



# **BANGLADESH TECHNICAL EDUCATION BOARD**

Agargaon, Dhaka-1207.

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

## **MACHANICAL TECHNOLOGY**

**TECHNOLOGY CODE: 670**

**FIRST SEMESTER**

**DIPLOMA IN ENGINEERING  
PROBIDHAN-2016**

**Mechanical Technology**

**1st Semester**

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				
						Theory		Practical		Total
						Cont. assess	Final exam	Cont. assess	Final exam	
1	61011	Engineering Drawing	0	6	2	0	0	50	50	100
2	65711	Bangla	3	3	4	60	90	50	0	200
3	65812	Physical Education & Life Skill Development	0	3	1	0	0	25	25	50
4	65911	Mathematics –I	3	3	4	60	90	50	0	200
5	65913	Chemistry	3	3	4	60	90	25	25	200
6	66712	Electrical Engineering Fundamentals	3	3	4	60	90	25	25	200
7	67013	Mechanical Engineering Materials	2	0	2	40	60	0	0	100
		Total	14	21	21	280	420	225	125	1050

## ENGINEERING DRAWING (61011)

T P C  
0 6 2

### OBJECTIVES:

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

### SHORT DESCRIPTION:

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

### DETAIL DESCRIPTION:

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

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

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

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

#### 3 Adopt the alphabet of lines.

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

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

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

**5 Prepare scale for drawing application.**

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

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

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

**7 Adopt standard symbols in drawing.**

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

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

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

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

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

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

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

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

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

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

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

**REFERENCE BOOKS:**

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

**BANGLA (65711)**

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**উদ্দেশ্য :**

১. মাতৃভাষা হিসেবে বাংলা ভাষার প্রকৃতি ও বৈশিষ্ট্য সম্পর্কে ধারণা লাভ। ভাষার ব্যবহারে প্রায়োগিক যোগ্যতা অর্জন।
২. বাংলা সাহিত্য পঠন-পাঠনের মাধ্যমে জাতীয় চেতনা, দেশপ্রেম, মুক্তিযুদ্ধের চেতনা, শুদ্ধাচার, নীতি ও মূল্যবোধের উন্মেষ ঘটানো।

**সংক্ষিপ্ত বিবরণী :**

মাতৃভাষা ও সৃজনশীলতা : বাংলা ভাষা রীতির বিচিত্রতা, বানান রীতি, পত্র রচনা এবং কবিতা, প্রবন্ধ, নাটক, উপন্যাস ও ছোট গল্প।

**বিশদ বিবরণী:**

**১। বাংলা ভাষার প্রয়োগ:**

ভাষার সংজ্ঞা, বাংলা ভাষা রীতি - সাধু, চলিত, আঞ্চলিক বা উপভাষা (সংজ্ঞা, বৈশিষ্ট্য, পার্থক্য ও উদাহরণ)

**২। বাংলা বানান রীতি ও শব্দ প্রয়োগ:**

- ২.১। বাংলা একডেমির প্রমিত বানান রীতি, গ-ত্ব ও ষ-ত্ব বিধি
- ২.২। শব্দ ও শব্দের শ্রেণি বিভাগ (সংজ্ঞা, শব্দের গঠন, উৎস বা উৎপত্তি ও অর্থগত )
- ২.৩। বাক্য প্রকরণ ও গঠন রীতি (সংজ্ঞা, বাক্য গঠন এবং প্রকার)

**৩। পত্র রচনা অনুশীলন:**

- ৩.১। আবেদন পত্র (চাকুরি, ছুটি),
- ৩.২। চাকুরিতে যোগদান পত্র,
- ৩.৩। মানপত্র,
- ৩.৪। স্মারকলিপি,
- ৩.৫। সংবাদপত্রে প্রকাশের জন্য পত্র

**৪। কবিতা চর্চা:**

- ৪.১। বঙ্গভাষা -মাইকেল মধুসূদন দত্ত
- ৪.২। সোনার তরী - রবীন্দ্র নাথ ঠাকুর
- ৪.৩। উমর ফারুক -কাজী নজরুল ইসলাম
- ৪.৪। বাংলার মুখ আমি- জীবনানন্দ দাশ
- ৪.৫। আসাদের শার্ট - শামসুর রাহমান
- ৪.৬। স্বাধীনতা শব্দটি কি করে আমাদের হলো? - নির্মলেন্দু গুণ

**৫। প্রবন্ধ জানা :**

- ৫.১। অর্ধাঙ্গী -রোকেয়া সাখাওয়াত হোসেন
- ৫.২। বইকেনা - সৈয়দ মুজতবা আলী

**৬। একাঙ্কিকা (নাটিকা):**

- ৬.১। মানুষ -মুনীর চৌধুরী

**৭। উপন্যাস:**

- ৭.১। লালসালু - সৈয়দ ওয়ালী উল্লাহ

**৮। ছোট গল্প:**

- ৮.১। হৈমন্তী - রবীন্দ্র নাথ ঠাকুর
- ৮.২। একুশের গল্প - জহির রায়হান
- ৮.৩। পাতালেহাসপাতালে - হাসান আজিজুল হক

**ব্যবহারিক:**

**১। নির্ধারিত বক্তৃতা অনুশীলন:**

বাংলাদেশ ও বাঙালি সংস্কৃতি, বিভিন্ন জাতীয় দিবস (একুশে ফেব্রুয়ারি ও আন্তর্জাতিক মাতৃভাষা দিবস, স্বাধীনতা দিবস, বিজয় দিবস, জাতীয় শোক দিবস, মুজিব নগর দিবস, মহান মে দিবস)

প্রাতিষ্ঠানিক বক্তৃতা- নবাগত শিক্ষক/ছাত্রছাত্রীদের বরণ, গুরুত্বপূর্ণ ব্যক্তিবর্গের আগমন উপলক্ষে বক্তৃতা।

**২. উপস্থিত বক্তৃতায় অংশগ্রহণ: বিষয়বস্তু উন্মুক্ত**

**৩. আবৃত্তি অনুশীলন :** ১. মানুষ

- কাজী নজরুল ইসলাম

২. আকাশ নীলা

- জীবনানন্দ দাশ

৩. পল্লী জননী

- জসীম উদ্দীন

৪. ছাড়পত্র

- সুকান্ত ভট্টাচার্য

৫. তোমাকে পাওয়ার জন্য হে স্বাধীনতা - শামসুর রাহমান

৬. নিষিদ্ধ সম্পাদকীয় - হেলাল হাফিজ

**৪. বিতর্ক প্রতিযোগিতা (নমুনা)**

সংস্কৃতিই আধুনিক মানুষের ধর্ম

তথ্য প্রযুক্তির অবাধ ব্যবহারই যুব সমাজের অবক্ষয়ের মূল কারণ

গতানুগতিক শিক্ষা নয় কর্মমুখি শিক্ষাই অর্থনৈতিক মুক্তির চাবিকাঠি

চালকের অসাবধানতাই সড়ক দুর্ঘটনার প্রধান কারণ

মুক্তিযুদ্ধের চেতনাই অসাম্প্রদায়িক বাংলাদেশ প্রতিষ্ঠার মূলমন্ত্র

প্রযুক্তির বিকাশই প্রকৃতি বিনাশের একমাত্র কারণ

**৫. প্রতিবেদন প্রণয়ন ও উপস্থাপন:**

স্থানীয় বিভিন্ন সমস্যা ও অনুসন্ধানী যে কোন বিষয়।

<b>PHYSICAL EDUCATION &amp; LIFE SKILL DEVELOPMENT (65812)</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>0</b>	<b>3</b>	<b>1</b>

### **OBJECTIVES:**

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

### **SHORT DESCRIPTION**

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

### **DETAIL DESCRIPTION**

#### **1. Recite national anthem and make assembly**

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

#### **2. Conduct warm up.**

- 2.1 Conduct general warm up :  
Spot running (Slow, Medium & Fast), Neck rotation, Hand rotation, Side twisting, Toe touching, Hip rotation, Ankle twisting, Sit up and Upper body bending (Front & Back).
- 2.2 Conduct squad drill :  
Line, File, Attention, Stand at ease, Stand easy, Left turn, Right turn, About turn, Mark time, Quick march, Right wheel, Left wheel, Open order march & Closed order march.
- 2.3 Conduct specific warm up :  
Legs raising one by one, Leg raising in slanting position, Knee bending and nose touching, Heels raising, Toes touching (standing and laying position), Hand stretch breathing (Tadasana, Horizontal, Vertical ).
- 2.4 Conduct mass physical exercise  
Hand raising, Side twisting, Front & back bending, Front curl, Straight arm curl two hand, Hands raising overhead and Push up.

#### **3. Conduct YOGA.**

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

#### **4. Exercise Muscle developing with equipment.**

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

#### **5. Conduct Meditation.**

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

**6. Demonstrate First Aid Skill.**

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

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

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

**8. Sports Science.**

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

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

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

**10. Understand human relation.**

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

**11. Experience vote of appreciation.**

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

**12. Practice stress management.**

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

**13. Practice time management.**

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

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

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

**15. Practice team work on:**

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

**16. Practice social work.**

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

**REFERENCE BOOK:**

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

## MATHEMATICS-1 (65911)

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### OBJECTIVES:

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

### SHORT DESCRIPTION:

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

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

### DETAIL DESCRIPTION:

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

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

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

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

#### 3 Understand the concept of complex numbers.

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

#### 4 Apply the concept of permutation.

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

#### 5 Apply the concept of Combination.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

13.2 Solve the problems of the type:

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

**REFERENCE:**

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

## CHEMISTRY (65913)

T	P	C
3	3	4

### OBJECTIVES:

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

### SHORT DESCRIPTION:

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

### DETAIL DESCRIPTION:

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

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

#### 2. Understand Ionic Equilibrium.

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

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

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

#### 4. Understand Water Treatment.

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

4.5 Visit a water treatment plant write a report.

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

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

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

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

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

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

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

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

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

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

## **PRACTICAL:**

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

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

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

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

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

**REFERENCE BOOKS:**

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

## ELECTRICAL ENGINEERING FUNDAMENTALS (66712)

T	P	C
3	3	4

### OBJECTIVES:

- To familiarize the basic electrical quantities & laws and to apply them in solving problems of electrical circuits.
- To acquaint with electromagnetism, electromagnetic induction.
- To develop skill in electrical wiring.
- To familiarize with DC generator, AC generator, AC motor, DC Motor & Transformers.
- To appreciate the safety measures to be taken for electrical wiring.

### SHORT DESCRIPTION:

Electric current, Voltage & Resistance; Conductors and insulators; Ohm's law; Kirchhoff's Law; Joule's law; Faraday's law; Basic electrical circuits; Power and energy; Electromagnetic induction; House wiring; Controlling devices; Protective devices; Earthing; DC Motor, AC Motor, DC Generator; AC Generator; Transformer & Electricity Act/Rule.

### DETAIL DESCRIPTION:

#### Theory:

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

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

#### 2. Understand conductor semiconductor & insulator.

- 2.1 Define conductor, semiconductor and insulator.
- 2.2 Explain the conductor, semiconductor and insulator according to electron theory.
- 2.3 List at least 5 conductors, 5 semiconductor 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  $R = \rho L/A$
- 2.7 Explain the meaning of resistivity and name the unit of resistivity.
- 2.8 Solve problems relating to laws of resistance.

#### 3. Understand Ohm's Law.

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

#### 4. Understand Kirchhoff's Law.

- 4.1 State Kirchhoff's current law.
- 4.2 Explain the [Kirchhoff's](#) current law.
- 4.3 State [Kirchhoff's](#) Voltage law.
- 4.4 Explain the [Kirchhoff's](#) Voltage law.
- 4.5 Solve problem by [Kirchhoff's Law](#)

#### 5. Understand electric circuit.

- 5.1 Define electric circuit.
- 5.2 Name the different types of electric circuits.
- 5.3 Define series circuit, parallel circuit and mixed circuit.
- 5.4 Describe the characteristics of series circuit and parallel circuit.
- 5.5 Calculate the equivalent resistance of series circuit, parallel circuit.

- 5.6 Solve problems relating to DC series circuit, parallel circuit and mixed circuit.
- 5.7 Define inductor, capacitor, inductive reactance & capacitive reactance.
- 5.8 Write the formula of inductive reactance, capacitive reactance & impedance.
- 5.9 Draw the AC circuit containing Resistor, Inductor and Capacitor in Series and parallel circuit.
- 5.10 Problem on AC series & parallel circuit.

**6. Apply the concept of electrical power and energy.**

- 6.1 Define electrical power and energy.
- 6.2 State the unit of electrical power and energy.
- 6.3 Show the relation between electrical power and energy.
- 6.4 Name the instruments for measuring electrical power and energy.
- 6.5 Draw the connection diagram of wattmeter and energy meter in an electrical circuit.
- 6.6 Solve problems relating to electrical power and energy calculation.

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

- 7.1 Explain Joule's law regarding the development of heat in electrical circuit.
- 7.2 Describe meaning of "J".
- 7.3 Solve problems relating to Joule's law.

**8. Understand the Faraday's laws of Electromagnetic Inductions**

- 8.1 Define Electromagnetic Inductions.
- 8.2 Explain Faraday's laws of Electromagnetic Induction.
- 8.3 Solve problems on Electromagnetic Induction.

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

- 9.1 Define electrical wires and cables.
- 9.2 Distinguish between wires and cables.
- 9.3 Describe the procedure of measuring the size of wires and cables by wire gauge.

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

- 10.1 State the meaning of wiring.
- 10.2 List the types of wiring.
- 10.3 State the types of wiring used in:
  - a) Residential building.
  - b) Workshop
  - c) Cinema hall/Auditorium
  - d) Temporary shed
- 10.4 List the name of fittings used in different types of electrical wiring.

**11. Understand the controlling and protective devices & use of those.**

- 11.1 Define controlling device.
- 11.2 Name the different types of controlling device.
- 11.3 Define protective device.
- 11.4 Name the different types of protective device.
- 11.5 Name the different types of fuses used in house wiring.
- 11.6 Name the different types of circuit breaker used in house wiring.

**12. Understand the necessity of earthing.**

- 12.1 Define earthing.
- 12.2 Explain necessity of earthing.
- 12.3 Name different types of earthing.

**13. Understand the principle of operation of transformer.**

- 13.1 Define transformer.
- 13.2 Explain the working principle of transformer.
- 13.3 Write the equation relating to voltage, current & turns of primary & secondary winding of transformer.
- 13.4 Name the different losses of transformer.
- 13.5 Define transformation ratio (voltage, current and turns).
- 13.6 Solve problems on transformation ratio.

**14. Understand the principle of DC generator.**

- 14.1 Define DC generator.
- 14.2 Classify DC generator.
- 14.3 Explain the constructional features of DC generator.
- 14.4 Explain the working principle of DC generator.
- 14.5 Name the different losses of DC generator.

**15. Understand the principle of AC generator.**

- 15.1 Define AC generator.
- 15.2 Explain the constructional features of AC generator.
- 15.3 Explain the working principle of AC generator.
- 15.4 Name the different losses of AC generator.

**16. Understand the principle of DC motor.**

- 16.1 Define DC motor.
- 16.2 Classify DC motor.
- 16.3 Name the different parts of DC motor.
- 16.4 Explain the working principle of DC motor.
- 16.5 Name the different losses of DC motor.
- 16.6 List the uses of different types of DC motor.

**17. Understand the principle of Induction motor.**

- 17.1 Define Induction motor.
- 17.2 Classify Induction motor.
- 17.3 Describe the principles of operation of capacitor motor.
- 17.4 List the uses of induction motor.

**18. Understand act/rule of Bangladesh and safety practices.**

- 18.1 State electricity act/rule of Bangladesh to be followed in electrical wiring.
- 18.2 Describe the importance of electricity act/rule.
- 18.3 Describe safety procedure against electricity hazard.
- 18.4 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, clip-on meter, frequency 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 materials required for the experiment.
- 2.3 Prepare the circuit according to the circuit diagram using proper equipment.
- 2.4 Check all connections before the circuit is energized.

2.5 Verify the law by collecting relevant data.

**3. Show skill in verification of Kirchhoff's Law.**

- 3.1 Sketch the circuit diagram for the verification of Kirchhoff's Law.
- 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 Verify the laws by collecting relevant data.

**4. Verify the characteristics of series and parallel circuits.**

- 4.1 Draw the working circuit diagram.
- 4.2 List tools, equipment and materials required for the experiment.
- 4.3 Prepare the circuit according to the circuit diagram using proper equipment.
- 4.4 Check all connections before the circuit is energized.
- 4.5 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.
- 4.6 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.

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

- 5.1 Sketch the necessary circuit diagram of an electrical circuit with electrical load, ammeter, voltmeter and wattmeter.
- 5.2 Prepare the circuit according to the circuit diagram using ammeter, voltmeter and wattmeter.
- 5.3 Record the power, measured by the wattmeter and verify the reading with that of calculated from ammeter and voltmeter.
- 5.4 Compare the measured data with that of calculated and rated power.

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

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

**7. Show skill in using of hand tools, wires and cables.**

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

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

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

**9. Show skill in preparing wiring circuit of one lamp controlled from two points.**

- 9.1 Sketch a working diagram of one lamp controlled by two SPD tumbler Switches.
- 9.2 Complete the wiring circuit using required materials and equipment on wiring board.
- 9.3 Test the connection of circuit by providing proper supply.

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

- 10.1 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 on wiring board.

13.3 Test the connection of circuit by providing proper supply.

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

11.1 Sketch a working diagram of a fluorescent tube light circuit.

11.2 Make the connection of a fluorescent tube light circuit using required materials and equipment.

11.3 Test the connection of the circuit by providing supply.

**12. Find the transformation ratio of a transformer.**

12.1 Develop a circuit to perform the experiment.

12.2 Select required equipment and materials.

12.3 Connect the components according to the circuit diagram.

12.4 Check the connections.

12.5 Record the primary (EP) and secondary (ES) voltages.

12.6 Calculate the transformation ratio using the relation

$$\frac{E_s}{E_p} = \frac{N_s}{N_p} = K$$

12.7 Note down the observations.

**13. Disassemble and re-assemble the parts of a DC generator/ DC motor.**

13.1 Select the necessary tools required for disassembling and re-assembling the parts of DC generator/ DC motor.

13.2 Identify at least ten main parts of the generator/motor.

13.3 Sketch at least ten main parts of the generator/motor.

13.4 Re-assemble the parts of the generator/motor.

13.5 Connect the generator/motor to the proper power source.

13.6 Start the generator/motor.

**14. Start a 1-phase capacitor type motor/ceiling fan with regulator.**

14.1 Select the equipment and tools required for the experiment.

14.2 Sketch a working diagram.

14.3 Identify the two sets of coils.

14.4 Connect the capacitor with the proper set of coil.

14.5 Connect power supply to the fan motor.

14.6 Test the rotation of the motor in opposite direction by changing the capacitor connection.

14.7 Note down the observations.

**REFERENCE BOOKS:**

- |  |                  |
|--|------------------|
| 1 A Text Book of Electrical Technology | - B. L. Theraja  |
| 2 Basic Electricity                    | - Charles W Ryan |
| 3 Basic Electrical Theory and Practice | - E. B. Babler   |
| 4 Electrical Machine                   | - Siskind        |

## **MECHANICAL ENGINEERING MATERIALS (67013)**

T	P	C
2	0	2

### **AIMS:**

- To identify and classify the materials used for manufacturing in mechanical engineering field.
- To recognize the sources of various engineering materials.
- To understand the characteristics of various engineering materials.
- Scope of materials application in mechanical engineering field.

### **SHORT DESCRIPTION:**

Aspects of engineering materials; Ferrous metals and alloys; Non-ferrous metals; Fundamental concept of aluminum; Bricks; Sand; Cement; Sound absorbing and heat insulating materials; Glass and ceramics, Paints and varnishes, Fire and water proofing materials; Fuels and lubricants; Plastic materials, Composite materials; Conducting magnetic materials and optical fiber.

### **DETAIL DESCRIPTION:**

#### **1 Understand engineering materials.**

- 1.1 Define engineering materials.
- 1.2 Classify the engineering materials.
- 1.3 Characteristics of engineering materials.

#### **2 Understand ferrous metals and alloys.**

- 2.1 Mention types of ferrous metals used in industry.
- 2.2 Define mild steel and cast iron.
- 2.3 Describe and types of alloy steel.
- 2.4 State the use of steel.

#### **3 Understand non-ferrous metals.**

- 3.1 Define non-ferrous metals.
- 3.2 Classify non-ferrous metals in industrial used.
- 3.3 Describe the use of non-ferrous metals and alloys like copper, zinc, tin, lead, brass and bronze.

#### **4 Understand the fundamental concept of aluminum.**

- 4.1 Define aluminum.
- 4.2 State the important properties of aluminum.
- 4.3 State the use of aluminum.

#### **5 Understand brick as construction materials.**

- 5.1 Define brick.
- 5.2 State manufacturing process of bricks.
- 5.3 Describe the process of brick drying.
- 5.4 Describe the methods of kiln burning of brick.
- 5.5 Draw the sketches Bull's trench kiln & Hoffman's kiln.

#### **6 Understand the application of sand.**

- 6.1 Mention the classification of sand according to their sources.
- 6.2 Mention the specifications of good sand.
- 6.3 Describe the purpose of grading of sand.
- 6.4 Mention the use of various grades of sand.

**7 Understand the application of cement.**

- 7.1 Define cement.
- 7.2 Mention types of cement.
- 7.3 Explain the functions of various ingredients of cement.
- 7.4 Distinguish between wet process and dry process of manufacturing Portland cement.
- 7.5 Draw a flow diagram based on wet process of manufacturing of cement.
- 7.6 Mention the uses of cement as engineering material.

**8 Understand sound absorbing and heat insulating materials.**

- 8.1 Mention the functions of insulating materials.
- 8.2 List five natural heat insulating materials.
- 8.3 Mention the names of synthetic insulating materials.
- 8.4 Describe the sources of obtaining rubber, cork and ebonite.
- 8.5 Describe the uses of asbestos as insulating material.
- 8.6 List three natural and artificial sound absorbing materials.
- 8.7 Explain light weight concrete used in acoustic works.

**9 Understand fundamental concepts of glass and ceramics.**

- 9.1 Define constituents of glass.
- 9.2 State properties of glass.
- 9.3 Describe uses of glass.
- 9.4 Mention the constituents of ceramics.
- 9.5 Classify ceramics.
- 9.6 Mention the properties of ceramics.
- 9.7 Explain the use of ceramics in engineering field.

**10 Understand concepts of paints and varnishes.**

- 10.1 Define paints and varnish with classification.
- 10.2 Define characteristics of paint.
- 10.3 Describe color code.
- 10.4 Mention the use of different types paint.

**11 Understand the fundamental aspects of fire and water proofing materials.**

- 11.1 Describe fire proofing materials and water proofing materials.
- 11.2 Mention the use of fire and waterproof materials.
- 11.3 Define characteristics of refractory materials.
- 11.4 Mention the use of refractory materials.

**12 Understand the basic concepts of fuels and lubricants.**

- 12.1 Discuss about fuel and lubricants.
- 12.2 State purposes of fuels with their classifications.
- 12.3 Mention different types of lubricants.
- 12.4 Explain characteristics of lubricating oils.

**13 Understand plastic materials.**

- 13.1 Define plastic.
- 13.2 List the names of raw materials for plastic.
- 13.3 Classify different types of plastic.
- 13.4 Mention the types of plastic molding.
- 13.5 Explain the use of plastic as engineering material.

**14 Understand the concept of composite materials.**

- 14.1 Define composite materials

14.2 Classify composite materials

14.3 Explain the application of composite materials

**15 Understand basic knowledge of conducting magnetic materials and optical fiber**

15.1 Define conducting, non-conducting and semi-conducting materials.

15.2 Describe the use of semi-conducting materials.

15.3 Name the types of soft and hard magnetic materials.

15.4 State the use of magnet in industrial field.

15.5 Mention the uses of optical fiber.

**REFERENCE BOOKS:**

- 1 A text book on Engineering Materials — G. J. Kulkarni
- 2 Engineering Materials — Dr. M. A. Aziz
- 3 Plastic Materials — J. A Brydson
- 4 Composite Materials — Krishan K. Chawla
- 5 The Complete Book on Ferrous, Non-Ferrous Metals with Casting and Forging Technology  
— NIIR Board of Consultants and Engineers. ( Website – NIIR.org)