credits:28

SEMESTER III

Code No.	Course Title	L	T	P	C
THEORY					
XPC301	Professional Ethics and Human values (PC)	3	0	0	3
XPC302	Process Calculations	3	1	0	4
XPC303	Material Science and Technology	3	0	0	3
XPC304	Chemical Technology	3	0	0	3
XPC305	Chemical Engineering Thermodynamics	3	1	0	4
XPC306	Physical chemistry	3	1	0	4
PRACTICAL					
XPC307	Unit operations Lab	0	0	4	2
XPC308	Organic Chemistry Lab	0	0	4	2

Total Hours:29

Total Credits:25

SEMESTER IV

Code No.	Course Title	L	T	P	C
THEORY					
XPC401	Environmental Science & Engineering	3	0	0	3
XPC402	Petrochemical Refinery Engineering I	3	1	0	4
XPC403	Heat Transfer	3	1	0	4
XPC404	Process Instrumentation	3	0	0	3
XPC405	Chemical Reaction Engineering I	3	1	0	4
XPC406	Petrochemical technology I	3	1	0	4
PRACTICAL					
XPC407	Petrochemical Analysis Lab	0	0	4	2
XPC408	Physical Chemistry Lab	0	0	4	2

Total Hours:30

Total Credits:26

SEMESTER V

Code No.	Course Title	L	T	P	C
THEORY					
XPC501	Applied mathematics	3	1	0	4
XPC502	Plant utilities and Heat engines	3	0	0	3
XPC503	Petrochemical technology II	3	0	0	3
XPC504	Mass Transfer I	3	1	0	4
XPC505	Petrochemical Refinery Engineering II	3	0	0	3
XPC506	Chemical Reaction Engineering II	3	1	0	4
PRACTICAL					
XPC507	Heat Transfer Lab	0	0	4	2
XPC508	Chemical Reaction Engineering Lab	0	0	4	2

Total Hours:29

Total Credits:25

SEMESTER VI

Code No.	Course Title	L	T	P	C
THEORY					
XPC601	Total Quality Management	3	0	0	3
XPC602	Multi-component distillation	3	1	0	4
XPC603	Natural Gas Engineering	3	0	0	3
XPC604	Mass Transfer II	3	1	0	4
XPC605	Process Dynamics and Control	3	1	0	4
XPC606*	Elective – I	3	0	0	3
PRACTICAL					
XPC607	Petrochemical Product Testing Lab	0	0	4	2
XPC608	Mass Transfer Lab	0	0	4	2
	TOTAL	18	3	8	25

Total Hours:29

Total Credits:25

SEMESTER VII

Code No.	Course Title	L	T	P	C
THEORY					
XPC701	Social Engineering	3	0	0	3
XPC702	Process Engineering Economics	3	0	0	3
XPC703	Optimization Techniques	3	0	0	3
XPC704	Process Modeling and Simulation	3	1	0	4
XPC705*	Elective - II	3	0	0	3
XPC706*	Elective - III	3	0	0	3
PRACTICAL					
XPC707	Process Dynamics and Control Lab	0	0	4	2
XPC708	Process Equipment Design and Drawing Lab	0	3	4	5
XPC709	Mini Project	0	0	4	4

Total Hours:34

Total Credits:30

SEMESTER VIII

Code No.	Course Title	L	T	P	C
THEORY					
XPC801	Entrepreneurial Development management	3	0	0	3
XPC802	Industrial Safety	3	0	0	3
XPC803*	Elective – IV	3	0	0	3
XPC804*	Elective – V	3	0	0	3
PRACTICAL					
XPC805	Project Work & IPT Evaluation	0	0	24	12

Total Hours:36

Total Credits:24

Over all Credits: 212

LIST OF ELECTIVES

ELECTIVE I

Code No.	Course Title	L	T	P	C
XPC606A	Fluidization Engineering	3	0	0	3
XPC606B	Polymer Engineering and Technology	3	0	0	3
XPC606C	Petro-Geology	3	0	0	3
XPC606D	Chemical work organization and Management	3	0	0	3

ELECTIVE II

Code No.	Course Title	L	T	P	C
XPC705A	Petroleum Reservoir Modeling & Reserve Calculation	3	0	0	3
XPC705B	Transport of Petroleum Products	3	0	0	3
XPC705C	Petroleum Exploration and Exploitation	3	0	0	3
XPC705D	Industrial Catalysis	3	0	0	3

ELECTIVE III

Code No.	Course Title	L	T	P	C
XPT706A	Computation Techniques in Engineering	3	0	0	3
XPT706B	Pinch Technology / Energy Audit	3	0	0	3
XPT706C	Pilot Plant and Scale up Methods	3	0	0	3
XPT706D	Computational Fluid Dynamics	3	0	0	3

ELECTIVE IV

Code No.	Course Title	L	T	P	C
XPT803A	Transport phenomena	3	0	0	3
XPT803B	Project Engineering	3	0	0	3
XPT803C	Novel Separation Techniques	3	0	0	3
XPT803D	Advanced Process Control	3	0	0	3

ELECTIVE V

Code No.	Course Title	L	T	P	C
XPT804A	Air pollution control	3	0	0	3
XPT804B	Corrosion engineering	3	0	0	3
XPT804C	Handling and storage of gas and oil	3	0	0	3
XPT804D	Energy Audit	3	0	0	3

SYLLABUS 2008

XPC101

3 1 0 4

TECHNICAL ENGLISH

UNIT – I FOCUS ON LANGUAGE

15

Word formation with prefixes and suffixes - synonyms and antonyms - nominal compounds , prepositions, homonyms, homophones and hyponyms, Part of speech, use of words as nouns and verbs, phrasal verbs, connectives, sentences patterns.

Suggested Activities

- Using prefixes and suffixes to change the grammatical functions of words – giving synonyms and antonyms, using the same words and its derivatives of different forms
- Expansion of noun + noun phrases - correction of errors in the given sentences.
- Using comparative forms of adjectives in sentences giving a pair of purpose and function statements to be linked with expressions like to in order to so as to (Eg: He used the ignition key. He started the engine. He used the ignition key in order to start the engine)
- Identification of content words in the given text.
- Learning multi functional words that can serve both nouns and verbs
- Analyzing sentences into S,V,O, C and A.

Note: All examples pertaining to this unit should preferably be related to science and technology.

UNIT – II FUNCTIONAL GRAMMAR

15

Tense forms and voice forms, concord, degrees of comparison, conditional clause, definition of technical terms, Sentences expressing purpose and function, comparison and contrast, cause and effect constructions, imperatives, reported speeches, Modal verbs, infinitives, gerund, participles

Suggested Activities

Giving pairs of cause and effect statements to be linked with expressions like *as / since / because*. Rewriting imperative sentences using assertive form '*should*' (Store energy and tap it when required energy should be and tapped when it is required)

- Rewriting infinitive forms as gerunds (e.g., To modernize the administrative office with computers is expensive, Modernizing the administrative office with computers is expensive) Fill in the blanks with appropriate prepositions.
- Choosing sentences in a given text that use different tense forms
- Subject-verb agreement of the sentences given practical
- Providing a context for the use of the tense forms - rewriting the sentences in the impersonal passive form
- Rewriting the sentences in the reported speeches

UNIT III READING

10

Techniques of Reading – Technical articles on invention and discoveries, Reading comprehension on biographies of eminent scientists, engineers and successful entrepreneurs, Practicing - skimming and scanning, Rhetorical functions (narrative, descriptive and argumentative) sequencing of sentences. Connective adverbs. Idioms and phrases, phrasal verbs and cloze test. .

Suggested Activities

- Taking a quick glance at the text to predict the content – reading to identify the main theme.
- Identifying the topic sentence in a paragraph – providing suitable titles for paragraphs – matching the titles with the paragraphs.
- Guessing the contextual meaning of words – comprehending a passage and answering questions of varied kinds.
- Transferring of information from a text to graphical representations like tree diagram / flow chart / bar chart / pie chart/ tables.
- Filling the gaps with appropriate missing words from the given list.
- Making notes based on a passage in the format given.
- Using an appropriate format to make notes from a given passage.
- Providing a suitable title after reading the passage.
- Identifying main and supporting ideas by scanning.
- Sequencing of jumbled sentences using linguistic clues (e.g.: reference words).

UNIT IV WRITING I

10

Framing questions and answering, (“Wh” type and “Yes or No”) type note making, (guided and open) making lists, stating problems and proposing solutions, recommendations, instructions, check lists, technical report writing, decoding from graphical representation (flow chart, pie chart, tree diagram) numerical expressions.

Suggested Activities

- Identifying the phrases used for making recommendations in given texts and employing them in making recommendations.
- Writing checklists in the appropriate format.
- Writing instructions for performing tasks at home or at work (use of imperatives).
- Summarizing the discussions and other oral practice activities like role play in the prescribed textbooks.
- Essay writing based on discussion of scientific and technical topics given in the prescribed textbooks.

UNIT V WRITING II

10

Paragraph writing, essay writing, technical report writing, letter writing, (personal, business, letter of application, letter to the editor) resume writing, drafting e-mails, minutes of meeting, memorandum, creative writing.

Suggested Activities

- Using appropriate expressions to define a concept / describe an object / device / process.
- Writing paragraphs on different scientific discourse patterns like classification, comparison and problem / solution – identifying the topic sentence.
- Using unity, cohesion and coherence in paragraph writing.
- Writing formal and business letters using the appropriate format.
- Note – making (guided and open).
- Summarizing and writing paragraphs based on listening tasks in the prescribed textbooks.
- Making recommendations by using modal auxiliary verbs like *should*, *must*, *ought to* etc.

L:45; T:15; Total:60

TEXT BOOKS:

1. Department of Humanities and Social Sciences, Anna University, English for Engineers and Technologists, Vols. I & II (Combined Edition), Orient Longman Pvt. Ltd., 2006.

REFERENCES:

1. V.R. Narayanaswami, Strengthen Your Writing, 3rd Edition, Orient Longman, 2005.
2. Andrea J. Rutherford, Basic Communication Skills for Technology, 1st Edition, Pearson Education Asia (Singapore) Pvt. Ltd., Bangalore, 2001.
3. Nell Ann Pickett, Ann A. Laster, Katherine E. Staples, Technical English (Writing, Reading and Speaking), 8th Edition, Pearson Education, USA, Addison Wesley Longman Inc., 2001.
4. “ Power words in Pairs”. Emerald publishers – Chennai

XPC102

3 1 0 4

MATHEMATICS – I

UNIT I MATRICES

9

Eigen values and Eigenvectors of a real matrix – Characteristic equation Properties of Eigen values and Eigen vectors - Cayley - Hamilton theorem (excluding proof) - Similarity transformation (Concept only) – Orthogonal matrix - Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to Canonical form by Orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY

9

Direction Cosine and Ratios – Angle between two lines – Equation of plane – Equation of Straight line – Coplanar lines – shortest distance between skew lines – Sphere – Tangent plane – Plane section of a sphere

UNIT III GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS

9

Curvature – Cartesian and polar co – ordinates – Centre and radius of curvature – Circle of curvature – Involutives and evolutes – Envelopes – Properties of envelopes and evolutes .

UNIT IV FUNCTION OF SEVERAL VARIABLES

9

Functions of two variables – Partial derivatives – Total differential – Taylor's expansion – Maxima and Minima – Constrained maxima and minima – Lagrange's Multiplier method – Jacobians .

UNIT V ORDINARY DIFFERENTIAL EQUATIONS (ODE) AND APPLICATIONS

9

Linear equations of second order with constant and variable coefficients - Simultaneous first order linear equations with constant coefficients – Method of variation of parameters.

L:45; T:15; Total:60

TEXT BOOKS:

1. Grewal .B.S., “Higher Engineering Mathematics”, 38th Edition- Khanna Publication –Delhi, 2004.
2. Kreyszi.E., “Advance Engineering Mathematics”, 8th Edition-John Wiley & Son (Asia) Ltd, Singapore,. 2001.

REFERENCES

1. Bali. N.P., Narayana Iyengar, and Chand.N., “Engineering Mathematics” Laxmi Publication Pvt. Ltd-New Delhi, 2003.
2. Veerarajan.T., “Engineering Mathematics (For First Year)”, 4th Edition , John Wiley & Son -Hill Publishing company Ltd, New Delhi, 2005.
3. Kandasamy. P., Thilagavathy. K, and Gunavathy. K., “Engineering Mathematics”-Volume I &II, S. Chand & Co, New Delhi, 2005.
4. Venkataraman. M. K., “Engineering Mathematics”-Volume I &II, Revised enlarged 4th Edition, The National Publishing Company-Chennai, 2004.

UNIT- IV Conducting Materials

9

Conductors: Wiedermann Franz law - Lorentz number –Fermi distribution function – Density of energy states – carrier concentration - effect of temperature on fermi energy level

Semiconductors: Semiconductor-properties- types of semiconductor, Hall effect – Determination of Hall co-efficient.

Superconductors: Super conducting phenomena – Properties of superconductors – Meissner effect , Isotope effect – Type I and Type II superconductors– Applications – Magnetic levitation and SQUID

UNIT–V Dielectrics and New Engineering Materials_

9

Dielectrics: Electrical susceptibility - Dielectric constant – Electronic, ionic, orientational and space charge polarization – Frequency and temperature dependence of polarization – Internal field – Claussius-Mosotti relation (derivation) - Dielectric loss – Dielectric breakdown – Uses of dielectric materials (Capacitor and Transformer).

Introduction to New Materials: Metallic glasses – Nano materials – Shape memory alloys – Bio-materials.

L:45; T:15; Total:60

TEXT BOOKS:

1. Avadhanulu M.N. and Kshirsagar P.G., “A Text Book of Engineering Physics”, S.Chand & Company Ltd., 7th Enlarged Revised Ed., 2005.
2. Gaur R. K. and Gupta S. L., “Engineering Physics”, Dhanpat Rai Publishers, New Delhi, 2001.

REFERENCES:

1. Pillai S. O., “Solid State Physics”, New Age International Publication, New Delhi, Fifth Edition, 2003.
2. Rajendran V. and Marikani A., “Materials Science”, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2004.

XPC104

3 1 0 4

APPLIED CHEMISTRY

UNIT I WATER TECHNOLOGY

9

Source and types of water – water quality parameters – definition and expression – hard water – estimation of hardness (EDTA method) and alkalinity – boiler feed water – requirements – disadvantages of using hard water in boilers – internal conditioning (phosphate, calgon and carbonate conditioning methods) – external conditioning – demineralization process – desalination (RO method) – domestic water treatment.

UNIT II ELECTROCHEMISTRY

9

Electrode potentials – difference between electrolytic cells and electrochemical cells – Standard electrodes (H₂ and calomel electrodes) – Determination of pH using glass electrodes – Nernst equation – problems – electrochemical series – emf – measurements and its applications – Galvanic cells – Concentration cell – problems – reversible and irreversible cells – conductometric titrations.

UNIT III CORROSION AND ITS INHIBITION

9

Corrosion – principles of chemical corrosion – Pilling – Bedworth rule – principles of electrochemical corrosion – difference between chemical and electrochemical corrosion – types of corrosion – factors influencing corrosion – corrosion control methods – pre-treatment of metal surface – electroplating and electroless plating.

UNIT IV NUCLEAR ENERGY AND ENERGY STORAGE DEVICES

9

Nuclear fission process – definition, mechanism and characteristics – chain reactions – nuclear energy and its calculations – types of nuclear fission reaction – atom bomb – light water nuclear power plant – breeder reactor – batteries – introduction – types of batteries – primary and secondary batteries – dry cell – lead acid, Ni-Cd and Li batteries – alkaline batteries – principles and applications of solar cells.

UNIT V

POLYMERS

9

Monomers and polymers – types of polymerization reaction – mechanism of polymerization (free radical) – engineering plastics – PVC, teflon, polycarbonate, polyurethane and thermocole – properties – applications – compounding of plastics, moulding methods – injection, compression moulding and blow moulding – polymer blends and alloys.

L:45; T:15; Total:60

TEXT BOOKS:

1. P.C. Jain and Monicka Jain, Engineering Chemistry, Dhanpat Raj Publishing Company (P) Ltd, New Delhi – 2002.
2. S.S. Dara. A Text book of Engineering Chemistry, S. Chand & Company Ltd, New Delhi – 2003.

REFERENCES:

1. B.K. Sharma, Engineering Chemistry, Krishna Prakasam Media (P) Ltd., Meerut, 2001.
2. Mars G. Fontana, Corrosion Engineering, Tata McGraw Hill Publishing Co., New Delhi, 2005.

XPC105

2 0 3 4

ENGINEERING GRAPHICS
(First Angle Projection only)

UNIT I PROJECTION OF POINTS, LINES AND PLANE SURFACES 4+8

General principles of orthographic projection – Layout of views – Projection of points, straight lines – Determination of true lengths and true inclinations and location of traces

UNIT II PROJECTION OF SOLIDS AND SECTION OF SOLIDS 4+8

Projection of polygonal surface and circular lamina inclined to any one plane - Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to both the reference plane.

UNIT III SECTION OF SOLIDS 4+8

Sectioning of solids in simple vertical position by cutting planes inclined to both the reference plane - Obtaining true shape of section.

UNIT IV DEVELOPMENT OF SURFACES AND INTERSECTION OF SOLIDS 4+8

Development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cones -Development of lateral surfaces of two Intersecting solids – prism & cylinder, cylinder & cylinder – Axis at right angles with no offset.

UNIT V 4+8

ISOMETRIC AND PERSPECTIVE PROJECTIONS

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.

Perspective projection of regular solids -by visual ray and vanishing point methods.

L:20; P:40; Total:60

NOTE

1. Five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.

UNIT - I MATERIALS AND BUILDINGS 9

Introduction - Civil Engineering – Materials – Brick, Stone, Cement, Steel, Concrete – Properties – Uses – factor of safety. Buildings – Classification - Components of buildings - Foundations - Functions – Classification of foundations – Bearing capacity - Floorings – Requirements - Cement Concrete flooring – Mosaic flooring - Marble flooring - Roofs - Types – Requirements – Madras Terrace roof

UNIT - II TRANSPORTATION, WATER SUPPLY AND SEWAGE DISPOSAL 9

Transportation system - Classification – Components of Roads - Railway – Cross-section of permanent way- requirements, Bridges – bridge site and components of a bridge site - Harbour – classification. Water supply - Sources - Standards of drinking water – Distribution system – Sewage – types – septic tank – function and components.

UNIT - III SOURCES OF ENERGY 9

Sources of energy. Conventional Energy – types, characteristic, advantages/disadvantages – Thermal – steam, gas and diesel - Hydro and Nuclear power plants – its layout, element / component description, advantages, disadvantages, locations in India.

Renewable sources of energy – Biomass- Solar- Wind- Tidal-OTEC etc types, characteristic, advantages/disadvantages.

UNIT - IV METAL JOINING AND SHEET METAL PROCESSES 9

Welding-Gas and Arc welding only– Introduction, types, equipments, tools and accessories, techniques employed, applications, advantages / disadvantages. Introduction to Brazing and soldering , Advanced welding process. Sheet Metal Work-Introduction, equipments, tools and accessories, Sheet Metal working process – various types, applications, advantages / disadvantages.

UNIT - V METAL FORMING AND MACHINING 9

Metal Forming Process-Defects, Advantages, Disadvantages Lathe – Introduction, types, description of main components, cutting tools, work holding devices, Basic operations performed. Drilling machine- Introduction, types, and description, drilling tools. Tapping – tap tools. Shaping machine

Total:45

TEXT BOOKS :

1. Raju K.V.B., Ravichandran P.T., Basics of Civil Engineering, Ayyappa Publications, Chennai, 2000.
2. Ramesh Babu, Elements of Civil Engineering, VRB Publishers, 2000
3. Willard H.A., Merit L.L and Dean J.A., "Instrumental methods of analysis" 6th Edition Van Nostrand, 1986.
4. Kamaraj P. & Arthanareeswari M., "Applied Chemistry", Sudhandhira Publications, 2nd Edition, 2003.
5. Venugopal.K., "Basic Mechanical Engineering", Anuradha Publishers, 1997.
6. Prabhu.T.J., Jai Ganesh.V., Jebaraj.S., "Basic Mechanical Engineering", Scitech Publications, 2000.

REFERENCES:

1. Hajra Choudhary S.K. & Hajra Choudhary A.K., "Elements of Manufacturing Technology" Vol. I & II", Media Publishers, 1986.
2. Rangwala,S.C., Engineering Materials, Charotar Publishing House, Anand, 1980.
3. National Building Code of India, Part V, Building Materials, 1983.
4. Surendra Singh, Building Materials, Vikas Publishing Company, New Delhi, 1996.

PHYSICS LABORATORY
(Common to all branches of B.E. / B.Tech)

XPC107

APPLIED PHYSICS LAB

0 0 3 2

Semester I

LIST OF EXPERIMENTS

1. Torsional Pendulum – Determination of moment of inertia of disc and rigidity modulus of the material of a wire.
2. Non -Uniform Bending – Determination of Young’s Modulus.
3. Viscosity – Determination of Co-efficient of Viscosity of a liquid by Poiseuille’s flow.
4. Spectrometer – Dispersive power of a prism.
5. Air wedge - Determination of thickness of thin wire.
6. Lee’s Disc – Determination of thermal conductivity of a bad conductor.
7. Spectrometer – Determination of wavelength of Hg source using Grating.
8. Band gap determination of a semiconductor.
9. Spectrometer – id curve.
10. Semiconductor laser –
 - i. Determination of wavelength of Laser using grating.
 - ii. Particle size determination.
 - iii. Determination of numerical aperture and acceptance angle of an optical fibre.

LIST OF EXPERIMENTS (Any 10 Experiments)

- 1) Determination of total hardness, temporary & permanent hardness of water by EDTA method.
- 2) Determination of alkalinity of water sample.
- 3) Determination of chloride content of water sample by argentometric method.
- 4) Determination of DO content by Winkler's method.
- 5) Estimation of copper in brass.
- 6) Determination of strength of Hydrochloric acid by pH metric method.
- 7) Conductometric titration between strong acid and strong base.
- 8) Conductometric titration of mixture of acids.
- 9) Conductometric precipitation titration using barium chloride and sodium sulphate.
- 10) Determination of strength of iron by potentiometric method using dichromate.
- 11) Estimation of iron (1,10 – phenanthroline / thiocyanate method) or Ni (DMG) in the given solution by spectrometric method
- 12) Determination of sodium and potassium ions in water sample by flame photometric method.
- 13) Determination of molecular weight of a polymer by viscometry method.
- 14) Determination of percentage of calcium in limestone by EDTA method.

References for Chemistry Laboratory

- (1) J. Mendham, R.C. Denney, J.D. Barnes and N.J.K. Thomas, Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearson Education, 2004.
- (2) D.P. Shoemaker and C.W. Garland, Experiments in Physical Chemistry, McGraw Hill, London.

BASIC WORKSHOP PRACTICES

- A) WOOD WORK** : Sawing, Planning and making common joints like TEE, Half lap and dovetail (any two)
- B) PLUMBING** : Basic pipe connection using valves, taps, couplings, unions, reducers, elbows in household fitting - Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances Preparation of line sketches for (i) water supply lines (ii) sewage lines.
- C) DEMONSTRATION (CIVIL ENGINEERING)** : Study of pipe connections on the suction and delivery pipe layouts.
Study of joints in door panels, wooden furniture.
Bar bending -Straightening of rods and cutting- 90°, 130° bend formation - 45°, 30° crank formation-Stirrups fabrication-Binding and placing of steel reinforcement
- D) FITTING** : Square, dovetail and hemisphere fitting of metal plate of 3mm
- E) WELDING** : (i) Preparation of arc welding of butt joints, lap joints and tee joints.
(ii) Gas welding practice.

UNIT I MULTIPLE INTEGRALS**9+3**

Double integration-Cartesian and polar coordinates-change of order of integration-area as a double integral-change of variables between Cartesian and polar coordinates-triple integration.

UNIT II VECTOR CALCULUS**9+3**

Gradient, divergence and curl-directional derivative-irrotational and solenoidal vector fields-Line, Surface and Volume Integral - Greens theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proof)-simple applications.

UNIT III ANALYTICAL FUNCTIONS**9+3**

Function of a complex variable-analytic function -necessary and sufficient condition (excluding proof)-Cauchy - Riemann equation - properties of analytical function-harmonic conjugate-construction of analytic function.

UNIT IV COMPLEX INTEGRATION**9+3**

Statement and application of Cauchy's integral theorem and integral formula-Taylor and Laurent expansion -residues-cauchy residue theorem. Contour integration over unit circle and semicircular contours (excluding poles on boundaries)

UNIT V LAPLACE TRANSFORM**9+3**

Transform of elementary functions- properties-derivatives and integrals of transforms-Transform of derivatives and integrals -Transforms of unit step function and impulse function-Transform of periodic functions – Convolution Theorem – Inverse transforms – Application to solution of linear ordinary differential equations up to second order with constant coefficients.

L: 45 ; T:15; Total: 60

TEXT BOOKS:

1. Grewal .B.S. Higher Engineering Mathematics, Thirty eighth Edition, Khann Publication , Delhi 2004.
2. Kreyszig, E , Advance Engineering Mathematics, Eighth Edition, John Wiley and Son (Asia) Ltd Singapore 2001.

REFERENCES:

1. Bali N.P and Narayana Iyengar, N.Chand, Engineering Mathematics Laxman Publication Pvt, Ltd, New Delhi, 2003.
2. Veerarajan. T., Engineering Mathematics Fourth Edition , John Wiley and Son Hill Publishing company Ltd, New Delhi, 2005.
3. Kandasamy. P., Thilagavathy. K, and Gunavathy. K Engineering Mathematics Volume I , II and III S. Chand & Co, New Delhi, 2005.4. Venkataraman. M. K., Engineering Mathematics, Volume I and II Revised enlarge Fourth Edition, The National Publishing Company, Chennai, 2004.

XPC202 COMPUTER PROGRAMMING**3 0 0 3****UNIT I BASICS OF COMPUTER AND PROGRAMMING 9**

Digital Computer Fundamentals –Block diagram of a computer–Component of a computer system–Hardware and Software–Categories of Software–Bootting–Installing and uninstalling Software–Software piracy–Software terminologies–Applications of Computers–Algorithm – Design - Flow chart –History of Internet–Internet Services.

UNIT II BASIC ELEMENTS OF C 9

Introduction to C – Lexical elements of C – Operators and expressions – Operator precedence and associativity of operators – Input and Output Functions – Simple computational problems - Program Control Structures- Control statements – Branching, looping, nested control structures, switch, break, continue, goto statements – Problems using control structures.

UNIT III FUNCTIONS AND PROGRAM STRUCTURES 9

Prototypes and Functions–Declaring, defining and accessing functions–Parameter passing methods–Recursion–Storage classes–auto, extern, static and register–Library functions-Programs using functions.**Arrays:**Defining and processing arrays–Passing arrays to functions–Multi-dimensional arrays–Strings and basic operations on strings–Enumerated data types–Programs using simple sorting, searching and merging of arrays.

UNIT IV POINTERS 9

Pointer concept–Declaration–Accessing variable through pointer–Initializing pointer variable–Pointers and Functions–Pointers and Arrays–Pointers and Structures–Example programs using pointers with function, arrays and structures–Command line arguments – Dynamic memory allocation–Operations on pointers.

UNIT V STRUCTURES, UNIONS AND FILE HANDLING 9

Structures–User defined data types–Union–Nested structure, passing structures to functions - Self referential structures - File pointer–High level File operations–Opening and closing of file–Creating, Processing and Updation on files–Simple file handling programs.

Total: 45

TEXT BOOKS:

1. Byron Gottfried, "Programming with C", II Edition, (Indian Adapted Edition), TMH publications, 2006. Yeshwant Kanethker, "Let us C", BPB Publications, 2004

REFERENCES:

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Pearson Education Inc. (2005).
2. Behrouz A. Forouzan and Richard. F. Gilberg, "A Structured Programming Approach Using C", II Edition, Brooks–Cole Thomson Learning Publications, 2001.
3. Johnsonbaugh R. and Kalin M., "Applications Programming in ANSI C", III Edition, Pearson Education India, 2003.

UNIT - I ELECTRICAL AND MAGNETIC CIRCUITS 8

Ohms Law -Kirchoffs Laws - steady state solution of D C Circuits - Introduction to AC circuits - Waveforms and RMS value - power and power factor, single phase and three phase balanced circuits. Definition of mmf flux and reluctance analysis of composite magnetic circuits, leakage flux, fringing, magnetic materials and B-H relationship Faradays laws, induced emf's and inductances. Energy storage in magnetic systems, Hysteresis and eddy currents

UNIT - II ELECTRICAL MACHINES AND MEASUREMENTS 9

Principles of operation and characteristics of D C machines, Transformers (single phase and three phase) - Synchronous Machines - three Phase and single-phase induction motors - (op. Principles). Moving coil and moving iron instruments (Ammeter and voltmeter). Dynamometer type wattmeters and energy meters (op. Principles)

UNIT - III SEMICONDUCTOR DEVICES & RECTIFIERS 9

Classification of solids based on energy band theory - Intrinsic semiconductors - Extrinsic semiconductors - P type and N type - P-N junction - V I characteristic of PN junction diode - Zener diode - Zener diode characteristics - Half wave and full wave rectifiers - Voltage regulation, SCR, Diac, Triac, Characteristics and simple applications.

UNIT - IV TRANSISTORS AND AMPLIFIERS 9

Bipolar junction transistor - CB, CE, CC – Configurations and characteristics – Biasing circuits - Field Effect Transistor - Configurations and characteristics - FET amplifier - UJT - characteristics and simple applications - switching transistors - concept of feed back - negative feed back - application in temperature and motor speed control. Elementary treatment of voltage amplifier - Class A, B and C power amplifiers principles of Tuned amplifiers.

UNIT - V SIGNAL GENERATORS AND LINEAR IC'S 10

Sinusoidal oscillators - positive feed back - RC phase shift, Hartley, Colpit's, Wien Bridge Oscillators -multivibrators - operational amplifier - adder, multiplier, integrator and differentiators -Integrated circuits. .Digital Electronics- Binary number system - AND, OR, NOT, NAND, NOR circuits - Boolean algebra Exclusive OR gate - Half and Full adders - flip flops - registers and counters - A/D, D/A conversion - Digital computer principle.

Total: 45

TEXT BOOKS:

1. Mittle, V.N., Basic Electrical Engineering, TMH Edition, New - Delhi, 1990
2. Del Taro, Electrical Engineering Fundamentals, Prentice Hall of India Pvt. Ltd., New Delhi, Second edition.
3. Muraleedharan K.A, Muthususbramanian R and Salivahanan S, "Basic Electrical, Electronics and Computer Engineering" Tata McGraw Hill 1999
4. Mehta V K, "Principles of Electronics", S.Chand & Co., 1980
5. Kalsi H S, "Electronic Instrumentation", ISTE publication, 1995

REFERENCES:

1. Millman & Halkias, Integrated Electronics, McGraw Hill, 1979
2. Kothari D P and Nagrath I J, "Basic Electrical Engineering", Tata McGraw Hill, 1991
3. Mithal G K, Electronic Devices & Circuits, Khanna Publications, 1997
4. Ben .G. Streetman, "Solid State Electronics Devices, Prentice Hall of India, 1999

UNIT - I PROPERTIES OF FLUIDS AND CONCEPT OF PRESSURE 9

Introduction - Nature of fluids - physical properties of fluids -types of fluids. Fluid statics: Pressure - density - height relationships. Pressure Measurement. Units & Dimensions. Dimensional analysis. Similarity - forces arising out of physical similarity - dimensionless numbers.

UNIT - II MOMENTUM BALANCE AND THEIR APPLICATIONS 9

Kinematics of fluid flow; Stream line-stream tube-velocity potential. Newtonian and non-Newtonian fluids - Time dependent fluids - Reynolds number - experiment and significance -Momentum balance - Forces acting on stream tubes - Potential flow - Bernoulli's equation - Correction for fluid friction - Correction for pump work. Continuity equation

UNIT - III FLOW OF INCOMPRESSIBLE FLUIDS THROUGH DUCTS 9

Flow of incompressible fluids in pipes- laminar and turbulent flow through closed conduits –velocity profile & friction factor for smooth and rough pipes-Head loss due to friction in pipes, fitting etc. Introduction to compressible flow - isentropic flow through convergent and divergent nozzles and sonic velocity.

UNIT - IV FLOW OF FLUIDS THROUGH SOLIDS 9

Friction, form & skin friction - Drag, Drag co-efficient. Flow around solids and packed beds. Friction factor for packed beds - Ergun's Equation - Motion of particles through fluids-Motion under gravitational and centrifugal fields - Terminal settling velocity. Fluidisation - Mechanism, types, general properties - applications.

UNIT - V TRANSPORTATION AND METERING 9

Measurement of fluid flow: Orifice meter, venturi meter, pitot tube, rotameter, weirs and notches Wet gas meter and dry gas meter. Hot wire anemometers. Transportation of fluids: Fluid moving machinery performance. Selection and specification. Airlift and diaphragm pump. Positive displacement pumps: Rotary & Reciprocating pumps. Centrifugal pumps and characteristics. Values and types, selection of valves

L:45; T:15; Total: 60

TEXT BOOKS:

1. R.K. Bansal, "Fluid Mechanics and Hydraulic machines", Laxmi Publications (P) Ltd., New Delhi
2. W.L. McCabe, J.C. Smith and P.Harriott, "Unit operations of Chemical Engineering", 5th Edn., McGraw Hill, International Edn., 1993.

REFERENCES:

1. J.M. Coulson and J. F.Richardson, "Chemical Engineering", Vol 1 3rd Edn., Butterworth – Heinmann Publishers.
2. Noel.D. Nevers, "Fluid Mechanics for Chemical Engineers", McGraw Hill, International Edition. 1990

WORD

Spreadsheet

Power Point

'C' PROGRAMMING

1. Programs using Operators and Expressions
2. Programs using IO Formatting
3. Programs using Control Structures
4. Programs using Looping Structures
5. Programs using Arrays and String manipulations
6. Programs using Functions and Recursion
7. Programs using Structures and Unions
8. Programs using Pointers
9. Programs using Files
10. Programs using Command line arguments

Total:45

REFERENCES:

1. Byron Gottfried, "Programming with C", II Edition, (Indian Adapted Edition), TMH publications, 2006. Yeshwant Kanethker, "Let us C", BPB Publications, 2004
2. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Pearson Education Inc. (2005).
3. Behrouz A. Forouzan and Richard. F. Gilberg, "A Structured Programming Approach Using C", II Edition, Brooks–Cole Thomson Learning Publications, 2001.

UNIT I EXTENSIVE LISTENING**12**

Listening and typing –Listening and sequencing of information – Filling in the blanks – Listening and answering the question. Cloze Exercises- Vocabulary building – Dictionary habits a brief note on Thesaurus.

Listening to specific speeches, discussions, interviews, debates, lectures. (Instructional Aids: Audio cassettes, Tape recorders, Language Software.

Suggested Activities

- Gap filling activities while listening to a text
- Listening and identifying the missing words in a given text
- Listening to a brief conversation and answering questions orally
- Listening to commentaries on television or radio to improve listening skills

Paying attention to speaker's appearance, expressions, body movements and posture that convey meaning to his/her words.

UNIT II INTENSIVE LISTENING**12**

Listening for specific information – note taking-guided and open – listening comprehension- listening to specific speeches-interviews –debates lectures.

Suggested Activities

- Taking notes during lectures.
- Listening to a discourse and filling up gaps in a work sheet.
- Informational comprehension and literal comprehension tasks based on listening- post listening quiz.
- Listening to a passage preferably technical and answering questions choosing appropriate options (multiple choice)

Note : These listening activities can be done using a work sheet in a language laboratory or in the class room using a tape recorder.

UNIT III SPEAKING

12

Oral practice –developing confidence-introducing oneself-asking for or eliciting information-offering suggestions and recommendations.

Analyzing problems and providing solutions- expressing opinions (agreement and disagreement) Role of idioms in Spoken Communication Pronunciation Practice-Stress intonation, accent, questions for oral discussions, describing objects, presenting information, Process description, narrating events, giving introduction, welcome speech and proposing a vote of thanks.

Suggested Activities

- Introducing oneself and others
- Role play activities based on real –life situations
- Discussing travel plan / industrial visit
- Giving oral instructions for performing tasks at home, at class-room and at work place
(use of imperatives)
- Participating in a short classroom-discussion on a controversial topic (eg. For and against reservation policy in educational institutions)
- Oral presentation on topics related to science and technology.

UNIT IV CONVERSATION

12

Face-to-Face conversation- Telephonic conversation- Role-play activities (Students take on roles and engage in conversation) participating in an interview situational dialogues.

Suggested Activities

Making either telephonic conversations or face to face conversation- making request- Asking questions-making recommendations using modal verbs-Giving instructions using imperatives – Expressing purpose and function-obligation and preference- Accepting and offering counseling.

UNIT V LABORATORY PRACTICE

12

Resume/ Report preparation / Letter writing

Structure the resume/ report letter writing/ E-mail communication samples

Presentation skills

Elements of an effective presentation – structure of presentation- presentation tools-voice modulation- audience analysis – body language- video samples.

Soft skills

The management- articulation – assertiveness – psychometrics- innovation and creative – stress management and poise- video samples

Group discussion

Why is GD part of selection process?- Structure of GD- moderator – led and other GDs – Strategies in GD- Team spirit- Body language(gestures)- Mock GD- Video samples.

Interview skills

Kinds of interviews- required key skills – corporate culture – mock interview- video samples.

L:30; P:30; Total: 60

TEXT BOOKS:

1. Meenakshi Raman, Sangeetha Sharma: Technical Communication Principles and Practice, Oxford University Press.

REFERENCES:

1. Jeremy Comfort, Pamela Rogerson, Trish Stott and Derek Utley: Speaking Effectively, Cambridge University Press.
2. Jayashree Balan; Spoken English, Vijay Nicole Imprints Private Ltd., Chennai.
3. Jean Naterop and Rod Revell (1988) Telephoning in English (Cambridge University Press David Martur (1994), Tough Talking, University Press, Hyderabad.

I CIVIL ENGINEERING PRACTICE

1. Basic pipe connection using valves, taps, couplings, unions, reducers, elbows in household fitting.
2. Study of pipe connections on the suction and delivery pipe layouts.
3. Test on Pipe (Impact, pressure, freezing and thawing)
4. Compression, deflection, hardness (Rockwell and Brinell), and torsion test

II MECHANICAL ENGINEERING PRACTICE

1. Study on 2, 4 –stroke IC engines
2. Study of steam generator, engine and gearbox.
3. Load test on 4- stroke diesel engine
4. Load test on 4- stroke P.S.G. diesel engine

III ELECTRICAL ENGINEERING PRACTICE

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Calibration of ammeter and voltmeter.
3. Measurement of power using watt meter
4. Measurement of energy using single-phase energy meter.

IV ELECTRONICS ENGINEERING PRACTICE

1. (a) Study of Electronic components and equipment (i) Resistor colour coding (ii) usage of CRO & Multimeter.
(b) Soldering of simple electronic components and checking the continuity.
(c) Assembling electronic components on a PCB.
1. Characteristics of PN & Zener Diodes.
2. Measurement of ripple factor for HWR & FWR.
3. Input and output characteristics of CE transistor.

Total: 60

UNIT I HUMAN VALUES**10**

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality.

UNIT II ENGINEERING ETHICS**9**

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION**9**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study. the three mile island and chernobyl case studies.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS**9**

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk -.

Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

UNIT V GLOBAL ISSUES**8**

Multinational corporations - Environmental ethics - computer ethics - weapons development .

Carbon trade - Co₂ Sequestration, and its environmental impact.

Engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics.

Total:45**TEXT BOOKS:**

1. Mike Martin and Roland Schinzinger, "Ethics in engineering", McGraw-Hill, New York 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, " Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

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 Learning, 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.

Unit I Introduction 9

Stoichiometric and composition relations, Excess and limiting reactants, Degree of completion. Ideal Gas- Ideal Gas law and its applications. Dissociating gases, gas mixture & vapour pressure – Effect of temperature vapour pressure plots. Vapour pressure of immiscible liquids. Raoult's law, relative vapor pressure.

Unit II Humidity and saturation 9

Humidity chart. Relative & percent saturation evaporation and condensation processes. Solubility and crystallization: Mass balance and yield calculations in dissolution and crystallization processes. Solubility of gases (Henry's law).

Unit III Material Balance 9

Calculation for batch and continuous processes, recycling processes, by pass and purging operation.

Fuels and combustion: Problems on combustion of solids. Liquids and gaseous fuels and pyrites. Two stage conversion of SO₂ to SO₃.

Unit IV Thermo Physics and Thermo Chemistry 9

Mean specific heat. Heat of fusion & vaporization. Heat of formation, combustion and reaction. Degree of conversion based on inlet and outlet temperature. Enthalpy – Hess law. Theoretical flame temperature.

Unit V Energy Balance 9

Energy balance for the systems with and without chemical reactions. Unsteady state energy balance.

L:45; T:15; Total: 60

TEXT BOOK:

1. Hougen, O.A., Watson, K.M., and R.A. Ragatz, Chemical Process Principles, Part – I, John Wiley and Asia Publishing Co., 1975.

REFERENCES:

1. Bhatt, B.I., and S.M. Vohra, Stoichiometry, Tata McGraw Hill.
2. Himmelblau, D.M., Basic Principles and Calculations in Chemical Engineering.
3. Mayers and Seider, Introduction to Chemical Engineering and Computer Calculations, Prentice Hall.

Unit I **9**

Nature and properties of materials, phases, binary phase diagrams, Iron-Carbon equilibrium diagram, time temperature – transformation curves, methods of fabrication and failure under service conditions testing of materials.

Unit II **9**

Heat treatment of ferrous metal and alloys: Quenching, tempering, normalizing, carburising, nitriding, carbonitriding, cyaniding and chormizing, siliconizing.

Unit III **9**

Corrosion – Dry corrosion – wet corrosion – mechanisms of corrosion. Polarization and corrosion rates, passivity, galvanic corrosion – concentration cell, corrosion. Atmospheric corrosion – Underground corrosion – Microbiological corrosion – stray current corrosion pitting, erosion corrosion, oxidation and tarnish.

Unit IV **9**

Corrosion control; and prevention: Cathodic protection, anodic protection, metallic coatings, organic coatings, inorganic coatings, inhibitors.

Unit V **9**

Applications of the following materials: Iron and steel, Copper, Nickel, chromium, Aluminium and Zinc and their alloys, Timber, Rubber, Plastics and Gases.

Total:45

TEXT BOOKS:

1. Jasrrzebski,Z.D., Nature and properties of Engineering Materials, John Wiley & Sons, 1987.
2. Uhlig,H, and R.Winston Reive, Corrosion and Corrosion Control, 3rd Edn., John Wiley, 1991.

REFERENCES:

1. Cremer and Davies, Chemical Engineering Practice, Vol. 9 Butterworths, 1965.
2. Raghavan,V., Materials Science and Engineering, Prentice Hall India, New Delhi, 1998.
3. .Lawrence H. Van Vlack, "Elements of Material Science and Engineering", AddisonWesley Publications, 1971.

UNIT I : ACIDS AND ALKALIES**9**

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

UNIT II : CEMENT, GLASS AND PAINTS**9**

Cement: Types and Manufacture of Portland cement, Glass: Manufacture of glasses and special glasses, Ceramics: Refractories. Manufacture of paints-Pigments

UNIT III**9**

Manufacture of sugar, ethanol, paper, explosives

UNIT IV : INDUSTRIAL GASES, WATER TREATMENT**9**

Industrial Gases: Carbon dioxide. Water gas, producer gas, Nitrogen, Hydrogen, Oxygen and Acetylene - Water Treatment: Industrial water treatment –aerobic and anaerobic., Reverse osmosis techniques

UNIT V : FERTILISERS AND PESTICIDES**9**

Nitrogen Fertilisers; Synthetic ammonia, nitric acid. Urea, Ammonium Chloride, CAN, Ammonium Sulphate - Phosphorous Fertilisers: Phosphate rock, phosphoric acid. Super phosphate and Triple Super phosphate - MAP,DAP - Potassium Fertilisers; Potassium chloride, and Potassium sulphate.

Total :45**TEXT BOOKS:**

- 1.Austins "Shreve's Chemical Process Industries", 7thEdn., McGraw Hill, New York, 1997.
- 2.R. Gopal Rao and M.Sittig,"Dryden's Outlines of Chemical Technology 2"d Edn., Affiliated East-West Press, New Delhi, 1965.

REFERENCES:

1. S.D. Shukla and G.N. Pandey, "Text book of Chemical Technology ", Vol. 1, Vikas Publishing Co., 1977

XPC 305 CHEMICAL ENGINEERING THERMODYNAMICS**3 1 0 4****UNIT I THERMODYNAMIC PROPERTIES OF FLUIDS****9**

Volumetric properties of fluids exhibiting non ideal behavior; residual properties; estimation of thermodynamic properties using equations of state; calculations involving actual property exchanges; Maxwell's relations and applications.

UNIT II SOLUTION THERMODYNAMICS**9**

Partial molar properties; concepts of chemical potential and fugacity; ideal and non-ideal solutions; concepts and applications of excess properties of mixtures; activity coefficient; composition models; Gibbs Duhem equation.

UNIT III PHASE EQUILIBRIA**9**

Criteria for phase equilibria; v-l-e calculations for binary and multi component systems; liquid-liquid equilibria and solid-solid equilibria.

UNIT IV CHEMICAL REACTION EQUILIBRIA**10**

Equilibrium criteria for homogeneous chemical reactions; evaluation of equilibrium constant; effect of temperature and pressure on equilibrium constant; calculation of equilibrium conversion and yields for single and multiple reactions.

UNIT V THERMODYNAMIC ANALYSIS OF PROCESSES**8**

Concept of lost work; entropy generation; calculation of real irreversible processes; power cycle; liquefaction.

L:45; T:15; Total: 60**TEXT BOOKS:**

1. Smith J.M., Van Ness H.C., Abbot M.M. Chemical Engineering Thermodynamics. 6th Edition. McGraw-Hill, 2001.
2. Narayanan K.V. A Text Book Of Chemical Engineering Thermodynamics. Prentice Hall India, 2001.

REFERENCES:

1. Sandler S.I. Chemical And Engineering Thermodynamics. John Wiley, 1989.

UNIT I 9

Conduction through a single homogeneous solid, thermal conductivity of solids, liquids and gases. Conduction through several bodies in series. Contact resistances. Unsteady state heat conduction, lumped heat capacity system, transient heat flow in a semi-infinite solid.

UNIT II 9

Natural convection: Heat transfer from plates and cylinders in verticals and horizontal configuration, natural convection to spheres. Heat transfer with phase change, i. e. heat transfer in Boiling and condensation, Single and multiple effect evaporators.

UNIT III 8

Heat Transfer by Radiation: Black and gray body radiations, view factor, luminous and non-luminous gases. Combined heat transfer, i.e. conduction, convection and radiation together. Concept of critical insulation thickness.

UNIT IV 10

Heat transfer by Convection: Combined natural and forced convection: Fluid flow and heat transfer across cylinders and spheres. Combined natural and forced convection heat transfer in horizontal circular conduits. Heat transfer in extended surfaces such as fins, conduction convection heat transfer, forced convection heat transfer in circular conduits with longitudinal fins.

Heat transfer in non Newtonian fluids.

UNIT V 9

Heat exchanger design: Design of single and multi pass shell and tube type exchangers using LMTD and effectiveness – NTU methods. Spiral coil and plate type heat exchangers. Single and multi phase condenser. Design of Reboilers vapourisers. Kettle type and Thermosiphon reboilers, forced circulation vaporizers. Heat transfer in agitated vessels both, jacketed and with coil, Determination of overall heat transfer coefficient, transient heating or cooling, Heat transfer in packed and fluidized beds.

L:45; T:15; Total: 60

TEXT BOOKS:

1. W. L. McCabe J. C. Smith and P. Harriot, "Unit Operations of Chemical Engineering", 4th ed. McGraw Hill 1985.
2. D. Q. Kern, "Process Heat Transfer", McGraw Hill, 1950.

REFERENCES:

1. J. M. Coulson and J. F. Richardson, "Chemical Engineering", Vol. 1 ELBS, Pergaman press, 1970
2. J. M. Coulson and J. F. Richardson, "Chemical Engineering" Vol. 2 ELBS, Pergaman press, 1970

1. Jaw crusher
2. Size analysis by sieving
3. Filter press
4. Leaf filter
5. Cyclone separator
6. Sedimentation
7. Effectiveness of screens
8. Calibration of constant and variable Head meters
9. Calibration of Weirs
10. Pressure drop studies in packed column
11. Fluidisation
12. Characteristic curves of centrifugal pump

Total : 60

1. Criteria of purity of Solid and Liquid compounds determination of Melting point, Boiling point, density, Refractive Index
2. Identification of organic compounds (Aliphatic or aromatic saturated / unsaturated compounds)
3. Characteristic reaction of functional groups in (Aldehydes, Ketones, acids, phenols, nitro compounds amino compounds and amides.
4. Characterisation of unknown organic compounds (Aldehydes, Ketones phenols, Acids, Esters, Amines alcohol, Carbohydrates)
5. Analysis and estimation of Pigments, Sugar, Polymers.
6. Organic preparation of:
7. Oxidation of benzaldehyde to benzoic acid
8. Hydrolysis of ethylbenzoate to benzoic acid Acetylation of aniline to acetanilide
9. Nitration of Nitrobenzene to meta dinitro Benzene

Total: 60

REFERENCES:

1. Laboratory Manual for organic chemistry Prof. B.B.Seetharaman, M.V.Viswanathan and Co publishers, 1989.
2. Advanced Practical organic chemistry, Agarwal, O.P., Goel Publishing House, 1991.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND ENERGY 12

Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS AND BIODIVERSITY 12

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT III ENVIRONMENTAL POLLUTION 8

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Soil waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation – Consumerism and waste products – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness

Population growth, variation among nations – Population explosion – Family Welfare Programme – Environment and human health – Human Rights – Value Education - HIV / AIDS – Women and Child Welfare – Role of Information Technology in Environment and human health – Case studies.

Total: 45

TEXT BOOKS:

1. Gilbert M.Masters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co.
3. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science.
4. Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications.

REFERENCES:

1. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media.
2. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, Jaico Publ., House, Mumbai, 2001.
3. Wager K.D., Environmental Management, W.B. Saunders Co., Philadelphia, USA, 1998.
4. S.K.Dhameja, Environmental Engineering and Management, S. K. Kataria and Sons, New Delhi, 1999.

UNIT I **9**

Origin, Exploration and production of petroleum, Types of crudes, composition, characteristics, Products pattern and characteristics, Indigenous and imported crudes, Availability Vs Demands, Future outlook.

UNIT II CRUDE PROCESSING **9**

Crude heating, Primary distillation, Principles, Separation of cuts, Gaps / overlaps, Stripping, Desalting, Heat balance in distillation, Energy input and recovery, Vacuum distillation, Types of trays, Drawoffs, Intermediate product quality control.

UNIT III HEAVY OILS PROCESSING **9**

Lube oil and Wax Processing, Solvent extraction, Dewaxing, Desilting, Deasphalting, Clay contacting, Principles, Technologies, Operating parameters, Feed and product qualities and yields. Asphalt manufacture, Product qualities, Airblowing technology Tankage operations –Storage and handling of crude / products – Bitumen and their properties.

UNIT IV SAFETY ASPECTS AND HAZARDOUS CONTROL **9**

Fire Chemistry - Fire hazards and control, Safety in handling and storage, Emergency preparations.

UNIT IV TESTING **9**

Testing of petroleum crude, products, Specifications and their significance –ASTM & API standards.

L:45; T:15; Total: 60

TEXT BOOK:

1. Dr. Ram Prasad “Petroleum Refining Technology Khanna publishers. New Delhi, 2000
2. B.K. Bhaskara Rao, “Modern Petroleum Refining Processes” Edn. 3, Oxford & IBH Publishing Company Pvt. Ltd. New Delhi

REFERENCES:

1. Nelson, W. L. – Petroleum Refinery Engineering, McGraw Hill Publishing Company Limited, 1985.
2. Watkins, R. N. – Petroleum Refinery Distillation, 2nd Edition, Gulf Publishing Company, Texas 1981.
3. Hobson, G. D. – Modern Petroleum Refining Technology, 4th edition, Institution of Petroleum, U.K. 1973.
4. ASTM Standards for Petroleum Product Testing & BIAS
5. G.N.Sarkar. “Advanced petroleum Refining” Khanna Publishers, New Delhi
6. Dr. B. K. B. Rao. “Petrochemicals” Khanna Publishers, New Delhi

Unit I**9**

Phase rule – Definition of terms – Application of Phase rule to water and sulfur systems Two component systems forming simple eutectic and forming compounds with congruent melting point – Thermal analysis and behaviours of molten liquids on cooling – brief study of systems forming solid solutions..Three component systems involving three liquids and two salts and water where the salt separates out only as simple salt without water of hydration. Factors affecting solubility of gases in liquids – Henry's law.

Systems of two liquids: Completely miscible liquids – Raoult's law – Ideal and nonideal solutions – vapor pressure and boiling point diagrams – fractional distillation – constant boiling mixtures. Partially miscible liquids – critical solution temperature – determination of C.S.T. for phenol – water system – effect of impurity on C.S.T. – Nicotine – Water system and triethylamine – water system.

Completely immiscible liquids: Nernst distribution law and its applications – steam distillation.Solubility equilibrium: Solubility product – applications – common ion effect.

Unit II**9**

Thermodynamics: Types of systems – first law of thermodynamics – Thermodynamics properties – internal energy and enthalpy – Path function and state function – Heat and work transfer during isothermal and Adiabatic processes for an ideal gas – Carnot cycle – II law of thermodynamics entropy and its significance – Gibbs free energy – Gibbs – Helmholtz equation – thermodynamic criterion of spontaneous process. Chemical equilibrium – relation between equilibrium constant and standard free energy change (Derivation not necessary) influence of temperature and equilibrium constant. Van't Hoffs equation (Derivation not necessary).

Unit III**9**

Theories of liquid state – liquid crystals – Derivation of Classius – Claypeyron equation – Applications.

Adsorption: Physical and chemical adsorption – Freundlich Langmuir adsorption isotherm – Surface films – Gibbs adsorption isotherm.

Colloids: Electrical properties of colloids, electro kinetic phenomenon – Zeta potential – Donnan membrane equilibrium – gels and emulsions.

Unit IV

9

Measurements of rates of first and second order reactions – Third order reactions – a brief study of consecutive, competitive and reversible reactions – A brief study of influence of temperature, solvents and neutral salts on reactions rates – Chain reactions and explosive reactions.

Catalysis: Definition – positive and negative catalysis promoters and catalytic poisons – homogeneous, pH and temperature on low rates of enzyme – catalyzed reactions.

Unit-V

9

EMF, concentration cells with and without transport applications, of EMF measurements – determination of solubility product, Potentiometric titrations and determination of pH using hydrogen, quinhydrone and glass electrodes.

Polar and non-polar molecules – dipole moment – electron, atomic and orientation polarizations (only definitions) – dielectric constant.

A study of paramagnetic, diamagnetic and ferromagnetic properties with examples super-conductors and their applications.

L:45; T:15; Total: 60

TEXT BOOK:

1. Puri B.H. and Sharma L.R. Principles of Physical Chemistry, S.Nagin Chand and Company, Delhi (1994).
2. Kund and Jain, Physical Chemistry, S.Chand and Company, Delhi (1996).

REFERENCES:

1. Sannel Glasstone, A Text Book in Electro Chemistry.
2. Gordon M. Barrow, Physical Chemistry, Sixth edition, Tata McGraw-Hill (1998).
3. Kuriakose, J.C. and Rajaram J, Chemistry in Engineering and Technology Vol. I, Tata McGraw-Hills. 1984
4. Soni,P.L., A Text Book of Physical Chemsitry, S.Chand & Co., New Delhi

UNIT I**9**

Introduction-Static and Dynamic performance Characteristics.Elements of Instrument, Transducer Elements, Intermediate Elements, Indicating,Recording Elements. Liquid level Measurements

UNIT II**9**

Temperature Measurements-Variou s Methods of Temperature measuring Instruments based on thermal expansion concept. Resistance Thermometer,Thermocouple, Radiation Type,Pyrometer,Ionization Principle, Recent Methods. Conductivity,PH measurements-Variou s types.

UNIT III**9**

Pressure measurement-Manometer, Bourdon Gauge, Diaphragm Gauge, Forced balancing type, Bellows type,Vacuum Gauge-Mcleod,Pirani,Ionization Gauge,Recent Developments.Density Measurements.

UNIT IV**9**

Flow Measurements-weight and volumetric flow measurements. Use of Bernoulli's principle.Orifice meter,Venturimeter, Weirs ,Notches, RotameterLaminar flow meter, Obstructionless flowmeters, Positive Displacement type,Valve type,Metering pump,Recent Developments.Viscosity Measurements,Moisture and Humidity measurements.

UNIT V**9**

Analytical Instruments-Liquid Chromatography, GLC, HPLC,Mass Spectrometer, IR, NMR, X-RAYS pectrometer, UV-SpectroPhotometer, Colorimetry, TGA & DTA,Polorography

Total : 45**TEXT BOOKS:**

1. Ewing G.W.,”Instrumental Methods of Chemical Analysis”, 5thEdn.,McGrawHill,1985
2. Nakra, B C and Chaudhry, K K. Instrumentation Measurement and Analysis. New York: Mcgraw Hill International Editions, 1994. (629.135, N4)
3. Sharma, B K. Instrumental Methods of Chemical Analysis. Meerut: Goel Publishing House, 1999. (543.083, N9)
4. Willard H, Hobart, Lynne L Merritt Jr and John A Dean. Instrumental Methods of Analysis 7th Edition. Delhi 110032: S.K Jain for Cps Pub, 1996. (621.361, M6)

UNIT I : REACTION KINETICS 9

Law of mass action, rate equation, elementary, non-elementary reactions and their mechanisms, theories of reaction rate and temperature dependency, analysis of experimental reactor data, evaluation of rate equation, integral and differential analysis for constant variable volume system, fitting of data complex reaction mechanism.

UNIT II : IDEAL REACTORS 9

Design of Homogeneous systems, batch, stirred tank and tubular floe reactor, design of reactors foe multiple reactions, combined reactor system, size comparison of reactors.

UNIT III : CHOICE OF REACTORS: 9

Factors affecting choice, optimum yield and conversion, selectivity, reactivity and yield problems, consecutive, parallel and mixed reactions, recycle.

UNIT IV : HEAT EFFECTS IN REACTORS 9

Isothermal and nonisothermal homogeneous reactor systems, adiabatic reactors, rates of heat exchanges for different reactors, design for constant rate heat input and constant heat transfer coefficient, operation, batch and continuous reactors, optimum temperature progression.

UNIT V : REACTOR STABILITY AND REACTION EQUILIBRIA 9

Criteria for stability of reactors, limit cycles and oscillating reaction, parameter sensitivity. Equilibrium in chemically reactive systems, evaluation of reaction equilibrium constant, effect of temperature on equilibrium, application to system involving gaseous components, computation of equilibrium composition.

L:45; T:15; Total: 60

TEXT BOOK:

- 1.O.Levenspiel, "Chemical Reaction Engineering", 3rdEdn., John Wiley, Singapore, W.S.E.
- 2.J.M. Smith, "Chemical Engineering Kinetics", 2ndEdn., McGraw Hill, New York.

REFERENCE:

- 1.W. Fogler "Chemical Reaction Engineering" Ed. 3., Prentice Hall of India, New Delhi

UNIT I**9**

Scenario of Petrochemical Industries and its feed stock. Product pattern of paraffins, olefins, dienes and acetylene.

Manufacturing of important paraffins, olefins, acetylene, butadiene, isoprene, oligomers and aromatics: Techniques, Equipments, Reactions, Catalyst, Solvents, Operating conditions, Separation and purification and developments in these areas.

UNIT II**9**

Production of synthesis gas : various routes, reactions, mechanisms, conditions, thermodynamics, kinetics, coal gasification and hydrogenation.

UNIT III**8**

Conversion of: Ethylene to ethylene oxide, ethylene glycol, ethanolamines. Propylene to acrylic acid, methyl ethyl ketone, acrylonitrile.

UNIT IV**9**

Conversion of: Butenes to, iso and n-butanols, MIBK, MTBE. Aromatics to maleic and phthalic anhydride, DMT, phenol and acetones. Cyclohexane to caprolactum, adipic acid, succinic acid etc.

UNIT V**10**

Hydration: Technologies for the production of alcohols such as ethanol, isobutyl alcohol and higher alcohols. Esterification: Process for production of few esters such as acrylates, terephthalates, esters for flavoring industries etc

L:45; T:15; Total: 60**TEXTS / REFERENCES:**

1. B. K. Bhaskarrao, "A Text on Petrochemicals", 2nd Ed, New Delhi, Khanna Publishers, -1996
2. M. Gopalrao and Marshall, " Outlines of Chemical Technology", 2nd Ed. Eastwest Press.
3. P. H.Groggins, " Unit Process in Organic Synthesis", 5th Ed., McGraw-Hill 1989.
4. N. N. Lebedev, "Chemistry and Technology of Basic Organic and Petrochemical Synthesis" Vol I, Mir Publishers, Moscow, 1981.
5. G. Lefebvre and A. Chauvel, "Petrochemical process: Technical and economical characteristic", vol. I & II, 2nd Ed., Gulf Publishers, 1989.
6. G.N.Sarkar "Advanced Petrochemicals" Khanna Publishers, 1st edition, 2002
7. G. C. Odion, "Principles of Polymerization", McGraw-Hill -1972.
Kumar and Rakesh Gupta, "Fundamental of Polymers", Mc Graw Hill, 1998
8. F. W. Billmeyer, "Textbook of Polymer Science", John Wiley, 3rd Edn. 1994

XPC 407 PETROCHEMICAL ANALYSIS LAB

0 0 4 2

- 1.Pensky – Marten Flash point Apparatus
- 2.Falling ball viscometer
- 3.Aniline point apparatus
- 4.Red wood viscometer
- 5.Sulphur content determination
- 6.Bomb calorimeter
- 7.Bitumen testing apparatus
- 8.Cloud point and pour point estimation apparatus
- 9.Congeaing point of waxes
- 10.Smoke point estimation

Total: 60

- (1) Molecular weight determination
 - Rast's method
 - F.Pt depression
 - B.Pt elevation and
 - Transition temperature methods
- (2) Partition experiments
 - (a) Partition coefficient of iodine between two immiscible solvents.
 - (b) Eq. Constant of $KI + I_2 = KI_2$
 - (c) Association factor of an organic acid
 - (d) Curramonium couples
- (3) Phase rules
 - (a) Two component System
 - (b) Three component System
 - (c) Phenol-water system
- (4) Optical experiments
 - (a) Polarimetry
 - (b) Refractometry
- (5) Conductivity experiments
 - Cell constant
 - Ostwald dilution acid
 - Basicity of an organic acid
 - Conductometric titration
- (6) Kinetics
 - First order reaction
 - Second order reaction
- (7) EMF
 - Single electro potentials
 - Concentration cells
 - Titration (d) pH determination
- (8) Miscellaneous
 - (a) Surface tension
 - (b) Viscosity
- (c) Adsorption

Total: 60