

## MATHEMATICS – III

CET : 2.101  
Sessionals : 30  
Examination : 70

Periods per Week : 4  
Duration of Exam : 3 Hrs.  
Natural Of Exam : Theory

### UNIT - I

Linear Equations of second order

- a. Change of dependent variable
- b. Reduction to the normal form
- c. Change of independent variable.
- d. Variation of parameters

### UNIT - II

- i. Exact equations of order
- ii. Total differential equation

### UNIT – III

Power Series Solutions:

Ordinary and Regular Points of a Differential Equations, Series solutions at an ordinary point and at a regular point.

### UNIT – IV

Properties of Gamma and Beta Functions

Solution of Hypergeometric equation. Properties of Hyper Geometric Functions.

### UNIT -V

Solution of Legendre's equation in series. Rodrigs formula, Generating function, Recurrence formulae and Orthogonal property. Solution of bessel equation. Generating function. Recurrence formulae, Orthogonal property and integral formula for  $J_n(X)$ .

**Examination:** One question from each unit with internal choice.

Reference Books:

1. Ordinary and partial differential equations by M.D.Raisinghania, Sultan & Chand Co.
2. Higher Engineering Mathematics by Dr.B.S.Gren, Khanna Publications

## INORGANIC CHEMICAL TECHNOLOGY

CET	: 2.102	Periods per Week	: 4
Sessionals	: 30	Duration of Exam.	: 3 Hours
Examination	: 70	Natural Of Exam	: Theory

### **UNIT - I**

Basic concepts of Unit Operations and Unit Processes. Water Conditioning using Ion Exchange and Lime Soda Process. Classification of Ferrous and Non-Ferrous metals. Metallurgy of Iron, Steel, Copper and Aluminium. Composition of various types of Steels

### **UNIT -II**

Manufacture of Porcelain, composition and uses of Enamel products. Manufacture of Port Land Cement. Composition and uses of special Cements.

Manufacture of Glass and uses of special Glasses. Properties and manufacture of refractories.

### **UNIT - III**

Manufacture and uses of Fuel gases - Producer gas - Water Gas - Substituted natural Gas - Manufacture of Industrial gases - Hydrogen by steam Hydrocarbon reforming process - Carbon dioxide from fuel oil - Oxygen and Nitrogen by Liquefaction and rectification of air

### **UNIT - IV**

Manufacture of Common salt, Soda ash and Caustic Soda. Manufacture of Sulphuric Acid, Hydrochloric Acid - Nitric Acid - Phosphoric Acid

### **UNIT - V**

Manufacture of Ammonia -Urea - DiAmmonium Phosphate - Super Phosphate. Manufacture of activated Carbons and Graphite's and their applications in Chemical Industry

**Examination** : One question from each unit with internal choice

**Text Books:**

1. Out lines of Chemical Technology by Charles E.Dryden, Willy Eastern 2001
2. Chemical Process Industries – IV Edition by Shreve. McGrew – Hill

## PHYSICAL CHEMISTRY

CET : 2.103  
Sessionals : 30  
Examination : 70

Periods per Week : 3  
Duration of Exam : 3 Hrs.  
Nature of Exam : Theory

### **UNIT - I**

Dilute Solutions - Lowering of Vapour pressure, Raoult's Law. Elevation and Boiling point, Depression of Freezing point and Osmosis pressure. Methods for determination of each of these properties. Vant Hoff's theory of Dilute Solutions. abnormal colligative Properties.

### **UNIT- II**

Electrical conductance - Conductance of Electrolytes, Faraday's Laws of Electrolysis, Specific and Equivalent Conductance and their determination. Transport numbers and their determination. Kohlrausch's Law and its application. The inter Ionic attraction theory. Ionic Equilibria . Ionic Product, Solubility Product, Buffer solution and Salt Hydrolysis.

### **UNIT - III**

Electromotive Force - Electromotive Force, Galvanic Cells, Reversible and Irreversible Cells, Measurement of  $E_{M.F.}$ , standard Electrode Potentials, various types of Electrodes, Thermodynamics of potentials. Nernst Equations. Chemical and concentration cells with and without transference. Potentiometric determination of  $P^H$  values, Potentiometric Hydration

### **UNIT - IV**

Chemical Kinetics and Photo-chemistry : - The scope of chemical kinetics, rate, rate constant, order, molecularly of chemical reactions derivation of rate laws. Determination of order of a reaction. Effect of temperature of reaction rates. Arrhenius equation. Theories of reaction rates, collision theory and activated complex theory. Determination of activation parameters for a chemical reaction.

Catalysis:- the criterion of catalysis, homogeneous catalysis, mechanism of catalysis equilibrium treatment and activation energies of catalyzed reactions, negative catalysis, acid base catalysis.

### **UNIT - V**

Physical properties and Molecular structures: -

Additive constitutive and colligative properties, Molar polarisation and Dipole moments. Determination and applications of Dipole moments. Rotational spectra, Rotational vibrational spectra, applications of I.R. Spectra, Raman Spectra.

**Examination:** One question from each unit with internal choice.

### **Reference:**

1. P.W. Atkins, Physical Chemistry (3<sup>rd</sup> Ed.), Oxford University Press
2. Outlines of Physical Chemistry by Donal, F., John Wiley & Sons
3. Physical Chemistry, by B.S.Bahl & G.D Tull, S.Chand & Co.
4. Physical Chemistry by W.J.More, Prentice Hall
5. Physical Chemistry by G.M.Barrow, McGraw Hill
6. Collection of problems in Physical Chemistry by Badon
7. Problems in Physical Chemistry by T.Navneeth Rao and Others, Mac Millan
8. Physical Chemistry by Proton and Maroon, Oxford & IBH Publishing Cp. New Delhi

## MATERIAL & ENERGY BALANCES

CET : 2.104  
Sessionals :30  
Examination : 70

Periods per Week : 4  
Duration of Exam : 3 Hours  
Natural Of Exam : Theory

### **UNIT - I**

Basic concepts-Graphical integration – Graphical differentiation – Use of semi-log, log-log and triangular graphs-Ideal gas – Expression of composition of solid. Liquid and gaseous mixtures- vapor pressure of pure component-Rouettes’s law and Henry’s Law – Vapor pressure of liquid mixture, p-x-y and t-x-y diagrams for ideal solutions.

### **UNIT – II**

Material balance without chemical reaction. Humidity – Use of psychometric charts – Solubility and crystallization (single solute systems) – Material balances over absorption. Distillation, evaporation, crystallization, leaching, extraction, drying and mixing units under steady state operation.

### **UNIT – III**

Material balance with chemical reaction – Material balances over units involving reactions including combustion. Proximate and ultimate analysis of coal, analysis of flue gas.

### **UNIT – IV**

Material balances for processes involving by-pass, recycle and purging with and with out chemical reaction.

### **UNIT-V**

Heat capacity, sensible and latent heat – Energy balances in operations involving phase change – Energy balance over heat exchanges, Dryers and simple evaporation systems.

Heat of reaction – Heat of formation and combustion – Effect of temperature of heat of reaction. Energy balance over reaction units – Adiabatic reaction temperature of products – Heating values of fuels.

**Examination:** one question from each unit with internal choice.

#### **Text Books:**

1. Stoichiometry – B.I Bhatt, 2<sup>nd</sup> Ed. Tata Mc.Graw Hill
2. Chemical Process Principles, Part – I, O.A.Hougen, K.M Watson and R.A Ragak, 2<sup>nd</sup>

#### **Reference Books:**

1. Basic Principles and Calculations Chemical Engineers” David M.Himeldlau, 5<sup>th</sup> Ed., Prentice Hall India Pvt. Ltd.

## MECHANICAL ENGINEERING

CET : 2.105  
Sessionals :30  
Hours

Periods per Week : 4  
Duration of Exam : 3

Examination : 70

Natural Of Exam : Theory

### UNIT I

**Stresses and strains:** Kinds of – Stress-Strains, Elasticity and plasticity, Hooks LAW, Stress – Strain diagram, Modules of elasticity Poission's ration, Linear and Volumetric strain, reaction between E,N and K Bars of uniform strength. Compound bars and Temperature Stresses.

### UNIT – II

**Thin Cylindrical Shells:** Stress in a cylindrical shells due to internal pressures circumferential stress longitudinal stress. Design of thin cylindrical shells, Spherical Shells. Change in dimension of the shell due to internal pressure, change in volume of the shell due to internal pressure.

**Shafts and Springs:** Torsional stress and strains, strength of a solid shaft, power transmitted by shaft strength of a hollow shaft. Types of springs, closely coiled helical springs and open coiled helical springs subjected to axial load, simple problems.

### UNIT – III

**Steam Boilers:-** Classification of boilers Essentialities of boilers, selection of boilers, study of boilers, Cochran boiler, Locomotive boiler, Lancashire boiler, Babcock and Wilcox boiler, Boiler mountings and accessories.

**Reciprocating air Compressors:** Uses of compressed air, Work done in single stage and two stage compression, Inter Cooling and simple problems.

### UNIT – IV

**Internal Combustion Engines:** Classification of IC Engines, Basic engine components and Nomenclature, working, principle of engines, Four strokes and two stroke petrol and diesel engines, comparison of SI and CI engines, comparison of four stroke and two stroke engines. Simple problems such as indicated power, brake power, friction power, specific fuel consumption, brake thermal efficiency, indicated thermal efficiency and mechanical efficiency.

### UNIT – V

**Bolts-Ropes and Chain:** Belt and rope drives, velocity ration, slip, length of belt, open belt and cross belt drives. Ration of friction tensions, centrifugal tension in a belt, power transmitted by bells and ropes, initial tensions in the belt simple problems.

**Gear Trains:-** Classification of gears, gear trains, velocity ration, simple, compound – reverted and epicyclic gear trains.

**Examination:** One question from each unit with internal choice.

### Books Recommended:

1. B.C.Punmia “Strength of Materials and Mechanics of Structures” Standard Publications and Distributions, 9<sup>th</sup> Ed.
2. S.Ramamrutham, Strength of Materials, Dhanpath and Sons, 10<sup>th</sup>
3. A.S.Sarao, thermal Engineering, Satya Prakasham, 5<sup>th</sup>
4. Internal Combustion Engines, Tata Mc.Graw Hill
5. S.S Rallan, Theory of Machines, Tata Mc.Graw hill Publishing company

## INORGANIC CHEMICAL TECHNOLOGY LAB

CEP : 2.106  
Sessionals : 25  
Examination : 50

Periods per Week : 4  
Duration of Exam : 4 Hours  
Nature of Exam : Practical

### **List of Experiments**

1. Estimation of carbonates and Bicarbonates ions
  2. Estimation of Hardness of water
  3. Estimation of sulphates in water (Gravimetric Analysis)
  4. Analysis of Iron Ore
  5. Analysis of Copper Ore
  6. Analysis of Manganese Ore
  7. Estimation of Borax
  8. Estimation of Calcium Ions in Natural Water
  9. Estimation of Chlorine in Water Sample
  10. Estimation of Oxygen in Water
  11. Estimation of free and combined carbon-dioxide in water
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1. Kinetic study of the reaction between  $\text{KMnO}_4$  and  $\text{H}_2\text{C}_2\text{O}_4$  catalyzed by  $\text{Mn}^{2+}$  ions.
  2. Conductometric titration of strong acid versus strong base and weak acid versus strong base.
  3. Conductometric titration of weak acid versus strong base.
  4. Conductometric titration of mixture of acids versus strong base.
  5. Determination of order of the reaction of inversion of sucrose by polarimetry.
  6. Determination of specific rotation of Glucose.
  7. Verification of Beer-Lambert's law and determination of concentration of  $\text{K}_2\text{Cr}_2\text{O}_7$  or  $\text{KMnO}_4$ .
  8. Titration of HCl against Na OH using  $\text{P}^{\text{H}}$  meter.
  9. Determination of rate constant of KI & persulphate reaction.
  10. Potentiometric reduction titration of  $\text{Fe}^{2+}$  and  $\text{K}_2\text{Cr}_2\text{O}_7$

## **PHYSICAL CHEMISTRY LAB**

CEP : 2.107  
Sessionals : 25  
Examination : 50

Periods per Week : 4  
Duration of Exam : 3 Hours  
Nature Of Exam : Practical

### **LIST OF EXPERIMENTS**

(Minimum of 8 experiments in the list are to be performed)

1. Determination of molecular state of acetic acid by studying the distribution of acetic acid between n-butanol and water.
2. Determination of molecular state of benzoic acid by studying the distribution of benzoic acid between benzene and water.
3. Determination of order of the reaction of hydrolysis of methyl acetate in dilute hydrochloric acid.
4. Comparison of strength of acids by studying the hydrolysis of an ester.
5. Determination of the temperature coefficient in the catalyzed hydrolysis of an ester.
6. Determination of order of the reaction between potassium persulphate and potassium iodide.

## MECHANICAL ENGINEERING LAB

CEP	: 2.108	Periods per Week	: 4
Sessionals	: 25	Duration of Exam	: 3 Hrs.
Examination	: 50	Natural Of Exam	: Practical

(Minimum of 8 experiments in the list are to be performed)

1. Determination of Modulus of Rigidity (G) on closed coiled helical spring
2. Determination of Modulus of Rigidity (G) on open coiled helical spring
3. Determination of Modulus of Elasticity (E) and salient point on stress – strain curve of given material by direct tension on universal Testing Machine (UTM)
4. Determination of 'E' of given material by transverse test on a beam with central loading
5. Determination of 'E' of given material by transfers test on a beam with non central loading
6. Determination of the Compressive strength of bricks on compression testing Machine
7. Determination of the tensile strength of bricks on Compression testing Machine
8. The tensile strength / E of a given Nylon wire on House field tensometer
9. Determination of the valve time diagram for a four Stroke Vertical Diesel Engine
10. Study of Boiler – Cochran boiler, Lancashire boiler, bed and Wilcox boiler
11. Determination of young's Modulus of propped cantilever beam
12. Brinell's hardness Test of material
13. Determination of rigidity modulus of a shaft by torsion test
14. Determination of rigidity modulus of a leaf spring
15. Determination of modulus of elasticity of continuous beam