

## SECOND SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME									Total Marks of Internal & External
		L	T	P		INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
						Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
2.1	*Applied Mathematics-II	5	-	-	4	20	-	20	50	2½	-	-	50	70	
2.2	*Applied Physics-II	5	-	2	5	20	10	30	50	2½	20	3	70	100	
2.3	Basic Electrical Engineering	5	-	4	5	20	10	30	50	2½	20	3	70	100	
2.4	**Basics of Mechanical and Civil Engineering	5	-	2	5	20	10	30	50	2½	20	3	70	100	
2.5	Analog Electronics	4	-	4	5	20	10	30	50	2½	20	3	70	100	
2.6	General Workshop Practice-II	-	-	8	2	-	40	40	-	-	60	4	60	100	
#Student Centred Activities		-	-	4	1		30	30	-	-	-	-	-	30	
Total		24	-	24	27	100	110	210	250	-	140	-	390	600	

\* Common with other diploma programmes

\*\* Common with diploma in Chemical Engg.

# Student Centred Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

## 2.1 APPLIED MATHEMATICS - II

<b>L</b>	<b>T</b>	<b>P</b>
<b>5</b>	<b>-</b>	<b>-</b>

### RATIONALE

Basic elements of integral calculus, differential calculus, numerical methods, differential equations included in this course will play a vital role in understanding engineering problem mathematically. This will also develop analytical as well as conceptual abilities among students.

### LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Calculate simple integration by methods of integration
- Evaluate the area under curves, surface by using definite integrals.
- Calculate the area and volume under a curve along areas
- Solve the engineering problems with numerical methods.
- Understand the geometric shapes used in engineering problems by co-ordinate geometry.

### DETAILED CONTENTS

#### 1. Integral Calculus - I (20 Periods)

Methods of Indefinite Integration

- 1.1 Integration by substitution.
- 1.2 Integration by rational function.
- 1.3 Integration by partial fraction.
- 1.4 Integration by parts.
- 1.5 Integration of special function

#### 2. Integral Calculus - II (20 Periods)

- 2.1 Meaning and properties of definite integrals, Evaluation of definite integrals.
- 2.2 Application : Length of simple curves, Finding areas bounded by simple curves Volume of solids of revolution, centre of mean of plane areas.
- 2.3 Simposns 1/3rd and Simposns3/8th rule and Trapezoidal Rule : their application in simple cases. Numerical solutions of algebraic equations; Bisections method, Regula-Falsi method, Newton-Raphson's method(without proof), Numerical solutions of simultaneous equations; Gauss elimination method(without proof)

3. Co-ordinate Geometry (2 Dimension) (18 Periods)

3.1 Circle

Equation of circle in standard form. Centre - Radius form, Diameter form, Two intercept form.

4. Co-ordinate Geometry (3 Dimension) (12 Periods)

4.1 Straight lines and planes in space

Distance between two points in space, direction cosine and direction ratios, Finding equation of a straight line (without proof)

### INSTRUCTIONAL STRATEGY

Basic elements of Differential Calculus, Integral Calculus and differential equations can be taught conceptually along with real engineering applications in which particular algorithm and theory can be applied. Numerical examples will be helpful in understanding the content of the subject.

### MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests
- Model/Prototype Making

### RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
3. Applied Mathematics-II by Chauhan and Chauhan, Krishna Publications, Meerut.
4. Applied Mathematics-I (B) by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut

### SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1.	20	28
2.	20	28
3.	18	24
4	12	20

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<b>Total</b>	<b>70</b>	<b>100</b>
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## 2.2 APPLIED PHYSICS – II

**L T P**  
**5 - 2**

### RATIONALE

Applied physics includes the study of a diversified topics related to the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this course content.

**Note: Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to learn and appreciate these concepts and principles. In all contents, SI units should be followed.**

### LEARNING OUTCOMES

After undergoing this subject, the student will be able to;

- Define wave motion its types (Transverse and Longitudinal), Periodic and Simple Harmonic Motion, solve simple problems.
- Define the terms: frequency, amplitude, wavelength, velocity of a wave.
- Explain various Engineering, Medical and Industrial applications of Ultrasonics.
- Apply acoustics principles to various types of buildings to get best sound effect
- Explain diffraction, interference, polarization.
- Define capacitance and its unit. They will be able to explain the function of capacitors in simple circuits, solve simple problems using  $C=Q/V$
- Explain the role of free electrons in insulators, conductors and semiconductors, qualitatively the terms: potential, potential difference, electromotive force.
- Explain the concept of electric current, resistance and its measurement.
- List the effects of an electric current and their common applications, State and apply Ohm's law, calculate the equivalent resistance of a variety of resistor combinations, determine the energy consumed by an appliance, distinguish between AC and DC electricity
- Explain Biot-Savart Law, Ampere's law, Lorenz Force.
- State the laws of electromagnetic induction, describe the effect on a current-carrying conductor when placed in a magnetic field
- Explain operation of moving coil galvanometer, simple DC motor

- Apply the knowledge of diodes in rectifiers, adapters IC's and various electronic circuits. Apply the concept of light amplification in designing of various LASER based instruments and optical sources.
- Explain total internal reflection and apply this concept for optical fibre and its uses in Medical field and Communication.

### **DETAILED CONTENTS**

1. Wave motion and its applications (12 periods)
  - 1.1 Wave motion, transverse and longitudinal wave motion with examples, sound and light waves, relationship among wave velocity, frequency and wave length and its application
  - 1.2 Wave equation  $y = r \sin wt$ , phase, phase difference, principle of superposition of waves
  - 1.3 Simple Harmonic Motion (SHM): definition and characteristic, expression for displacement, velocity, acceleration, time period, frequency in S.H.M., Energy of a body executing S. H. M., simple pendulum, concept of simple harmonic progressive wave,
  - 1.4 Free, Damped and forced oscillations, Resonance with examples, Q-factor
  - 1.5 Definition of pitch, loudness, quality and intensity of sound waves, intensity level, Echo and reverberation, Sabine formula for reverberation time(without derivation), coefficient of absorption of sound, methods to control reverberation time and their applications, Acoustics of building defects and remedy.
  - 1.6 Ultrasonics –production, detection, properties and applications in engineering and medical applications.
  
2. Wave Optics (6 periods)
  - 2.1 Dual nature of light, wave theory of light, laws of reflection and refraction, Snell's law, Power of lens, magnification.
  - 2.2 Two-Source Interference, Double-Slit interference, Interference due to thin films, Fresnel's biprism.
  - 2.3 use of interference making highly efficient solar panel.
  - 2.4 diffraction, Single Slit diffraction, Intensity calculation etc
  - 2.5 Polarization of electromagnetic waves, polarizing sheets, polarizing by Reflection (Brewster's law), Malus law, use of polarizers.
  
3. Electrostatics (12 periods)

- 3.1 Concept of charge, Coulombs law, Electric field of point charges, Electric lines of force and their properties, Electric flux, Electric potential and potential difference.
  - 3.2 Gauss law of electrostatics: Application of Gauss law to find electric field intensity of straight charged conductor, plane charged sheet and charged sphere.
  - 3.3 Capacitor and its working principle, Capacitance and its units. Capacitance of parallel plate capacitor. Series and parallel combination of capacitors (numericals), charging and discharging of a capacitor.
  - 3.4 Dielectric and its effect on capacitance, dielectric break down.
  - 3.5 Application of electrostatics in electrostatic precipitation of microbes and moisture separation from air and gases in industry for pollution control (Brief explanation only)
4. Current Electricity (12 periods)
- 4.1 Electric Current, Resistance, Specific Resistance, Conductance, Specific Conductance, Series and Parallel combination of Resistances. Factors affecting Resistance, Colour coding of carbon Resistances, Ohm's law. Superconductivity.
  - 4.2 Kirchoff's laws, Wheatstone bridge and its applications (meter bridge and slide wire bridge)
  - 4.3 Concept of terminal potential difference and Electro motive force (EMF), potentiometer.
  - 4.4 Heating effect of current, Electric power, Electric energy and its units (related numerical problems), Advantages of Electric Energy over other forms of energy
  - 4.5 Examples of application of DC circuits in various electrical and electronics equipment such as C.R.O, T.V., Audio-Video System, Computers etc.
5. Magneto Statics and Electromagnetism (12 periods)
- 5.1 Magnetic poles, force on a moving charge, circulating charges, force on a current carrying wire, Hall effect, torque on a current loop.
  - 5.2 Magnetic field due to moving charge(Biot-Savart Law), due to current (Biot-Savart Law), parallel currents, field of a solenoid, Ampere's law.
  - 5.3 Faraday's law, Lenz' law, motional emf, induced electric fields.
  - 5.4 Magnetic dipole and force on a magnetic dipole in a non-uniform field, Magnetization, Gauss' law for magnetism.
  - 5.5 Types of magnetic materials. Dia, para and ferromagnetic materials with their properties,
  - 5.6 Application of electromagnetism in ac/dc motors and generators.
6. Semiconductor physics (8 periods)

- 6.1 Types of materials (insulator, semi conductor, conductor), intrinsic and extrinsic semiconductors, p-n junction diode and its V-I characteristics
- 6.2 Diode as rectifier – half wave and full wave rectifier (centre taped),
- 6.3 Semiconductor transistor, pnp and npn (concepts only)
- 6.4 Application of semiconductor diodes (Zener, LED) and that of transistor as amplifier and oscillator.

## 7. Modern Physics (8 Periods)

- 7.1 Lasers: concept of energy levels, ionizations and excitation potentials; spontaneous and stimulated emission; laser and its characteristics, population inversion, Types of lasers; Ruby and He-Ne lasers, engineering and medical applications of lasers.
- 7.2 Fibre optics: Total internal reflection and its applications, Critical angle and conditions for total internal reflection, introduction to optical fibers, light propagation, types, acceptance angle and numerical aperture, types and applications of optical fibre in communication.
- 7.3 Introduction to nanotechnology, nanoparticles and nano materials,

### LIST OF PRACTICALS (To perform minimum six experiments)

1. To determine the velocity of sound with the help of resonance tube.
2. To find the focal length of convex lens by displacement method.
3. To find the refractive index of the material of given prism using spectrometer.
4. To find the wavelength of sodium light using Fresnel's biprism.
5. To verify laws of resistances in series and parallel combination
6. To verify ohm's laws by drawing a graph between voltage and current.
7. To measure very low resistance and very high resistances using Slide Wire bridge
8. Conversion of Galvanometer into an Ammeter and Voltmeter of given range.
9. To draw hysteresis curve of a ferromagnetic material.
10. To draw characteristics of a pn junction diode and determine knee and break down voltages.
11. To find wave length of the laser beam.
12. To find numerical aperture of an optical fiber.

### INSTRUCTIONAL STATREGY

Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration and animations can make the subject interesting and may

develop scientific temper in the students. Teacher must plan a tour of Science Park/planetarium available in nearby areas in order to enhance the interest in this course.

### MEANS OF ASSESSMENT

- Assignment & Quiz
- Mid-Term and End-Term written test
- Model Making
- Actual Lab & Practical Work
- Viva-Voice

### RECOMMENDED BOOKS

1. Text Book of Physics (Part-I, Part-II); N.C.E.R.T., Delhi
2. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
3. A Text Book of Optics, Subramanian and Brij Lal, S Chand & Co., New Delhi
4. Practical Physics, by C. L. Arora, S Chand publications
5. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
6. Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications.
7. Physics Volume 2, 5<sup>th</sup> edition, Haliday Resnick and Krane, Wiley publication
8. Fundamentals of Physics by Haliday, Resnick & Walker 7<sup>th</sup> edition, Wiley publication

### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	12	18
2	6	8
3	12	18
4	12	16
5	12	16
6	8	12
7	8	12
<b>Total</b>	<b>70</b>	<b>100</b>



## 2.3. BASIC ELECTRICAL ENGINEERING

**L T P**  
**5 - 4**

### RATIONALE

A diploma holder may be involved in various jobs ranging from preventive maintenance of electrical installation to fault location. In addition, he/she may be working in testing laboratories where he/she uses measuring instruments. To carry out these and similar jobs effectively, knowledge of basic concepts, principles and their applications is very essential. This course will enable the students to understand the basic concepts and principles of DC and AC fundamental, ac circuits, batteries, electromagnetic induction, voltage and current sources etc

### LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- **Identify and able to take readings on various electrical equipments(voltmeter, ammeter, CRO, wattmeter, multi-meter)**
- **Determination of voltage-current relationship in a DC circuit under specific physical conditions**
- **Measure resistance of an ammeter and a voltmeter**
- **Verify DC circuits (Thevenin, Nortons, Superposition theorem, Maximum Power Transfer Theorem)**
- **Verify Kirchhoff's Current and Voltage Laws in a dc circuit**
- **Find the ratio of inductance of a coil having air-core and iron-core respectively and to observe the effect of introduction of a magnetic core on coil inductance**
- **Test a lead - acid storage battery**
- **Measure power and power factor in a single phase R-.L-.C. Circuit and calculation of active and reactive powers in the circuit.**
- **Measure voltages and currents in polyphase a.c. circuits for star and delta connections.**

### DETAILED CONTENTS

1. Overview of DC Circuits (08 periods)
  - 1.1 Definition of basic terms, such as current, EMF, Potential Difference (PD); Ohm's Law and its limitations; Factors affecting resistors and capacitors; simple problems on series and parallel combinations of resistors with their wattage considerations.
  - 1.2 Application of Kirchhoff's current law and Kirchhoff's voltage law to simple circuits. Star – Delta connections and their conversion.

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2. DC Circuit Theorems (06 periods)
- Superposition principle, Maximum Power Transfer Theorem, Thevenin's theorem, Norton's theorem, application of network theorems in solving D.C. circuit problems.
3. Voltage and Current Sources (04 periods)
- 3.1 Concept of voltage source, symbol and graphical representation characteristics of ideal and practical sources.
- 3.2 Concept of current sources, symbol, characteristics and graphical representation of ideal and practical current sources.
- 3.3 Inter Conversion of Voltage-Source and Current Source.
4. Electro Magnetic Induction (10 periods)
- 4.1 Concept of electro-magnetic field produced by flow of electric current, magnetic circuit, concept of magneto-motive force (MMF), flux, reluctance, permeability, analogy between electric and magnetic circuit.\
- 4.2 Faraday's laws of electro-magnetic induction, principles of self and mutual induction, self and mutually induced e.m.f, simple numerical problems.
- 4.3 Concept of current growth, decay and time constant in an inductive (RL) circuit.
- 4.4 Energy stored in an inductor, series and parallel combination of inductors.
5. Batteries (08 periods)
- 5.1 Basic idea of primary and secondary cells
- 5.2 Construction, working principle and applications of Lead-Acid, Nickel-Cadmium and Silver-Oxide batteries
- 5.3 Charging methods used for lead-acid battery (accumulator)
- 5.4 Care and maintenance of lead-acid battery
- 5.5 Series and parallel connections of batteries
- 5.6 General idea of solar cells, solar panels and their applications
- 5.7 Introduction to maintenance free batteries
6. AC Fundamentals (10 periods)
- 6.1 Concept of alternating quantities
- 6.2 Difference between ac and dc
- 6.3 Concepts of: cycle, frequency, time period, amplitude, instantaneous value, average value, r.m.s. value, maximum value, form factor and peak factor.
- 6.4 Representation of sinusoidal quantities by phasor diagrams.
- 6.5 Equation of sinusoidal wave form for an alternating quantity and its derivation

- 6.6 Effect of alternating voltage applied to a pure resistance, pure inductance and pure capacitance.
7. AC Circuits (18 periods)
- 7.1 Concept of inductive and capacitive reactance
- 7.2 Alternating voltage applied to resistance and inductance in series.
- 7.3 Alternating voltage applied to resistance and capacitance in series.
- 7.4 Introduction to series and parallel resonance and its conditions
- 7.5 Power in pure resistance, inductance and capacitance, power in combined RLC circuits. Power factor, active and reactive power and their significance, definition and significance of power factor.
- 7.6 Definition of conductance, susceptance, admittance, impedance and their units
- 7.7 Introduction to polyphase a.c. systems, advantages of polyphase system over single phase system. Relations between line and phase value of voltages and currents for star and delta connections and their phasor diagram, power in polyphase circuits.
8. Various Types of Power Plants (06 periods)
- 8.1 Brief explanation of principle of power generation practices in thermal, hydro and nuclear power stations and their comparative study. A Visit to a nearby Power Station(s) may be organized for better understanding and exposure.
- 8.2 Elementary block diagram of above mentioned power stations

### LIST OF PRACTICALS

1. Operation and use of measuring instruments viz voltmeter, ammeter, CRO, Wattmeter, multi-meter and other accessories
2. Determination of voltage-current relationship in a dc circuit under specific physical conditions and to draw conclusions.
3. Measurement of resistance of an ammeter and a voltmeter
4. Verification of dc circuits:
  - a. Thevenin's theorem,
  - b. Norton's theorem,
5. Observation of change in resistance of a bulb in hot and cold conditions, using voltmeter and ammeter.
6. Verification of Kirchhoff's Current and Voltage Laws in a dc circuit
7. To find the ratio of inductance of a coil having air-core and iron-core respectively and to observe the effect of introduction of a magnetic core on coil inductance
8. Charging and testing of a lead - acid storage battery.
9. Measurement of power and power factor in a single phase R-.L-.C. circuit and calculation of active and reactive powers in the circuit.

- 10 Verification of line to line and line to neutral voltages and current in star and delta connections.

**Note:** Visit to a nearby Power Station(s) may be arranged to demonstrate various aspects of subject

### **INSTRUCTIONAL STRATEGY**

Basic electrical engineering being a fundamental subject, it needs to be handled very carefully and in a manner such that students develop clear understanding of the related concepts and principles. The teacher may lay more emphasis on laboratory work and give home assignments to students to inculcate self-study and problem solving abilities amongst them.

### **MEANS OF ASSESSMENT**

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Presentation
- Model Making

### **RECOMMENDED BOOKS**

1. Basic Electrical Engineering by PS Dhogal, Tata Mc Graw-Hill Education Pvt Ltd., New Delhi.
2. Experiments in Basic Electrical Engineering by SK Bhattacharya, KM Rastogi; New Age International (P) Ltd.; Publishers New Delhi.
3. Electrical Technology by BL Theraja, S Chand and Co, New Delhi.
4. Basic Electrical Engineering by JB Gupta; SK Kataria and Sons, New Delhi.
5. Basic Electrical Engineering by Asfaque Husain, Jain Book Depot, New Delhi

### **SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1.	08	11
2.	06	09
3.	04	06
4.	10	14
5.	08	11
6.	10	14
7.	18	26
8	06	09
<b>Total</b>	<b>70</b>	<b>100</b>

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## 2.4 BASICS OF MECHANICAL AND CIVIL ENGINEERING

**L T P**  
**5 - 2**

### RATIONALE

Apart from the common core subjects, some engineering subjects are included in the diploma course of electrical engineering. One of these subjects is Elementary Mech. Engg. to impart some necessary knowledge and skill about mechanical nature. Inclusion of the subject is further justified by the fact that in practical field, any job of electrical and civil technician is intermingled with either civil or mechanical engineering. As such the relevant basic topics of these disciplines are included in the content of the subject.

Some study exercises along with some field work have been suggested to give feel of jobs and equipments involved.

### LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Apply Thermodynamics Laws.
- Use of various energy sources.
- Solve basics problems related to fuel and combustion.
- Have an idea of loading on machine components.
- Explain the application of different types of bearings.
- Explain the uses of different types of gears and springs.
- Explain the working principle of different lubrication systems.

## SECTION A - MECHANICAL ENGINEERING

### DETAILED CONTENTS

1. Thermal Engineering (14 periods)

#### 1.1 Sources of Energy

Definition, Concept of thermodynamic system and surroundings, Closed system, Open system, Isolated system, Thermodynamics definition of work. Zeroth law of thermodynamics

Basic ideas, conventional and nonconventional forms- Thermal, Hydel, Tidal, wind, Solar, Biomass and Nuclear and their uses.

## 1.2 Fuels & Combustion:

Combustion of fuels- their higher and lower calorific values. Combustion equations for carbon, sulphur, hydrogen and their simple compounds. Calculation of minimum amount of air required for complete combustion. Combustion analysis on mass basis and on volume basis. Concept of excess air in a boiler furnace combustion. Heat carried away by flue gases. Analysis of flue gases by Orsat apparatus. Simple numerical problems

Idea of specific properties of liquid fuels such as detonation, knock resistance (cetane and octane numbers), viscosity, solidification point, flash point and flame point.

## 2. Machine Components

(20 periods)

Brief idea of loading on machine components.

- (i) Pins, Cottor and Knuckle Joints.
- (ii) Keys, Key ways and spline on the shaft.
- (iii) Shafts, Collars, Cranks, Eccentrics.
- (iv) Couplings and Clutches.
- (v) Bearings-Plane, Bushed, Split-step, ball, Roller bearing, Journal bearing, Foot step bearing, thrust bearing, collar bearing and Special type bearings and their applications.
- (vi) Gears  
Different types of gears, gear trains and their use for transmission of motion. Determination of velocity ratio for spur gear trains; spur gear, single and double helical gears, Bevel gears, Mitre wheel, worms, Rack and Pinion. Simple and compound and epicyclic gear trains and their use. Definition of pitch and pitch circle & module.
- (vii) Springs  
Compression, Tension, Helical springs, Torsion springs, Leaf and Laminated springs. Their use and material.

## 3. Lubrication

(08 periods)

Different lubrication system for lubricating the components of machines.

Principle of working of wet sump and dry sump system of lubrication. ( Explain with simple line diagram). Selection of lubricant based on different application (Requirement with the help of manufacturer catalogue).

## SECTION B : CIVIL ENGINEERING

4. Construction Materials (06 periods)

Properties and uses of various construction materials such as stones, bricks, lime, content and timber with their properties, physical/field testing, elements of brick masonry.

5. Foundations (08 periods)

5.1 Bearing capacity of soil and its importance

5.2 Types of various foundations and their salient features, suitability of various foundations for heavy, light and vibrating machines.

6. Concrete (08 periods)

Various ingredients of concrete, different grades of concrete, water cement ratio, workability, physical/field testing of concrete, mixing of concrete, placing and curing of concrete..

7. RCC (06 periods )

Basics of reinforced cement concrete and its use (elementary knowledge), introduction to various structural elements of a building.

Note: While imparting instructions, teachers are expected to lay more emphasis on concepts and principles. It will be better if the classes for general engineering are conducted by organized demonstrations for explaining various concepts and principles.

### LIST OF PRACTICALS

1. Study and Sketch of Pins and Cottor
2. Study and Sketch of Keys and Key ways
3. Study and sketch of Couplings and Clutches
4. Study and Sketch of Bearings
5. Study and Sketch of Springs
6. Study of green energy
- 7 Testing of bricks
  - a) Shape and size
  - b) Soundness test
  - c) Water absorption



- d) Crushing strength
- 8 Testing of concrete
  - a) Slump test
  - b) Compressive Strength of concrete cube
- 9 The students should be taken to different construction sites to show them various construction materials, concreting process and construction of RCC structural elements, foundations and other civil works.

### **INSTRUCTIONAL STRATEGY**

Teachers should lay emphasis on basic principles and use charts in class, visits to labs and industry may be arranged to demonstrate certain materials and practices.

### **MEANS OF ASSESSMENT**

- Sessional Tests
- End term Tests
- Practicals
- Viva-Voce

### **RECOMMENDED BOOKS**

1. Textbook of Concrete Technology 2<sup>nd</sup> Edition, by Kulkarni, PD Ghosh TK and Phull, YR; New Age International(P) Ltd, Publishers, New Delhi
2. Materials of Construction by Ghosh; Tata McGraw Hill Publishing Co. Ltd., New Delhi
3. Civil Engineering Materials by TTTI, Chandigarh; Tata McGraw Hill Publishing Co. Ltd., New Delhi
4. Concrete Technology by J.Jha and Sinha; Khanna Publishers, Delhi
5. Building Construction by Jha and Sinha; Khanna Publishers, Delhi
6. Building Construction by Vairani and Chandola; Khanna Publishers, Delhi
7. Civil Engineering Materials by SV Deodhar and Singhai; Khanna Publishers, New Delhi
8. Soil Mechanics and Foundation Engineering by SK Garg; Khanna Publishers, New

### **SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1.	14	20
2.	20	28
3.	08	12
4	06	08

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5	08	12
6	08	12
7	06	08
<b>Total</b>	<b>70</b>	<b>100</b>

## 2.5 ANALOG ELECTRONICS

**L T P**  
**4 - 4**

### RATIONALE

At present, electronic gadgets are being extensively used in various manufacturing processes in industries, power system operations, communication systems, computers etc. Even for an electrical diploma holder, it is absolutely necessary to have a basic understanding of electronic components, their function and applications. This understanding should facilitate in operation and maintenance equipment, which are electronically controlled.

In this course, topics like semi-conductor Diodes, Bipolar transistors, rectifiers, single stage and multistage amplifiers and field effect transistors have been included.

### LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Use P.N. junction as rectifier
- Use Zener diode as voltage stabilizer
- Use bi-polar transistors and its application as an amplifier and as a switch
- Analyse amplifier and enhance the gain of amplifier
- Use unipolar transistors as amplifier
- Identify and testing of various active and passive components such as resistor, inductor, capacitor, diode and transistor

### DETAILED CONTENTS

1. Semiconductor Diodes (12 periods)
  - 1.1 PN Junction, mechanism of current flow in PN junction, drift and diffusion currents, depletion layer, potential barrier, effect of forward and reverse biasing in a PN junction. Concept of junction capacitance in forward and reverse biased conditions. Breakdown mechanism
  - 1.2 Ideal diode, Semiconductor diode characteristics, static and dynamic resistance

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- 1.3 Use of diode as half wave and full wave rectifiers (centre tapped and bridge type), relation between DC output and AC input voltage, efficiency of rectifier
  - 1.4 Concept of ripples, filter circuits – shunt capacitor, series inductor, and pie ( $\pi$ ) filters and their applications
  - 1.5 Diode ratings/specifications
  - 1.6 Various types of diodes such as zener diode, varactor diode, schottky diode, light emitting diode, tunnel diode, photo diode; their working characteristics and applications
  - 1.7 Zener diode and its characteristics
  - 1.8 Use of zener diode for voltage stabilization
- 2 Bi-polar Transistors (06 periods)
- 2.1 Concept of junction transistor, PNP and NPN transistors, their symbols and mechanism of current flow
  - 2.2 Transistor configurations: common base (CB), common emitter (CE) and common collector (CC), current relation and their input/output characteristics; comparison of the three configurations
3. Transistor Biasing and Stabilization (10 periods)
- 3.1 Transistor biasing, its need, operating point, effect of temperature on the operating point of a transistor and need of stabilization of operating point.
  - 3.2 Different biasing circuits, limitations, simple problems to calculate operating point in different biasing circuits. Use of Thevenin's theorem to determine operating point
  - 3.3 Concept of h-parameters of a transistor
  - 3.4 Use of data book to know the parameters of a given transistor
4. Single-Stage Transistor Amplifiers (10 periods)
- 4.1 Single stage transistor amplifier circuit in CE configuration, function of each component
  - 4.2 Working of single stage transistor amplifier, physical and graphical explanation, phase reversal
  - 4.3 Concept of DC and AC load line
  - 4.4 Voltage gain of single stage transistor amplifier using characteristics of the device
  - 4.5 Concept of input and output impedance
  - 4.6 AC equivalent circuit of single stage transistor amplifiers
  - 4.7 Calculation of voltage gain using AC equivalent circuit
  - 4.8 Frequency response of a single stage transistor amplifier

5. Multi-Stage Transistor Amplifiers (10 periods)
- 5.1 Need of multi-stage transistor amplifiers – different types of couplings, their purpose and applications.
  - 5.2 Knowledge of various terms such as voltage gain, current gain, power gain, frequency response, decibel gain and band width
  - 5.3 RC coupled two-stage amplifiers, circuit details, working, frequency response, applications
  - 5.4 Loading effect in multistage amplifiers
  - 5.5 Elementary idea about direct coupled amplifier, its limitations and applications
  - 5.6 Transformer coupled amplifiers, its frequency response. Effect of co-efficient of coupling on frequency response. Applications of transformer coupled amplifiers
6. Field Effect Transistor (FET) (08 periods)
- 6.1 Construction, operation, characteristics and applications of a N channel JFET and P channel JFET
  - 6.2 JFET as an amplifier
  - 6.3 Types, construction, operation, characteristics and applications of a MOSFET
  - 6.4 Comparison between BJT, JFET and MOSFET

### LIST OF PRACTICALS

1.
  - a) Identification and testing of electronic components such as resistor, inductor, capacitor, diode, transistor and different types of switches used in Electronic circuits
  - b) Measurement of resistances using multimeter and their comparison with colour code values
2. To plot V-I characteristics of a Semiconductor diode and to calculate its static and dynamic resistance
3.
  - a) To plot V-I characteristics of a zener diode and finding its reverse breakdown voltage
  - b) Fabrication of a zener diode voltage stabilizer circuit using PCB
4. Observation of input and output wave shapes of a half-wave rectifier and verification of relationship between dc output and ac input voltage
5. Observation of input and output wave shapes of a full wave rectifier and verification of relationship between dc and ac input voltage
6. Observation of input and output wave shapes of a full wave rectifier with (i) shunt capacitor (ii) series inductor (iii)  $\Pi$  filter circuits
7. Plotting input and output characteristics of a transistor in CB configuration
8. Plotting input and output characteristics of a transistor in CE configuration

9. Measurement of operating point in case of (i) fixed biased circuit (ii) potential divider biasing circuit and to observe the effect of temperature variation on the operating point.

### **INSTRUCTIONAL STRATEGY**

This subject gives the knowledge of fundamental concepts of basic electronics. The teacher should give emphasis on understanding of concepts and various term used in the subject. The students be made familiar with diodes, transistors, resistors, capacitors, inductors etc. and electrical measuring instruments etc. Practical exercises will reinforce various concepts. Application of Semiconductor Diodes, Transistors, Field Effect Transistors etc must be told to students.

### **MEANS OF ASSESSMENT**

- Assignments and quiz/class Tests
- Midterm and End-term tests
- Laboratory and Practical work
- Presentations
- Viva-Voce

### **RECOMMENDED BOOKS**

1. Basic Electronics and Linear Circuit by NN Bhargava, Kulshreshta and SC Gupta, Tata McGraw Hill Education Pvt Ltd, New Delhi.
2. Principles of Electrical and Electronics Engineering by VK Mehta; S Chand and Co., New Delhi
3. Electronics Devices and Circuits by Millman and Halkias; McGraw Hill.
4. Electronic Devices and Circuits by Dharma Raj Cheruku and Battula Tirumala Krishna: Pearson Education (Singapore) Pvt Ltd., Indian Branch, 482 F.I.E Patparganj, Delhi- 92
5. Basic Electronics by JB Gupta, SK Kataria and Sons, New Delhi
6. Electronics Devices and circuit by Boylested, Tata McGraw Hill, New Delhi

### **SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allocation (%)</b>
1	12	21
2	06	11
3	10	18
4	10	18
5	10	18

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6	08	14
<b>Total</b>	<b>56</b>	<b>100</b>

## 2.6 GENERAL WORKSHOP PRACTICE –II

(Common for Civil Engineering, Electrical Engineering and Chemical Engineering )

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### RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General workshop practices are included in the curriculum in order to provide hands-on experience about use of different tools and basic manufacturing practices. This subject aims at developing general manual and machining skills in the students. In addition, the development of dignity of labour, safety at work place, team working and development of right attitude are the other objectives.

### LEARNING OUTCOMES

After completing the course, the students will be able to:

- Identify tools and equipment used and their respective functions.
- Identify different types of materials and their basic properties.
- Use and take measurements with the help of basic measuring tools/equipment.
- Select proper tools for a particular operation.
- Select materials, tools, and sequence of operations to make a job as per given specification/drawing.
- Prepare simple jobs independently and inspect the same.
- Follow safety procedures and precautionary measures.
- Use safety equipment and Personal Protection Equipment.

### DETAILED CONTENTS (PRACTICAL EXERCISES)

**Note:** The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the following shops should be explained and practiced. The students should prepare sketches of various tools/jobs in their practical Notebook.

The following shops are included in the syllabus:

- 1 Fitting Shop
- 2 Sheet Metal Shop
- 3 Mason Shop
- 4 Machine Shop

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## 1. FITTING SHOP

- 1.1 Use of personal protective equipment and safety precautions while working.
- 1.2 Basic deburring processes.
- 1.3 Introduction to fitting shop tools, marking and measuring devices/equipment.
- 1.4 Identification of materials. (Iron, Copper, Stainless Steel, Aluminium etc.)
- 1.5 Identification of various steel sections (flat, angle, channel, bar etc.).
- 1.6 Introduction to various fitting shop operations/processes (Hacksawing, Drilling, Chipping and Filing).
- 1.7 Job Practice

Job I Marking of job, use of marking tools, filing and use of measuring instruments. (Vernier caliper, Micrometer and Vernier height gauge).

Job II Filing a rectangular/square piece to maintain dimensions within an accuracy of  $\pm 0.25$  mm.

Job III Making a cut-out from a square piece of MS flat using hand hacksaw and chipping

Job IV Drilling and tapping practice on MS Flat.

## 2. SHEET METAL SHOP

- 2.1. Introduction to sheet metal shop, use of hand tools and accessories e.g. different types of hammers, hard and soft mallet, sheet and wire gauge, necessary allowance required during job fabrication, selection of material.
- 2.2 Introduction and demonstration of hand tools used in sheet metal shop.
- 2.3 Introduction and demonstration of various machines and equipment used in sheet metal shop e.g. Shearing Machine, Bar Folder, Burring Machine,
- 2.4 Introduction and demonstration of various raw materials used in sheet metal shop e.g. black-plain sheet, galvanized-iron plain sheet, galvanised corrugated sheet, aluminium sheet etc.
- 2.5 Study of various types of nuts, bolts, rivets, screws etc.
- 2.6 Job Practice
  - Job I: Shearing practice on a sheet using hand shears.
  - Job II: Practice on making Single riveted lap joint/Double riveted lap Joint.
  - Job III :Practice on making Single cover plate chain type, zig-zag type and single rivetted Butt Joint.

## 3 MASON SHOP

- 3.1. Introduction and importance of Mason shop



3.2. Introduction of tools, equipment and machines used in Mason shop

3.3. Job Practice

Job I : Preparation of simple bond

Job II : Preparation of Arched bond

Job III: Preparation of RCC structure (column and beam)

#### **4 MACHINE SHOP**

4.1 Study and sketch of lathe machine

4.2 Study and Sketch of grinders, milling machine, drilling machine and CNC machine.

4.3 Plain and step turning and knurling practice.

4.4 Study and sketch of planing/shaping machine and to plane a rectangle of cast iron.

#### **MEANS OF ASSESSMENT**

- Workshop jobs
- Report writing, presentation and viva voce

#### **RECOMMENDED BOOKS**

1. Workshop Technology I,II,III, by SK Hajra, Choudhary and AK Choudhary; Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. Workshop Technology Vol. I, II, III by Manchanda; India Publishing House, Jalandhar.
3. Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.
4. Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., New Delhi
5. Basic Workshop Practice Manual by T Jeyapooan; Vikas Publishing House (P) Ltd., New Delhi
6. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Co., New Delhi
7. Workshop Technology by HS Bawa; Tata McGraw Hill Publishers, New Delhi.