



# **BANGLADESH TECHNICAL EDUCATION BOARD**

Agargaon, Dhaka-1207.

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM  
SYLLABUS (PROBIDHAN-2016)

## **ELECTRICAL TECHNOLOGY**

TECHNOLOGY CODE: 667

FIRST SEMESTER

**DIPLOMA IN ENGINEERING  
PROBIDHAN-2016**

**Electrical Technology**

**1st Semester**

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				
						Theory		Practical		Total
						Cont. assess	Final exam	Cont. assess	Final exam	
1	61011	Engineering Drawing	0	6	2	0	0	50	50	100
2	65812	Physical Education & Life Skill Education	0	3	1	0	0	25	25	50
3	65911	Mathematics-1	3	3	4	60	90	50	0	200
4	65913	Chemistry	3	3	4	60	90	25	25	200
5	66711	Basic Electricity	3	3	4	60	90	25	25	200
6	66713	Electrical Engineering Materials	2	0	2	40	60	0	0	100
7	66811	Basic Electronics	2	3	3	40	60	25	25	150
		<b>Total</b>	13	21	20	260	390	200	150	1000

## OBJECTIVES:

- To develop the ability to use various drawing instruments and materials.
- To enable in constructing and using various types of scales in drawing.
- To provide the ability to construct various geometrical figures.
- To enable to adopt various symbols used in drawing.
- To understand the orthographic and isometric projection.

## SHORT DESCRIPTION:

Drawing instruments and their uses; Lettering, numbering and constructing title strip; Adopting alphabet of lines and dimensioning; Constructing scales; Constructing geometrical figures; Constructing conic sections; Adopting symbols; Views and isometric projections.

## DETAIL DESCRIPTION:

### 1 Practice with drawing instruments and materials for basic drawing technique.

- 1.1 Identify the different types of drawing instruments.
- 1.2 Use different types of drafting equipment.
- 1.3 Identify different types of drafting software.
- 1.4 Identify the standard sizes of drawing board and sheets.
- 1.5 Draw the border lines in drawing sheets following standard rule.
- 1.6 Draw horizontal, vertical and inclined lines with the help of set squares and T-square.
- 1.7 Draw 15 degree, 75 degree, 105 degree and 120 degree angles with the help of set squares.
- 1.8 Use lettering guide, template, scale pantograph and French curve.

### 2 Practice Letter and number freehand and with instruments.

- 2.1 Identify the necessity of good lettering in engineering drawing.
- 2.2 Draw freehand single stroke vertical letters from A to Z (upper and lower case) and numbers 0 to 9.
- 2.3 Draw freehand inclined (65 degree to 75 degree) single stroke letters from A to Z (upper and lower case) and numbers from 0 to 9.
- 2.4 Draw block letters (Gothic) using 5: 4 proportions.
- 2.5 Select a suitable size of letters and write a few sentences using all the letters selecting suitable scale.
- 2.6 Draw title strip with proper placement using suitable size of letters and measurements.

### 3 Adopt the alphabet of lines.

- 3.1 Select different lines in drawing.
- 3.2 Use center line, hidden line, phantom line, break line, dimension line, extension line, section line and cutting plane line.
- 3.3 Use different thickness of line to emphasize a part of drawing.
- 3.4 Select recommended grades of pencils for various types of lines for engineering drawing.

### 4 Adopt the elements and theory of dimensioning.

- 4.1 Put dimensions in engineering drawing according to an accepted standard.
- 4.2 Identify the elements of dimensions from a given dimensioned drawing.
- 4.3 Apply aligned and unidirectional system of dimensioning.
- 4.4 Draw size and location of dimension, continuous dimension, staggered dimension and dimensioning in limited space.
- 4.5 Add necessary dimension to a given drawing with suitable arrows.

## **5 Prepare scale for drawing application.**

- 5.1 Calculate representative fraction and interpret a scale reading.
- 5.2 Use different types of scale to find full size dimension.
- 5.3 Draw a plain scale to show meter, centimeter and millimeter of a given distance on object.
- 5.4 Draw a diagonal scale to show three units having given RF.
- 5.5 Read particular distance on plain and diagonal scale.
- 5.6 Use scale of chord.
- 5.7 Draw angle of 49 degree, 78 degree and 95 degree with the help of scale of chord.

## **6 Construct geometric figures (regular polygons) & Construct conic sections.**

- 6.1 Draw regular polygons i.e. pentagon, hexagon and octagon having given one side.
- 6.2 Draw an ellipse by concentric circle method.
- 6.3 Draw an ellipse by parallelogram method.
- 6.4 Draw an ellipse by four center method.
- 6.5 Draw a parabola having given foci and director.
- 6.6 Draw a parabola from given abscissa and ordinate.

## **7 Adopt standard symbols in drawing.**

- 7.1 Identify symbols used in drawing.
- 7.2 Draw a legend using symbols of different engineering materials.
- 7.3 Draw the symbols of different plumbing fittings and fixtures used in drawing.
- 7.4 Draw the symbols of different electrical fittings and fixtures used in drawing.
- 7.5 Interpret information from drawing containing standard symbols.

## **8. Understand the views of engineering drawing.**

- 8.1 Identify different types of views
- 8.2 Interpret different types of views

## **9 Apply the Principles of orthographic projection to a straight line.**

- 9.1 Draw the orthographic projection of a straight line under the following conditions : -
  - a) Line parallel to both planes
  - b) Line perpendicular in vertical plane and parallel to horizontal plane
  - c) Line parallel to vertical plane and perpendicular to horizontal plane
  - d) Line inclined at given angle to horizontal plane and parallel to vertical plane
  - e) Line inclined at given angle to vertical plane and parallel to horizontal plane

## **10 Apply the principles of orthographic projection of rectangular and circular planes (Lamina)**

- 10.1 Draw the orthographic projection of rectangular lamina Parallel to both planes.
- 10.2 Draw the orthographic projection of rectangular lamina inclined at given angle to horizontal plane
- 10.3 Draw the orthographic projection of circular lamina parallel to both planes

## **11 Apply the principles of orthographic projections of geometric solids**

- 11.1 Draw the orthographic projection of a cube kept at an angle with one of the planes in first angle method
- 11.2 Draw the orthographic projection of a pyramid kept at an angle with both the planes in 1<sup>st</sup> angle method
- 11.3 Draw the orthographic projection of a cone kept at an angle with both the planes in third angle method.
- 11.4 Draw the orthographic projection of a prism kept at an angle with vertical plane in third angle method.

## **12 Understand the importance, use and scope of isometric views in engineering.**

- 12.1 Identify isometric views
- 12.2 Draw the isometric view of rectangular and circular lamina
- 12.3 Draw the isometric projection of solids such as: cube, cylinder, pyramid, prism and steps from different orthographic views
- 12.4 Draw the isometric projection of three deterrent engineering parts from orthographic views

**REFERENCE BOOKS:**

- 1 Geometrical Drawing - I H Morris
- 2 Prathomic Engineering Drawing - Hemanta Kumar Bhattacharia
- 3 Civil Engineering Drawing - Guru Charan singh

# PHYSICAL EDUCATION & LIFE SKILL DEVELOPMENT (65812)

T	P	C
0	3	1

## OBJECTIVES:

- To enhance body fitness.
- To make aware of First aid procedure.
- To acquaint with the common games and sports.
- To develop Life Skill.

## SHORT DESCRIPTION

Warm up; Yoga; Muscle developing with equipment; Meditation, First aid; Sports science, Games & sports; Life skill development.

## DETAIL DESCRIPTION

### 1. Recite national anthem and make assembly

- 1.1 line and file.
- 1.2 Make assembly.
- 1.3 Recitation of national anthem.
- 1.4 National anthem in music.

### 2. Conduct warm up.

- 2.1 Conduct general warm up :

**Spot running (Slow, Medium & Fast), Neck rotation, Hand rotation, Side twisting, Toe touching, Hip rotation, Ankle twisting, Sit up and Upper body bending (Front & Back).**

- 2.2 Conduct squad drill :  
Line, File, Attention, Stand at ease, Stand easy, Left turn, Right turn, About turn, Mark time, Quick march, Right wheel, Left wheel, Open order march & Closed order march.
- 2.3 Conduct specific warm up :

**Legs raising one by one, Leg raising in slanting position, Knee bending and nose touching, Heels raising, Toes touching (standing and laying position), Hand stretch breathing (Tadasana, Horizontal, Vertical ).**

- 2.4 Conduct mass physical exercise

**Hand raising, Side twisting, Front & back bending, Front curl, Straight arm curl two hand, Hands raising overhead and Push up.**

### 3. Conduct YOGA.

- 3.1 Dhyanasan : Shabasan, Padmasan, Gomukhasan, Sharbangasan, Shashangasan, Shirshasan
- 3.2 Shasthyasan : Halasan, Matshasan, Paban Mukhasan, Ustrasana.
- 3.3 Prana and Pranayama: Nadisuddhi Pranayama, cooling pranayamas (sitali pranayama, Sitkari Pranayama, Sadanta pranayama), Ujjayi pranayama,

### 4. Exercise Muscle developing with equipment.

- 4.1 Practice Damball: Front curl, Hand sidewise stretching, Arms raising overhead.
- 4.2 Practice Barbell: Front press, Leg press, rowing motion with leverage bar.
- 4.3 Practice Rope climbing: Straight way climbing, Leg raising climbing.
- 4.4 Practice Horizontal bar: Chinning the bar with front grip, chinning the bar with wide back grip.
- 4.5 Practice Jogging Machine: Slow, Medium, and Fast running.
- 4.6 Practice A. B king pro (Rowing Machine): Sit up.
- 4.7 Practice Sit up bench: Sit up.

### 5. Conduct Meditation.

- 5.1 Define meditation.

- 5.2 Classification of Meditation.
- 5.3 Nadanusandhana (A-Kara chanting, U-Kara chanting, M-Kara chanting, AUM-kara chanting).
- 5.4 OM-Meditation.
- 5.5 Cyclic Meditation (Starting Prayer, Instant Relaxation Technique, Centering, Standing Asanas, Sitting Asanas, Quick Relaxation Technique).

**6. Demonstrate First Aid Skill.**

- 6.1 Define First aid.
- 6.2 Know First aider.
- 6.3 Discuss the responsibilities of a First aider.
- 6.4 Identify different types of equipment of First aid.
- 6.5 Practice Muscle Cramp-Ice applications (Remedy).
- 6.7 Practice dislocation-Ice application (Remedy).

**7. Exercise Rules and technique of following games and sports.**

- 7.1 Kabadi.
- 7.2 Football.
- 7.3 Cricket.
- 7.4 Badminton.
- 7.5 Athletics.
- 7.6 Swimming.

**8. Sports Science.**

- 8.1 Define exercise physiology.
- 8.2 State the function of muscles.
- 8.3 Know the concept of work, energy and power.
- 8.4 Express the effect of exercise on heart and circulatory system.
- 8.5 Show the motor components for physical fitness.
- 8.6 Define sports biomechanics.
- 8.7 Define sports psychology.
- 8.8 State the meaning of nutrition, diet and balanced diet.
- 8.9 State the meaning of the terms –test, measurement and evaluation.

**9. Show skill on conversation on day to day life of the following:**

- 9.1 Today's market price.
- 9.2 Festivals (religious festivals, National festivals).
- 9.3 Celebration of National days.
- 9.4 Aim in life.
- 9.5 Visite to historical places/sites.

**10. Understand human relation.**

- 10.1 Define family relation.
- 10.2 Know the relation with neighbor.
- 10.3 Identify humanitarian service.
- 10.4 Explain service for handicapped (intelligent, physical, social etc).
- 10.5 Explain service for orphan/patient.

**11. Experience vote of appreciation.**

- 11.1 About dress.
- 11.2 For good work.
- 11.3 For good result.
- 11.4 For good news.

**12. Practice stress management.**

- 12.1 Grow habit to be a man of humor.
- 12.2 Always keep brain cool.
- 12.3 Run with positive thinking.
- 12.4 Explain factors that determine our attitude.
- 12.5 State the benefits of a positive attitude.
- 12.6 Follow steps to building a positive attitude.

**13. Practice time management.**

- 13.1 Determine essential time for a task.
- 13.2 Determine delay and unexpected time.
- 13.3 Determine time for daily activities.
- 13.4 Plan for daily activities.

**14. Play roll to conduct interview technique on:**

- 14.1 Mental preparation to face an interview.
- 14.2 Selection of dress for interview.
- 14.3 Introducing himself/herself to the interviewer.
- 14.4 Coping interview.

**15. Practice team work on:**

- 15.1 Organize a team.
- 15.2 Select a team leader.
- 15.3 Distribute the task to the members.
- 15.4 Accept opinion of team members.
- 15.5 Completing the task as a team.

**16. Practice social work.**

- 16.1 Exercise tree plantation.
- 16.2 Exercise community service.
- 16.3 Rover Scout.
- 16.4 Sanitation.
- 16.5 Pure drinking water.
- 16.6 Social Culture.

**REFERENCE BOOK:**

- Modern Yoga \_ Kany Lal Shah
- Rules of games and sports \_ Kazi Abdul Alim
- Yoga \_ Sobita Mallick
- Iron Man \_ Nilmoni Dass

# MATHEMATICS-1 (65911)

T P C  
3 3 4

## OBJECTIVES:

- To acquaint the students with the basic terminology of Algebra.
- To be able to understand the complex numbers which are being used in electrical engineering.
- To be able to understand the binomial expansion.
- To be able to use the knowledge of trigonometry in solving problems of engineering importance.

## SHORT DESCRIPTION:

**Algebra:** AP & GP, polynomials & polynomial equations, complex number, permutation & combination, binomial theorem for positive integral index and negative & fractional index.

**Trigonometry:** ratio of associated angles, compound angles, transformation formulae, multiple angles and sub-multiple angles.

## DETAIL DESCRIPTION:

### 1 Understand the concept of AP & GP.

- 1.1 Define AP and common difference.
- 1.2 Find last term and sum of n terms, given first term and common difference.
- 1.3 Define GP and common ratio.
- 1.4 Find the sum of n terms given first and common ratio.

### 2 Apply the concept of polynomial in solving the problems.

- 2.1 Define polynomials and polynomial equation.
- 2.2 Explain the roots and co-efficient of polynomial equations.
- 2.3 Find the relation between roots and co-efficient of the polynomial equations.
- 2.4 Determine the roots and their nature of quadratic polynomial equations.
- 2.5 Form the equation when the roots of the quadratic polynomial equations are given.
- 2.6 Find the condition of the common roots of quadratic polynomial equations.
- 2.7 Solve the problems related to the above.

### 3 Understand the concept of complex numbers.

- 3.1 Define complex numbers.
- 3.2 Perform algebraic operation (addition, subtraction, multiplication, division, square root) with complex number of the form  $a + ib$ .
- 3.3 Find the cube roots of unity.
- 3.4 Apply the properties of cube root of unity in solving problems.

### 4 Apply the concept of permutation.

- 4.1 Explain permutation.
- 4.2 Find the number of permutation of n things taken r at a time when,
  - i) Things are all different.
  - ii) Things are not all different.
- 4.3 Solve problems related to permutation:
  - i) Be arranged so that the vowels may never be separated.
  - ii) From 10 men and 6 women a committee of 7 is to be formed. In how many ways can this be done so as to include at least two women in the committee.

### 5 Apply the concept of Combination.

- 5.1 Explain combination.
- 5.2 Find the number of combination of n different things taken r at a time.
- 5.3 Explain  $nCr$ ,  $nCn$ ,  $nC0$
- 5.4 Find the number of combination of n things taken r at a time in which p particular things
  - i) Always occur
  - ii) never occur.

- 5.5 Establish i)  $nCr = nCn-r$   
 ii)  $nCr + nCr-1 = n+1Cr$   
 5.6 Solve problems related to the combination.

**6 Apply partial fractions to break the numerator and denominator.**

- 6.1 Define proper and improper fractions.  
 6.2 Resolve into partial fraction of the following types:  
 a) Denominator having a non-repeated linear factor.  
 b) Denominator having a repeated linear factor.  
 c) Denominator having a quadratic factor.  
 d) Denominator having a combination of repeated, non repeated and quadratic factors.

**7 Apply the concept of the binomial theorem.**

- 7.1 State binomial expression.  
 7.2 Express the binomial theorem for positive index.  
 7.3 Find the general term, middle term, equidistant term and term independent of x.  
 7.4 Use binomial theorem to find the value of  
 i)  $(0.9998)^2$ , correct to six places of decimal.  
 ii)  $(1 + \sqrt{2})^5 - (1 - \sqrt{2})^5$

**8 Apply the concept of the binomial theorem for negative index.**

- 8.1 Express the binomial theorem for negative and fractional index.  
 8.2 Solve problems of the following types:

Expand (i)  $(1 - nx)^{-\frac{1}{n}}$  (ii)  $\frac{1}{\sqrt{4.08}}$

**9 Apply the concept of associated angles.**

- 9.1 Define associated angles.  
 9.2 Find the sign of trigonometrical function in different quadrants.  
 9.3 Calculate trigonometrical ratios of associated angle.  
 9.4 Solve the problems using above.

**10 Apply the principle of trigonometrical ratios of compound angles.**

- 10.1 Define compound angles.  
 10.2 Establish the following relation geometrically for acute angles.  
 i)  $\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$ .  
 ii)  $\cos(A \pm B) = \cos A \cos B \pm \sin A \sin B$ .  
 10.3 Deduce formula for  $\tan(A \pm B)$ ,  $\cot(A \pm B)$ .  
 10.4 Apply the identities to work out the problems:  
 i) Find the value of  $\sin 75^\circ$ ,  $\tan 75^\circ$ .  
 ii) Show that  $\frac{\sin 75^\circ + \sin 15^\circ}{\sin 75^\circ - \sin 15^\circ} = \sqrt{3}$   
 iii) if  $\alpha + \beta = \theta$ ,  $\tan \alpha + \tan \beta = b$ ,  $\cot \alpha + \cot \beta = a$ ,  
 Show that  $(a - b) = ab \cot \theta$ .

**11 Apply sum and product formula of trigonometrical ratios.**

- 11.1 Express sum or difference of two sines and cosines as a product and vice-versa  
 11.2 Solve problems of the Following types:  
 i) Show that,  $\sin 55^\circ + \cos 55^\circ = \sqrt{2} \cos 10^\circ$   
 ii) Prove that,  $\cos 80^\circ \cos 60^\circ \cos 40^\circ \cos 20^\circ = \frac{1}{16}$

**12 Apply the concept of ratios of multiple angles.**

- 12.1 State the identities for  $\sin 2A$ ,  $\cos 2A$  and  $\tan 2A$ .  
 12.2 Deduce formula for  $\sin 3A$ ,  $\cos 3A$  and  $\tan 3A$ .  
 12.3 Solve the problems of the following types.  
 i) express  $\cos 5\theta$  in terms of  $\cos \theta$ .

ii) if  $\tan \alpha = 2 \tan \beta$ , show that,  $\tan (\alpha + \beta) = \frac{3 \sin 2\alpha}{1 + 3 \cos 2\alpha}$

**13 Apply the concept of ratios of sub-multiple angles.**

13.1 Find mathematically the identities for  $\sin \alpha$ ,  $\cos \alpha$  and  $\tan \alpha$  in terms of  $\frac{\alpha}{2}$  and  $\frac{\alpha}{3}$

13.2 Solve the problems of the type:

find the value of  $\cos 3^\circ$ ,  $\cos 6^\circ$ ,  $\cos 9^\circ$ ,  $\cos 18^\circ$ ,  $\cos 36^\circ$  etc.

**REFERENCE:**

SL No	Author	Title	Publication
01	S. P Deshpande	Mathematics for Polytechnic Students	Pune Vidyarthi Graha Prakashan
02	H. K. Das	Mathematics for Polytechnic Students (Volume I)	S.Chand Prakashan
03	Ashim Kumar Saha	Higher Mathematics	Akshar Patra Prakashani
04	S.U Ahamed & M A Jabbar	Higher Mathematics	Alpha Prakashani

## CHEMISTRY (65913)

T	P	C
3	3	4

### OBJECTIVES:

1. To understand mole concept and volumetric analysis.
2. To represent the formation of bonds in molecules.
3. Able to select appropriate materials used in construction.
4. Apply knowledge to enhance operative life span of engineering material and structure by various protective methods.

### SHORT DESCRIPTION:

Chemistry is a basic science subject which is essential to all engineering courses. It gives knowledge of engineering material, their properties related application and selection of material for engineering application. It is intended to teach student the quality of water and its treatment as per the requirement and selection of various construction materials and their protection by metallic and organic coatings. The topics covered will provide sufficient fundamental as well as background knowledge for the particular branch.

### DETAIL DESCRIPTION:

#### 1. Understand Atomic Structure and Chemical Bond.

- 1.1 Define element, atoms, molecules, Fundamental particle of atom, their mass, charge, location.
- 1.2 Define atomic number, mass number, Isotope, Isotone and Isobar.
- 1.3 Explain electronic configuration based on Hunds Rule, Aufbau's principle, Paulis exclusion principle.
- 1.4 Define atomic weight, equivalent weight of an element, molecular weight, mole in terms of number, mass, volume.
- 1.5 Define symbol, valency and formula.
- 1.6 Explain Chemical bond, octet rule.
- 1.7 Explain Formation of various types of chemical bonds: Covalent, Ionic, Co-ordinate bond.
- 1.8 Explain the bonding along with example  $\text{CH}_4$ ,  $\text{H}_2$ ,  $\text{O}_2$ ,  $\text{NaCl}$ ,  $\text{MgCl}_2$ .
- 1.9 Explain Quantum number, Orbit and Orbital.

#### 2. Understand Ionic Equilibrium.

- 2.1 Explain the concept of acid, base, salt and types of salts.
- 2.2 Define pH, pOH, pH scale.
- 2.3 Distinguish between basicity of an acid and acidity of a base.
- 2.4 State normality, molarity, molality, volumetric analysis.
- 2.5 Explain Titration and Indicator.
- 2.6 Describe buffer solution and its mechanism.

#### 3. Understand chemical reaction, oxidation and reduction.

- 3.1 Define Chemical reaction and explain the various types of chemical reaction.
- 3.2 Explain the full meaning of a chemical equation.
- 3.3 State the concept of catalyst.
- 3.4 Explain the modern concept of oxidation and reduction.
- 3.5 Describe the simultaneous process of oxidation and reduction.
- 3.6 Explain the oxidation number.

#### 4. Understand Water Treatment.

- 4.1 State the concept of hard and soft water.
- 4.2 Define hardness of water.
- 4.3 Describe the softening method of permuted process and ion exchange resin process.
- 4.4 Mention the advantages and disadvantages of hard water in different industries.

4.5 Visit a water treatment plant write a report.

## **5. Understand Corrosion and Alloy.**

- 5.1 Mention the types of corrosion(dry and wet corrosion).
- 5.2 Describe atmospheric corrosion, types of atmospheric corrosion and their mechanism, oxide films factors affecting atmospheric corrosion.
- 5.3 Explain electrochemical corrosion, mechanism of electrochemical corrosion, types of electrochemical corrosion. factors affecting electrochemical corrosion.
- 5.4. Explain protective measures against corrosion: Coating (Galvanic and Zinc, Organic coating agents, Electroplating, metal cladding)
- 5.5 Explain the concept of alloy.

## **6. Understand the Concept of Organic Chemistry and Introduction to polymers.**

- 6.1 Mention types of Chemistry.
- 6.2 Mention the catenation property of carbon.
- 6.3 State organic compounds, its properties and applications.
- 6.4 Explain the classification of organic compound by structure and functional group: Define Homologous series, Alkanes, Alkenes and Alkynes; properties and uses of general formula; Names and structure of first five members hydrocarbons.
- 6.5 Explain polymer, monomer, classification of polymers, polymerization, addition and condensation polymerization.
- 6.6 Define plastics and explain its types and uses.

## **7. Understand Glass and Ceramic.**

- 7.1 Define glass and its constituents; classify glasses, give elementary idea of manufacturing process of glass.
- 7.2 Give introduction to ceramic materials and its constituent.
- 7.3 Describe industrial application of glass and ceramic.
- 7.4 Visit industry and write a report.

## **8. Understand Soap and Detergent.**

- 8.1 Give introduction to Lipid, Fats and oils.
- 8.2 Explain saponification of fats and oils, manufacturing of soap.
- 8.3 Describe synthetic detergent, types of detergents and its manufacturing.
- 8.4 State explosives: TNT, RDX, Dynamite.
- 8.5 Define paint and varnish.
- 8.6 Describe adhesives.

## **9. Cement, pulp and papers.**

- 9.1 Classify cement and mention its uses and manufacturing process.
- 9.2 Describe manufacturing process of pulp and papers.
- 9.3 Conduct industry visit and reporting.

## **PRACTICAL:**

### **1. Practice the use of laboratory tools and safety measures.**

### **2. Conduct observation and measurement.**

- 2.1 Determine the strength of HCl solution using 0.1N  $\text{Na}_2\text{CO}_3$
- 2.2 Determine the strength of NaOH by using 0.1N HCl solution.

### **3. Perform qualitative analysis of known and unknown salts.**

- 3.1 Identify known salt (sample Copper, Iron, Aluminum, lead, Ammonium and Zinc salt.)
- 3.2 Identify unknown basic radical (e.g. lead, Copper, Iron, Zinc, Aluminum, Ammonium)
- 3.3 Identify unknown acid radicals (e.g. Chloride, Nitrate, Sulphate, Carbonate)

**REFERENCE BOOKS:**

1. Higher secondary Chemistry (paper 1<sup>st</sup> and 2<sup>nd</sup>) -Dr.Gazi Md.Ahsanul Karim. And Md.Robiul Islam
2. Higher secondary Chemistry (Paper 1<sup>st</sup> and 2<sup>nd</sup>) -Dr.Soroz kanti Singha Hazari .
3. An Introduction to Metallic corrosion and its prevention - Raj Narayan.
4. Organic Chemistry - Morrison and Boyd.
5. Inorganic Chemistry - Ali Haider

# BASIC ELECTRICITY (66711)

T	P	C
3	3	4

## OBJECTIVES:

- To familiarize the basic electrical quantities & laws and to apply those in solving problems of electrical circuits.
- To acquaint with electrochemistry, electromagnetism, electromagnetic induction and electrostatic.
- To introduce electrical wiring.

## SHORT DESCRIPTION:

Electric current, voltage, resistance ; Ohm's law; conductors, semiconductors and insulators; Basic electrical circuits; Power and energy; Basic electrochemistry; Electromagnetism; Electromagnetic induction; Electrostatics; Wires and cables; Hand tools used in wiring; House wiring; Controlling devices; Protective devices; Earthing.

## DETAIL DESCRIPTION:

### Theory:

#### 1. Understand electricity and its nature.

- 1.1 State the meaning of electricity.
- 1.2 Describe the structure of atom.
- 1.3 Define current, voltage and resistance.
- 1.4 State the units of current, voltage and resistance.

#### 2. Understand conductor, semiconductor and insulator.

- 2.1 Define conductor, semiconductor and insulator.
- 2.2 Explain the conductor, semiconductor, and insulator according to electron theory.
- 2.3 List different types of conductors, semiconductors and insulators.
- 2.4 Describe the factors affecting the resistance of a conductor.
- 2.5 State laws of resistance.
- 2.6 Prove the relation,  $R = \rho \frac{L}{A}$
- 2.7 Explain the meaning of resistivity and name the unit of resistivity.
- 2.8 Solve problems relating to laws of resistance.

#### 3. Understand Ohm's Law

- 3.1 State Ohm's law.
- 3.2 Explain the limitations of Ohm's law
- 3.3 Deduce the relation among current, voltage and resistance.
- 3.4 Solve problems relating to Ohm's law.

#### 4. Understand electric circuit.

- 4.1 Define electric circuit.
- 4.2 State the elements of electric circuit
- 4.3 Classify electric circuits.
- 4.4 Define series circuit, parallel circuit and mixed circuit.
- 4.5 Describe the characteristics of series circuit and parallel circuit.
- 4.6 Calculate the equivalent resistance of series circuit, parallel circuit and mixed circuit.
- 4.7 Solve problems relating to series, parallel and mixed circuit.

#### 5. Apply the concept of electrical power and energy.

- 5.1 Define electrical power and energy.
- 5.2 State the unit of electrical power and energy.

- 5.3 Show the relation between electrical power and energy.
- 5.4 List the name of instruments for measuring electrical power and energy.
- 5.5 Draw the connection diagram of wattmeter and energy meter in an electric circuit.
- 5.6 Solve problems relating to electrical power and energy.

#### **6. Understand the principles of Joule's law.**

- 6.1 Describe the heating effect of electricity.
- 6.2 Explain Joule's law regarding the development of heat in electric circuit.
- 6.3 Explain mechanical equivalent of heat (J)
- 6.4 Solve problems relating to Joule's law.

#### **7. Understand the concept of cells.**

- 7.1 Describe the meaning of potential difference.
- 7.2 Define the meaning of cell.
- 7.3 Classify cell.
- 7.4 Define primary cell
- 7.5 List different types of primary cell
- 7.6 Describe the construction and principle of action of a simple voltaic cell.
- 7.7 List the defects of a simple voltaic cell.
- 7.8 Describe the causes of defects of a simple voltaic cell.
- 7.9 Describe the methods of removing the defects of a simple voltaic cell.
- 7.10 Distinguish between primary & secondary cell

#### **8. Understand the concept of capacitors and inductors.**

- 8.1 Define capacitor and capacitance.
- 8.2 Name the unit of capacitance.
- 8.3 Name the different types of capacitor.
- 8.4 State the uses of capacitor.
- 8.5 Define inductor and inductance.
- 8.6 Name the unit of inductance
- 8.7 Name the different types of inductor.
- 8.8 State the uses of inductor.
- 8.9 Determine the equivalent capacitance of a number of capacitors connected in series and parallel.
- 8.10 Explain the energy storage in a capacitor.
- 8.11 Solve the problems relating to capacitors.

#### **9 Understand Electromagnetism.**

- 9.1 Describe magnetic field, magnetic lines of force and its properties.
- 9.2 Describe field intensity and magnetic flux density.
- 9.3 Distinguish between absolute permeability and relative permeability.
- 9.4 Describe the concept of magnetic effect of electrical current.
- 9.5 States Maxwell's cork screw rule.
- 9.6 Explain the force experienced in a current carrying conductor in a magnetic field.
- 9.7 State Fleming's left hand rule.
- 9.8 Explain the work done by a moving conductor in a magnetic field.
- 9.9 Explain the force between two parallel current carrying conductors.

#### **10. Understand electromagnetic induction.**

- 10.1 Define Faraday's laws of electromagnetic induction.
- 10.2 Describe the magnitude of dynamically induced emf and statically induced emf.
- 10.3 Solve problems relating to emf generation.
- 10.4 Define Lenz's law and Fleming's right hand rule for determining the direction of induced emf and current.

- 10.5 Define self-induced emf and self-inductance.
- 10.6 Explain inductance of an iron cored inductor.
- 10.7 Define mutual inductance and co-efficient of coupling.

**11. Understand the uses of wires and cables.**

- 11.1 Define electrical wires and cables.
- 11.2 Distinguish between wire and cable.
- 11.3 Describe the construction and uses of PVC, VIR, TRS or CTS and flexible wires
- 11.4 Describe the procedure of measuring the size of wires and cables by wire gauge.
- 11.5 Describe the current carrying capacity of a wire.

**12. Understand the usefulness of joints and splices.**

- 12.1 Define the meaning of joints and splices.
- 12.2 State the five steps of making a joint.
- 12.3 Describe the procedure to make a pig tail joint, western union joint, Britannia joint, duplex joint, tap joint and simple splice.
- 12.4 Give example of the uses of above mentioned joints.

**13. Understand the different methods of house wiring.**

- 13.1 State the meaning of wiring.
- 13.2 List the types of wiring.
- 13.3 State the procedure for channel wiring, surface conduit wiring and concealed wiring.
- 13.4 State the types of wiring used in :
  - a) Residential building.
  - b) Workshop
  - c) Cinema hall/Auditorium
  - d) Temporary shed
- 13.5 List the name of fittings used in different types of electrical wiring.

**14. Understand the construction and uses of controlling devices.**

- 14.1 Define controlling device.
- 14.2 Name the different types of controlling device.
- 14.3 Describe the constructional features and uses of tumbler switch, iron clad switch, push button switch and gang switch.

**15. Understand the construction and uses of protective devices.**

- 15.1 Define protective device.
- 15.2 Name the different types of protective device.
- 15.3 Name the different types of fuse used in house wiring.
- 15.4 Describe the construction and uses of renewable fuse.
- 15.5 Name the different types of circuit breaker used in house wiring.
- 15.6 Describe safety procedure against electrical hazards.
- 15.7 List the performance of safety practices for electrical equipment, machines and accessories.

**16. Understand the necessity of earthing.**

- 16.1 Define earthing and mention the elements of earthing.
- 16.2 Explain the necessity of earthing.
- 16.3 Name different types of earthing.
- 16.4 List the value of earthing resistance in different conditions.

**17. Apply the principle of controlling electrical circuit by switch.**

- 17.1 Sketch the wiring diagram of one lamp controlled by one SPST switch and describe its uses.

- 17.2 Sketch the wiring diagram of one lamp controlled by two SPDT switches and describe its uses.
- 17.3 Draw the wiring diagram of a calling bell.
- 17.4 Draw the wiring diagram of a calling bell with more than one lamp controlled from more than one point.
- 17.5 Draw the wiring diagram of a fluorescent tube light circuit.
- 17.6 Describe the working principle of fluorescent tube light.

## **PRACTICAL:**

### **1. Practice with electrical measuring instruments.**

- 1.1 Identify Voltmeters, Ammeters, Ohmmeter, Wattmeter, Energy meter and AVO meter.
- 1.2 Select & read the scale of given meters.
- 1.3 Connect correctly voltmeter, ammeter, wattmeter and energy meter to a given circuit.

### **2. Verify Ohm's Law.**

- 2.1 Sketch the circuit diagram for the verification of Ohm's Law.
- 2.2 List tools, equipment and materials required for the experiment.
- 2.3 Prepare the circuit according to the circuit diagram using proper equipment.
- 2.4 Check all connections before the circuit is energized.
- 2.5 Verify the law by collecting relevant data.

### **3. Verify the characteristics of series and parallel circuits.**

- 3.1 Draw the working circuit diagram.
- 3.2 List tools, equipment and materials required for the experiment.
- 3.3 Prepare the circuit according to the circuit diagram using proper equipment.
- 3.4 Check all connections before the circuit is energized.
- 3.5 Record data and verify that in a series circuit total voltage and resistance is equal to the summation of individual voltage and resistance respectively but total current is equal to the individual current.
- 3.6 Record data and verify that for a parallel circuit supply voltage is equal to the branch voltage, supply current is equal to summation of branch currents and total conductance is equal to the summation of branch conductance.

### **4. Show skill in measuring the power of an electric circuit.**

- 4.1 Sketch the necessary circuit diagram of an electrical circuit with electrical load, ammeter, voltmeter and wattmeter.
- 4.2 Prepare the circuit according to the circuit diagram using ammeter, voltmeter and wattmeter.
- 4.3 Record the power, measured by the wattmeter and verify the reading with that of calculated from ammeter and voltmeter.
- 4.4 Compare the measured data with that of calculated and rat power.

### **5. Show skill in measuring the energy consumed in an electrical circuit.**

- 5.1 Sketch the necessary diagram of an electric circuit with wattmeter, energy meter and electrical load.
- 5.2 Prepare the circuit according to the circuit diagram user wattmeter and energy meter.
- 5.3 Record the energy measured by the energy meter and verify with that of calculated from wattmeter for a fixed time.

### **6. Make artificial magnets.**

- 6.1 Make an artificial magnet by rubbing method (Single touch)
- 6.2 Make an artificial magnet by divided touch method.
- 6.3 Make an artificial magnet by passing electrical current.
- 6.4 Detect the polarity of the produced artificial magnet with the help of a compass needle.

### **7. Practice with hand tools, wires and cables.**

- 7.1 List the hand tools used in electrical wiring.

- 7.2 Identify the hand tools used in electrical wiring.
- 7.3 Draw neat sketches of hand tools used in electrical wiring.
- 7.4 Identify different types of wires and cables.
- 7.5 Measure the diameter of the identified wire and cables using standard wire gauge.

**8. Show skill in making a duplex joint and a T-joint.**

- 8.1 Sketch a duplex joint and a T-joint
- 8.2 Perform skinning and scraping of two pieces of PVC duplex cables and two pieces of simplex PVC cables.
- 8.3 Make the joints according to sketches.
- 8.4 Write a report.

**9. Show skill in preparing wiring circuit of two lamps controlled from the points separately.**

- 9.1 Sketch a working circuit of two lamps controlled from two points separately.
- 9.2 Make the wiring circuit using required materials and equipment on a wiring board.
- 9.3 Test the connection of circuit by providing proper supply.

**10. Show skill in preparing wiring circuit of one lamp controlled from the points.**

- 10.1 Sketch a working diagram of one lamp controlled by two SPD tumbler switches.
- 10.2 Complete the wiring circuit using required materials and equipment on wiring board.
- 10.3 Test the connection of circuit by providing proper supply.

**11. Show skill in preparing wiring circuit of one bell with two indicating lamps controlled from two points.**

- 11.1 Sketch a working diagram of one bell with two indicating lamps controlled by two push button switches.
- 11.2 Make the wiring circuit using required materials and equipment on wiring board.
- 11.3 Test the connection of circuit by providing proper supply.

**12. Show skill in preparing wiring circuit of a fluorescent tube light.**

- 12.1 Sketch a working diagram of a fluorescent tube light circuit.
- 12.2 Make the connection of a fluorescent tube light circuit using required materials and equipment.
- 12.3 Test the connection of the circuit by providing supply.

**REFERENCE BOOKS:**

- |  |                  |
|--|------------------|
| 1 A text book of Electrical Technology       | - B. L. Theraja  |
| 2 Basic Electricity                          | - Charles W Ryan |
| 3 Basic Electrical theory and Practice       | - E. B. Babler   |
| 4. Solved Examples in Electrical Calculation | - D. K. Sharma   |
| 5. Introduction to Electrical Engineering    | - V.K. Mehta     |

# ELECTRICAL ENGINEERING MATERIALS (66713)

T	P	C
2	0	2

## OBJECTIVES:

- Develop and understand the concept of conducting materials.
- Develop and understand the concept of insulating materials.
- Develop and understand the concept of semiconducting materials.
- Understand the magnetic materials.
- Understand the transformer oil.
- Understand the optical fiber.

## SHORT DESCRIPTION:

Conducting and non-conducting materials, conducting materials, high resistive materials, magnetic materials, insulating materials, transformer oil, semiconducting materials, optical fiber.

## DETAIL DESCRIPTION:

### 1. Differentiate the conducting and non-conducting materials.

- 1.1 Define conducting, non-conducting and semi-conducting materials.
- 1.2 Explain energy band diagram of conducting, non-conducting and semi-conducting materials.
- 1.3 Distinguish between conducting, non-conducting and semi-conducting materials.
- 1.4 List at least five names of each group of materials.

### 2. Understand the concept of receptivity and mechanical properties of conducting materials.

- 2.1 Define receptivity of materials.
- 2.2 Define temperature coefficient of materials and melting point of solid materials.
- 2.3 List the factors affecting receptivity of electrical materials.
- 2.4 Define malleability, conductivity and tensile stress.
- 2.5 Describe the mechanical properties and receptivity of hard and annealed copper, aluminum, low and high tensile steel.

### 3. Understand the concept of contact materials.

- 3.1 Define contact materials.
- 3.2 Describe the physical and electrical properties of silver, tungsten, carbon and copper.
- 3.3 Explain the uses of copper, carbon and graphite as materials for brush.
- 3.4 Compare the advantages of using copper, carbon and graphite as brush materials.

### 4. Understand the high resistive materials

- 4.1 Define the term high resistivity.
- 4.2 State general properties of nichrome, eureka, manganin, german silver, tungsten and carbon.
- 4.3 State composition of nichrome, eureka, manganin, german silver and tungsten.
- 4.4 List uses of high resistive materials.

### 5. Understand the concepts of fuse materials

- 5.1 Define fuse, metal and alloys.
- 5.2 Describe the properties of fuse material.
- 5.3 List the name of metals and alloys to be used as fuse materials.
- 5.4 Compare the advantage of using metals and alloys as fuse materials.

### 6. Understand the magnetic properties of materials.

- 6.1 Define magnetic materials, soft magnetic materials and hard magnetic materials with examples.
- 6.2 Classify the magnetic materials as diamagnetic, paramagnetic and ferromagnetic types.

- 6.3 Describe the composition and properties of soft magnetic materials.
- 6.5 Describe composition and properties of hard magnetic materials.
- 6.6 List the use of hard and soft magnetic materials.
- 6.7 Describe magnetization curve, hysteresis loop and hysteresis loss.

## **7. Understand the concepts of insulating material.**

- 7.1 Describe insulating materials.
- 7.2 State the importance of insulating materials.
- 7.3 State the basic of classifying insulating materials.
- 7.4 Interpret the classification of insulating materials on the basis of temperature.
- 7.5 State the criteria for selection of proper insulating materials.
- 7.6 List the properties of ideal insulating materials.
- 7.7 State electrical properties of insulating materials.
- 7.8 Name the normal range for the receptivity of a low grade, medium grade and high grade insulating materials.
- 7.9 State the effect of temperature on the insulating materials.
- 7.10 State the factors affecting the electric breakdown strength of insulating materials.
- 7.11 State the temperature limit for class "C" and class "F" insulating materials.
- 7.12 Name insulating materials which can withstand temperature higher than 180 degree C.
- 7.13 State the effect of moisture on the insulating materials.
- 7.14 Define "Loss angle" with respect to an insulating materials.

## **8. Understand the characteristics of solid insulating materials.**

- 8.1 Define solid insulating materials.
- 8.2 List the solid insulating materials.
- 8.3 List the fibrous type of insulating materials.
- 8.4 State the properties and application of cotton, varnish, cloth and insulating materials.
- 8.5 Compare the properties and applications of cotton, varnish, cloth and silk insulating materials.
- 8.6 State the properties of impregnated paper insulation.
- 8.7 List the application of impregnated paper insulation materials.
- 8.8 State the properties of glass and asbestos insulation.
- 8.9 List the application of glass and asbestos insulation.
- 8.10 Describe the properties and application of ceramic/porcelain insulating materials.
- 8.11 List two types of Mica insulating materials.
- 8.12 State the properties and application of Mica.
- 8.13 Write down the properties of Poly ISO Butyl (PIB) insulating materials.
- 8.14 State the properties of cross link Poly Ethylene (XLPE) insulating materials.
- 8.15 List the application of Poly ISO Butyl and cross Link Poly Ethylene insulating materials.
- 8.16 Short description and application of Silicon resins and Epoxy resins.
- 8.17 State the importance of mechanical properties for insulating materials.
- 8.18 Define gasket.
- 8.19 Mention the composition, properties and application of gasket.
- 8.20 Prepare a list of insulating materials used in transformer.

## **9. Understand the characteristics of Liquid Insulating Materials.**

- 9.1 Define insulating oil.
- 9.2 State the properties of insulating oil.
- 9.3 State the physical properties of liquid insulating materials.
- 9.4 Describe the electrical properties of liquid insulating materials.
- 9.5 State thermal properties of liquid insulating materials.
- 9.6 Describe the causes of failure of insulating oil.
- 9.7 Compare the advantages and disadvantages of liquid insulating materials with the solid insulating materials.
- 9.8 State the uses of insulating oil in high voltage equipment.

## **10. Understand Transformer oil and Silica gel.**

- 10.1 Define transformer oil.
- 10.2 Describe the properties of transformer oil.
- 10.3 Explain the testing of dielectric strength of transformer oil.
- 10.5 Discuss the contamination and purification of transformer oil.
- 10.6 Define silica gel.
- 10.7 Mention the composition of silica gel.
- 10.8 Describe the properties of silica gel.
- 10.9 Discuss the importance of silica gel.

## **11. Understand the characteristics of gaseous insulating materials.**

- 11.1 Define gaseous insulating materials.
- 11.2 List the gaseous insulating materials.
- 11.3 State the characteristics of gaseous insulating materials.
- 11.4 State the characteristics of SF<sub>6</sub> gas.
- 11.5 List the advantages of SF<sub>6</sub> gas.
- 11.6 State the characteristics of Nitrogen.
- 11.7 State the characteristics of Hydrogen.
- 11.8 List the uses of gaseous insulating materials.

## **12. Understand the semiconducting materials.**

- 12.1 Define semiconductor.
- 12.2 Classify semiconducting materials.
- 12.3 Describe the properties of semiconducting materials.
- 12.4 State the importance of semiconducting materials.
- 12.5 Identify the physical and electrical properties of semiconductor.
- 12.6 State the Hall Effect.
- 12.7 Describe the uses of semiconducting materials.
- 12.8 Discuss the uses of photo conducting materials.
- 12.9 Describe Gallium Arsenide materials.
- 12.10 Describe the properties of Gallium Arsenide materials.
- 12.11 Describe the uses of Gallium Arsenide materials.

## **13. Understand the concept of optical fiber.**

- 13.1 Define optical fiber.
- 13.2 Materials used for commercial optical fiber.
- 13.3 Describe the construction details of optical fiber.
- 13.4 Discuss the types of optical fiber.
- 13.5 Describe the advantages of optical fiber.
- 13.6 Describe the applications of optical fiber.

## **REFERENCE BOOKS**

- Engineering Materials by Dakker
- Engineering Materials by Sushil
- Optical Fiber Communications by John M. Senior
- Text Book of Electrical Engineering by Raina, Bhattacharya, Joneja
- Electrical Engineering Materials by N. Alagappan & N.T Kumer

# BASIC ELECTRONICS (66811)

T	P	C
2	3	3

## OBJECTIVES:

- To provide the understanding skill on Electronic Components, Electronic measuring and testing equipment.
- To provide understanding and skill on the basic concept of semiconductor junction and to identify physically a range of semiconductor diodes.
- To develop comprehensive knowledge and skill on special diodes and devices.
- To develop the abilities to construct different rectifier circuits.
- To provide understanding of the basic concept and principle of transistor and to identify physically a range of transistor.
- To provide understanding and skill on the basic concept of logic gates.

## SHORT DESCRIPTION:

Electronic components; measuring and test equipment; color code and soldering; semiconductor; P-N junction diode; special diodes and devices; power supply; transistor; transistor amplifier; logic gates.

## DETAIL DESCRIPTION:

### Theory:

#### 1. Understand the Electronics, its components and measuring and testing equipment.

- 1.1 Define electronics.
- 1.2 Describe the scope of electronics.
- 1.3 Describe the active and passive components used in electronic circuits.
- 1.4 Define resistor, inductor and capacitor and mention the function of those in electronic circuits.
- 1.5 Describe the procedure of determining the value of resistor, inductor and capacitor using numeric and color code.
- 1.6 Describe the function of (i) Ammeter, (ii) Voltmeter, (iii) AVO meter, (iv) Function Generator, (v) Logic Probe, (vi) Semiconductor Device Tester and (vii) Oscilloscope.

#### 2. Understand the Concept of Semiconductor used in Electronics.

- 2.1 Define Semiconductor.
- 2.2 Describe covalent bond and the effect of temperature on Semiconductor.
- 2.3 Explain the energy band diagram of conductor, semiconductor and insulator.
- 2.4 Explain the characteristics of carbon, silicon, germanium and gallium arsenide.
- 2.5 Describe the classification of Semiconductor.
- 2.6 Describe the generation & recombination of hole and electron during doping in extrinsic semiconductor.
- 2.7 Describe the formation of P-type & N-Type semiconductor material.
- 2.8 Explain the majority & minority charge carriers of P-type & N-Type Semiconductor.

#### 3. Understand the Concept of P-N Junction Diode

- 3.1 Define PN junction diode
- 3.2 Describe the formation of depletion layer in PN junction.
- 3.3 Discuss potential barrier, drift & diffusion current and their physical significance.
- 3.4 Explain forward and reverse bias in PN junction with barrier voltage.
- 3.5 Mention the behavior of PN junction under forward and reverse bias.
- 3.6 Explain the forward and reverse Voltage-Current (VI) characteristics curve of PN junction diode.
- 3.7 Define (i) static resistance, (ii) dynamic resistance, (iii) forward breakdown voltage, (iv) peak inverse voltage (PIV) and (v) reverse break down voltage.

3.8 Describe the specification of PN Junction diode.

#### 4. Understand the DC power supply.

- 4.1 Define dc power supply and describe its importance in electronics.
- 4.2 Define regulated and unregulated power supply.
- 4.3 Describe the operation of a typical regulated dc power supply with block diagram.
- 4.4 Define rectifier and rectification.
- 4.5 Explain the operation of half wave, full wave and bridge rectifier circuit.
- 4.6 Determine the ripple factor, efficiency and TUF of half wave, full wave and bridge rectifier.
- 4.7 Define filter circuit and explain the operation of capacitor, inductor-capacitor and pi ( $\pi$ ) filter circuit.

#### 5. Understand the Concepts of Special diode.

- 5.1 Define Zener Diode.
- 5.2 Describe the operation of Zener diode.
- 5.3 Explain VI characteristics of Zener diode.
- 5.4 Explain Zener diode as a auto-variable resistor.
- 5.5 Describe the application of Zener diode in (i) voltage stabilization, (ii) meter protection and (iii) peck clipper circuits.
- 5.6 Describe the construction, operation and application of (i) Tunnel diode, (ii) Varactor diode, (iii) Schottky diode, (iv) Step-Recovery diode, (v) PIN diode, (vi) LED, (vii) LCD, (viii) photo diode and (ix) Solar cell.

#### 6. Understand the construction and operation of Bipolar Junction Transistor (BJT)

- 6.1 Define Transistor.
- 6.2 Describe the construction of PNP and NPN Transistor.
- 6.3 State the biasing rules of BJT.
- 6.4 Explain the mechanism of current flow of PNP and NPN Transistor.
- 6.5 Establish the relation among Base, Emitter and Collector current ( $I_E = I_C + I_B$ ).
- 6.6 Draw the three basic transistor configuration (CB, CC, CE) circuits.
- 6.7 Describe current amplification factor  $\alpha$ ,  $\beta$  and  $\gamma$ .
- 6.8 Establish the relation among  $\alpha$ ,  $\beta$  and  $\gamma$ .
- 6.9 Solve problem related to  $I_E$ ,  $I_C$ ,  $I_B$ ,  $\alpha$ ,  $\beta$  and  $\gamma$

#### 7. Understand the concept of BJT Amplifier

- 7.1 Define (i) amplifier, (ii) amplification and (iii) gain.
- 7.2 Mention the classification of amplifier.
- 7.3 Describe the principle of operation of a common emitter (ce) amplifier.
- 7.4 Draw DC & AC equivalent circuits of the CE amplifier circuit.
- 7.5 Mention the formula of (i) input resistance, (ii) output resistance, (iii) current gain, (iv) voltage gain and (v) power gain.
- 7.6 Solve problem related to different gain and resistance.

#### 8. Understand the main feature of digital electronics

- 8.1 Describe the difference between analog and digital system.
- 8.2 State the advantage of digital system over analog system.
- 8.3 Define logic gate.
- 8.4 Describe the basic logic gates and their functions (AND gate, OR gate and NOT circuit or INVERTER).
- 8.5 Describe the NAND, NOR, XOR & XNOR logic gates and their functions.
- 8.6 Define Truth table and Prepare truth table to describe the functions of AND, OR, NOT, NAND, NOR, XOR and XNOR logic gates.

## **PRACTICAL:**

### **1 Show skill in identifying the electronic components.**

- 1.1 Observe the electronic components board and read the manuals.
- 1.2 Identify the different types of resistor with their values, tolerance and wattage.
- 1.3 Identify the different types of potentiometer with their values and wattage.
- 1.4 Identify the different types of capacitor with their values, dc working voltages and types.
- 1.5 Identify the different types of diode and rectifier with the specification numbers and specifications.
- 1.6 Identify the different types of transistor with their specification numbers and specifications.
- 1.7 Identify the different types of LED's, IC's and miniature relays with their specification numbers and specifications.
- 1.8 Identify different types of transformer with their specifications.
- 1.9 Identify different inductors with their values and current ratings.
- 1.10 Study the printed circuit boards.
- 1.11 Sketch the symbols of components used in electronic circuits.
- 1.12 Describe the basic function of each component.
- 1.13 Write a report on above activities.

### **2 Show skill in electrical measurement.**

- 2.1 Perform simple voltage and current measurements on basic series and parallel resistor circuits using the following instruments.
  - a) Voltmeter and ammeter.
  - b) AVO meter.
  - c) Digital multi-meter.
  - d) Basic CRO.

### **3 Show skill for determining the values of different resistors and capacitors with the help of color code.**

- 3.1 Select color code resistors of different values.
- 3.2 Identify the colors and their numerical numbers.
- 3.3 Determine the value of resistors with tolerance.
- 3.4 Determine the value of capacitors and dc working voltage.
- 3.5 Write a report on above activities.

### **4 Show skill in performing soldering.**

- 4.1 Select wires (single strand and multi strand) and cut wires to required length.
- 4.2 Select soldering iron, soldering tag and soldering lead.
- 4.3 Remove wire insulation to required length.
- 4.4 Clean and tin both iron and work piece.
- 4.5 Use a tinned iron in order to transfer adequate heat to the joint.
- 4.6 Joint two single-stranded wires mechanically and solder.
- 4.7 Joint two multi-strand wires mechanically and solder.
- 4.8 Perform soldering exercise for making three dimensional wire frames.
- 4.9 Sketch and write a report on the job.

### **5 Show skill in soldering & de-soldering of electronic components and wires to the other components and circuit boards.**

- 5.1 Select electronic components, wires and PCB.
- 5.2 Determine the rating of the soldering iron suitable for the work piece.
- 5.3 Clean and tin both iron & work piece.
- 5.4 Feed new soldering materials to the tinned and heated joint in order to produce a correct soldering.
- 5.5 Check the quality of soldering.
- 5.6 Clean and tin iron and de-solder the joint and components.
- 5.7 Use solder suckers and solder braid for de-soldering.

5.8 Write a report on the Job.

**6 Show skill in checking the semiconductor diode.**

- 6.1 Collect a range of semi-conductor diodes and manufacturer's literature.
- 6.2 Select the digital multi-meter and set the selector switch to ohm range.
- 6.3 Determine the specification of semi-conductor diode.
- 6.4 Compare the determined specification with that of manufacturer's literature.
- 6.5 Measure forward & reverse resistances of the diode.
- 6.6 Identify P and N side of the diode.
- 6.7 Determine the condition of the diode.

**7 Show skill in sketching forward and reverse characteristics curves of a semiconductor diode.**

- 7.1 Select meter, power supply, components and materials.
- 7.2 Complete circuit according to circuit diagram for forward bias.
- 7.3 Check all connections.
- 7.4 Measure forward bias and corresponding forward current.
- 7.5 Record results in tabular form.
- 7.6 Connect circuit according to circuit diagram of reverse bias.
- 7.7 Measure reverse bias and corresponding reverse current.
- 7.8 Record results in tabular form.
- 7.9 Sketch the curves from collected data.

**8 Show skill in sketching waves of half-wave rectifier circuit.**

- 8.1 Select meter, component, oscilloscope and materials.
- 8.2 Complete circuit of a half wave rectifier according to the circuit diagram.
- 8.3 Check the circuit before operation.
- 8.4 Measure the input and output voltage and observe wave shapes in the oscilloscope.
- 8.5 Sketch the input and output voltage wave shapes.

**9 Show skill in sketching waves of full-wave center tapped rectifier circuit.**

- 9.1 Select meter, component, oscilloscope and materials.
- 9.2 Complete a full-wave rectifier circuit according to the circuit diagram.
- 9.3 Check the circuit supply & polarity of supply.
- 9.4 Measure the input & output voltages and observe wave shapes in the oscilloscope.
- 9.5 Sketch the output voltage wave shape.
- 9.6 Compare the result with full-wave rectifier circuit.

**10 Show skill in constructing full-wave bridge rectifier.**

- 10.1 Select meter, component, oscilloscope and materials.
- 10.2 Build the circuit according to the circuit diagram.
- 10.3 Check the circuit.
- 10.4 Measure the input and output voltages.
- 10.5 Observe wave shape.
- 10.6 Compare the result with other rectifiers.

**11 Show skill in identifying the bipolar junction transistor.**

- 11.1 Select PNP and NPN bipolar junction transistors.
- 11.2 Take DMM and manufacturer's literature of transistor.
- 11.3 Identify transistor terminals.
- 11.4 Measure base-emitter, base-collector, forward and reverse resistance.
- 11.5 Determine the specifications with the help of manufacturer's literatures.
- 11.6 Identify PNP and NPN transistors.

**12 Show skill in determining input and output characteristics of a transistor in common emitter connection.**

- 12.1 Select component, AVO meters, circuit board and required materials.
- 12.2 Complete the circuit.
- 12.3 Adjust the biasing voltage to appropriate point.
- 12.4 Record input and output voltage and current.
- 12.5 Plot the curve with recorded data.

**13 Show skill in testing special diodes.**

- 13.1 Select different types of special diodes.
- 13.2 Set the AVO meter in the ohm scale.
- 13.3 Measure resistances for each of two terminals.
- 13.4 Determine the condition (good and bad).
- 13.5 Determine the different terminals.

**14 Verify the truth tables of different types of logic gate.**

- 14.1 Select the specific gate.
- 14.2 Prepare the experimental circuit.
- 14.3 Adjust the power supply.
- 14.4 Verify the truth table.

**REFERENCE BOOKS:**

- |  |   |
|--|---|
| 1. A Text Book Of Applied Electronics    | - R.S. Sedha                            |
| 2. Principles Of Electronics             | - V. K. Mehta                           |
| 3. Basic Electronics (Solid Stater)      | - B. L. Theraja                         |
| 4. Electronic Devices And Circuit Theory | - Robert Boylestad<br>- Louis Nashelsky |

