

BANGLADESH TECHNICAL EDUCATION BOARD

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

ELECTRONICS TECHNOLOGY

SYLLABUS

SECOND SEMESTER

Electronics Technology (68)

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	1011	Engineering drawing	0	6	2	-	-	50	50	100
2	5711	Bangla	2	2	3	20	80	50	-	150
3	5911	Mathematics -1	3	3	4	30	120	50	-	200
4	5913	Chemistry	3	3	4	30	120	25	25	200
5	6711	Basic Electricity	3	3	4	30	120	25	25	200
6	6811	Basic Electronics	2	3	3	20	80	25	25	150
7	7011	Basic Workshop Practice	0	6	2	-	-	50	50	100
Total			13	27	22					1100

Electronics Technology (68)

2nd 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	Engendering materials	2	3	3	20	80	25	25	150
2	5712	English-1	2	0	2	20	80	-	-	100
3	5812	Physical education	0	2	1	-	-	50	-	50
4	5912	Physics -1	3	3	4	30	120	25	25	200
5	5921	Mathematics -2	3	3	4	30	120	50	-	200
6	6723	Electrical Engineering -1	3	3	4	30	120	25	25	200
7	6821	Electronic Devices & circuits-1	3	3	4	30	120	25	25	200
Total			16	17	22					1100

1011	ENGINEERING DRAWING	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 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 |

5711

BANGLA

T	P	C
2	2	3

উদ্দেশ্য :

- ১। ভাষা দক্ষতা সমূহের (Language skills) প্রায়োগিক যোগ্যতা অর্জন।
- ২। বাংলা সাহিত্য পঠন- পাঠনের মাধ্যমে বাঙালী জাতীয়তাবোধ, দেশ প্রেম, নৈতিকতা, মুক্তচিন্তা ও মূল্য বোধের উন্মেষ ঘটানো।

সংক্ষিপ্ত বিবরণী :

বাংলা ভাষা ও মাতৃভাষা ও সৃজনশীলতা ; গল্প, কবিতা, প্রবন্ধ, নাটক ও উপন্যাস সংকলন এবং বাংলা ভাষা রীতির বিভিন্নতা বানান ঘটিত সমস্যা ও উচ্চারণ রীতি বিবরণ ও পত্র রচনা।

বিশদ বিবরণী :

১ বাংলা ভাষার নির্ভুল প্রয়োগ :

- ক) বাংলা ভাষা : ভাষার সংজ্ঞা, বাংলা ভাষার উৎপত্তি ও ক্রম বিকাশ, বাংলা ভাষা রীতি- সাধু, চলিত রীতি ও আঞ্চলিক বা উপভাষা (সংজ্ঞা, বৈশিষ্ট্য, পার্থক্য ও উদাহরণ)
- খ) বাংলা বানান ও উচ্চারণ বিধি : স্বরবর্ণ, ব্যঞ্জনবর্ণ ও যুক্ত বর্ণের গঠন কৌশল, নাম, উচ্চারণ ও উদাহরণ; বাংলা একাডেমীর প্রমিত বানান রীতি জাতীয় শিক্ষাক্রম ও পাঠ্য পুস্তক বোডের বানান রীতি; উচ্চারণ রীতি ও উচ্চারণ সূত্র-বাংলা উচ্চারণের রীতি সমূহ, বহুল প্রচলিত কিছু শব্দের বানান ও উচ্চারণ বানানের অশুদ্ধি, বাক্যে পদের পদ-প্রয়োগ ও পদ বিন্যাসে ভুল, সাধু ও চলিত রীতির মিশ্রণজনিত ভুল।
- গ) বিবরণ : ভাবসম্প্রসারণ, সারাংশ ও সারমর্ম; প্রতিবেদন রচনা।
- ঘ) পত্র রচনা : ব্যক্তিগত, সামাজিক, দার্শনিক, সংবাদপত্র প্রকাশ উপযোগী, স্মারক লিপি, মান পত্র; আবেদন পত্র--প্রাতিষ্ঠানিক, চাকুরির আবেদন, জীবনবৃত্তান্ত ইত্যাদি।

২ বাংলা সাহিত্য :

ক) কবিতা

- বঙ্গ ভাষা-- মাইকেল মধুসূদন দত্ত
- সোনার তরী -- রবীন্দ্রনাথ ঠাকুর
- মানুষ-- কাজী নজরুল ইসলাম
- বাংলার মুখ আমি দেখিযাছি-- জীবনানন্দ দাশ

খ) ছোট গল্প :

- খোকাবাবুর প্রত্যাবর্তন --রবীন্দ্র ঠাকুর
- মহেশ -- শরৎ চন্দ্র চট্টোপাধ্যায়
- একুশের গল্প -- জহির রায়হান

গ) প্রবন্ধ :

- অর্ধাঙ্গী -- বেগম রোকেয়া সাখাওয়াত হোসেন
- জীবন ও বৃক্ষ -- মোতাহের হোসেন চৌধুরী
- সংস্কৃতি - আবুল ফজল

ঘ) একাঙ্কিকা

মানুষ -- মুনীর চৌধুরী

ঙ) মুক্তিযুদ্ধের উপন্যাস : (যে কোন একটি)

- আঙনের পরশমনি- হুমায়ূন আহমেদ
- জননী সাহসিনী - ১৯৭১ --আনিসুল হক

১. নির্ধারিত বক্তৃতা : বিভিন্ন জাতীয় দিবস বিষয়ক -- বিজয় দিবস, একুশে ফেব্রুয়ারি, আন্তর্জাতিক মাতৃভাষা দিবস, স্বাধীনতা দিবস, ১৫ আগস্ট-জাতীয় শোক দিবস, মে দিবস।

প্রাতিষ্ঠানিক বক্তৃতা – নবাগত শিক্ষকের বরণ, বিদায়ী ছাত্রদের উদ্দেশ্যে বক্তৃতা, শিক্ষা মন্ত্রী/ মহাপরিচালক/ চেয়ারম্যান এর আগমন উপলক্ষে বক্তৃতা।

২. আবৃত্তি :

- বাঁশী -- রবান্দ্রনাথ ঠাকুর
- কাশারী হুশিয়ার -- কাজী নজরুল ইসলাম
- হায় চিল--জীবনানন্দ দাশ
- প্রতিদান -- জসীম উদ্দিন
- সিঁড়ি - সুকান্নর ভট্টাচার্য
- তোমাকে পাওয়ার জন্য হে স্বাধীনতা --শামসুর রহমান
- বর্ণমালা আমার দুঃখিনী বর্ণমালা -শামসুর রহমান
- চিঠি দিও - মহাদেব সাহা।

৩. বিতর্ক :

- বিজ্ঞান আর্শীর্বাদ না অভিশাপ।
- ছাত্র রাজনীতি নিয়ন্ত্রনই প্রকৃত গণতন্ত্র প্রতিষ্ঠার পথ।
- ইংরেজি মাধ্যম শিক্ষা পদ্ধতি জাতীয়তাবোধ ও দেশপ্রেম সৃষ্টির প্রধান অস্ত্ররায়।
- প্রযুক্তির বিকাশই প্রকৃতি বিনাশের একমাত্র কারণ।
- সংস্কৃতিই আধুনিক মানুষের ধর্ম।
- মুক্তিযুদ্ধের চেতনাই অসাম্প্রদায়িক বাংলাদেশ প্রতিষ্ঠার মূলমন্ত্র।
- আকাশ সংস্কৃতি যুব সমাজের নৈতিক অবক্ষয়ের মূল কারণ।
- চালকের অসর্তকতাই সড়ক দুর্ঘটনার প্রধানতম কারণ।

৪. উপস্থিতি বক্তৃতা :

বিষয়বস্তু উন্মুক্ত।

৫. প্রতিবেদন উপস্থাপন :

- উর্দ্ধতন কর্তৃপক্ষের কাছে উপস্থাপন
- সংবাদপত্রে প্রকাশের জন্য প্রেরণ

5911	MATHEMATICS-1	T	P	C
		3	3	4

OBJECTIVES

- To acquaint the students with the basic terminology of Algebra.
- To be able to understand the complex numbers (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.
- $\text{Log}_a (m \times n) = \text{Log}_a m + \text{Log}_a n$
 - $\text{Log}_a \left(\frac{m}{n} \right) = \text{Log}_a m - \text{Log}_a n$
 - $\text{Log}_a (m)^n = n \text{Log}_a m$
 - $\text{Log}_b a \times \text{Log}_a b = 1$
 - $\text{Log}_a 1 = 0$
- 3.3 Solve problems using 3.2.
- 3.4 State the difference between Napierian 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,
- things are all different.
 - things are not all different.
- 7.3 Solve problems of the related to permutation :
- be arranged so that the vowels may never be separated.

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.

- 7.4 Explain combination.
 7.5 Find the number of combination of n different things taken r at a time.
 7.6 Explain ${}^n C_r$, ${}^n C_n$, ${}^n C_0$
 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) ${}^n C_r = {}^n C_{n-r}$
 ii) ${}^n C_r + {}^n C_{r-1} = {}^{n+1} C_r$
 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 $\sin \frac{\alpha}{2}$, $\cos \frac{\alpha}{2}$ and $\tan \frac{\alpha}{2}$ 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

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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.

6711	BASIC ELECTRICITY	T	P	C
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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 points 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

6811	BASIC ELECTRONICS	T	P	C
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OBJECTIVES

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

SHORT DESCRIPTION

Color code and soldering; Semiconductor; P-N junction diode; Special diodes and devices; Power supply; Transistor; Transistor amplifier; Logic gates Electronic measuring and test equipment.

DETAIL DESCRIPTION**Theory:**

- 1 Understand the Concept of soldering and Color Code.**
 - 1.1 Define soldering.
 - 1.2 Describe the different types of solder.
 - 1.3 List the things needed in soldering.
 - 1.4 Mention the properties of a good soldered joint.
 - 1.5 Describe the functions and construction of (i) Single sided, (ii). Double sided & (III) Multi layered Printed circuit board.
 - 1.6 Mention the function of resistor, capacitor and inductor in electronic circuits.
 - 1.7 Describe the procedure of determining the value of Capacitor, & Resistor using numeric and color code.

- 2 Understand the Concept of Semiconductor.**
 - 2.1 Define Conductor, Semiconductor and Insulator.
 - 2.2 Describe Semiconductor with atomic structure.
 - 2.3 Describe the effect of temperature on conductivity of Semiconductor.
 - 2.4 Explain the energy band diagram of Conductor, Semiconductor and Insulator.
 - 2.5 Classify Semiconductor.
 - 2.6 Describe the generation & recombination of hole and electron in Intrinsic Semiconductor.
 - 2.7 Define doping, P-type & N-Type material, covalent bond, majority & minority charge carrier.
 - 2.8 Explain the characteristics of Carbon, Gallium Arsenide/Phosphide.

3 Understand the Concept of P-N Junction Diode

- 3.1 Define PN junction diode
- 3.2 Describe the formation of depletion layer in PN junction.
- 3.3 Discuss potential barrier, drift & diffusion current and their physical significance.
- 3.4 Mention the behavior of PN junction under forward and reverse bias.
- 3.5 Explain the forward & reverse current voltage (IV) characteristics of PN junction diode.
- 3.6 Explain the effect of temperature Si & Ge diode characteristics
- 3.7 Define (i) static resistance (II) Dynamic resistance, (III) forward breakdown voltage and (II) Reverse break down voltage.
- 3.8 Draw the equivalent circuit of PN junction diode.
- 3.9 Describe the specification of diode.

4 Understand the DC power supplies.

- 4.1 Define dc power supply.
- 4.2 Mention the importance of dc power supply.
- 4.3 Define rectification and rectifier.
- 4.4 Explain the operation of Half wave, Full wave and Bridge rectifier.
- 4.5 Discuss ripple factor & efficiency and TUF of Half wave, Full wave and Bridge rectifier.
- 4.6 Explain the operation of different types filter circuits with wave shape.
- 4.7 Define regulated and unregulated power supply.
- 4.8 Describe the block diagram of a typical regulated dc power supply.

5 Understand the Concepts of Special diode.

- 5.1 Define Zener break down.
- 5.2 Describe the operation of Zener diode.
- 5.3 Explain IV characteristics of Zener diode.
- 5.4 Describe the application of Zener diode in (i) voltage stabilization, (ii) meter protection and (II) peck clipper circuits.
- 5.5 Describe the construction operation and application of (I) Tunnel diode (II) varactor diode (III) Schottky diode (iv) Step-Recovery diode (v) PIN diode, (vi) LED (vii) LCD (viii) photo diode (ix) Solar cell.
- 5.6 Describe the construction operation and application of (i) DIAC (ii) TRIAC and (iii) SCR.

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

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

7 Understand the concept of BJT Amplifier

- 7.1 Define (i) Amplifier (ii) Amplification and (III) Gain
- 7.2 Mention the classification of Amplifier.
- 7.3 Describe the principle of operation of a common emitter (CE) Amplifier.
- 7.4 Draw DC & AC equivalent circuits of the CE amplifier circuit.
- 7.5 Mention the formula of (i) input resistance (ii) Output Resistance (iii) Current gain (iv) Voltage gain and (v) power gain.
- 7.6 Solve problem related to different gain resistance.

8 Understand the main feature of digital electronics

- 8.1 Describe the difference between analog and digital signal.
- 8.2 State the advantage of digital system.
- 8.3 Define logic gate.
- 8.4 Describe the basic operation of logic gates AND, OR, NOT NAND, NOR, XOR & XNOR.
- 8.5 Prepare truth table of logic gates AND, OR, NOT NAND, NOR, XOR & XNOR.

9 Understand the Electronic measuring and testing equipment

- 9.1 Define AVO meter.
- 9.2 Describe the procedure of measuring current, voltage and resistance using AVO meter.
- 9.3 List the control knobs of Oscilloscope.
- 9.4 Explain the procedure of measuring frequency and voltage using Oscilloscope.
- 9.5 Mention the function of (i) Function Generator (ii) Logic Probe (iii) Semiconductor Tester.

Practical :**1 Show skill in identifying the electronic components.**

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

- 2 Show skill in electrical measurement.**
- 2.1 Perform simple voltage and current measurements on basic series and parallel resistor circuits using the following instruments.
- Voltmeters and ammeters
 - AVO meters
 - Digital multimeter
 - Basic CRO
- 3 Show skill for determining the values of different resistors and capacitors with the help of color code.**
- 3.1 Select color code resistors & capacitors of different values.
- 3.2 Identify the colors and their numerical numbers.
- 3.3 Determine the value of resistors with tolerance.
- 3.4 Determine the value of capacitors and dc working voltage.
- 3.5 Write a report on above activities.
- 4 Show skill in performing soldering.**
- 4.1 Select wires (single strand and multi strand) and cut wires to required length.
- 4.2 Select soldering iron, soldering tag and soldering lead.
- 4.3 Remove wire insulation to required length.
- 4.4 Clean and tin both iron and work piece.
- 4.5 Use a tinned iron in order to transfer adequate heat to the joint.
- 4.6 Joint two singles stranded wires mechanically and solder.
- 4.7 Joint two multi-strand wires mechanically and solder.
- 4.8 Perform soldering exercise for making three dimensional wire frame.
- 4.9 Sketch and write a report on the job.
- 5 Show skill in soldering & desoldering of electronic components and wires to the other components and circuit boards.**
- 5.1 Select electronic components, wires and PCB.
- 5.2 Determine the rating of the soldering iron suitable for the work piece.
- 5.3 Clean and tin both iron & work piece.
- 5.4 Feed new soldering materials to the tinned and heated joint, in order to produce a correctly soldering.
- 5.5 Check the quality of soldering.
- 5.6 Clean and tin iron and de-solder the joint and components.
- 5.7 Use solder suckers and solder braid for de-soldering.
- 5.8 Write a report on the Job.

- 6 Show skill in checking the semi-conductor diode.**
- 6.1 Collect a range of semi-conductor diodes and manufactures literature.
 - 6.2 Select the digital multimeter and set the selector switch to ohm range.
 - 6.3 Determine the specification of semi-conductor diode.
 - 6.4 Compare the determined specification with that of manufactures literature.
 - 6.5 Measure forward & reverse resistances of the diode.
 - 6.6 Identify p and p side of the diode.
 - 6.7 Determine the condition of the diode.
- 7 Show skill in sketching forward and reverse characteristics curves of a semiconductor diode.**
- 7.1 Select meter, power supply, components and materials.
 - 7.2 Complete circuit according to circuit diagram for forward bias.
 - 7.3 Check all connections.
 - 7.4 Measure forward bias and corresponding forward current.
 - 7.5 Record results in tabular form.
 - 7.6 Connect circuit according to circuit diagram of reverse bias.
 - 7.7 Measure reverse bias and corresponding reverse current.
 - 7.8 Record results in tabular form.
 - 7.9 Sketch the curves form data.
- 8 Show skill in sketching waves of half wave rectifier circuit.**
- 8.1 Select meter, component, oscilloscope and materials.
 - 8.2 Complete circuit of a half wave rectifier according to circuit diagram.
 - 8.3 Check the circuit before operation.
 - 8.4 Measure the input and output voltage and observe wave shapes in the oscilloscope.
 - 8.5 Sketch the output voltage wave shape.
- 9 Show skill in sketching waves of full wave center tapped rectifier circuit.**
- 9.1 Select meter, component, oscilloscope and materials.
 - 9.2 Complete a full wave rectifier circuit according to circuit diagram.
 - 9.3 Check the circuit supply & polarity of supply.
 - 9.4 Measure the input & output voltages and observe wave shapes in the oscilloscope.
 - 9.5 Sketch the output voltage wave shape.
 - 9.6 Compare the result with half-wave rectifier circuit.
- 10 Show skill in constructing full wave bridge rectifier.**
- 10.1 Select meter, component, oscilloscope and materials.
 - 10.2 Build the circuit according to the circuit diagram.
 - 10.3 Check the circuit.
 - 10.4 Measure the input and output voltage.
 - 10.5 Observe wave shape.
 - 10.6 Compare the result with other rectifiers.

- 11 Show skill in identifying the bipolar junction transistor.**
- 11.1 Select pnp & npn bipolar junction transistors.
 - 11.2 Take DMM and manufacture's literature of transistor.
 - 11.3 Identify transistor legs.
 - 11.4 Measure base-emitter, base-collector, forward and reverse resistance.
 - 11.5 Determine the specifications with help of manufacturer's literatures.
 - 11.6 Identify pnp & npn transistor.
- 12 Show skill in determining input and output characteristics of a transistor in common emitter connection.**
- 12.1 Select component, AVO meters, circuit board and required materials.
 - 12.2 Construct the circuit.
 - 12.3 Adjust the biasing voltage to appropriate point.
 - 12.4 Record input and output voltage and current.
 - 12.5 Plot the curve with recorded data.
- 13 Show skill in testing special diodes.**
- 13.1 Select different types of special diodes.
 - 13.2 Set the AVO meter in the ohm scale.
 - 13.3 Measure resistances for each of two terminals.
 - 13.4 Determine the condition (good and bad).
 - 13.5 Determine the different terminals.
- 14 Verify the truth tables of different types of logic gates.**
- 14.1 Select the specific gate.
 - 14.2 Prepare the experimental circuit.
 - 14.3 Adjust the power supply.
 - 14.4 Verify the truth table.

REFERENCE BOOKS :

- 1. A Text Book of Applied Electronics - R.S. SEDHA
- 2. Principles of Electronics - V. K. Mehta
- 3. Basic Electronics (Solid Stater) - B. L. Theraja
- 4. Electronic Devices and Circuit Theory - ROBERT BOYLESTAD
- LOUIS NASHELSKY

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.

1012	ENGINEERING MATERIALS	T	P	C
		2	3	3

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 filed.
- 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 1st class , 2nd class, 3rd 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 |

5712

ENGLISH – I

T	P	C
2	0	2

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 (1st 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

T	P	C
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 Mukhtasan, Ustrasan

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.)

5912

PHYSICS-I

T	P	C
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 $P=mf$, 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 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.

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MATHEMATICS – II

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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 $e^x = 1 + \frac{x}{L^1} + \frac{x^2}{L^2} + \frac{x^3}{L^3} + \frac{x^4}{L^4} + \dots$ to ∞
- 4.4 Solve problems of the followings types :
- i) $1 + \frac{1}{L^2} + \frac{1}{L^4} + \frac{1}{L^6} + \dots$ to ∞
- ii) $\frac{1}{L^2} + \frac{1+2}{L^3} + \frac{1+2+3}{L^4} + \frac{1+2+3+4}{L^5} + \dots$ to ∞

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

$$i) \quad \tan^{-1} x + \tan^{-1} y = \tan^{-1} \frac{x+y}{1-xy} .$$

$$ii) \quad \tan^{-1} x + \tan^{-1} y + \tan^{-1} z = \tan^{-1} \frac{x+y+z-xyz}{1-xy-yz-zx}$$

$$iii) \quad \sin^{-1} x + \sin^{-1} y = \sin^{-1} \left(x\sqrt{1-y^2} + y\sqrt{1-x^2} \right)$$

$$iv) \quad 2 \tan^{-1} x = \sin^{-1} \frac{2x}{1+x^2} = \cos^{-1} \frac{1-x^2}{1+x^2} = \tan^{-1} \frac{2x}{1-x^2}$$

- 5.5 Solve problems of the following types.

$$a) \quad 2 \tan^{-1} \frac{1}{3} + \tan^{-1} \frac{1}{4} = \frac{\pi}{4}$$

$$b) \quad \cos \tan^{-1} \cot \sin^{-1} x = x.$$

- 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° 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) octagonwhen 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.

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OBJECTIVES

- To provide understanding and skill on network theorems.
- To make understanding on the concept of ac fundamentals.
- To provide knowledge and skill on single phase ac circuits.
- To provide understanding of power & power factor in ac circuits.
- To provide comprehensive understanding and skill on polyphase system.

SHORT DESCRIPTION

Electrical network; Network theorems; AC fundamentals; Single phase AC circuits; Power and power factor in AC circuit; Polyphase system; Star/delta connection.

DETAIL DESCRIPTION**Theory :****DC CIRCUITS**

- 1 Apply the concept of electrical circuits.**
 - 1.1 Describe Kirchhoff's laws.
 - 1.2 Solve problems relating to Kirchhoff's laws.
 - 1.3 Describe Maxwell's theorem.
 - 1.4 Solve problems relating to Maxwell's theorem.

- 2 Understand the concept of electrical network.**
 - 2.1 Define circuit parameters.
 - 2.2 State the different circuit parameters.
 - 2.3 Name the units of different circuit parameters.
 - 2.4 Define the different types of electric network.
 - 2.5 List the different types of electric network.
 - 2.6 Explain the current source and voltage source in electric network.
 - 2.7 Give examples of current source & voltage source.
 - 2.8 Constant voltage source, current source device.

- 3 Apply the principles of circuit's theorem.**
 - 3.1 Explain Thevenin's theorem.
 - 3.2 Solve problems relating to Thevenin's theorem.
 - 3.3 Explain superposition theorem.
 - 3.4 Solve problems on super power theorem.
 - 3.5 Explain the reciprocity and duality theorem.

- 3.6 Solve problems on reciprocity and duality theorem.
- 3.7 Explain star/delta conversion.
- 3.8 Solve problems relating to star / delta conversion.
- 3.9 Explain maximum power transfer theorem.
- 3.10 Solve problems on maximum power theorem.

AC FUNDAMENTALS

4 Understand the concept of AC fundamentals.

- 4.1 Explain the generation of AC voltage.
- 4.2 Derive the equation, $e = E_{\max} \sin \omega t$.
- 4.3 Construct a sine wave in relation to emf generation.
- 4.4 Define cycle, frequency & time period.
- 4.5 Show the relation, $f = \frac{NP}{120}$
- 4.6 Name the commercial frequency of different countries of the world.
- 4.7 Explain phase and phase difference with diagram.
- 4.8 Solve problems relating to AC generation.

5 Understand the concept of alternating quantities and rms values.

- 5.1 Define instantaneous, maximum, average and rms values of alternating quantities.
- 5.2 Define form factor and peak factor.
- 5.3 Solve problems relating to instantaneous, average and rms values.
- 5.4 Define ohmic resistance and skin effect.
- 5.5 Compare ohmic & effective resistance.
- 5.6 Distinguish between AC and fluctuating DC.
- 5.7 Draw sine, square and triangular waves.

SINGLE PHASE CIRCUIT

6 Apply the concept of ac circuit consists of resistance and reactance.

- 6.1 Sketch a circuit containing ohmic resistance and reactance.
- 6.2 Explain the vector and phasor diagram of resistive and reactive circuit.
- 6.3 Evaluate inductive and capacitive reactance, current and voltage relations in reactive circuit.
- 6.4 Solve problems relating to resistance, inductive reactance and capacitive reactance.

7 Apply the concept of AC series/parallel circuit containing RL and RC.

- 7.1 Sketch a circuit containing resistance and inductance in series/parallel.
- 7.2 Explain the vector & phasor diagram of RL series/parallel circuit.
- 7.3 Formulate the impedance, current and voltage drop in RL series/parallel circuit.

- 7.4 Draw the impedance triangle of RL series/parallel circuit.
- 7.5 Sketch a RC series/parallel circuit.
- 7.6 Explain the vector & phasor diagram of RC series/parallel circuit.
- 7.7 Formulate the impedance, current and voltage drop in RC series/parallel.
- 7.8 Draw the impedance triangle of RC series/parallel circuit.
- 7.9 Solve problems relating to RL & RC circuit.

8 Apply the concept of RLC series/parallel circuit.

- 8.1 Draw the circuit containing resistance, inductance, capacitance in series/parallel.
- 8.2 Explain the vector and phasor diagram of RLC series/parallel circuit.
- 8.3 Draw the impedance triangle of a RLC circuit.
- 8.4 Calculate the inductive reactance, capacitive reactance, total impedance, current & voltage drops in RLC circuit.
- 8.5 Describe resonance and resonance frequency in RLC circuit.
- 8.6 Solve problems relating to RLC circuit.

9 Apply the concept of power & power factor in ac circuit.

- 9.1 Define power, power factor, active and reactive power.
- 9.2 Calculate the power and power factor of resistive and reactive circuits.
- 9.3 Calculate power, power factor, active & reactive power of RL, RC, & RLC circuit.
- 9.4 Explain the power diagram of R, L, C, RL, RC, RLC circuit.
- 9.5 Solve problems relating to power & power factor of different circuit.

POLYPHASE SYSTEMS

10 Understand the concept of polyphase system.

- 10.1 State polyphase system.
- 10.2 Mention the advantage of polyphase system over single phase system.
- 10.3 State the generation of polyphase emf.
- 10.4 State double subscript notation.
- 10.5 Describe the phase sequence of polyphase system.
- 10.6 State the effects of reverse phase sequence.

11 Understand the concept of star connection.

- 11.1 Define neutral wire.
- 11.2 Evaluate the current in the neutral wire in an balanced 3-phase, 4 - wire star connection system.
- 11.3 Draw the phasor diagram of a 3-phase, 3-wire star connection system.
- 11.4 Deduce the formulae, $I_L = I_p$ and $V_L = \sqrt{3}V_p$.

- 11.5 Calculate volt-ampere, power and power factor in a balanced 3-phase, 3-wire star connection system.
- 11.6 Solve problems relating to star connection system.

12 Understand the concept of delta connection.

- 12.1 Draw the circuit diagram of a 3-phase delta connection system.
- 12.2 Draw the phasor diagram of delta connection system.
- 12.3 Deduce the formulae, $V_L = V_p$ and $I_L = \sqrt{3}I_p$
- 12.4 Simplify the relation between line and phase current & voltage in a balanced delta connection.
- 12.5 Calculate the volt-ampere, power and power factor in a balanced 3-phase delta connection.
- 12.6 Solve problems on delta connected balanced loaded system.
- 12.7 Compare the advantages of star connection with those of delta connection.

Practical :

1 Show skill in verifying kirchhoff's law (KVL AND KCL).

- 1.1 Sketch the circuit diagram for the experiment.
- 1.2 Select required tools equipment and materials.
- 1.3 Make all the connections.
- 1.4 Check the connections.
- 1.5 Verify kirchhoff's current and voltage law collecting relevant data.

2 Show skill in verifying thevenin's theorem.

- 2.1 Sketch the circuit diagram.
- 2.2 Make thevenin equivalent circuit theoretically.
- 2.3 Collect required component tools and equipment's
- 2.4 Make the connections for both the circuit.
- 2.5 Verify the equivalence of both the circuit for the thevenin element.

3 Show skill in verifying Norton's theorem.

- 3.1 Sketch the circuit diagram.
- 3.2 Prepare a Norton's equivalent circuit theoretically for the given circuit.
- 3.3 Collect component, tools and equipment's for both the circuits.
- 3.4 Construct both the circuits.
- 3.5 Obtain data for the equivalent terminal and verify the theorem.

4 Show skill in verifying superposition theorem.

- 4.1 Sketch the circuit diagram for the verification of super position theorem.
- 4.2 Collect required tools and materials.
- 4.3 Prepare the circuit.
- 4.4 Collect data and verify the theorem.

- 5 Show skill in verifying maximum power transfer theorem.**
 - 5.1 Skill the circuit diagrams.
 - 5.2 Collect required tools & materials.
 - 5.3 Prepare the circuit.
 - 5.4 Collect data and verify the theorem.

- 6 Show skill in measuring maximum value, rms value, frequency by oscilloscope.**
 - 6.1 Identify the control & function knobs of oscilloscope.
 - 6.2 Prepare the oscilloscope to measure the values.
 - 6.3 Check all connections.
 - 6.4 Observe the ac signal and measure the maximum ,rms values and frequency.

- 7 Show skill in determining the value of resistance & inductance and draw the vector diagram of RL series circuit and draw vector diagram of voltage & current.**
 - 7.1 Draw the circuit diagram for determining resistance & inductance of a RL series circuit.
 - 7.2 Collect tools, equipment & materials required for the experiment.
 - 7.3 Connect the circuit according to the circuit diagram using proper equipment.
 - 7.4 Check all connection points before energize the circuit.
 - 7.5 Apply proper voltage & record readings from the meters.
 - 7.6 Find the value of resistance & phase angle from relevant data.
 - 7.7 Sketch the vector diagram with the relevant data as obtained.

- 8 Show skill in determining the value of resistance & capacitance and drawing vector diagram of RC series circuit and draw vector diagram of voltage & current.**
 - 8.1 Sketch the circuit diagram for RC series circuit.
 - 8.2 Collect tools, equipment & materials for the experiment.
 - 8.3 Connect the circuit according to the circuit diagram using proper equipment.
 - 8.4 Check all connection points before energizing the circuit.
 - 8.5 Apply the voltage and record the relevant readings.
 - 8.6 Determine the value of resistance, capacitance & phase angle from the data obtained.
 - 8.7 Sketch the vector diagram with the help of relevant data as obtained.

- 9 Show skill in determining the value of resistance, inductance & capacitance and drawing vector diagram of RLC series circuit and draw vector diagram of voltage & current.**
 - 9.1 Sketch the circuit diagram for RLC series circuit.
 - 9.2 Collect tools, equipment & materials for the experiment.
 - 9.3 Connect the circuit-according to the circuit diagram using proper equipment.
 - 9.4 Check all connection points before energize the circuit.

- 9.5 Connect proper supply to the circuit and record the readings from the meter.
- 9.6 Determine the values of resistance, inductance, capacitance and phase angle from the relevant data.
- 9.7 Verify the supply voltage is equal to the vector sum of voltage drop in each parameters.
- 9.8 Sketch the vector diagram with the help of relevant data as obtained.

10 Show skill in determining the values of resistance, inductance, capacitance and drawing the vector diagram of RLC parallel circuit and draw vector diagram of voltage & current.

- 10.1 Sketch the circuit diagram for RLC parallel circuit.
- 10.2 Collect tools, equipment & materials required for the experiment.
- 10.3 Connect the circuit according to the circuit diagram using proper equipment.
- 10.4 Check all connection points before energize the circuit.
- 10.5 Connect proper supply to the circuit and record the data from the meters.
- 10.6 Determine the value of resistance, inductance, capacitance and phaseangle from the relevant data.
- 10.7 Verify the line current is equal to the vector sum of branch currents.
- 10.8 Sketch the vector diagram with the relevant data as obtained.

11 Show skill in determining power factor of a RLC series circuit and drawing vector diagram.

- 11.1 Sketch a circuit diagram for RLC series circuit.
- 11.2 Collect tools, equipment & materials for the experiment.
- 11.3 Connect the circuit according to the circuit diagram using proper equipment.
- 11.4 Check all connection points before energize the circuit.
- 11.5 Connect power supply to the circuit and record the readings from the meter.
- 11.6 Determine the value of phase angle and power factor from the relevant data.
- 11.7 Sketch the vector diagram with the relevant data.

12 Show skill in measuring line and phase voltage & current in a 3-phase star/delta connected load and neutral current for balanced and unbalanced condition for star connected load.

- 12.1 Sketch a circuit diagram for a 3-phase star/delta connected load.
- 12.2 Collect the tools, instrument and materials required.
- 12.3 Select proper range of instruments required.
- 12.4 Connect the circuit according to the circuit diagram using proper equipment.
- 12.5 Check all connection points before energize the circuit.
- 12.6 Record the readings of instruments.

- 12.7 Compare the recorded values with calculated values.
- 12.8 List the safety practices adopted.
- 12.9 Write down the remarks.

13 Show skill in measuring current, voltage and power in a balanced 3-phase delta connected inductive load and construction of vector.

- 13.1 Draw the circuit diagram for measuring power by 3-wattmeter methods of 3-phase delta connected load.
- 13.2 Collect the tools, equipment and materials required for the experiment.
- 13.3 Connect the circuit according to the circuit diagram by using proper equipment.
- 13.4 Check all connection, equipment and instruments before energize the circuit.
- 13.5 Record the reading from the meters used in the circuit.
- 13.6 Draw the vector diagram for the circuit.

14 Show skill in converting star / delta connection.

- 14.1 Draw the circuit diagram of a balanced 3-phase star and delta connection.
- 14.2 Collect tools, equipment and materials required for the experiment.
- 14.3 Connect the circuit for star connection.
- 14.4 Check all connection points before energize the circuit.
- 14.5 Record the reading from the meters used in the circuit.
- 14.6 Calculate the equivalent values of impedance in delta connection.
- 14.7 Connect the circuit with equivalent values of impedance in delta connection.
- 14.8 Record the reading for delta connection.
- 14.9 Compare both the result obtained.
- 14.10 Write a report on the experiment.

REFERENCE BOOKS

A text book of Electrical Technology	—	B. L. Theraja
Basic Electrical Theory and Practice	—	E. B. Babler
Introduction to Electrical Engineering.	—	V.K Metha.
Solved Examples in Electrical Calculation	—	D. K. Sharma
Basic Electricity	—	Charles W. Ryan
Electrical Trade Theory	—	ML Ghosh

6821	ELECTRONICS DEVICES AND CIRCUITS - I	T	P	C
		3	3	4

OBJECTIVES

- To provide understanding and skill of transistor biasing and characteristics.
- To develop the comprehensive skill on Transistor model and equivalent circuits.
- To provide understanding of the Multistage, power and tuned voltage amplifier.
- To develop the understanding and of FET and FET amplifier.
- To provide understanding and skill on Feedback amplifier and oscillator.
- To develop the clear concept and skill on time base circuit and multivibrator.

SHORT DESCRIPTION

Transistor characteristics, Transistor biasing & stabilization, Transistor model, Multistage amplifier, Power & tuned amplifier, FET & FET amplifier, Feedback amplifier, Sinusoidal oscillators, Time base circuit and Multivibrator circuits.

DETAILS DESCRIPTION**Theory:**

- 1. Understand the concept of Transistor characteristics.**
 - 1.1 State the biasing rule of transistor
 - 1.2 Explain the characteristics of transistor in CB, CC & CE configuration.
 - 1.3 Determine the input and output resistance of transistor in CB, CC, CE configuration.
 - 1.4 Describe the Base width modulation or Early effects.
 - 1.5 Mention transistor cut-off, active and saturation region.
 - 1.6 Discuss transistor ratings.
 - 1.7 Compare CB, CC, CE configuration.

- 2. Understand Concept of Transistor Biasing and Stabilization**
 - 2.1 Define (i) load line (ii) Operating Point (iii) Stability factor.
 - 2.2 Describe the methods of drawing load line.
 - 2.3 Explain the leakage current in CB & CE circuits.
 - 2.4 List the factors affecting stability of Q-points.
 - 2.5 Mention the condition for proper biasing of transistor.
 - 2.6 Describe various methods of transistor biasing.
 - 2.7 Determine the stability factor of various transistor biasing circuits.
 - 2.8 Describe the Thermal Runway and bias compensation methods.
 - 2.9 Solve problem related to components values, Q-Points and stability factor.

3. Understand the Concept of Transistor Model and equivalent circuits.

- 3.1 Explain the operation of a single stage CE transistor amplifier.
- 3.2 Mention the notation for currents and voltages of transistor amplifier.
- 3.3 Describe the transistor as a four terminal device.
- 3.4 Describe the low frequency small signal (Shockley relationship $r'_{e} = \frac{25mV}{I_E}$) model of transistor.
- 3.5 Solve problem related to amplifier parameters using small signal (r_e) model.
- 3.6 Explain the transistor model with h-parameters.
- 3.7 Derive formula for current gain, voltage gain, input impedance, and output impedance of CE, CB and CC transistor amplifier by h-parameters.
- 3.8 Mention the effects of source and load resistance.
- 3.9 Solve problem for various transistor amplifier using h-parameters.

4. Understand the Concept of Multistage amplifier.

- 4.1 Define (i) Multistage amplifier (ii) Cascade amplifier (iii) Cascode amplifier (iv) Decibel gain.
- 4.2 Mention the advantages of expressing the gain in dB.
- 4.3 Classify multistage amplifier.
- 4.4 Describe the need and types of coupling.
- 4.5 Explain the operation of multistage direct coupled, transformer coupled and R-C coupled amplifier.
- 4.6 Describe frequency response and its dependence on component values and transistor parameters.
- 4.7 Describe the term frequency response, half power point, 3dB point, upper and lower cutoff frequencies, bandwidth and gain bandwidth product related to frequency response.
- 4.8 Derive voltage gain of two stage R-C coupled amplifier for low and high frequency equivalent circuit.
- 4.9 Describe the advantages, disadvantages & applications for above types of multistage amplifier.

5. Understand the Concept of Power Amplifier.

- 5.1 Define class A, B, AB and C amplifier.
- 5.2 State the difference between voltage and power amplifier.
- 5.3 Explain the circuit operation and efficiency of RC and transformers coupled class-A power amplifier.
- 5.4 Explain the operation and efficiency of class - A and class-B push pull amplifier.
- 5.5 Describe the operation of complementary symmetry push pull amplifier.
- 5.6 Explain the operation, efficiency and distortion of class-C amplifier.
- 5.7 Explain the operation and frequency response of various tuned amplifier.
- 5.8 Explain the operation and frequency response of various tuned amplifier.
- 5.9 Describe the advantages, disadvantages & application of the various types power amplifier.

- 6. Understand the Concept of Field-Effect Transistor(FET).**
 - 6.1 Define field effect transistor(FET).
 - 6.2 Mention the types of FET
 - 6.3 Describe the construction and operation Junction Field Effect Transistor (JFET).
 - 6.4 Explain characteristics of JFET .
 - 6.5 Describe the parameters of JFET.
 - 6.6 Establish the relationship among FET parameters.
 - 6.7 Describe the DC biasing of JFET and its load line.
 - 6.8 Explain the operation of CS, CD and CG JFET amplifiers.
 - 6.9 Solve problems based on FET parameters.
- 7. Understand the concept of Metal Oxide Semiconductor FET (MOSFET).**
 - 7.1 Define MOSFET.
 - 7.2 Mention the Types of MOSFET.
 - 7.3 Describe the Construction and operation of DE and E-Only MOSFET.
 - 7.4 Explain the characteristics of DE and E-Only MOSFET.
 - 7.5 Compare BJT and JFET.
 - 7.6 Compare MOSFET and JFET.
 - 7.7 Mention the application of JFET and MOSFET in analog and digital circuits.
- 8. Understand the Concept of Feedback Amplifier.**
 - 8.1 Define feedback
 - 8.2 List the types of feedback.
 - 8.3 Describe different types of feedback with block diagram.
 - 8.4 Calculate the gain of amplifier with feedback (positive and negative).
 - 8.5 Describe the effect of positive and negative feedback in oscillator and amplifier.
 - 8.6 Mention the advantages and disadvantages of negative feedback in amplifier.
- 9. Understand The concept of Sinusoidal Oscillators.**
 - 9.1 Define Oscillator.
 - 9.2 List the types of Oscillator.
 - 9.3 Explain the principle of operation of a oscillatory tank circuit.
 - 9.4 Describe the essentials of feedback LC oscillators.
 - 9.5 State the Barkhausen criterion.
 - 9.6 Explain the principle of operation of tuned collector, tuned base and Tuned Drain oscillators.
 - 9.7 Explain the principle of operation of Hartly, Colpitt and Wein-bridge oscillators.
 - 9.8 Explain the principle of operation phase shift & crystal oscillators.
 - 9.9 Solve problem related to the frequency of various oscillators.

- 10. Understand the operation of time base circuit.**
- 10.1 Define time base circuit.
 - 10.2 Describe the need for time base wave forms.
 - 10.3 Mention the methods of generating time base waveform.
 - 10.4 Explain the generation of saw-tooth wave using charging and discharging of a capacitor.
 - 10.5 Describe the operation of transistor as a switch.
 - 10.6 Describe the operation of sweep circuit using transistor switch.
 - 10.7 Explain the operation of Miller sweep circuit and Bootstrap sweep circuit.
- 11. Understand the features of multivibrator circuits (square wave generator).**
- 11.1 State what is meant by multivibrator.
 - 11.2 Identify the types of multivibrator.
 - 11.3 Explain the operation of astable, monostable and bistable multivibrator circuits with wave shapes.
 - 11.4 Explain triggering techniques for bistable multivibrator circuit.
 - 11.5 Mention the principle of operation of Schmitt trigger circuit.
 - 11.6 Mention the operating principle of transistorized voltage controlled oscillator.

Practical:

- 1. Show skill of determining input and output characteristics of a transistor in common base connection.**
- 1.1. Select a circuit diagram.
 - 1.2. Select proper tools, equipment and materials.
 - 1.3. Prepare the circuit.
 - 1.4. Check the connections.
 - 1.5. Collect the required data.
 - 1.6. Plot input and output characteristic curves.
- 2. Show skill in measuring operating points (V_{CE} and I_C) for Transistor circuit.**
- 2.1. Select a fixed bias transistor circuit.
 - 2.2. Select required equipment.
 - 2.3. Prepare the circuit.
 - 2.4. Check the connections.
 - 2.5. Adjust the circuit.
 - 2.6. Measure the operating points.
- 3. Demonstrate the frequency response of single stage R-C coupled transistor amplifier.**
- 3.1 Draw the circuit diagram for the experiment.
 - 3.2 List required tools, equipment and materials.
 - 3.3 Make all the connections according to the circuit diagram.
 - 3.4 Check the connections.
 - 3.5 Energize the circuit and record the data.
 - 3.6 Draw the frequency response curve from the data.

4. **Study the operation of any transistor class- B power amplifier.**
 - 4.1 Select an appropriate circuit diagram.
 - 4.2 Select required tools, equipment and materials.
 - 4.3 Make the circuit connection according to the given diagram.
 - 4.4 Energize the circuit.
 - 4.5 Observe the output wave and calculate the power gain.
5. **Investigate the properties of a single tuned voltage amplifier.**
 - 5.1 Draw the circuit for the experiment.
 - 5.2 Indent requires materials, tools and equipment.
 - 5.3 Make all the connection.
 - 5.4 Check the circuit.
 - 5.5 Energize the circuit and note the important properties.
6. **Study the operation of negative feedback on the gain and band width of an amplifier.**
 - 6.1 Select a required circuit diagram for the experiment.
 - 6.2 List required materials, tools and equipment.
 - 6.3 Connect everything according to the diagram.
 - 6.4 Check and energize the circuit.
 - 6.5 Record the data for frequency response with and without negative feedback.
 - 6.6 Plot the frequency response curves and observe the difference.
7. **Demonstrate the operation of a Hartly, Colpitt and R-C oscillator.**
 - 7.1 Draw the circuit diagram.
 - 7.2 Select tools, equipment and materials.
 - 7.3 Connect the circuit diagram.
 - 7.4 Check and energize the circuit.
 - 7.5 Observe the output for different frequencies.
8. **Show the skill in plotting input and output characteristics of JFET in Common source mode.**
 - 8.1 Select a circuit diagram.
 - 8.2 Select required tools, equipment and materials.
 - 8.3 Make all the connections according to the circuit diagram.
 - 8.4 Check the circuit.
 - 8.5 Record required data.
 - 8.6 Plot input and output characteristic curves.
9. **Show skill in determining characteristics of MOSFET (enhancement and depletion type) Select a circuit diagram.**
 - 9.1 Indent required tools, equipment and materials.
 - 9.2 Connect the components and equipment according to the circuit diagram.
 - 9.3 Check the circuit.
 - 9.4 Record required data.
 - 9.5 Plot the characteristic curves.

- 10. Study the operation of a transistor monostablemultivibrator circuit.**
- 10.1 Select an experiment circuit.
 - 10.1 Select the required tools and materials.
 - 10.1 Build up the circuit as per diagram.
 - 10.1 Switch on the power supply.
 - 10.1 Switch on the trigger signal.
 - 10.1 Observe the wave shapes at each collector & base of the transistor.
- 11. Study the operation of a transistor bistablemultivibrator circuit.**
- 11.1 Select an experiment circuit.
 - 11.2 Select the required tools and materials.
 - 11.3 Build up the circuit as per diagram.
 - 11.4 Switch on the power supply.
 - 11.5 Observe the wave form at each collector & base of the transistor.
 - 11.6 Observe the effect of changing base resistor and or coupling capacitors on the frequency of the square wave output.
- 12. Study the operation of anastablemultivibrator circuit.**
- a. Select an experiment circuit.
 - b. Select the required tools and materials.
 - c. Build up the circuit as per diagram.
 - d. Switch on the power supply.
 - e. Observe the wave form at each collector & base of the transistor.
 - f. Observe the effect of changing base resistor and or coupling capacitors on the frequency of the square wave output.
- 13. Study the operation of a transistor Schmitt trigger circuit.**
- 13.1 Select an experiment circuit.
 - 13.2 Select the required tools and materials.
 - 13.3 Build up the circuit as per diagram.
 - 13.4 Switch on the power supply.
 - 13.5 Switch on the trigger signal.
 - 13.6 Observe the input & output wave shapes.
- 14. Study the Operation of a time base circuit.**
- 14.1 Indent required tools, equipment and materials.
 - 14.2 Connect the components and equipment according to the circuit diagram.
 - 14.3 Check the circuit.
 - 14.4 Record required data.
 - 14.5 Plot the characteristic curves.

REFERENCE BOOKS

A Text Book of Applied Electronics	—	R.S. Sedha
Principles of Electronics	—	V. K Metha
Electronics and Radio Engineering	—	M. L Gupta
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