

**BANGLADESH TECHNICAL EDUCATION BOARD**

**4-YEAR DIPLOMA-IN-ENGINEERING  
PROGRAM**

**AUTOMOBILE TECHNOLOGY**

**SYLLABUS**

**FIRST AND SECOND SEMESTER**

**Automobile Technology (62)**  
**1<sup>st</sup> 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.	1011	Engineering Drawing	0	6	2	-	-	50	50	100
2.	5712	English-1	2	0	2	20	80	-	-	100
3.	5812	Physical Education & Life Skill Development	0	2	1	-	-	50	-	50
4.	5911	Mathematics -1	3	3	4	30	120	50	-	200
5.	5913	Chemistry	3	3	4	30	120	25	25	
6.	6211	Automobile fundamentals	3	3	4	30	120	25	25	200
7.	7011	Basic workshop Practice	0	6	2	-	-	50	50	200
		<b>Total</b>	<b>11</b>	<b>23</b>	<b>19</b>	<b>110</b>	<b>440</b>	<b>200</b>	<b>200</b>	<b>950</b>

**Automobile Technology (62)**  
**2<sup>nd</sup> 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.	1012	Engineering Materials	2	3	3	20	80	25	25	150
2.	5722	English-2	2	2	3	20	80	50	-	150
3.	5912	Physics-1	3	3	4	30	120	25	25	200
4.	5921	Mathematics -2	3	3	4	30	120	50	-	200
5.	6221	Basic RAC & Transport refrigeration	2	6	4	20	80	50	50	200
6.	6621	Computer application -1	0	6	2	-	-	50	50	100
7.	6711	Basic Electricity	3	3	4	30	120	25	25	200
		<b>Total</b>	<b>15</b>	<b>26</b>	<b>24</b>	<b>150</b>	<b>600</b>	<b>225</b>	<b>225</b>	<b>1200</b>

<b>1011</b>	<b>ENGINEERING DRAWING</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>6</b>	<b>2</b>

### **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 provide the skill of freehand sketching with shades and shadows.
- To provide the basic skill of drawing orthographic views.

### **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; Freehand sketching (with shades and shadows), Drawing orthographic views.

### **DETAIL DESCRIPTION**

#### **DRAWING INSTRUMENTS AND MATERIALS**

- 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 Use 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.

## LETTERING NUMBERING AND TITLE STRIP

### 2 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 and 7 : 5 proportions and height.
- 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.

## ALPHABET OF LINES AND DIMENSIONING

### 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.

## CONSTRUCTION OF SCALE

### 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 meters, centimeters and millimeters 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.

## GEOMETRICAL CONSTRUCTIONS

### 6 Construct geometric figures (lines, triangles & squares).

- 6.1 Divide given straight line into any number of equal parts.
- 6.2 Draw perpendicular when the given point is at or near the end of the line.
- 6.3 Bisect a given angle.
- 6.4 Trisect a given angle.
- 6.5 Draw a straight line parallel to given straight line at some given distance.
- 6.6 Draw a square on a given straight line.

### 7 Construct geometric figures (circles and regular polygons).

- 7.1 Draw regular polygons i.e. pentagon, hexagon and octagon having given one side.
- 7.2 Locate the center of circle and arc.
- 7.3 Inscribe circle in triangles.
- 7.4 Inscribe a circle about a triangle.
- 7.5 Divide a triangle into any number of equal parts.
- 7.6 Draw an equilateral triangle equal in area of a square.
- 7.7 Determine the length of the circumference of circle.

## CONIC SECTIONS

### 8 Construct conic sections.

- 8.1 Draw an ellipse by concentric circle method.
- 8.2 Draw an ellipse by parallelogram method.
- 8.3 Draw an ellipse by four center method.
- 8.4 Draw a parabola having given foci and directrix.
- 8.5 Draw a parabola from given abscissa and ordinate.

## SYMBOLS

### 9 Adopt standard symbols in drawing.

- 9.1 Identify symbols used in drawing.
- 9.2 Draw a legend using symbols of different engineering materials.
- 9.3 Draw the symbols of different plumbing fittings and fixtures used in drawing.
- 9.4 Draw the symbols of different electrical fittings and fixtures used in drawing.
- 9.5 Interpret information from drawing containing standard symbols.

## **FREEHAND SKETCHING (WITH SHADES AND SHADOWS)**

### **10 Sketch freehand with shades and shadows.**

10.1 Produce freehand sketches of the following with shade and shadow technique:

- |                      |                      |
|----------------------|----------------------|
| a. Book              | h. Bib-cock          |
| b. Brick             | i. Bench vice        |
| c. Step              | j. Open box          |
| d. Cylinder          | k. Electric lamps    |
| e. Hand tubewell     | l. Electric switches |
| f. Spade with handle | m. Electric fan      |
| g. Pipe wrench       | n. Nuts and bolts    |

10.2 Use different materials and methods of shading and shadowing freehand sketches.

## **ORTHOGRAPHIC PROJECTION**

- 11 Translate pictorial views of simple objects into orthographic views.  
 Identify different planes.  
 Draw third angle orthographic views of simple objects.  
 Draw first and third angle views of a simple object and add proper dimensions.  
 Solve missing Lines problems of different objective.

## **REFERENCE BOOKS**

- |   |                             |   |                            |
|---|-----------------------------|---|----------------------------|
| 1 | Geometrical Drawing         | — | I H Morris                 |
| 2 | Pratham Engineering Drawing | — | Hemanta Kumar Bhattacharia |

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**ENGLISH – I**

<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>0</b>	<b>2</b>

**Objectives:**

After the completion of the course, learners will be able to develop-

- \* Listening with understanding
- \* The fluency of speech
- \* Reading with understanding
- \* Grammatical accuracy with emphasis on spelling & punctuation
- \* Creative writing
- \* Transferring information
- \* Communicating effectively

**CONTENTS****Seen comprehension**

Unit	Lesson	Title
Three: Learning English	1	Learning a language
	2	Why learn English
	3	How to learn English
Six: Our Environment	1	The environment and the ecosystem
	2	How the environment is polluted
	7	How to manage waste
Seven: Disasters we live with	5	The shake and the quake
Thirteen: We and our rights	2	Women have rights too.

N.B: The Unit mentioned refers to the Text Book (1<sup>st</sup> Paper) English for Today for class 11 – 12 by National Curriculum & Text Book Board, Dhaka.

**GRAMMAR****1. (a) Uses of Articles.**

- (b) Uses of Tense \*(Right forms of verbs with indicators)
- (c) Classify verbs: (Auxiliary, Principal, transitive, intransitive, finite, non-finite, causative, quasi-passive)
- (d) Uses of voice.

**2. Sentence:**

- (a) Sentence structure: (Assertive, Interrogative, Optative, Imperative, Exclamatory, Simple, Complex and Compound)
  - (b) Question making: WH, Yes/No, Tag question
3. Enrich vocabulary: synonyms, Antonyms
4. Change Parts of speech and uses of suffix and prefix.

**Communication**

- 1. Style of letters: (full blocked, blocked, semi- blocked)
- 2. Parts of writing official letters: Techniques of writing (Heading, reference, date, inside address, topic, greetings, complementary closing, signature, supplements.)
- 3. Write dialogues: (with teacher, principal, shopkeeper, hotel manager, station master, OC, DC, newcomer, buyers, doctor, friend, colleagues etc).

**4. Write a guided paragraph with questions.**

**5812 PHYSICAL EDUCATION AND LIFE SKILL DEVELOPMENT**

<b>T</b>	<b>P</b>	<b>C</b>
0	2	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**

Warming up; Yoga; Muscle developing with equipment; First aid; Games & sports; life skill development.

**DETAIL DESCRIPTION****1. National Anthem and Assembly**

- 1.1 Make assembly
- 1.2 Recitation of national anthem
- 1.3 National anthem in music

**2. Warming up**

- 1.1 General Warming-up :  
Head rotation, Hand rotation, Side twisting, Toe touching, Hip rotation, Keen twisting, Ankle twisting, Push up & Sit up.
- 1.2 Squad Drill :  
Line, File, Attention, Stand at easy, Stand easy, Left turn, Right turn, About turn, Mark time, Quick march, Right wheel, Left wheel, Open order march & Closed order march.
- 1.3 Specific warming up :  
Legs raising one by one, Legs raising in slanting position, Knee bending and nose touching, Heels raising, Toes touching & Laying position.
- 1.4 Mass Physical Exercise (Free hand) :  
Hand raising, Side twisting, Front & back bending, Front curl, Straight arms curl two hands, Hands raising overhead and Push up & Push down.

**3. Yoga**

- 3.1 Dhyanasan : Shabasan, Padmasan, Gomukhasan, Sharbangasan, Shirshsan
- 3.2 Shasthyasan : Halasan, Matshasan, Paban Muktasana, Ustrasana

**4. Muscle Developing with equipment**

- 4.1 Damball : Front curl, Hand sidewise stretching, Arms raising overhead.
- 4.2 Barball : Front press, Leg press, Rowing motion with leverage bar.
- 4.3 Rope climbing : Straight way climbing, Leg raising climbing.
- 4.3 Horizontal bar : Chinning the bar front grip, Chinning the bar wide back grip.
- 4.4 Jogging Machine : Slow, medium, and fast running
- 4.5 Rowing Machine :



5. **Show skill on conversation on day to day life**
  - 5.1 Today's Market price
  - 5.2 Festivals(religious festivals, National festivals)
  - 5.3 Celebration of National days
  - 5.4 Aim of life
  - 5.5 Visited historical places/sites
6. **Human relation**
  - 6.1 Family relation
  - 6.2 Relation with neighbor
  - 6.3 Humanitarian Service
  - 6.4 Service for handicapped (intelligent, physical, social etc.)
  - 6.5 Service for orphan / Patient
7. **Vote of appreciation**
  - 7.1 About dress
  - 7.2 For good work
  - 7.3 For good result
  - 7.4 For good news
8. **Telephone conversation**
  - 8.1 Use of telephone
  - 8.2 Courtesy for using telephone
  - 8.3 Receiving and sending messages through telephone
  - 8.4 Presenting the gist
9. **Stress Management**
  - 9.1 Habit to be a man of humor
  - 9.2 Positive thinking
  - 9.3 Habit to changing thinking
10. **Time Management**
  - 10.1 Determine essential time for a task
  - 10.2 Determine delay and unexpected time
  - 10.3 Determine time for daily activities
  - 10.4 Plan for daily activities
11. **Interview Technique**
  - 11.1 Mental preparation to face an interview
  - 11.2 Selection of dress for interview
  - 11.3 Introducing himself/herself to the interviewer
  - 11.4 Coping interview
12. **Team work**
  - 12.1 Organized a team
  - 12.2 Selection of team leader
  - 12.3 Distribution to the task to the members
  - 12.4 Accepting opinion of team members
  - 12.5 Completion of task as a team
13. **Social work**
  - 13.1 Tree plantation
  - 13.2 Community service (Sanitation, pure drinking water, social culture etc.)

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## MATHEMATICS-1

<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>3</b>	<b>4</b>

**OBJECTIVES**

- To acquaint the students with the basic terminology of Algebra.
- To be able to understand the complex numbers (J-operator) 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:** Set, Indices, Logarithms, 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****Algebra:****1 Apply the concept of set in solving problem.**

- 1.1 Define set, sub-set and universal set.
- 1.2 Define the different types of number set.
- 1.3 Define union of set, intersection of set, complement of set, power set, disjoint set.
- 1.4 Prove (using Venn diagram) the relation of following types where A, B and C are any set.
  - i)  $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
  - ii)  $(A \cup B)^c = A^c \cap B^c$
  - iii)  $(A \cap B)^c = A^c \cup B^c$
- 1.5 Find the number of elements in the union of two sets.
- 1.6 Solve the problems using above.

**2 Apply the laws of indices in solving mathematical problem.**

- 2.1 State the laws of indices.
- 2.2 Apply the laws of indices to solve the problem.
- 2.3 Perform algebraic operation on surd.
- 2.4 Use the scientific calculator in solving the problems of indices.

**LOGARITHMS****3 Apply the concept of logarithms.**

- 3.1 Define logarithm.
- 3.2 Prove the following laws of logarithm.
  - a)  $\text{Log}_a (m \times n) = \text{Log}_a m + \text{Log}_a n$
  - b)  $\text{Log}_a \left( \frac{m}{n} \right) = \text{Log}_a m - \text{Log}_a n$
  - c)  $\text{Log}_a (m)^n = n \text{Log}_a m$
  - d)  $\text{Log}_b a \times \text{Log}_a b = 1$
  - e)  $\text{Log}_a 1 = 0$
- 3.3 Solve problems using 3.2.
- 3.4 State the difference between Napierion and common logarithms.

**4 Understand the concept of AP & GP.**

- 4.1 Define AP and common difference.
- 4.2 Find last term and sum of n terms, given first term and common difference.
- 4.3 Define GP and common ratio.
- 4.4 Find the sum of n terms given first and common ratio.

**5 Apply the concept of polynomial in solving the problems.**

- 5.1 Define polynomials and polynomial equation.
- 5.2 Explain the roots and co-efficient of polynomial equations.
- 5.3 Find the relation between roots and co-efficient of the polynomial equations.
- 5.4 Determine the roots and their nature of quadratic polynomial equations.
- 5.5 Form the equation when the roots of the quadratic polynomial equations are given.
- 5.6 Find the condition of the common roots of quadratic polynomial equations.
- 5.7 Solve the problems related to the above.

**6 Understand the concept of complex numbers.**

- 6.1 Define complex numbers.
- 6.2 Perform algebraic operation (addition, subtraction, multiplication, division, square root) with complex number of the form  $a+jb$ .
- 6.3 Find the cube roots of unity.
- 6.4 Apply the properties of cube root of unity in solving problems.

**7 Apply the concept of permutation & Combination.**

- 7.1 Explain permutation.
- 7.2 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.
- 7.3 Solve problems of the related to permutation :
  - i) be arranged so that the vowels may never be separated.

From 10 man 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.

- 7.4 Explain combination.  
 7.5 Find the number of combination of  $n$  different things taken  $r$  at a time.  
 7.6 Explain  ${}^nC_r$ ,  ${}^nC_n$ ,  ${}^nC_0$   
 7.7 Find the number of combination of  $n$  things taken  $r$  at a time in which  $p$  particular things  
     i) Always occur ii) never occur.  
 7.8 Establish i)  ${}^nC_r = {}^nC_{n-r}$   
                     ii)  ${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$   
 7.9 Solve problems related to combination.

## 8 Apply the concept of binomial theorem.

- 8.1 State binomial expression.  
 8.2 Find the general term, middle term, equidistant term and term independent of  $x$ .  
 8.3 Use binomial theorem to find the value of  
     i)  $(0.9998)^2$ , correct to six places of decimal .  
     ii)  $(1 + \sqrt{2})^5 - (1 - \sqrt{2})^5$   
 8.4 Express the binomial theorem for negative and fractional index.  
 8.5 Solve problems of the following types:

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

## 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 followings 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 followings 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

$$\frac{\alpha}{2} \text{ and } \frac{\alpha}{3}$$

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.

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**CHEMISTRY**

<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>3</b>	<b>4</b>

**OBJECTIVES**

- To provide the students a background of basic science required for understanding technology subjects.
- To develop a working knowledge of common engineering and industrial materials including physical and chemical properties and to enable to determine through experiments the properties of such materials.
- To develop a basic knowledge and concept of chemical reactions of common engineering and industrial materials.
- To develop through experiments the understanding of fundamental scientific concept which will provide a common base for further studies in science and technology.

**SHORT DESCRIPTION**

Role of Chemistry in the field of engineering and technology; Matter and its changes; Symbol, valency and chemical equations; Different types of chemical reactions; Catalyst and Catalysis; Acid, Base and Salt; Properties of gases; Dalton atomic theory; Avogadro's hypothesis; Laws of chemical equivalent; Atomic Mass and molecular mass; Atomic structure; Quantum numbers; Periodic table; Oxidation & Reduction; Chemical bond; Electrolytic conductance and electrolysis; Acid base equilibria; Water; Metals; Concept of Organic Chemistry; Aliphatic Hydrocarbon and Alcohols.

**DETAIL DESCRIPTION****Theory :MATTER AND ITS CHANGES****1 Symbol, Valency & Chemical Equation**

- 1.1 Define matter, element, compound, mixtures, solutions and suspensions.
- 1.2 Distinguish between, " atoms and molecules", "physical change and chemical change", "exothermic and endothermic changes and reactions".
- 1.3 Identify exothermic and endothermic reactions from a given list of reactions.
- 1.4 Define symbol and formula, valency of elements and radicals.
- 1.5 Discuss the variations of valency with examples.
- 1.6 Define active and latent valency.
- 1.7 Define chemical equation .
- 1.8 Explain the full meaning of a given chemical equation.

**DIFFERENT TYPES OF CHEMICAL REACTIONS , CATALIST & CATALYSIS****2 Understand the concept of chemical reactions.**

- 2.1 Define chemical reaction.
- 2.2 Name the methods of bringing about chemical reaction.
- 2.3 Give examples of different types of chemical reactions with suitable examples.
- 2.4 Define catalysis and catalyst.
- 2.5 Mention different types of catalyst with examples.
- 2.6 List five uses of catalysts in industries.

**ACID, BASE & SALT****3 Understand acid, base and salt.**

- 3.1 Define acid, base and salt.
- 3.2 List five properties of acid, base and salt.
- 3.3 Classify salts according to their chemical properties.
- 3.4 Explain basicity of an acid and acidity of a base.

**STATES OF MATTER****4 Understand properties of gases.**

- 4.1 Identify the basic properties of gases.
- 4.2 Define Boyle's law & Charles' law, absolute temperature S.T. P /N.T.P
- 4.3 Deduce the relationship between pressure, volume and temperature of a gas to establish Boyle's Law, Charles' law and the law of pressure.
- 4.4 Combine the gas laws to establish the gas equation.
- 4.5 Establish the partial pressure of mixed gases using Dalton's law of partial pressure.
- 4.6 Solve problems in relation to pressure, volume, temperature and partial pressure of a mixture of gases.

**DALTON'S ATOMIC THEORY & AVOGADRO'S HYPOTHESIS****5 Understand Dalton's atomic theory & Avogadro's hypothesis**

- 5.1 List the four postulates of Dalton's atomic theory.
- 5.2 Explain at least five limitations of Dalton's atomic theory.
- 5.3 State Avogadro's hypothesis.
- 5.4 Explain Avogadro's constant.
- 5.5 Explain five applications of Avogadro's hypothesis in Chemistry.
- 5.6 Solve problems using the knowledge of Avogadro's hypothesis.

**6 Understand chemical equivalent, Atomic & molecular Mass.**

- 6.1 Define the chemical equivalent of an element, a compound, a radical, an acid an alkali and a salt.
- 6.2 Explain the variations in chemical equivalent of an element.
- 6.3 Define atomic mass and molecular Mass.
- 6.4 Establish a relationship among chemical equivalent, valency and atomic Mass.
- 6.5 Solve problems to find out atomic Mass, chemical equivalent and valency.

**7 Understand the modern concept of atomic structure.**

- 7.1 State the fundamental particles of atom.
- 7.2 Explain the following terms:
  - i) Atomic number ii) Isotopes iii) Isobar iv) Gram-atom
  - v) Mass Number and vi) Gram molecular Mass, vii) Mole viii) ISO tone.
- 7.3 Describe Rutherford's and Bohr's atomic model.

**8 Understand the quantum numbers.**

- 8.1 Define quantum numbers.
- 8.2 Explain the significance of the following quantum numbers:
  - i) Principal quantum number
  - ii) Subsidiary quantum number

- iii) Magnetic quantum number
  - iv) Spin quantum number
- 8.3 Explain the Pauli's exclusion principle.
- 8.4 Explain the probability distribution of electrons round the nucleus.
- 8.5 Define orbit and orbital.
- 9 Understand the modern periodic table.**
  - 9.1 State the periodic law of elements.
  - 9.2 Describe the modern long periodic table.
  - 9.3 Explain the limitations of periodic table.
  - 9.4 Give the Name of IA, VII-A and Zero group elements.
- 10 Understand oxidation and reduction.**
  - 10.1 Explain the modern concepts of oxidation and reduction with examples.
  - 10.2 Explain "oxidizing agent" and "reducing agents" with examples.
  - 10.3 Explain the oxidation and reduction takes place simultaneously.
  - 10.4 Explain the oxidation number and oxidation state.
  - 10.5 Write the oxidation number of an element from its compounds.
- 11 Understand the modern concept of chemical bonds.**
  - 11.1 Define chemical bond.
  - 11.2 List the different types of bonds.
  - 11.3 Explain the modern concept of ionic bonds.
  - 11.4 Explain the co-valent bonds, co-ordinate bond, Sigma bond, Pie bond.
- 12 Understand the fundamentals of electrolysis.**
  - 12.1 Define electrolysis.
  - 12.2 Differentiate between electrical conductor and electrolyte.
  - 12.3 Explain the process of electrolysis.
  - 12.4 Explain Faraday's laws of electrolysis.
  - 12.5 List at least four Industrial applications of electrolysis.
- 13 Understand pH value, Acidimetry and Alkalimetry.**
  - 13.1 Define pH, acidimetry and alkalimetry.
  - 13.2 Explain pH scale and its uses.
  - 13.3 Explain acid base titration.
  - 13.4 Explain the method of preparation of normal solutions.
  - 13.5 Define of indicators and their uses.
  - 13.6 Explain buffer solutions and their working mechanism.
- 14 Understand oxides and hydroxides.**
  - 14.1 Define oxide and hydroxide.
  - 14.2 Describe the classification of oxides and hydroxides.
  - 14.3 Explain different types of oxides and hydroxides with examples.
- 15 Understand the chemical process involved in water treatment.**
  - 15.1 Distinguish between hard water and soft water.
  - 15.2 Differentiate between temporary and permanent hardness of water.
  - 15.3 List at least three disadvantages and three advantages of using hard water.



- 15.4 Describe the Permutit process of softening hard water by explaining the reactions that take place.
- 15.5 Explain the ion exchange resin process of softening water.
- 15.6 Describe chemical tests of water.
- 16 Understand the extraction and refining process for Iron, Copper, Zinc and Aluminum.**
  - 16.1 Compare the properties of metal and non-metal.
  - 16.2 Define (i) ores (ii) roasting (iii) calcination (iv) smelting (v) alloy (vi) slag, (vii) Flux.
  - 16.3 Give names and formulae of important ores of Iron, Copper, Aluminum and Zinc.
  - 16.4 Describe the manufacturing process of iron and copper from its ore.
  - 16.5 Compare the properties of (i) Cast Iron (ii) iron (iii) Steel (iv) Wrought Iron.
- 17 Understand the concept of Organic Chemistry and organic compounds.**
  - 17.1 Define Organic Chemistry.
  - 17.2 Distinguish between organic and inorganic compounds.
  - 17.3 Explain homologous series of organic compounds.
  - 17.4 List the molecular and structural formulae of methane, ethane, propane and butane.
  - 17.5 Explain functional groups of organic compounds.
- 18 Understand the aliphatic hydrocarbons and the alcohols.**
  - 18.1 Define hydrocarbon, saturated and unsaturated hydrocarbons.
  - 18.2 Define alkane, alkene and alkynes.
  - 18.3 Explain common system, derived system and IUPAC system of nomenclature of organic compounds.
  - 18.4 Define Alcohols.
  - 18.5 Explain the classification of alcohol.
  - 18.6 Define the term Enzyme, Fermentation, De-carboxylation, Power Alcohol, Absolute Alcohol.

### **PRACTICAL :**

#### **OBSERVATION AND MEASUREMENT**

1. Measure the pH value of unknown solutions to classify them as neutral, acidic or alkalis.
2. Prepare a decinormal solution of sodium carbonate.
3. Determine the unknown strength of an acid. Solve by a standard alkalis solution with a suitable indicator.

#### **QUALITATIVE ANALYSIS OF KNOWN SALTS**

4. Perform test tube tests for the known salt samples Copper salt, Iron salt, Lead salt, Aluminum salt, Ammonium salt, etc.
5. Perform charcoal oxidation and reduction test for the different salt e.g. such as Lead salt, Copper salt, Iron salt, Calcium salt, etc.
6. Perform tests to detect unknown basic radicals e.g. Lead, Copper, Iron Calcium, Zinc, Aluminium, Ammonium and Sodium.
7. Perform tests to detect unknown acid radicals e.g. chloride, nitrate, carbonate and sulphate.

<b>6211</b>	<b>AUTOMOBILE FUNDAMENTALS</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>3</b>	<b>4</b>

**AIMS**

To provide the students with an opportunity to develop fundamental knowledge and basic skills of automobiles with special emphasis on:

- Automotive Industries
- Automobile Components
- Automobile Systems
- Automobile engines
- Use and care of automobile workshop tools and equipment
- Follow safety practice of automobile works

**SHORT DESCRIPTION**

History and background of automobiles, automotive industries & dealers in Bangladesh, automobile divisions, automobile Specifications; automobile layouts; automobile systems; automobile engines; tools and equipment used in automobile Shop and safety practice in automobile workshop.

- 1 Understand the background & development of automobile**
  - 1.1 Describe the history of automobile.
  - 1.2 Mention the world wide remarkable automobile industries & their products.
  - 1.3 Mention the automotive Job market in Bangladesh & overseas.
- 2 Know the automotive industries & dealers in Bangladesh**
  - 2.1 List the automotive industries & dealers in Bangladesh .
  - 2.2 Femiller with the automotive industries & dealers in Bangladesh.
  - 2.3 Mention the brand & Country of origin of two wheelers used in Bangladesh.
  - 2.4 Mention the brand & country of origin of three wheelers used in Bangladesh.
  - 2.5 Mention the brand & country of origin of car, Jeep, pick up & microbus used in Bangladesh.
  - 2.6 Mention the brand & country of origin of commercial vehicles used in Bangladesh.
- 3 Understand the division of automobile.**
  - 3.1 State the meaning of automobile.
  - 3.2 Classify automobile vehicles.
  - 3.3 Describe different types of automobile.
- 4 Know the layout of automobiles**
  - 4.1 Define & draw the front engine front wheel drive vehicle.
  - 4.2 Define & draw the front engine rear wheel drive vehicle.
  - 4.3 Define & draw the rear engine rear wheel drive vehicle.
  - 4.4 Define & draw the four wheel drive vehicle.
  - 4.5 Define & draw the articulated vehicle.

- 5 Understand the general specification of automobile.**
  - 5.1 Define Specification.
  - 5.2 Mention the different factors used in automotive specification.
  - 5.3 Mention Specification of two-wheeler.
  - 5.4 Mention Specification of three -wheeler.
  - 5.5 Mention Specification of car, jeep & microbus.
  - 5.6 Mention Specification of bus & truck.
- 6 Understand the dimension of automobile.**
  - 6.1 Define Chassis & body.
  - 6.2 Identify the components of chassis
  - 6.3 Mention the function of components & chassis.
  - 6.4 Name the different types of automobile body
  - 6.5 Mention the components of Car body.
- 7 Understand the dimension of automobile.**
  - 7.1 Define wheel base.
  - 7.2 Explain the necessity of wheel base.
  - 7.3 Define wheel tread.
  - 7.4 Explain the necessity of wheel tread.
  - 7.5 Define road clearance.
  - 7.6 Explain the necessity of road clearance.
  - 7.7 Define Overhang.
  - 7.8 Explain the necessity of front & rear overhang.
- 8 Understand the feature of automotive engines.**
  - 8.1 Mention the classification of automotive engine.
  - 8.2 Explain the principle of operation of external combustion & internal combustion engine.
  - 8.3 Explain the principle of operation of S.I engine.
  - 8.4 Explain the principle of operation of c.I engine
  - 8.5 Identify the two strokes & four stroke engine.
  - 8.6 Identify the stationary parts of automotive engine.
  - 8.7 Identify the moving parts of automotive engine.
- 9 Understand the different system of automobile.**
  - 9.1 Name the different systems of automobile.
  - 9.2 Mention the functions of different systems of automobile.
  - 9.3 List components of different system of automobile.
- 10 Know the tools & equipment used in automobile workshop.**
  - 10.1 Identify the common hand tools used in automobile workshop.
  - 10.2 Identify the special hand tools used in automobile workshop.
  - 10.3 Identify the equipment used in automobile workshop.
- 11 Understand the safety practice in automobile workshop.**
  - 11.1 Define safety.
  - 11.2 Explain the necessity of safety practice.
  - 11.3 Describe the safety rules for automobile workshop.

**Practical :**

1. Identify the different type of automobile.
2. Identify the different type of power transmission system.
3. Identify the different Components & automotive body.
4. Identify the different Components & automotive Chassis
5. Measure wheel base, wheel tread, rear clearance and over hang of automobile.
6. Identify the different types of automotive engine.
7. Identify the different stationary & moving engine parts.
8. Identify the different systems of automobile.
9. Identify the different components of main system of automobile.
10. Identify the common and special hand tools used in automobile workshop.
11. Identify the equipments used in automobile workshop.

**REFERENCE BOOKS**

1. Automotive fundamentals –Frederic Nash.
2. Automotive mechanics – Martin
3. Automobiles Engineered – O. Dr. kripal Singh
4. Automobile Subgenera- R.B Gupta.
5. Automotive Mechanics – Crouse –Anglia
6. The Automobile – Harban Sigh.

7011	BASIC WORKSHOP PRACTICE	T	P	C
		0	6	2

**AIMS**

To provide the students with an opportunity to acquire knowledge and skills to

- perform different metal & fitting works.
- perform basic welding works.
- Use and take care of fitting and welding tools & equipment.

**SHORT DESCRIPTION**

Fitting : Safety Precautions, Common hand tools; Measuring instruments; Laying out; Sawing, chipping, filing, grinding and finishing, drilling and thread cutting;

Welding : Arc welding; Gas welding; Welding with non-ferrous metal; Resistance welding.

**Practical :**

- 1 Understand the safely productions in Fitting & welding shop:**
  - 1.1. State general safety precaution in Fitting shop.
  - 1.2. State general safety precaution in welding shop.
  - 1.3. State the importance of good house keeping.
- 2 Demonstrate the application of basic metal working hand tools.**
  - 2.1 Identify common hand tools used for metal and fitting works.
  - 2.2 Check hand tools for sharpness.
  - 2.3 Carryout minor maintenance and sharpening of tools used for fitting works.
  - 2.4 Follow safety procedure during working in the fitting shop.
- 3 Demonstrate the application of measuring instruments and gages for bench work.**
  - 3.1 Identify the measuring and layout tools.
  - 3.2 Take measurement with vernier caliper and micrometer.
  - 3.3 Measure and layout a fitting job.
  - 3.4 Check/measure with gages (sheet and wire gage, drill gage, etc).
- 4 Demonstrate the application of machines and equipment for fitting works.**
  - 4.1 Identify machines and equipment for specific use.
  - 4.2 Take care and maintenance of machines and equipment used in the fitting shop.
- 5 Show skill in sawing, chipping, filing, drilling and reaming.**
  - 5.1 Identify the operations of sawing, chipping, filing, drilling and reaming.
  - 5.2 Perform sawing, chipping, filing, drilling and reaming operations.
  - 5.3 Make a job involving sawing, chipping, filing, drilling and reaming operations (Hinge, Angle gage, etc).
  - 5.4 Follow safety procedures during sawing, chipping, filing, drilling and reaming.
- 6 Show skill in cutting threads.**
  - 6.1 Identify the taps and dies.
  - 6.2 Cut internal and external threads with tap and die.
  - 6.3 Follow safety procedures during working with taps and dies.

- 7 Show skill in making sheet metal jobs.**
  - 7.1 Select appropriate sheet metal.
  - 7.2 Select tools and equipment for sheet metal works.
  - 7.3 Layout the sheet for jobs.(Development Drawing)
  - 7.4 Make wire edge.
  - 7.5 Make seam joint.
  - 7.6 Make mug/measuring can/sugar scoup, etc.
- 8 Show skill in making pipe and duct.**
  - 8.1 Estimate the sheets required for pipe and duct.
  - 8.2 Layout a sheet for pipe and duct.
  - 8.3 Make pipe and duct.
  - 8.4 Take care during making pipe and duct.
- 9 Show skill in soldering and brazing.**
  - 9.1 Select tools and equipment for soldering and brazing.
  - 9.2 Make soldering and brazing joint.
  - 9.3 Take care during soldering and brazing.
- 10 Show skill in arc welding.**
  - 10.1 Select welding tools and equipment.
  - 10.2 Prepare work piece for welding joint.
  - 10.3 Select proper current and voltage for arc welding.
  - 10.4 Select appropriate electrodes.
  - 10.5 Make arc welding joints ( Lap, Butt, Tee, Corner, etc.)
  - 10.6 Follow safe working procedures during arc welding.
- 11 Show skill in welding by gas.**
  - 11.1 Select tools and equipment for gas welding and gas cutting.
  - 11.2 Select appropriate filler rod and flux.
  - 11.3 Select appropriate flame for welding and cutting.
  - 11.4 Make gas welding joints ( Lap, Butt, Tee, Corner, etc.)
  - 11.5 Follow safe working procedures during arc welding.
- 12 Show skill in resistance welding.**
  - 12.1 Identify the resistance welding machines.
  - 12.2 Identify accessories and tools for resistance welding.
  - 12.3 Make spot welding joints.
  - 12.4 Follow safe working procedures during working with spot welding machine.

#### REFERENCE BOOKS

- |   |                                  |   |                            |
|---|----------------------------------|---|----------------------------|
| 1 | Basic Sheet Metal Practice       | — | J. W. Giachino             |
| 2 | Prathomic Fitting Sikkha         | — | Hemanta Kumar Bhattacharia |
| 3 | Welding Principles for Engineers | — | Morris                     |
| 4 | Metal Fabrication                | — | Robert L. O'con            |
| 5 | Sheet Metal Work                 | — | Blackburn & Cassidy        |

<b>1012</b>	<b>ENGINEERING MATERIALS</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>3</b>	<b>3</b>

**AIMS**

- To be able to identify and classify the materials used for construction in engineering field.
- To be able to recognize the sources of various engineering materials.
- To be able to understand the characteristics of various engineering materials.
- To be able to understand the uses of different engineering materials.

**SHORT DESCRIPTION**

Aspects of engineering materials; Engineering uses of ferrous metals and alloys; Engineering use of non-ferrous metal; Bricks; Sand; Cement; Lime as mortar; Aluminum as construction materials; Timber; Stone; Insulating materials; Glass and ceramics, Paints and varnishes, Sound absorbing materials; Fire and water proofing materials; Fuels and lubricants; Plastic materials, optical fiber and Gallium Arsenide Materials.

**DETAIL DESCRIPTION**

- 1 Understand the various aspects of engineering materials.**
  - 1.1 Define engineering materials.
  - 1.2 Mention the classification of engineering materials in different technology
  - 1.3 List the characteristics of engineering materials.
- 2 Understand the application of stone**
  - 2.1 Define building stones.
  - 2.2 Mention geological, physical and chemical classification of stones.
  - 2.3 List the characteristics of good building stones.
  - 2.4 Describe the dressing of stones.
  - 2.5 Describe the uses of stone in engineering field.
- 3 Understand the characteristic of brick as construction materials.**
  - 3.1 Define brick.
  - 3.2 Mention different constituents for manufacturing of good bricks.
  - 3.3 Explain pug mill, table molding and machine molding.
  - 3.4 Describe the process of brick drying.
  - 3.5 Describe the methods of kiln burning of brick.
  - 3.6 Draw the sketches Bull's trench kiln & Hoffman's kiln.
- 4 Understand the application of sand.**
  - 4.1 Mention the classification of sand according to their sources.
  - 4.2 Mention the specifications of good sand.
  - 4.3 Describe the purpose of grading of sand.
  - 4.4 Mention the use of various grades of sand.
- 5 Understand the application of cement.**
  - 5.1 Define cement.
  - 5.2 Mention the functions of various ingredients of cement.
  - 5.3 Distinguish between wet process and dry process of manufacturing Portland cement.
  - 5.4 Draw a flow diagram based on wet process of manufacturing of cement.
  - 5.5 Mention the uses of cement as engineering material.

- 6 Understand the application of tiles**
  - 6.1 Identify the following tiles: clay tiles, concrete tiles, Plastic tiles, Mosaic tiles, Marble tiles, Glazed tiles.
  - 6.2 Describe the uses of different kinds of tiles.
- 7 Understand the Light metal (aluminum/white metal) as construction materials.**
  - 7.1 Explain the important properties of light metal (aluminum/white metal) as construction material.
  - 7.2 Mention the uses of aluminum white/metals .
  - 7.3 Describe the advantages and disadvantages of using aluminum as construction material.
- 8 Understand the fundamental concepts of glass and ceramics.**
  - 8.1 Mention the constituents of glass.
  - 8.2 List the properties of glass.
  - 8.3 Mention the uses of glass.
  - 8.4 Describe the constituents of ceramics.
  - 8.5 Mention the classification of ceramics.
  - 8.6 List the properties of ceramics.
  - 8.7 Describe the uses of ceramics in engineering field.
- 9 Understand the basic concepts of paints and varnishes.**
  - 9.1 Define paints and varnish.
  - 9.2 Explain the characteristics of good paint.
  - 9.3 List the essential constituents of paint.
  - 9.4 Explain the functions of pigment.
  - 9.5 List the main constituents of varnishes.
  - 9.6 Explain the characteristics of good varnish.
  - 9.7 Mention the functions of vehicle.
  - 9.8 Describe synthetic materials used for paint and varnishes.
- 10 Understand the characteristic of timber as construction materials.**
  - 10.1 Define timber.
  - 10.2 Mention the classification of trees depending on botanical groups.
  - 10.3 Explain conservation of timber in various market forms.
  - 10.4 Describe the major defects in timber.
  - 10.5 Describe the advantages and disadvantages of using timber in the engineering field.
  - 10.6 Describe the characteristics of good timber.
- 11 Understand the application of various heat and sound insulating materials.**
  - 11.1 Mention the functions of insulating materials.
  - 11.2 List five natural heat insulating materials.
  - 11.3 Mention the names of synthetic insulating materials.
  - 11.4 Describe the sources of obtaining rubber, cork and ebonite.
  - 11.5 Describe the uses of asbestos as insulating material.
  - 11.6 List three natural sound absorbing materials.
  - 11.7 Mention the names of five sound absorbing materials.
  - 11.8 Explain light weight concrete used in acoustic works.



- 12 Understand the fundamental aspects of fire and water proofing materials.**
  - 12.1 Mention the term of fire proofing materials and water proofing materials.
  - 12.2 Explain the uses of asbestos as fire and waterproof materials.
  - 12.3 List the characteristics of refractory materials.
  - 12.4 Explain the uses of rubber as water proofing material.
- 13 Understand the basic concepts of fuels and lubricants.**
  - 13.1 Define the term fuel and lubricants.
  - 13.2 Mention the main purposes of fuels with their classifications.
  - 13.3 List different types of lubricants.
  - 13.4 Explain the characteristics of lubricating oils.
- 14 Understand the engineering applications of plastic materials.**
  - 14.1 Define plastic.
  - 14.2 List the names of raw materials for plastic.
  - 14.3 Explain the properties of plastic.
  - 14.4 Mention the characteristics of thermoplastic and thermosetting plastic.
  - 14.5 Describe the manufacturing process of plastic.
  - 14.6 Explain the molding methods of plastic products.
  - 14.7 Identify the uses of plastic as engineering materials.
  - 14.8 Explain laminating plastic.
- 15 Understand the engineering uses of metals and alloys.**
  - 15.1 Name the common types of iron used in industry.
  - 15.2 Mention the uses of wrought iron and cast iron.
  - 15.3 Mention the classification of steel on the basis of carbon content.
  - 15.4 List the names of commercial steels.
  - 15.5 Describe alloy steel.
  - 15.6 Mention the uses of various alloy steels.
  - 15.7 Define non-ferrous metals.
  - 15.8 List the important non-ferrous metals used in engineering field.
  - 15.9 Mention the uses of non-ferrous metals and alloys like copper, zinc, tin, lead, brass and bronze.
- 16 Understand the Engineering use of Conducting, Magnetic, Optical fiber and Gallium Arsenide Materials**
  - 16.1 List of least three items for conducting, none conducting and semi-conducting materials.
  - 16.2 Describe the uses of semi-conducting materials.
  - 16.3 Name the types of soft and hard magnetic materials.
  - 16.4 Mention the uses of optical fiber.
  - 16.5 Mention the uses of Gallium Arsenide Materials.

**PRACTICAL:**

1. **Show skill in identifying various types of stone**
  - 1.1. Selected different type of stone in the laboratory.
  - 1.2. Sketch different type of stone on the basis of formation.
2. **Show skill in field test of bricks**
  - 2.1. Perform field test of bricks
  - 2.2. Select 1<sup>st</sup> class, 2<sup>nd</sup> class, 3<sup>rd</sup> class bricks and jhama bricks
3. **Show skill in conducting laboratory test of bricks**
  - 3.1. Perform:
    - (a) Compression test
    - (b) Absorption test
  - 3.2. Determine average weight of a brick.
4. **Show skill in conducting laboratory test of cement**
  - 4.1. Conduct laboratory tests of cement
    - (a) Make cement paste of Normal Consistency (CPNC)
    - (b) Determine initial setting time
    - (c) Perform final setting time
    - (d) Perform compressive strength test
    - (e) Perform tensile strength test
    - (f) Perform fineness test
  - 4.2. Conduct field tests of cement
5. **Show skill in conducting tests of coarse aggregate**
  - (a) Specific gravity of sand
  - (b) Grading of aggregates
6. **Show skill in conducting test of sand**
  - (a) Bulking of sand
  - (b) F M of sand
  - (c) Specific gravity of sand
7. **Show skill in identifying various ferrous and non ferrous metal**
  - 7.1. Identify mild steel, cast iron, copper, and aluminum, tin by physical observation.
8. **Show skill in identifying various type fuels and lubricants**
9. **Show skill in identifying various type of conducting & non conducting, semi conducting, magnetic and optical fiber materials.**

**REFERENCE BOOKS**

- |   |                                      |   |                |
|---|--------------------------------------|---|----------------|
| 6 | A text book on Engineering Materials | — | G. J. Kulkarni |
| 7 | Engineering Materials                | — | Dr. M. A. Aziz |
| 8 | Plastic Materials                    | — | J. A Brydson   |

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## ENGLISH – II

<b>T</b>	<b>P</b>	<b>C</b>
2	2	3

**OBJECTIVES :**

After the completion of the course, learners will be able to develop-

- \* Reading and writing skills
- \* Grammatical accuracy with emphasis on spelling & punctuation
- \* Information Collection
- \* Creative Writing
- \* Effective Communication and Correspondence

*CONTENTS*

Seen comprehension

*Marks 20*

<i>Fourteen:</i> Human Resources	3	Enriching the workforce
<i>Sixteen:</i> Wonders Home and Abroad	1	The Sangsad Bhaban
	2	The Jamuna Multi-Purpose Bridge
<i>Seventeen:</i> Modes of Communication	6	E-mail
<i>Nineteen :</i> Healthy Living	5	The disabled among us
<i>Twenty:</i> Jobs and Professions	2	How can I be self-employed?
	3	Self-help a key to success
<i>Twenty-one:</i> Globalization	1	The world as a global village
	3	Modern technology and globalization
	6	Globalization and English

N.B: The Unit mentioned refers to the Text Book (1<sup>st</sup> Paper) English for Today for class 11 – 12 by National Curriculum & Text Book Board, Dhaka.

*GRAMMAR**Marks 30*

Unit	Lesson	Title
<i>One:</i> Pronouns & Determiners	3	Modifier: Pick out modifiers, determiners, Infinitive, participles headword, in the sentence. Question : A beautiful girl of Thirteen dances well. : Headword: girl Pre modifier – a, beautiful Post modifier – of thirteen

<i>Twelve:</i> Further Use of Preposition	2	Use Appropriate Prepositions
<i>Patterns of Sentence Structure</i>		3. Sentence Structure ----- Question a) Analyse sentences Exam : He goes to school. Ans: Sub : He Verb intransitive: goes b) Make Sentence according to the structure Question S+V <sub>I</sub> +Ob <sub>i</sub> +Ob <sub>2</sub> Answer : He called me a liar.
<i>Fourteen:</i> Idiom and Phrase	9	Make Sentences with the idioms and Phrases in the following. (any five)
<i>Changing Speech</i>		Direct & indirect narration

N.B: The Unit mentioned refers to the Text Book (2<sup>nd</sup> Paper) English Grammar and Composition for class XI - XII by National Curriculum & Text Book Board, Dhaka.

## COMPOSITION

marks 30

Area of interest: With hints/ key words

National, Social, Political Problems: Terrorism, Drug Addiction, Acid Violence, Dowry, Load shedding, Price Hike, Gender Discrimination, Traffic Jam, Deforestation etc.

Calamities: Drought, Erosion, Flood, Cyclone, Earth quake, Landslide etc.

National days and festivals: International Mother Language Day, Independence Day, Victory Day, Pahela Baishakh, May Day etc.

Scientific Development: Satellite, Optical Fiber, E-mail, Internet & Agricultural Development.

Environment Pollution: Water, Air, Sound, Global Warming.

Heritage sites: The Sundarbans, National Memorial, Cox's Bazar Sea Beach, Bhashani Novo Theatre.

Industries: Garments, Textile, Poultry, Leather, Ceramics, Fertilizer.

1. Writing a short composition
2. Writing a formal letter/CV.
3. Writing Letter (Personal/Official)

5. Writing Reports on work place of standard form/ instrument or Construction or fault on / instrument or Construction/ Repairing of instrument or Construction/ a situation/event/incident.
6. Writing letter to the print & Electronic media.

Practical

1. Asking Questions : WH, Yes/No, Tag questions
2. Conversations on real life situations
  - a) Today's market price
  - b) About festival
  - c) Preparation for the examination
  - d) Last day of your Class.
  - e) Visit to the place of interest
  - f) Choice of profession
  - g) Current Topics from Newspapers.

5912

**PHYSICS-I**

<b>T</b>	<b>P</b>	<b>C</b>
3	3	4

**OBJECTIVES**

- To provide the students a background of basic science i.e. Physics required for understanding technological subjects.
- To develop a working knowledge of common engineering and industrial materials and to enable to determine through experiments the properties of such materials.
- To develop through experiments an understanding of fundamental scientific concept.
- To develop a basic knowledge and concept of physical properties of common engineering and industrial materials.

**SHORT DESCRIPTION**

Units; Vector and Scalar quantities; Motion and Equations of motion; Force and Newton's Laws of motion; Gravity and Gravitation; Simple Harmonic motion; Hydrostatics; Surface tension and viscosity; Pressure, Sound: wave and sound Concepts and nature of sound, Velocity of sound, Ultrasonic.

**DETAIL DESCRIPTION****Theory :****1. UNITS VECTOR AND SCALAR QUANTITIES****Understand vector and scalar quantities.**

- 1.1 List and identify the symbols of fundamental SI Unit and some derived SI Unit.
- 1.2 Define vector quantities with examples.
- 1.3 Define scalar quantities with examples.
- 1.4 Show the various representations of the vector quantities; and representation of a vector by unit vector.
- 1.5 Distinguish between vector and scalar quantities.
- 1.6 Find and explain the resultant of two vectors in different directions.
- 1.7 Resolve a vector into horizontal & vertical component.
- 1.8 Explain the dot and cross product of two vectors.
- 1.9 Projection of a vector.
- 1.10 Define laws of triangle of vector.

**2. MOTION AND EQUATIONS OF MOTION****Understand motion and equations of motion.**

- 2.1 Define rest and motion.
- 2.2 Classify motion.
- 2.3 Define and explain displacement, speed, velocity, acceleration and retardation.
- 2.4 Deduce the relationship between displacement, velocity, acceleration and retardation from these definitions.
- 2.5 Distinguish between (i) speed and velocity (ii) velocity and acceleration.
- 2.6 Projectile motion.

- 2.7 Equation of motion of a freely moving body thrown obliquely vertically upward or motion of projectile.

### 3. Understand circular motion

- 3.1 Define circular motion.  
 3.2 Define angular velocity and linear velocity with their units.  
 3.3 Deduce the relation between angular velocity and linear velocity.  
 3.4 Define centripetal and centrifugal force with examples.  
 3.5 Prove centrifugal force =  $\frac{mv^2}{r}$   
 3.6 Define and explain angular momentum, torque and moment of inertia.  
 3.7 Angular acceleration and relation between torque and angular acceleration.

## 4. FORCE AND NEWTON'S LAWS OF MOTION

### Understand force and Newton's laws of motion

- 4.1 Define force.  
 4.2 Define different units of force and their correlation and also mention the dimension of force.  
 4.3 Define parallel force and a couple.  
 4.4 Find out the resultant of parallel forces.  
 4.5 Define inertia and momentum.  
 4.6 Impulsive force and impulse of a force.  
 4.7 Relation between impulse of force and momentum.  
 4.8 State and prove the principals of conservation of momentum.  
 4.9 State Newton's laws of motion.  
 4.10 Prove  $P=mv$ , from Newton's 2nd law of motion.

## 5. GRAVITY AND GRAVITATION

### Understand gravity and gravitation.

- 5.1 Define and explain the Kepler's Law.  
 5.2 Define gravity and gravitation.  
 5.3 State the laws of gravity and gravitation.  
 5.4 Define and determine the gravitational constant (G) and also mention its units and dimension.  
 5.5 Define acceleration due to gravity 'g' and also mention its units and dimension.  
 5.6 Discuss the variation of 'g' at different places.  
 5.7 Define mass and weight with their units and dimension.  
 5.8 Distinguish between mass and weight.  
 5.9 Define and explain gravitational potential and escape velocity  
 5.10 State and explain the laws of falling bodies and mention the equation of motion of a body when it is projected vertically upwards or downwards.

## 6. SIMPLE HARMONIC MOTION (SHM)

### Understand simple harmonic motion.

- 6.1. Define simple harmonic motion (SHM).
- 6.2. State the characteristics of SHM.
- 6.3. Describe a simple pendulum and a second pendulum.
- 6.4. Define effective length, amplitude, phase, complete oscillation, period of oscillation, frequency.
- 6.5. State and explain the laws of simple pendulum.
- 6.6. Describe a compound pendulum.
- 6.7. Discuss the conditions under which a pendulum clock will go slow or fast.
- 6.8. Potential energy, kinetic energy and average potential and kinetic energy of a particle executing SMH.
- 6.9. Principle of conservation of mechanical energy.

## 7. WORK, POWER AND ENERGY

### Understand work, power and energy.

- 7.1 Define work, power and energy.
- 7.2 State the units and dimensions of work, power and energy.
- 7.3 State and prove the principle of the conservation of energy.
- 7.4 Define potential energy (PE) and kinetic energy (KE).
- 7.5 Derive the equation of potential and kinetic energy.
- 7.6 Show that the K.E. gained by a falling body is equal to the P.E. Lost by the body.
- 7.7 Describe transformation of energy and work energy theorem.
- 7.8 Recognize that the useful work can be found from:

$$\text{Efficiency} = \frac{\text{output work}}{\text{input work}} \times 100.$$

- 7.9 Describe conservative and non- conservative force.

## 8. ELASTICITY

### Understand the concept of elasticity.

- 8.1 Name some of the general and special properties of matter.
- 8.2 Define Elasticity and Elastic limit.
- 8.3 Define perfectly elastic body and perfectly rigid body.
- 8.4 Define stress and strain with their units and dimensions.
- 8.5 State and explain the Hook's law.
- 8.6 Describe various kinds of modulus of elasticity.
- 8.7 Mention the units and dimensions of modulus of elasticity.
- 8.8 Define Poisson's ratio and work done in deforming a body or potential energy.
- 8.9 Elastic behavior of a solid and stress- strain graph.



**FRICTION****9. Understand Friction**

- 9.1 Define friction.
- 9.2 Describe the different kinds of friction.
- 9.3 Define the laws of static friction.
- 9.4 Define the co-efficient of static friction.
- 9.5 Describe the angle of static friction and angle of repose.
- 9.6 Describe the laws of kinetic friction.
- 9.7 State the co-efficient and angle of kinetic friction.
- 9.8 Show that the co-efficient of static friction is equal to the tangent of angle of repose.
- 9.9 Describe an experiment to determine the co-efficient of static friction.
- 9.10 State the merits and demerits of friction.

**10. HYDROSTATICS****Understand behavior of fluids.**

- 10.1 Define pressure as force per unit area and state that it is measured in  $\text{N/m}^2$  or Pa (Pascal).
- 10.2 State characteristics of liquid pressure.
- 10.3 Establish that pressure at a point in a fluid is dependent upon the density of the fluid, the depths in the fluid and acceleration due to gravity.
- 10.4 Surface tension and surface energy, Angle of contact.
- 10.5 Capillarity and theory of capillarity.
- 10.6 Viscosity and co-efficient of viscosity.
- 10.7 Necessity of viscosity.

**11. Wave and Sound**

- 11.1 Wave and wave motion.
- 11.2 Transverse wave and longitudinal wave.
- 11.3 Some definitions relating waves.
- 11.4 Progressive wave and stationary waves.
- 11.5 Equation of progressive wave.
- 11.6 Sound and production of sound.
- 11.7 Sound is a longitudinal traveling wave.
- 11.8 Interference of sound: Constructive and Destructive interference.
- 11.9 Mathematical analysis of interference of sound.
- 11.10 Define beats and Mechanism of formation of beats.

## 12. SOUND

### Understand nature and behavior of sound.

- 12.1 Identify that sound is produced by vibration and travels through a medium as a longitudinal wave.
- 12.2 Distinguish between the production and behavior of longitudinal and transverse waves.
- 12.3 Recognize that sound can be produced of different pitches (frequencies) & that the human ear has an audible frequency range covering approximately 20 Hz to 20 KHz.
- 12.4 State the approximate frequency range for
  - a. infrasonic sound
  - b. Ultrasonic (supersonic) sound.
- 12.5 Explain how sound is absorbed, reflected & refracted by different types of surface.
- 12.6 Describe the practical uses of echo sounding devices.
- 12.7 Define velocity of sound.
- 12.8 State the velocity of sound at NTP in still air.
- 12.9 Compare the effects of pressure, temperature & humidity on the velocity of sound in air.
- 12.10 Doppler Effect and Expression for the change of frequency or pitch due to Doppler Effect.

## PRACTICAL

### Observations and Measurements

1. Determine accurate diameter/side of an object using vernier calipers.
2. Measure the area of cross section of a wire by micrometer screw gage.
3. Measure the thickness of a glass plate by speedometer.
4. Verify the law of parallelogram of forces by a force board.
5. Draw  $L-T^2$  graph and determine the value of "g" by using a simple pendulum.
6. Determine the coefficient of static friction.
7. Determine Young's modulus of a steel wire by Searle's apparatus.
8. Determine gravity of a solid heavier than and insoluble in water by hydrostatic balance.
9. Determine specific gravity of a liquid by specific gravity bottle.
10. Determine velocity of sound by resonance air column method.

5921

**MATHEMATICS – II**

<b>T</b>	<b>P</b>	<b>C</b>
3	3	4

**OBJECTIVES**

- To enable in solving the simultaneous equations with the help of determinant and matrix.
- To make understand the exponential series.
- To enable to calculate the areas of regular polygons , hexagons, octagon, hydraulic mean depth (HMD) of a channel, area occupied by water of circular culvert. excavation work.
- To provide the ability to calculate volume of regular solids like pyramid frustum of pyramid, prismoid, wedge and area of curved surfaces .

**SHORT DESCRIPTION**

Algebra: Determinants, Matrix, Partial Fractions, Exponential Series.

Trigonometry: Inverse circular functions, Properties of triangle and solution of triangles.

Menstruation: Area of rectangles, squares, triangles, quadrilaterals, parallelograms, rhombus, trapezium, circle, sector, segment; Volume of rectangular solids, prism, parallelepiped , pyramids, cones , spheres, frustum of pyramid and cone; Area of curved surface of prism. Cylinder cone, pyramid and frustum of cone.

**DETAIL DESCRIPTION****ALGEBRA :**

- 1 Apply determinants to solve simultaneous equations.
  - 1.1 Expand a third order determinant.
  - 1.2 Define minor and co-factors.
  - 1.3 State the properties of determinants.
  - 1.4 Solve the problems of determinants.
  - 1.5 Apply Cramer's rule to solve the linear equation.
- 2 Apply partial fraction to break the numerator and denominator.
  - 2.1 Define matrix, null matrix, unit matrix, square matrix. column matrix, row matrix, inverse matrix, transpose matrix, adjoin matrix, rank of a matrix, singular matrix.
  - 2.2 Explain equality, addition and multiplication of matrix.
  - 2.3 Find the rank of a matrix.
  - 2.4 solve the problems of the following types:
    - i) Solve the given set of linear equations with the help of matrix.
    - ii) Find the transpose and adjoin matrix of a given matrix.
- 3 Solve problems using binomial theorem
  - 3.1 Define proper and improper fractions.
  - 3.2 Resolve in to partial fraction of the followings types :
    - a) Denominator having a non-repeated linear factor.
    - b) Denominator having a repeated linear factor.
    - c) Denominator having a quadratic factors.
    - d) Denominator having a combination of repeated, non-repeated and quadratic factors.

- 4 Understand exponential series.
- 4.1 Define e.
- 4.2 Prove that e is finite and lies between 2 and 3.
- 4.3 Prove that  $e^x = 1 + \frac{x}{1} + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \dots$  to  $\infty$
- 4.4 Solve problems of the followings types :
- i)  $1 + \frac{1}{2!} + \frac{1}{4!} + \frac{1}{6!} + \dots$  to  $\infty$
- ii)  $\frac{1}{2!} + \frac{1+2}{3!} + \frac{1+2+3}{4!} + \frac{1+2+3+4}{5!} + \dots$  to  $\infty$

### TRIGONOMETRY

- 5 Apply the concept of inverse circular function.
- 5.1 Explain the term inverse circular function and principal value of a trigonometrical ratio.
- 5.2 Deduce mathematically the fundamental relations of different circular functions.
- 5.3 Convert a given inverse circular function in terms of other functions.
- 5.4 Prove mathematically
- i)  $\tan^{-1} x + \tan^{-1} y = \tan^{-1} \frac{x+y}{1-xy}$
- ii)  $\tan^{-1} x + \tan^{-1} y + \tan^{-1} z = \tan^{-1} \frac{x+y+z-xyz}{1-xy-yz-zx}$
- iii)  $\sin^{-1} x + \sin^{-1} y = \sin^{-1} \left( x\sqrt{1-y^2} + y\sqrt{1-x^2} \right)$
- iv)  $2 \tan^{-1} x = \sin^{-1} \frac{2x}{1+x^2} = \cos^{-1} \frac{1-x^2}{1+x^2} = \tan^{-1} \frac{2x}{1-x^2}$
- 5.5 Solve problems of the following types.
- a)  $2 \tan^{-1} \frac{1}{3} + \tan^{-1} \frac{1}{4} = \frac{\pi}{4}$
- b)  $\cos \tan^{-1} \cot \sin^{-1} x = x$ .
- c) Prove that the area of the segment cut from a circle of radius r by a chord at a distance d from the centre is given by  $K = r^2 \cos^{-1} \frac{d}{r} - d\sqrt{r^2 - d^2}$

6 Apply the principle of properties of triangles.

6.1 Prove the followings identities :

i)  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2R$  .

ii)  $a^2 = b^2 + c^2 - 2bc \cos A$

iii)  $a = b \cos C + c \cos B$  .

v)  $\Delta = \frac{1}{2} bc \sin A$ .

6.2 Establish the followings.

a)  $\tan \frac{A}{2} = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}}$

b)  $\tan \frac{B-C}{2} = \frac{b-c}{b+c} \cot \frac{A}{2}$

c)  $\Delta = \frac{abc}{4R}$

6.3 Solve the problems of the following types:

i) Prove  $\cos (B - C) + \cos A = \frac{bc}{2R}$

ii) An object experiences two forces  $F_1$  and  $F_2$  of magnitude 9 and 13 Newtons with an angle  $100^\circ$  between their directions. Find the magnitude of the resultant R.

7 Apply the concept of area of triangle.

7.1 Find the area of triangle in the form,

i)  $A = \frac{\sqrt{3}}{4} a^2$  , a = length of a side of equilateral triangle.

ii)  $A = \frac{c}{4} \sqrt{4a^2 - c^2}$  , where a = length of equal sides,  
c = third side.

iii)  $A = \sqrt{s(s-a)(s-b)(s-c)}$  , where a, b, c = length of the sides of a triangle and 2s is the perimeter of the triangle.

7.2 Use formula in 7.1 to solve problems.

8 Apply the concept of finding areas of quadrilateral & Parallelogram.

8.1 Define quadrilateral & Parallelogram.

8.2 Find the areas of quadrilateral when off sets are given.

8.3 Find the areas of a parallelogram.

8.4 Solve problems using above formulae.

- 9 Apply the concept of finding areas of rhombus & trapezium.
  - 9.1 Define rhombus & trapezium.
  - 9.2 Find the areas of rhombus when the diagonals are given.
  - 9.3 Find the areas of trapezium in terms of its parallel sides and the perpendicular distance between them.
  - 9.4 Solve problems related to rhombus & trapezium.
- 10 Apply the concept of finding areas of regular polygon.
  - 10.1 Define a regular polygon.
  - 10.2 Find the area of a regular polygon of  $n$  sides, when
    - i) the length of one side and the radius of inscribed circle are given.
    - ii) the length of one side and the radius of circumscribed circle are given.
  - 10.3 Find the area of a regular .
    - a) hexagon
    - b) octagon
 when length of side is given.
  - 10.4 Solve problems of the followings types:  
A hexagonal polygon 6 m length of each side has a 20 cm width road surrounded the polygon. Find the area of the road.
- 11 Understand areas of circle , sector and segment.
  - 11.1 Define circle, circumference, sector and segment.
  - 11.2 Find the circumference and area of a circle when its radius is given.
  - 11.3 Find the area of sector and segment of a circle.
  - 11.4 Solve problems related to the above formulae.
- 12 Apply the concept of volume of a rectangular solid.
  - 12.1 Define rectangular solid and a cube.
  - 12.2 Find geometrically the volume of a rectangular solid when its length, breadth and height are given.
  - 12.3 Find the volume and diagonal of a cube when side is given.
  - 12.4 Solve problems with the help of 12.2 & 12.3.
- 13 Apply the concept of the volume of a prism and a parallelepiped.
  - 13.1 Define a prism, parallelepiped and a cylinder.
  - 13.2 Find the volume of prism, parallelepiped and cylinder when base and height are given.
  - 13.3 Solve problems related to 13.2.
- 14 Apply the concept of the volume of pyramid, cone and sphere.
  - 14.1 Define pyramid, cone and sphere.
  - 14.2 Explain the formula for volume of pyramid, cone and sphere.
  - 14.3 Solve problems related to 14.2.
- 15 Apply the concept of surface area of prism, cylinder and cone.
  - 15.1 Explain the formulae for areas of curved surfaces of prism cylinder and cone.
  - 15.2 Solve problems related to 15.1.

<b>6221</b>	<b>BASIC RAC &amp; TRANSPORT REFRIGERATION</b>	<b>T</b>	<b>P</b>	<b>C</b>
		2	6	4

**AIMS**

To provide the students with an opportunity to acquire knowledge, skill and attitude in the area of basic refrigeration and auto airconditioning with special emphasis on:

- Refrigeration science.
- Different methods of refrigeration.
- Components and accessories of refrigeration cycle.
- Refrigerants.
- Air-conditioning fundamentals
- Automobile bus air conditioning system
- Van & Trailer refrigeration system
- Automobile air-conditioning system and servicing.

**SHORT DESCRIPTION**

Refrigeration science; Different methods of refrigeration; Vapor compression cycle components and accessories; Refrigerants; Air-conditioning fundamentals; Automobile air conditioner; Automobile air conditioner control system; Automobile bus air conditioning system; Van & Trailer refrigeration system, Automobile air conditioner servicing.

**DETAIL DESCRIPTION****Theory :****SCIENCE OF REFRIGERATION**

- 1. Understand the science of refrigeration.**
  - 1.1. Define refrigeration, refrigerant and refrigerator.
  - 1.2. Mention the laws of refrigeration.
  - 1.3. Mention the application of refrigeration in our daily life.
  - 1.4. Define the heat, temperature & pressure.
  - 1.5. Mention the units of heat, temperature and pressure.
  - 1.6. Describe the methods of heat transfer in the field of refrigeration.

**METHODS OF REFRIGERATION**

- 2. Understand different methods of refrigeration.**
  - 2.1. List different methods of refrigeration.
  - 2.2. Identify the refrigeration systems used in automobile airconditioning.
  - 2.3. Mention the principle of evaporative refrigeration.
  - 2.4. Describe operation of vapor compression refrigeration system.

## COMPONENTS OF VAPOR COMPRESSION SYSTEM

### 3. Understand the features of vapor compression system components.

- 3.1. Mention the function of compressor, condenser, expansion device and evaporator.
- 3.2. Mention the classification of compressors, condensers, expansion valves and evaporators used in automobile air conditioner
- 3.3. State the cycling and non cycling compressor.
- 3.4. Describe the operation of swash-plate compressors, scotch yoke compressors and scroll compressors.
- 3.5. Mention the advantages and disadvantages of different types of compressors used in automobile air conditioner.
- 3.6. Mention the advantages & disadvantages of plate, fin type, serpentine type and drawn cup type evaporators.
- 3.7. Describe the operation of thermostatic expansion valve, H-type expansion valve and orifice (expansion tube) used in automobile air conditioner.

## ACCESSORIES

### 4. Understand the features of the accessories used in auto airconditioner refrigeration cycle.

- 4.1. List the accessories used in auto airconditioner refrigeration cycle.
- 4.2. Mention the function of accessories used in automobile airconditioner refrigeration cycle.
- 4.3. Describe the operation of receiver, dryer, sight glass and fusible plug.
- 4.4. Describe the operation of low side accumulator.
- 4.5. Mention the purpose of refrigeration lines used in automobile air conditioner application.
- 4.6. Explain the design features of refrigeration lines.
- 4.7. Identify the fittings used in refrigerant lines.

## REFRIGERANT

### 5. Understand the application of refrigerants.

- 5.1. Define refrigerant
- 5.2. Mention the classification of refrigerants
- 5.3. List the refrigerant of CFCs, HCFCs and HFCs groups.
- 5.4. State the desirable properties of an ideal refrigerants.
- 5.5. Identify the refrigerants by number.
- 5.6. List the applications of common refrigerants.
- 5.7. Mention the properties of most commonly used refrigerant viz. R-12 & R-134a
- 5.8. Describe the refrigerant cylinder handling.
- 5.9. Identify the color codes of refrigerant cylinder.
- 5.10. Mention the properties of refrigerant oil used with R-12 and R-134a system.



## **AUTOMOBILE AIRCONDITIONING**

- 6. Understand the features of automobile air-conditioning system.**
  - 6.1. Define air conditioning system
  - 6.2. State the purpose of auto air-conditioning.
  - 6.3. Identify the components of automobile air-conditioning system.
  - 6.4. Describe the operation of automobile air-conditioning system (cooling and heating).
  - 6.5. Describe the ducting system of automobile air-conditioning system.
  - 6.6. Describe the air distribution system of a car air conditioner (including ventilation system).
  - 6.7. Describe the automotive vehicle body insulation system.
  - 6.8. Describe the filtering system of automobile air-condition system.

## **AUTOMOBILE AIRCONDITIONER CONTROL SYSTEMS**

- 7. Understand the features of automobile air conditioner control system.**
  - 7.1. Identify the control panel switches and levers of automobile air conditioner (heating and cooling system).
  - 7.2. Describe the operation of control panel unit with sketch (heating and cooling)
  - 7.3. Describe the anti icing control system of automobile air conditioner.
  - 7.4. Draw the electric wiring diagram of auto air conditioner including all safety and control devices.
  - 7.5. Describe the manual and automatic control systems (including HVAC controller) of automotive air-conditioning system.
- 8. Understand the features of coupling & safety devices of automobile air conditioner.**
  - 8.1. Mention the purpose of magnetic clutch.
  - 8.2. Mention the classification of magnetic clutch.
  - 8.3. Describe the operation of magnetic clutch.
  - 8.4. Identify the safety devices used in cycling compressors automobile air-conditioning systems.
  - 8.5. Mention the function of various safety device in automobile air conditioner.

## **REFRIGERATED TRUCKS AND TRAILERS**

- 9. Understand the concept of transport refrigeration.**
  - 9.1. Define transport refrigeration
  - 9.2. Outline the importance of transport refrigeration
  - 9.3. Mention the field of application of transport refrigeration.
  - 9.4. List various non-mechanical transport refrigeration system.
  - 9.5. List various mechanical transport refrigeration
  - 9.6. Mention the advantages and disadvantages of non-mechanical transport refrigeration system.
  - 9.7. Mention the advantages and disadvantages of mechanical transport refrigeration system.

**10. Understand features of refrigerated Covered Van and trailers.**

- 10.1. Identify the various refrigeration system used in covered Van and trailers.
- 10.2. Describe the body insulation process of refrigerated Covered Van and trailers.
- 10.3. Describe the product sub-cooling in Covered Van refrigeration system.
- 10.4. Describe the operation of expendable refrigerant refrigeration system.
- 10.5. Describe the operation of eutectic solution in Covered Van refrigeration system.
- 10.6. Describe the servicing procedure of a conventional Covered Van refrigeration system.

**11. Understand the concept of bus air-conditioning system.**

- 11.1. Describe the dual compressor refrigeration cycle of a bus air-conditioning system.
- 11.2. Describe the different components of bus air conditioner refrigeration cycle.
- 11.3. Mention possible locations on bus air conditioner.
- 11.4. Describe air distribution systems of bus air conditioner.
- 11.5. Describe the control system of bus air-conditioning system.
- 11.6. Identify the electric circuit of bus air-conditioning system.
- 11.7. Mention typical specification of bus air conditioner.

**AUTOMOBILE AIRCONDITIONER SERVICING****12. Understand the automobile air-conditioning system servicing.**

- 12.1. Identify the equipment and tools used in automobile air-conditioning servicing works.
- 12.2. Mention the cautions for air conditioner service and special cautions for refrigerant 134a system.
- 12.3. List the various contaminants of air conditioner.
- 12.4. Mention the effects of various contaminants of air conditioner.
- 12.5. Describe the refrigerant system quick check and air conditioner visual inspection.
- 12.6. Mention the sight glass indication for various conditions in the refrigeration system.
- 12.7. Describe the leak detection methods of automobile air-conditioning system.
- 12.8. Mention the evacuation, refrigerant charging and oil adding procedure of automobile air conditioner unit.
- 12.9. Mention the performance test procedure of automobile air conditioner.
- 12.10. Mention the fault diagnosis and remedies of automobile air conditioner.

**Practical :**

1. Identify the equipment & tools and materials used in basic refrigeration and automobile air-conditioning works.
2. Perform the tube cutting, bending and swaging of copper tube.
3. Perform the soldering and brazing of refrigeration & air-conditioning work.
4. Connect the gage manifold and observe the low side and high side pressure of automobile air-conditioning refrigeration cycle.
5. Perform the visual inspection of automobile air-conditioning system for proper operation.
6. Isolate the compressor from the system.
7. Add oil to the compressor.
8. Remove and replace clutch pulley bearing.
9. Service the magnetic clutch.
10. Service and repair the hairgrip clutch.
11. Replace the refrigerant hose.
12. Replace the refrigerant filter.
13. Measure the saturation pressure of R -12 and R -134a at prevailing ambient temperature.
14. Evacuate the automobile air-conditioning system and charge refrigerant in the system.
15. Test the leaks in the automobile air-conditioning system.
16. Purge the air-conditioning system.
17. Test and adjust the thermostatic expansion valve.
18. Replace the compressor shaft seal.
19. Test the performance of automobile air conditioner.

**REFERENCE BOOKS**

1. Modern Refrigeration and Airconditioning  
— Althouse/Turnquist/ Bracciano.
2. Basic Refrigeration and Airconditioning  
— Hazrh & Chakravarty.
3. Automobile Mechanics  
— Crouse – Anglin.

<b>6621</b>	<b>Computer application –1</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	6	2

**OBJECTIVES.**

- To develop skill to use computer and computer operating system.
- To perform skill on using word processing software packages to create documents.
- To perform skill on using presentation software packages for documents presentation..
- To perform skill on using Internet and e-mail for sending and receiving documents.

**SHORT DESCRIPTION**

Computer hardware System, Operating Systems, perating system environment, Customizing and configuring operating System files; Utility software and Anti viruses; Fundamentals of word processing; Create Simple documents; Print and preview the document; Manage files; Format the documents; Merge files; skill on presentation software, skill on Internet, e-mail and web browsing.

**DETAIL DESCRIPTION****1. Show skill on computer hardware.**

- 1.1 Identify the main components of Personal Computer.
- 1.2 Identify the CPU components and commonly used I/O devices and memories.
- 1.3 Identify Primary and secondary storage devices & demonstrate the maintenance of the devices.
- 1.4 Identify the allied equipment used with PC system(UPS, Stabilizer band IPS).
- 1.5 Make the cable connection of PC system, UPS and printer with power line.
- 1.6 Turn ON the power Switch and demonstrate booting effect of PC system.

**2 Practice on windows operating system environment.**

- 2.1 Observe the windows Screen and identify each item on desktop.
- 2.2 Show the function of start button & taskbar.
- 2.3 Start and quit programs.
- 2.4 Switch between programs.
- 2.5 Open and close a document.
- 2.6 Find something using find command.
- 2.7 Start a program by using run command.

**3 Practice on customizing and configuring windows operating system.**

- 3.1 Change system setting (say, system date, time, password, etc).
- 3.2 Configure the taskbar, shortcuts, desktop items etc.
- 3.3 Install driver software & configure printer, plotter, mouse & other PC equipment.
- 3.4 Use windows explorer for copy, move, delete or rename files and folder.
- 3.5 Add items to the start menu.
- 3.6 Create a shortcut on the desktop.
- 3.7 Customize windows i.e. desktop colors, patterns, wallpaper, screen saver, etc.

- 4 Practice on advance features of windows operating system and disk utilities.**
  - 4.1 Use windows efficiently (i.e. copying, moving files quickly).
  - 4.2 Organize your applications into groups (i.e. creating & deleting a group).
  - 4.3 Install a new application program.
  - 4.4 Back up, compare and restore files.
  - 4.5 Freeze disk space(i.e. check your system's disk space, delete unnecessary files).
- 5 Practice on Disk Operating System(DOS).**
  - 5.1 Restart the computer in DOS mode.
  - 5.2 Use internal and external DOS commands.
  - 5.3 Create, delete and view directories.
  - 5.4 Change directories.
  - 5.5 Use wild card in DOS mode.
- 6 Perform skill in managing disk.**
  - 6.1 Format and unformat a disk.
  - 6.2 Create a system disk.
  - 6.3 Make a system disk.
  - 6.4 Restore directories and files.
  - 6.5 Recover files from defective disks.
- 7 Perform skill in working with files and folder.**
  - 7.1 Organize files and folders.
  - 7.2 Copy files (copy a single file, a group of files).
  - 7.3 Rename a file.
  - 7.4 Delete files (delete a single file, a group of files).
  - 7.5 Copy directories & sub directories.
  - 7.6 Show directories such as directory tree directory name, paths, and the current directory.
- 8 Perform skill in working with utilities software and anti viruses.**
  - 8.1 Run anti virus software (say Toolkit, Norton Anti virus, PC cillin, Kaspersky etc) and scan for viruses.
  - 8.2 Protect the computer from viruses.
  - 8.3 Run utility software such as PC, Tools, NC, NU, etc.
  - 8.4 Use utility software for copying, renaming, deleting and moving folders or files.
  - 8.5 Develop keyboard skills by standard touch typing rules using typing tutor packages.
- 9 project1: Connect each part of a personal computer(PC) ,operate it with windows operating system and install / uninstall programs/software.**

**WORD PROCESSING:**

- 10 Practice on creating a simple document using word processor.**
- 10.1 Open windows based word processor and identify the different elements of the editing window.
  - 10.2 Type text, edit text using word processor.
  - 10.3 Select text and modify the text.
  - 10.4 Save the document then quit & reopen the document.
  - 10.5 Copy, move, and delete text.
  - 10.6 Copy from one word document to another.
- 11 Practice on working with graphics and drawing.**
- 11.1 Import graphics using insert picture command.
  - 11.2 Use clipboard to insert art.
  - 11.3 Resize graphics, crop graphics with mouse and with picture command.
  - 11.4 Open drawing tools bar.
  - 11.5 Draw a textbox and write text to it.
  - 11.6 Draw graphs using different objects from the drawing tools bar.
  - 11.7 Group, Ungroup, rotate and flip objects.
  - 11.8 Fill drawn items with different color, change line styles, arrow heads, line colors & shades of gray.
- 12 Show skill on managing file.**
- 12.1 Open previously saved documents.
  - 12.2 Open documents from or within word.
  - 12.3 Open non-word documents.
  - 12.4 Open documents as read only.
  - 12.5 Find files, searching by file names, dealing with large lists, Searching inside documents.
  - 12.6 Save under a different file name and save to other location.
  - 12.7 Save in non-word formats.
  - 12.8 Make backup files for safe keeping and recover damaged file.
- 13 Show skill on formatting a document.**
- 13.1 Change document margins.
  - 13.2 Set margin with the page setup dialog box.
  - 13.3 Drag margins in print preview.
  - 13.4 Print in the margins.
  - 13.5 Repaginate documents.
  - 13.6 Force page breaks and force paragraphs to start on a new page.
  - 13.7 Move and delete page breaks.
  - 13.8 Keep things (lines, paragraphs, etc.) together on a page.
- 14 Show skill in selecting characters and fonts.**
- 14.1 Format the character with the formatting toolbar.
  - 14.2 Create and use different options of font dialog box.
  - 14.3 Create keyboard shortcuts for character formatting.
  - 14.4 Underline text (double, single, dotted, etc) and create bold Italicized character.

- 14.5 Expand and condense character spacing.
  - 14.6 Create superscripts and subscripts and color character.
  - 14.7 Demonstrate the change case command.
  - 14.8 Remove and toggle to remove character formatting.
  - 14.9 Type special characters and symbols using the symbol command.
  - 14.10 Bullet the existing paragraphs.
  - 14.11 Type new bullet lists, change bullet styles and specify custom bullets.
- 15 Practice on paragraphs, line spacing, borders and shading.**
- 15.1 Create paragraphs and split text into multiple paragraph.
  - 15.2 Join and delete paragraphs.
  - 15.3 Format the paragraph with the formatting toolbar, paragraph dialog box & keyboard shortcuts.
  - 15.4 Index paragraphs automatically and index with the ruler, toolbar keyboard shortcuts and with paragraph dialog box.
  - 15.5 Align and justify text and adjust the space between lines such as single spacing, double spacing etc.
  - 15.6 Create and remove borders and shading.
  - 15.7 Create lines with the border command.
  - 15.8 Show the border toolbar.
  - 15.9 Show custom border and lines increase the space between border and text.
- 16 Practice on tables and Perform skill in modifies table design.**
- 16.1 Create a simple table using table button & table menu.
  - 16.2 Enter and edit text in a table.
  - 16.3 Select cells, columns, rows group of cells and the whole table.
  - 16.4 Add rows at the end and in the middle of a table, then delete rows.
  - 16.5 Change row heights, and resize rows with cell height and width.
  - 16.6 Change the spacing between rows.
  - 16.7 Insert columns at the right edge and in the middle of a table, then delete the columns.
  - 16.8 Change column and cell width with the ruler and the auto fit bottom.
  - 16.9 Merge cells.
  - 16.10 Change the space between columns merge different cells.
- 17 Project 2 : Create a complete document(such as a personal bio-data) with MS Word in Bengali and English using all necessary formatting with graphics,table and save it in a created folder.**
- 18 Practice on previewing & printing.**
- 18.1 Connect printer to computer and keep paper in the printer tray.
  - 18.2 Open page setup dialogue box and set the paper size.
  - 18.3 Show print preview to adjust document.
  - 18.4 Open print dialog box options to print document.
  - 18.5 Show, use and leave print dialog box.

**Presentation Software:****19 Create a powerpoint Presentation .**

- 19.1 Identify the different components of MS powerpoint package.
- 19.2 Design templates.,colour schemes, animation schemes etc.
- 19.3 Add/delete slides in the Presentation .
- 19.4 Add pictures, graphs, charts and other objects into slides.
- 19.5 Animate text and other objects in a very attractive way or motion.
- 19.6 Save and execute the slides.

**20 Enhance powerpoint Presentation.**

- 20.1 Use sound effects and custom path of animation effects in the Presentation
- 20.2 Add video clips.
- 20.3 View slides of powerpoint Presentation in different ways(for exmple outlining,slide shorer etc.).
- 20.4 Reorder slides on the outline tab.
- 20.5 Preview and print the Presentation .

**21. Perform attractive Presentation using MS powerpoint.**

- 21.1 Customize slide show setup for a prticular audiance.
- 2 1.2 Setup a slide show, rehashing and timing of a Presentation .
- 21.3 Review and adjust slide timing as per requirements.
- 21.4 Perform skill on Packaging for CD and Show the Presentation .

**22. Perform skill on Internet applications.**

- 22.1 Connect to the Inernet using dial up or broadband connection.
- 22.2 Identify the different components of browsing softwares like Internet explorer, mozilla firefox etc.
- 22.3 Browse and visit the reputed websites all over the world.
- 22.4 Use the search engines for searching informaion on the web.
- 22.5 Read news papers from the Internet.

**23. Perform skill on Electronic mailing system.**

- 23.1 Create an e-mail account (on yahoo, hotmail, gmail etc.)
- 23.2 Compose an e-mail message.
- 23.3 Attach file to an e-mail message and open an attached file.
- 23.5 Send and receive e-mil messages by using your created account..
- 23.6 Delete messages temporarily and permanently.
- 23.5 Sign out from your created e-mail account.



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**BASIC ELECTRICITY**

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<b>3</b>	<b>3</b>	<b>4</b>

**OBJECTIVES**

- To familiarize the basic electrical quantities & laws and to apply them in solving problems of electrical circuits.
- To acquaint with electro-chemistry, electro-magnetism, electro-magnetic induction and electrostatic.
- To develop skill in electrical wiring.
- To appreciate the safety measures to be taken for electrical wiring.

**SHORT DESCRIPTION**

Electric current and ohm's law; Conductors and insulators; Basic electrical circuits; Power and energy; Basic electro-chemistry; Electro-magnetism; Electro-magnetic induction; Electrostatics; Wires and cables; Hand tools used in wiring; House wiring; Controlling devices; Protective devices; Earthing.

**DETAIL DESCRIPTION****Theory :****ELECTRIC CURRENT**

- 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.

**CONDUCTOR & INSULATOR**

- 2 Understand conductor and insulator.**
  - 2.1 Define conductor and insulator.
  - 2.2 Explain the conductor and insulator according to electron theory .
  - 2.3 List at least 5 conductors and 5 insulators.
  - 2.4 Describe the factors upon which the resistance of a conductor depends.
  - 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.

**OHM'S LAW****3 Understand Ohm's Law**

- 3.1 State Ohm's law.
- 3.2 Deduce the relation between current, voltage and resistance.
- 3.3 Solve problems relating to Ohm's law.

**BASIC ELECTRIC CIRCUITS****4 Understand electric circuit.**

- 4.1 Define electric circuit.
- 4.2 Name the different types of electric circuits.
- 4.3 Define series circuit, parallel circuit and mixed ckt.
- 4.4 Describe the characteristic of series circuit and parallel circuit.
- 4.5 Calculate the equivalent resistance of series circuit, parallel circuit and Mixed circuit.
- 4.6 Solve problems relating to series circuit, parallel circuit and mixed ckt .

**POWER AND ENERGY****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 of electrical power and energy.
- 5.5 Draw the connection diagram of wattmeter and energy meter in an electrical circuit.
- 5.6 Solve problems relating to electrical power and energy Calculation.

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

- 6.1 Describe the heating effect of electricity when current flows through a conductor.
- 6.1 Explain Joule's law regarding the development of heat in electrical circuit.
- 6.2 Describe meaning of "J".
- 6.3 Solve problems relating to Joule's law.
- 6.4 Solve problems relating to Joule's law.

**BASIC ELECTRO-CHEMISTRY****7 Understand the concept of cells.**

- 7.1 Describe the meaning of potential difference.
- 7.2 Define the meaning of cell.
- 7.3 Classify the Cell
- 7.4 Define Primary Cell
- 7.5 List the 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.

**8. Understand the construction and principle of action of secondary cell.**

- 8.1 Define secondary cell.
- 8.2 Describe the construction and principle of action of a lead acid cell.
- 8.3 List the uses of lead acid cell.
- 8.4 List the advantages of secondary cell.
- 8.5 Distinguish between a cell and a battery.
- 8.6 Describe the series and parallel grouping of cells.
- 8.7 Distinguish between Primary & Secondary Cell

**9 Understand the concept of capacitors and capacitance.**

- 9.1 Define capacitor and capacitance.
- 9.2 Name the unit of capacitance.
- 9.3 Name the different types of capacitor.
- 9.4 Write the uses of capacitor.
- 9.5 Determine the equivalent capacitance of a number of capacitors connected in series.
- 9.6 Determine the equivalent capacitance of a number capacitors connected in parallel.
- 9.7 Explain the energy stored in a capacitor.
- 9.8 Solve problems relating to capacitor connected in series and in parallel.

**ELECTRO - MAGNETISM****10 Understand Electro - magnetism.**

- 10.1 Describe magnetic field, magnetic lines of force and its properties.
- 10.2 Describe field intensity and magnetic flux density.
- 10.3 Distinguish between absolute permeability and relative permeability.
- 10.4 Describe the concept of magnetic effect of electrical current.
- 10.5 States Maxwell's cork screw rule and Fleming's right hand rule for determining the direction of magnetic field and current.
- 10.6 Explain the force experienced in a current carrying conductor placed in a magnetic field.
- 10.7 State Fleming's left hand rule.
- 10.8 Explain the work done by a moving conductor in a magnetic field.
- 10.9 Explain the force between two parallel current carrying conductor.

**11 Understand magnetic circuit.**

- 11.1 Define a magnetic circuit.
- 11.2 Define the terms magnetizing force, magnetomotive force, ampere – turns, reluctance, permeance, permeability, magnetic linkage and leakage.
- 11.3 Show the relation between magnetomotive force, reluctance and magnetic field intensity or magnetizing force.
- 11.4 Compare a magnetic circuit with an electrical circuit.

## **ELECTRO MAGNETIC INDUCTION**

### **12 Understand electro- magnetic induction.**

- 12.1 Define Faraday's laws of electro-magnetic induction.
- 12.2 Describe the magnitude of dynamically induced emf and statically induced emf
- 12.3 Solve problems relating to emf generation.
- 12.4 Define Lenz's law and Fleming's right hand rule for determining the direction of induced emf and current.
- 12.5 Define self induced emf and self inductance.
- 12.6 Explain inductance of a iron cored inductor.
- 12.7 Define mutual inductance and co-efficient of coupling.

## **WIRES AND CABLES**

### **13 Understand the uses of wires and cables.**

- 13.1 Define electrical wires and cables.
- 13.2 Distinguish between wires and cables.
- 13.3 Describe the construction and uses of PVC, VIR, TRS or CTS and flexible wires
- 13.4 Describe the procedure of measuring the size of wires and cables by wire gauge.
- 13.5 Describe the current carrying capacity of a wire.

## **JOINTS AND SPLICES**

### **14 Understand the usefulness of joints and splices.**

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

## **HOUSE WIRING**

### **15 Understand the different methods of house wiring.**

- 15.1 State the meaning of wiring.
- 15.2 List the types of wiring.
- 15.3 State the procedure for Channel wiring, surface conduit wiring and concealed wiring.
- 15.4 State the types of wiring used in :
  - a) Residential building.
  - b) Workshop
  - c) Cinema hall/Auditorium
  - d) Temporary shed
- 15.5 List the name of fittings used in different types of electrical wiring.

**CONTROLLING DEVICES****16 Understand the construction and uses of controlling devices.**

- 16.1 Define controlling device.
- 16.2 Name the different types of controlling devices.
- 16.3 Describe the constructional features and uses of tumbler switch, iron clad switch, push button switch and gang switch.

**PROTECTIVE DEVICES****17 Understand the construction and uses of protective devices.**

- 17.1 Define protective devices.
- 17.2 Name the different types of protective devices.
- 17.3 Name the different types of fuses used in house wiring.
- 17.4 Describe the construction and uses of renewable fuse.
- 17.5 Name the different types of circuit breaker used in house wiring.

**EARTHING****18 Understand the necessity of ear thing.**

- 18.1 Define earthing
- 18.2 Explain necessity of earthing
- 18.3 Name different types of ear thing

**WIRING CIRCUITS****19 Apply the principle of controlling electrical circuit by switch.**

- 19.1 Sketch the wiring diagram of one lamp controlled by one SPST switch and describe its uses.
- 19.2 Sketch the wiring diagram of one lamp controlled by two SPDT switch and describe its uses.
- 19.3 Draw the wiring diagram of one calling bell with a lamp controlled from one point.
- 19.4 Draw the wiring diagram of a fluorescent tube light circuit.
- 19.5 Describe the working principle of fluorescent tube light.

**ELECTRICITY ACT****20 Understand electricity act/rule of Bangladesh and safety practices.**

- 20.1 State electricity act/rule of Bangladesh to be followed in electrical wiring.
- 20.2 Describe the importance of electricity act/rule.
- 20.3 Describe safety procedure against electrical hazards.
- 20.4 List the performance of safety practices for electrical equipment, machines and accessories.

**Practical :**

- 1 Identify and use electrical measuring instruments.**
  - 1.1 Identify Voltmeters, Ammeters, Ohm Meter, 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 Show skill in verification of Ohm's Law.**
  - 2.1 Sketch the circuit diagram for the verification of Ohm's Law.
  - 2.2 List tools, equipment and material 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 w 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 t 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 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 Show skill in grouping a number of cell to form a battery .**
  - 6.1 Sketch the connection diagram of 4 cells (1.5 V each) in series.
  - 6.2 List the materials and equipment required for the experiment.
  - 6.3 Connect the terminals of the cells according to the diagram.
  - 6.4 Determine the terminal voltage of the group and verify it with the calculated result.
- 7 Make a simple Cell.**
  - 7.1 List the materials for constructing a simple cell.
  - 7.2 Prepare electrolyte by diluting  $H_2SO_4$  with distilled water on proper ratio.
  - 7.3 Assemble the cell using required electrolyte and electrodes along with necessary materials.
  - 7.4 Measure the emf of the cell.
- 8 Show skill in making artificial magnets.**
  - 8.1 Make an artificial magnet by rubbing method (Single touch)
  - 8.2 Make an artificial magnet by divided touch method.
  - 8.3 Make an artificial magnet by passing electrical current.
  - 8.4 Detect the polarity of the produced artificial magnet with the help of a compass needle.
- 9. Show skill in uses of hand tools, wires and cables.**
  - 9.1 List the hand tools used in electrical wiring.
  - 9.2 Identify the hand tools used in electrical wiring.
  - 9.3 Draw neat sketches of hand tools used in electrical wiring.
  - 9.4 Identify different types of wires and cables.
  - 9.5 Measure the diameter of the identified wire and cables using standard wire gauge.
- 10. Show skill in making a duplex joint and a T-joint .**
  - 10.1 Sketch a duplex joint and a T-joint
  - 10.2 Perform skinning and scraping of two pieces of PVC duplex cal and two pieces of simplex PVC cables.
  - 10.3 Make the joints according to sketches.
  - 10.4 Write a report.
- 11 Show skill in preparing wiring circuit of two lamps controlled from the points separately.**
  - 11.1 Sketch a working circuit of two lamps controlled from two point separately.
  - 11.2 Make the wiring circuit using required materials and equipment a wiring board.
  - 11.3 Test the connection of circuit by providing proper supply.

- 12. Show skill in preparing wiring circuit of one lamp controlled from the points.**
  - 12.1 Sketch a working diagram of one lamp controlled by two SPD tumbler switches.
  - 12.2 Complete the wiring circuit using required materials and equipment on wiring board.
  - 12.3 Test the connection of circuit by providing proper supply.
- 13 Show skill in preparing wiring circuit of one bell with two indicating lamp controlled from two points.**
  - 13.1 Sketch a working diagram of one bell with two indicating lamps controlled by two push button switch.
  - 13.2 Make the wiring circuit using required materials and equipment in wiring board.
  - 13.3 Test the connection of circuit by providing proper supply.
- 14 Show skill in preparing wiring circuit of a fluorescent tube light.**
  - 14.1 Sketch a working diagram of a fluorescent tube light circuit.
  - 14.2 Make the connection of a fluorescent tube light circuit using required materials and equipment.
  - 14.3 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