

**1**  
**Engineering and Technology,**  
**R.T.M. Nagpur University, Nagpur.**  
**Syllabus for B.Tech. Chemical Technology**  
  
**(Second Semester)**  
**Engineering Mathematics – II (CT (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 Organic Chemistry (CT (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 Aromatic hydrocarbon** Preparation, properties and Industrial uses, and its structure determination of Benzene, Naphthalene.

**Alcohol** - monohydric alcohol. e.g. ethyl alcohol, di hydric alcohol. e.g. ethylene glycol, trihydric alcohol e.g. glycerol.-its study . Preparations, properties and Industrial uses.

**Heterocyclic hydrocarbon**- total synthesis, preparations, properties and uses of Pyrrole, Indigo.

**Unit 2 Carbohydrates** Industrial uses and structure determination of glucose, saccharin.

**Acids and esters** Preparations and properties and uses of Acetic acid, Acetoacetic acid, Malonic acid and their esters.

**Amines**- Preparations and properties and uses of mono-, di -, tri- ethyl amines ,Aniline and diazotization with special reference to formation of azo dyes - e.g. Aniline yellow, Methyl Red, Congo Red.

**Unit 3 Nitration**, nitrating agents, Kinetics and Mechanism of aromatic nitration process, Equipments for nitration, typical industrial nitration process e.g. preparation of nitrobenzene, nitro acetanilide.

**Unit 4 Halogenation**, Thermodynamics and Kinetics of halogenation reactions. Apparatus and materials for construction. Technical preparation of chloral and vinyl chloride.

**Unit 5 Sulphonation and sulphation**: Sulphonating and sulphating agents. Mechanism of sulphonation Industrial Equipments: Technique and Technical Preparation of dodecyl Benzene Sulphonate, Sulphation of Lauryl Alcohol, Dimethyl ether.

**Unit 6 Principles of Polymer Chemistry**, Industrial Practices and applications, Techniques of Polymerization, Types of Polymerization Examples: Addition and Condensation Polymerization, Mechanism of Additional Polymerization. Study of Polymers e.g. PVC, PVA, Conducting Polymer- Polyaniline, Polypyrroles, Polythiophenes, .

#### Books Recommended:

1. Text book of Organic Chemistry- by P.L.Soni, H. M. Chawala
2. Text book of Organic Chemistry – By Arun Bahal, B.S. Bahal
3. Unit Processes in Organic Synthesis- by P. H. Groggins
4. Principles of Polymer Chemistry- by Vasant Gowariker
5. Chemistry of Organic Natural Products Vol-1 and 2- by O. P. Agrawal

# 3

(Second Semester)

## APPLIED PHYSICS II (CT (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 Technology (CT (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, Hysterisis 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)

## Applied Mechanics (CT (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 I Basics & Statics of Particles** Basic concepts System of Forces, Resolution and composition of forces , system of parallel, concurrent and non concurrent co-planer forces, Resultant.

**Equilibrium Of Rigid Bodies** Free body diagram , Types of supports and their reactions, requirements of stable equilibrium, Moments and Couples, Varignon's theorem , Equilibrium of Rigid bodies in two dimensions.

**UNIT II Centroid and Center of Gravity** Centroid of plane and composite figures, Moment of inertia of plane area, Parallel Axes Theorem, Perpendicular axes theorems.

**Simple lifting machines** Velocity ratio, mechanical advantage and efficiency of simple machines, Law of machine, Differential wheel and axle, Screw Jack, Single and Double purchase crabs.

**UNIT III Truss** Analysis of simple plane trusses by method of joints and method of sections.

**Friction** Types of friction, Limiting friction, Laws of Friction, static and Dynamic Frictions, Motion of Bodies.

**UNIT IV Dynamics of Particles** Displacement velocity and Acceleration (rectilinear and rotary ), Motion with uniform and variable acceleration and projectiles , D'Alembert's principle, kinetics of rectilinear translation and rotary motion of rigid body. Dynamic equilibrium in plane motion.

**UNIT V Work, Power and Energy, Conservation of Momentum and Energy.**

**UNIT VI Transmission of power by belts** Belt Drivers - Open, Crossed and compound belt drives, length of belt, tensions - tight side, slack side, Power transmitted and condition for maximum power. gears and epicyclic gear trains.

### BOOKS RECOMMENDED

1. Engineering mechanics by Timoshenko and Young.
2. Applied Mechanics by Saluja, Satya Prakash.
3. Engineering mechanics by Beer and Johnson.



4. Engineering mechanics by Singer.
5. Engineering mechanics by R.S.Khurmi.
6. Engineering Mechanics by Kumar.
7. Engineering Mechanics by Shames.

**6**  
**(Second Semester)**  
**COMMUNICATION SKILLS (CT (BGE) 2.06)**

**(Total Credits: 02)**

**Teaching Scheme**

**Examination Scheme**

**Practical: 2 Hours / Week**

**Practical**

Marks

**P ( U ) : 25 Marks**

**P ( I ) : 25**

Hours

**Duration of University Exam. : 03**

**LIST OF EXPERIMENTS**

Following points are to be discussed with the students before conducting the practicals.

- A) Principles and Practice of letter writing: Business, Job and Bank Correspondence
- B) Technical Report Writing
- C) Grammar:
  - 1. Correction of Common Errors
  - 2. Exercise on rewrite as directed
  - 3. Correct use of words, idioms, phrases, prepositions, etc.
- D) 1. Principles of Public Speaking
  - 2. Reading Comprehension
- E) 1. Professional Communication Skills (Meaning, Significance, Types, Dimensions & Barriers)
  - 2. Group Discussion and Personal Interview (Importance of GD, Modules of GD, How to prepare for GD, Meaning, types & techniques of PI, How to prepare for PI)

Books:

- 1. Public Speaking and Influencing Men in Business- Dale Carnegie
- 2. Professional Communication Skills-Bhatia and Sheik
- 3. Business Communication- K.K.Sinha
- 4. Communication Skills- Dr.P.Prasad
- 5. Technical Communication- Raman and Sharma
- 6. High School Grammar and Composition-Wren and Martin
- 7. Modern English Grammar Usage and Composition –N.Krishnaswamy

### Communication Skills Laboratory Practical

Sr.No	Name of the Practical	Activity to be Taken	Medium of Practical
1	Barriers to Communication	<ol style="list-style-type: none"> <li>1. Intro to various kinds of barriers</li> <li>2. Activity class on semantic barriers</li> </ol>	PPT Based, Activity Based
2	Reading Skills	<ol style="list-style-type: none"> <li>1. Skimming, Scanning &amp; Gist Reading</li> <li>2. Comprehending Passages</li> </ol>	PPT Based, Activity Based
3	Development of Word Power	<ol style="list-style-type: none"> <li>1. IPA, Pronunciation techniques</li> <li>2. Often wrongly pronounced words</li> <li>3. Word Power, homophones, synonyms/antonyms</li> </ol>	Software based PPT Based, Activity Based
4	Non-Verbal Communication	<ol style="list-style-type: none"> <li>1. Kinesics in comm./Interviews</li> <li>2. Activities/ role play</li> </ol>	Software based PPT Based, Activity Based
5	Speaking Skills	<ol style="list-style-type: none"> <li>1. Intro of effective way of speaking</li> <li>2. Oral presentations Extempore/ Debate/JAM</li> </ol>	PPT Based, Activity Based
6	Group Discussion	<ol style="list-style-type: none"> <li>1. GD rules</li> <li>2. GD of groups in 6</li> </ol>	Software based PPT Based, Activity Based
7	Interview Techniques	<ol style="list-style-type: none"> <li>1. Various types of interviews</li> <li>2. Resume making</li> <li>3. Mock Interviews( one to one)</li> </ol>	Software based PPT Based, Activity Based
8	Use of Figurative Language	<ol style="list-style-type: none"> <li>1. Intro phrases/idioms/proverb</li> </ol>	PPT Based, Activity

		<ul style="list-style-type: none"> <li>s</li> <li>2. Idioms related to color/Number/animals/parts of the body/Misc.</li> </ul>	Based
9	Listening Skills	Listening Barriers	PPT Based, Activity Based
10	Presentation Skills	<ul style="list-style-type: none"> <li>1. Preparing visual aids/PPTs</li> <li>2. Writing references</li> </ul>	PPT Based, Activity Based

# 7

(Second Semester)

## Applied Organic Chemistry Practical (CT (BGE) 2.07)

(Total Credits: 02)

### Teaching Scheme

**Practical:** 3 Hours / Week

Marks

Hours

### Examination Scheme

**Practical**

**P ( U ) : 25 Marks**

**P ( I ) : 25**

**Duration of University Exam. : 06**

### LIST OF EXPERIMENTS

- 1) Separation of Organic Mixtures.
- 2) Elemental Analysis of C, H, N, Cl, Br, I etc.
- 3) Functional group detection for example : COOH, CONH<sub>2</sub>, Primary Amine, Secondary Amine, Tertiary Amine , Carbohydrate, Phenols, Alcohols, etc.
- 4) Identification of Organic Compounds.

# 8

(Second Semester)

## APPLIED PHYSICS PRACTICAL (CT (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 Technology Practical (CT (BGE) 2.09)

(Total Credits: 02)

### Teaching Scheme

**Practical:** 3Hours / 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)

## ENGINEERING GRAPHICS (PRACTICAL (CT (BGE) 2.10)

(Total Credits: 02)

### Teaching Scheme

Practical: 2 Hours / Week

Marks

Hours

### Examination Scheme

Practical

P ( U ) : 25 Marks

P ( I ) : 25

Duration of University Exam. : 06

### LIST OF EXPERIMENTS

**NOTE – ONLY FIRST ANGLE METHOD OF PROJECTIONS SHOULD BE USED**

#### **Introduction to Engineering Drawing & Curves used in Engineering Practice:**

Introduction, Use of various drawing instruments, Lettering, Types of lines used in drawing practice, Dimensioning, Types of Scales and representative fraction (R. F.) of scale.

Conic sections- Ellipse, Parabola, Hyperbola, Cycloid, Involute & Archimedean Spiral.

#### **Projections of Points and Lines:**

Basic principles of orthographic projection, reference planes, concepts of four quadrants, methods of orthographic projections: First angle projections and Third angle projections, conventions used to represent methods of orthographic projection.

Projections of points in all possible positions w.r.t. reference planes, projections of lines when it is perpendicular to one of the reference planes, when line is inclined to one & parallel to other reference plane, lines inclined to both reference planes. (lines in first quadrant only).

#### **Projections of Planes:**

Projection of planes when it is parallel to one of the reference planes, when it is perpendicular to one & inclined to other reference plane, when it is inclined to both reference planes.

#### **Projections of Solids:**

Projections of solids when axis is perpendicular to one of the reference planes, when axis is inclined to one & parallel to other reference plane, when axis is inclined to both the reference planes. (Projections of cube, right regular prisms, right regular pyramids, right circular cylinder, right circular cone, tetrahedron).

#### **Orthographic Projections:**

Conversion of pictorial view into orthographic views.

#### **Isometric Projections:**



Definition of Isometric view/projection, Isometric scale to draw Isometric projection, construction of Isometric view from given orthographic views.

**PRACTICAL:**

**Seven Half imperial size drawing sheets as detailed below:**

Sheet No. 1: Lines, Lettering and Dimensioning

Sheet No. 2: Curves (Minimum four problems)

Sheet No. 3: Projection of straight lines (Minimum four problems)

Sheet No. 4: Projection of Planes (Minimum four problems)

Sheet No. 5: Projections of solids (Minimum four problems)

Sheet No. 6: Orthographic Views (To draw three principal views from given isometric View-minimum two problems)

Sheet No. 7: Isometric Views/Projection (minimum four problems on Isometric views/projections)

**Text Books:**

1. N.D. Bhatt, Elementary Engineering Drawing, Charotor Publishing house, Anand, India.
2. R.K. Dhawan- Engineering Drawing-
3. K. Venu Gopal- Engineering Drawing and graphics+ Autocad-
4. D. N. Johle- Engineering Drawing, Tata McGraw-hill Publishing Co. Ltd.
5. Pakhatkar- Engg. Drawing , Nirali Prakashan

**Reference Books:**

1. P.S. Gill, Engineering Graphics.
2. N.D. Bhatt, Machine Drawing, Charotor Publishing house, Anand, India.