

**Curriculum for  
Diploma Programme in  
PAINT TECHNOLOGY**

**For the State of Uttar Pradesh**



Prepared by:

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## STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN PAINT TECHNOLOGY

### FIRST SEMESTER:

| Sr. No.                     | SUBJECTS                             | STUDY SCHEME |          |           | Credits   | MARKS IN EVALUATION SCHEME |            |            |                     |          |            |          |            | Total Marks of Internal & External |
|-----------------------------|--------------------------------------|--------------|----------|-----------|-----------|----------------------------|------------|------------|---------------------|----------|------------|----------|------------|------------------------------------|
|                             |                                      | Periods/Week |          |           |           | INTERNAL ASSESSMENT        |            |            | EXTERNAL ASSESSMENT |          |            |          |            |                                    |
|                             |                                      | L            | T        | P         |           | Th                         | Pr         | Tot        | Th                  | Hrs      | Pr         | Hrs      | Tot        |                                    |
| 1.1                         | *Communication Skills-I              | 4            | -        | 2         | 4         | 20                         | 10         | 30         | 50                  | 2 ½      | 20         | 3        | 70         | 100                                |
| 1.2                         | *Applied Mathematics-1               | 5            | -        | -         | 4         | 20                         | -          | 20         | 50                  | 2 ½      | -          | -        | 50         | 70                                 |
| 1.3                         | *Applied Physics-1                   | 5            | -        | 2         | 5         | 20                         | 10         | 30         | 50                  | 2 ½      | 20         | 3        | 70         | 100                                |
| 1.4                         | *Applied Chemistry                   | 5            | -        | 2         | 5         | 20                         | 10         | 30         | 50                  | 2 ½      | 20         | 3        | 70         | 100                                |
| 1.5                         | *Engineering Drawing-I               | -            | -        | 8         | 3         | -                          | 40         | 40         | 60                  | 3        | -          | -        | 60         | 100                                |
| 1.6                         | Measuring Instruments & Measurements | 4            | -        | 2         | 4         | 20                         | 10         | 30         | 50                  | 2 ½      | 20         | 3        | 70         | 100                                |
| 1.7                         | General Workshop Practice 1          | -            | -        | 8         | 3         | -                          | 40         | 40         | -                   | -        | 60         | 4        | 60         | 100                                |
| #Student Centred Activities |                                      | -            | -        | 1         | 1         | -                          | 30         | 30         | -                   | -        | -          | -        | -          | 30                                 |
| <b>Total</b>                |                                      | <b>23</b>    | <b>-</b> | <b>25</b> | <b>29</b> | <b>100</b>                 | <b>150</b> | <b>250</b> | <b>310</b>          | <b>-</b> | <b>140</b> | <b>-</b> | <b>450</b> | <b>700</b>                         |

\* Common with other diploma programmes

# 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.

**SECOND SEMESTER:**

| Sr. No.                     | SUBJECTS                                   | STUDY SCHEME |   |           | Credits   | MARKS IN EVALUATION SCHEME |            |            |                     |          |            |          |            |            | Total Marks of Internal & External |
|-----------------------------|--|--------------|---|-----------|-----------|----------------------------|------------|------------|---------------------|----------|------------|----------|------------|------------|------------------------------------|
|                             |  | Periods/Week |   |           |           | INTERNAL ASSESSMENT        |            |            | EXTERNAL ASSESSMENT |          |            |          |            |            |                                    |
|                             |  | L            | T | P         |           | 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                         | Introduction to Paint & Polymer Technology | 4            |   | 4         | 5         | 20                         | 10         | 30         | 50                  | 2 ½      | 20         | 3        | 70         | 100        |                                    |
| 2.5                         | Drying Oil, Driers, Solvent & Additives    | 5            |   | 6         | 6         | 20                         | 10         | 30         | 50                  | 2 ½      | 20         | 3        | 70         | 100        |                                    |
| 2.6                         | General Workshop Practice II               | -            | - | 8         | 3         | -                          | 40         | 40         | -                   | -        | 60         | 4        | 60         | 100        |                                    |
| #Student Centred Activities |  | -            |   | 2         | 1         | -                          | 30         | 30         | -                   | -        | -          | -        | -          | 30         |                                    |
| <b>Total</b>                |  | <b>24</b>    |   | <b>24</b> | <b>29</b> | <b>100</b>                 | <b>110</b> | <b>210</b> | <b>250</b>          | <b>-</b> | <b>140</b> | <b>-</b> | <b>390</b> | <b>600</b> |                                    |

\* Common with other diploma programmes

+ Common with diploma in Mechanical Engineering and Civil 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.

## 1.1 COMMUNICATION SKILLS – I

L T P  
4 - 2

### RATIONALE

Knowledge of English Language plays an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills as parts of Communication Skill.

### LEARNING OUTCOMES

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

- Understand the importance of effective communication
- Describe the process of communication
- Communicate effectively in different contexts
- Identify parts of speech
- Write correct sentences using appropriate vocabulary
- Reproduce and match words and sentences in a paragraph
- Write various types of paragraphs, notices for different purposes and composition on picture with appropriate format
- Read unseen texts with comprehension

### DETAILED CONTENTS

- |     |   |              |
|-----|---|--------------|
| 1   | Basics of Communication   | (13 periods) |
| 1.1 | Definition and process of communication   |              |
| 1.2 | Types of communication - formal and informal, oral and written, verbal and non-verbal |              |
| 1.3 | Communications barriers and how to overcome them                                      |              |
| 1.4 | Barriers to Communication, Tools of Communication                                     |              |
| 2   | Application of Grammar  | (18 periods) |
| 2.1 | Parts of Speech (Noun, verb, adjective, adverb) and modals                            |              |
| 2.2 | Sentences and its types   |              |
| 2.3 | Tenses  |              |
| 2.4 | Active and Passive Voice  |              |
| 2.5 | Punctuation   |              |
| 2.6 | Direct and Indirect Speech  |              |

- 3 Reading Skill (10 periods)  
Unseen passage for comprehension (one word substitution, prefixes, suffixes, antonyms, synonyms etc. based upon the passage to be covered under this topic)
- 4 Writing Skill (15 periods)
- 4.1 Picture composition  
4.2 Writing paragraph  
4.3 Notice writing

## LIST OF PRACTICALS

**Note:** Teaching Learning Process should be focused on the use of the language in writing reports and making presentations.

Topics such as Effective listening, effective note taking, group discussions and regular presentations by the students need to be taught in a project oriented manner where the learning happens as a byproduct.

## Listening and Speaking Exercises

1. Self and peer introduction
2. Newspaper reading
3. Just a minute session-Extempore
4. Greeting and starting a conversation
5. Leave taking
6. Thanking
7. Wishing well
8. Talking about likes and dislikes
9. Group Discussion
10. Listening Exercises.

## INSTRUCTIONAL STRATEGY

Student should be encouraged to participate in role play and other student centred activities in class room and actively participate in listening exercises

## MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

## RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by RevathiSrinivas; Abhishek Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; DhanpatRai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. Excellent General English-R.B.Varshnay, R.K. Bansal, Mittal Book Depot, Malhotra
5. The Functional aspects of Communication Skills – Dr. P. Prasad, S.K. Katria & Sons, New Delhi
6. Q. Skills for success – Level & Margaret Books, Oxford University Press.
7. E-books/e-tools/relevant software to be used as recommended by AICTE/UPBTE/NITTTR.

**Websites for Reference:**

1. [http://www.mindtools.com/ page 8.html](http://www.mindtools.com/page 8.html) – 99k
2. <http://www.letstalk.com.in>
3. <http://www.englishlearning.com>
4. <http://learnenglish.britishcouncil.org/en/>
5. <http://swayam.gov.in>

**SUGGESTED DISTRIBUTION OF MARKS**

| <b>Topic No.</b> | <b>Time Allotted<br/>(Periods)</b> | <b>Marks Allotted<br/>(%)</b> |
|------------------|------------------------------------|-------------------------------|
| 1                | 13                                 | 24                            |
| 2                | 18                                 | 32                            |
| 3                | 10                                 | 16                            |
| 4                | 15                                 | 28                            |
| <b>Total</b>     | <b>56</b>                          | <b>100</b>                    |

## 1.2 APPLIED MATHEMATICS - I

L T P  
5 - -

### RATIONALE

Contents of this course provide fundamental base for understanding elementary mathematics and their uses in solving engineering problems. Contents of this course will enable students to use basic mathematical function like logarithms, partial fractions, matrices and basic 2D, curves in solving various engineering problems of all fields.

### LEARNING OUTCOMES

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

- Apply Binomial theorem to solve engineering problems
- Apply determinants properties and Cramer's rule to solve engineering problems
- Apply dot & cross product of vectors to find the solution of engineering problems
- Use complex numbers in various engineering problems
- Apply differential calculus and higher order to solve engineering problems
- Find velocity, acceleration, errors and approximation in engineering problems with application of derivatives.

### DETAILED CONTENTS

1. Algebra -I (12 Periods)
  - 1.1 Series : AP and GP; Sum, nth term, Mean
  - 1.2 Binomial theorem for positive, negative and fractional index (without proof).  
Application of Binomial theorem.
  - 1.3 Determinants : Elementary properties of determinant of order 2 and 3,  
Multiplication system of algebraic equation, Consistency of equation,  
Cramer's rule
2. Algebra- II (12 Periods )
  - 2.1 Vector algebra : Dot and Cross product, Scaler and vector triple product.
  - 2.2 Complex number.  
Complex numbers, Representation, Modulus and amplitude Demoivre theorem, its application in solving algebraic equations, Mod. function and its properties..

3. Trigonometry (10 Periods )
- 3.1 Relation between sides and angles of a triangle : Statement of various formulae showing relationship between sides and angle of a triangle.
- 3.2 Inverse circular functions: Simple case only
4. Differential Calculus - I (18 Periods)
- 4.1 Functions, limits, continuity, - functions and their graphs, range and domain, elementary methods of finding limits (right and left), elementary test for continuity and differentiability.
- 4.2 Methods of finding derivative, Trigonometric functions, exponential function, Function of a function, Logarithmic differentiation, Differentiation of Inverse trigonometric function, Differentiation of implicit functions.
5. Differential Calculus - II (18 Periods)
- 5.1 Higher order derivatives, Leibnitz theorem (without proof). Simple applications.
- 5.2 Application - Finding Tangents, Normal, Points of Maxima/Minima, Increasing/Decreasing functions, Rate, Measure, velocity, Acceleration, Errors and approximation.

### **INSTRUCTIONAL STRATEGY**

The basic instructional strategy to teach basic mathematics, Binomial theorem, trigonometry, differential equations etc. should be conceptual with real world applications of relevant branch. More numerical and theory examples can be used for clear understanding of the content.

### **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-I by Chauhan and Chauhan, Krishna Publications, Meerut.
4. Applied Mathematics-I (A) by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut



### SUGGESTED DISTRIBUTION OF MARKS

| <b>Topic</b> | <b>Time Allotted<br/>(Periods)</b> | <b>Marks Allotted<br/>(%)</b> |
|--------------|------------------------------------|-------------------------------|
| 1.           | 12                                 | 20                            |
| 2.           | 12                                 | 20                            |
| 3.           | 10                                 | 12                            |
| 4            | 18                                 | 24                            |
| 5            | 18                                 | 24                            |
| <b>Total</b> | <b>70</b>                          | <b>100</b>                    |

### 1.3 APPLIED PHYSICS – I

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 course, the students must be able to:

- Identify the use of S.I. system of measurement with accuracy and how it is used in engineering
- Represent physical quantities as scalars and vectors, applying the physical laws and concepts of linear and circular motion in everyday life.
- Solve difficult problems (walking of man, horse and cart problem, flying of bird/ aircraft, etc.)
- Analyse and design banking of roads/railway tracks and apply conservation of momentum principle to Explain rocket propulsion, recoil of gun etc.
- Derive work, power and energy relationship and solve problems about work and power.
- Define work, energy and power and their units.
- Describe conservation of energy and its applications
- Understand the concept of rotational motion of a rigid body and its applications
- Apply the physical laws and concepts of gravity, its variation with longitude and latitude and its uses in space satellite etc.
- Understand the concept of elasticity, surface tension, pressure and the laws governing movement of fluids.
- Express physical work in term of heat and temperature; Measure temperature in various processes on different scales (Celsius, Kelvin, Fahrenheit etc.)
- Distinguish between conduction, convection and radiation, identify the different methods for reducing heat losses
- Understand the laws of thermodynamics, Carnot cycle and their applications.

## DETAILED CONTENTS

1. Units and Dimensions (10 Periods)
  - 1.1 Need of Measurement in engineering and science, unit of a physical quantities - fundamental and derived units, systems of units (FPS, CGS and SI units)
  - 1.2 Dimensions and dimensional formulae of physical quantities.
  - 1.3 Principle of homogeneity of dimensions
  - 1.4 Dimensional equations and their applications, conversion of numerical values of physical quantities from one system of units into another, checking the correctness of physical equations and deriving relations among various physical quantities
  - 1.5 Limitations of dimensional analysis
  - 1.6 Error in measurement, accuracy and precision of instruments, random and systematic errors, absolute error, relative error, and percentage error, Estimation of probable errors in the results of measurement (combination of errors in addition, subtraction, multiplication, division and powers), rules for representing significant figures in calculation.
  - 1.7 Application of units and dimensions in measuring length, diameter, circumference, volume, surface area etc. of metallic and non metallic blocks, wires, pipes etc (at least two each).
  
2. Force and Motion (10 periods)
  - 2.1 Scalar and vector quantities – examples, representation of vector, types of vectors
  - 2.2 Addition and Subtraction of Vectors, Triangle and Parallelogram law (Statement only), Scalar and Vector Product.
  - 2.3 Resolution of Vectors and its application to lawn roller.
  - 2.4 Force, Momentum, Statement and Derivation of Conservation of linear momentum, its applications such as recoil of gun.
  - 2.5 Impulse and its Applications
  - 2.6 Circular motion (Uniform and Non-uniform), definition of angular displacement, angular velocity, angular acceleration, frequency, time period.
  - 2.7 Relation between linear and angular velocity, linear acceleration and angular acceleration (related numerical)
  - 2.8 Central force, Expression and Applications of Centripetal and centrifugal forces with examples such as banking of roads and bending of cyclist, Principle of centrifuge.
  - 2.9 Application of various forces in lifts, cranes, large steam engines and turbines

3. Work, Power and Energy (10 periods)
- 3.1 Work: and its units, examples of zero work, positive work and negative work, conservative and non-conservative force,
  - 3.2 Friction: modern concept, types, laws of limiting friction, Coefficient of friction and its Engineering Applications.
  - 3.3 Work done in moving an object on horizontal and inclined plane for rough and plane surfaces with its applications
  - 3.4 Energy and its units: Kinetic energy and potential energy with examples and their derivation, work energy theorem.
  - 3.5 Principle of conservation of mechanical energy for freely falling bodies, examples of transformation of energy.
  - 3.6 Power and its units, calculation of power in numerical problems
  - 3.7 Application of Friction in brake system of moving vehicles, bicycle, scooter, car trains etc.
- 4 Rotational Motion (10 periods)
- 4.1 Concept of translatory and rotatory motions with examples
  - 4.2 Definition of torque with examples
  - 4.3 Angular momentum, Conservation of angular momentum (quantitative) and its examples
  - 4.4 Moment of inertia and its physical significance, radius of gyration for rigid body, Theorems of parallel and perpendicular axes (statements only), Moment of inertia of rod, disc, ring and sphere (hollow and solid) (Formulae only). Concept of Fly wheel.
  - 4.5 Rotational kinetic energy, Rolling of sphere on the slant plane
  - 4.6 Comparison of linear motion and rotational motion.
  - 4.7 Application of rotational motions in transport vehicles, and machines.
- 5 Motion of planets and satellites (08 periods)
- 5.1 Gravitational force, Kepler's law of planetary motion
  - 5.2 Acceleration due gravity and its variation
  - 5.3 Gravitational Potential and Gravitational potential energy
  - 5.4 Motion of satellite, orbital velocity and time period of satellite, Total energy and Binding energy of a satellite, Escape energy and escape velocity
  - 5.5 Types of satellites, Geo-stationary satellite, semi-synchronous, polar satellite (concept only) and their uses in science and technology
  - 5.6 Concept of Black Holes

6. Properties of Matter (12 periods)
- 6.1 Elasticity: definition of stress and strain, different types of moduli of elasticity, Hooke's law, significance of stress strain curve
  - 6.2 Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and its applications
  - 6.3 Surface tension: concept, its units, angle of contact, Capillary action and determination of surface tension from capillary rise method, applications of surface tension, effect of temperature and impurity on surface tension
  - 6.4 Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law and effect of temperature on viscosity, application in hydraulic systems.
  - 6.5 Concept of fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem and their applications.
7. Heat and Thermodynamics (10 periods)
- 7.1 Difference between heat and temperature
  - 7.2 Modes of transfer of heat (Conduction, convection and radiation with examples)
  - 7.3 Different scales of temperature and their relationship
  - 7.4 Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them
  - 7.5 Heat conduction in a metal rod, Temperature gradient, Concept of Co-efficient of thermal conductivity, Uses and effects of Heat conduction in Daily life.
  - 7.6 Isothermal and Adibatic process
  - 7.7 Zeroth, First and second law of thermodynamics, Heat engine (concept Only), Carnot cycle.
  - 7.8 Application of various systems of thermometry in refrigeration and air-conditioning etc.

### LIST OF PRACTICALS

- 1 To find radius of wire and its volume and the maximum permissible error in these quantities by using both vernier calipers and screw gauge.
- 2 To find the value of acceleration due to gravity on the surface of earth by using a simple pendulum.
- 3 To determine the Radius of curvature of (i) convex mirror, (ii) concave mirror by spherometer
- 4 To verify parallelogram law of forces
- 5 To study conservation of energy of a ball or cylinder rolling down an inclined plane.
- 6 To find the Moment of Inertia of a flywheel about its axis of rotation
- 7 To determine the atmospheric pressure at a place using Fortin's Barometer
- 8 To determine the viscosity of glycerin by Stoke's method

- 9 To determine the coefficient of linear expansion of a metal rod
- 10 To determine force constant of spring using Hooks law

## 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 ASSEMENTS

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

## RECOMMENDED BOOKS

- 1 Text Book of Physics for Class XI (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 Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
- 4 B.Sc.Practical Physics by C L Arora, S. Chand Publication..
- 5 Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
- 6 Engineering Physics by DK Bhattacharya & Poonam Tandan; Oxford University Press, New Delhi
- 7 Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications
- 8 V. Rajendran,physics-I, Tata McGraw-Hill raw Hill publication, New Delhi
- 9 Arthur Beiser, Applied Physics, Tata McGraw-Hill raw Hill publication, New Delhi
- 10 Physics Volume 1, 5<sup>th</sup> edition, Haliday Resnick and Krane, Wiley publication

## SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted<br>(Periods) | Marks Allotted<br>(%) |
|-----------|----------------------------|-----------------------|
| 1         | 10                         | 15                    |
| 2         | 10                         | 15                    |
| 3         | 10                         | 15                    |
| 4         | 10                         | 15                    |

|              |           |            |
|--------------|-----------|------------|
| 5            | 08        | 10         |
| 6            | 12        | 16         |
| 7            | 10        | 14         |
| <b>Total</b> | <b>70</b> | <b>100</b> |

## 1.4 APPLIED CHEMISTRY

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

### RATIONALE

The use of various chemicals and chemical products in diverse technical and engineering fields have repeatedly proved the importance of Applied Chemistry, which enhances its role to a new peak. On the other hand, ever increasing use of such materials will compel engineers, technocrats to acquire essential applied chemistry knowledge in order to select engineering materials, which not only suit them but also provide more environmental compatibility. This situation demands principles of Applied Chemistry in diploma-engineering courses. Principles of Applied Chemistry will enable budding engineers and technocrats to develop scientific temper and appreciate physical, chemical and engineering properties of materials. Hence the subject of Applied Chemistry.

### LEARNING OUTCOMES

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

- Classify various substances based on state of aggregation
- Substantiate the laws and principles on which structure of atom is established.
- Explain and predict properties of substances.
- Explain sources of water and various characteristics of water (quantitatively).
- Explain cause and factors which can adversely affecting natural water quality and remedial measures available for water purification
- Think critically, develop and adapt water conservation techniques.
- Explain corrosion of metal and their preventive measures.
- explain chemical nature and causes of corrosion
- apply correct and efficient methods of corrosion prevention.
- explain chemistry of fuels and their relative advantages.
- select most efficient fuel for the engine and engineering applications.
- suggest how to subside air pollution caused by the use of fossil fuels
- explain the chemistry of various polymers and plastics
- verify suitability and select polymer/rubber/plastic materials for engineering applications.

## DETAILED CONTENTS

1. Atomic Structure, Periodic Table and Chemical Bonding (14 periods)
  - 1.1 Fundamental particles- mass and charges of electrons, protons and neutrons with names of the scientists who discovered these fundamental particles.
  - 1.2 Bohr's model of atom and successes and limitations of atomic theory (qualitative treatment only).
  - 1.3 Atomic number, atomic mass number isotopes and isobars.
  - 1.4 Definition of orbit and orbitals, shapes of s and p orbitals only, quantum numbers and their significance,
  - 1.5 Aufbau's principle, Pauli's exclusion principle and Hund's rule electronic configuration of elements with atomic number ( $Z$ ) = 30 only. (Electronic configurations of elements with atomic number greater than 30 are excluded).
  - 1.6 Modern periodic law and periodic table, groups and periods, classification of elements into s, p, d and f blocks (periodicity in properties - excluded)
  - 1.7 Chemical bonding and cause of bonding and types such as ionic bond in NaCl sigma ( $\sigma$ ) and pi ( $\pi$ ) covalent bonds in  $H_2$ , HCl,  $Cl_2$ , elementary idea of hybridization in  $BeCl_2$ ,  $BF_3$ ,  $CH_4$ ,  $NH_3$  and  $H_2O$ , VSEPR, Molecular orbital Theory
  - 1.8 States of Matter: Solid, Liquid & Gas, Metallic bonding- explanation with the help of electron gas (sea) model.
  
2. Fuels and Lubricants (18 periods)
  - 2.1 Definition of fuel, classification of fuels, characteristics of good fuel, relative merits of gaseous, liquid and solid fuels
  - 2.2 Calorific value-higher calorific value, lower calorific value, determination of calorific value of solid or liquid fuel using Bomb calorimeter and numerical examples.
  - 2.3 Coal - types of coal and proximate analysis of coal
  - 2.4 Fuel rating – Octane number and Cetane number, fuel-structural influence on Octane and Cetane numbers
  - 2.5 Gaseous fuels – chemical composition, calorific value and applications of natural gas (CNG), LPG, producer gas, water gas and biogas.
  - 2.6 Elementary ideal on – hydrogen as future fuels, nuclear fuels.
  - 2.7 Lubricants: Definition and properties, mechanism, industrial application and its function in bearings.
  - 2.8 Synthetic lubricants and cutting fluids.



3. Water (14 periods)
- 3.1 Demonstration of water resources on Earth using pie chart.
  - 3.2 Classification of water – soft water and hard water, action of soap on hard water, types of hardness, causes of hardness, units of hardness – mg per liter ( $\text{mgL}^{-1}$ ) and part per million (ppm) and simple numerical, pH and buffer solutions and their applications.
  - 3.3 Disadvantages caused by the use of hard water in domestic and boiler feed water. Priming and foaming and caustic embrittlement in boilers.
  - 3.4 Removal of hardness -Permutit process and Ion-exchange process.
  - 3.5 Physico-Chemical methods for Water Quality Testing
    - a) Determination of pH using pH meter, total dissolved solids (TDS)
    - b) Testing and Estimation of- alkalinity, indicator their types and application total hardness by EDTA method and O’Hener’s Method. (chemical reaction of EDTA method are excluded).
    - c) Understanding of Indian Water Quality standards as per WHO
  - 3.6 Natural water sterilization by chlorine and UV radiation and reverse osmosis.
  - 3.7 Municipality waste water treatment. Definition of B.O.D and C.O.D.
4. Electrochemistry (4 periods)
- Redox Reaction, Electrode Potential, Nernst equation, Electrochemical cell (Galvanic and Electrobytes); Nernst equation.
5. Corrosion and its Control (10 periods)
- 5.1 Definition of corrosion and factors affecting corrosion rate.
  - 5.2 Theories of
    - a) Dry (chemical) corrosion- Pilling Bedworth rule
    - b) Wet corrosion in acidic atmosphere by hydrogen evolution mechanism
  - 5.3 Definition of passivity and galvanic series
  - 5.4 Corrosion control:
    - a) Metal coatings – Cathodic protection, Cementation on Base Metal Steel – Application of Metal Zn (Sheradizing),Cr (Chromozing) and Al (Calorizing), Sacrificial protection and impressed current voltage
    - b) Inorganic coatings – Anodizing and phosphating,
    - c) Organic coatings - use of paints varnishes and enamels
    - d) Internal corrosion preventive measures- alloying (with reference to passivating, neutralizing and inhibition) and heat treatment (quenching, annealing)

6. Organic compounds, Polymers and Plastics (10 periods)
- 6.1 Classification of organic compounds and IUPAC Nomenclature
  - 6.2 Definition of polymer, monomer and degree of polymerization
  - 6.3 Brief introduction to addition and condensation polymers with suitable examples (PE, PS, PVC, Teflon, Nylon -66 and Bakelite)
  - 6.4 Definition of plastics, thermo plastics and thermo setting plastics with suitable examples, distinctions between thermo and thermo setting plastics
  - 6.5 Applications of polymers in industry and daily life

### **LIST OF PRACTICALS**

1. Estimation of total hardness of water using standard EDTA solution  
Estimation of total alkalinity of given water sample by titrating it against standard sulphuric acid solution
3. Proximate analysis of solid fuel)
4. Estimation of temporary hardness of water sample by O' Hener's Method.
5. Determination of flash and fire point of given lubricating oil using Able's flash point apparatus

### **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.

### **MEANS OF ASSEMENTS**

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

### **RECOMMENDED BOOKS**

1. Chemistry in Engineering by J.C. Kuricose & J. Rajaram, Tata McGraw Hill, Publishing Company Limited, New Delhi.
2. Engineering Chemistry by P.C. Jain & Monika Jain, Dhanapat Rai Publishing Company, New Delhi.

3. Eagle's Applied Chemistry - I by S. C. Ahuja & G. H. Hugar, Eagle Prakashan, Jalandhar.
4. Engineering Chemistry – A Text Book by H. K. Chopra & A. Parmar, Narosa Publishing House, New Delhi.
5. Applied Chemistry - I by Dr. P. K Vij & Shiksha Vij, Lords Publications, Jalandhar.
6. Engineering Chemistry by Dr. Himanshu Pandey, Goel Publishing House, Meerut, India

### SUGGESTED DISTRIBUTION OF MARKS

| Topics       | Time Allotted<br>(hrs) | Marks Allotted<br>(%) |
|--------------|------------------------|-----------------------|
| 1.           | 14                     | 20                    |
| 2.           | 18                     | 24                    |
| 3.           | 14                     | 20                    |
| 4.           | 4                      | 6                     |
| 5.           | 10                     | 15                    |
| 6.           | 10                     | 15                    |
| <b>Total</b> | <b>70</b>              | <b>100</b>            |

### 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:

- i) First angle projection is to be followed
- ii) Minimum of 18 sheets to be prepared and atleast 2 sheets on AutoCAD
- iii) Instructions relevant to various drawings may be given along with appropriate demonstrations, before assigning drawing practice to students

### LEARNING OUTCOMES

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

- Identify and use of different grades of pencils and other drafting instruments which are used in engineering field
- Draw free hand sketches of various kinds of objects.
- Utilize various types of lines used in engineering drawing.
- Read and apply different dimensioning methods on drawing of objects.
- Use different types of scales and their utilization in reading and reproducing drawings of objects and maps.
- Draw 2 - dimensional view of different objects viewed from different angles (orthographic views)
- Draw and interpret complete inner hidden details of an object which are otherwise not visible in normal view
- To make projections of Solid
- Generate isometric (3D) drawing from different 2D (orthographic) views/sketches
- Identify conventions for different engineering materials, symbols, sections of regular objects and general fittings used in Civil and Electrical household appliances
- Use basic commands of AutoCAD.

## DETAILED CONTENTS

1. Introduction to Engineering Drawing (03 sheets)
  - 1.1 Introduction to drawing instruments, materials, layout and sizes of drawing sheets and drawing boards.
  - 1.2 Different types of lines in Engineering drawing as per BIS specifications
  - 1.3 Practice of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagonal, pentagon with the help of drawing instruments.
  - 1.4 Free hand and instrumental lettering (Alphabet and numerals) – upper case (Capital Letter), single stroke, vertical and inclined at 75 degree, series of 5,8,12 mm of free hand and instrumental lettering of height 25 to 35 mm in the ratio of 7:4
  
2. Dimensioning Technique (01 sheet)
  - 2.1 Necessity of dimensioning, method and principles of dimensioning (mainly theoretical instructions)
  - 2.2 Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes, equally spaced on P.C.D., counter sunk holes, counter bored holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches
  
3. Scales (02 sheets)
  - 3.1 Scales –their needs and importance (theoretical instructions), type of scales, definition of R.F. and length of scale
  - 3.2 Drawing of plain and diagonal scales
  
4. Orthographic Projections (06 sheets)
  - 4.1 Theory of orthographic projections (Elaborate theoretical instructions)
  - 4.2 Projection of Points in different quadrant
  - 4.3 Projection of Straight Line (1<sup>st</sup> and 3<sup>rd</sup> angle)
    - 4.3.1. Line parallel to both the planes
    - 4.3.2. Line perpendicular to any one of the reference plane
    - 4.3.3. Line inclined to any one of the reference plane.
  - 4.4 Projection of Plane – Different lamina like square, rectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in 1<sup>st</sup> angle only
  - 4.5 Three views of orthographic projection of different objects. (At least one sheet in 3<sup>rd</sup> angle)
  - 4.6 Identification of surfaces
  
- 5 Projection of Solid (02 sheets)

- 5.1. Definition and salient features of Solid
  - 5.2. Types of Solid (Polyhedron and Solid of revolution)
  - 5.3. To make projections, sources, Top view, Front view and Side view of various types of Solid.
6. Sections (02 sheets)
- 6.1 Importance and salient features
  - 6.2 Drawing of full section, half section, partial or broken out sections, Offset sections, revolved sections and removed sections.
  - 6.3 Convention sectional representation of various materials, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections
  - 6.4 Orthographic sectional views of different objects.
7. Isometric Views (02 sheets)
- 7.1 Fundamentals of isometric projections and isometric scale.
  - 7.2 Isometric views of combination of regular solids like cylinder, cone, cube and prism.
8. Common Symbols and Conventions used in Engineering (02 sheets)
- 8.1 Civil Engineering sanitary fitting symbols
  - 8.2 Electrical fitting symbols for domestic interior installations
- \*9. Introduction to AutoCAD (02 sheets)
- Basic introduction and operational instructions of various commands in AutoCAD. At least two sheets on AutoCAD of cube, cuboid, cone, pyramid, truncated cone and pyramid, sphere and combination of above solids.
- \* **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. Engineering Drawing I by DK Goel, GBD Publication.

## 1.6 MEASURING INSTRUMENTS AND MEASUREMENTS

L T P  
4 - 2

### RATIONALE

The subject of Measuring Instruments and Measurements provides the students necessary knowledge about calibrating, conducting experiments or handling various measuring instruments like Pressure Gauges, Thermometers, Pyrometers, Level Indicators etc.

### LEARNING OUTCOMES

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

- Understand various process instrumentation in process industry
- Operate various measuring instruments like pressure gauge, thermometer, etc.
- Find errors and test various instruments and justify their use in systems and improve productivity.
- Select instruments for various applications.

### DETAILED CONTENTS

#### 1. Introduction and Classification of Instruments (12 Periods)

Importance of instruments in chemical process industries, General classification of industrial instruments, Functional elements of instruments, Indicating and recording type instruments, Static and dynamic characteristics of instruments, Description and constructional details, working principle, Ranges and applications of Strip chart recorder, Circular chart recorder, Thermal conductivity measuring instrument.

#### 2. Pressure Measurements (12 Periods)

Absolute, Gauge and Vacuum pressure, Liquid column gauge, Bourden tube gauge, McLeod gauge, Ionization gauge.

#### 3. Temperature Measurement (12 Periods)

Temperature scales, Bimetallic thermometer, Liquid expansion thermometer, Thermocouples, Resistance thermometer, Optical and radiation pyrometers, Thermistor.

#### 4. Liquid-Level Meters (12 Periods)

Visual indicators, Float actuated instrument, the-bubbler system, diaphragm box and air trap systems, electrical contact type liquid level indicators. Hydrostatic head density compensator level meter, hydro step, Radar or microwave level indicator, Ultrasonic or sonic level indicator.



5. Mass and Weight Measurement (08 periods)

Two-pan balance and single pan mechanical balances, Single pan electronic balance.

### **LIST OF PRACTICALS**

1. Calibration of Pressure Gauge
2. Calibration of Thermister
3. Calibration of Thermocouple for temperature measurement
4. Calibration of McLeod Gauge for low pressure
5. Calibration of Optical pyrometer.
6. Sketch of single pan electronic balance.
7. Measurement of pressure using Bourden tube.
8. Sketch of diaphragm and air trap system.

### **INSTRUCTIONAL STRATEGY**

This subject gives the knowledge of various instruments used to measure various process parameters. So the theoretical knowledge of this subject should be properly imparted to the students with the help of practical examples. The teacher should use audio-visual aids to show the working of these instruments.

### **MEANS OF ASSESSMENT**

- Assignments and Quiz/Class Tests
- End-term Written Tests
- Laboratory Work
- Viva-Voce

### **RECOMMENDED BOOKS**

1. Industrial Instrumentation by Donald.P. Eckmann; CBS., 2004
2. Industrial instrumentation and Control by S.K. Singh; Tata McGraw , 20016
3. Industrial instrumentation, K. Krishnaswamy; New Age International.

### SUGGESTED DISTRIBUTION OF MARKS

| <b>Topic</b> | <b>Time Allotted<br/>(Periods)</b> | <b>Marks Allotted<br/>(%)</b> |
|--------------|------------------------------------|-------------------------------|
| 1.           | 12                                 | 22                            |
| 2.           | 12                                 | 22                            |
| 3.           | 12                                 | 20                            |
| 4            | 12                                 | 22                            |
| 5            | 08                                 | 14                            |
| <b>Total</b> | <b>56</b>                          | <b>100</b>                    |

## 1.7 GENERAL WORKSHOP PRACTICE – I

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

L T P  
- - 8

### 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

**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. Carpentry Shop
2. Painting and Polishing Shop
3. Electrical Shop
4. Welding Shop
5. Plumbing Shop

## 1. CARPENTRY SHOP

- 1.1 General Shop Talk
  - 1.1.1 Name and use of raw materials used in carpentry shop : wood & alternative materials
  - 1.1.2 Names, uses, care and maintenance of hand tools such as different types of Saws, C-Clamp, Chisels, Mallets, Carpenter's vices, Marking gauges, Try-squares, Rulers and other commonly used tools and materials used in carpentry shop by segregating as cutting tools, supporting tools, holding tools , measuring tools etc.
  - 1.1.3 Specification of tools used in carpentry shop.
  - 1.1.4 Different types of Timbers, their properties, uses & defects.
  - 1.1.5 Seasoning of wood.
- 1.2. Practice
  - 1.2.1 Practices for Basic Carpentry Work
  - 1.2.2 Sawing practice using different types of saws
  - 1.2.3 Assembling jack plane — Planning practice including sharpening of jack plane cutter
  - 1.2.4 Chiselling practice using different types of chisels including sharpening of chisel
  - 1.2.5 Making of different types of wooden pin and fixing methods. Marking measuring and inspection of jobs.
- 1.3 Job Practice
  - Job I Marking, sawing, planning and chiselling and their practice
  - Job II Half Lap Joint (cross, L or T – any one)
  - Job III Mortise and Tenon joint (T-Joint)
  - Job IV Dove tail Joint (Lap or Bridle Joint)
- 1.4. Demonstration of job showing use of Rip Saw, Bow saw and Tenon saw, method of sharpening various saws.

## 2. PAINTING AND POLISHING SHOP

- 2.1. Introduction of paints, varnishes, Reason for surface preparation, Advantages of Painting, other method of surface coating ie. Electroplating etc.
- 2.2. Job Practice
  - Job 1: To prepare a wooden surface for painting apply primer on one side and to paint the same side. To prepare french polish for wooden surface and polish the other side.
  - Job II: To prepare metal surface for painting, apply primer and paint the same.
  - Job III: To prepare a metal surface for spray painting, first spray primer and

paint the same by spray painting gun and compressor system.

The sequence of polishing will be as follows:

- i) Abrasive cutting by leather wheel
- ii) Polishing with hard cotton wheel and with polishing material
- iii) Buffing with cotton wheel or buff wheel.

### **3. ELECTRICAL SHOP**

- 3.1 Study, demonstration and identification of common electrical materials with standard ratings and specifications such as wires, cables, switches, fuses, cleats, clamps and allied items, tools and accessories.
- 3.2 Study of electrical safety measures and protective devices.
  - Job I Identification of phase, Neutral and Earth wires for connection to domestic electrical appliances and their connections to three pin plugs.
  - Job II Carrying out house wiring circuits using fuse, switches, sockets, ceiling rose etc. in batten or P.V.C. casing-caping.
- 3.3 Study of common electrical appliances such as auto electric iron, electric kettle, ceiling/table fan, desert cooler etc.
- 3.4 Introduction to the construction of lead acid battery and its working.
  - Job III Installation of battery and connecting two or three batteries in series and parallel.
- 3.5 Introduction to battery charger and its functioning.
  - Job IV Charging a battery and testing with hydrometer and cell tester

### **4. WELDING SHOP**

- 4.1 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.
- 4.2 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

## **5. PLUMBING SHOP**

- 5.1. Use of personal protective equipments, safety precautions while working and cleaning of shop.
- 5.2. Introduction and demonstration of tools, equipment and machines used in plumbing shop.
- 5.3. Introduction of various pipes and pipe fittings of elbow, nipple, socket, union etc.
- 5.4. Job Practice  
Job 1 : Preparation of job using elbow, bend and nipple  
Job II: Preparation of job using Union, Tap, Plug and Socket.  
Job III: Threading practice on pipe with die

### **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 Jeyapoovan; 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.

## 2.1 APPLIED MATHEMATICS - II

L T P  
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 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 Kirchhoff'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 STRATEGY**

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**

| <b>Topic No.</b> | <b>Time Allotted<br/>(Periods)</b> | <b>Marks Allotted<br/>(%)</b> |
|------------------|------------------------------------|-------------------------------|
| 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

L T P  
5 - 2

### 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 lamina 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 (14 periods)
- 3. Moment
  - 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 Upadhyya, 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 INTRODUCTION TO PAINT & POLYMER TECHNOLOGY

|   |   |   |
|---|---|---|
| L | T | P |
| 4 | - | 4 |

### RATIONALE

In this subject Students will get to know the basic knowledge of Paint as material , and different types of polymers and polymerization techniques to get the film formers.

### LEARNING OUTCOMES

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

- Understand the Fundamentals of Paints
- Understand the Fundamentals of Polymers.
- Understand the Polymerization techniques
- Understand the Fundamentals of Synthetic Film Formers.

### DETAILED CONTENTS

#### 1. BASICS OF PAINT: (12 Periods)

General Introduction of Paint Industry, definition of Paints, Varnishes and Lacquers, their constituents and functions. General classification of surface coatings, mechanism of film formation, sources and composition of oils, non-glyceride, components of oils, classification, extraction and refining of oils.

#### 2. FUNDAMENTAL OF POLYMERS: (16 Periods)

Introduction & historical background of polymers, macro-molecular concept, monomers & polymers nomenclature of polymers, features ,characteristics and applications of a polymer, definition of polymerization, rate of polymerization, average degree of polymerization, functionality and polymerization. oligomers and high polymers, scope of elastomeric, fiber forming and plastic materials.

#### 3. CLASSIFICATION OF POLYMERIZATION: (14 Periods)

Types of polymerization, addition (chain) polymerization, condensation polymerization, Comparison between addition and condensation polymerization. Bulk, suspension, solution & emulsion polymerization.

#### 4. FUNDAMENTAL OF SYNTHETIC FILM FORMERS: (14 Periods)

Fundamental of film formers, chemical structure of monomers, functionality and its determination, polymerization and molecular weight, convertible, non- convertible film formers, linear, branched and cross-linked film formers and co polymers.

### LIST OF PRACTICALS

1. Preparation of Acrylic Emulsions.
2. Preparation of Polystyrene by bulk polymerization.
3. Preparation of Polyacrylate by solution/ polymerization

## INSTRUCTIONAL STRATEGY

### MEANS OF ASSESSMENT

Assignments and quiz/class tests, mid and end-term written tests, model/prototype making.

### RECOMMENDED BOOKS

- 1 Basics of Paint Technology- Part- 1 By V.C.Maliha, Meenal. A.Sikchi
- 2 Organic Coating Technology vol-1 By Henry Fleming, Payne Publisher John Wiley & Sons.
- 3 Surface Coatings : Raw materials & their usage Volume-1 By OCCA-Australia Publisher Champas & Hall
- 4 Outlines of Paint Technology By W.M.Margans Publisher Edward Arnold.
- 5 Introduction To Paint Chemistry By G.P.A.Turner Publisher champan & Hall
- 6 Polymer Science By V.R.Gowariker Publisher New Age International

### SUGGESTED DISTRIBUTION OF MARKS

| Topic No.    | Time Allotted (Hrs) | Marks Allotted (%) |
|--------------|---------------------|--------------------|
| 1            | 12                  | 20                 |
| 2            | 16                  | 30                 |
| 3            | 14                  | 25                 |
| 4            | 14                  | 25                 |
| <b>Total</b> | <b>56</b>           | <b>100</b>         |



## 2.5 DRYING OILS , DRIERS , SOLVENTS & PAINT ADDITIVES

L T P  
5 - 6

### RATIONALE

This Subject equips the students with the knowledge of the oils used in surface Coating as film formers. It also gives the basic knowledge about driers , solvents and additives.

### LEARNING OUTCOMES

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

- Have understanding of the oils used in Paint.
- Understand about the of Solvents used in Paint.
- Understand about the driers and other additives.

### DETAILED CONTENTS

#### 1. INTRODUCTION TO DRYING AND NON DRYING OILS: (18 Periods)

Properties and uses of some commonly used drying, semi drying & non drying oils, yellowing of oils, Chemical reactions of oils, like oxidation, hydrolysis, glyceralysis, saponification etc, Evaluation & characterization of oils, modified oils like heat treated oils, maleinised oils, co polymerized oils, dehydrated castor oils, isomerized oils, reconstituted oils etc.

#### 2. DRIERS: (16 Periods)

Definition of driers, types of driers like primary, secondary and auxiliary. Function of metals as well as, acid part of driers, driers mechanisms, manufacture of driers, their evaluation and recommendation for water based and solvent based coatings, combination and dosage of driers, properties of different metal as well as organic radical of driers.

#### 3. SOLVENTS: (16 Periods)

Types of volatile solvents, general properties of solvents like solvent power, toxicity rate of evaporation, boiling point & aromatic content, etc classification like true solvents, latent solvents and diluents, effect of solvent on film properties, classes of solvents with their sources, properties, evaluation of solvents, solubility parameters.

#### 4. PLASTICIZERS & ADDITIVES: (20 Periods)

Definition, importance, mechanism of plasticization, types of plasticizers with their properties, evaluation of plasticizers. Function of additives, additives for solvent-thinned coating like wetting, and dispersing agents, anti settling and bodying agents, anti skinning agents, anti flooding agents etc, additives for latex paints like surface – active agents, antifoam agents, emulsifier, thickening agents, preservatives & coalescing agents etc.

## **LIST OF PRACTICALS**

1. Physical testing of drying oils for colour, sp. gr, R.I, etc.
2. Physical testing of semidrying oils for colour, sp. gr., R.I. , etc.
3. Physical testing of non-drying oils for colour, sp. gr., R.I. , etc.
4. Determination of acid value of oils.
5. Determination of iodine value of oils.
6. Determination of saponification of oils.
7. Oil/fat splitting to recover fatty acids & glycerol
8. Testing of volatile solvent for Distillation Range.
9. Determination of Flash & Fire Point of volatile solvent.

## **INSTRUCTIONAL STRATEGY**

Mechanical operations has significant importance in the area of chemical engineering. Adequate competency needs to be developed by giving sufficient practical knowledge to mechanical operation (characterization of solid particles, size reduction, energy requirement and mechanical separation). A field visit may be conducted to expose the working of various conveyers and filtration equipment in industries.

## **MEANS OF ASSESSMENT**

1. Assignments
2. Class Tests
3. Practical Work
4. End Semester Exam
5. Viva-Voce

## RECOMMENDED BOOKS

- 1 Basics of Paint Technology- Part- 1 By V.C.Maliha, Meenal. A.Sikchi
- 2 Organic Coating Technology vol-1 By Henry Fleming, Payne Publisher John Wiley & Sons.
- 3 Surface Coatings : Raw materials & their usage Volume-1 By OCCA-Australia Publisher Champas & Hall
- 4 Outlines of Paint Technology By W M Margans Publisher Edward Arnold., London
- 5 The Chemistry of Organic film formers By D.H.Solomon , R.E.Kriegar
- 6 Surface Coatings: Science & Technology By Swaraj Paul Publisher John wiley & Sons.

## SUGGESTED DISTRIBUTION OF MARKS

| <b>Topic</b> | <b>Time Allotted<br/>(Periods)</b> | <b>Marks Allotted<br/>(%)</b> |
|--------------|------------------------------------|-------------------------------|
| 1.           | 18                                 | 25                            |
| 2.           | 16                                 | 22                            |
| 3.           | 16                                 | 23                            |
| 4            | 20                                 | 30                            |
| <b>Total</b> | <b>70</b>                          | <b>100</b>                    |



## **2.6 GENERAL WORKSHOP PRACTICE –II**

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

**L T P**  
**- - 8**

### **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

## 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 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 Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi
6. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Co., New Delhi  
Workshop Technology by HS Bawa; Tata McGraw Hill Publishers, New Delhi.