**SUBJECT: Fundamental of Mechanics and Technical Drawing (FMTD)**

**CLASS XI**

**SEMESTER I**

<u>**Group A:**</u> **(Fundamental of Mechanics)**

<u>**FULL MARKS – 25**</u>

**(MCQ Type Question)**

| UNIT | Topic | No of periods assigned | Marks |
|:---:|:---|:---:|:---:|
| 1 | Introduction | 6 | 3 |
| 2 | System of Forces | 12 | 7 |
| 3 | Moment & its applications | 12 | 7 |
| 4 | Equilibrium of Force system | 15 | 8 |
| | **Total** | **45** | **25** |

**DETAIL SYLLABUS**

| Unit | Topic / Sub Topic | No of periods assigned |
|:---:|:---|:---:|
| 1 | **Introduction:**<br>1.1 Concept of Engineering Mechanics – Statics & Dynamics<br>1.2 Scalar quantity, Vector quantity, Basic Units – SI units<br>1.3 Representation of Vector, Addition & subtraction of Vectors | 6 |
| 2 | **System of Forces:**<br>2.1 Definition of Force, System of Co-planner forces, Resultant Force<br>2.2 Graphical methods for determination of resultant Force<br>(Parallelogram Law, Triangle Law & Polygon Law of Forces) | 12 |
| 3 | **Moment & its applications:**<br>3.1 Definition, unit & Type of Moment<br>3.2 Physical significance of Moment<br>3.3 Varignon's theorem<br>3.4 Simple related problems | 12 |
| 4 | **Equilibrium of Force system:**<br>4.1 Explain Lami's theorem<br>4.2 Condition of equilibrium of co-planner & concurrent force system<br>4.3 Condition of equilibrium of co-planner & non-concurrent force system (Both Like & Unlike)<br>4.4 Simple related problems | 15 |
| | **Total** | **45** |

## Group B: (Fundamental of Mechanics)

### FULL MARKS – 25

### (SAQ AND LAQ Type Question)

| UNIT | Topic | No of periods assigned | Marks |
|------|-------|------------------------|-------|
| 1 | Friction | 15 | 2(SAQ) & 4(LAQ) |
| 2 | Simple Lifting Machines | 18 | 3(SAQ) & 4(LAQ) |
| 3 | Centre of Gravity | 15 | 2(SAQ) & 4(LAQ) |
| 4 | Moment of Inertia | 15 | 2(SAQ) & 4(LAQ) |
| | **Total** | **63** | **25** |

**DETAIL SYLLABUS**

| Unit | Topic / Sub Topic | No of periods assigned |
|------|-------------------|------------------------|
| 1 | **Friction**:<br>1.1 Concept of Friction & its types,<br>1.2 Basic terminologies: Limiting Friction, Angle of Friction, Co-efficient of Friction, Angle of Repose, Laws of static Friction, Block Friction | 15 |
| 2 | **Simple Lifting Machines**:<br>2.1 Definition of some common terms related to lifting machine- Mechanical advantage, velocity ratio, input, output & efficiency of a machine, ideal machine, machine friction, frictional load, and effort lost in friction.<br>2.2 Law of machine, maximum mechanical advantage & maximum efficiency of a lifting machine<br>2.3 Reversibility of a machine, condition of Reversibility of a machine, self-locking machine.<br>2.4 Study of Simple machines: Simple Wheel & Axle, Single Purchase crab, Screw Jack, Pulleys (first & second system of pulleys). [Formula of Mechanical Advantage and Velocity ratio] | 18 |
| 3 | **Centre of Gravity**:<br>3.1 Concept & definition – Centre of Mass & Centroid,<br>3.2 Concept of Symmetrical & asymmetrical objects, Axis of Reference 3.3 Location of centroids for simple area like uniform triangular lamina, uniform rectangular lamina, uniform circular lamina | 15 |
| 4 | **Moment of Inertia**:<br>4.1 Definition & Unit of Moment of Inertia, | 15 |

| | 4.2 Parallel axis theorem, Perpendicular axis theorem, Radius of Gyration, [No deduction] 4.3 Moment of inertia of 'I' & 'T' section | |
|---|---|---|
| | **Total** | **63** |

## PROJECT/ PRACTICAL: Fundamental of Mechanics

### NO OF PERIODS ASSIGNED – 36

**DETAIL SYLLABUS**

**List of Practical to be performed: (Any Five)**

1. To determine resultant of coplanar concurrent force system graphically.
2. To determine resultant of parallel force system graphically.
3. To verify Lami's theorem graphically.
4. To verify the principle of moments with the help of Bell Crank Lever Apparatus.
5. To make a working model of friction showing static, kinetic and rolling friction with suitable material.
6. To find centre of gravity of an irregular lamina made of cardboard. (The shape of the lamina will be supplied by the subject teacher)
7. To make a working model for a first system of pulleys.

## PROJECT/ PRACTICAL: Technical Drawing

### NO OF PERIODS ASSIGNED – 144

**DETAIL SYLLABUS**                                                                    **Marks - 50**

| Unit | Topic / Sub Topic | No of periods assigned |
|---|---|---|
| 1 | **Orthographic Projection & Sectional Drawing of Solids:**<br><br>1.1 Recapitulation of Orthographic projections<br>1.2 Concept of Right & Oblique solids – Prism, Pyramid—Solids of revolution (Cylinder, Cone)<br>1.3 Projection of the above solids in their simple positions such as –<br>i. Axis perpendicular to HP & parallel to VP & vice versa.<br>ii. Axis parallel to both VP & HP.<br>1.4 Concept of Sectional View – Section Plane – Section Line — Sectional Plan, Sectional Elevation & True shape of the section – Full Section, Half Section of cube, prisms, pyramids, cylinder & cones | Lecture – 06<br>Practical - 15 |
| 2 | **Concept of Isometric Views, Isometric Projections & Development of Surfaces:** | Lecture – 06<br>Practical - 15 |

| | | |
|---|---|---|
| 5 | 2.1 Concept of isometric axes – Isometric Scale — Isometric Views & Projections<br><br>2.2 Isometric Views & Projections of regular lamina such as square, rectangular, triangular, pentagonal, hexagonal, circular etc.<br><br>2.3 Isometric Views of right regular solid such as cube, prisms, pyramids, cylinder & cones<br><br>2.4 Development of Surface of Right regular solid such as –<br>  i) Cube, ii) Prisms, iii) Pyramids, iv) Cylinder, v) Cones, vi) Hollow cylinder | |
| 3 | **Freehand Sketch:**<br><br>3.1 Introduction – Necessity.<br>3.2 Free hand sketches of rolled steel sections – i) T-section, ii) I-section, iii) Angle section, iv) Channel section, v) Circular section, vi) Rectangular Section, vii) Steel flat | Lecture – 01<br>Practical - 09 |
| 4 | **Discipline based Drawing & Sketching:**<br><br>[Student must choose any one category depending upon their Vocational Trade]<br>**Category – A** (*For Civil Based Vocational Trade*)<br>4.1 Introduction to civil engineering drawing.<br>4.2 Plan, Elevation, Section of a single storied building with RCC slab, RCC beam & masonry wall.<br>**Category – B** (*For Mechanical Based Vocational Trade*)<br>4.1 Draw three principal views of Hexagonal headed Nut-Bolt assembly (with lock nut & washer). The size of the bolt will be supplied by the subject-teacher.<br>4.2 Draw two principal views of key & key-way assembly. The size of shaft & type of key will be supplied by the subject-teacher.<br>4.3 Draw the proportionate sketch of the thread section –<br>  i) B.S.W., ii) Metric (internal & external), iii) Acme & iv) Square thread<br>**Category – C** (*For Electrical Based Vocational Trade*)<br>4.1 Draw pictorial view of the following items:<br>  Field Poles, Armature, Commutator, Lap winding & wave winding of DC machine<br>4.2 Rotor & Stator of squirrel cage induction motor<br>**Category – D** (*For Electronics Based Vocational Trade*)<br>4.1 Draw pictorial view of the following items:<br>  1. Diode valve, Triode valve, Ordinary diode & Zener diode.<br>  2. Transistor (Both NPN & PNP), SCR | Lecture – 06<br>Practical - 15 |
| 5 | **Introduction to CAD:**<br><br>5.1 Introduction to CAD software<br>5.2 Common 2D command for drawing simple sketch: | Lecture – 02<br>Practical - 09 |

| | | | |
|---|---|---|---|
| | Creation of work plane, Line, Circle, Rectangle, arc, Ellipse, curve, Move, Copy, Trim, Fillet, Chamfer, Extend, offset, Array, break <br> 5.3 Practice on 2D Drawing | | |
| 6 | **Introduction of technical drawing and lettering:** <br><br> 6.1 Importance of Drawing as a medium of communication <br> 6.2 Definition of Technical drawing, Difference between technical and free hand drawing <br> 6.3 Use and care of drawing boards and different drawing instruments <br> 6.4 Drawing Board and sheet & their sizes <br> 6.5 Types of lines and their applications <br> 6.6 Drawing of — i) Horizontal lines, ii) Vertical lines, iii) Inclined lines, iv) Parallel lines, v) Dividing a straight line in to equal no of divisions (with the help of Drawing Board, T-square, Set squares, Pencil Compass & Divider) <br> 6.7 Single stroke Lettering (7:4 & 5:4) by conventional method <br> 6.8 Dimensioning—System of Dimensioning | Lecture – 03 <br> Practical - 09 | |
| 7 | **Geometrical Construction:** <br><br> 7.1 Bisecting a line and angle, draw perpendicular and parallel lines, divide a line and circle, Find the center of an arc <br> 7.2 Geometrical construction of Square, regular Polygons (Pentagon, Hexagon & Octagon) by general method | Lecture – 03 <br> Practical - 12 | |
| 8 | **Scale:** <br><br> 8.1 Concept of using Scales in Drawing – Enlarging, Full Size & Reducing Scale. <br> 8.2 Representative fraction – Plain Scale, Diagonal Scale <br> 8.3 Construction of – i) Plain Scale, ii) Diagonal Scale | Lecture – 03 <br> Practical - 09 | |
| 9 | **Orthographic Projection of Line & Lamina:** <br><br> 9.1 Projector & Plane of projection – Vertical Plane, Horizontal Plane & Profile Plane <br> 9.2 Concept of 1st angle Projection & 3rd angle Projection <br> 9.3 Symbol of projections (Demonstration with models) <br> 9.4 Projection of Points, Lines & Lamina (Square, rectangular, triangular, hexagonal, pentagonal and circular) parallel to VP and angle with HP & vice versa. | Lecture – 06 <br> Practical - 15 | |
| | **Total:** | **Lecture – 36 <br> Practical - 108** | |