SECOND SEMESTER:

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week L	STUDY SCHEME Periods/Week P	Credits (C) L+P = C	INTERNAL ASSESSMENT Th	INTERNAL ASSESSMENT Pr	INTERNAL ASSESSMENT Tot	EXTERNAL ASSESSMENT Th	EXTERNAL ASSESSMENT Pr	EXTERNAL ASSESSMENT Tot	Total Marks of Internal & External
2.1	*Applied Mathematics II	4	-	4+0=4	40	-	40	60	-	60	100
2.2	*Applied Physics-II	2	2	2+1=3	40	40	80	60	60	120	200
2.3	*Applied Chemistry	3	2	3+1=4	40	40	80	60	60	120	200
2.4	Applied Mechanics	3	2	3+1=4	40	40	80	60	60	120	200
2.5	Mechanical Engineering Drawing- I	-	6	0+3=3	-	40	40	60	-	60	100
2.6	Workshop Technology -I	3	-	3+0=3	40	-	40	60	-	60	100
2.7	Workshop Practice- I	-	6	0+3=3	-	40	40	-	60	60	100
#Student Centred Activities (SCA)		-	2	-	-	-	-	-	-	-	-
Total		**15**	**20**	**24**	**200**	**200**	**400**	**360**	**240**	**600**	**1000**

* Common with other diploma programmes

\# Student Centred Activities will comprise of co-curricular activities like extension lectures on Constitution of India, etc, Games, Yoga, Human Values & Ethics, Knowledge of Indian System, Hobby Clubs e.g. Photography etc., Seminars, Declamation Contests, Educational Field Visits, NCC, NSS, Cultural Activities and Self-study etc.

Summer Industrial/In-house Training: After 2nd semester, students shall undergo Summer Training **of 4 Weeks.**

SECOND SEMESTER

SECOND SEMESTER

2.1 APPLIED MATHEMATICS - II

L   P
4   -

RATIONALE

Applied mathematics forms the backbone of engineering students. Basic elements of Differential calculus, Integral calculus and Differential Equations have been included in this course. This will develop analytical abilities to apply in engineering field and will provide continuing educational base to the students.

COURSE OUTCOMES

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

CO1:   Formulate the engineering problems into mathematical format with the use of differential equations and differential

C02:   Use the differentiation and Integration in solving various Mathematical and Engineering problems.

CO3:   Calculate the approximate area under a curve by applying integration and numerical methods.

CO4:   Discuss the purposes of measures of central tendency and calculate the measures of central tendency (mode, median, mean) for a set of data.

CO5:   Learn about basic fundamentals about MATLAB/ SciLab and mathematical calculation with MATLAB/ SciLab software.

DETAILED CONTENTS

UNIT I
Differential Calculus

1.1   Definition of function; Concept of limits (Introduction only) and problems related to four standard limits only.

1.2   Differentiation of x^n, sin x, cos x, e^x by first principle.

1.3   Differentiation of sum, product and quotient of functions.

UNIT II
Differential Calculus and Its Applications

2.1   Differentiation of trigonometric functions, inverse trigonometric functions. Logarithmic differentiation, successive differentiation (upto 2nd order)

2.2   Application of differential calculus in:

(a)   Rate measures   (b)   Maxima and minima

UNIT III
Integral Calculus
3.1 Integration as inverse operation of differentiation with simple examples.

3.2 Simple standard integrals and related problems, Integration by Substitution method and Integration by parts.

3.3 Evaluation of definite integrals with given limits.

$$\int_0^{\pi/2} \sin^n x \, dx, \quad \int_0^{\pi/2} \cos^n x \, dx, \quad \int_0^{\pi/2} \sin^m x \, \cos^n x \, dx$$

using formulae without proof (m and n being positive integers only) using pre-existing mathematical models.

UNIT IV
Application of Integration, Numerical Integration and Differential Equations
4.1 Applications of integration: for evaluation of area under a curve and axes (Simple problems).

4.2 Numerical integration by Trapezoidal Rule and Simpson's 1/3rd Rule using pre-existing mathematical models.

Differential Equations
4.3 Definition, order, degree, Type of differential Equations, linearity, Formulation of ordinary differential equation (up to 1st order), solution of ODE (1st order) by variable separation method.

UNIT V
Statistics and Software
Statistics
5.1 Measures of Central Tendency: Mean, Median, Mode

5.2 Measures of Dispersion: Mean deviation, Standard deviation

Software
5.3 SciLab software – Theoretical Introduction.

5.4 Basic difference between MATLAB and SciLab software,

5.5 Calculations with MATLAB or ScilLab - (a) Representation of matrix (2×2 order),
(b) Addition, Subtraction of matrices (2×2 order) in MATLAB or SciLab

RECOMMENDED BOOKS

1 R. D. Sharma, "Applied Mathematics – I & II for Diploma Courses", Dhanpat Rai Publications.

2 "Mathematics for Class XI", NCERT Publication, New Delhi.

3 "Mathematics for Class XII", NCERT Publication, New Delhi.

4   H. K Dass, "Applied Mathematics for Polytechnics", CBS Publishers & Distributers.

5   A Ganesh and G Balasubramanian, "Textbook of Engineering Mathematics –I", CBS Publisher, New Delhi.

6   A Ganesh and G Balasubramanian, "Textbook of Engineering Mathematics –II", CBS Publisher, New Delhi.

7   G. B. Thomas, R. L. Finney, "Calculus and Analytic Geometry", Addison Wesley, Ninth Edition.

8   B S Grewal, "Elementary Engineering Mathematics", Khanna Publishers, Delhi, Thirty-fifth Edition.

9   R.K. Jain and S.R.K. Iyengar, "Advanced Engineering Mathematics" Narosa Publishing House, New Delhi, Second Edition, 2003.

10   SS Sabharwal & Dr Sunita Jain, "Applied Mathematics Vol. I & II", Eagle Parkashan, Jalandhar.

11   S Kohli, "Engineering Mathematics Vol. I & II", IPH, Jalandhar.

12   Reena Garg & Chandrika Prasad, "Advanced Engineering Mathematics", Khanna Publishing House, New Delhi.

13   R. Pratap, "Getting Started with MATLAB 7", Oxford University Press, Seventh Edition.

14   E-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1)   https://www.scilab.org
2)   http://swayam.gov.in

INSTRUCTIONAL STRATEGY

This is theoretical subject and contains five units of 20% equal weight age.

Basic elements of Differential Calculus, Integral Calculus, and Differential Equations can be taught in the light of their applications in the field of engineering and technology. By laying more stress on applied part, teachers can also help in providing continuing education base to the students. Students need to be taught the skills needed to use software tools built by experts through multiple problem solving based on the topics that the industry requires. For example they need to know how to use mathematical models that use integration as opposed to learning how integration can be used. Useful authenticated software MATLAB or open source software SciLab can be taught theoretically by books/online literatures and basic operations can be shown practically with practical software laboratory or small mobile apps of these software or authentic Trial version of MATLAB/ SciLab software. Diploma students need to know which tools to use and how to do the job.

2.2 APPLIED PHYSICS - II

L   P
2   2

RATIONALE

Applied physics includes the study of a large number of diverse topics all related to things that go on in 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 will behave. Concrete use of physical principles and analysis in various technical fields are given prominence in the course content to prepare students for various technical applications.

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:   Differentiate between types of waves and their motion.

CO2:   Illustrate laws of reflection and refraction of light.

CO3:   Demonstrate competency in phenomena of electrostatics and electricity.

CO4:   Characterize properties of material to prepare new materials for various technical applications.

CO5:   Demonstrate a strong foundation on Modern Physics to use at various technical applications.

DETAILED CONTENTS

UNIT I
Wave Motion and its Applications

1.1   Waves: definition, types (mechanical and electromagnetic wave).

1.2   Wave motion- transverse and longitudinal with examples, terms used in wave motion like displacement, amplitude, time period, frequency, wavelength, wave velocity; relationship among wave velocity, frequency and wave length.

1.3   Simple harmonic motion (SHM): definition, examples.

1.4   Cantilever: definition, formula of time period (without derivation).

1.5   Free, forced and resonant vibrations with examples

1.6   Sound waves: types (infrasonic, audible, ultrasonic) on the basis of frequency, noise, coefficient of absorption of sound, echo

UNIT II
Optics

2.1   Reflection and refraction of light with laws, refractive index.

2.2   Lens: introduction, lens formulae (no derivation), power of lens and simple numerical problems.

2.3   Total internal reflection and its applications, critical angle and conditions for total internal reflection.

2.4   Superposition of waves (concept only), definition of Interference, Diffraction and Polarization of waves.

2.5   Introduction to Microscope, Telescope and their applications.

UNIT III
Electrostatics and Electricity

3.1   Electric charge, unit of charge, conservation of charge.

3.2   Coulomb's law of electrostatics.

3.3   Electric field, electric lines of force (definition and properties), electric field intensity due to a point charge.

3.4   Definition of electric flux, Gauss law (statement and formula).

3.5   Capacitor and capacitance (with formula and unit).

3.6   Electric current and its SI Unit, direct and alternating current.

3.7   Resistance, conductance (definition and unit).

3.8   Series and parallel combination of resistances.

3.9   Ohm's law (statement and formula).

UNIT IV
Classification of Materials and their Properties

4.1   Definition of energy level, energy bands.

4.2   Types of materials (conductor, semiconductor, insulator and dielectric) with examples, intrinsic and extrinsic semiconductors (introduction only).

4.3 Introduction to magnetism, type of magnetic materials: diamagnetic, paramagneticand ferromagnetic materials with examples

4.4 Magnetic field, magnetic lines of force, magnetic flux

4.5 Electromagnetic induction (definition)

UNIT V

Modern Physics

5.1 Laser: introduction, principle, absorption, spontaneous emission, stimulated emission, population inversion

5.2 Engineering and medical applications of laser

5.3 Fibre optics**:** introduction to optical fibers (definition, principle and parts), light propagation, fiber types (mono-mode, multi-mode), applications in medical, telecommunication and sensors

5.4 Nanotechnology: introduction, definition of nanomaterials with examples, properties at nanoscale, applications of nanotechnology (brief)

PRACTICAL EXERCISES

1. Familiarization with apparatus (resistor, rheostat, key, ammeter, voltmeter, telescope, microscope etc.)

2. To find the time period of a simple pendulum.

3. To study variation of time period of a simple pendulum with change in length of pendulum.

4. To determine and verify the time period of Cantilever.

5. To verify Ohm's laws by plotting a graph between voltage and current.

6. To study colour coding scheme of resistance.

7. To verify laws of resistances in series combination.

8. To verify laws of resistance in parallel combination.

9. To find resistance of galvanometer by half deflection method.

10. To verify laws of reflection of light using mirror.

11. To verify laws of refraction using glass slab.

12. To find the focal length of a concave lens, using a convex lens.

RECOMMENDED BOOKS

1. "Text Book of Physics for Class XII (Part-I, Part-II)", N.C.E.R.T., Delhi.
2. Dr. HH Lal, "Applied Physics, Vol. I & II", TTTI Publications, Tata McGraw Hill,Delhi.
3. AS Vasudeva, "Applied Physics –II", Modern Publishers, Jalandhar.
4. R A Banwait, "Applied Physics – II", Eagle Prakashan, Jalandhar.
5. N Subrahmanyam, Brij Lal and Avadhanulu, "A text book of OPTICS", S ChandPublishing, New Delhi.
6. E-books/e-tools/relevant software to be used as recommended by AICTE/ HSBTE/NITTTR.
7. M H Fulekar, "Nanotechnology: Importance and Applications", IK InternationalPublishing House (P) Ltd., New Delhi.
8. C. L. Arora, "Practical Physics", S Chand Publication.

SUGGESTED WEBSITES

1. http://swayam.gov.in

INSTRUCTIONAL STATREGY

This is hands-on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weightage.

Teacher may use various teaching aids like models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. Students need to be exposed to use of different sets of units and conversion from one unit type to another. Software may be used to solve problems involving conversion of units. The teacher should explain about field applications before teaching the basics of mechanics, work, power and energy, rotational motion, properties of matter etc. to develop proper understanding of the physical phenomenon. Use of demonstration can make the subject interesting and develop scientific temper in the students.

Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to appreciate learning of these concepts and principles. In all contents, SI units should be followed. Working in different sets of units can be taught through relevant software.

2.3 APPLIED CHEMISTRY

L P
3 2

RATIONALE

The regular use of a variety of chemistry based materials and processes in diverse technical and engineering fields have repeatedly proven the importance of Applied Chemistry and its role in current and future technological advancements. Ever increasing use of chemical materials in the emerging engineering applications demands engineers and technocrats to acquire an in-depth knowledge of Applied Chemistry to be able to choose the best suited materials to meet their needs while maintaining the environment sustainability. An understanding of the principles of Applied Chemistry will develop scientific attitude in the budding engineers to understand the physical and chemical properties of the available materials for engineering applications as well as an ability to design new and effective materials.

COURSE OUTCOMES

After studying this subject, students will be able to:

CO1: Classify the elements into metals, non-metals and metalloids.

CO2: Explain the extraction of metals from ores, their mechanical properties and modification of properties by alloy formation.

CO3: Classify fuels and lubricants and apply them in different engineering applications.

CO4: Identify the polymeric materials, assess their properties and design suitable polymericmaterials for current and future applications.

CO5: Apply effective methods for corrosion prevention,

DETAILED CONTENTS

UNIT 1

Atomic Structure, Periodic Table and Chemical Bonding.

1.1   Bohr's model of atom (qualitative treatment only), dual character of matter: derivation of de-Broglie's equation, Heisenberg's Principle of Uncertainty, modern concept of atomic structure: definition of orbitals, shapes of s, p and d-orbitals, quantum numbers and their significance. Electronic configuration: Aufbau and Pauli's exclusion principles and Hund's rule, electronic

configuration of elements up to atomic number 30.

1.2 Modern Periodic law and Periodic table, classification of elements into s, p, d and f-blocks, metals, non-metals and metalloids (periodicity in properties excluded).

1.3 Chemical bonding: cause of bonding, ionic bond, covalent bond, and metallic bond (electron sea or gas model), Physical properties of ionic, covalent and metallic substances.

UNIT II

Metals and Alloys

2.1 Metals: mechanical properties of metals such as conductivity, elasticity, strength and stiffness, luster, hardness, toughness, ductility, malleability, brittleness, and impact resistance and their uses.

2.2 Definition of a mineral, ore, gangue, flux and slag. Metallurgy of iron from haematite using a blast furnace. Commercial varieties of iron.

2.3 Alloys: definition, necessity of making alloys, composition, properties and uses of duralumin and steel. Heat treatment of steel- normalizing, annealing, quenching, tempering.

UNIT III

Water, Solutions, Acids and Bases

3.1 Solutions: definition, expression of the concentration of a solution in percentage (w/w, w/v and v/v), normality, molarity and molality and ppm. Simple problems on solution preparation.

3.2 Arrhenius concept of acids and bases, strong and weak acids and bases, pH value of a solution and its significance, pH scale. Simple numerical problems on pH of acids and bases.

3.3 Hard and soft water, causes of hardness of water, types of hardness – temporary and permanent hardness, expression of hardness of water, ppm unit of hardness; disadvantages of hard water; removal of hardness: removal of temporary hardness by boiling and Clark's method; removal of permanent hardness of water by Ion-Exchange method; boiler problems caused by hard water: scale and sludge formation, priming and foaming, caustic embrittlement; water sterilization by chlorine, UV radiation and RO.

UNIT IV

Fuels and Lubricants

4.1 Fuels: definition and classification of higher and lower calorific values, units of calorific value, characteristics of an ideal fuel. Petroleum: composition and refining of petroleum; gaseous fuels: composition, properties and uses of CNG, PNG, LNG, LPG; relative advantages of liquid and gaseous fuels over solid fuels. Scope of hydrogen as future fuel.

4.2 Lubricants- Functions and qualities of a good lubricant, classification of lubricants with

examples; lubrication mechanism (brief idea only); physical properties (brief idea only) of a lubricant: oiliness, viscosity, viscosity index, flash and fire point, ignition temperature, pour point.

UNIT V

Polymers and Electrochemistry

5.1 Polymers and Plastics: definition of polymer, classification, addition and condensation polymerization; preparation properties and uses of polythene, PVC, Nylon-66, Bakelite; definition of plastic, thermoplastics and thermosetting polymers; natural rubber and neoprene, other synthetic rubbers (names only).

5.2 Corrosion: definition, dry and wet corrosion, factors affecting rate of corrosion, methods of prevention of corrosion—hot dipping, metal cladding, cementation, quenching, cathodic protection methods

5.3 Introduction and application of nanotechnology: nano-materials and their classification, applications of nanotechnology in various engineering applications (brief).

PRACTICAL EXERCISES

1. To prepare standard solution of oxalic acid.
2. To dilute the given KMnO4 solution
3. To find out the strength in grams per litre of an unknown solution of sodium hydroxide using a standard (N/10) oxalic acid solution.
4. To find out the total alkalinity in parts per million (ppm) of a water sample with the help of a standard sulphuric acid solution.
5. To determine the total hardness of given water sample by EDTA method
6. To determine the amount of total dissolved solids(TDS) in ppm in a given sample of water gravimetrically
7. To determine the pH of different solutions using a digital pH meter.
8. To determine the calorific value of a solid/liquid fuel using a Bomb calorimeter.
9. To determine the viscosity of a lubricating oil using a Redwood viscometer
10. To prepare a sample of Phenol-formaldehyde resin (Bakelite)/Nylon-66 in the lab.

RECOMMENDED BOOKS

1. "Textbook of Chemistry for class XI and XII (part I & II)", NCERT, Delhi, 2017-18.
2. C.N. R. Rao, "Understanding Chemistry", Universities Press (India) Pvt. Ltd, 2011.

3.   Jain & Jain, "Engineering Chemistry", Dhanpat Rai and Sons; New Delhi, 2015.

4.   Dr. G. H. Hugar & Prof A. N. Pathak, "Applied Chemistry Laboratory Practices, Vol. I and Vol. II", NITTTR, Chandigarh, Publications, 2013-14.

5.   Rajesh Agnihotri, "Chemistry for Engineers", Wiley India Pvt. Ltd, 2014.

6.   "Applied Chemistry" by Usha Raju.

SUGGESTED WEBSITES

1.   www.chemguide.co.uk/atommenu.html (Atomic structure and chemical bonding)

2.   www.visionlearning.com (Atomic structure and chemical bonding)

3.   www.cheml.com (Atomic structure and chemical bonding)

4.   https://www.wastewaterelearning.com/elearning/ (Water treatment)

5.   www.capital-refractories.com (Metals, Alloys, Cement, and Refractory Materials)

6.   www.em-ea.org/guide%20books/book-2/2.1%20fuels%20and%20combustion.pdf   (Fuel and Combustion)

INSTRUCTIONAL STRATEGY

Teachers may take help of various models and charts while imparting instructions to make the concept clear. More emphasis should be laid on discussing and explaining practical applications of various chemical process and reactions. In addition, students should be encouraged or motivated to study those processes in more details, which may find practical application in their future professional career. This subject contains five units of equal weightage.

2.4 APPLIED MECHANICS

L   P
3   2

RATIONALE

This course 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.

COURSE OUTCOMES

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

CO1:   Draw free body diagrams.by analyzing different types of forces acting on a body.

CO2:   Determine the resultant of coplanar concurrent forces.

CO3:   Solve problems by using principle of moment.

CO4:   Calculate the least force required to maintain equilibrium on an inclined plane.

CO5:   Determine the centroid/centre of gravity of plain and composite laminar and solid bodies.

CO6:   Determine velocity ratio, mechanical advantage and efficiency of simple machines.

DETAILED CONTENTS

UNIT 1
1.   Introduction
Concept of mechanics, Classification of mechanics, utility of mechanics in engineering field, Concept of rigid body, scalar and vector quantities.

2.   Laws of forces
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, Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of superposition, Free body diagram, Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, parallelogram law of forces (with derivation), triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces, resolving

a force into two rectangular components, Lami's theorem, Simple numericals, Equilibrium of forces and its determination.

UNIT II

3. Moment

Concept of moment, Moment of a force and units of moment, Varignon's theorem (definition only), Principle of moment and its applications (Levers – simple and compound, steel yard, safety valve), Simple numericals. Parallel forces (like and unlike parallel force), calculating their resultant, Concept of couple, its properties and effects, General conditions of equilibrium of bodies under coplanar forces, Position of resultant force by moment.

UNIT III

4. Friction

Definition and concept of friction, types of friction, force of friction, Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction, Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane. Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force acting along the inclined plane and subjected to a force acting at some angle with the inclined plane, Simple numericals.

UNIT IV

5. Centre of Gravity and Centroid

Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies. Axis of symmetry, Reference axis. Determination of centroid of plain and composite lamina (T, L, C and I shape) using moment method only, centroid of bodies with removed portion. Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed.

6. Laws of Motion

Newton's laws of motion and their applications, Concept of momentum. Derivation of force equation from second law of motion, numerical problems on second law of motion. Bodies tied with string, Newton's third law of motion, numerical problems, conservation of momentum, impulse and impulsive force.

UNIT V

7.   Simple Machines

Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines, Simple and compound machine (Examples). Definition of ideal machine, reversible and self locking machine. Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency, Simple numericals. System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency. 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.

PRACTICAL EXERCISES

1.   Verification of polygon law of forces using universal force table/Gravesend apparatus.
2.   Verification of Lami's theorem.
3   To verify law of moments by using Bell crank lever.
4.   To verify the forces in different members of jib crane.
5.   To determine coefficient of friction between three pairs of given surface.
6.   To find out center of gravity of regular lamina.
7.   To find out center of gravity of irregular lamina.
8.   To find the mechanical advantage, velocity ratio and efficiency of a screw jack.
9.   To find the mechanical advantage, velocity ratio and efficiency of worm andworm wheel.
10.   To find mechanical advantage, velocity ratio and efficiency of single purchase crab.

RECOMMENDED BOOKS

1.   Birinder Singh,"Text Book of Applied Mechanics", Katson Publishing House, New Delhi.
2.   A. K. Upadhyay, "Text Book of Applied Mechanics", SK Kataria & Sons, New Delhi.
3.   S. Ramamurtham, "A Text Book of Applied Mechanics", Dhanpat Rai Publishing Company Pvt. Ltd, Delhi.
4.   R. S. Khurmi, "A Text Book of Engineering Mechanics (Applied Mechanics)", S Chand andCo. Ltd., New Delhi.
5.   R. K. Rajput, "A Text Book of Applied Mechanics", Laxmi Publications, New Delhi.
6.   D. S. Bedi, "Engineering Mechanics", Khanna Publishing House, New Delhi.

INSTRUCTIONAL STRATEGY

This is hands-on practice based subject and topics taught in the class should be practiced in the lab regularly for development of required skills in the students. This subject contains five units of equal weightage.

2.5 MECHANICAL ENGINEERING DRAWING-I

L   P

-   6

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 15 sheets to be prepared.
3)   BIS Code SP 46-1988 should be followed.
4)   Instructions relevant to various drawings may be given along with appropriate demonstration before assigning drawing practice to the students.
5)   20 percent of drawing sheets to be prepared on the third angle projection.
6)   Use CAD software.

COURSE OUTCOMES

After undergoing the course, the students will be able to:
CO1:   Draw the assembly from part details of objects.
CO2:   Identify and draw different types of screw threads.
CO3:   Draw different types of nuts, bolts and washers.
CO4:   Draw various locking devices.
CO5:   Draw different section of various types of keys and cotter joints.
CO6:   Draw various riveted joints.
CO7:   Draw various types of couplings used in power transmission.
CO8:   Prepare drawing using AutoCAD.

DETAILED CONTENTS

1.   Detail and Assembly Drawing   (02 sheets)

Principle and utility of detail and assembly drawings, Practical exercise on drawing from detail to assembly or vice versa using different wooden joints as example (lap joint – T joint and corner joint, Mortise and tenon joint, Bridle joint, Mitre faced corner joint).

2.   Threads   (02 sheets)

Nomenclature of threads, types of threads. Single and multiple start threads, right hand and left hand thread. Forms of various external thread sections such as V thread (Metric thread, British associate, American thread, Basic whitworth thread), Square, Acme, Knuckle, and Buttress thread. Simplified conventional representation of V thread.

3.   Nuts and Bolts   (03 sheets)

Different views of hexagonal and square headed nuts and bolts. Assembled view of nuts and bolts with washers. Foundation bolt- Rag bolt, Hook bolt. Lewis bolt, Eye bolt and curved bolt (Free hand)

4.   Locking Devices   (01 sheet)

Locking nuts - Castle nut, Sawn nut, and Split pin lock nut. Locking by spring washers,Locking plates.

5.   Screws, Studs and Washers   (01 sheet)

Drawing of various types of machine and set screws. Drawing of various types' of studs, through bolt, tap bolt and stud bolt.

6.   Keys and Cotters   (03 sheets)

Various types of keys and their application. Preparation of drawings of various keys and cotters. Various types of joints (a) Gib and Cotter joint (b) Knuckle joint (c) Spigot and Socket joint

7.   Rivets and Riveted Joints   (02 sheets)

Types of general purpose rivet heads (Snap Head, Pan Head , Flat and counter sunk). Types of riveted joints – lap (single and double riveted), butt (single cover plate and double cover plate), chain and zig-zag riveting (Double riveted). Caulking and fullering operation of riveted joints.

8.   Shaft Coupling   **(02 sheets)**

Introduction to coupling, their uses and types, Muff Coupling, Protected type flange coupling. Flexible or non-rigid coupling

9.   Computer Aided Drafting (CAD)   **(04 sheets)**

Introduction, Various 2 D commands – Draw, modify and option commands, Prepare at least 4 sheets using CAD software – one drawing each from wooden joint, threads, nut and bolts, coupling.

Note : CAD drawing will be evaluated internally for sessional marks and not by final theory paper.

RECOMMENDED BOOKS

1.   Surjit Singh, "A Text Book of Engineering Drawing", Dhanpat Rai Publishing Company, New Delhi.
2.   P.S. Gill, "Engineering Drawing", SK Kataria and Sons, New Delhi.
3.   N.D. Bhatt, "Mechanical Engineering Drawing", Charotar Publishing House, Anand
4.   T Jeyapoovan, "Engineering Drawing and Graphics Using AutoCAD", Vikas Publishing House Pvt. Limited, Delhi.
5.   Sham Tickoo and D. Sarvanan, "AutoCAD : For Engineers & Designers", Wiley India Pvt. Ltd., Delhi

INSTRUCTIONAL STRATEGY

The teachers should first demonstrate then assist the students to prepare drawing sheets. The student should also be encouraged and motivated to learn CAD software at the earliest and do the given exercises.

2.6   WORKSHOP TECHNOLOGY- I

L   P
3   -

RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about hand tools, measuring instruments, welding, and various machining processes is required to be imparted.   Hence the subject of workshop technology.

COURSE OUTCOMES

After undergoing the subject, students will be able to:
CO1:   Classify various types of hand tools.
CO2:   Explain working principle of vernier caliper and micrometer for measurement.
CO3:   Explain the parts of lathe and their functions.
CO4:   Select material and tool geometry for cutting tools on lathe.
CO5:   Explain geometry of single point tool, various types of lathe tools and tool materials.
CO6:   Explain the working of drilling and boring process.
CO7:   Explain the nomenclature of a drill and boring tools.
CO8:   Select most appropriate process, electrodes, various process parameters for a job.
CO9:   Explain principle of gas welding and arc welding process.
CO10: Select a cutting fluid for an operation.

DETAILED CONTENTS

UNIT I
1.   Hand Tools
Chisels – Types and uses of chisels, wood working chisels, metal working chisels – cold chisel, hard chisel, stone chisel, masonry chisel. Hammers – Types, Basic design and variations, Physics of hammering, Hammer as force multiplier, effect of head's mass, effect of handle.
Saw – Saw terminology, types of saws, types of saw blades, material used for saw, Hacksaw frame and its types. Pliers – Function and types. Wrenches/ Spanners – Common General wrenches/spanners, Specialized wrenches/spanners, Surface plate, V block, files, Surface Gauge.

2.   Measuring Instruments

Calipers – Types – Inside, outside, divider, Odd leg caliper. Vernier Caliper- Parts, uses, checking error, least count, working principle. Outside micrometer - Introduction, parts, Principle, Least count, Checking zero error.

UNIT II
3.   Cutting Tools and Cutting Materials

Cutting Tools - Various types of single point cutting tools and their uses, Single point cutting tool geometry, tool signature and its effect, Heat produced during cutting and its effect, Cutting speed, feed and depth of cut and their effect.

Cutting Tool Materials - Properties of cutting tool material, Study of various cutting tool materials viz. High-speed steel, tungsten carbide, cobalt steel cemented carbides, stellite, ceramics and diamond.

UNIT III
4.   Welding

Welding Process - Principle of welding, Classification of welding processes, Advantages and limitations of welding, Industrial applications of welding, Welding positions and techniques, symbols. Safety precautions in welding.

Gas Welding - Principle of operation, Types of gas welding flames and their applications, Gas welding equipment - Gas welding torch, Oxygen cylinder, acetylene cylinder, cutting torch, Blow pipe, Pressure regulators, Filler rods and fluxes and personal safety equipment for welding.

Arc Welding - Principle of operation, Arc welding machines and equipment. A.C. and D.C. arc welding, Effect of polarity, current regulation and voltage regulation, Electrodes: Classification,

B.I.S. specification and selection, Flux for arc welding. Requirements of pre heating, post heating of electrodes and work piece. Welding defects and their testing methods.

UNIT IV
5.   Lathe

Principle of turning, Description and function of various parts of a lathe. Classification and specification of various types of lathe, Drives and transmission, Work holding devices. Lathe tools: Parameters/Nomenclature and applications. Lathe operations - Plain and step turning, facing, parting off, taper turning, eccentric turning, drilling, reaming, boring, threading and knurling, form turning, spinning. Cutting parameters – Speed, feed and depth of cut for various materials and for various operations, machining time. Speed ratio, preferred numbers of speed selection. Lathe accessories:- Centers, dogs, different types of chucks, collets, face plate, angle plate, mandrel, steady rest, follower

rest, taper turning attachment, tool post grinder, milling attachment, Quick change device for tools. Brief description of capstan and turret lathe, comparison of capstan/turret lathe, work holding and tool guiding devices in capstan and turret lathe.

UNIT V

6.   Drilling

Principle of drilling. Classification of drilling machines and their description. Various operation performed on drilling machine – drilling, spot facing, reaming, boring, counter boring, counter sinking, hole milling, tapping. Speeds and feeds during drilling, impact of these parameters on drilling, machining time. Types of drills and their features, nomenclature of a drill. Drill holding devices. Types of reamers.

7.   Boring

Principle of boring, Classification of boring machines and their brief description. Specification of boring machines. Boring tools, boring bars and boring heads. Description ofjig boring machine.

8.   Cutting Fluids and Lubricants

Function of cutting fluid, Types of cutting fluids, Difference between cutting fluid and lubricant, Selection of cutting fluids for different materials and operations, Common methods of lubrication of machine tools, Certifying Organizations (such as SAE, ASTM) forrating standards of lubricants.

RECOMMENDED BOOKS

1.   B.S. Raghuwanshi, "A Course in Workshop Technology (Vol. I, Manufacturing Processes)'', Dhanpat Rai and Sons, New Delhi, 2015.
2.   B.S. Raghuwanshi, "A Course in Workshop Technology (Vol. II Machine Tools)", Dhanpat Rai and Sons, New Delhi, 2017.
3.   R. K. Jain, "Workshop Technology Vol I & II'', Khanna Publishers, New Delhi, First Edition, 2021.
4.   T. L. Choudhary, "Workshop Technology Part - 1 & 2", Khanna Publishers, New Delhi, Sixth Edition, 2019.
5.   S. K. Choudhry and Hajra, "Elements of Workshop Technology (Vol. I Manufacturing Processes)", Media Promoters and Publishers Pvt. Ltd., 2008.
6.   S. K. Choudhry, Hajra and Nirja Roy, "Elements of Workshop Technology (Vol. II Machine Tools)'', Media Promoters and Publishers Pvt. Ltd., Fifteenth Edition, 2016.

7. P. C. Sharma, "A Text Book of Production Engineering'', S Chand and Company Ltd., Delhi, Eleventh Edition, 2013.

8. R. K. Jain, "Production Technology", New Delhi, Nineteenth Edition, 2019.

9. P. N. Rao, "Manufacturing Technology Volume –I '', Tata McGraw Hill, Delhi, FifthEdition, 2019.

10. P. N. Rao, "Manufacturing Technology Volume –II'', Tata McGraw Hill, Delhi, Fourth Edition, 2019.

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis in making students conversant with concepts and principles of manufacturing processes. This is theoretical subject and contains five units of equal weight age.

2.7 WORKSHOP PRACTICE - I

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RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. This course is included in the curriculum in order to provide hands-on experience about basic manufacturing practices. This subject aims at developing general manual 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.

COURSE OUTCOMES

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

CO1: Identify tools, equipment and materials used in preparing jobs.

CO2: Take measurements with the help of basic measuring tools/equipment.

CO3: Select materials, tools, and sequence of operations to make a job as per given specifications/drawing.

CO4: Prepare simple jobs independently and inspect the same.

CO5: Use safety equipment and Personal Protection Equipment (PPE).

CO6: Maintain good housekeeping practices.

DETAILED CONTENTS CUM PRACTICAL EXERCISES

The following shops are included in the syllabus.

1   Welding Shop – II

2   Fitting and Plumbing Shop – II

3   Carpentry Shop II

4   Smithy Shop

5   Electric and Electronics Shop II

6   Turning Shop

1.   WELDING SHOP – II

1.1   Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

1.2 Introduction to gas welding, gas welding equipment, introduction to soldering and brazing, introduction to resistance welding, safety precautions.

1.3 Identification and adjustment of various types of gas flames

1.4 Demonstration of brazing and gas cutting

1.5 Demonstration of Welding defects

1.6 Jobs to be prepared

Job I   Beading Practice by gas welding.

Job II   Preparation of lap joint on M.S. flat using gas welding.

Job III   Preparation of double V butt joint/corner joint on M.S. flat using gaswelding / arc welding process

Job IV   Preparation of pipe joint using gas/arc welding

Job V   Preparation of a small cot frame/stool/table frame/drawing tableframe) using gas or arc welding.

2.   FITTING AND PLUMBING SHOP – II

2.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

2.2 Handling of measuring instruments, Use of dial gauges and feeler gauges.

2.3 Demonstration of various types of drills, taps and dies.

2.4 Introduction to tapping and dieing

Job I   To perform drilling and reaming operation on mild steel flat.

2.5 file and make angle, surfaces (Bevel gauge accuracy 1 degree) make simple open and sliding fits Inside square fit, make combined open and sliding fit, straight sides

Job II   To make assembly for V shape or square shape fit.

Job III   Radius form filing on the corners

2.6 Sliding fitting, Diamond fitting, Lapping flat surfaces using lapping plate. Application of lapping, material for lapping tools, lapping abrasives, charging of lapping tool. Surface finish importance, equipment for testing-terms relation to surface finish

Job IV   To make step assembly.

2.7 Introduction to various types of threads (internal and external)-single start, multi-start,left hand and right hand threads.

2.8 Description and demonstration of various types of drills, taps and dies. Selection ofdies for threading, selection of drills, taps and reamers for tapping operations.

2.9 Introduction to use of plumbing tools like pipe wrench , plumber vice and materials likePutty, thread, duct(Teflon) tape, epoxy resin, araldite, m-seal.

2.10 Precautions while drilling soft metals, e.g. copper, brass, aluminium etc.

Job V   To make overhead tank assembly with GI/C-PVC pipes and joints.

3.   CARPENTRY SHOP – II

3.1   Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

3.2   Introduction to joints, their relative advantages and uses.

Job I   To make a dovetail joint.

Job II   To make a mitred joint.

Job III   To make a lengthening joint by using different joints.

3.3   Demonstration of machines like Band Saw and Circular Saw, Chain and Chisel, Universal wood working machine, Saw re-sharpening machine, Saw Brazing unit.

3.4   Introduction and function of various parts of Wood Working Lathe

a)   Study of wood working lathe tool.

b)   Sharpening of lathe tools.

c)   Setting of jobs and tools.

Job IV   To make a job using different type of wood turning operations including form turning and grooving.

OR   Repair of any utility item.

Job V   To make a medium size wooden dust bin/ wooden tray.

4.   SMITHY SHOP

4.1   Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

4.2   Introduction and industrial applications of smithy jobs.

4.2.1 Purpose of Smithy shop.

4.2.2 Different types of Hearths used in Smithy shop, Types of fuel used and maximum temperature obtained.

4.2.3 Purpose, specifications, uses, care and maintenance of various tools and equipment used in hand forging by segregating as cutting tools, supporting tools, holding tools, measuring tools, punches etc.

4.2.4 Types of raw materials used in Smithy shop.

4.2.5 Uses of Fire Bricks and Clays in Forging workshop.

4.3   Practice

4.3.1 Practice of firing of hearth/Furnace, Cleaning of Clinkers and Temperature Control of Fire.

4.3.2 Practice on different basic Smithy/Forging operations such as Cutting, Upsetting, Drawing down, Setting down, Necking, Bending, Fullering, Swaging, Punching and Drifting.

Demonstration of making cube, hexagonal cube, hexagonal bar from round bar

4.3.3 Practice of Simple Heat treatment processes like Tempering, Normalizing, and Hardening.

4.4 Introduction to various heat treatment processes e.g annealing, hardening, tempering, normalizing.

4.5 Description of various types of power hammers and their usage (Demonstrationonly).

4.6 Jobs to be prepared

Job I   To forge a square/hexagonal shape on both endsfrom a MS round by cold forging

Job II   To make a utility item like fan hook, ring, U type door handle

Job III To make a ring of MS round by forge welding

Job IV   To make a hexagonal chisel by hot forging process withhardening and tempering

Job V   To perform bending process by hot forging.

5. ELECTRICAL AND ELECTRONICS SHOP - II

5.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, Best practices in the concerned shop.

5.2 Introduction to single phase and three phase supply and wiring system. Importance of three phase supply (RYB) and its sequence and wiring system. Estimating and costing of power consumption.

Job I   Connecting single phase energy meter with supply and load. Reading and working out power consumption and cost of energy.

5.3 Study of internal wiring diagram of common electrical appliances such as auto electric iron, electric kettle, ceiling/table fan, desert cooler etc. Demonstration of dismantling, servicing and reassembling of table/ceiling fan, air-cooler, auto electric iron, heater etc.

Job II   Connection of single phase/three phase motor by using starter. Reversing direction of rotation of single phase and three phase motors.

Job III Cut, bend, tin components, leads, inserts. Solder components for example resistor, capacitor, diode, transistor and other components ona PCB.

5.4 Demonstrate the joining for connecting methods mounting and dismounting method as well as using of the various plugs, sockets, conductors, suitable for general purpose, audio video used conductors, banana plugs, socket and similar male and female conductor and terminal strips

5.5 Various types of switches such as normal, miniature toggle, slide, push button.

Job IV   Wiring of a small circuit on a PCB/ TAG strip involving laying, sleeving and use of identifier tags.

Job V   Cut, strip, join and insulate two lengths of wires/cables.

Desoldering practice with desoldering pump and desoldering wick.

6. TURNING SHOP

6.1 Safety Precautions of concerned shop and use of personal protective equipment (PPE), demonstration of tools, equipment, sample jobs, best practices in the concerned shop.

6.2 Jobs to be Prepared

Job 1   Centering practice in 4 jaw chuck, setting of cutting tool point at appropriate height and perform facing and plain turning operationson MS rod.

Job II   To sharpen various angles of turning tool.

Job III   To perform step turning on MS rod.

Job IV   To perform taper turning and under cutting operation.

Job V   To perform step turning and knurling operation on MS rod.

RECOMMENDED BOOKS

1. SK Hajra Choudhary and AK Choudhary, "Workshop Technology I,II,III", Media Promotersand Publishers Pvt. Ltd., Mumbai, Fifteenth Edition, 2016.

2. RK Jain, "Workshop Technology Vol I& II'', Khanna Publishers, New Delhi , First Edition, 2021.

3. Manchanda, "Workshop Technology Vol. I, II, III", India Publishing House, Jalandhar.

4. S.S. Ubhi, "Workshop Training Manual Vol. I, II'', Katson Publishers, Ludhiana.

5. K Venkata Reddy, "Manual on Workshop Practice", MacMillan India Ltd., New Delhi,Sixth Edition, 2020.

6. "General Workshop Manual (Diploma Jobs)", Khanna Publishers, First Edition, 2021.

7. T Jeyapoovan, "Basic Workshop Practice Manual", Vikas Publishing House (P) Ltd., New Delhi.

8. B. S. Raghuvanshi, "Workshop Technology, Vol. I", Dhanpat Rai and Sons, Delhi, Eleventh Edition, 2017.

9. Kannaiah K L, Narayana , "Workshop Manual", Scitech Publications, Chennai, Second Edition 1998.

10. H S Bawa, "Workshop Practice", Tata McGraw Hill Publication, First Edition, 2004

INSTRUCTIONAL STRATEGY

This is hands-on practice based workshop for development of required skills in the students.