ENGINEERING MECHANICS

TH-2   **Exam- 3 Hours**

Periods per week- 06   **End Exam-80 marks**

Total Periods-   90   **I.A. - 20**

Topic wise distribution of periods

SI No.	Topic	Periods
1.	Force and moments	18
2.	Center of Gravity and Moment of Inertia	15
3.	Friction	15
4.	Gear drive	06
5.	Lifting machines	06
6.	Simple stress and strain	08
7.	Dynamics	22
	Total	**90**

OBJECTIVES:

On completion of the subject a student will be able to

1. Compute the force & moment and their application on solution of simple problems on co-planar forces.

2. Locate the C.G and M.I. of geometrical figures.

3. Find the existence of the friction and its application on solution of problems.

4. Explain the gear drive terminologies.

5. Explain the application of simple lifting machine.

6. Comprehend the behavior of the materials under different types of simple stress and strain.

7. Find out the behavior of the particle in motion under the application of forces.

Course Content

1.0 FORCE AND MOMENTS

1.1 Define force and its effects

1.2 Classification of forces, Principle of Transmissibility, Principle of Superposition, Action and Reaction, Tension and Compression, Free Body Diagram

1.3 Co-planar concurrent forces

    1.3.1 Define resultant of forces, equilibrium of forces and equilibrant.

    1.3.2 State parallelogram law of forces and determine the resultant of two concurrent forces

    1.3.3 Solve problems using the parallelogram law of forces

    1.3.4 State components and resolve parts of a force

    1.3.5 State principle of resolution of a force and any number of forces,

    1.3.6 Analytical determination of resultant of number of concurrent forces

    1.3.7 State and prove Lami's Theorem and solve problems on application of Lami's Theorem

    1.3.8 State triangle law of forces and polygon law of forces

1.4 Coplanar non-concurrent forces

    1.4.1 Define moment of a force

    1.4.2 State and prove Varignon's theorem

    1.4.3 State conditions of equilibrium

    1.4.4 Determine resultant of two like and unlike parallel forces

    1.4.5 Define couple and its moment

    1.4.6 Explain various types of supports with their reactions

    1.4.7 Solve simple problems on coplanar non concurrent forces with the help of free body diagram.

2.0 CENTER OF GRAVITY AND MOMENT OF INERTIA

2.1 Define Centroid and Center of Gravity(C.G)

    2.1.1 Derive expression for C.G of straight line (uniform rod), triangle, rectangle, circular, semicircular lamina. State the expression for C.G of solids like hemisphere and cone (Expression only). State different types of engineering sections (symmetrical and non-symmetrical built up sections)

    2.1.2 Locate the C.G of the above sections.

2.2 Define Moment of Inertia of plain figure as second moment of area

    2.2.1 State and prove perpendicular axes theorem, parallel axis theorem

    2.2.2 Find out M.I. of plane lamina like rectangle, triangle, circle, and semicircle (from 1st principle). M.I. of different engineering sections.

2.2.3 Solve simple problems

3.0   FRICTION

3.1   Define Frictional force, angle of friction, limiting friction, co-efficient of friction
3.2   State laws of Static Friction..
3.3   Solve simple problems on
     3.3.1 Ladder
     3.3.2 Body on Inclined planes with applied force parallel to the plane and horizontal.
     3.3.3 Screw Jack

4.0   GEAR DRIVE

4.1   Define and classify various types of gear

4.2   Explain the various Gear terminology

4.3   Define velocity ratio and derive the velocity ratio for simple gears.

4.4   Explain the types of gear trains(simple and compound gear trains)

5.0   SIMPLE LIFTING MACHINE

5.1   Define a machine

5.2   Explain simple and compound lifting machines

5.3   Define MA, VR and efficiency and derive the relationship between them

5.4   Define the law of machine. Friction in machines. Friction in terms of load and friction
    in terms of effort.

5.5   State reversible machine and self-locking machine. Derive the condition of
    reversibility of a machine.

5.6   Explain the working principles, to find out the Velocity Ratio and efficiency of
    following simple machines
     5.6.1 1st, 2nd & 3rd system of pulleys
     5.6.2 Simple and differential wheel & axel
     5.6.3 Screw jack

6.0   SIMPLE STRESS AND STRAIN

6.1   Define stress, strain

6.2   Explain tensile, compressive and shear types of stress and strain

6.3   State Hook's Law of elasticity

6.4   Define Poisson's ratio

6.5   Define Elastic limit, Elastic Constants (E, G & K.). relationship between E, G & K (No
    derivation)

6.6   Draw the stress-strain curve and explain the salient points on it for ductile material.

6.7   Solve simple problems on stress and strain in case of material with uniform cross
    section.

7.0 DYNAMICS

7.1   Define kinematics and kinetics of a particle

7.2   Principle of Dynamics:-Newton's laws of motion, D'Alembert's Principle and its application to solve simple problems.

7.3   Motion of particle acted upon by a constant force.

7.4   Engineering Application of Work, Power and Energy.

       7.4.1 Work done, force-displacement diagram, Work done in stretching a Spring.

       7.4.2 Explain power, units of power. Explain I.P., B.P. and efficiency. Solve simple problems on it.

       7.4.3 Explain Kinetic and potential energy & its application to solve Engg. Problems

7.5   Define Simple Harmonic Motion (SHM) with examples. .

7.6   Define and explain Free Vibration

7.7   Explain terms: amplitude, frequency and time period in SHM

7.8   Find out velocity and acceleration of particle executing SHM, application of SHM to engineering problems

7.9   Define Force, Momentum and Impulse. Explain conservation of energy and linear momentum,

7.10   Explain collision of elastic bodies, Define co-efficient of restitution (e)

7.11   Find velocity after impact.Impact of body with a fixed plane.

7.12   Solve simple problems on above

REFERENE BOOKS

1. A Text book of Engineering Mechanics -   R. S. Khurmi

2. A Text book of Engineering Mechanics -   S. Rammruthan

3. A Text book of Engineering Mechanics -   A. R. Basu (T.M.H. Publication)

4. Applied Mechanics and strength of Material – I. B. Prasad

5. Engineering Mechanics -   Timoshenko, Young and Rao