# Department of ECM

**EM1T6** 

PVP12

# 1/4 B.Tech. FIRST SEMESTER ENGINEERING MECHANICS Credits: 4

Lecture: 4 periods/week	Internal assessment: 30 marks
Tutorial: 1 period /week	Semester end examination: 70 marks

# **Objectives:**

- To gain a basic knowledge of rigid-body mechanics, elasticity and structural analysis
- To understand the Moment of inertia of plane areas and material bodies and the dynamics of particles and rigid bodies

# Learning outcomes:

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

- Determine the resultant of a force system and construct free body diagrams and develop appropriate equilibrium equations.
- Simplify the system of forces and moments to equivalent systems.
- Locate centroids and determine moment of inertia for composite areas.
- Determine the mass moment of inertia of rigid bodies.
- Apply equations of motions to particle and rigid body motion.
- Analyze motion of particles & rigid bodies using the principle of energy.

# UNIT – I

# **CONCURRENT FORCES IN A PLANE:**

Principles of statics, Force, Addition of two forces: Parallelogram Law – Composition and resolution of forces – Constraint, Action and Reaction. Types of supports and support reactions. Free body diagram. Equilibrium of concurrent forces in a plane.

# UNIT –II

# **FRICTION:**

Introduction, Classification of friction, Laws of dry friction. Co-efficient of friction, Angle of friction, Angle of repose, Cone of friction, Frictional forces on wheel, Wedge friction.

# UNIT – III

# **CENTROIDS:**

Introduction, Determination of centroids of simple figures by integration method, Centroids of composite plane figures, Pappus theorem.

# UNIT - IV

# AREA MOMENTS OF INERTIA:

Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.

# MOMENT OF INERTIA OF MATERIAL BODIES:

Moment of inertia of a rigid body – Moment of inertia of laminas- slender bar, rectangular plate, Circular plate, circular ring, Moment of inertia of 3D bodies- cone, solid cylinder, sphere & parallelepiped.

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# UNIT – V

# ANALYSIS OF TRUSSES BY METHOD OF JOINTS:

Types of Trusses – Assumptions for forces in members of a perfect truss, Force table, Cantilever Trusses, Structures with one end hinged and the other freely supported on rollers carrying horizontal or inclined loads.

# UNIT – VI

# **PRINCIPLE OF VIRTUAL WORK:**

Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion.

# UNIT – VII

# **KINEMATICS OF RECTILINEAR TRANSLATION - I:**

Introduction, displacement, velocity and acceleration. Motion with Uniform and Variable acceleration.

# UNIT – VIII

# **KINETICS OF RECTILINEAR TRANSLATION - II:**

Equations of rectilinear motion. Equations of Dynamic Equilibrium: D'Alembert's Principle. Work and Energy, Conservation of energy, Impulse and Momentum, Impact-Direct central Impact.

# Learning resources

# **Text books :**

- 1. Engineering Mechanics, (4<sup>th</sup> edition) by Timoshenko, S. and Young, D.H., Tata McGraw-Hill, 1956. (For Concepts and symbolic Problems).
- 2. Engineering Mechanics Statics and dynamics, (14<sup>th</sup> edition) by Tayal, A.K., Umesh Publication, Delhi, 2012.

# **Reference books:**

- 1. Vector Mechanics for Engineers Statics and Dynamics, (3<sup>rd</sup> edition) by Beer and Johnston., Tata McGraw-Hill, New Delhi, 1997.
- 2. Engineering Mechanics by Bhavikatti, S.S. and Rajasekharappa, J.G., New Age International Publications, 2009.
- 3. Singer's Engineering Mechanics Statics and Dynamics, (3<sup>rd</sup> Edition) by Vijaya Kumar Reddy, K. and Suresh Kumar. J., BS Publications, 2012.

# Web Reference:

- 1. http://openlibrary.org/books/OL22136590M/Basic\_engineering\_mechanics
- 2. http://en.wikibooks.org/wiki/Engineering\_Mechanics
- 3. http://nptel.iitm.ac.in/video.php?courseId=1048
- 4. http://imechanica.org/node/1551
- 5. http://emweb.unl.edu/
- 6. http://ebooks-freedownload.com/2009/11/engineering-mechanics-statics-12.html
- 7. http://www.ebookee.com/Engineering-Mechanics-Statics\_37859.html