Syllabus
II Year-III Semester
B.Tech. : Chemical Engineering

3CH2-01 : Advanced Mathematics		
Credit: 3		**Max. Marks: 150(IA:30, ETE:120)**
3L+0T+0P		**Term End Exam: 3 Hours**
SN	**Contents**	**Hours**
1	**Complex Variables:** Analytic functions, Cauchy-Riemann equations, Elementary conformal mapping with simple applications, Line integral in complex domain, Cauchy's theorem, Cauchy's integral formula, Taylor's series, Laurent's series, Poles, Residues, evaluation of simple definite real integrals using the theorem of residues. Simple contour integration.	**14**
2	**Introduction to Statistics:** Probability distribution: Bimodal, Poisson, Uniform, Normal, Correlation and Regression, Linear regression, Confidence limits, types of errors, testing of hypothesis based on normal, Chi-square test, F-test, Z-test, Student's T-test. Comparison of means and variances.	**12**
3	**Finite differences-** Forward, Backward, and Central differences, Newton's forward and backward difference interpolation formulae, Stirling's formula.Numerical differentiation, Numerical Integration – Trapezoidal rule, Simpson's one-third and three-eighth rule. Introduction to numerical solution of ordinary differential equation	**14**
	Total	**40**

3CH1-02/4CH1-02 : TECHNICAL COMMUNICATION		
Credit: 2	**Max. Marks: 100 (IA:20, ETE:80)**	
2L+0T+0P	**Term End Exam: 2 Hours**	
SN	**Contents**	**Hours**
1	**Vocabulary Building.** Concept of Word Formation. Affixes. Synonyms and Antonyms.	**5**
2	**Grammar** Words and Sentences. Verbs and Tenses. Questions and Question Tags. The Infinitive and the '…ing' form.	**5**
3	**Grammar** Nouns and Articles. Determiners. Adjectives and Adverbs. Relative clauses.	**5**
4	**Identifying Common Errors in Writing** Subject- Verb Agreement. Noun-Pronoun Agreement. Articles. Prepositions.	**5**
5	**Composition** Précis Writing. Essay Writing. Comprehension of Passage.	**5**
	Total	**25**

3CH1-03/4CH1-03 : MANAGERIAL ECONOMICS AND FINANCIAL ACCOUNTING		
Credit: 2		**Max. Marks: 100 (IA:20, ETE:80)**
2L+0T+0P		**Term End Exam: 2 Hours**
SN	**Contents**	**Hours**
1	**Basic economic concepts-** Meaning, nature and scope of economics, deductive vs inductive methods, static and dynamics, Economic problems: scarcity and choice, circular flow of economic activity, national income-concepts and measurement.	**4**
2	**Demand and Supply analysis-** Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting –purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply.	**5**
3	**Production and Cost analysis-** Theory of production- production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts-explicit and implicit cost, fixed and variable cost, opportunity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation.	**5**
4	**Market structure and pricing theory**- Perfect competition, Monopoly, Monopolistic competition, Oligopoly.	**4**
5	**Financial statement analysis-** Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash-flow analysis, funds-flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.	**8**
	TOTAL	**26**

3CH3-04 : Thermodynamics – I		
Credit: 3	**Max. Marks: 150 (IA:30, ETE:120)**	
3L+0T+0P	**Term End Exam: 3 Hours**	
SN	**Contents**	**Hours**
	Introduction- scope of thermodynamics, Dimensions and Units, Temperature, Pressure, Work,Energy, Heat, Energy conservation & first law of thermodynamics; State functions; Equilibrium; Phase Rule; Reversible process; Constant P,V, T processes; Mass and energy balances for open systems . Phases, phase transitions, PVT behavior; description of materials – Ideal gas law, van der Waals, virial and cubic equations of state; Reduced conditions & corresponding states theories; correlations in description of material properties and behavior. Heat effects-latent heat, sensible heat, standard heats of formation, reaction and combustion. Statements of the second law; Heat engines, Carnot's theorem,; Thermodynamic Temperature Scales; Entropy; Entropy changes of an ideal gas; Mathematical statement of the second law;Entropy balance for open systems; Calculation of ideal work, Lost work. Thermodynamic property of fluids, Maxwell relations, 2-phase systems, graphs and tables of thermodynamic properties. Application of thermodynamics to flow processes-pumps, compressors and turbines.Thermodynamic analysis of steam power plants; Rankine cycle; Internal combustion engine,Otto engine; Diesel engine; Jet engine. The Carnot refrigerator; Vapor-compression cycle; Absorption refrigeration; Heat pump, Liquefaction processes.	

3CH4-05: Fluid Mechanics		
Credit: 3	**Max. Marks: 150 (IA:30, ETE:120)**	
3L+0T+0P	**Term End Exam: 3 Hours**	
SN	**Contents**	**Hours**
1	**Properties of fluids;** Classification; Ideal fluid, Newtonian and Non-Newtonian fluids; Newton's law of viscosity. Pascal's and Hydrostatic law, manometers. Types of manometer	
2	**Fluid Statics:** fluid pressure and its measurement.	
3	**Fluid Kinetics:** Continuity equation; types of flow.	
4	**Fluid dynamics:** One dimensional equation of motion; Bernoulli's equation; application; application of Bernoulli's equation. Friction losses in pipe flow, valves and fittings, k-values, sudden expansion and contraction, pipe flow problems Nozzle. Introduction to laminar & turbulent flow. Velocity Distribution for turbulent flow, concept of Reynolds number & friction factor.	
5	**Flow through Pipes** – Darcy – Weisbach's equation. Head loss in pipes. Pipes in series/ Parallel. Classification, basic construction and application of different types of pumps.	
6	**Pump:** Centrifugal pump, Principles and application in Bernoulli's theorem Types of Pump:Axial pumps, Gear pump, Plunger Pumps Vane pump, Reciprocation pump and Screw pump. Characteristic Curves of Pumps. Valves, types of valves.	
7	**Flow Metering:** Metering of fluids; orifice meter, Venturimeter, Pitot tube, Rotameter, Notches, Gas flow meters, coefficient of discharge.	

3CH4-06 : Material and Energy Balance		
Credit:3	**Max. Marks: 150 (IA:30, ETE:120)**	
3L+0T+0P	**Term End Exam: 3 Hours**	
SN	**Contents**	**Hours**
1	**Introduction:** Unit Operations and Unit Processes and their industrial examples; Steady state and unsteady state processes; Batch, Continuous and Semi-batch Processes.	
2	**Units and Dimensions**: Dimensions, Basic Units and Derived Units, Units Systems Conversion of units systems; Density and Specific gravity: API, Baume', Twaddell and Brix scale.	
3	**Basic process variables:** Temperature, Pressure, Volume, Mass and Mole, Volume Fractions, Mass Fraction and Mole Fraction, Mass Flow Rate, Volume Flow Rate, Molar Flow Rate	
4	**Chemical Composition:** Weight ratio, Mole ratio, Molality, Molarity, Normality, Wet basis and dry basis, Average molecular weight.	
5	**Behavior of gases:** Ideal and Van der Waal Gases, Assumptions of Ideal gas, Ideal Gas Law and Van-der-Wall Equation, Gaseous Mixture, Specific volume of gas mixtures.	
6	**Material Balance:** Law of Conservation of Mass, Overall and Component balances; Degree of Freedom, Degrees of Freedom analysis for given process unit; Material Balances and Calculations for Non-reacting Systems: Absorber, Stripper, Extraction, Distillation; Recycle, bypass and Purge calculations.	
7	**Stoichiometry:** Introduction to Stoichiometry, Limiting Reactants, Excessive Reactant, Percentage Excess, Fractional conversion, Extent of reactions, Relation between fractional conversion and extent of reaction, Yield and selectivity, Balances and calculations for on reacting systems; Recycle, Bypass and Purge material balances and calculations involving chemical reaction.	
8	**Energy Balance:** General energy balance equation for open systems and close system. Heat capacities of solid, liquid and gases; Sensible and Latent heat. Problems involving enthalpy change for gaseous and liquid streams. Energy balance for phase change in Condensation and Boiling; Balances on dissolution and heat of mixing processes.	
9	**Unsteady State Process Calculations:** for a mixer, heating or cooling of a mixed liquid.	
10	**Heat of Reaction:** Standard State, Heat of formation, Heat of combustion, Heat of reaction, Heat of mixing; Heat effects accompanying chemical reactions, Hess's Law, Kopp's law; Standard Heat of Reaction, combustion and formation. Effect of temperature on standard heat; Adiabatic Reaction Temperature, Theoretical Flame Temperature.	

3CH4-07 : Particle & Fluid Particle Processing		
Credit: 3	**Max. Marks: 150 (IA:30, ETE:120)**	
3L+0T+0P	**Term End Exam: 3 Hours**	
SN	**(Common with Petrochemical Engineering 3PC4-0 5)**	**Hours**
1	**Particulate Solid**: Properties of particulate solids Evaluation of size & shape, surface and population of particles, standard screens Particle size distribution. Mean particle size. Screen analysis of solids. Size measurement, Efficiency of separation and grade efficiency.	
2	**Size Reduction**: Mechanism of size reduction. Energy for size reduction. Kics's law, Rittinger's law Screening, Methods of operating crushers. Nature of the material to be crushed. Type of crushing equipment. Coarse crushers. Intermediate crushers. Fine crushers. Specialized applications. Brief outline of particle size enlargement/reduction. Resistance to shear and tensile forces. Angles of repose and of friction.	
3	**Separation:** :Theory of motion of particles through fluids, motion under gravitational and centrifugal fields, Terminal settling velocity of particles in a fluid (Stroke's law, Newton's law region and K-criteria for settling) Free settling and hindered settling. Gravity settling, centrifugal separation (cyclone separator) and sedimentation: Principles of sedimentation.	
4	**Mixing and Conveying:** Transportation and Handling of Solids Selection of conveying devices for solids: Belt, Chain, Screw – conveyors, Elevators and pneumatic conveying devices; Elementary design aspects of the devices. Storage of solids-hoppers, silos. Agitation and mixing of fluids and solids, types of mixers, Standard design of mixing vessel **Types of Agitators:** axial flow impellers and radial flow impellers, Power number and Reynolds number for mixing, Power consumption of agitated vessels, Suspension of solids, the degree of mixing, Rate of mixing.	
5	**Filtration Theory**. Relation between thickness of cake and volume of filtrate. Flow of liquid through the cloth. Flow of filtrate through the cloth and cake combined. Compressible filter cakes. Filtration Practice. The filter medium. Blocking filtration. Common Industrial filters	

3CH4-21 : Fluid Mechanics Lab	
Credit: 2	**Max. Marks: 100 (IA:60, ETE:40)**
0L+0T+4P	**Term End Exam: 2 Hours**
	Contents
	1. Reynolds experiment for Laminar, transitional and turbulent flow identification, through Reynolds apparatus 2. Verification of Bernoulli's Equation through Bernoulli's Theorem Apparatus. 3. Determination of co efficient of Discharge for Orifice, Venturimeter through Venturimeter and orifice meter test rig. 4. Estimation of losses through pipe fitting, sudden enlargement and contraction frictional Pressure drop in Circular pipes. 5. Verification of Darcy's Law through Darcy apparatus. 6. To Study Construction, Working of Centrifugal, Reciprocating, Gear and Plunger Pumps through test rig 7. To Study pitot tube apparatus and cavitation apparatus in a pipe flow.

3CH4-22 : Particle &Fluid Particle Processing Lab	
Credit: 2	**Max. Marks: 100 (IA:60, ETE:40)**
0L+0T+4P	**Term End Exam: 2 Hours**

Contents

1. To determine particle size distribution for a given sample using standard sieve series.
2. Experiment on the working of gas-solid cyclone separator.
3. Experiment on particle size reduction in ball mill.
4. Experiment on characteristics of fluidized beds.
5. Experiment on magnetic separator.
6. Study of the froth flotation cell.
7. Experiment of agitation and mixing.
8. Experiment on batch settling.
9. Experiment on jaw crucher.
10. Experiment of filtration on rotator vacuum filter.

3CH4-23 : DBMS (Data Base Management System) Lab		
Credit: 2		**Max. Marks: 100 (IA:60, ETE:40)**
0L+0T+4P		**Term End Exam: 2 Hours**
SN	**Contents**	
1	Objectives: At the end of the semester, the students should have clearly understood and implemented the following: 1. Stating a database design & application problem. 2. Preparing ER diagram 3. Finding the data fields to be used in the database. 4. Selecting fields for keys. 5. Normalizing the database including analysis of functional dependencies. 6. Installing and configuring the database server and the front end tools. 7. Designing database and writing applications for manipulation of data for a standalone and shared data base including concepts like concurrency control, transaction roll back, logging, report generation etc. 8. Get acquainted with SQL. In order to achieve the above objectives, it is expected that each students will chose one problem. The implementation shall being with the statement of the objectives to be achieved, preparing ER diagram, designing of database, normalization and finally manipulation of the database including generation of reports, views etc. The problem may first be implemented for a standalone system to be used by a single user. All the above steps may then be followed for development of a database application to be used by multiple users in a client server environment with access control. The application shall NOT use web techniques. One exercise may be assigned on creation of table, manipulation of data and report generation using SQL.	
2	**Suggested Tools:** For standalone environment, Visual FoxPro or any similar database having both the database and manipulation language may be used. For multi-user application, MYSql is suggested. However, any other database may also be used. For front end, VB.Net, Java, VB Script or any other convenient but currently used by industry may be chosen. Indicative List of exercises: 1. Student information system for your college. 2. Student grievance registration and redressal system. 3. A video library management system for a shop. 4. Inventory management system for a hardware/ sanitary item shop. 5. Inventory management system for your college. 6. Guarantee management system for the equipments in your college.	