ANNA UNIVERSITY CHENNAI : CHENNAI 600 025

UNIVERSITY DEPARTMENT

B.TECH. PETROLEUM ENGINEERING AND TECHNOLOGY

I TO VIII SEMESTERS CURRICULA AND SYLLABI

SEMESTER I

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
HS8151	Technical English – I	3	1	0	4
MA8151	Mathematics – I	3	1	0	4
PH8151	Engineering Physics	3	0	0	3
CY8151	Enginnering Chemistry	3	0	0	3
GE8151	Computing Techniques	3	0	0	3
GE8152	Engineering Graphics	2	0	3	4
PRACTICALS					
PH8161	Physics Laboratory	0	0	2	1
CY8161	Chemistry Laboratory	0	0	2	1
GE8161	Computer Practices Laboratory	0	0	3	2
GE8162	Engineering Practices Laboratory	0	0	3	2
	TOTAL	**17**	**2**	**13**	**27**

SEMESTER II

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
HS8251	Technical English – II	3	1	0	4
MA8251	Mathematics – II	3	1	0	4
PH8255	Physics of Materials	3	0	0	3
CY8253	Chemistry of Technologists	3	0	0	3
GE8251	Engineering Mechanics	3	1	0	4
CH8201	Principles of Chemical Engineering	3	0	0	3
EE8252	Principles of Electrical and Electronics Engineering	3	0	0	3
PRACTICALS					
CY8261	Applied Chemistry Lab	0	0	3	2
CH8261	UNIX Programming Lab	0	0	4	2
	TOTAL	**21**	**3**	**7**	**28**

SEMESETER III

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MA8356	Probability And Stastics	3	1	0	4
CY8301	Organic Chemistry	3	0	0	3
AS8301	Petroleum Engineering	4	0	0	4
AS8302	Fluid Mechanics for Petrochemical Engineers	3	1	0	4
CH8302	Process Calculations	3	0	0	3
ME8351	Basic Mechanical Engineering	3	0	0	3
PRACTICALS					
CH8311	Electrical Engineering Lab For Technologists	0	0	4	2
CH8312	Organic Chemistry Lab	0	0	4	2
ME8361	Mechanical Engineering Lab	0	0	3	2
	TOTAL	**19**	**2**	**8**	**27**

SEMESETER IV

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MA 8353	Numerical Methods	3	1	0	4
CY8451	Physical Chemistry	3	0	0	3
AS8401	Chemical Engineering Thermodynamics	3	1	0	4
CH8402	Heat Transfer	3	0	0	3
AS8402	Spectroscopic Techniques	3	0	0	3
AS8402	Natural Gas Engineering	3	0	0	3
PRACTICALS					
CH8411	Fluid Mechanics Lab	0	0	4	2
CH8412	Technical Analysis Lab	0	0	4	2
	TOTAL	**18**	**2**	**8**	**24**

SEMESETER V

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
GE8351	Environmental Science And Engineering	3	0	0	3
AS8501	Petroleum Refining I	3	0	0	3
CH8502	Chemical Reaction Engineering I	3	1	0	4
CH8651	Process Instrumentation Dynamics and Control	3	0	0	3
CH8504	Mass Transfer – I	3	0	0	3
	Elective I	3	0	0	3
PRACTICALS					
HS8561	Employability Skills	0	0	2	1
CH8511	Heat Transfer Lab	0	0	3	2
AS8511	Petroleum Testing Lab I	0	0	4	2
	TOTAL	**18**	**1**	**9**	**24**

SEMESETER VI

CODE NO	COURSE TITLE	L	T	P	C
AS8601	Equilibrium Staged Operations	3	1	0	4
AS8602	Chemical Reaction Engineering II	3	0	0	3
AS8603	Petroleum Refining II	3	0	0	3
CH8604	Plant Safety And Risk Analysis	3	0	0	3
AS8604	Petrochemicals	4	0	0	4
	Elective II	3	0	0	3
PRACTICALS					
AS8611	Process Control Lab	0	0	4	2
AS8612	Petroleum Testing Lab II	0	0	4	2
CH8612	Computational Chemical Engineering Lab	0	0	4	2
	TOTAL	**19**	**1**	**12**	**26**

SEMESTER VII

COURSE CODE	COURSE TITLE	L	T	P	C
CH8751	Transport Phenomena	3	1	0	4
CH8701	Chemical Process Design	3	0	0	3
CH8702	Process Economics	3	0	0	3
AS8701	Petroleum Equipment Design	3	1	0	4
AS8702	Petroleum Refining III	3	0	0	3
	Elective III	3	0	0	3
PRACTICALS					
CH8711	Mass Transfer Lab	0	0	4	2
CH8611	Chemical Reaction Engineering Lab	0	0	3	2
	TOTAL	**18**	**2**	**7**	**24**

SEMESTER VIII

COURSE CODE	COURSE TITLE	L	T	P	C
	Elective IV	3	0	0	3
	Elective V	3	0	0	3
PRACTICALS					
AS8811	Project Work	0	0	12	6
	TOTAL	**6**	**0**	**12**	**12**

LIST OF ELECTIVES FOR PETROLEUM ENGINEERING AND TECHNOLOGY

COURSE CODE	COURSE TITLE	L	T	P	C
MA8001	Statistics and Linear Programming	3	0	0	3
AS8001	Petroleum Chemistry	3	0	0	3
AS8002	Drilling and Well Engineering	3	0	0	3
AS8003	Reservoir Engineering	3	0	0	3
AS8004	Enhanced Oil Recovery	3	0	0	3
AS8005	Production Engineering	3	0	0	3
AS8006	Multicomponent Distillation	3	0	0	3
CH8003	Energy Technology	3	0	0	3
CH8005	Modern Separation Techniques	3	0	0	3
CH8006	Optimization of Chemical Process	3	0	0	3
CH8009	Process Modeling and Simulation	3	0	0	3
CH8010	Process Plant Utilities	3	0	0	3
CH8011	Supply Chain Management	3	0	0	3
GE8751	Engineering Ethics and Human Values	3	0	0	3
ME9039	Design of Heat Exchangers	3	0	0	3
MF9021	Product Design and Development	3	0	0	3
ME9032	Computational Fluid Dynamics	3	0	0	3
ME9034	Design of Pressure Vessels and Piping	3	0	0	3

HS8251 TECHNICAL ENGLISH-11

L	T	P	C
3	1	0	4

AIM

To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

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

OBJECTIVES

To enable students write letters and reports effectively in formal and business situations

UNIT I

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

12

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

Suggested activities:

UNIT II

12

Phrases / Structures indicating use / purpose – Adverbs-Skimming – Non-verbal communication - Listening – correlating verbal and non-verbal communication -Speaking in group discussions – Formal Letter writing – Writing analytical paragraphs.

Suggested activities:

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

UNIT III **12**

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

UNIT IV **12**

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

Suggested Activities:

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

Suggested Activities:

1. Case Studies on problems and solutions
2. Brain storming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, formal letters – Writing letter of application with CV/Bio-data – Writing general and safety instructions – Preparing checklists – Writing e-mail messages.

UNIT V
12

Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing a proposal

` 5. Writing advertisements

TEXT BOOK

1. Chapters 5 – 8. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006. Themes 5 – 8 (Technology, Communication, Environment,

Suggested activities:

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

REFERENCES

1. P. K. Dutt, G. Rajeevan and C.L.N Prakash, 'A Course in CommunicationSkills',

Cambridge University Press, India 2007.
2. Krishna Mohan and Meera Banerjee, 'Developing Communication Skills', Macmillan India Ltd., (Reprinted 1994 – 2007).
3. Edgar Thorpe, Showick Thorpe, 'Objective English', Second Edition,Pearson Education, 2007.

Extensive Reading:
1. Robin Sharma, 'The Monk Who Sold His Ferrari', Jaico Publishing House, 2007

TOTAL: 60 PERIODS

MA2111 MATHEMATICS – I L T P C
3 1 0 4

UNIT I MATRICES 12

Characteristic equation – Eigen values and eigen vectors of a real matrix – Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY 12

Equation of a sphere – Plane section of a sphere – Tangent Plane – Equation of a cone – Right circular cone – Equation of a cylinder – Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS 12

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes – Evolute as envelope of normals.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Differentiation of implicit functions – Jacobians – Taylor's expansion – Maxima and Minima – Method of Lagrangian multipliers.

UNIT V MULTIPLE INTEGRALS 12

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between Cartesian and polar coordinates – Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral

TEXT BOOK:

1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", Third edition, Laxmi Publications(p) Ltd.,(2008).
2. Grewal. B.S, "Higher Engineering Mathematics", 40 th Edition, Khanna Publications, Delhi, (2007).

REFERENCES:

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2007).
2. Glyn James, "Advanced Engineering Mathematics", 7 th Edition, Pearson Education, (2007).
3. Jain R.K and Iyengar S.R.K," Advanced Engineering Mathematics", 3 rdEdition, Narosa Publishing House Pvt. Ltd., (2007).

TOTAL: 60 PERIODS

PH8151 **ENGINEERING PHYSICS**

L T P C

3 0 0 3

UNIT I CONDUCTING MATERIALS

8

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantumtheory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS

5

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors – carrier concentration derivation in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration – compound semiconductors – Hall effect –Determination of Hall coefficient – Applications.

UNIT II MAGNETIC AND SUPERCONDUCTING MATERIALS

12

Origin of magnetic moment – Bohr magneton – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti – ferromagnetic materials – Ferrites – applications – magnetic recording and readout – storage of magnetic data – tapes, floppy and magnetic disc drives. Superconductivity : properties - Types of super conductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS

10

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT VMODERN ENGINEERING MATERIALS

10

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy,application, advantages and disadvantages of SMA Nanomaterials: synthesis –plasma arcing – chemical vapour deposition sol-gels – electrodeposition – ball milling - properties of nanoparticles and applications. Carbon nanotubes: fabrication – arc method – pulsed laser deposition – chemical vapour deposition - structure – properties and applications.

TEXT BOOKS

1.charles kittel ‘Introduction to solid Physics’, john wiley & sons

2. Charles P. Poole and Frank J.Ownen, ’Introduction to Nanotechnology’, Wiley India(2007)

(for Unit V)

REFERENCES

1. Rajendran, V, and Marikani A, 'Materials science'Tata McGraw Hill publications, (2004) New delhi.
2. Jayakumar, S. 'Materials science', R.K. Publishers, Coimbatore, (2008).
3. Palanisamy P.K, 'Materials science', Scitech publications(India) Pvt. LTd., Chennai, second Edition(2007)
4. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3 Publishing House Pvt. Ltd., (2007).

TOTAL:60PERIODS

CY8151 ENGINEERING CHEMISTRY

L T P C

3 0 0 3

UNIT I ELECTROCHEMISTRY 9

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes –Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance – potentiometer titrations (redox - Fe^2 dichromate and precipitation – Ag vs CI titrations) and conduct metric titrations (acid-base – HCI vs, NaOH) titrations,

UNIT II CORROSION AND CORROSION CONTROL

9

Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – paints – constituents and functions – metallic coatings – electroplating (Au) and electroless (Ni) plating.

UNIT IIIFUELS AND COMBUSTION

9

Calorific value – classification – Coal – proximate and ultimate analysis metallurgical coke – manufacture by Otto-Hoffmann method – Petroleum processing and fractions – cracking – catalytic cracking and methods knocking – octane number and cetane number – synthetic petrol – Fischer Tropsch and Bergius processes – Gaseous fuels- water gas, producer gas,CNG and LPG, Flue gas analysis – Orsat apparatus – theoretical air for combustion.

UNIT IVPHASE RULE AND ALLOYS

9

Statement and explanation of terms involved – one component system – water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic systems (lead-silver system only) – alloys – importance, ferrous alloys – nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze.

UNIT VANALYTICAL TECHNIQUES

9

Beer-Lambert's law (problem) – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (problem) (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy.

TEXT BOOKS

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).

2. S.S.Dara “A text book of Engineering Chemistry” S.Chand & Co.Ltd., New Delhi (2006).

REFERENCES

1. B.Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
2. B.K.Sharma “Engineering Chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2001).

TOTAL:45PERIODS

GE 8151 COMPUTING TECHNIQUES **L T P C**
3 0 0 3

AIM :
To provide an awareness to Computing and Programming

OBJECTIVES :
• To enable the student to learn the major components of a computer system
• To know the correct and efficient ways of solving problems
• To learn to use office automation tools
• To learn to program in C

UNIT I INTRODUCTION TO COMPUTERS **9**
Introduction – Characteristics of Computers – Evolution of Computers – Computer Generations – Classification of Computers – Basic Computer organization – Number Systems

UNIT II COMPUTER SOFTWARE **9**
Computer Software –Types of Software – Software Development Steps – Internet Evolution - Basic Internet Terminology – Getting connected to Internet Applications.

UNIT III PROBLEM SOLVING AND OFFICE APPLICATION SOFTWARE **9**
Planning the Computer Program – Purpose – Algorithm – Flow Charts – Pseudocode - Application Software Packages- Introduction to Office Packages (not detailed commands for examination).

UNIT IV INTRODUCTION TO C **9**
Overview of C – Constants, Variables and Data Types – Operators and Expressions – Managing Input and Output operators – Decision Making - Branching and Looping.

UNIT V FUNCTIONS AND POINTERS **9**
Handling of Character Strings – User-defined Functions – Definitions – Declarations - Call by reference – Call by value – Structures and Unions – Pointers – Arrays – The Preprocessor – Developing a C Program : Some Guidelines

TEXT BOOKS:
1. Ashok.N.Kamthane,“ Computer Programming”, Pearson Education (India) (2008).
2. Behrouz A.Forouzan and Richard.F.Gilberg, “A Structured Programming Approach Using C”, II Edition, Brooks-Cole Thomson Learning Publications, (2007).

REFERENCES:
1. Pradip Dey, Manas Ghoush, “Programming in C”, Oxford University Press. (2007).
2. Byron Gottfried, “Programming with C”, 2nd Edition, (Indian Adapted Edition), TMH publications, (2006).
3. Stephen G.Kochan, “Programming in C”, Third Edition, Pearson Education India,(2005).
4. Brian W.Kernighan and Dennis M.Ritchie, “The C Programming Language”, Pearson Education Inc., (2005).
5. E.Balagurusamy, “Computing fundamentals and C Programming”, Tata McGraw-Hill Publishing Company Limited, (2008).

6. S.Thamarai Selvi and R.Murugan, “C for All”, Anuradha Publishers, (2008).
TOTAL: 45 PERIODS

GE 8152 ENGINEERING GRAPHICS L T P C
2 0 3 4

AIM
To develop graphic skills in students.

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

Concepts and conventions (Not for Examination) 1
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning

UNIT I PLANE CURVES AND FREE HAND SKETCHING 15

Curves used in engineering practices:
Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of squad and circle – Drawing of tangents and normal to the above curves.

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

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 14
Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT III PROJECTION OF SOLIDS 15
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 15
Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 15
Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.Perspective projection of prisms, pyramids and cylinders by visual ray method.

TEXT BOOKS:

1. N.D. Bhatt, "Engineering Drawing" Charotar Publishing House, 46thEdition, (2003).

REFERENCES:

1. K. V. Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers,Chennai (2006).
2. M.S. Kumar, "Engineering Graphics", D.D. Publications, (2007).
3. K. Venugopal & V. Prabhu Raja, "Engineering Graphics", New Age International (P)Limited (2008).
4. M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education (2005).
5. K. R. Gopalakrishnana, "Engineering Drawing" (Vol.I&II), Subhas Publications(1998).
6. Dhananjay A.Jolhe, "Engineering Drawing with an introduction to AutoCAD" TataMcGraw Hill Publishing Company Limited (2008).
7. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw HillPublishing Company Limited, New Delhi, (2008).

Publication of Bureau of Indian Standards:

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

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. Whenever the total number of candidates in a college exceeds 150, the University Examination in that college will be conducted in two sessions (FN and AN on the same day) for 50 percent of student (approx) at a time.

TOTAL: 75 PERIODS

PH8161 **PHYSICS LABORATORY** **L T P C**

0 0 2 1

LIST OF EXPERIMENTS

1. Determination of Young's modulus of the material – non uniform bending.
2. Determination of Band Gap of a semiconductor material.
3. Determination of specific resistance of a given coil of wire – Carey Foster
4. Determination of viscosity of liquid – Poiseuille's method.
5. Spectrometer dispersive power of a prism.
6. Determination of Young's modulus of the material – uniform bending.
7. Torsional pendulum – Determination of rigidity modulus.

• A minimum of FIVE experiments shall be offered.
• Laboratory classes on alternate weeks for Physics and Chemistry.
• The lab examinations will be held only in the second semester.

CY8161 **CHEMISTRY LABORATORY**

L T P C

0 0 2 1

LIST OF EXPERIMENTS

1. Conduct metric titration (Simple acid base)
2. Conduct metric titration (Mixture of weak and strong acids)
3. Conduct metric titration using BaCl vs Na SO
4. potentometric titration
5. PH titration (acid & base)
6. Determination of water of crystallization of a crystalline salt (Copper
7. Estimation of Ferric iron by spectrophotometry

• A minimum of FIVE experiments shall be offered.
• Laboratory classes on alternate weeks for Physics and Chemistry.
• The lab examinations will be held only in the second semester.

GE8161 **COMPUTER PRACTICE LABORATORY**

L T P C

0 0 3 2

LIST OF EXPERIMENTS

1. UNIX COMMANDS 15

Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING 15

Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX 15

Dynamic Storage Allocation-Pointers-Functions-File Handling

HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

Hardware

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

Software

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

TOTAL: 45 PERIODS

GE2116 ENGINEERING PRACTICES LABORATORY L T P C
0 0 3 2

OBJECTIVES

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

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 9

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise: Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 13

Welding:

(a) Preparation of arc welding of butt joints, lap joints and tee joints.
(b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending:
(b) Model making – Trays, funnels, etc.
(c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 10

1. Residential house wiring using switches, fuse, indicator, lamp and energymeter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE 13

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EOR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

REFERENCES:

1. K.Jeyachandran, S.Natarajan & S, Balasubramanian, "A Primer on Engineering Practices Laboratory", Anuradha Publications, (2007).
2. T.Jeyapoovan, M.Saravanapandian & S.Pranitha, "Engineering Practices Lab Manual", Vikas Puplishing House Pvt.Ltd, (2006)
3. H.S. Bawa, "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, (2007).
4. A.Rajendra Prasad & P.M.M.S. Sarma, "Workshop Practice", Sree Sai Publication, (2002).
5. P.Kannaiah & K.L.Narayana, "Manual on Workshop Practice", Scitech Publications, (1999).

SEMESTER EXAMINATION PATTERN

The Laboratory examination is to be conducted for Group A & Group B, allotting 90 minutes for each group, with a break of 15 minutes. Both the examinations are to be taken together in sequence, either in the FN session or in the AN session. The maximum marks for Group A and Group B lab examinations will be 50 each, totaling 100 for the Lab course. The candidates shall answer either I or II under Group A and either III or IV under Group B, based on lots.

Engineering Practices Laboratory
List of equipment and components
(For a Batch of 30 Students)

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
3. Standard woodworking tools 15 Sets.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools: (a) Rotary Hammer 2 Nos
(b) Demolition Hammer 2 Nos
(c) Circular Saw 2 Nos
(d) Planer 2 Nos
(e) Hand Drilling Machine 2 Nos
(f) Jigsaw 2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
8. Power Tool: Angle Grinder 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner One each.

ELECTRICAL

1. Assorted electrical components for house wiring 15 Sets
2. Electrical measuring instruments 10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V) 1 No.
5. Power Tools: (a) Range Finder 2 Nos
(b) Digital Live-wire detector 2 Nos

ELECTRONICS

1. Soldering guns 10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs 10 Nos.
4. Multimeters 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power Supply

TOTAL: 45 PERIODS

HS8251 TECHNICAL ENGLISH-11

L T P C

3 1 0 4

AIM

To encourage students to actively involve in participative learning of English and to help

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

them acquire Communication Skills.

OBJECTIVES

- To enable students write letters and reports effectively in formal and business situations

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

UNIT I **12**

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

Suggested activities:

UNIT II **12**

Phrases / Structures indicating use / purpose – Adverbs-Skimming – Non-verbal communication - Listening – correlating verbal and non-verbal communication -Speaking in group discussions – Formal Letter writing – Writing analytical paragraphs.

Suggested activities:

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

UNIT III **12**

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

recommendations .

UNIT IV **12**

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

Suggested Activities:

1. Rewriting exercises using numerical adjectives.
2. Reading comprehension exercises with analytical questions on content – Evaluation of

Suggested Activities:

1. Case Studies on problems and solutions
2. Brain storming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, content.

3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking - Role play – group discussions – Activities giving oral instructions.
5. Writing descriptions, expanding hints – Writing argumentative paragraphs – Writing formal letters – Writing letter of application with CV/Bio-data – Writing general and safety instructions – Preparing checklists – Writing e-mail messages.

UNIT V

12

Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing a proposal

` 5. Writing advertisements

TEXT BOOK

1. Chapters 5 – 8. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient

Suggested activities:

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

Longman Pvt. Ltd., 2006. Themes 5 – 8 (Technology, Communication, Environment, Industry)

REFERENCES

1. P. K. Dutt, G. Rajeevan and C.L.N Prakash, 'A Course in CommunicationSkills', Cambridge University Press, India 2007.
2. Krishna Mohan and Meera Banerjee, 'Developing Communication Skills', Macmillan India Ltd., (Reprinted 1994 – 2007).
3. Edgar Thorpe, Showick Thorpe, 'Objective English', Second Edition,Pearson Education, 2007.

Extensive Reading:

1. Robin Sharma, 'The Monk Who Sold His Ferrari', Jaico Publishing House, 2007

TOTAL: 60 PERIODS

MA8251 **MATHEMATICS -11** **L T P C**
3 0 0 3

UNIT I ORDINARY DIFFERENTIAL EQUATIONS **8**

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULAS **5**

Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelpipeds.

UNIT III ANALYTIC FUNCTIONS **12**

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

UNIT IV COMPLEX INTEGRATION **10**

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor and Laurent expansions – Singular points – Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi- circular contour(excluding poles on boundaries).

UNIT V LAPLACE TRANSFORM **10**

Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions. Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TEXT BOOKS

1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", 3 Edition, Laxmi Publications (p) Ltd., (2008).
2. Grewal. B.S, "Higher Engineering Mathematics", 40 Edition, Khanna Publications, Delhi, (2007).

REFERENCES

2. Glyn James, "Advanced Engineering Mathematics", 3 (2007).

1. Ramana B.V, "Higher Engineering Mathematics",Tata McGraw Hill Publishing Company, New Delhi, (2007).

1. Ramana B.V, "Higher Engineering Mathematics",Tata McGraw Hill Publishing Company, New Delhi, (2007).

TOTAL:45 PERIODS

PH8255 PHYSICS OF MATERIALS L T P C
3 0 0 3

OBJECTIVE

To introduce the essential principles of physics for chemical and related engineering applications.

UNIT I MATERIALS PREPARATION AND PROCESSING 9

Gibbs phase Rule – Phase Diagram – One component and multi component systems – eutectic – peritectic – eutectoid – peritectoid – invariant reactions – Lever Rule – Nucleation – homogeneous and heterogeneous nucleation – Free energy of formation of a critical nucleus – Nucleation rate – Experimental techniques of crystal growth – Czochralski Bridgman, Flux, Solution, Vapour, Sol-gel - hydrothermal – Epitaxy.

UNIT II CONDUCTING MATERIALS 9

Classical free electron theory of metals - Schrödinger wave equation - Time independent and time dependent equations. Physical significance of wave function, particle in a box (in one dimension) – electrons in a metal - Fermi distribution function – Density of energy states – effect of temperature on Fermi energy, Superconducting Phenomena, Properties of superconductors – Meissner effect and Isotope effect. Type I and Type II superconductors, High Tc superconductors – Magnetic levitation and SQUIDS.

UNIT III SEMICONDUCTING MATERIALS 9

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

UNIT IV MAGNETIC AND DIELECTRIC MATERIALS 9

Introduction to magnetic materials - Domain theory of ferromagnetism, Hysteresis, Soft and

3. Erwin Kreyszig, "Advanced Engineering Mathematics", 7 Edition, Wiley India, (2007).
4. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3
Publishing House Pvt. Ltd., (2007).

Hard magnetic materials – Anti-ferromagnetic materials – Ferrites, Giant Magneto Resistance materials, Electronic, Ionic, Orientational and space charge polarization – Internal field and deduction of Clausius Mosotti equation – dielectric loss – different types of dielectric breakdown – classification of insulating materials and their applications.

UNIT V NEW MATERIALS AND APPLICATIONS 9

Introduction to Ceramics and its applications - Ceramic Fibres - Fibre reinforced Plastics – Fibre reinforced Metal – Metallic glasses – Shape memory alloys – Copper base alloys – Nickel – Titanium alloys - Sensors and Actuators – Range - Accuracy Determination –- Photo detectors, Bio-sensors, Scintillation detectors (Position sensitive) – Renogram – Computed Tomography Scan (CT Scan) - Magnetic Resonance Imaging (MRI) - Performance and Reliability testing.

TEXT BOOKS

1. Kumar.J, Moorthy Babu. S and Vasudevan. S., Engineering Physics, Vijay Nicole Imprints, 2006.
2. Palanisamy. P.K., Materials Science, Scitech., 2003.

REFERENCES

1. Gaur. R.K. and Gupta. S.L., Engineering Physics, Dhanpat Rai Publication., 2003.
2. Raghavan. V. Materials Science and Engineering, Prentice Hall of India, 2002.
3. Arumugam, M, Biomedical Instrumentation, 2nd Edition, Anuradha Agencies, 2003.

TOTAL: 45 PERIODS

GE8251 ENGINEERING MECHANICS L T P C

3 1 0 4

OBJECTIVE

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

UNIT IBASICS & STATICS OF PARTICLES 12

Introduction – Units and Dimensions – Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT IIEQUILIBRIUM OF RIGID BODIES 12

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

UNIT IIIPROPERTIES OF SURFACES AND SOLIDS 12

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

UNIT IVDYNAMICS OF PARTICLES 12

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

UNIT VFRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12

Frictional force – Laws of Coloumb friction – simple contact friction – Rolling resistance – Belt friction.

Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

TEXT BOOK

1. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, (1997).

REFERENCES

1. Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., (2000).
2. Hibbeller, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., (2000).
3. Palanichamy, M.S., Nagam, S., "Engineering Mechanics – Statics & Dynamics", Tata McGraw-Hill, (2001).
4. Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", IV Edition – Pearson Education Asia Pvt. Ltd., (2003).
5. Ashok Gupta, "Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM)" Pearson Education Asia Pvt., Ltd., (2002).

TOTAL : 60 PERIODS

EE8252 PRINCIPLES OF ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

UNIT I CIRCUIT ANALYSIS TECHNIQUES 12

Kirchoff's current and voltage laws – series and parallel connection of independent sources – R, L and C – Network Theorems – Thevenin, Superposition, Norton, Maximum power transfer and duality – Star-delta conversion.

UNIT II ELECTRICAL MECHANICS 12

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

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 12

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

UNIT IV DIGITAL ELECTRONICS 12

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

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 12

Types of Signals Amplitude and Frequency Modulations. Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TEXT BOOKS

1. V.N. Mittle "Basic Electrical Engineering",Tata McGraw Hill Edition, New Delhi, 1990.
2. R.S. Sedha, "Applied Electronics" S. Chand & Co., 2006.

REFERENCES

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering",Tata McGraw Hill, Second Edition, (2006).
2. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press (2005).
3. Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, (1994).
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, (2002).
5. Premkumar N, "Basic Electrical Engineering", Anuradha Publishers, (2003).

TOTAL:60PERIODS

CY8151 ENGINEERING CHEMISTRY L T P C
3 0 0 3

UNIT I ELECTROCHEMISTRY 9

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes –Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance – potentiometer titrations (redox - Fe^2 dichromate and precipitation – Ag vs CI titrations) and conduct metric titrations (acid-base – HCI vs, NaOH) titrations,

UNIT II CORROSION AND CORROSION CONTROL 9

Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – paints – constituents and functions – metallic coatings – electroplating (Au) and electroless (Ni) plating.

UNIT IIIFUELS AND COMBUSTION **9**

Calorific value – classification – Coal – proximate and ultimate analysis metallurgical coke – manufacture by Otto-Hoffmann method – Petroleum processing and fractions – cracking – catalytic cracking and methods knocking – octane number and cetane number – synthetic petrol – Fischer Tropsch and Bergius processes – Gaseous fuels- water gas, producer gas,CNG and LPG, Flue gas analysis – Orsat apparatus – theoretical air for combustion.

UNIT IVPHASE RULE AND ALLOYS **9**

Statement and explanation of terms involved – one component system – water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic systems (lead-silver system only) – alloys – importance, ferrous alloys – nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze.

UNIT VANALYTICAL TECHNIQUES **9**

Beer-Lambert's law (problem) – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (problem) (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy.

TEXT BOOKS

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2006).

REFERENCES

1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).

TOTAL:45PERIODS

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

AIM

With the present development of the computer technology, it is necessary to develop efficient algorithms for solving problems in science, engineering and technology. This course gives a complete procedure for solving different kinds of problems occur in engineering numerically.

OBJECTIVES

At the end of the course, the students would
1. Acquire skills in handling situations involving more than one random variable and functions of random variables.
2. Be introduced to the notion of sampling distributions and have acquired knowledge of statistical techniques useful in making rational decision in management problems.
3. Be exposed to statistical methods designed to contribute to the process of

making scientific judgments in the face of uncertainty and variation.

UNIT I RANDOM VARIABLES 12

Discrete and continuous random variables - Properties- Moments - Moment generating functions and their properties. Binomial, Poisson ,Geometric, Negative binomial, Uniform, Exponential, Gamma, and Weibull distributions.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 12

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression – function of a random variable-Transformation of random variables - Central limit theorem.

UNIT III TESTING OF HYPOTHESIS 12

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

UNIT IV DESIGN OF EXPERIMENTS 12

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

UNIT V RELIABILTY AND QUALITY CONTROL 12

Concepts of reliability-hazard functions-Reliability of series and parallel systems- control charts for measurements (x and R charts) – control charts for attributes (p, c and np charts)

TOTAL : 60 PERIODS

TEXT BOOKS

1. J. S. Milton and J.C. Arnold, " Introduction to Probability and Statistics", Tata McGraw Hill, 4th edition, 2007. (For units 1 and 2)
2. R.A. Johnson and C.B. Gupta, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, (2007)

REFERENCES

1. Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, "Probability and Statistics for Engineers and Scientists", Seventh Edition, Pearsons Education, Delhi, 2002.
2. Navidi, W, "Statistics for Engineers and Scientists", Special Indian Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi,2008.
3. Spiegel, M.R, Schiller, J and Alu Srinivasan, R, "Schaum's Outlines Probability and Statistics", Tata McGraw-Hill Publishing Company Ltd. New Delhi ,2007.

CY8301 ORGANIC CHEMISTRY L T P C

3 0 0 3

AIM

To study the type of components in which organic reaction are taking place and also to know the preparation of the essential organic compounds.

OBJECTIVES

At the end of the course students are in a position to have knowledge on various reaction, Mechanism, preparation of organic compounds classification of the

compounds. This will be a pre cursor for the study on Chemical Reaction Engineering.

UNIT I UNIT PROCESS (9)

Definitions – reagents- mechanism – catalyst – illustrations of the following unit process– nitration – halogenation – oxidation & reduction – esterification.

UNIT II ORGANIC REACTIONS MECHANISM AND ESTIMATION (9)

Electrophilic reaction - Friedel craft reaction, Riemer Timenn Reaction; Nucleophilic reactions - Aldol condensation, Benzion condensation; Free radical reaction - Halogenation of Alkane, Addition HBR on Alkene in presence of peroxide

UNIT III (9)

Alylic halogination using N-Bromo succinamide (NBS); Thermal halogination of Alkane (CH3-CH=CH); condensation and polymerization reaction – oxidation and reduction reactions; estimation of some organic compounds – phenol – aniline – acetone - glucose

UNIT IV SYNTHETIC CHEMISTRY (9)

synthesis of different types of compounds like alcohol, aldehyde, acid, amine and synthesis of dicarboylic acids and unsaturated acids. Synthesis of azodyes –methyl orange and congo dye. Synthesis of triphenyl methane dyes – alizarin-melachite green.

UNIT V AMINO ACIDS AND PROTEINS (9)

Amino acids and proteins- classification - synthesis of amino acids - reactions of carboxyl group and amino group - peptide linkage - end group analysis - colour reaction of proteins- denaturation.

TOTAL: 45 PERIODS

TEXT BOOK

1. Tiwari K.S. Vishnoi N.K. and Marhotra S.N., A text book of Organic Chemistry, II Edition , Vikas Publishing House Pvt.Ltd., (1998), New Delhi.

REFERENCE

1. P. H. Groggins Unit processes in organic synthesis. (Third Edition). McGraw-Hill, New York, 1947.

AS8301 PETROLEUM ENGINEERING L T P C
4 0 0 4

UNIT I INTRODUCTION (9)

Refinery products – Refinery Feeds – Crude distillation – Coking and thermal process.

UNIT II CATALYTIC CRACKING (9)

Catalytic Cracking - Catalytical hydro cracking – Hydroprocessing and Reused processing hydro treating.

UNIT III CATALYTICAL (9)

Reforming and isomerization alkylation and polymerization – Product blending – Supporting processes.

UNIT IV LUBRICIATING (9)

Lubriciating oil blending stocks petrochemical feedstocks.

UNIT V COST EVALUATION (9)

Cost Evaluation – Economic evaluation of petroleum reused and refineries.

TOTAL: 45 PERIODS

Text Book

1. Petroleum Refining : Technology and economics CRC Press V Edition 2007 J.CH Garry , Hardward G.E and M.J.Kaiser.
2. Modern Petroleum Technology Upstream Vol I A.G. Lucas Hurley Edition 2002.
3. Modern Petroleum Technology Downstream Vol II A.Lucas Hurley VI Edition 2002.

AS8302 FLUID MECHANICS FOR PETROCHEMICAL ENGINEERS L T P C
3 1 0 4

AIM :

To have a general idea about the Mechanism of fluid, fluid flow, flow measuring devices through basic concepts and fluid dynamics in Porous Media.

OBJECTIVES :

The subject will help the students to have knowledge on the fluid properties, their characteristics while static and during flow through ducts, pipes and porous medium. Knowledge on several machineries used to transport the fluid and their performance are assessed.

UNIT I (9)

The concept of fluid, the fluid as a continuum physical and thermodynamic properties – basic laws – Newtorian and non-newtorian fluids – flow patterns – Velocity field – streamlines and stream tubes – vorticity and irrotationality.

The principle of dimensional hormogeneity – dimensional analysis, the Pi-theorems. Similitude – use of dimensional analysis for scale up studies.

UNIT II (9)

Pressure and Pressure gradient – equilibrium of fluid element – hydrostatic pressure distributions – application to manometry – mass, energy and momentum balances – continuity equation, equation of motion, Navier – stokes equation and Bernoullis theorem.

UNIT III (9)

Reynold's number regimes, flow through pipes – head loss, friction factor, minor losses in pipe systems and multiple pipe systems – boundary layer concepts, drag forces on solid particles in fluids – flow through fixed and fluidized beds.

UNIT IV (9)

Constant and variable head meters – pipes, fittings and valves, classification of pumps – performance, curves – compressors and its efficiency. Introduction to compressible flow, comparison of adiabatic and isothermal flow of gases.

UNIT V **(9)**

Fluid dynamics in Porous Media – Hydrostatic pressure and geothermal gradients. Porosity – permeability relationships and rock microstructure. Diffusivity equation steady state, pseudo-steady state and transfer flow Radial flow and well models. Skin, partial penetration and well productivity index. Horizontal wells. Gas flow and Kbinkenberg effect.

Total Number of periods – 45

TEXT BOOKS

1. Neol de Nevers, "Fluid Mechanics for Chemical Engineers." II Edition, Mc.Graw Hill (1991).
2. James O.Wilkes and Stacy G.Bikes, "Fluid Mechanics for Chemical Engineers" Prentice Hall PTR (International Series in Chemical Engineering) – (1999).
3. Mc.Cabe W.L.Smith, J.C and Harriot..P "Unit operations in Chemical Engineering", Mc.Graw Hill, V Edition, 2001.

REFERENCE BOOKS

1. White F.M., "Fluid Mechanics", IV Edition, Mc.Graw – Hill Inc. 1999.

Darby, R. "Chemical Engineering Fluid Mechanics" Marcel Decker, 1998.

CH8302 PROCESS CALCULATIONS **L T P C**
3 0 0 3

AIM

The aim of this course is to give fundamental knowledge on material and energy balances and steady state simulation.

OBJECTIVES

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

UNIT I **(6)**

Units, dimensions and conversion; Process variables and properties; Degree of freedom;

UNIT II
(11)

Concept of material balance Material balance calculations not involving and involving single and
multiple reactions including combustion Material balance calculations involving phase change

UNIT III
(11)

Heat capacity; Calculation of enthalpy changes without phase change; Energy balance calculations without and with reactions including combustion.

UNIT IV **(11)**

Simultaneous material and energy balance calculations for Humidification, vaporization, condensation, mixing, crystallization.

UNIT V **(6)**

Material balance and energy balance calculations for network of units without and with recycle.

Demonstration of ASPEN Process Simulator

TOTAL : 45 PERIODS

TEXT BOOKS

1. Himmelblau, D.M., "Basic Principles and Calculations in Chemical Engineering ", EEE Sixth Edition, Prentice Hall Inc., 2003
2. Bhatt, B.L., Vora, S.M., "Stoichiometry ", 4 th Edition,Tata McGraw-Hill (2004)
3. Felder, R. M. and Rousseau, R. W., "Elementary Principles of Chemical Processes", 3rd Edition, John Wiley & Sons, New York, 2000.

REFERENCE

1. Hougen O A, Watson K M and Ragatz R A, "Chemical process principles" Part I, CBS publishers (1973)

ME8351 BASIC MECHANICAL ENGINEERING **L T P C**
3 0 0 3

AIM :

To have a general idea about the basic mechanical engineering on various thermal cycles, IC engines, power plant engineering and refrigeration systems.

OBJECTIVES :

The subject will help the students to have knowledge on the power plant systems, their characteristics, Air-conditioning systems and power drives.

UNIT I **(9)**

Thermodynamics: Basic concepts and definitions, Gas laws, specific heat –Universal gas constant- Isothermal, adiabatic and polytrophic processes, work done, heat transferred, internal energy and entropy.

Cycles: Carnot, Otto and Diesel- Air standard efficiency.

Basic laws of heat transfer (Fourier's law of heat conduction, Newton's law of cooling Steffen Boltzmann's law)

UNIT II **(9)**

I.C. Engines: Classification of I.C Engines, Different parts of I.C engines, Working of two stroke and four stroke engines-petrol and diesel engines-air intake system, exhaust system, fuel supply system, ignition system, lubrication system, cooling system and engine starting system-Performance of I.C. engines, advantage of MPFI and CRDI over conventional system.

Refrigeration: Unit of refrigeration, COP, Block diagram and general descriptions of air refrigeration system, vapour compression and vapour absorption systems- Required properties of a refrigerant, important refrigerants– Domestic refrigerator- Ice plant.

Air conditioning system: Concept of Air conditioning, psychometry, psychometric properties, psychometric chart, psychometric processes, human comfort– winter and summer air conditioning systems (general description), air conditioning application.

UNIT III **(9)**

Power transmission elements: Belt Drive - velocity ratio of belt drive, length of belt, slip in belt- simple problems– Power transmitted– Ratio of tensions– Centrifugal tension Initial tension– Rope drive, chain drive and gear drive-Types of gear trains (simple description only).

UNIT IV **(9)**

Power plants: General layout of hydraulic, diesel, thermal and nuclear power plants-nonconventional energy sources (general description only). Hydraulic turbines and pumps : Classifications of hydraulic turbines –types of hydraulic turbines –runaway speed, specific speed, draft tube, cavitations, selection of hydraulic turbines. Classification of pumps– positive displacement and rotodynamic pumps (description only)- applications.

Steam turbines: Classification of steam turbines, description of common types of steam turbines: Impulse and reaction, compounding methods.

UNIT V **(9)**

Simple description of general purpose machines like lathe, shaping machines, drilling machines, grinding machines and milling machines, Basic concepts of CNC, DNC, CIM and CAD/CAM

Manufacturing Processes: Moulding and casting, forging, rolling, welding- arc welding-gas welding (fundamentals and simple descriptions only)

CH8311 ELECTRICAL ENGINEERING LAB FOR TECHNOLOGISTS **L T P C**
0 0 3 2

AIM

- To expose the students to the basic operations of electrical machines and help them to develop experimental skills.
- To study the concepts, performance characteristics, time and frequency response of linear systems.
- To study the effects of controllers.

List of Experiments

1. Open circuit and load characteristics of separately excited and self excited D.C. generator.
2. Load test on D.C. shunt motor.
3. Swinburne's test and speed control of D.C. shunt motor.
4. Load test on single phase transformer and open circuit and short circuit test on single phase transformer
5. Regulation of three phase alternator by EMF and MMF methods.
6. Load test on three phase induction motor.
7. No load and blocked rotor tests on three phase induction motor (Determination of equivalent circuit parameters)
8. Study of D.C. motor and induction motor starters.

9. Digital simulation of linear systems.
10. Stability Analysis of Linear system using Mat lab.
11. Study the effect of P, PI, PID controllers using Mat lab.
12. Design of Lead and Lag compensator.
13. Transfer Function of separately excited D.C.Generator.
14. Transfer Function of armature and Field Controller D.C.Motor.

CH8312 ORGANIC CHEMISTRY LABORATORY L T P C
0 0 3 2

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

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 Proteins.
5. Methodology of filtrations and recrystallization.
6. 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-dinitrobenze from nitrobenzene.
    v. Oxidation – Preparation of benzoic acid from benzaldehyde / benzylalcohol.

TOTAL : 45 PERIODS

REFERENCES
1. Vogels's Text Book of Practical Organic Chemistry, Fifth Edition, Longman Singapore Publishers Pte. Ltd., Singapore (1989).
2. Organic Chemistry Lab Manual, Chemistry Division, Chemical Engineering Departemnt, A.C. Tech, Anna University (2007).

ME8361 MECHANICAL ENGINEERING LAB L T P C
0 0 4 2

AIM
To impart practical knowledge in operating IC engines and conduct experiments. To understand
test procedures in testing material for engineering applications
OBJECTIVES
Students will be able to understand Power-generating units such as engines and operate IC

engines and conduct tests. They will be able to appreciate the theory behind the functioning of
engines. Material properties, their behavior under different kinds of loading and testing can be
visualized.

LIST OF EXPERIMENTS

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

TOTAL : 60 PERIODS

MA1251 NUMERICAL METHODS 3 1 0 3

AIM

With the present development of the computer technology, it is necessary to develop efficient algorithms for solving problems in science, engineering and technology. This course gives a complete procedure for solving different kinds of problems occur in engineering numerically.

OBJECTIVES

At the end of the course, the students would be acquainted with the basic concepts in numerical methods and their uses are summarized as follows:

- The roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations and eigenvalue problem of a matrix can be obtained numerically where analytical methods fail to give solution.
- When huge amounts of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

9+3

Linear interpolation methods (method of false position) – Newton's method – Statement of Fixed Point Theorem – Fixed point iteration: x=g(x) method – Solution of linear system by Gaussian elimination and Gauss-Jordon methods- Iterative methods: Gauss Jacobi and Gauss-Seidel methods- Inverse of a matrix by Gauss Jordon method – Eigenvalue of a matrix by power method.

UNIT II INTERPOLATION AND APPROXIMATION 9+3

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton's forward and backward difference formulas.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3

Derivatives from difference tables – Divided differences and finite differences –Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpson's rules.

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

Single step methods: Taylor series method – Euler and modified Euler methods – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9+3

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

TUTORIAL 15

TOTAL : 60

TEXT BOOKS

1. Gerald, C.F, and Wheatley, P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi, 2002.
2. Balagurusamy, E., "Numerical Methods", Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.

REFERENCES

1. Kandasamy, P., Thilagavathy, K. and Gunavathy, K., "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2003.

2. Burden, R.L and Faires, T.D., "Numerical Analysis", Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.

CY8451 PHYSICAL CHEMISTRY L T P C
3 0 0 3

AIM

To know the basic concepts of physical chemistry aspects of chemical compounds and their behaviour at different processing conditions.

OBJECTIVES

The students get knowledge on the reactors mechanism. Use of catalyst and also the reactions stages involved in a particular process operations.

UNIT I CHEMICAL KINETICS (9)

Rate equations – order of reaction – I order – II order – III order – zero order – pseudo order reactions – effect of temperature on reaction rate – concept of activation energychain reactions – branched chain reactions – reactions in solutions – influence of ionic strength in rates of reactions.

UNIT II ELECTROCHEMISTRY (9)

Electrolytic conductance – specific conductance – equivalent conductance – molar conductance-variation with dilution – kohlrausch's law- applications of kohlrausch's law - molar ionic conductance - conductometric titrations – ostwald dilution law – Debye – Huckel theory of mean ionic activity coefficient.

UNIT III PHASE RULE AND DISTRIBUTION LAW (9)

Definition of terms- one component system – water – sulphur – two component system – simple eutectic system – reduced phase rule. Distribution-chemical combinationsapplications-
applications of distribution law-Raoults law-Henry's law-ideal and non-ideal solutions-vapour pressure & boiling point

UNIT IV SURFACE CHEMISTRY (9)

ADSORPTION

Definition – types – isotherms – theories of adsorption – BET method – applications.

CATALYSIS

Homogeneous catalysis – acid –base – enzyme catalysis autocatalysis mechanism and kinetics – Michaelis-Menten equation - Heterogeneous catalysis – kinetics – effect of temperature on surface reactions

UNIT V MACRO MOLECULES (9)

COLLOIDS

Classification – preparations – coagulation – flocculation – determination of size of particles- surfactants – emulsions – emulsifiers –gels – applications.

POLYMERS

Classification – polymerization reactions – molar masses of reactions – determination of molar masses- kinetic study.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Puri B.H and Sharma L.R. Principles of Physical Chemistry, S. Nagin Chand and Company, Delhi (1994)
2. P.L.Soni , O.P. Dharmarha & U.N. Dash, Textbook of Physical Chemistry , Sultan Chand & Sons.

REFERENCES

1. Kund and Jain, Physical Chemistry, S.Chand and Company, Delhi (1996)

AS8401 CHEMICAL ENGINEERING THERMODYNAMICS L T P C

3 0 0 3

UNIT I BASIC CONCEPTS (5)

The terminologies of thermodynamics, the variables and quantities of thermodynamics, categorization of systems and processes. Energy classifications, point and path properties, energy in transition, heat and work, reversible and irreversible processes, phase rule.

UNIT II FIRST LAW OF THERMODYNAMICS (5)

The first law and internal energy, statements of first law for the non flow and flow systems, enthalpy and heat capacity limitations of the first law.

UNIT III SECOND LAW OF THERMODYNAMICS (5)

Statements of the second law of thermodynamics, available and unavailable energies, The entropy function, applications of the second law.

UNIT IV THERMODYNAMIC FORMULATIONS (12)

Measurable quantities, basic energy relations, maxwell relations, thermodynamic formulations to calculate enthalpy, internal energy and entropy as fuction of pressure and temperature, other formulations involving Cp and Cv, complex thermodynamic formulations, thermodynamic properties of an ideal gas, entropy change in reversible and irreversible process.

UNIT V THERMODYNAMIC PROPERTIES OF REAL GASES (10)

The PVT behaviour of fluids, laws of corresponding states and equation of states approaches to the PVT
relationships of non ideal gas problems, compressiblity factors, generalised equations of state, property
estimation via generalised eqaution of state , fugacity and fugacity coefficients of real gases.

UNIT VI COMPRESSION OF FLUIDS (8)

Thermodynamic aspects of compression process,classification of compression processes, basic equation for change of state of gases, the work expression for different situations, the effect of clearance volume, multistage compression, convergent divergent flow, Ejectors.

TOTAL : 45 PERIODS

Text Book

1. Smith, J.M., Van Ness, H.C., " Introduction to Chemical Engineering Thermodynamics ", Kogakushai 1976.

References

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.

CH8402 HEAT TRANSFER L T P C
3 0 0 3

AIM :

To provide fundamental instruction in various methods of heat transfer through difference media. To impart knowledge on how certain substances undergo go the change in composition, change in phases and exhibit the properties according to the changed environment.

OBJECTIVES :

Students gain knowledge in various heat transfer methodology in chemical process engineering. Also students develop a sound knowledge in Mass Transfer operation.

UNIT I :

Introduction to various modes and mechanisms of heat transfer. Fourier's law of heat conduction – one dimensional steady state heat conduction equation for flat plate, hollow cylinder, rate equations, Heat conduction through a series of resistances – Thermal conductivity measurement, effect of temperature on thermal conductivity. Difusional heat transfer based on shell balances approach for one-dimensional steady state and transient transfer with heat generation and chemical reactions. Composite walls, heat transfer in extended surfaces.

UNIT II :

Concepts of heat transfer by convection – Natural and forced convection, analogies between transfer of momentum and heat transfer. Reynold's analogy, prandtl and coulburn analogy. Dimensional analysis in heat transfer. Correlations for calculation of heat transfer co-efficients, heat transfer co-efficient for flow through a pipe.

Heat transfer to fluids with phase change – heat transfer from condensing vapours, dropwise and film wise condensation, Nusselt equation for vertical and horizontal tubes, effect of non-condensable gases on rate of condensation.

UNIT III :

Paraplel and Counterflow heat exchangers – Log mean temperature difference – single pass and multipass heat exchangers, plate heat exchangers. Fouling factors design of various types of heat exchangers.

UNIT IV:

Diffusion in fluids – Molecular and eddy diffusion measurement and calculation of diffusivities. Ordinary diffusion in multi component gaseous mixtures.

Mass Transfer co-efficients. Theories of mass transfer, concept of NTU & HTU. Analogies between momentum, heat and mass transfer. Equilibrium and operating lines. JD factor.

Liquid – Liquid Equilibrium – Extraction principles – Batch and continuous extractors – Design equation for extraction. Spray, packed and mechanically agitated contactors and their design calculations – packed bed extraction with reflux.

UNIT V

Vapour liquid equilibria – Raoult's law, Vapor liquid equilibrium diagrams for ideal and non-ideal systems, enthalpy concentration diagrams. Principles of distillation, flash distillations, differential distillation, steam distillation, multistage continuous rectification, number of ideal stages by Mecabe – Thiele method panchan – Savarit method. Total reflex, minimum reflex ratio, optimum reflex ratio. Multicomponent distillation. Areotropic and extractive distillation.

Text Books :

1. W.L.Mecabe, J.C.Smith and P.Harriot, "Unit Operations of Chemical Engineering", 6th Edition, McGraw Hill Book Co., New York 2001.
2. R.E.Treybal "Mass Transfer Operations", 3rd Edition, Mc.Graw Hill Book Co., New York, 1985.
3. Kern D-Q "Process Heat Transfer"Mc.Graw Hill, 1999.

References :

1. J.H.Coulson and J.F.Richardson, "Chemical Engineering", Vol.I, II & III Butterworth, Hein – Mann publishers, New Delhi, 1999.
2. C.J.Gankopolis "Transport processes and unit operations" 3rd Edition, Prentice Hall of India, New Delhi, 1996.
3. Coulson J.M. and Richardson,J.F "Chemical Engineering" Vol.1, 4th Edition, Asian Books Pvt. Ltd., India, 1998.
4. Holman, J.P."Heat Transfer" 8th Edition, Mc.Graw Hill, 1997.

AS8402 NATURAL GAS ENGINEERING L T P C
3 0 0 3

AIM

The main of learning this subject is that student will be able to understand the basics of Natural Gas engineering techniques.

OBJECTIVE

The objective of studying this subject is that student will be understanding the basic concept and applications of Natural Gas Engineering.

UNIT I **(9)**

Natural gas technology and earth science: Branches of petroleum Industry. Sources of Information for natural gas engineering and its applications. Geology and earth sciences: Earth sciences-Historical geology, Sedimentation process, Petroleum reservoirs, Origin of petroleum. Earth temperatures & pressure, Earth temperatures, Earth pressure. Petroleum : Natural gas, LP gas, Condensate, & Crude oil.

UNIT II **(9)**

Properties of Natural Gases: typical compositions. Equations of state: general cubic equations, specific high accuracy equations. Use of equation of state to find residual energy properties, gas measurement gas hydrates, condensate stabilization, acid gas treating, gas dehydrations, compressors, process control deliverability test, gathering and transmission, and natural gas liquefaction.

UNIT III **(9)**

Gas Compression: Positive displacement and centrifugal compressors; fans. Calculation of poser requirements. Compressible Flow in Pipes: Fundamental equations of flow: continuity, momentum, elegy equations.

UNIT IV **(9)**

Isothermal flow in pipes: the Weymouth equation. Static and flowing bottom-hole pressures in
wells. Fundamentals of Gas flow in porous media: Steady state flow equations. Definition of pseudo-pressure function. Gas flow in cylindrical reservoirs: general equation for radial flow of gases in symmetrical homogeneous reservoirs.
52

UNIT V **(9)**

Non-dimensional forms of the equation; derivation of coefficients relation dimensionless to real
variables. Infinite reservoir solution: Pseudo-steady-state solution. Gas Well Deliverability Tests: Flow-after-flow tests: prediction of IPR curve and AOF for the well. Isochronal tests. Draw down tests: need for data at two flow rates.

TOTAL : 45 PERIODS

TEXT BOOK

1. Katz D.L.et al., Natural Gas Engineering (Production & storage), McGraw-Hill, Singapore.

REFERENCE

1. Standard Handbook of Petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary C Plisga. Gulf Professional Publishing.

CH8411 FLUID MECHANICS LAB **L T P C**
0 0 3 2

OBJECTIVE

To study the flow measurement and the performance of fluid machinery

LIST OF EXPERIMENTS

1. Calibration of venturimeter
2. Pressure measurement with pitot static tube
3. Determination of pipe flow losses.
4. Verification of Bernoulli's theorem
5. Flow visualization by Heleshaw apparatus
6. Performance test on centrifugal pumps
7. Performance test on reciprocating pumps
8. Performance test on piston wheel turbine
9. Performance test on Francis turbine
10. Determination of Viscosity of a Fluid

TOTAL: 45 PERIODS

CH8412 TECHNICAL ANALYSIS LAB **L T P C**
0 0 3 2

AIM

To determine experimentally the various elements and compounds used in chemical engineering

OBJECTIVES

To have a thorough understanding on the estimation and analysis of chemical compounds.

LIST OF EXPERIMENTS

1. Ore Analysis
   Estimation of manganese in pyrolusite ore
   Estimation of magnesium in dolomite
2. Analysis of alloys .
3. Analysis of fertilizer.
   Estimation of nitrogen in urea by kjeldal method
4. Sugar Analysis .
5. Estimation of phenol by Iodimetry / UV-Vis Spectrometer.
6. Water Analysis
   Determination of total residual chlorine in water
   Determination of chemical oxygen demand
   Determination of dissolved oxygen
7. Polymer analysis
8. Conductometric Titration
9. Potentiometry
   Estimation of iron
   Determination of standard – electrode potential of Zn , Fe , Copper
10. Estimation of sodium and potassium by flame photometry
11. Gravimetric analysis
    Estimation of barium in barium sulphate
    Estimation of nickel as DMG
12. pH metry (acid – basic titration)

TOTAL: 45 PERIODS

INSTRUMENTS REQUIRED

1. UV/Vis Spectrophotometer
2. Colorimeter
3. pH meter
4. Flame photometer
5. Conductivity meter
6. Glass electrodes
7. Kjeldal's apparatus
8. Potentiometer

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

Aim:

The main of learning this subject is that student will be able to understand the basics of Environmental Science.

Objective:

The objective of studying this subject is that student will be able identify different Environmental Factors.

UNIT – I **(9)**

Pollution of the Environment: Air pollution, composition and evaluation of atmosphere; Earth radiation balance: Particles, ions and radicals in the atmospheres, chemical and photochemical reactions, depletion of the ozone layer, green house effect. Air pollutant and their effects.

UNIT – II **(9)**

Water pollution: Water resources. The hydrologic cycle, complexation in natural water and waste water, micro organisms-catalysts of aquatic chemical reaction, eutirification, water pollutants inorganic, organic sediments, radioactive materials.

UNIT – III **(9)**

Waste pollution Control processes: Study of physical and biological process employed for biological processes employed for pollution control, removal of suspended, colloidal and dissolved phases of pollution.

UNIT – IV **(9)**

Industrial wastes: Waste water treatment, study of unit operation and processes, sludge handling and disposal effects of waste waters in ground water travel of pollutants through soil, nutrients and pollutants by soil interaction**.**

UNIT – V **(9)**

Solid wastes, sources, municipal refuse, industrial solid wastes, contamination by basic organics chemicals and toxic metals, comparative treatment of incineration, chemical treatment, solidification encapsulation and landfill. Environmental problems in Indian and Bangladesh.

Total 45 Hrs.

Text Books

1. Gilbert.M.Masters, 'Introduction to Environmental Engineering and Science, 2nd Edition Pearson Education 2004.
2. T.G.Miller, 'Environmental Science' Wads Worth publishing Co.
3. C.Townsend.J.Harper and Michael Bgon, Essentials of Ecology' Blackwell Science.
4. R.K.Trivedi and p.K. Goel' Introduction to Air pollution Techno science publications.

References:

1. Bharuche Evach, 'The Biodiversity of India' Mapin Publishing Limited, Ahmedabad, India.
2. 'R.K.Trivedi' handbook of Envrionmental laws, Rules, Guidelines, Compliances and Standards, Vol I and II, Enviromedia.

Cunningham.W.P.Cooper, T.H.Gorhani, Enviromental Encyclopedia. Jaico Publication House, Mumbai.

AS8501 PETROLEUM REFINING I **L T P C**
3 0 0 3

UNIT I **(9)**

Exploration and Refining of Crude Oil : Introduction, Indian and world reserve of crude oil and its processing capacity, Market demand & supply of petroleum Fractions. Exploration, Drilling and Production of crude oil; engineering data of crude and fractions.
Characterization factor, Key Fraction Number and correlaton index methods for evaluation of crude & fractions. TBP, ASTM, EFV, and their inter-convertibility, yield Curve etc.

UNIT II **(9)**

Desalting of crude, pipe still furnaces, preflashing operation, Atmospheric and vacuum distillation units, different types of Reflux arrangements, Calculation of tray requirement for ADU column. Test methods and specifications:
Distillation, Aniline point, Reid vapour pressure, Smoke point, flash point fire point, Carbon residue, viscosity and viscosity index, refractive index, Copper & silver strip corrosion, Octane No, cetane No, sulphur content, calorific value, Total acid number, oxidation stability, cloud point, pour point etc.

UNIT III **(9)**

Thermal conversion Processes: Thermal cracking processes – mechanism, applications e.g. visbreaking, thermal cracking, coking operations, Catalytic Conversion Processes : Catalytic cracking processes, Different FCC operating modes, Catalytic reforming operations, Hydro cracking, Simple process calculations.

UNIT IV **(9)**

Thermal Polymerization, Isomerization processes, Alkylation, Catalytic Polymerization for gasoline stock preparation.

UNIT V **(9)**

Finishing & Treatment processes : Different Hydrotreatment (eg. Hydro desulfurization) processes, Merox process, Doctor's sweetening, Smoke point improvement, etc. Simple process calculations Alternative fuels, Production and Specifications: Synthetic gasoline, Bio Diesel, Ethanol, Automotive LPG

TEXT BOOKS

1. Petroleum Refinery Engineering – W.L. Nelson, Mc Graw Hill.
2. Modern Petroleum Refining Processes – B.K. Rao. Oxford & IBM.

REFERENCES

1. Petroleum Refining Technology – Dr. Ram Prasad, Khanna Publishers.
2. Advanced Petroleum Refining: Dr. G. N. Sarkar, Khanna Publishers.

CH8502 CHEMICAL REACTION ENGINEERING I **L T P C**
3 0 0 3

OBJECTIVES

• To impart the basic concepts of chemical reaction engineering
• To develop understanding about reactor analysis and design

UNIT I **(9)**

Overview of chemical reaction engineering. Cl assification of chemical reactions. Variables affecting the rate of reaction. Definition of reaction rate. Kinetics of homogeneous reaction. Concentration dependent term of rate equation. Searching for a mechanism. Temperature dependent term of rate equation. Temperature dependency from Arrhenius law, Collision theory and transition state theory. Interpretation of batch reactor data. Evaluation of rate equation by integral and differential analysis for constant volume and variable volume system

UNIT II **(9)**

Introduction to reactor design. Classification of reactors. Ideal reactors for a single reaction- Ideal batch reactor- Steady state mixed flow reactor-Steady state plug flow reactor. Design of single reactions-Size comparison of single reactors- Multiple reactor system. Recycle reactor. Auto catalytic reactions. Design of multiple reactions.

UNIT III **(9)**

Heat effects in reactor. Non isothermal reactor design. General graphical design procedure. Optimum temperture progression. Adiabatic and non adiabatic operations. Multiple steady state. Non ideality in reactors. Basics of non ideal flow. Residence time distribution studies- C,E & F curves and their relationships. Conversion in non ideal reactors. Micro mixing and macro mixing. Models for non ideal flow-dispersion model and tank in series model.

UNIT IV **(9)**

Heterogeneous processes. Globa l rates of reaction. Catalysis. General characteristics of catalysis. Physical adsorption and chemisorption. Adsorption isotherms, Determination of surface area of a catalyst. Classification of catalyst, catalyst preparation. Catalyst deactivation (no kinetics).

UNIT V **(9)**

Gas – liquid reaction. Absorption combined with chemical reaction. Mass transfer coefficients and kinetic constants. Application of film penetration and surface renewal theories. Hatta number and enhancement factor for first order reaction.

TEXT BOOKS

1. Levenspiel O., Chemical R eaction Engineering, John Wiley
2. Fogler H.S., Elements of Chemical Reaction Engineering, Prentice Hall of India

REFERENCES

1. Smith J.M., Chemical Engineer ing Kinectics, McGraw Hill
2. C.G., An Introduction to Chemical Engineering Kinetics & Reactor Design, John Wiley

CH8651 PROCESS INSTRUMENTATION DYNAMICS AND CONTROL L T P C
3 0 0 3

AIM

To introduce control equipments used to control the production process of a chemical factory and to introduce the control mechanism thro' automation and computers.

OBJECTIVES

Gains knowledge in designing a control system and identifying the alternative control configuration for a given process plant or entire plant. He will be familiar with the control mechanism before attempting to tackle process control problems.

UNIT I **(9)**

Laplace transformation, transform of standard functions, derivatives and integrals, inversion, theorems in Laplace transformation, application .Open-loop systems, first order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics, transfer function for chemical reactors and dynamics.

UNIT II **(9)**

Closed loop control systems, development of block diagram for feed-back control systems, servo and regulator problems, Transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transportation lag, transient response of closed-loop control systems and their stability.

UNIT III **(9)**

Introduction to frequency response of closed-loop systems, control system design by frequency, Bode diagram, stability criterion, Nyquist diagram; Tuning of controller settings.

UNIT IV **(9)**

Controller mechanism ,introduction to advanced control systems, cascade control, feed forward control, control of distillation towers and heat exchangers, introduction to microprocessors and computer control of chemical processes.

UNIT V **(9)**

Principles of measurements and classification of process control instruments, measurements of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity and consistency, pH, concentration, electrical and thermal conductivity, humidity of gases, composition by physical and chemical properties and spectroscopy.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Coughnowr and Koppel, "Process Systems Analysis and Control", McGraw-Hill, New York,1986.
2. George Stephanopolous, "Chemical Process Control", Prentice-Hall of India Pvt. Ltd.,NewDelhi,1990.
3. Patranabis.D, Principles of Process control, II edition, Tata McGraw-Hill Publishing Co.Ltd.,1981.
4. Peter Harriott, Processcontrol, Tata McGraw-Hill Publishing Co., Reprint 2004.

REFERENCES
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.

CH 8504 MASS TRANSFER I **L T P C**
3 0 0 3

AIM
To impart knowledge on fundamentals of mass transfer phenomena and rate based mass transfer operations.
OBJECTIVES
Students will learn to determine mass transfer rates under laminar and turbulent conditions and apply these concepts in the design of humidification columns, dryers and crystallisers.

UNIT I **(9)**
Introduction to mass transfer operations; Molecular diffusion in gases, liquids and solids; diffusivity measurement and prediction; multi-component diffusion.

UNIT II
(10)
Eddy diffusion, concept of mass transfer coefficients, theories of mass transfer, different transport analogies, application of correlations for mass transfer coefficients, inter phase mass transfer, relationship between individual and overall mass transfer coefficients.

UNIT III **(9)**
Humidification – Equilibrium, humidity chart, adiabatic and wet bulb temperatures; humidification operations; theory and design of cooling towers, dehumidifiers and humidifiers using enthalpy transfer unit concept.
.

UNIT IV **(9)**
Drying – Equilibrium; classification of dryers; batch drying – Mechanism and time of Cross through circulation drying, continuous dryers – material and energy balance; determination of length of rotary dryer using rate concept

UNIT V **(8)**
Crystallization - Equilibrium, classification of crystallizers, mass and energy balance; kinetics of crystallization – nucleation and growth; design of batch crystallizers; population balance model and design of continuous crystallizers.

TOTAL : 45 PERIODS

TEXT BOOKS
1. Treybal, R.E., "Mass Transfer Operations", 3rd Edn, McGraw-Hill, 1981.

2. Geankoplis, C.J., “Transport Processes and Unit Operations”, 4th Edition, Prentice Hall Inc.,
New Jersey, 2003.

REFERENCES

1. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 6th
Edn., McGraw-Hill, 2001.
2. Coulson, J.M. and Richardson, J.F., "Chemical Engineering" Vol. I and II, Asian Books Pvt.
Ltd., India, 1998.
3. J.D. Seader and E.J. Henley, “Separation Process Principles”, 2nd Ed., John Wiley, 2006.

HS8561 EMPLOYABILITY SKILLS **L T P C**
0 0 2 1

List of Exercises

1. Communication skills
2. Listening skills
3. Motivational training
4. Facing interviews
5. Time management skill
6. Occupational safety and health
7. Accident prevention techniques
8. Entrepreneurship
9. Training methodologies

TOTAL : 45 PERIODS

CH8511 HEAT TRANSFER LAB **L T P C**
0 0 3 2

1. Transient state heat conduction
2. Surface evaporation
3. Jacketted kettle
4. Temperature profile of a rod
5. Natural convection
6. Thermal conductivity of composite wall
7. Emissivity measurement
8. Measurement of diffusion coefficient
9. Simple distillation
10. Leaching
11. Adsorption

TOTAL : 60 PERIODS

AS8511 PETROLEUM TESTING LAB I **L T P C**
0 0 4 2

AIM

To introduce various methods of analysis by using sophisticated instruments and analytical

equipments to determine various physical properties of crude, natural gas, petroleum products and petro-chemicals

OBJECTIVES
On completion of the course, the students should be conversant with the theoretical principles and experimental procedures for quantitative estimation.

List of Experiments:
1. Aromatic content Determination
2. Carbon residue determination
3. Karl-Fisher Conductometer Apparatus for water estimation
4. Foaming characteristics of lube oil
5. Mercaptan as sulphur estimation
6. Copper Corrosion test of petroleum oil
7. Freezing point of Aqueous Engine coolant solution
8. Automatic Vacuum Distillation
9. Characteristics of Hydrocarbon in Petroleum products
10. Coking tendency of oil
11. Testing of Petroleum products using Saybolt

TOTAL: 45 PERIODS

List of Equipments
1. Conradson Apparatus
2. Karl –Fisher
3. Dr. Test Apparatus
4. Bomb Calorimeter
5. API Distillation Apparatus
6. Junkers Gas Calorimeter
7. Abbey Refractometer
8. Mercaptan as sulphur Estimation Apparatus

AS8601	**EQUILIBRIUM STAGED OPERATIONS**	**L T P C**
		3 1 0 4

AIM

To impart knowledge on the design of different staged operations using the concept of equilibrium

OBJECTIVE

The students will learn in detail the unifying theory and design of different staged operations like absorption, distillation, extraction and adsorption.

UNIT I - ABSORPTION **12**

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

UNIT II - DISTILLATION 12

Vapour liquid equilibria - Raoult's law, vapor-liquid equilibrium diagrams for ideal and non-ideal systems, enthalpy concentration diagrams. Principle of distillation - flash distillation, differential distillation, steam distillation, multistage continuous rectification, Number of ideal stages by Mc.Cabe - Thiele method and Ponchan - Savarit method, Total reflux, minimum reflux ratio, optimum reflux ratio. Desing of azeotropic and extractive distillation columns.

UNIT III - MULTICOMPONENT DISTILLATION 12

Fundamental principles involved in the separation of multi component mixtures –equilibrium flash distillation calculations for multi component mixtures – separation of multi component mixtures at total reflux. Calculation of minimum reflux ratio. Determination of number of trays

UNIT IV - LIQUID-LIQUID EXTRACTION 10

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

UNIT V - ADSORPTION & MEMBRANE SEPARATION PROCESS 14

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

TEXT BOOKS

1. Wankat, P., "Equilibrium Stage Separations", Prentice Hall, 1993.
2. Treybal, R.E., "Mass Transfer Operations ", 3rd Edn., McGraw-Hill, 1981.
3. Seader, J.D. and E.J. Henley, "Separation Process Principles", 2nd Ed., John Wiley, 2006.

REFERENCES

1. W.L McCabe J.C.Smith, and Harriot. P., " Unit Operations of Chemical Engineering ", sixth edition McGraw-Hill. International Edition, 2001
2. C.Judson King " Separation Processes ", Tata McGraw-Hill 1974.
3. R.F.Strigle (jr), Packed Tower Design and Application, 2nd Edn Gulf Publishing company U.S.A.1994

TOTAL: 60 PERIODS

AS8602 CHEMICAL REACTION ENGINEERING II L T P C
3 0 0 3

AIM

Introduce various types of Reactions and Reactors that are commonly used in Chemical Engineering operations.

OBJECTIVE

Get ability in deciding and designing the type of Reactors that are necessary for a particular type of reaction in an Industry. They also learn mechanism and control of several types of reactions.

UNIT I - NON-IDEAL REACTORS 9

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

UNIT II - HETEROGENEOUS PROCESS AND SOLID CATALYSIS 9

Rate equations for heterogeneous reactions nature of catalysis, adsorption isothermal and rates of adsorption, desorption and surface reaction analysis of rate equation and rate controlling steps, surface area and pore-volume distribution, catalyst preparation.

UNIT III - GAS-SOLID CATALYTIC REACTORS 9

Diffusion within catalyst particle effective thermal conductivity mass and heat transfer within catalyst pellets; effective factors, Thiele Modulus, fixed bed reactors.

UNIT IV - GAS-SOLID NON-CATALYTIC REACTORS 9

Models for explaining the kinetics; volume and surface models; controlling resistances and rate controlling steps; time for complete conversion for single and mixed sizes, fluidized and static reactors.

UNIT V - GAS-LIQUID REACTIONS 9

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

TEXT BOOKS

1. Fogler. H.S., “Elements of Chemical reaction engineering III edition, Prentice Hall of
   India Pvt. Ltd., 1998 (Indians Reprint 2003)
2. Levenspiel, O; “Chemical Reaction Engineering”, III Edition, John Wiley, 1998.

REFERENCES

1. Smith J.M., "Chemical Engineering Kinetics", 3rd edition, McGraw-Hill, New York,1981.

TOTAL: 45 PERIODS

AS8603	**PETROLEUM REFINING II**	**L T P C**
		3 0 0 3

UNIT I – CRACKING **9**

Need and significance, types and functions of Secondary Processing. Cracking, Thermal Cracking and Visbreaking. Different Feed Stocks, Products Yields, Qualities and Recent Development. Catalytic Cracking, Commercial Catalyst, Feedstock and Catalytic Cracking Conditions, Types and Processes- Fixed Bed Cracker, Fluid Catalytic Cracking (FCC), Flexi Cracking.

UNIT II - CATALYTIC REFORMING **9**

Theory, Reaction Conditions and Catalyst for Catalytic Reforming, Platforming, Houdri Forming,Rhein Forming, Power Forming, Selecto Forming. Ultra Forming and Rex Forming.Naphtha Cracking, Feedstock Selection and Effect of Steam.

UNIT III - ALKYLATION AND ISOMERIZATION **9**

Feed Stocks and Reactions for Alkylation Process- Cascade Sulphuric Acid Alkylation, Hydrofluoric Acid Alkylation. Isomerization Process- Isomerization with Platinum Catalyst and Aluminium Chloride Process.

UNIT IV - COKING **9**

Methods of Petroleum Coke Production – Koppers, Thermal Cracking, Delayed Coking, Fluid Coking and Contact Coking. Hydro Cracking- principles, reactions in Hydro Cracking, Catalyst, Hydro Cracking Reaction Conditions, Iso Max Processes and Hydro Desulphurization Processes.

UNIT V - ASPHALT TECHNOLOGY **9**

Source of Asphalt (Bitumen), Chemical Structure of Asphalt, Action of Heat on Asphalt, Types of Asphalts. Air Blowing of Bitumen and Upgradarion of Heavy Crudes. Specialty

Products:Industrial Grease- Manufacture of Calcium Grease, Liquid Paraffin and Petroleum Jellys.

TEXT BOOKS

1. Jones, D.S.J. and Pujadó, P.R., Handbook of petroleum processing, Springer, The Netherlands, 2006
2. Nelson, W. L "Petroleum Refinery Engineering", McGraw Hill Publishing Company Limited, 1985.
3. Watkins, R. N "Petroleum Refinery Distillations", 2nd Edition, Gulf Publishing Company, Texas, 1981.

REFERENCES

1. Parkash, S., Refining processes handbook, Gulf Professional Publishing, 2003
2. Hobson, G. D "Modern Petroleum Refining Technology", 4th Edition, Institute of Petroleum,U. K. 1973.

TOTAL: 45 PERIODS

CH8604	**PLANT SAFETY AND RISK ANALYSIS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

AIM

To get awareness on the important of total plant safety in a Chemical Industry

OBJECTIVE

Become a skill and person in hazopard hazarel analysis and able to find out the• root cause of an accident. Gain knowledge in devising safety policy and procedures to be adopted to implement total safety in a plant
.

UNIT I - INDUSTRIAL SAFETY **15**

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

UNIT II - HAZARD IDENTIFICATION AND CONTROL **15**

HAZOP, job safety analysis – Fault tree analysis – Event tree analysis – Failure modes and effect analysis and relative ranking techniques – Safety audit – Plant inspection – Past accident analysis.

UNIT III - RISK MANAGEMENT **15**

Overall risk analysis – Chapains model, E and FI model– Methods for determining consequences effects: Effect of fire, Effect of explosion and toxic effect – Disaster management plan – Emergency planning – Onsite and offsite emergency planning – Risk management – Gas processing complex, refinery – First aids.

UNIT IV - SAFETY PROCEDURES **7**

Safety in plant design and layout – Safety provisions in the factory act 1948 – Indian explosive act 1884 – ESI act 1948 – Advantages of adopting safety laws.

UNIT V - SAFETY IN HANDLING AND STORAGE OF CHEMICALS **8**

Safety measures in handling and storage of chemicals – Fire chemistry and its control – Personnel protection – Safety color codes of chemicals.

TEXT BOOKS

1. Blake, R.P., "Industrial Safety", Prentice Hall, 1953.

2. Lees, F.P., "Loss Prevention in Process Industries", 2nd Edition, Butterworth Heinemann, 1996.

REFERENCES

1.Geoff Wells, "Hazard Identification and Risk Assessment", I.ChE.

2. John Ridley and John Channing, "Safety at Work", 6th Edition. Butterworth Heinemann,2003.

3. Raghavan, K.V. and Khan, A.A., "Methodologies in Hazard Identification and Risk Assessment", Manual by CLRI, 1990.

TOTAL: 60 PERIODS

AS8604	**PETROCHEMICALS**	**L T P C**
		3 0 0 3

UNIT I **9**

Overview of petrochemical industrial Growth in India, Economics, Feedstock Selection for Petrochemicals

UNIT II **9**

Steam reforming, Hydrogen, Synthesis gas, cracking of gaseous and liquid for stocks,

Olefins, Diolifins, Acetylene and Aromatics and their separation.

UNIT III **9**

Alkylation, Oxidation, Dehydrogenation, Nitration, Chlorination, Sulphonation and Isomerization

UNIT IV **9**

Chemicals from synthesis gas, Olefins, Diolefins, Acetylene and Aromatics.

UNIT V **9**

Modes and techniques, Production of Polyethylene, PVC, Polypropylene, SAN, ABS, SBR, Polyacrylonitrile, Polycarbonates, Polyurethane, Nylon, PET.

REFERENCES

1. Brownstein A.M. Trends in Petrochemical Technology, Petroleum Publishing Company, 1976.
2. Sitting M., Aromatics Hydrocarbons, Manufacture and Technology, Noyes Data Corporation, 1976.
3. Stevens P.M. Polymer Chemistry, Addison Wesley Publishing Company, 1975.
4. Hatch F. and Sami Mater, "From Hydrocarbon to Petrochemicals", Gulf Publishing Company, Texas 1998.Petrochemical Hand book Hydrocarbon Processing 1988, 1989.

TOTAL: 45 PERIODS

PRACTICALS

AS8611	**PROCESS CONTROL LAB**	**L T P C**
		0 0 4 2

LIST OF EXPERIMENTS

1. Response of first order system
2. Response of second order system
3. Response of Non-Interacting level System
4. Response of Interacting level System
5. Open loop study on a level system
6. Open loop study on a flow system
7. Open loop study on a thermal system
8. Closed loop study on a level system
9. Closed loop study on a flow system

10. Closed loop study on a thermal system
11. Tuning of a level system
12. Tuning of a flow system
13. Tuning of a thermal system
14. Flow co-efficient of control valves
15. Characteristics of different types of control valves

Minimum 10 experiments shall be offered

TOTAL: 60 PERIODS

		L	T	P	C
AS8612	**PETROLEUM TESTING LAB II**	**0**	**0**	**4**	**2**

AIM

To impart practical knowledge on different petroleum testing methods

OBJECTIVE

Students learn petroleum testing, determination of aniline point, softening point, carbon residue,foaming characteristics, sulphur content etc.

LIST OF EXPERIMENTS

1. Petroleum testing using Distillation Apparatus
2. Moisture estimation using Dean and Stark Apparatus
3. Determination of Aniline Point
4. Determination of Softening Point
5. Determination of Conradson Carbon Residue
6. Determination of Binder Content using Bitumen Apparatus.
7. Determination of foaming Characteristics
8. Determination of Congealing Point of Wax.
9. Determination of H2S and Sulphur Content
10. Determination of Aromatic Content Determination

TOTAL: 60 PERIODS

		L	T	P	C
CH8612	**COMPUTATIONAL CHEMICAL ENGINEERING LABORATORY**	**0**	**0**	**4**	**2**

AIM

To give practice to students to solve chemical engineering problems through programming and using computational tools.

OBJECTIVE

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

PROGRAMMING IN C

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

MICROSOFT EXCEL SOFTWARE

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

PROGRAMMING IN MATLAB

Chemical engineering problems will be solved using the powerful computational and graphical capability of MATLAB.

ASPEN SOFTWARE

Individual process equipments and flowsheets will be simulated using Aspen Plus and property analysis and estimation will be done using Aspen Properties.

EVALUATION

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

REFERENCES

1. Finlayson, B. A., Introduction to Chemical Engineering Computing, John Wiley & Sons, New Jersey, 2006.

TOTAL: 60 PERIODS

SEMESTER VII

CH8751	**TRANSPORT PHENOMENA**	**L T P C**
		3 1 0 4

AIM

To have an in depth study on fluid transport

OBJECTIVE

Different types of Fluids, their flow characteristics and different mathematical• models are analysed and applied to actual situations. This subject helps the students to understand the mechanism of fluids in motion under different conditions.

UNIT I - TRANSPORT PHENOMENA BY MOLECULAR MOTION 9

Importance of transport phenomena; analogous nature of transfer process; basic concepts, conservation laws; continuous concept, field, reference frames, substantial derivative and boundary conditions; methods of analysis; differential, integral and experimental methods.

Phenomenological laws of transport properties Newtonian and non Newtonian fluids; rheological models; theories of transport properties of gases and liquids; effect of pressure and temperature.

UNIT II - ONE DIMENSIONAL TRANSPORT IN LAMINAR FLOW (SHELL BALANCE) 12

General method of shell balance approach to transfer problems; Choosing the shape of the shell; most common boundary conditions; momentum flux and velocity distribution for flow of Newtonian and non-Newtonian fluids in pipes for flow of Newtonian fluids in planes, slits and annulus heat flux and temperature distribution for heat sources such as electrical, nuclear viscous and chemical; forced and free convection; mass flux and concentration profile for diffusion in stagnant gas, systems involving reaction and forced convection.

UNIT III - EQUATIONS OF CHANGE AND THEIR APPLICATIONS 14

Conservation laws and equations of change; Development of equations of continuity motion and energy in single multicomponents systems in rectangular co-ordinates and the forms in curvilinear co-ordinates; simplified forms of equations for special cases, solutions of momentum mass and heat transfer problems discussed under shell balance by applications of equation of change, scale factors; applications in scale-up

UNIT IV - TRANSPORT IN TURBULENT AND BOUNDARY LAYER FLOW 6

Turbulents phenomena; phenomenological relations for transfer fluxes; time smoothed equations of change and their applications for turbulent flow in pipes; boundary layer theory; laminar and turbulent hydrodynamics thermal and concentration boundary layer and their thicknesses; analysis of flow overflat surface.

UNIT V - ANALOGIES BETWEEN TRANSPORT PROCESSES 4

Importance of analogy; development and applications of analogies between momentum and mass transfer; Reynolds, Prandtl, Von Karman and Colbum analogies.

TEXT BOOKS

1. R.B. Bird, W.E. Stewart and E.W. Lightfoot, “Transport Phenomena”, John Wiley, II Edition 2006.
2. Robert, S Brodkey, Harry C. Hershey, “Transport Phenomena A Unified Approach ”, Brodkey Publishing 2003.

REFERENCES

1. L.S.Sissom, and D.R.Pitts, "Elements of Transport Phenomena", McGraw-Hill, New York, 1972.
2. R.W.Fahien, "Elementary Transport Phenomena", McGraw-Hill, New York, 1983.
3. J.R. Welty, R.W. Wilson, and C.W.Wicks, Rorer G.E, Wilson R.W. "Fundamentals of Momentum Heat and Mass Transfer", V Edn. John Wiley, New York, 2007.

TOTAL: 45 PERIODS

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

UNIT I – INTRODUCTION **5**

The Hierarchy of Chemical process Design- Overall process Design, approaches to design

UNIT II - CHOICE OF REACTORS AND SEPARATOR **8**

Reaction path, reactor performance, practical reactors, Separation of Heterogeneous mixtures, homogeneous fluid mixtures.

UNIT III - SYNTHESIS OF REACTION – SEPARATION SYSTEMS **8**

Process recycle, Batch processes, process yield

UNIT IV - DISTILLATION SEQUENCING **8**

Using simple columns, using columns with more than two products, Distillation Sequencing Using thermal coupling.

UNIT V- HEAT EXCHANGER NETWORK & UTILITIES – ENERGY TARGETS **8**

Heat recovery pinch, The Problem table Algorithm, Utilities Selection, Energy targets capital & total Cost targets.

UNIT VI - HEAT EXCHANGER NETWORK & UTILITIES – CAPITAL AND TOTAL COST TARGETS **8**

Number of Heat Exchanger Units, Area Targets, Number of Shells Targets, Capital Cost Targets, Total Cost Targets.

REFERENCES

1. Smith, R., "Chemical Process Design", McGraw Hill, New York, 1995.
2. Douglas, J.M., "Conceptual Design of Chemical Process", McGraw Hill, New York, 1988

TOTAL: 45 PERIODS

CH8702 PROCESS ECONOMICS L T P C
3 0 0 3

AIM

To introduce process economics and industrial management principles to chemical engineers.

OBJECTIVE

The objective of this course is to teach principles of cost estimation, feasibility• analysis, management, organization and quality control that will enable the students to perform as efficient managers.

UNIT I - PRINCIPLES OF MANAGEMENT AND ORGANISATION 12

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

UNIT II - INVESTMENT COSTS AND COST ESTIMATION 8

Time Value of money; capital costs and depreciation, estimation of capital cost, manufacturing costs and working capital, invested capital and profitability.

UNIT III - PROFITABILITY, INVESTMENT ALTERNATIVE AND REPLACEMENT 9

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

UNIT IV - ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE 8

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

UNIT V - ECONOMIC BALANCE 8

Essentials of economic balance – Economic balance approach, economic balance for insulation, evaporation, heat transfer.

TEXT BOOKS

1. Peters, M. S. and Timmerhaus, C. D. RE West , “Plant Design and Economics for
Chemical Engineers”, III Edn, McGraw Hill, 2003.
2. Holand, F.A., Watson, F.A. and Wilkinson, J.K."Introduction to process Economics", 2nd Edn, John Wiley, 1983.
3. Narang, G.B.S. and Kumar, V., “Production and Costing”, Khanna Publishers, NewDelhi,

REFERENCES

1. Allen, L.A., “Management and Organization”, McGraw Hill.
2. Perry, R. H. and Green, D., “Chemical Engineer’s Handbook “, 7th Edition, McGraw Hill.

TOTAL: 45 PERIODS

AS8701 PETROLEUM EQUIPMENT DESIGN L T P C
3 1 0 4

AIM

To understand the concept of designing Equipments for Petroleum Exploration

OBJECTIVE

To study and analyze the suitable equipment for particular reservoir conditions.

UNIT I

Casing program, casing and tubing design, principles of cementing, completion added skin, well perforating, hydraulic fracturing. DRILL BIT DESIGN.ROLLER CONE BITS.PDC DRILL BITS.NOMENCLATURE AND IADC CODES for drill bits. BHA (Bottom hole assembly).ESP(Electrical submersible pumps). SRP(Sucker rod pumping) unit design.
.

UNIT II 5

Design of Surface Facilities -Design of production and processing equipment, including deparation problems, treating, and transmission systems.

UNIT III 12

Capstone design Student teams apply knowledge in the areas of geology, reservoir engineering, production, drilling and well completions to practical design problems based on real field data with all of the associated shortcomings and uncertainties. Use of commercial software.

UNIT IV **10**

Oil desalting-horizontal and spherical electrical dehydrators- Natural Gas Dehydration-Hortonsphere- Natural Gas Sweetening. Crude & Condensate Stabilization-design of stabilizer- Oil and Gas Treatment. Treating Equipment.

UNIT V **10**

Refinery Equipment Design-atmospheric distillation column Design and construction of on/ offshore pipelines, Fields Problems in pipeline, Hydrates, scaling & wax etc and their mitigation

TEXT BOOKS

1. Petroleum Exploration Hand Book by Moody, G.B.
2. Wellsite Geological Techniques for petroleum Exploration by Sahay.B et al

REFERENCES

1. Standard Hand Book of Petroleum & Natural Gas Engineering" – 2nd Edition 2005-William C.Lyons & Gary J.Plisga-Gulf professional publishing comp (Elsevier).

TOTAL: 45 PERIODS

AS8702 PETROLEUM REFINING III **L T P C**
3 1 0 4

AIM

To impart detailed knowledge on petroleum refining operations, this course being the last part in a three parts series

OBJECTIVE

Students learn about the petroleum additives, support systems, safety measures, environmental, quality and economic aspects.

UNIT I **9**

Octane Improver – TEL, MTBE, Viscosity Index Improver, Pour Point Depressor, Anti Oxidants and others.

UNIT II **9**

Support systems – control systems, offsite systems, safety systems

UNIT III **9**

Components of Fire, Classification of Fires and Fire Extinguishment, Fire Hazards and Control,Causes of Refinery Fires and Explosion Hazards, Safety in Handling and Storage, Emergency Preparation.

UNIT IV **9**

Environmental control and engineering – aqueous wastes, emission to the atmosphere, noise pollution,

UNIT V **9**

Quality control of products, Refinery operation planning, process evaluation and economics

TEXT BOOKS

1. Jones, D.S.J. and Pujadó, P.R., Handbook of petroleum processing, Springer, The Netherlands, 2006
2. Nelson, W. L "Petroleum Refinery Engineering", McGraw Hill Publishing Company Limited,1985.
3. Watkins, R. N "Petroleum Refinery Distillations", 2nd Edition, Gulf Publishing Company, Texas, 1981.

REFERENCES

1. Parkash, S., Refining processes handbook, Gulf Professional Publishing, 2003
2. Hobson, G. D "Modern Petroleum Refining Technology", 4th Edition, Institute of Petroleum,U. K. 1973.

TOTAL: 45 PERIODS

PRACTICALS

CH8711	**MASS TRANSFER LAB**	**L T P C**
		0 0 4 2

AIM

To impart knowledge on mass transfer by practice

OBJECTIVE

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

LIST OF EXPERIMENTS

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

EQUIPMENTS REQUIRED

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

Minimum 10 experiments shall be offered.

TOTAL: 60 PERIODS

		L	T	P	C
CH8611	**CHEMICAL REACTION ENGINEERING LAB**	**0**	**0**	**3**	**2**

AIM

To impart knowledge on reaction engineering by practice

OBJECTIVE

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

LIST OF EXPERIMENTS

1. Kinetic studies in a Batch reactor
2. Kinetic studies in a Plug Flow reactor
3. Kinetic studies in a PFR followed by a CSTR
4. RTD studies in a PFR
5. RTD studies in a Packed Bed Reactor.
6. RTD studies in CSTRs in series
7. Studies on micellar catalysis
8. Study of temperature dependence of rate constant using CSTR.
9. Kinetic studies in sono-chemical reactor
10. Batch reactive distillation
11. Kinetics of photochemical reaction
12. Demonstration of heterogeneous catalytic reaction
13. Demonstration of gas-liquid reaction

EQUIPMENTS REQUIRED

1. Batch reactor
2. Plug flow reactor
3. CSTR
4. Sono-chemical reactor
5. Photochemical reactor

TOTAL: 45 PERIODS

MA8001 STATISTICS AND LINEAR PROGRAMMING L T P C
3 0 0 3

OBJECTIVE

The students will have a fundamental knowledge of the concepts of statistical Inference
Have the knowledge of applying Linear programming tools in management problems.

UNIT I TESTING OF HYPOTHESIS **9**

Sampling distributions - Tests for single mean , proportion and difference of means (large and small samples) – Tests for single variance and equality of variances – $\chi 2$-test for goodness of fit – Independence of attributes – Non-parametric tests: Test for Randomness and Rank-sum test (Wilcoxon test).

UNIT II DESIGN OF EXPERIMENTS **9**

Completely randomized design – Randomized block design – Latin square design - 22 - factorial design.

UNIT III STATISTICAL QUALITY CONTROL **9**

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

UNIT IV LINEAR PROGRAMMING **9**

Formulation – Graphical solution – Simplex method – Big-M method - Transportation and Assignment models

UNIT V ADVANCED LINEAR PROGRAMMING **9**

Duality – Dual simplex method – Integer programming – Cutting-plane method.

TEXT BOOKS

1. Johnson, R.A. and Gupta, C.B., "Miller and Freund's Probability and Statistics for
2. Engineers", Pearson Education, Asia, 7th edition, (2007).
3. Taha, H.A., "Operations Research", Pearson Education, Asia, 8th edition, (2007).

REFERENCES

1. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., "Probability and Statistics for
2. Engineers and Scientists", Pearson Education, Asia, 8th edition, (2007).
3. Devore, J.L., "Probability and Statistics for Engineering and the Sciences", Thomson
4. Brooks/Cole, International Student Edition, 7th edition, (2008).
5. Winston, W.L.,"Operations Research – Applications and Algorithms", Thomson, 1st
6. Indian Reprint, 4th edition, (2007).

TOTAL : 45 PERIODS

AS8001 PETROLEUM CHEMISTRY **L T P C**
3 0 0 3

UNIT I **9**

Composition of Petroleum – separation by molecular weight, type; Composition maps; Petroleum analysis and evaluation – ASTM evaluation, spectroscopic methods

UNIT II **9**

Metals and heteroatoms in heavy crude oil – hetroatoms concentrations, structure of heteroatom functions; Asphaltenes and structure of petroleum

UNIT III **9**

Thermal chemistry of petroleum constituents – visbreaking, coking, hydrotreating, hrdocracking

UNIT IV **9**

Heavy oil upgradation processes- carbon rejection, hydrogen addition; Hydrocracking – reactions, catalysts, process configurations

UNIT V **9**

Instability of petroleum products – distillate and residual products; Incompatibility in refining Operations

TOTAL : 45 PERIODS

TEXT BOOK

1. Speight, J.G., Petroleum chemistry and refining Taylor and Francis, London, 1998

REFERENCE

1. Speight, J.G., The chemistry and technology of petroleum, Marcel Dekker, New York, 1998

AS8002 DRILLING AND WELL ENGINEERING L T P C
3 0 0 3

UNIT I DRILLING GEOLOGY, OIL AND GAS MIGRATION 9

Rock Strengths and Stresses, Hydrostatic Pressure Forced by a Fluid. Rock Properties, Primary Migration, Reservoir Rock, Seal Rock and Secondary Migration. Reservoir Drives, Problems Related Fluids in the Reservoir.

UNIT II PLANNING AND DRILLING OF WELL 9

Well Proposal, Gathering Data, Designing the Well, Drilling the Well and Testing the Well. Planning of Well, Hole and Casing Sizes and Drilling the Well. Selecting a suitable Drilling Rig, Classification of Drilling Rig, Rig Systems and Equipments.

UNIT III DRILL BITS AND DRILLING FLUIDS 9

Roller Cone Bits, Fixed Cutter Bits and Cone Bits. Optimizing Drilling Parameters- Grading the Dull Bit and Bit Selection. Functions of Drilling Fluid, Basic Mud Classification Designing the Drilling Fluid.

UNIT IV DIRECTIONAL DRILLING, CASING, CEMENTING AND EVALUATION 9

Controlling the Well Path of a Deviated Well, Horizontal Wells and Multi Lateral Well. Importance of Casing in a Well, Designing the Casing String, Role of the Cement Outside the Casing, Mud Removal, Cement Design, Running and Cement Casing and other Cement Jobs.

Evaluation Techniques, Physical Sampling at Surface and Downhole, Electrical Logging and Production testing.

UNIT V MANAGING DRILLING OPERATIONS, SAFETY AND ENVIRONMENTAL ISSUES **9**

Personnel involved in Drilling Operation, Decision Making at the Well site and in the Office, Estimating the Well Cost. Safety Meetings, New Comers on the Rig, Training and Certification, Permit to Work Systems, Safety Alerts, Safety Equipments, Minimizing Spills and Environmental Impact Studies.

TOTAL: 45 PERIODS

REFERENCES

1. Devereux, S., "Drilling Technology", PennWell Publishing Company, 1999.
2. Azar, J.J. and G. Rabello Samuel, "Drilling Engineering", PennWell Corporation, 1937.
3. Devereux, S., "Practical Well Planning and Drilling", PennWell Corporation, 1998.

AS8003 RESERVOIR ENGINEERING **L T P C**
3 0 0 3

UNIT I RESERVOIR FLUID BEHAVIOR AND PROPERTIES **9**

Classification of Reservoir and Reservoir Fluids. Properties of Natural Gases. Direct Calculation of Compressibility Factors. Methods of Calculating Viscosity of Natural Gases, Properties of Crude Oil Systems. Methods of Calculating Viscosity of the Dead Oil. Properties of Reservoir Water.

UNIT II ANALYSIS OF RESERVOIR FLUID AND ROCK PROPERTIES **9**

Composition of Reservoir Fluid, Separation Test, Laboratory Analysis of Gas Condensate System, Porosity and Capillary Pressure. Rock Compressibility, Reservoir Heterogeneity. Dynamic Pseudo-Relative Permeabilities, Two Phase and Three Phase Relative Permeability.

UNIT III FUNDAMENTALS OF RESERVOIR FLUID FLOW **9**

Reservoir Geometry, Fluid Flow Equations, Steady State and Unsteady State Flow, Constant Terminal Pressure Solution. Horizontal and Vertical Oil Well and Gas Well Performance.

UNIT IV RECOVERY MECHANISM AND MATERIAL BALANCE **9**

Primary Recovery Mechanism, Material Balance Equation, Performance prediction Methods and Relating Reservoir Performance to Time. Volumetric Method and the Material Balance Equations as a Straight Line in Gas Reservoir.

UNIT V WATER FLOODING AND VAPOR LIQUID PHASE EQUILIBRIUM 9

Factors to consider in Water Flooding, Optimum Time to Water Flooding, Selection of Flooding Patterns, Overall Recovery Efficiency, Displacement Efficiency, Vertical Sweep Efficiency. Equilibrium Ratio, Flash Calculations, Equilibrium Ratios for Real Solution. Application of the Equilibrium Ratio in Reservoir Engineering.

TOTA : 45 PERIODS

REFERENCES

1. Ahmed, T, "Reservoir Engineering Handbook", 3rd Edition, Elsevier, 2006.
2. Slip Slider, H.C. "World wide Practical Petroleum Reservoir Engineering Method", PennWell Publishing Company, 1983.
3. Gianluigichierici, "Principles of Petroleum Reservoir Engineering", Elsevier, 1994.

AS8004 ENHANCED OIL RECOVERY L T P C
3 0 0 3

UNIT I FUNDAMENTALS OF ENHANCED OIL RECOVERY 9

Pore Geometry, Microscopic Aspects of Displacement. Residual Oil Magnitude and Mobilization. Buoyancy Forces and Prevention of Trapping, Wettability, Residual Oil and Oil Recovery. Macroscopic Aspect of Displacement.

UNIT II WATER FLOODING 9

Properties, sampling and analysis of Oil Field Water; Injection waters; Water flooding – Sweep Efficiency, Predictive Techniques, Improved Water Flood Processes, Performance of some Important Water Floods.

UNIT III ENHANCED OIL RECOVERY OPERATIONS-1 10

Flooding – miscible, CO2, polymer, alkaline, surfactants, steam;

UNIT IV ENHANCED OIL RECOVERY OPERATIONS-2 10

Gas injection, in-situ combustion technology, microbial method

UNIT V PROBLEMS IN ENHANCED OIL RECOVERY 7

Precipitation and Deposition of Asphaltenes and Paraffins, Scaling Problems, Formation of Damage Due to Migration of Fines, Environmental factors.

TOTAL: 45 PERIODS

REFERENCES

1. Donaldson, E.C. and G. V. Chilingarian, T. F. Yen, "Enhanced oil Recovery – I & II",
2. Fundamentals and Analysis, Elsevier Science Publishers, New York, 1985.
3. Lake, L.W., "Enhanced oil recovery", Prentice Hall, 1989.
4. Schumacher, M.M., "Enhanced oil recovery: Secondary and tertiary methods", Noyes Data Corp., 1978.
5. Van Poollen, H.K. "Fundamentals of enhanced oil recovery", PennWell Books, 1980.

AS8005 PRODUCTION ENGINEERING L T P C
3 0 0 3

UNIT I **9**
Petroleum production system, properties of oil and natural gas, reservoir deliverability

UNIT II **9**
Wellbore performance, choke performance, well deliverability, forecast of well production, production decline analysis

UNIT III **9**
Equipment design and selection – well tubing, separation and transportation systems

UNIT **9**
Artificial lift methods - sucker rod pumping, gas lift, artificial lift methods

UNIT V **9**
Production enhancement – well problem identification, matrix acidizing, hydraulic fracturing, production optimization

TOTAL : 45 PERIODS

REFERENCE

1. Guo, B, Lyons, W.C. and Ghalambor, A., Petroleum production engineering: a computerassisted approach, Gulf Professional Publishing, Burlington,

AS8006 MULTICOMPONENT DISTILLATION L T P C
3 0 0 3

UNIT I THERMODYNAMIC PRINCIPLES 9

Fundamental Thermodynamic principles involved in the calculation of vapor – liquid equilibria and enthalpies of multi component mixtures – Use of multiple equation of state for the calculation of K values – Estimation of the fugacity coefficients for the vapor phase of polar gas mixtures – calculation of liquid – phase activity coefficients.

UNIT II THERMODYNAMIC PROPERTY EVALUATION 9

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

UNIT III MINIMUM REFLUX RATIO FOR MCD SYSTEM 9

General considerations in the design of columns – Column sequencing – Heuristics for column sequencing – Key components – Distributed components – Non-Distributed components – Adjacent keys. Definition of minimum reflux ratio – calculation of Rm for multi component distillation – Underwood method – Colburn method.

UNIT IV VARIOUS METHODS OF MCD COLUMN DESIGN 9

Theta method of convergence – Kb method and the constant composition method – Application of the Theta method to complex columns and to system of columns – Lewis Matheson method – Stage and reflux requirements – Short cut methods and Simplified graphical procedures.

UNIT V VARIOUS TYPES OF MCD COLUMNS 9

Design of sieve, bubble cap, valve trays and structured packing columns for multi component distillation – computation of plate efficiencies.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Holland, C.D., "Fundamentals of Multi Component Distillation", McGraw Hill Book Company,1981
2. Van Winkle, "Distillation Operations", McGraw Hill Publications, 1987.

CH8003 ENERGY TECHNOLOGY L T P C
3 0 0 3

UNIT I ENERGY 8

Units of energy, conversion factors, general classification of energy, world energy resources and energy consumption, Indian energy resources and energy consumption, energy crisis, energy alternatives, Renewable and non-renewable energy sources and their availability. Prospects of Renewable energy sources

UNIT II CONVENTIONAL ENERGY 8

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

UNIT III NON-CONVENTIONAL ENERGY 10

Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, energy plantations. Wind energy, types of windmills, types of wind rotors, Darrieus rotor and Gravian rotor, wind electric

power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy.

UNIT IV BIOMASS ENERGY **10**

Biomass energy resources, thermo-chemical and biochemical methods of biomass conversion,combustion, gasification, pyrolysis, biogas production, ethanol, fuel cells, alkaline fuel cell, phosphoric acid fuel cell, molten carbonate fuel cell, solid oxide fuel cell, solid polymer electrolyte fuel cell, magneto hydrodynamic power generation, energy storage routes like thermal energy storage, chemical, mechanical storage and electrical storage.

UNIT V ENERGY CONSERVATION **9**

Energy conservation in chemical process plants, energy audit, energy saving in heat exchangers, distillation columns, dryers, ovens and furnaces and boilers, steam economy in chemical plants, energy conservation.

TOTAL : 45 PERIODS

TEXTBOOKS

1. Rao, S. and Parulekar, B.B., Energy Technology, Khanna Publishers, 2005.
2. Rai, G.D., Non-conventional Energy Sources, Khanna Publishers, New Delhi, 1984.
3. Bansal, N.K., Kleeman, M. and Meliss, M., Renewable Energy Sources and Conversion Technology, Tata McGraw Hill, 1990.
4. Nagpal, G.R., Power Plant Engineering, Khanna Publishers, 2008.

REFERENCES

1. Nejat Vezirog, Alternate Energy Sources, IT, McGraw Hill, New York.
2. El. Wakil, Power Plant Technology, Tata McGraw Hill, New York, 2002.
3. Sukhatme. S.P., Solar Enery - Thermal Collection and Storage, Tata McGraw hill, New Delhi, 1981.