ENGINEERING MATHEMATICS III

Sub Code : 15MAT31 IA Marks : 20
Hrs/Week : 04 Exam Hours: 03
Total Hrs : 50 Exam Marks: 80
Credits: 04

[COMMON TO ALL BRANCHES]

MOMENTUM TRANSFER

Sub Code : 15CH32 IA Marks : 20
Hrs/Week : 04 Exam Hours: 03
Total Hrs : 50 Exam Marks : 80
Credits: 04

COURSE OBJECTIVES: The students will

1. 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.
2. Learn detailed explanation on types of fluids, stress and velocity relations, type of fluid flow and boundary layer relations.
3. Understand relationship between kinetic energy, potential energy, internal energy and work complex flow systems using Bernoulli's equation with application to industrial problems.
4. 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.
5. Study Flow of compressible fluids, Dimensional analysis, Dimensional homogeneity and various dimensionless numbers and their applications.
6. Understand principles and working of various types of pumps, transportation and metering of fluids using various experimental techniques and applications to industry.

Module 1	Content	Contact Hours	Blooms Taxonomy
FLUID STATICS AND ITS APPLCATIONS: Concept of unit operations, Concept of momentum transfer, Nature of fluids and pressure concept, variation of pressure with height – hydrostatic equilibrium, Barometric equation, Measurement of fluid pressure – manometers, Continuous gravity decanter, Centrifugal decanter.		**10 Hrs.**	**L-1, L-2**
FLUID FLOW PHENOMENA: Type of fluids – shear stress and velocity gradient relation, Newtonian and non- Newtonian fluids, Viscosity of gases and liquids. Types of flow – laminar and turbulent flow, Reynolds stress, Eddy viscosity. Flow in boundary layers, Reynolds number, and Boundary layer separation and wake formation.			**L-1, L2**

Module 2	Content	Contact Hours	Blooms Taxonomy
BASIC EQUATIONS OF FLUID FLOW: Average velocity, Mass velocity, Continuity equation, Euler and Bernoulli equations Modified equations for real fluids with correction factors, Pump work in Bernoulli equation, Angular momentum equation.		**10 Hrs.**	**L-2, L-3**
FLOW OF INCOMPRESSIBLE FLUIDS IN CONDUITS AND THIN LAYERS: Laminar flow through circular and non-circular conduits, Hagen Poiseuille equation, Laminar flow of non-Newtonian liquids. Turbulent flow			**L-2, L-3**

Module 3	Content	Contact Hours	Blooms Taxonomy
FLOW OF INCOMPRESSIBLE FLUIDS IN CONDUITS AND THIN LAYERS :(Contd...) Friction factor chart, friction from changes in velocity or direction, Form friction losses in Bernoulli equation, Flow of fluids in thin layers		**10 Hrs**	**L-2, L-3**
FLOW OF COMPRESSEBLE FLUIDS: Continuity equation, Concept of Mach number, Total energy balance, Velocity of sound, Ideal gas equations, Flow through variable-area conduits, Adiabatic frictional flow, Isothermal frictional flow (elementary treatment only).			**L-2, L-3**

Module 4	Content	Contact Hours	Blooms Taxonomy
TRANSPORTATION AND METERING OF FLUIDS: Pipes, Fittings and valves, Measurement of fluid and gas flow rates by orifice, venturi & rotameters. Pitot tube. Elementary concept of target meter, vortex-shedding meters, turbine meters, positive displacement meters, magnetic meters, coriolis meters and thermal meters, Flow through open channel-weirs and notches.		**10Hrs**	**L-2, L-3**

Module 5	Content	Contact Hours	Blooms Taxonomy
PUMPS: Performance and Characteristics of pumps-positive displacement and centrifugal pumps, Fans, compressors, and blowers.		**10 Hrs.**	**L-2, L-3**
DIMENSIONAL ANALYSIS: Dimensional homogeneity, Rayleigh's and Buckingham's Π- methods, Significance of different dimensionless numbers, Elementary treatment of similitude between model and prototype.			**L-2, L-3**

COURSE OUTCOMES: On completion of this course the students will be able to

1. Analyze different types of fluids and they will be able to measure pressure difference for flow of fluids.
2. Understand and analyze the relationship between kinetic and potential energy, internal energy, work, and heat in complex flow systems using Bernoulli's equation, perform macroscopic energy balances.
3. Analyze and calculate friction factor for different types of flow in various types of constructions.
4. Develop mathematical relations using Dimensional analysis by Rayleigh and Buckingham –π method.

GRADUATE ATTRIBUTES:

- Design and Development of Solutions.
- Problem Analysis

QUESTION PAPER PATTERN:

- The question paper will have ten questions. Each full is for 16 marks. There will be two full questions (with a maximum of four sub questions) from each module. Each full question will have sub questions covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module.

TEXT BOOKS:

1. McCabe, W.L., et.al., **"Unit Operations in Chemical Engineering"**, 5th edn., Mc Graw Hill, New York 1993
2. Kumar K.L., **"Engineering Fluid Mechanics"**, Eurasia Publishing House (p) Ltd., New Delhi, 3rd edn. 1984
3. Dr R K Bansal., "**A Text Book of Fluid Mechanics**" 1st edn., Laxmi Publications (P) Ltd., New Delhi. 2005.

REFERENCE BOOKS:

5. Coulson J.H. and Richardson J.F., **"Chemical Engineering"**, Vol-I, 5th edn., Asian Books (p) Ltd., New Delhi, 1998
6. Badger W.L. and Banchero J.T., **"Introduction to Chemical Engineering"**, Tata McGraw Hill, New York, 1997

CHEMICAL PROCESS CALCULATIONS

Sub Code : 15CH33 | **IA Marks : 20**
Hrs/Week : 04 | **Exam Hours : 03**
Total Hrs : 50 | **Exam Marks : 80**
Credits: 04

COURSE OBJECTIVES: The students will

1. Learn basic laws about the behavior of gases, liquids and solids and some basic mathematical tools.
2. Understand systematic problem solving skills, enhance confidence, and generate careful work habits.
3. Learn what material balances are, how to formulate and apply them, how to solve them.
4. Learn what energy balances are, and how to apply them and finally, to learn how to deal with the complexity of big problems

Module 1	Content	Contact Hours	Blooms Taxonomy
UNITS AND DIMENSIONS: Fundamental and derived units, Conversion, Dimensional consistency of equations, conversions of equations. **BASIC CHEMICAL CALCULATIONS:** Concept of mole, mole fraction, Compositions of mixtures of solids, liquids and gases, Concept of Normality, Molarity, Molality, ppm, Use of semi-log, log-log, triangular graphs, Ideal gas law calculations.		**10Hrs**	**L-1, L-2.**

Module 2	Content	Contact Hours	Blooms Taxonomy
MATERIAL BALANCE WITHOUT REACTION: General material balance equation for steady and unsteady state, Typical steady state material balances in distillation, absorption, extraction, crystallization,		**10Hrs**	**L-2, L3.**
Module 3	**Content**	**Contact Hours**	**Blooms Taxonomy**
MATERIAL BALANCE WITHOUT REACTION: Drying, mixing and evaporation, Elementary treatment of material balances involving bypass, recycle and purging, Psychrometry, Humidification and dehumidification.		**10Hrs**	**L-2, L3.**

Module 4	Content	Contact Hours	Blooms Taxonomy

STEADY STATE MATERIAL BALANCE WITH REACTION: Principles of Stoichiometry, Concept of limiting, excess reactants and inerts, fractional and percentage conversion, fractional yield and percentage yield, selectivity, related problems.	**10Hrs**	**L-2, L3.**

Module 5	**Content**	**Contact Hours**	**Blooms Taxonomy**
ENERGY BALANCE: General steady state energy balance equation, Heat capacity, Enthalpy, Heat of formation, Heat of reaction, Heat of combustion and Calorific values. Heat of solution, Heat of mixing, Heat of crystallization, determination of ΔH_R at standard and elevated temperatures, Theoretical flame temperature and adiabatic flame temperature.		**10Hrs**	**L-2, L3.**

COURSE OUTCOMES: On completion of this course the student will have

1. Clear idea of various types of unit systems and they will be able to convert units from one form of the unit to other.
2. Sound strategy for solving material and energy balance problems.
3. Adopt the tools learned from the course from the numerical problems which contain more than two unit operations.
4. Develop mathematical relations for mass balance and energy balances for any processes.

GRADUATE ATTRIBUTES:

- Design and Development of Solutions.
- Problem Analysis
- Computational Knowledge.

QUESTION PAPER PATTERN:

- The question paper will have ten questions. Each full is for 16 marks. There will be two full questions (with a maximum of four sub questions) from each module. Each full question will have sub questions covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module.

NOTE: QUESTION PAPER TO CONTAIN AT LEAST 30% THEORY

TEXT BOOKS:

1. Bhatt B.I. and Vora S.M., **"Stoichiometry (SI Units)"**, Third edition, 1996, Tata McGraw Hill Publishing Ltd., New Delhi, 1996
2. Hougen O.A., Watson K.M. and Ragatz R.A., **"Chemical Process Principles - Part I"**
3. **"Material and Energy balances"**, Second edition, CBS publishers and distributors, New Delhi, 1995

REFERENCE BOOK:

1. Himmelblau D.M., **"Basic principle and Calculations in Chemical Engineering"**, 6th edn, Prentice Hall of India, New Delhi,1997

MECHANICAL OPERATIONS

Sub Code : 15CH34 **IA Marks : 20**
Hrs/Week : 04 **Exam Hours : 03**
Total Hrs : 50 **Exam Marks: 80**

Credit: 04

COURSE OBJECTIVES: The students will

1. Study different properties of particulate solids, handling and mixing of solid particles.
2. Study principles of communition and different types of equipment for size reduction like crushers, grinders etc.
3. Understand mechanical separation aspect such as screening, filtration, sedimentation, transportation of solids etc.
4. Understand energy requirements in solids handling, agitation and mixing, solid conveying and storage.
5. Hands on experience of working by conducting experiments on some of the basic unit operations such as separation and size reduction.
6. Present seminar on current separation techniques and submit the report on the same.

Module 1	Content	Contact Hours	Blooms Taxonomy
PARTICLE TECHNOLOGY: Particle shape, particle size, different ways of expression of particle size, shape factor, sphericity, particle size analysis, screens – ideal and actual screens, Differential and cumulative size analysis, effectiveness of screen, Specific surface of a mixture of particles, Number of particles in a mixture, standard screens, Industrial screening equipment, Motion of screen, Grizzly, Gyratory screen, Vibrating screen, Trammels, sub sieve analysis - Air permeability		**10Hrs**	**L-1, L-2, L-3**

Module 2	Content	Contact Hours	Blooms Taxonomy
SIZE REDUCTION: Introduction – types of forces used for comminution, Criteria for communition, Characteristics of comminuted products, Laws of size reduction, Work Index, Energy utilization, methods of operating crushers – Free crushing, choke feeding, open circuit grinding, Closed circuit grinding, wet and dry grinding, Equipment for size reduction – Classification of size reduction equipment, equipment – Blake jaw crusher, Gyratory crusher, Smooth roll crusher, Toothed roll crusher, impactor, Attrition mill, Ball mill, Critical speed of ball mill, Ultra fine grinders, Fluid energy mill, colloid mill, Cutters – Knife cutter.		**10Hrs**	**L-1, L-2, L-3**
Module 3	**Content**	**Contact Hours**	**Blooms Taxonomy**
FLOW OF FLUID PAST IMMERSED BODIES: Fluidization, conditions for fluidization, Minimum fluidization velocity, Types of fluidization, Applications of fluidization, Slurry Transport, Pneumatic conveying.		**10 Hrs**	**L-1, L-2, L-3**
MOTION OF PARTICLES THROUGH FLUIDS: Mechanics of particle motion, Equation for one dimensional motion of particles through a fluid in gravitational and centrifugal field, Terminal velocity, Drag coefficient, Motion of spherical particles in Stoke's region, Newton's region, and Intermediate region, Criterion for settling regime, Hindered settling, Modification of equation for hindered settling, Centrifugal separators, Cyclones and Hydro cyclones.			**L-1, L-2, L-3**
Module 4	**Content**	**Contact Hours**	**Blooms Taxonomy**
SEDIMENTATION: Batch settling test, Application of batch settling test to design of a continuous thickener, Coe and Clevenger theory, Kynch theory, thickener design, Determination of thickener area.		**10 Hrs**	**L-1, L-2, L-3**
FILTRATION: Introduction, Classification of filtration, Cake filtration, Clarification, batch and continuous filtration, Pressure and vacuum filtration, Constant rate filtration and cake filtration, Characteristics of filter media, Industrial filters, Sand filter, Filter press, Leaf filter, Rotary drum filter, Horizontal belt filter, Bag filter, Centrifugal filtration – Suspended batch centrifuge, Filter aids, Application of filter aids, Principles of cake filtration, Modification of Kozeny – Carmen for filtration.			**L-1, L-2, L-3**

Module 5	Content	Contact Hours	Blooms Taxonomy
AGITATION AND MIXING: Application of agitation, Agitation equipment, Types of impellers – Propellers, Paddles and Turbines, Flow patterns in agitated vessels, Prevention of swirling, Standard turbine design, Mixing of solids, Types of mixers – Change can mixers, Muller mixers, Mixing index, Ribbon blender, Internal screw mixer, Tumbling mixer.		**10 Hrs**	**L-1, L-2, L-3**
SAMPLING, STORAGE AND CONVEYING OF SOLIDS: Sampling of solids, Storage of solids, Open and closed storage, Bulk and bin storage, Conveyors – Belt conveyers, Bucket conveyor, Screw conveyor.			**L-1, L-2, L-3**
MISCELLANEOUS SEPARATION: Magnetic separation, Electrostatic separation, Jigging, Heavy media separation, Froth floatation process, Floatation cells, Typical floatation circuits, Size enlargement – Flocculation, Briquetting, Granulation (only principle and equipment).			**L-1, L-2, L-3**

COURSE OUTCOMES: The students are expected to do the following

1. Classify and suggest different type of separation processes required for the feed material.
2. Suggest different types of size reduction methods such as crushing, grinding milling depending on the type and size of the material.
3. Calculate the power requirements for different type of mechanical operations.
4. Select different type of conveying methods.
5. Hands on experience on various separation and size reduction experiments.

GRADUATE ATTRIBUTES:

- Problem analysis.
- Design/development of solutions.

QUESTION PAPER PATTERN:

- The question paper will have ten questions. Each full is for 16 marks. There will be two full questions (with a maximum of four sub questions) from each module. Each full question will have sub questions covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module.

TEXT BOOKS:

1. McCabe, W.L., et.al., **"Unit Operations in Chemical Engineering"**, 5th edn., Mc Graw Hill International, Singapore, 2000
2. Badger W.L. and Banchero J.T., **"Introduction to Chemical Engineering"**, 3rd edn. Tata McGraw Hill International Edition, Singapore , 1999
3. Coulson J.H. and Richardson J.F., **"**Coulson and Richardson's **Chemical Engineering"**, Vol-II Particle Technology and Separation Process, 6th edn., Asian Books (p) Ltd., New Delhi, 1998

REFERENCE BOOKS:

1. Brown G.G., et.al., "Unit Operations", I edn., CBS Publisher, New Delhi, 1995
2. Foust A.S., et.al., "Principles of Unit Operations", III edn., John Wiley and Sons, New York, 1997

CHEMICAL TECHNOLOGY-I

Sub Code : 15CH35 **IA Marks : 20**
Hrs/Week : 04 **Exam Hours: 03**
Total Hrs : 50 **Exam Marks: 80**

Credit: 04

COURSE OBJECTIVES: The students will

1. Understand industrial scale operations and processes employed at inorganic chemical industries.
2. Be exposed to various types of reactions and reactor types involved.
3. Understand various types of engineering problems encountered at these industries.
4. Be exposed to National importance and major plant locations of these industries.
5. Understand safety and environmental concerns of these industries.

Note: Unit processes and unit operations involved, main/side reactions, raw materials / utility required, material and energy balances, flow sheet of the process, equipment used, major and minor engineering problems, uses, examples of such industries in India, reasons for their locations of the above industries are to be discussed.

Module 1	Content	Contact Hours	Blooms Taxonomy
Water and Air : **Water:** Introduction, sources of water , impurities in water, soft water-hard water, causes of hardness, disadvantages of hard water, measurement of hardness, methods of softening of water, drinking water, purification of water, treatment of boiler feed water. **Air:** Introduction, constituents, compressed air, blower air, fan air, types of compressors, instrumental air.		**10Hrs**	**L-1, L-2, L-3**

Module 2	Content	Contact Hours	Blooms Taxonomy
Industrial Gases and Acids: **Industrial Gases:** CO_2, H_2, O_2, N_2, SO_2, SO_3, Water Gas, Shift Gas**.** **Industrial Acids:** Sulfuric, Nitric, Hydrochloric and Phosphoric Acids.		**10Hrs**	**L-1, L-2, L-3**

Module 3	Content	Contact Hours	Blooms taxonomy
Chlor-alkali and Cement industries: **Alkali industries:** Sodium chloride, Soda ash, Caustic soda, Chlorine, Bleaching powder. **Cement industries:** Classification, manufacture, reactions, flow diagrams, major and minor engineering problems, applications.		**10Hrs**	**L-1, L-2, L-3**

Module 4	Content	Contact Hours	Blooms Taxonomy
Inorganic Fertilizers: Ammonia, urea, ammonium phosphate, ammonium nitrate, ammonium sulphate, DAP, Potash fertilizers, phosphorous pentoxide, phosphatic fertilizers, super phosphate and triple super phosphate.		**10Hrs**	**L-1, L-2, L-3**
Module 5	**Content**	**Contact Hours**	**Blooms Taxonomy**

Miscellaneous Industries: Paints, pigments, varnishes, enamel, lacquers, hydrogen peroxide, silicon carbide, glass.	**10Hrs**	**L-1, L-2, L-3**

COURSE OUTCOME: At the end of the course, students are expected to

1. Understand the industrial activities at different inorganic industries.
2. Know the major and minor engineering problems in different industries.
3. Importance of these industries in National economy.
4. Understand the safety practices in these industries.

GRADUATE ATTRIBUTES:

- Problem analysis.
- Design/development of solutions.

QUESTION PAPER PATTERN:

- The question paper will have ten questions. Each full is for 16 marks. There will be two full questions (with a maximum of four sub questions) from each module. Each full question will have sub questions covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module.

TEXT BOOKS:

1. **Chemical Process Industries,** Shreve's, 4th Edition, McGraw Hill.
2. **Dryden – Outlines of Chemical Technology for 21st Century,** Gopal Rao & Marshall Sittig, 3rd Edition. EWP.
3. **Unit Processes in Organic Chemical Industries**, Desikan and Sivakumar (Eds.), CEDC, IITM, 1982.

REFERENCE BOOK:

1. **Encyclopedia of Chemical Technology**, Kirk and Othmer, 27 volume set, 5th Edition, Wiley, 2004.**Proce**

TECHNICAL CHEMISTRY

Sub Code : 15CH36 **IA Marks : 20**
Hrs/Week : 03 **Exam Hours: 03**
Total Hrs : 50 **Exam Marks : 80**

Credits : 04

COURSE OBJECTIVES: The students will

1. Study the basic of bond formation Types bonding Anti bonding
2. Study of Colligative properties; determine the effects of solutes on boiling point, freezing point, and osmotic pressure and to calculate the molecular weight of the unknown solute using freezing point depression
3. 3 Study of isomerism nomenclature properties of isomers
4. Study of Coordinate compounds
5. Study of Heterocyclic compounds
6. Study of reactions & mechanisms

Module 1	Content	Contact Hours	Blooms Taxonomy
BONDING: Atomic and Molecular orbital theory: Theory of bonding, Types of Bonds, Hydrogen bond with discussion on interaction between two atoms such as exchange of electron, screen effect of electrons, ionic character of H-OH bond. Anti Bonding, Band Theory of metals Theory of Resonance, Structural stability, structure of carbonate ion and benzene, Importance of resonance compounds		**10Hrs**	**L-1, L-2, L-3**

Module 2	Content	Contact Hours	Blooms Taxonomy
COLLIGATIVE PROPERTIES: Colligative properties - meaning and types, Lowering of vapor pressure - Raoult's law - statement, limitation, Determination of molecular weight by lowering of vapor pressure. Problems, Ostwald's and Walker's method, Elevation in boiling point of a solvent – derivation, Experimental determination of molecular weight by ebullioscopy method, problems, Isotonic solutions - abnormal molecular weight. Osmosis and osmotic pressure – explanation of the terms, effect of temperature and concentration and simultaneous effect of both, Determination of molecular weight,		**10Hrs**	**L-1, L-2, L-3**

Berkeley and Hartley's method.		

Module 3	Content	Contact Hours	Blooms Taxonomy
ISOMERISM: Definition, Types Conformational isomerism in alkanes, free rotation about carbon- carbon single bond, conformation of ethane, propane n, butane , relative stability of different conformations. Optical isomers – Isomer number & tetrahedral carbon atom chirality, optical isomerism with one asymmetric carbon atom, Polarimeter, Specific rotation, Enantiomerism R & S Nomenclature. Geometrical isomerism – Definition, conditions for geometrical isomerism, cis-trans & E-Z nomenclature, physical & chemical properties of geometrical isomerism		**10 Hrs.**	**L-1, L-2, L-3**
COORDINATION CHEMISTRY: Werner's theory, Nomenclature, effective atomic number, stability of complex ions, factors affecting the stability, stereochemistry of co-ordination compounds. Isomerism of co-ordination compounds. Importance of coordination compounds.			**L-1, L-2, L-3**

Module 4	Content	Contact Hours	Blooms taxonomy
HETEROCYCLIC COMPOUNDS: Nomenclature Classification Structure, Preperation Properties & Reactions of Heterocyclic, Anagues of Cyclopropane Cypclo butane Cyclopentadiene Heterocyclic's one or more hetero atoms Azetidenes Furans Pyratidine, Pyroles diazines Fused heterocyclics Heterocyclics in Dyes Medicines Natural products		**10Hrs**	**L-1, L-2, L-3**

Module 5	Content	Contact	Blooms

		Hours	taxonomy
REACTIONS & MECHANISMS: Concept of Steady states, reactive intermediates, Carbanions, Carbocations, Inductive and resonance effects. Mechanism of nucleophilic substitution (SN1 and s2) in alkyl halides. Mechanism of elimination reactions (E1 and E2). Mechanism of electrophilic substitution in benzene, nitration, sulphonation, halogenation. Friedel-crafts alkyl and acylation reactions. Electronic interpretation of orienting influence of substituents in aromatic electrophilic of toluene, chlorobenzene, phenol and nitrobenzene. Solvents effects		**10Hrs**	**L-1, L-2, L-3**

COURSE OUTCOMES: On successful completion of this course students will be able to

1. Explain the bond theory Resonance theory H-OH Bonds
2. Explain the effects of solutes on boiling point, freezing point, and osmotic pressure and to calculate the molecular weight of the unknown solute using freezing point depression.
3. Explain the structure and bonding of coordination compounds with proper reason of deviation, isomerism prevailing
4. Write reaction mechanisms in various types of reactions.

GRADUATE ATTRIBUTES:

- Problem analysis.
- Design/development of solutions.

QUESTION PAPER PATTERN:

- The question paper will have ten questions. Each full is for 16 marks. There will be two full questions (with a maximum of four sub questions) from each module. Each full question will have sub questions covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module.

TEXT BOOKS:

1. Arun Bahl and Bahl B.S., **"A text book of Organic Chemistry"**, 15th edn., Chand S. and Company, New Delhi, 1998
2. Morrison B.R. and Boyd L.L., **"Organic Chemistry"**, 6th edn, ELBS, New Delhi, 1998
3. Tiwari Melhotra and Vishnoi, **"Organic Chemistry"**, 7th edn., Chand S. and Company, New Delhi, 1996

REFERENCE BOOKS:

1. Puri L.R. and Sharma B.R., **"Physical Chemistry"**, 14th edn., Chand S. and Company, New Delhi, 1998
2. James Huheey, **"Inorganic Chemistry"**, 19th edn. Willey Publishers, New Delhi, 1997
3. Dhone D. B., A Text Book of Plant Utilities, Nirali Publications.

MOMENTUM TRANSFER LAB

Sub Code : 15CHL37 **IA Marks : 20**
Hrs/Week : 1T + 2L **Exam Hours : 03**
Total Hrs : 42 **Exam Marks : 80**

Credits: 02

The experiments are to be conducted on the following topics,

1. Friction in circular pipes.
2. Friction in non-circular pipes.
3. Friction in helical/spiral coils.
4. Flow measurement using venturi/orifice meters (incompressible fluid).
5. Local velocity measurement using Pitot tube
6. Flow over notches
7. Hydraulic coefficients – open orifice
8. Packed bed
9. Fluidized bed
10. Study of characteristics for centrifugal , Positive displacement pump
11. Study of various pipe fittings and their equivalent lengths.

12. Compressible fluid flow

13. Reynolds apparatus.

14. Unsteady flows - Emptying of Tank

Note: Minimum of 10 experiments are to be conducted.

TECHNICAL CHEMISTRY LAB

Sub Code : 15CHL38 **IA Marks : 20**
Hrs/Week : 1T + 2L **Exam Hours: 03**
Total Hrs : 42 **Exam Marks: 80**

Credits: 02

Experiments are to be conducted on the following topics:

1. Critical Solution Temperature- Water – Phenol System
2. Distribution Coefficients - Benzoic acid between Water and Benzene
3. Boiling Point Elevation -Water acetic acid solution
4. Estimation of dissolved oxygen in given sample of water by Winkler's method.
5. Estimation of Iodine & Saponification number of vegetable oil
6. Analysis of alloy- Stainless steel/ Brass
7. Analysis of Bleaching Powder -Available chlorine
8. Molecular weight determination -Victor Mayer's Method
9. Freezing point depression- Ice-salt system
10. Refract metric Estimation - Sugar content of solution
11. Heats of mixing -Water –HCl system
12. Conduct metric estimation- Water hardness estimation
13. Colorimetric Estimation – Potassium dichromate Estimation
14. Analysis of coal- Moisture Volatile matter & Ash content
15. Study of kinetics of reaction between $K_2S_2O_8$ and KI
16. Study of kinetics of hydrolysis of ester
17. Conductometric determination of equivalent conductance of acetic acid at infinite dilution (using Kohlrausch Law)
18. Estimation of phenol by iodometric method
19. Preparation of p-bromo acetanilide from acetanilide
20. Colorimetric estimation of fluoride in water using SPADNS reagent

Minimum of 10 experiments are to be performed