ANURAG
Engineering Engineers

ANURAG GROUP OF INSTITUTIONS

(AUTONOMOUS)

(Formerly CVSR College of Engineering)

Venkatapur, Ghatkesar, Hyderabad – 501 301.
www.cvsr.ac.in

B.Tech. Programs:
Chemical Engineering
Civil Engineering
Computer Science and Engineering
Electrical and Electronics Engineering
Electronics and Communication Engineering
Information Technology
Mechanical Engineering

Pharmacy Programs:
B.Pharmacy
Pharma-D
Pharma-D (Post Baccalaureate)
M.Pharm (Pharmaceutics)
M.Pharm (Pharmacology)
M.Pharm (Pharmaceutical Analysis & Quality Assurance)
M.Pharm (Industrial Pharmacy)

M.Tech. Programs:
M.Tech (Computer Science and Engineering)
M.Tech (Software Engineering)
M.Tech (Computer Science)
M.Tech (Computer Networks & Information Security)
M.Tech (Power Electronics & Electrical Drives)
M.Tech (Electrical Power Systems)
M.Tech (CAD/CAM)
M.Tech (Machine Design)
M.Tech (VLSI System Design)
M.Tech (Embedded Systems)
M.Tech (Electronics & Communications Engineering)
M.Tech (Wireless & Mobile Communication)
M.Tech (Structural Engineering)
M.Tech (Construction Management)

Master of Business Administration
Master of Computer Application

COURSE STRUCTURE AND DETAILED SYLLABUS

CHEMICAL ENGINEERING

FOR
B.TECH FOUR YEAR DEGREE COURSE
(Applicable for the batches admitted from 2014-2015)

ANURAG
Engineering Engineers

ANURAG GROUP OF INSTITUTIONS

(AUTONOMOUS)

(Formerly CVSR College of Engineering)

Venkatapur, Ghatkesar, Hyderabad – 501 301.
www.cvsr.ac.in

COURSE STRUCTURE AND DETAILED SYLLABUS

CHEMICAL ENGINEERING

FOR

B.TECH FOUR YEAR DEGREE COURSE

(Applicable for the batches admitted from 2014-2015)

ANURAG GROUP OF INSTITUTIONS

(AUTONOMOUS)

(Formerly CVSR College of Engineering)

Venkatapur, Ghatkesar, Hyderabad – 501 301

www.cvsr.ac.in

COURSE STRUCTURE AND SYLLABUS

II YEAR I SEMESTER **COURSE STRUCTURE**

Code	Subject Name	Lectures	T/P/D	Credits
A53001	Mathematics - III	4	1	4
A53027	Basic Electrical and Electronics Engineering	3	1	3
A53028	Energy Engineering	3	1	3
A53003	Environmental Studies	3	1	3
A53029	Analytical Chemistry	4	1	4
A53030	Chemical Process Calculations	4	1	4
A53211	Electrical Engineering Lab	0	3	2
A53212	Analytical Chemistry Lab	0	3	2
	TOTAL	21	12	25

II YEAR II SEMESTER **COURSE STRUCTURE**

Code	Subject Name	Lectures	T/P/D	Credits
A54001	Probability and Statistics	3	1	3
A54023	Management Science	3	1	3
A54024	Chemical Engineering Fluid Mechanics	4	1	4
A54025	Organic Chemistry	3	1	3
A54026	Chemical Engineering Thermodynamics-I	4	1	4
A54027	Mechanical Unit Operations	4	1	4
A54213	Chemical Engineering Fluid Mechanics Lab	0	3	2
A54214	Mechanical Unit Operations Lab	0	3	2
	TOTAL	21	12	25

Note: All End Examinations (Theory and Practical) are of three hours duration.

T – Tutorial P – Practical D – Drawing

ANURAG GROUP OF INSTITUTIONS
(Autonomous)

II Year B.Tech. Chem-I Sem **L T/P C**
4 1/- 4

MATHEMATICS-III

Course Objective:
•lTo acquaint students with the fundamental concepts of Numerical Analysis
•To develop an understanding of the role of Numerical Analysis in engineering.
•To familiarize students with computer-based computational analysis through a suitable Software Package
•To develop alternative ways to solve a problem and systematic approach of a solution in real Life
•To provide an understanding of the processes by which real life problems are analyzed
•To develop an understanding of the role of numerical methods in engineering.
•Able to know basic properties of standard partial differential equations to solve engineering problems.
•To gain experience of doing independent study and research

UNIT-I: Solution of Non- linear Equations and Linear System of Equations.
Solution of Algebraic and Transcendental Equations – The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method.
Solving system of non-homogeneous equations by L-U Decomposition method(Crout's Method)Jacobi's and Gauss-Seidel Iteration method,

UNIT-II: Interpolation:
Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences- Backward differences –Central differences – Symbolic relations and separation of symbols- Difference Equations - Differences of a polynomial-Newton's formulae for interpolation – Central difference interpolation Formulae – Gauss Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

UNIT-III: Numerical Differentiation, Numerical Integration & Curve fitting
Numerical Differentiation, Generalized Quadrature (Newton's Cote's formula), Trapezoidal, Simson's and Weddle's rules and problems. Curve fitting: Fitting a straight line – Second degree curve – exponentional curve-power curve by method of least squares.

UNIT – IV: Numerical solution of IVP's in ODE
Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method-Runge-Kutta Methods –Predictor-Corrector Methods- Adams-Bashforth Method-Milne Thamson Method.

UNIT-V: Partial differential equations
Introduction and Formation of partial differential equation by elimination of arbitrary constants and arbitrary functions, solutions of first order linear (Lagrange) equation and nonlinear (Standard type) equations, Charpits Method, Method of separation of Variables for second order equations. Classification of general second order partial differential equations. Applications of Partial Differential Equations-One dimensional wave equation, Heat equation.

COURSE OUTCOMES:
Upon successful completion of this course, the student will be able to:
- Be aware of the use of scientific methods in modern scientific computing.
- Be Familiar with numerical solution of Non Linear equations.
- Be Familiar with numerical interpolation and approximation of functions.
- Be Familiar with calculation and interpretation of errors in Numerical Methods
- Be Familiar with numerical differentiation and integration.
- Be Familiar with curve fitting.
- Apply Partial differential equations to solve complex engineering problems.

TEXT BOOKS:
1.Grewal B.S (2007), Higher Engineering Mathematics, 40th Edition, New Delhi, Khanna Publishers.
2. Iyengar T.K.V., Krishna Gandhi B. & Others (2011), Mathematical Methods, 10th Revised Edition, New Delhi, S. Chand & Company Limited.
3.Advanced Engineering Mathematics: Erwin Kreyszig, Wiley.
REFERENCE BOOKS:
1.Shahanaz Bathul (2007), Mathematical Methods, 3rd Edition, Hyderabad, Right Publishers.
2.Jain R. K., and Iyengar S. R. K (2008), Advanced Engineering Mathematics, 3rd Edition, New Delhi, Narosa Publication House.
3.Introductory Methods of Numerical Analysis. S.S. Sastry, Prentice Hall.
4.Numerical Analysis (Paper IV), First Edition 2010, Telugu Akademi, Hyderabad.
5.Schaum's outline series on Matrices.
6.Mathematical Methods of Science and Engineering (Aided with Matlab) Kanti B.Datta (2012), Seventh Edition, CENGAGE Learning.

ANURAG GROUP OF INSTITUTIONS
(Autonomous)

II Year B.Tech. Chem-I Sem **L T/P C**
3 1/- 3

(A53025) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Course Objective:
- Able to get the basic knowledge about the electric & magnetic circuits.
- Able to understand the AC fundamentals
- Able to understand the working of various electrical machines (DC/AC).
- Able to get the knowledge about various measuring investments.

UNIT I:
Ohm's law, Kirchhoff's laws- Nodal Analysis , Mesh analysis - Series, and Parallel circuit's.- star-delta Transformation (simple problems)- Electromagnetic induction. Faraday's law, Lenz's Law- Self and mutual Inductances. Coefficient Of Coupling.
Generation of alternating emf- average and rms values of alternating quantity- representation of alternating quantities by phasors - single phase series and parallel circuits(simple problems)- series and parallel resonance.

UNIT II:
DC Generators: Principle operation of DC machines-emf equation-types of DC generators-magnetization and load characteristics of DC generators.
DC Motor: Principle of operation of DC Motor. Torque equation, back emf equation, types of dc motors, characteristics of DC Motor. Dc motor starter (Three point starter), efficiency calculation, Swinburne's test, speed control.

UNIT- III
Construction and principle of operation of Single phase transformer- emf equation- O.C & S.C tests -efficiency and regulation calculation.

UNIT – IV:
Principle and Operation of Three phase Induction Motors-Types of Induction motors, Slip-Torque Characteristics.
Principle and operation of three phase Alternators , O.C & S.C Tests- Regulation by Synchronous impedance method.

UNIT- V:
Electrical Instruments: Basic principle of indicating instruments - Moving coil and Moving iron instruments (Ammeter and Voltmeters).

COURSE OUTCOMES:
•Explore in designing basic electric circuits using fundamentals of electrical engineering.
•To study the application &operation of various DC & AC machines.
•Identify requirements of electric machines for domestic & industrial purpose.
•Operation & application of various electrical measuring instruments.

TEXT BOOKS:
1.Introduction to Electrical Engineering by M.S Naidu AND S. Kamakshiah,TMH.
2.Basic electrical engineering by T.K.Nagasarkar and M.S sukhija, oxford university press, 2005.

REFERENCES:
1.Theory and problems of Basic Electrical Engineering BY D.P. KOTARI& I.J NAGARAT PEARSON EDUCATION/PHI
2.Principle of Electrical Engineering BY V.K. MEHETHA,S.CHAND PUBLICATIONS.
3.Basic electrical Engineering V.N MITTLE, Second Edition, TMH

ANURAG GROUP OF INSTITUTIONS
(Autonomous)

II Year B.Tech. Chem-I Sem **L T/P C**
3 1/- 3

(A53026) ENERGY ENGINEERING

Course Objective:

•To enable the students to understand the interaction between different parts of the energy system

UNIT I:
Sources of energy, types of fuels- energy and relative forms. Calorific value-gross and net value, calculation of calorific value from fuel analysis, experimental determination of calorific value, present and future energy demands with reference to India; Alternate sources of energy (with special reference to solar and Biomass).

UNIT II:
Coal: origin, occurrence, reserves, petrography, classification, ranking, analysis, testing, storage, coal carbonization and byproduct recovery, liquefaction of coal, gasification of coal, burning of coal and firing mechanism, burning of pulverized coal.

UNIT III:
Liquid fuels: petroleum: origin, occurrence, reserves, composition, classification, characteristics, fractionation, reforming, cracking, petroleum products, specification of petroleum products, burning of liquid fuels.

UNIT IV:
Natural gas, coke oven gas, producer gas, water gas, LPG, burning of gaseous fuels, flue gas- analysis: orsat apparatus, steam distribution and utilization, combined heat and power systems. Waste heat recovery, sources of waste heat and potential application, various types of heat recovery systems, regenerators, recuperators, waste heat boilers

UNIT V:
Energy auditing: short term, medium term, long term schemes, energy conversion, energy index, energy cost, representation of energy consumption, Sankey diagram, energy auditing.

Energy conservation: conservation methods in process industries, theoretical analysis, practical limitations

COURSE OUTCOME:

•Applying their fundamental knowledge of nuclear science and engineering to design and other technical problems in order to address society's needs.

•Communicating effectively among their professional peers, within multi-disciplinary teams, and to the broader public community.

•Incorporating the complexities of environmental, safety and economic concerns into their work, while practicing and promoting the highest ethical standards during that work.

•Continually challenging themselves to increase their intellectual breadth and provide leadership, innovation and up to date knowledge to the wide range of nuclear science and engineering applications.

TEXT BOOKS

1. Fuels, furnaces and refractories by O.P.Gupta.
2. Fuels and combustion by Sami Sarkar 2nd edition orient Longman (1998).

REFERENCES

1.Non-conventional energy resources by G.D.Rai
2.Solar energy by S.P.Sukhathame.
3.Conventional energy technology, Fuel and chemical energy by Tata McGraw- Hill book Co.Ltd. (1987).
4.Fuel and energy by harker and Backhurst Academic press London 1981.
5.Fuel science- harker and Allen Oliver and Boyd 1972.
6.W.R.Murphy, G.Mc.Kay- Energy Management, 1st edition – Butterwolfer & Co.Ltd.(2001).
7.Energy management by Turner

ANURAG GROUP OF INSTITUTIONS
(Autonomous)

II Year B.Tech. Chem-I Sem **L T/P C**
3 1/- 3

(A53003) ENVIRONMENTAL STUDIES

Course Objective:
1)To introduce the knowledge about Environment.
2)To introduce students to the concepts of pollution, Biodiversity
3)To develop an awareness about global Environmental problems.
4)To learn to protect environment, legal issues, Sustainable development.

UNIT – I
Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance – Need for Public Awareness.
(a)Ecosystems: Concept of an ecosystem – Classification, structure and function of different ecosystems - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids.
(b)Biodiversity and its conservation: Introduction - Definition: genetic, species and ecosystem diversity. - Bio-geographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. ICUN categories of biodiversity and RED DATA book - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT - II
Natural Resources : Renewable and non-renewable – Natural resources and associated problems: Forest resources – Use and over – exploitation, deforestation,– Timber extraction, mining, dams and other effects on forest and tribal people: Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. - Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in

conservation of natural resources: Equitable use of resources for sustainable lifestyles.

UNIT – III

(a) Environmental Pollution: Definition, Cause, effects and control measures of different kinds of pollution (Air, Water , Soil , Marine , Noise , Thermal, Nuclear, e –Waste)

(b) Social Issues and the Environment: From Unsustainable to Sustainable development -Urban problems related to energy -Water conservation, rain water harvesting, and watershed management. -Climate change, global warming, ozone layer depletion, nuclear accidents and holocaust.

UNIT – VI:

(a) Waste management technology: Solid waste Management: Causes, effects and control measures of urban and industrial wastes. - Role of an individual in prevention of pollution, Disaster management: floods, earthquake, cyclone and landslides.

Waste water and sewage treatment technology: primary, secondary and tertiary treatments. Bioremediation, Phyto-remediation, ZLD (zero liquid discharge), membrane technology. Application of GIS and GPS system in environmental science.

(b) Environmental policy, Rules and regulations. EIA (Environmental Impact Assessment) & EMP (ENVIRONMENTAL Management Plan) – Environment Protection Act. - Air (Prevention and Control of Pollution) Act. - Water (Prevention and control of Pollution) Act -Wildlife Protection Act –Forest Conservation Act.-Public awareness. Global environmental problems and global efforts.

UNIT – V

(a)Towards sustainable future: concept of sustainable development, threats of sustainability, population and its explosion, over exploitation of resources, strategies for achieving sustainable development. Environmental education, Conservation of resources. Urban sprawl, sustainable cities and sustainable communities, human health. Role of IT in environment, environmental ethics, concept of green building, Basic principles of Green engineering, clean development mechanism (CDM), Low carbon life cycle, Polluters-pay principle.

(b) Field work: Visit to a local area to document environmental assets River/forest grassland/hill/ mountain Visit to a local polluted site-Urban/Rural/industrial/

Agricultural Study of common plants, insects, birds, Visit to effluent treatment plant/sewage treatment plant Study of simple eco systems pond, river, hill slopes, etc.

Mini projects by students which is mandatory.

COURSE OUTCOMES:

•Conservation of natural resources
•Understand Requirement to conserve environment.
•Understand the National and international efforts to save globe.
•Know importance of sustainable development

TEXT BOOK:

1.Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, University Press.
2.Environmental studies, From Crisis to cure by R.Rajagopalan,2005

REFERENCES:

1.Environmental Science: towards a sustainable future by Richard T.Wright.2008 PHL Learning Private Ltd .New Delhi
2.Environmental Engineering and science by Gilbert M.Masters and Wendell P.Ela.2008 PHI Learning Pvt. Ltd.

ANURAG GROUP OF INSTITUTIONS
(Autonomous)

II Year B.Tech. Chem-I Sem **L T/P C**
4 1/- 4

(A53027) ANALYTICAL CHEMISTRY

Course Objective:
•To understand Basic Analysis of chemical compounds using volumetric and Gravimetric Analysis.
• To develop the concepts of electronic Spectroscopy & its analysis.
•To develop the concepts of Infrared Spectroscopy & its analysis.
•Be familiar with the correct use and operation of spectrometers, including UV/visible, FTIR, and atomic absoprtion/emission.
•To study of Industrial Analysis techniques such as Gas Chromatography & HPLC.
• Be familiar with basic chromatographic theory and the operation of ion chromatographs for water analysis

UNIT – I
Principle of Analytical Methods: Gravimetric analysis: Precipitation, types of precipitates, impurities, coprecipitation, post-precipitation, conditions for participation, precipitation from homogeneous solution, Gravimetric determination of Fe and Ni calculations.
Volumetric Analysis: Acid base titrations: Indicators; Oxidation-reduction titrations; Iodometric and Iodimetric titrations, Estimation of Chlorine and chlorides, Complexation using ligands, complexometric titration with EDTA, simple calculations; analysis of Na2CO3, Fe2O3.

UNIT –II
Electronic Spectroscopy: Absorption spectra, Lamberts Law, Beer's Law - Combined law equation; Deviations from Beer's Law. Terminology associated with electronic spectroscopy-(Molar absorptivity, bathochromic effect, hypsochromic effect) types of absorption bands and theoretical interpretation, effect of solvent and structure on λ max-, Various electronic transitions. Woodward – Fieser rules for calculating absorption maximum in conjugated dienes, trienes and α, β- unsaturated carbonyl compounds.
Block diagram of a UV- visible spectrophotometer – quantitative analysis ; Direct method for the determination of metal ions; Chromium and Manganese, Quantitative analysis, structure determination- based on bonding, electron transitions and group frequencies.

UNIT – III

Infrared Spectroscopy: Introduction – Requirement of IR absorption (selection rule), Principle of IR spectroscopy, Types of molecular vibrations – Stretching vibrations and Bending vibrations, Fundamental modes of vibrations – Linear and nonlinear molecules. Factors affecting the group frequencies – coupled interactions, electronic effects and hydrogen bonding. Instrumentation - IR radiation source, monochromator, and detectors. FTIR Instrument and its advantages, sample handling techniques – solution, nujol mull and KBr pellet, Characteristic group infrared absorption for organic molecules, Applications of IR to structural elucidation of simple organic molecules and to functional group analysis (-OH, -NH2, -CHO, -CO-R -CONH).

UNIT – IV:

Introduction to Chromatrography: Classification - Theory - distribution coefficient, rate of travel, retention time, retention volume, adjusted retention volume, net retention volume, specific retention volume, column capacity, separation number, column efficiency, resolution.

Paper chromatography: Types of Paper chromatography, RF value.

Thin Layer Chromatography: Stationary phase, mobile phase, sample application, development techniques – evaluation and documentation, advantages and disadvantages.

UNIT – V:

Gas Chromatography: Principle of Gas Chromatography, block diagram of gas chromatograph, Function of each component, Detectors (FID, ECD), stationary phase for column, mobile phase, chromatogram, qualitative analysis, quantitative analysis, retention time, retention volume, capacity factor.

HPCL: Principles of high performance liquid chromatography, Block diagram of HPCL, Systems, functions of each component, stationary phases, eluting solvents, pumps, detectors, quantitative applications of HPLC.

Course Outcomes:

1. Have firm foundations in the fundamentals and application of current analytical chemistry and scientific theories.
2.Are able to design, carry out, record and analyze the results of chemical experiments.
3.Are able to use modern instrumentation and classical techniques, to design experiments, and to properly record the results of their experiment.
4.Are skilled in problems solving, critical thinking and analytical reasoning.

5.Are able to use modern library searching and retrieval methods to obtain information about a topic, chemical, chemical technique or an issue relating to chemistry.
6.Knowledge of the proper procedures and regulations for safe handling and use of chemicals and can follow the proper procedures and regulations for safe handling when using chemicals.
7.Find gainful employment in industry or government or be accepted at graduate or professional schools or find employment in various organizations.

TEXT BOOK:

1.Instrumentaiotn methods of analysis – Chatwal & Anand– Himalaya Publications, 2003.
2.Analytical Chemistry – Y.Anjaneylu, K. Chandrasekhar, V. Manickam-PharmaMed Press, 2007.

REFERENCES:

1.Quantitative analysis – R.A. Day & A.L.Underwood Printice – Hall of India, pvt. Ltd. 5th edition, 2000.
2.Vogels Text book of Quantitative chemical analysis – J.Mendham, R.C Denny, J.D. Barnes, M J.K.Thomas, pearson education, 6th edition, 2002.
3.Instrumental methods of analysis – Willand merrit and dean, caps publications & Distribution, 1999.

ANURAG GROUP OF INSTITUTIONS
(Autonomous)

II Year B.Tech. Chem-I Sem **L T/P C**
4 1/- 4

(A53028) CHEMICAL PROCESS CALCULATIONS

Course Objective:
•To gain apply the principles of process calculations in the project, design and complex systems by making it a simple by complete understanding.
•To learn modern estimation techniques of process calculations to solve chemical engineering problems.

UNIT-I:
Stoichiometric relation: basis of calculations, methods of expressing compositions of mixtures and solutions, density and specific gravity, Baume and API gravity scales Behavior of ideal gases: applications of ideal gas law to gaseous mixtures, gases in chemical reactions, including combustion processes.

UNIT-II:
Vapor pressure: Liquefaction and liquid state, vaporization, boiling Point, effect of temperature on vapor pressure, Antoine equation, Vapor pressure plots, estimation of critical properties, vapor pressure of immiscible liquids and ideal solutions, Raoult's law. Nonvolatile solutes.

UNIT-III:
Humidity and Saturation: Properties of air-water vapor mixtures, Absolute Humidity,molal humidity,Relative and percentage saturation, dew point, humid heat, wet bulb and dry bulb temperatures, use of humidity charts for engineering calculations.

UNIT-IV:
Material balances: Tie substances, yield, conversion, limiting reactants, excess reactants, processes involving chemical reactions, Material balances with the help of stoichiometric equations, Material balance calculations for processes involving recycle, bypass and purge Material balances involving drying, dissolution and crystallization.

Unit-V:

Thermophysics: Energy, energy balances, heat capacity of gases, liquid and mixture solutions, Kopp's rule, latent heats, heat of fusion and Heat of vaporization, Trouton's rule, Kistyakowsky equation for non-Polar liquids, enthalpy and its evaluation Thermochemistry: Calculation and applications of heat of reaction, combustion, formation and neutralization, Kirchoff's equation, enthalpy concentration change, calculation of theoretical actual flame temperature.

Course Outcomes:

•Fundamental laws of Stoichiometry

•Calculation of Vapor Pressures for Liquids using appropriate laws & critical Properties of ideal solution mixtures.

•Calculation of Properties for AIR-WATER system using Humidification principles.

•Study of Material balances for Unit Operations with and with chemical reactions & Energy balance calculations.

•

TEXT BOOKS:

1.Chemical Process Proinciples, Part-I, Material and Energy Balance by Hougen O A, Watson K.M and Ragatz R. A. John Wiley and sons, New York, 1963, 2nd Ed.

REFERENCES:

1.Basic Principles and Calculation in Chemical Engineering by D. H. Himmelblau, 5th Ed. PHI, 2001

2.Stoichiometry by B.I, Bhatt and S.M. Vora (3rd Ed.) Tata Mc Graw Hill Publishing Company, Ltd. New Delhi (1996)

ANURAG GROUP OF INSTITUTIONS
(Autonomous)

II Year B.Tech. Chem-I Sem

L	T/P	C
-	3	2

(A53211) ELECTRICAL ENGINEERING LAB

Course Objective:
•Know about fundamental of electric circuits.
•Realize basic theoretical concepts & laws real physical world.
•Acquaint with symbolic representation of different circuit elements.
•Acquaint with different AC & DC measuring devices
•Know physically about rotating machines
•Realize about different sources used
•Know about electrical safety & standards

(Atleast Ten experiments out of the following Twelve experiments should be performed)
1.Verification of KVL and KCL
2.Series and Parallel resonance (to determine bandwidth, quality factor, selectivity)
3.Magnetization Characteristics of dc shunt generator (to determine critical resistance and critical speed)
4.Load test on DC Shunt Generator (to draw the characteristics of dc shunt generator)
5.Swinburne's Test (to calculate predetermined efficiency of dc shunt machine)
6.Brake test on DC Shunt Motor
7.Speed control of DC Shunt Motor
8.O.C & S.C Test on Single phase Transformer
9.Brake test on three phase Induction Motor
10.Regulation of Three phase Alternator by Synchronous Impedance Method
11.Load Test on single phase Transformer
12.Brake test on DC Compound Motor

COURSE OUTCOME S:
1.Realise fundamentals of electrical Technology
2.Identify and use various electrical measuring devices
3.Explore themselves in designing basic electric circuits.
4.Use symbolic representation to represent any electric circuits.

5.Aware of various electric safety rules used while working in electric circuits and equipments.
6.Identify requirements of electric machines for domestic and industrial purpose.

Note: Conduct any 10 experiments

ANURAG GROUP OF INSTITUTIONS
(Autonomous)

II Year B.Tech. Chem-I Sem **L T/P C**
- 3 2

(A53212) ANALYTICAL CHEMISTRY LAB

Course Objective:
•Be familiar with good laboratory practice and the development of standard operating procedures.
•To describe the practice of analytical chemistry.
•To teach the proper use and importance of measurement statistics.
•To teach proper solution handling and standards preparation.
•To reinforce the principles of good laboratory practice.
•To provide a basic understanding of common analytical techniques.
•To provide guidance on the appropriate choice of technique for a given size & type of sample.

(Atleast Ten experiments out of the following Thirteen experiments should be performed)
1. Estimation of ferrous iron (II) in solution using Potassium Dichromate.
2. Estimation of copper (II) using standard sodium thiosulphate.
3. Estimation of total, permanent and temporary hardness of water by EDTA.
4. Estimation of Total alkalinity of water.
5. Determination of λ max of a given solution and verify Beer's law and apply it to find the concentration of the KMNO4 using colorimeter.
6. Estimation of Zinc using potassium ferrocyanide.
7. Percentage purity of lime stone.
8. Estimation of Chlorides in water.
9. Estimation of Dissolved oxygen in water.
10. Determination of total residual chlorine in water.
11. Determination of stability constant by Job's method.
12. Assay of paracetamol/ Ibuprofen sample using spectrophotometer.

COURSE OUTCOMES:
This will be achieved through a mixture of highly integrated lectures, tutorials, and laboratory experiments. By the end of the course, students will be expected to demonstrate the following core competencies:
correctly identify absolute and relative errors, and use significant figures.
present results correctly, and test for precision and accuracy.

correctly prepare standard solutions and use appropriate calibration methods.
use appropriate method to perform scientific calculations and produce graphs.
be familiar with the correct use of volumetric glassware to prepare solutions and perform titrations.

TEXT BOOKS:

1. Vogel's Text book of Quantitative Chemical Analysis, Sixth Edition – J. Mendham et al, Pearson Education.
2. Laboratory manual of engineering chemistry, S.K.Bhasin and Sudha Rani , Dhanpat Rai & Co.

REFERENCE BOOKS:

1. A text book on experiments and calculations. S.S. Dara.
2. Text Book of engineering chemistry by R. N. Goyal and Harrmendra Goel.

APPARATUS AND EQUIPMENT REQUIRED

GLASSWARE:

Burettes, Pipettes (10ml, 20 ml, 25 ml), Conical Flasks (250 ml), Standard Flasks (25 ml, 50 ml, 100 ml, 250 ml, 500 ml, 1000 ml) Graduated Pipettes, Beakers (100 ml, 250 ml, 500 ml, 1000 ml) Reagent Bottels (100 ml, 250 ml, 500 ml,), Test Tubes, Test Tube Stands, Burette Stands, Porcelain Tiles, Brushes, Wash Bottles, Droppers, Conical Flaks (250 ml, 100 ml), Weighing Bottles.

EQUIPMENT :

Colorimeter, UV- Visible Spectrophotometer, Hot Water Bath, Hot Plates, Distilled Water, Plant/De - ionizer, Magnetic- Stirrer, Chemical Balances, Weighing Boxes and Electrical Balance.

ANURAG GROUP OF INSTITUTIONS
(Autonomous)

II Year B.Tech. Chem-II Sem	**L**	**T/P**	**C**
	3	**1/-**	**3**

PROBABILITY AND STATISTICS

Course Objective:

•Understand Chance causes and random variable that describes randomness or an uncertainty in certain realistic situation. It can be of either discrete or continuous type.

•In the discrete case, study of the binomial and the Poisson random variables and the Normal random variable for the continuous case predominantly describe important probability distributions. Important statistical properties for these random variables provide very good insight and are essential for industrial applications.

•The types of sampling, Sampling distribution of means ,Sampling distribution of variance, Estimations of statistical parameters, Testing of hypothesis of few unknown statistical parameters.

•Understanding the Experiment and the design of experiment.

•The random processes, The classification of random processes, Markov chain, Classification of states

•Stochastic matrix (transition probability matrix),Limiting probabilities, Applications of Markov chains

UNIT-I: Probability: Sample space and events, Classical and Statistical definition of Probability, The axioms of probability, Some Elementary theorems of Probability, Conditional probability, Baye's theorem. Random variables, Discrete and continuous random variable,

UNIT-II: Definitions of Probability Distribution function, Probability mass function, Probability density function and properties. Definitions of Mathematical expectation, Moments (about origin & Centre), Definition of moment generating function for discrete and continuous random variable.

Discrete Distributions: Binomial and Poisson distributions (definition and problems) their mean, variance and moment generating function.

Continuous Distribution: Normal and exponential distributions (definition and problems) related properties.

Concepts of Joint Distribution function of more than one random variable, Definition of joint, marginal and conditional distribution (for two variables only).

UNIT-III: Sampling distribution: Populations and samples - Sampling distributions of mean (σ known and unknown)
Estimation: Concept of Point estimation and its properties (definition only), Concept of interval estimation with examples.
Test of Hypothesis: Null & Alternative Hypothesis, Critical region, Type I and Type II errors, level of significance, one tail, two-tail tests.
Large sample test: concerning means – proportions (One and Two samples).

UNIT-IV: Small sample test: Chi-Square test, Student's t-test (Single mean, Difference of mean and Paired samples) and F-test.
Design of Experiment: Introduction to ANOVA (one – way, two – way), Principles of Design of Experiment, completely randomized design (CRD), randomized complete block design (RBD), Latin Square Design (LSD).(No Derivations only concept, definitions and problems)

UNIT-V: Stochastic Process: Introduction to stochastic Process, Classification of Random Processes, Stationary and non-stationary random process, Stochastic Matrix.
Markov Chain: Classification of States, Classification of chains, Random Walk and Gambler Ruin.

Course Outcomes:
•Students would be able to identify distribution in certain realistic situation. It is mainly useful for circuit as well as non-circuit branches of engineering. Also able to differentiate among many random variable involved in the probability models. It is quite useful for all branches of engineering.
•The student would be able to calculate mean and proportions (small and large sample) and to make important decisions from few samples which are taken out of unmanageably huge populations .It is Mainly useful for non-circuit branches of engineering.
•Students would be able to design their experiment with the basic norms and test their design efficiency. It is useful to all the branches of engineering.
•The student would able to understand about the random process, Markov process and Markov chains which are essentially models of many time dependent processes such as signals in communications, time series analysis, queuing systems. The student would be able to find the limiting probabilities and the probabilities in nth state. It is quite useful for all branches of engineering

Text Books:

1.Probability and Statistics for Engineers and Scientists by Sheldon M. Ross, Academic Press.
2.Probability and Statistics for Engineers by Richard A Johnson, Pearson Education.
3.Introduction to Probability by Charles M Grinstead, J Laurie Snell, American Mathematical Society.

References:

1.A.V. Skorokhod, Basic Principles and Applications of Probability Theory, Springer.
2.Arnold O. Allen, Probability & Statistics, Academic Press.
3.Hwei P. Hsu, Theory and Problems of Probability, Random Variables, and RandomProcesses, Schaum's Outline Series, McGraw- Hill.
4.Mendan Hall, Probability & Statistics, Beaver Thomson Publishers.
5.Miller and John E. Freund, Probability & Statistics for Engineers, Prentice Hall of India.
6.Montgomery: Design and Analysis of Experiments, Wiley.
7.T.T. Soong, Fundamentals of Probability and Statistics for Engineers, JohnWiley & Sons, Ltd.
8.Zivorad R. Lazic, Design of Experiments in Chemical Engineering, Wiley-VCH.

ANURAG GROUP OF INSTITUTIONS
(Autonomous)

II Year B.Tech. Chem-II Sem **L T/P C**
3 1/- 3

(A54026) MANAGEMENT SCIENCE

Course Objective:
1.To teach the fundamentals of the key elements of a business organization.
2.To provide a critical perspective on theoretical knowledge and practical approach to various functional areas of management and decision making..
3.To provide insights on management concepts and to built team work and leadership skills within them.

Unit-I
Introduction to Management: Entrepreneurship and organization – Nature and importance of Management, Functions of Management, Taylor's scientific Management Theory, Fayol's principles of management, Maslow's theory of Human Needs, Douglas Mc Gregor's Theory X and Theory Y, Herzberg's Two factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social Responsibilities of Management. Types of organization structures.

Unit-II
A) Operations Management: Principles and Types of Plant Layout-Methods of production(Job, batch and Mass production), Work Study – Basic procedure involved in Method Study and work measurement-Statistical Quality Control: X chart, R chart, C chart, P chart, (simple problems), Acceptance Sampling, Deming's contribution to quality.
b) Materials Management: Objectives, Need for Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Stores Records – supply chain management.

Unit –III
A) Human Resources Management (HRM): Evolution of HRM, Concepts of HRM, Basic functions of HR Manager: Manpower Planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating.

B) Marketing: Functions of Marketing, Marketing Mix, Marketing strategies based on Product Life cycle,. Channels of distribution.

Unit –IV

Project Management(PERT/CPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method(CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing.(simple Problem)

Unit –V

Strategic & Contemporary Management Practices: Mission, Goals, objectives, policy, strategy, programmes, Elements of corporate planning process, Environmental Scanning, SWOT analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives. Basic concepts of Just-In-Time(JIT) system, Total Quality Management(TQM), Six Sigma and Capability Maturity Model(CMM) levels, Value chain Analysis, Enterprise Resource Planning(ERP), Performance management, Business Process Outsourcing(BPO), Business process Re-engineering 5S Model, Deming's PDCA, Kaizen, Poka-Yoke, Muda, Benchmarking, Balanced Score Card

COURSE OUTCOMES:

On completion of this course, the graduate should be able:

a.To have the knowledge on various concepts of business management and approaches.

b.To understand and analyze the interconnections between the development of key functional areas of business organization and the management thought process.

c.To be ethically conscious and socially responsible managers, capable of contributing to the development of the nation and quality of life.

TEXT BOOKS:

1.Aryasri: Management Science, TMH, New Delhi, 2009

REFERENCES:

1.Stoner , Management, Pearson, 2009.
2.Kotler Philip & Keller Kevin Lane: Marketing Management PH, 2009.
3.Koontz, Weihrich & Aryasri: Principles of Management, TMH, 2009.
4.Thomas N. Duening & John M. Ivancevich Management-Principles and Guidelines, Cengage, 2009.

5.Kanishka Bedi, Production and Operations Management, Oxford University Press, 2009.
6.Memoria & S.V.Ganker, Personnel Management, Himalaya, 2009.
7.Schermerhorn: Management, Wiley, 2009
8.Parnell: Strategic Management, Biztantra, 2009.
9.L.S. Srinath: PERT/CPM, Affiliated East-West Press, 2009.
10.William J. Stevenson & Ceyhun Ozgur: Introduction to Management Science, TMH, 2007

ANURAG GROUP OF INSTITUTIONS
(Autonomous)

II Year B.Tech. Chem-II Sem **L T/P C**
4 1/- 4

(A54027) CHEMICAL ENGINEERING FLUID MECHANICS

Course Objective:
•To impart to the student knowledge on fluid properties, fluid statics, dynamic characteristics for through pipes and porous medium, flow measurement and fluid machineries.

UNIT-I
BASIC CONCEPTS, Fluid statics, Applications of fluid statics, Manometers, decanters, centrifuge, dimentional analysis: Buckingham π theorem,
FLUID FLOW PHENOMENA: Newtonian and Non- Newtonian fluid flow, turbulence, Reynolds number-its significance, Boundary layer theory.

UNIT-II
BASIC LAWS FOR SYSTEMS: Mass, momentum and energy balance, Bernoulli's equation, introduction to navier stoke's and Euler's equations, macroscopic balance.

UNIT-III
INCOMPRESSIBLE FLOW in pipes and channels, laminor flow in pipes and channels, Hagen- poiseullie equation, turbulent flow in pipes and channels, moody chart, friction losses in expansion and contractions, effects of fittings and valves
COMPRESSIBLE FLUIDS: Processes of compressible flow, Isentropic flow through nozzles (chocked flow), adiabatic frictional flow, and isothermal frictional flow.

UNIT-IV
FLOW PAST IMMERSED BODIES: concept of drag, drag coefficient with Reynolds number, flow through packed bed and fluidized bed, flow through bed of solids, motion of particles through the fluid, particle settling.
FLUIDIZATION: types of fluidization, minimum fluidization velocity, pneumatic conveying and other industrial uses.

UNIT-V

TRANSPORTATION AND METERING OF FLUIDS: pipe, fittings and valves, classification of pumps, classification of pumps, centrifugal pumps-cavitation, NPSH,charactristic curves, positive displacement pumps,fans,blowers and compressors.

FLUID METERS: volume flow measurement: full bore meters, Area meters, and local velocity measurement: Pitot tube, hot wire anemoters, mass flow meters

COURSE OUTCOME:

On completion of this course, the students would have knowledge on

- Fluid properties, their characteristics while static and during flow through ducts, pipes and porous medium.
- Several machineries used to transport the fluid and their performance

TEXT BOOKS:

1.McCabe, W, L., Smith, J, C., Harriott, Peter. Unit Operations of Chemical Engineering, McGraw Hill Higher Education Publication, New Delhi.
2.Transport processes and unit operations by Christie j. Geankoplis, PHI

REFERENCES

1.Vijay Gupta, Santhosh Kumar Gupta, Fluid Mechanics and its application, New Age International Publication, New Delhi.
2.Ron Darby, Chemical Engineering fluid Mechanics, Marcel Dekker Inc, NY (1996).
3.J. O. Wilkes, Fluid Mechanics for Chemical Engineers, Prentice Hall (1999).

ANURAG GROUP OF INSTITUTIONS
(Autonomous)

II Year B.Tech. Chem-II Sem **L T/P C**
3 1/- 3

(A54028) ORGANIC CHEMISTRY

Course Objective:

- Organic chemistry is the study of the general principles of the organic chemistry of carbon.
- The main purpose of chemical nomenclature is to identify a chemical species by means of written or spoken words
- Understand some important types of organic reactions in terms of the underlying mechanism principles involved.
- The objective of the aldol condensation is to understand the aspects of carbonyl chemistry and carbon-carbon bond formations
- The reactions friedal-crafts alkylation and acylation are useful for the preparation of an alkyl benzene and acyl benzene.
- Understand the basics of stereochemistry, physical properties of isomers, synthesis and applications of stereochemistry.
- Gain of knowledge of stereo isomers, conformational isomers.
- Understand the synthesis, properties and applications of some important polymers.
- Understand the synthesis, properties and applications of some important heterocyclic compounds
- Understand the synthesis and applications of some important dyes.

UNIT-I

Organic Compounds (nomenclature), Basic concepts of functional groups, Fundamentals of reaction mechanism; electro negativity, dipole moment, Types of Organic reactions.

Polar effects – Inductive effect, electromeric effect, mesomeric effect, Concept of reactive intermediates- carbanions, carbocations, carbenes and free radicals, Hyper conjugation, steric inhibition of resonance – examples.

nucleophilic addition and substitution reactions. Aldol condensation and Perkin reaction.

UNIT II:

Electrophilic addition and substitution reactions. Friedel-Craft alkylation & acylation reaction, Beckmann rearrangement.

Free radical reactions (a) Halogenation of Alkane (b) Addition of HBr to

Alkene in the presence of peroxide
(2) Allylic halogenations Using N-Bromosuccinamide(NBS)
(3) Thermal halogenation of Alkanes.

UNIT – III

Stereo isomerism; Optical isomerism; Symmetry and chirality; Optical isomerism in lactic acid and tartaric acid; Sequence rules; Enantiomers, diastereomers; Geometrical Isomerism; E-Z system of nomenclature, conformational analysis of ethane and Cyclohexane.

UNIT – IV

Polymerization Reactions – Basic concepts; Types of Polymerization – Addtion and Condensation Polymerizations, Plastics- Thermosetting and Thermoplastics – Differences, Molecular weights of polymer: Number average molecular weight, Weight average molecular weight, Preparation, Properties and Engineering uses of the Following: Polyethylene, Polypropylene, PMMA, Epoxy resins and Silicone Resins, Rubber - Processing of Natural Rubber, Vulcanization and Compounding. Elastomers- Neoprene, Butyl rubber and Polyurethane Rubber.

UNIT V:

Heterocyclic compounds: Aromatic Character, basicity and chemical reactivity, Nomenclature, Preparation, Properties and uses of (1) Pyrrole (2) Furan (3) Pyridine (4) Quinoline (5) Iso-quinoline.
Dyes - colours and constitution, chromophore and auxochrome theory, modern theory of colour, classification of dyes - by structure and by methods of application. Preparation, colour and application of (1) Malachite green (2) Fluoroscien (3) Congored (4) Bismark brown.

COURSE OUTCOMES.

Students will:

- Understand the terminology associated with the IUPAC nomenclature.
- Describe, analyze and interpret the structure and reactivity relationship of organic molecules.
- Describe the general approaches to study organic mechanism.
- Have ability to synthesize the alkyl and acyl benzenes by using friedal-crafts alkylation and acylation.
- Understand the bromination especially at allylic position by using NBS
- Recognize the basis of chirality and symmetry in organic chemistry,streogenic elements and stereoisomerism, polarimetry, optical activity of organic molecules.

- Understand processes involving the production of polymers, properties and applications.
- Have ability to synthesize the hetero cyclic compounds and dyes and their applications

TEXT BOOKS:

1.Organic Chemistry- Reactions and Reagents- O.P. Agrawal– Krishna Prakashan media(P) Ltd. – 2009.
2.Organic Reactions and their Mechanisms, II Edition – P. S. Kalsi– New age International Publishers– 2000.

REFERENCES:

1.Organic Chemistry Vol- I-IL. Finar, V Edition– Pearson Publication.
2.Text book of Organic Chemistry – P.L. Soni– Sultan Chand & Sons, New Delhi– 2003.
3.Polymer Science – Gaurikar and others– New age International Publishers, New Delhi – 2003.

ANURAG GROUP OF INSTITUTIONS
(Autonomous)

II Year B.Tech. Chem-II Sem **L T/P C**
4 1/- 4

(A54029) CHEMICAL ENGINEERING THERMODYNAMICS-I

Course Objective:
•Understand the concepts of internal energy, heat, work and energy conversion, and can calculate heat and work quantities for industrial processes.
•Use equations of state, correlations and tables for real fluids.
•Reiterate the laws of thermodynamics, and understand the practical implications of these laws in engineering design.
•Understand processes involving power production, refrigeration, and liquefaction, and be able to calculate relevant system efficiencies for these processes.

UNIT I
Introduction: The scope of thermodynamics, temperature and Zeroth Law of Thermodynamics, defined quantities; volume, pressure, work, ,heat, Energy classifications, , energy in transition, heat and work, point and path properties, thermodynamic state and state functions, reversible and irreversible processes, equilibrium, The phase rule.

UNIT-II:
The first law and other basic concepts: Joules Experiments, The first law of thermodynamics and Internal Energy, enthalpy, the steady-state steady-flow process, constant-V and constant- P processes heat capacity.
Volumetric properties of pure fluids: The PVT behavior of pure substances, virial equations, the ideal gas, the applications of the virial equations, second virial coefficients from potential functions. Cubic equations of state, generalized correlations for gases, generalized correlations for liquids.

UNIT-III:
Thermodynamic properties of fluids: Property relations for homogeneous phases, residual properties, two phase systems, thermodynamic diagrams, tables of thermodynamic properties, generalized property correlation for gases. Thermodynamics of flow processes ; principles of conservation of mass and energy for flow systems, analysis of expansion processes ; turbines, throttling ; compression processes –compressors and pumps ; calculation of ideal work and lost work.

UNIT-IV:

The second law of thermodynamics: Statements of the second law, heat engines, thermodynamic temperatures scales, thermodynamic temperature and the ideal gas scale, Entropy, Entropy changes of an ideal gas, mathematical statement of the second law, the third law of thermodynamics, entropy from the microscopic view point

UNIT-V:

Refrigeration and liquefaction: The Carnot refrigerator, the vapor compression cycle, the comparison of refrigeration cycles, the choice of refrigerant, absorption refrigeration, the heat pump, liquefaction processes

COURSE OUTCOMES

Students will:

•Identify, formulate and solve engineering problems in classical thermodynamics involving closed and open systems for both steady state and transient processes.

•Have the ability to estimate thermodynamic properties of substances in gas or liquid state of ideal and real mixture.

•To introduce the principles of chemical engineering thermodynamics and illustrate their applications in the design of chemical process plants.

•Understand the terminology associated with engineering thermodynamics and have knowledge of contemporary issues related to chemical engineering thermodynamics.

TEXT BOOKS :

1.Smith , J.M., Van Ness, H.C., " Introduction to Chemical Engineering Thermodynamics ", 6th
ed, Mc Graw Hill 2003.

REFERENCES:

1.Kyle, B.G., " Chemical and Process Thermodynamics 3rd edn. ", Pearson, Prentice Hall of India Pvt.Ltd., 1999.

2.Y.V.C. Rao, Chemical Engineering Thermodynamics, University Publications.

3.. Hougen, O.A., Watson, K.M., and Ragatz, R.A., " Chemical Process Principles, Part II ",Thermodynamics, John Wiley, 1970.

4.Dodge, B.F., " Chemical Engineering Thermodynamics ", McGraw-Hill, 1960

ANURAG GROUP OF INSTITUTIONS
(Autonomous)

II Year B.Tech. Chem-II Sem **L T/P C**
4 1/- 4

(A54030) MECHANICAL UNIT OPERATIONS

Course Objective:
In this course, the students will learn characterization of solids, size reduction, techniques of solid – fluid separation and mixing

UNIT-I:
Properties, handling and mixing of particulate solids: Characterization of solid particles, properties of particulate masses, storage and mixing of solids, types of mixers, mixers for cohesive solids, mixers for free flowing solids.
Transportation of solid particulate mass, belt, screw, apron conveyers, bucket elevators, pneumatic conveying

UNIT-II:
Size reduction: Principles of comminution, size reduction equipment crushers, grinders, ultra fine grinders, cutting machines, Equipment operation. Screening, Industrial screening equipments

UNIT–III:
Filtration, cake filters, centrifugal filters, Principles of cake filtration. Clarifying filters, liquid clarification, gas cleaning, and principles of clarification.
Cross flow filtration, types of membranes, permeate flux for ultra-filtration, Concentration polarization, particle rejection of solutes

UNIT-IV:
Separations based on motion of particles through fluids, gravity settling processes and centrifugal settling processes, float and sink method, differential settling, coagulation, Flotation-separation of ores, flotation agents

UNIT -V:
Agitation and mixing of liquids: Agitation of liquids, circulation velocities, power consumption in agitated vessels. Blending and mixing of liquids, suspension of solid particles, dispersion operations.
Crystallization: crystal geometry, principles of crystallization equilibrium and yields, nucleation, crystal growth.

COURSE OUTCOMES:

Upon completion of this course, the students would understand about different types of size reduction processes & solid -fluid separation techniques and equipment involved.

TEXT BOOK:

1.Unit Operations in Chemical Engineering by W.L. McCabe and J.C. Smith and Peter Harriott, Mc Graw Hill 5th ed. 1993.

REFERENCES:

1.Chemical engineers hand book, J.H. Perry, 7th ed. Mc Graw Hill .
2. Badger and Bencharo, " Introduction to Chemical Engineering". TMH,
3. Narayanan C.M.& Bhattacharya B.C.
"Mechanical opeartions for chemical engineers", Khanna.

ANURAG GROUP OF INSTITUTIONS
(Autonomous)

II Year B.Tech. Chem-II Sem **L T/P C**
4 1/- 4

(A54214) CHEMICAL ENGINEERING FLUID MECHANICS LAB

Course Objective:
To gain practical knowledge on the measurement of Fluid Flow and their characteristics at different operating conditions. To determine experimentally the flow characteristics of fluids and also to determine the efficiency of the flow measuring devices and fluid transport machineries.

(At least Ten experiments out of the following Twelve experiments should be performed)
1.Experiments on Reynolds Apparatus for determination of flow regime.
2.Determination of co efficient of Discharge for Orifice meter
3.Determination of co efficient of Discharge for Venturi meter
4.Determination of Discharge co- efficient of given V-notch.
5.Determination of efficiency of a centrifugal pump.
6.Calibration of a Rota-meter
7.Frictional losses in straight pipes and construction of fanning friction factor vs. Reynolds Number plot.
8.Frictional losses in bend pipes and construction of fanning friction factor vs. Reynolds Number plot.
9.Determine absolute viscosity of glycerol – water mixture.
10.To determine the pressure drop across the packed column.
11.Experiment on fluidization techniques and determination of
(a)Minimum fluidization velocity;
(b)Pressure drop profile
12.Experiment is to verify the Bernoulli's theorem

LIST OF EQUIPMENTS/MACHINES REQUIRED:
1.Reynolds apparatus
2.Orifice meter
3.Venturi meter
4.V - notch apparatus
5.Centrifugal pump
6.Rota meter

7.Set of straight pipes.
8.Set of fittings in pipe
9.Canon viscometer
10.Packed column apparatus
11.Bernoulli's apparatus

COURSE OUTCOMES

•Understand concepts on nature of fluids, pressure concepts and measurement of pressure by various experimental methods and by mathematical relations and enhancement of problem solving skills.
•Understand clear concepts on flow of incompressible fluids in conduits and thin layers and friction factor variations with velocity and friction losses using bernoulli's equations and they will be demonstrated experimentally.
•Determine viscosity using cannon fenske viscometer and terminal velocity experiment.
•Understand principles and working of various types of pumps, transportation and metering of fluids using various experimental techniques and applications to industry.

RECOMMENDED BOOK:

1. W. L. McCabe and J. C. Smith, "Unit Operations In Chemical Engineering", 4th Edn.,McGraw Hill Publishing Co., 1985.

ANURAG GROUP OF INSTITUTIONS
(Autonomous)

II Year B.Tech. Chem-II Sem **L T/P C**
4 1/- 4

(A54215) MECHANICAL UNIT OPERATIONS LAB

Course Objective:
To enable the students to develop a sound working knowledge on different types of crushing equipments and separation characteristics of different mechanical operation separators.

(Atleast Ten experiments out of the following twelve experiments should be performed)
List of Experiments:
1. To determine the time of grinding in a ball mill for producing a product with 80 % passing a given screen.
Major equipment - Ball mill Apparatus, Sieve shaker, Different sizes of sieves, Weighing balance.
2. To verify the laws of crushing using any size reduction equipment like crushing rolls or vibrating mills and to find out the working index of the material.
Major equipment – Jaw Crusher, Sieve shaker, Different sizes of sieves, Weighing
Balance, Energy meter
3. To find the effectiveness of hand screening of a given sample by a given screen.
Major equipment - Vibrating Sieve shaker, Different sizes of sieves, Weighing Balance
4. To separate a mixture of oil into two fractions using froth flotation technique.
Major equipment - Froth flotation cell
5. To obtain batch sedimentation data and to calculate the minimum thickener area under given conditions.
Major equipment- Sedimentation apparatus
6. To determine the specific cake resistance and filter medium resistance of slurry in plate and frame filter press.
Major equipment - Plate and Frame filter press.
7. Verification of Stoke's law.
Major equipment – Stoke's law apparatus.

8. To take a representative sample from a bulk by two methods, Cone& Quartering and to find out the average size {volume-surface mean diameter} of the samples.
9. To find the size analysis of a given fine sample using beaker decantation method.
10. To verify the laws of crushing using any size reduction equipment like roll crusher find out the working index of the material.
– Roll Crusher, Sieve shaker, Different sizes of sieves, Weighing
Balance, Energy meter.
11. To separate a mixture of particles by jigging
Major Equipment – Mineral Jig
12. To analyze a given powder for its particle size distribution. / Cumulative and Differential methods of particle size distributions
13.To calculate separation efficiency of particles in a mixture using cyclone separator.
Major Equipment – Cyclone separator
14. To determine the bulk, tapped and true density along with the flowability and porosity of a given fine sample

COURSE OUTCOME:
Students would gain the practical knowledge and hands on various separation techniques like filtration, sedimentation, screening, froth flotation, and beaker Decantation and size reduction operations.

TEXT BOOK:
1. Unit Operations in Chemical Engineering by W.L. McCabe and J.C. Smith and Peter Harriott, Mc Graw Hill 5th ed. 1993.