

**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	2 ½	-	-	50	70		
2.2	*Applied Physics -II	5	-	2	5	20	10	30	50	2 ½	20	3	70	100		
2.3	+Applied Mechanics	5	-	2	5	20	10	30	50	2 ½	20	3	70	100		
2.4	General Engineering	6	-	2	5	20	10	30	50	2 ½	20	3	70	100		
2.5	*Engineering Drawing -II	-	-	8	2	-	40	40	60	3	-	-	60	100		
2.6	General Workshop Practice-II	-	-	8	2	-	40	40	-	-	60	4	60	100		
#Student Centred Activities (SCA)		-	-	5	1	-	30	30	-	-	-	-	-	30		
Total		21	-	27	24	80	140	220	260	-	120	-	380	600		

\* Common with other diploma programmes

+ Common with diploma in Chemical Engg. and Civil Engg.

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

## 2.1 APPLIED MATHEMATICS - II

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5	-	-

### 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 Simpsons 1/3rd and Simpsons 3/8th 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
<b>Total</b>	<b>70</b>	<b>100</b>

## 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 polaroids.
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 APPLIED MECHANICS

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<b>5</b>	<b>-</b>	<b>2</b>

### RATIONALE

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

### LEARNING OUTCOMES

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

- Interpret various types of units and their conversion from one to another.
- Analyze different types of forces acting on a body and draw free body diagrams.
- Determine the resultant of coplanar concurrent forces.
- Calculate the co-efficient of friction for different types of surfaces.
- Calculate the least force required to maintain equilibrium on an inclined plane.
- Determine the centroid/centre of gravity of plain and composite laminar and solid bodies.
- Determine velocity ratio, mechanical advantage and efficiency of simple machines

### DETAILED CONTENTS

- |     |                                                                                                                                                                                                       |              |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 1.  | Introduction                                                                                                                                                                                          | (06 periods) |
| 1.1 | Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields. Definition of Applied Mechanics.                               |              |
| 1.2 | Definition, basic quantities and derived quantities of basic units and derived units                                                                                                                  |              |
| 1.3 | Different systems of units (FPS, CGS, MKS and SI) and their conversion from one to another for density, force, pressure, work, power, velocity, acceleration                                          |              |
| 1.4 | Concept of rigid body, scalar and vector quantities                                                                                                                                                   |              |
| 2.  | Laws of forces                                                                                                                                                                                        | (12 periods) |
| 2.1 | Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, effects of force, characteristics of a force |              |
| 2.2 | Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of superposition                                                                                    |              |
| 2.3 | Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of                                    |              |



- forces - graphically, analytically, resolution of forces, resolving a force into two rectangular components
- 2.4 Free body diagram
  - 2.5 Equilibrant force and its determination
  - 2.6 Lami's theorem (concept only)  
[Simple problems on above topics]
  - 2.7 Type of Load, supports, Beams- analysis for simply supported, cantilever beams
3. Moment (14 periods)
- 3.1 Concept of moment
  - 3.2 Moment of a force and units of moment
  - 3.3 Varignon's theorem (definition only)
  - 3.4 Principle of moment and its applications (Levers – simple and compound, steel yard, safety valve, reaction at support)
  - 3.5 Parallel forces (like and unlike parallel force), calculating their resultant
  - 3.6 Concept of couple, its properties and effects
  - 3.7 General conditions of equilibrium of bodies under coplanar forces
  - 3.8 Position of resultant force by moment  
[Simple problems on the above topics]
4. Friction (14 periods)
- 4.1 Definition and concept of friction, types of friction, force of friction
  - 4.2 Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction
  - 4.3 Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane.
  - 4.4 Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:
    - a) Acting along the inclined plane Horizontally
    - b) At some angle with the inclined plane
5. Centre of Gravity (10 periods)
- 5.1 Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies
  - 5.2 Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion
  - 5.3 Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed  
[Simple problems on the above topics]
6. Simple Machines (14 periods)

- 6.1. Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines
- 6.2. Simple and compound machine (Examples)
- 6.3. Definition of ideal machine, reversible and self locking machine
- 6.4. Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency
- 6.5. System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency
- 6.6. Working principle and application of wheel and axle, Weston's Differential Pulley Block, simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application  
[Simple problems on the above topics]

### LIST OF PRACTICALS

1. Verification of the polygon law of forces using Gravesend apparatus.
2. To verify the forces in different members of jib crane.
3. To verify the reaction at the supports of a simply supported beam.
4. To find the mechanical advantage, velocity ratio and efficiency in case of an inclined plane.
5. To find the mechanical advantage, velocity ratio and efficiency of a screw jack.
6. To find the mechanical advantage, velocity ratio and efficiency of worm and worm wheel.
7. To find mechanical advantage, velocity ratio and efficiency of single purchase crab.
8. To find out center of gravity of regular lamina.
9. To find out center of gravity of irregular lamina.
10. To determine coefficient of friction between three pairs of given surface.

### INSTRUCTIONAL STRATEGY

Applied Mechanics being a fundamental subject, the teacher are expected to emphasize on the application of "Applied Mechanics" in various subjects so that students are able to appreciate the importance of the subject. Students should also be made conversant with the use of scientific calculator to solve numerical problems

### MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid and end-term written tests
- Model/prototype making.

**RECOMMENDED BOOKS**

1. A Text Book of Applied Mechanics by S Ramamurtham, Dhanpat Rai Publishing Co. Ltd.
2. A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.
3. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi..
4. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.
5. Test Book of Applied Mechanics by AK Upadhya, SK Kataria & Sons, New Delhi

**SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	06	8
2	12	18
3	14	20
4	14	20
5	10	14
6	14	20
<b>Total</b>	<b>70</b>	<b>100</b>

## 2.4 GENERAL ENGINEERING

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**6 - 2**

### RATIONALE

Apart from the core subjects, some engineering subjects are included in this diploma course. One of these subjects is General Engg. which aims to impart some necessary knowledge and skill about other engg disciplines. Inclusion of the subject is further justified by the fact that in practical field, any job of technician is intermingled. 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:

- **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 and Norton 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 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.
- Identify different construction materials and check their quality
- Determine the bearing capacity of soils and select suitable foundations for heavy installations and machineries.
- Identify various types of concrete and check its quality
- Identify different structural elements in a building and the working of RCC.

## DETAILED CONTENTS

### SECTION A - ELECTRICAL ENGINEERING

1. Overview of DC Circuits (06 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.
2. DC Circuit Theorems (06 periods)

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.
4. Electro Magnetic Induction (08 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 (8 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 (12 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.
  - 8.2 Elementary block diagram of above mentioned power stations

### **SECTION B : CIVIL ENGINEERING**

9. Construction Materials (06 periods)
- Properties and uses of various construction materials such as stones, bricks, lime, cement and timber with their properties, physical/field testing, elements of brick masonry.
10. Foundations (08 periods)
- 10.1 Bearing capacity of soil and its importance
  - 10.2 Types of various foundations and their salient features, suitability of various foundations for heavy, light and vibrating machines.

11. 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..
12. RCC (04 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. 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.
11. Study of green energy
12. Testing of bricks
  - a) Shape and size
  - b) Soundness test
  - c) Water absorption
  - d) Crushing strength
13. Testing of concrete

- a) Slump test
  - b) Compressive Strength of concrete cube
14. 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.

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

### **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. 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
6. 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
7. Materials of Construction by Ghosh; Tata McGraw Hill Publishing Co. Ltd., New Delhi
8. Civil Engineering Materials by TTTI, Chandigarh; Tata McGraw Hill Publishing Co. Ltd., New Delhi
9. Concrete Technology by J.Jha and Sinha; Khanna Publishers, Delhi
10. Building Construction by Jha and Sinha; Khanna Publishers, Delhi
11. Building Construction by Vairani and Chandola; Khanna Publishers, Delhi
12. Civil Engineering Materials by SV Deodhar and Singhai; Khanna Publishers, New Delhi



**SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1.	06	8
2.	06	6
3.	04	4
4.	08	10
5.	08	10
6.	08	10
7.	12	14
8.	06	8
9.	06	6
10.	08	10
11.	08	8
12.	04	4
<b>Total</b>	<b>84</b>	<b>100</b>

## 2.5 ENGINEERING DRAWING - II

**L T P**  
- - 8

### RATIONALE

Drawing is the language of engineers and technicians. Reading and interpreting engineering drawing is their day-to-day responsibility. The subject is aimed at developing basic graphic skills in the students so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation. The emphasis, while imparting instructions, should be to develop conceptual skills in the students following BIS SP 46 – 1988.

#### Note:

- 1) First angle projection is to be followed.
- 2) Minimum 16 sheets to be prepared. At least 2 sheets in AutoCAD.
- 3) Instructions relevant to various drawings may be given along with appropriate demonstration, before assigning drawing practice to the students.
- 4) Continuous evaluation be done by the teachers for exercises/work done on CAD software. For this proper record may be maintained for its inclusion in the internal assessment.

### LEARNING OUTCOMES

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

- Draw and learn different types of wooden joints used in furniture.
- Draw the assembly from part details of objects
- Identify and draw different types of screw threads used in various machines and assemblies as per domestic and international standards
- Draw different types of nuts, bolts and washers
- Draw various locking devices and foundation bolts
- Draw different section of various types of keys and cotter joints
- Draw various riveted joints
- Draw various types of couplings used in power transmission.
- Prepare drawing of given joints/couplings using AutoCAD

### DETAILED CONTENTS

1. Detail and Assembly Drawing (02 sheets)

Principle and utility of detail and assembly drawings

- 1.1 Wooden joints i.e. corner mortice and tenon joint, Tee halving joint, Mitre faced corner joint, Tee bridle joint, Crossed wooden joint, Cogged joint, Dovetail joint,

Through Mortice and Tenon joint, furniture drawing - freehand and with the help of drawing instruments.

2. Screw Threads (03 sheets)
  - 2.1 Thread Terms and Nomenclature
    - 2.1.1 Types of threads-External and Internal threads, Right and Left hand threads (Actual and Conventional representation), single and multiple start threads.
    - 2.1.2 Different Forms of screw threads-V threads (B.S.W threads, B.A thread, American National and Metric thread), Square threads (square, Acme, Buttress and Knuckle thread)
  
3. Nuts and Bolt (02 sheets)
  - 3.1 Different views of hexagonal and square nuts. Square and hexagonal headed bolt
  - 3.2 Assembly of Hexagonal headed bolt and Hexagonal nut with washer.
  - 3.3 Assembly of square headed bolt with hexagonal and with washer.
  
4. Locking Devices (02 sheets)
  - 4.1 Different types of locking devices-Lock nut, castle nut, split pin nut, locking plate, slotted nut and spring washer.
  - 4.2 Foundations bolts-Rag bolt, Lewis bolt, curved bolt and eye bolt.
  - 4.3 Drawing of various types of studs
  
5. Keys and Cotters (03 sheets)
  - 5.1 Various types of keys and cotters - their practical application, drawings of various keys and cotters showing keys and cotters in position
  - 5.2 Various types of joints
    - Spigot and socket joint
    - Gib and cotter joint
    - Knuckle joint
  
6. Rivets and Riveted Joints (04 sheets)
  - 6.1 Types of general purpose-rivets heads
  - 6.2 Caulking and fullering of riveted joints
  - 6.3 Types of riveted joints
    - (i) Lap joint-Single riveted, double riveted (chain and zig-zag type)
    - (ii) Single riveted, Single cover plate butt joint
    - (iii) Single riveted, double cover plate butt joint
    - (iv) Double riveted, double cover plate butt joint(chain and zig-zag type)

7. Couplings (02 sheets)

- 7.1 Introduction to coupling, their use and types
- 7.2 Flange coupling (protected)
- 7.3 Flexible Coupling

\*8. Use of CAD software (02 sheets)

Draw any two joints/coupling using CAD software from the following:

- i) Sleeve and cotter joint
- ii) Knuckle joint
- iii) Spigot and socket joint
- iv) Gib and cotter joint
- v) Flange coupling
- vi) Muff coupling

\* **Auto CAD drawing will be evaluated internally by sessional marks and not by final theory paper.**

### INSTRUCTIONAL STRATEGY

Teacher should show model of realia of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet. Focus should be on proper selection of drawing instruments and their proper use. The institute should procure AutoCAD or other engineering graphics software for practice in engineering drawings. Teachers should undergo training in AutoCAD/Engineering Graphic. Separate labs for practice on AutoCAD should be established.

### MEANS OF ASSESSMENT

- Sketches
- Drawing
- Use of software

### RECOMMENDED BOOKS

1. A Text Book of Engineering Drawing by Surjit Singh; Dhanpat Rai & Co., Delhi
2. Engineering Drawing by PS Gill; SK Kataria & Sons, New Delhi
3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House (Pvt. Ltd.), Anand
4. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar

5. AutoCAD 2010: For Engineers & Designers by Prof. Sham Tickoo & D. Sarvanan; Wiley India Pvt. Ltd., Delhi.

**2.6 GENERAL WORKSHOP PRACTICE –II**  
(Common for Mechanical Engineering and Agriculture 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 Welding Shop
- 4 Foundry Shop

## 5 Machine Shop

### 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  $\pm .25$  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 WELDING SHOP – I

- 3.1 Introduction and importance of welding as compared to other material joining processes. Specifications and type of welding machines, classification and coding of electrodes, welding parameters, welding joints and welding positions. Materials to be welded, safety precautions.

### 3.2 Job Practice

- Job I Practice of striking arc (Minimum 4 beads on 100 mm long M.S. flat).  
 Job II Practice of depositing beads on plate at different current levels. (Minimum 4 beads on M.S. plate at four setting of current level).  
 Job III Preparation of lap joint using arc welding process.  
 Job IV Preparation of T-joint using gas welding or arc welding on 100 mm x 6 mm MS Flat

## 4 FOUNDRY SHOP

- 4.1 Study of metal and non metals  
 4.2 Study and Sketch of the Foundry tools  
 4.3 Study and sketch of Cupola and pit furnace  
 4.4 To prepare green moulding sand and to prepare moulds (single piece and double piece pattern sweep mould)  
 4.5. Casting of non ferrous (lead or aluminium)

## 5 MACHINE SHOP

- 5.1 Study and sketch of lathe machine  
 5.2 Study and Sketch of grinders, milling machine, drilling machine and CNC machine.  
 5.3 Plain and step turning and knurling practice.  
 5.4 Study and sketch of planning/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.