

**1**  
**Engineering and Technology,**  
**R.T.M. Nagpur University, Nagpur.**  
**Syllabus for B.Tech. Chemical Engineering**

**(Second Semester)**  
**Engineering Mathematics – II (CE (BGE) 2.01)**  
**(Total Credits: 04)**

**Teaching Scheme**

**Lectures:** 3Hours/ Week

**Tutorial:** 1 Hours / Week

**Examination Scheme**

**Theory**

**T (U) : 80 Marks      T (I) : 20 Marks**

**Duration of University Exam. : 03 Hours**

**UNIT - I : Ordinary differential Equation and Higher Order Differential Equation**

Differential Equations: First order first degree differential equations: Linear, reducible to linear and exact differential equations. Higher order differential equations with constant coefficient, method of variation of parameters. Cauchy's and Legendre's homogeneous differential equations, simultaneous differential equations.

**UNIT - II : Fourier Series**

Fourier series , expansion of function ,Even and odd function, Half range fourier series, Change of interval, Harmonic analysis.

**UNIT - III : Series Solution**

Method of infinite series solution for ordinary D. E. when  $x = 0$  as a ordinary point &  $x = a$  as a regular singular point

**UNIT - IV : Special Function**

Bessel's equation, Bessel's functions: recurrence relations, orthogonality property, generating function, Legendre's equation, Legendre Polynomials: Rodrigue's formula generating function, recurrence relations, orthogonality property,

**UNIT – V : Vector Calculus**

Definition of vector scalar function & vector point function , gradient ,directional derivative , divergence and curl , Line , surface and volume integral , Gauss divergence theorem , Stokes Theorem and Green theorem( excluding proof) .

UNIT – VI : Difference equation and Numerical Method

- A) Homogeneous and non – homogeneous differential equation with constant coefficient, first order linear difference equation with constant coefficient.
- B) Numerical solution of ordinary and higher differential equation: Picard method , Euler’s method , Taylors method and Runga – Kutta method

Books Recommended:

1. Higher Engineering Mathematics by H.K. Das, Er.Rajnish Verma
2. A text book of engineering mathematics by N.P. Bali, Manish Goyal
3. A text book of engineering mathematics (Vol –I,Vol-II) by Dr. D.T. Deshmukh
4. Higher Engineering Mathematics by B.S. Grewal

## 2

**(Second Semester)**  
**Applied Physical Chemistry (CE (BGE) 2.02)**  
**(Total Credits: 03)**

**Teaching Scheme**

**Lectures:** 2 Hours/ Week

**Tutorial:** 1 Hours / Week

**Examination Scheme**

**Theory**

**T (U) : 80 Marks      T (I) : 20 Marks**

**Duration of University Exam. : 03 Hours**

Unit 1: Equation of State for ideal and real gases, Critical Phenomena, principal of corresponding states, compressibility factor, Principle of Equipartition of Energy, and Joule-Thomson effect.

Unit 2: The first law of Thermodynamics, reversible processes, enthalpy, heat capacity, isothermal and adiabatic processes, thermochemistry laws, standard heats of formation, the bomb calorimeter, flame and explosion temperatures.

Unit 3: The second law of thermodynamics, the Carnot theorem and Carnot Cycle, the refrigeration engine.

Unit 4: Entropy and irreversible processes. The free energy, work function and Gibbs Helmholtz equation, the criteria of Chemical Equilibrium.

Unit 5: Objectives of chemical Kinetics, elementary reaction steps and rate expressions, order of reaction. Factors influencing the reaction rates. Integrated rate expression with examples. Methods for determining the order of chemical reaction.

Unit 6: Radiation chemistry, photochemical reactions, laws of photochemistry, photochemical combination of hydrogen and chlorine.

**Books Recommended:**

1. Thermodynamics for chemists by S. Glasstone, D Van Nostrand Inc, New York.
2. Physical Chemistry by G.M. Barrow, Benjamin Publishers, New York.
3. Physical Chemistry by Sheehan, W.F. Prentics hall of India, Pvt Ltd., New Delhi 1963
4. Principles of Physical Chemistry by Puri and Sharma, S.Chand and Co. New Delhi
5. An Introduction to Chemical Thermodynamics by R P Rastogi and R R Mishra
6. Physical Chemistry through problems, S. Dogra and S. K. Dogra

# 3

**(Second Semester)**  
**APPLIED PHYSICS II (CE (BGE) 2.03)**  
**(Total Credits: 03)**

**Teaching Scheme**

**Lectures:** 2 Hours/ Week

**Tutorial:** 1 Hours / Week

**Examination Scheme**

**Theory**

**T (U) : 80 Marks      T (I) : 20 Marks**

**Duration of University Exam. : 03 Hours**

**UNIT –I      Basic Semiconductor devices** Classification of solids on the basis of band gap theory into insulators, semiconductors and conductors, Symbol and formation of a diode, P-N Junction diode: Forward and reverse bias characteristics, Zener diode: Forward and reverse bias characteristics, Avalanche breakdown Applications: Half wave rectifier & Full wave rectifier, LED, Photodiode

Intrinsic semiconductors; Extrinsic semiconductor, Germanium and silicon, Transistors: PNP and NPN. Configuration: - CB, CE and Solar cell.

**UNIT – II      Crystal structure and X-Rays** Crystal structures: SC, BCC & FCC, Miller Indices and Planes, Interplanar distance, Numericals.

Production of X-Rays: Coolidge tube, Origin of X-rays, Properties of X-rays, Applications of X-Rays, Bragg's law and Bragg's X-ray spectrometer.

**UNIT – III      Instrumental analysis** Thermal analysis: Differential thermal analysis(DTA), Thermogravimetric analysis(TGA), Differential Thermogravimetric analysis(DTGA), Differential scanning calorimetry(DSC), Atomic absorption spectrometry(AAS).

**UNIT –V      Ultrasonics** Magnetostriction Effect, Pierce Oscillator, Piezoelectric Effect, Piezoelectric Oscillator, properties and applications, Numericals.

**UNIT – V      Optical Fibres** Optical fibers; structure, Propagation of light through a clad fibre, Acceptance angle, acceptance cone, Fractional refractive index change, Numerical aperture, Modes of propagation; Types of Optical fibres: Single mode step index fibre , Multimode step index fibre, Graded Index fibre, V-number Attenuation, Dispersion: Material dispersion, Waveguide dispersion, Intermodal dispersion; Applications: Medical, Military and Communication applications; sensors. Numericals.

**UNIT- VI        Nanotechnology** Introduction to Nanotechnology, Quantum nature of the Nanoworld, Methods of preparation: Top Down, Bottom Up approach, Chemical vapour deposition, sol-gel process, RF Plasma, Thermolysis. Characterisation of Nano materials: Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM). Applications: Energy, Medical application, Information and communication, Displays, Nanoparticles in coating.

**Books Recommended**

1. Text book of Engineering Physics By Avadhanulu and Kshirsagar
2. Instrumental methods of analysis By H.W. Willard
3. Material Science and Engineering By R.K. Rajput
4. Physics for Engineers By M.R. Srinivasan

# 4

**(Second Semester)**  
**Basic Electrical Engineering (CE (BGE) 2.04)**  
**(Total Credits: 03)**

**Teaching Scheme**

**Lectures:** 2 Hours/ Week

**Tutorial:** 1 Hours / Week

**Examination Scheme**

**Theory**

**T (U) : 80 Marks      T (I) : 20 Marks**

**Duration of University Exam. : 03 Hours**

**Unit 1:** The Electrical Circuits, Concepts of Voltage, Current, Resistance, Resistance in series and in parallel, Kirchoff's laws, Super position ,Analysis of simple circuits. Effect of temperature on resistance and temperature coefficient of resistance.

Magnetic Circuits, Concepts of M M F, Flux, reluctance, Magnetising Force, Leakage Flux, B – H Curve, Hysteresis and Eddy Current Power loss, Properties of common magnetic materials. Analysis of magnetic circuits.

**Unit 2:** A.C. Fundamentals, Concept of A C Currents and voltages, Mathematical representations in the form of Vectors and waves, R M S and average values, Form Factors, Phase and Phase difference, Concept of Inductance, Capacitance, Reactance, Impedance, Power and Power Factor.

**Unit 3:** Transformers – General theory of transformers, Phasor Diagrams, Equivalent Circuits, Open and Short circuit tests, Regulation, Normal and all day Efficiency of transformer

**Unit 4:** General Principles of electrical Motors and Generators, Synchronous Machines, Construction, E M F and Frequency equations, Behaviour on Load, Synchronous impedance, Open Circuit and Short Circuit tests. Regulation, Principle of rotation, V Characteristics and its applications.

**Unit 5:** Induction Motors, Principle of rotation and construction of three phase induction motors, Phasor diagrams, operating characteristics, Induction motor starters. Working Principle and application of single phase induction motors

**Unit 6:** Power generation, working of thermal, hydro and nuclear power stations.

**Books recommended:**

1. Elements of Electrical Science by P. Mukhopadhyaya -Nem Chand & Bros.
2. A textbook of electrical technology Vol. I&II, B.L.Theraja (M/s S.Chand & Co. W. Delhi).
3. Electrical Technology: Cotton (wheeler)
4. Introduction to Electrical Engineering by Naidu, Kamakshaiah, Tata McGrawHill.
5. Basic Electrical Engineering by H. Cotton.
6. A Textbook of Electrical Engineering Electrical Engineering Vol. I & II by B.L.Theraja, S. Chand & Co.
7. A Textbook of Basic Electrical Engineering by S.B. Bodkhe, N.M.Deskar, Professional Publishing House Pvt. Ltd.
8. Electric Machinery by Nagrath, Kothari, Tata McGraw Hill.
9. Basic Electrical Engineering- S.B.Bodkhe & Deshkar

# 5

**(Second Semester)**  
**Basic Mechanical Engineering (CE (BGE) 2.05)**  
**(Total Credits: 03)**

**Teaching Scheme**

**Lectures:** 2 Hours/ Week

**Tutorial:** 1 Hours / Week

**Examination Scheme**

**Theory**

**T (U) : 80 Marks      T (I) : 20 Marks**

**Duration of University Exam. : 03 Hours**

**UNIT 1:** Introduction to Production Technology, Fundamentals of metals and alloys, Properties testing and inspection, Ferrous metals and alloys, Non ferrous metals and alloys, heat treatment.

**UNIT 2:** Pattern making and Foundry, Powder Metallurgy

**UNIT 3:** Welding, Smithing and Forging, Mechanical Working.

**UNIT 4:** Bench work and Fitting, Wood and Wood working, Plastic processing, Plumbing threaded fasterns and joints, Sheet metal works.

**UNIT 5:** Theory of cutting, tool driving mechanism and salient features if construction of machine tools, specification, types construction and operation on lathe, Drill and Grinders. Introduction to Capstan and Turrets.

**UNIT 6:** Limits, fits and Surface Quality, Surface finishing processes, surface Coating of metals, Non traditional machining, introduction to numerical control of machine tools, processes planning and evaluation techniques CAD, CAM and CIM.

**BOOKS RECOMMENDED:-**

- 1) Elements Of Workshop Technology Vol -1 Manufacturing Processes -Hajra Choudhary
- 2) Elements Of Workshop Technology Vol 2 Machine Tools -Hajra Choudhary
- 3) A textbook of production technology (manufacturing processes) -P.C.Sharma



- 4) Introduction To Basic Manufacturing Process & Workshop Technology -Rajender Singh
- 5) A Textbook of Manufacturing Processes Workshop Technology -R S Khurmi, J K Gupta
- 6) Manufacturing Engineering and Technology -Serope Kalpakjian

# **6**

**(Second Semester)**  
**Ethical Sciences (CE (BGE) 2.06)**  
**(Total Credits: 02)**

**Teaching Scheme**

**Lectures:** 2 Hours/ Week

**Tutorial:** -

**Examination Scheme**

**Theory**

**T (U) : -- T (I) : 50 Marks**

**Duration of Internal Exam. : 02 Hours**

**Unit-I**

1. Concept of Culture and Civilization
2. Applied Humanities and Social Engineering
3. Socio-Legal Awareness: Right to Information(RIL), Public Interest Litigation(PIL), Intellectual Property Rights(IPR) & Patents, Lokpal and Lokayukta

**Unit-II**

1. Meaning and Scope of Industrial Psychology and Industrial Sociology
2. Fatigue, Selection and Training of Workers, Motives for work in industry
3. Transactional Analysis

**Unit-III**

1. Sustainable Development
2. Professional Ethics
3. Organizational Behavioral Dynamics: Leadership in Industry

**Unit-IV**

1. Indian Constitution and Federal System
2. Fundamental Rights and Directive Principles of State Policy
3. Role of Bureaucracy in Modern Society

**Unit-V**

1. Industrial Democracy
2. Works Organization: Power, Authority and Status system; Formal and Informal Organization
3. Industrialization, Urbanization: Study of Slums

**Books:**

- 1) A New Look into Social Sciences- Shabbir, Sheik and Dwadashiwar
- 2) An Introduction to Sociology- Vidya Bhushan and Sachdeva
- 3) Social Science: The Indian Scene-Yogesh Atal
- 4) Applied Humanities-Rajni Tandon
- 5) A History of World Civilizations-J.E.Swain
- 6) Industrial Psychology-Haire Mason
- 7) Introduction to Constitution of India- Durga Das Basu
- 8) Industrial Sociology in India-N.R.Seth
- 9) Human Resource Development and Management- Dr.A.M.Sheikh
- 10) The Economics of Sustainable Development-Surender Kumar

# 7

**(Second Semester)**

**APPLIED PHYSICAL CHEMISTRY PRACTICAL (CE (BGE) 2.07)**

**(Total Credits: 02)**

**Teaching Scheme**

**Practical: 3 Hours / Week**

Hours

**Examination Scheme**

**Practical**

**P ( U ) : 25 Marks    P ( I ) : 25 Marks**

**Duration of University Exam.        : 06**

## **LIST OF EXPERIMENTS**

1. To determine the surface tension & Parachor value of liquid using Stalagmometer.
2. To Study the viscosity of pure liquid using Oswald's Viscometer.
3. To study the effect of addition of NaCl on the solubility of Benzoic acid.
4. To determine the heat of solution of an organic acid by the solubility method.
5. To study the distribution of Iodine between  $\text{CCl}_4$  and water, and hence determine the partition co-efficient of Iodine between two.
6. To study the molecular condition of benzoic acid in Toluene by determining the partition co-efficient between Toluene and water.
7. To study the effect of addition of KCL on the solubility of Salicylic acid.
8. To study the kinetics of hydrolysis of Methyl acetate by a strong acid.
9. To study the kinetics of the reaction between Potassium Persulphate and Potassium-Iodide.
10. To study the miscibility of Phenol and water at various temperatures.
11. To determine the molecular weight of a compound using Rast's camphor method.
12. To study the relative strength of acids using method of kinetics.

# 8

(Second Semester)

## APPLIED PHYSICS- II PRACTICAL (CE (BGE) 2.08)

(Total Credits: 02)

**Teaching Scheme**

**Practical:** 3 Hours / Week

Hours

**Examination Scheme**

**Practical**

**P ( U ) : 25 Marks    P ( I ) : 25 Marks**

**Duration of University Exam.        : 06**

### List of Experiments

1. To study the characteristics of a pn-junction diode in forward and reverse bias & determine its cut in voltage, static & dynamic resistance.
2. To study the characteristics of a zener diode in forward and reverse bias & determine its breakdown voltage.
3. To determine the Energy gap  $E_g$  of semiconductor using PN junction diode in reverse bias mode.
4. Study of Hall Effect.
5. To study the input and output characteristics of a transistor in Common base mode & calculate input resistance and current gain.
6. To study the input and output characteristics of a transistor in Common emitter mode & calculate input resistance and current gain  $\beta$ .
7. To determine the Electrical conductivity by Four Probe method.
8. Study of Optical Fibre kit.
9. To determine the wavelength of sodium light using plane diffraction grating.

# 9

(Second Semester)

## Basic Electrical Engineering Practical (CE (BGE) 2.09)

(Total Credits: 01)

### Teaching Scheme

Practical: 2Hours / Week

Hours

### Examination Scheme

Practical

P ( U ) : 25 Marks    P ( I ) : 25 Marks

Duration of University Exam.    : 06

### List of Experiments

1. Study and verify kirchoffs laws.
2. Study and verify superposition theorem.
3. To plot B-H curve for magnetic material of single phase transformer.
- 4 . To plot phasor diagram for series RLC circuit.
5. To plot phasor diagram for parallel RLC circuit.
6. To determines the resistance and Inductance of Choke.
7. Find efficiency and regulation for single phase transformer by open and short circuit test.
8. Find efficiency and regulation by direct loading method of single phase transformer.
9. Speed control method of slip ring induction motor by rotor resistance method.
10. Speed control and reversal of phase of induction motor by voltage variation method.
11. To find regulation of alternator by open circuit and short circuit test.

Textbook for Practical Work:

1. A text Book on Laboratory Course in Electrical Engineering by S.G. Tarnekar & P.K. Kharbanda, M/s. S. Chand & Co., NEW DELHI.

**10**  
**(Second Semester)**  
**WORKSHOP (CE (BGE) 2.10)**  
**(Total Credits: 02)**

**Teaching Scheme**

**Practical:** 2 Hours / Week

Hours

**Examination Scheme**

**Practical**

**P ( U ) : 25 Marks    P ( I ) : 25 Marks**

**Duration of University Exam.        : 06**

Teachers/Instructors are expected to introduce the students with the tools & equipments used in following workshop sections with their operations & safety precautions.

1. Fitting Shop
2. Carpentry
3. Welding
4. Smithy

Students are expected to prepare minimum four Jobs during practical periods of workshop.

**Text/Reference Books:**

1. Elements of Workshop Technology VOL- I by S.K. Hajra Choudhary, A.K. Hajra Choudhary, Nirjhar Roy
2. Elements of Workshop Technology VOL- II by S.K. Hajra Choudhary, A.K. Hajra Choudhary, Nirjhar Roy

