**20CE1202 - ENGINEERING MECHANICS**

(Civil Engineering)

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| **Course category:** | Engineering Science  | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3-0-0 |
| **Prerequisite:** | Engineering Physics, Engineering Mathematics | **Sessional Evaluation :****End Exam. Evaluation:****Total Marks:** | 4060100 |

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| **Course****Objectives** | 1. To analyse the system of forces acting in a plane in different conditions.
2. To calculate unknown force components under the action of frictional forces.
3. To explain the properties of surfaces by calculating centroid, moment of inertia and other related concepts.
4. To evaluate motion characteristics of body subjected to given force.
5. To analyse the system of forces using D Alembert principle and Work-Energy equations.
6. To analyze the components of forces in trusses and learn about mechanical vibrations
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| **Course Outcomes** | CO1 | Determine the components of forces in rectangular and non-rectangular coordinates. |
| CO2 | Determine the support reactions on structures and analyze systems that include frictional forces. |
| CO3 | Locate the centroid of an area, calculate the second moment and principal second moment of an area |
| CO4 | Calculate the motion characteristics of a body subjected to a given force system |
| CO5 | Determine the resultant forces using moment of momentum principle, D Alembert principle and Work-Energy equations. |
| CO6 | Determine resultant forces in trusses and frequency and amplitude for a given system.  |
| **Course****Content** | **UNIT-I****STATICS**: Introduction – Units and Dimensions – Laws of mechanics – Vectors – Vectorial representation of forces and moments –Vector operations – Coplanar and concurrent forces –Resolution and composition of forces – Equilibrium of a particle –Equivalent systems of forces –Principle of transmissibility – Single equivalent force and Free body diagram – Types of supports and their reactions –Equilibrium of rigid bodies in two dimensions.**UNIT – II****FRICTION:** Types of friction – Laws of friction – Limiting friction – Cone of limiting friction - Static and dynamic frictions – Motion of bodies – Wedge, Screw jack and differential jack.**UNIT – III****CENTROID AND CENTRE OF GRAVITY:** Centroids of simple figures – Centroids of composite figures - Centre of gravity of bodies – Area moment of inertia - Parallel axis theorems and perpendicular axis theorems – Moment of inertia of composite figures.**MASS MOMENT OF INERTIA:**  Moment of inertia of simple solids – Moment of inertia of composite masses (Simple problems only)**UNIT – IV****DYNAMICS-1**: Displacement – Velocity and acceleration and their relationship – Relative motion – Curvilinear motion – Newton’s law of motion.**UNIT – V****DYNAMICS-2**: Basic terms – General principles in dynamics - Types of motion – instantaneous centre of rotation in plane motion (simple problems) - Work energy equation – D Alembert’s Principle and its uses – kinetics of rigid body rotation. **UNIT – VI****ANALYSIS OF PLANE TRUSSES:** Assumptions – rigid and non-rigid trusses – Simple truss, analysis by method of joints, method of sections and tension coefficient method.**MECHANICAL VIBRATIONS:** Basic terminology – Free and forced vibrations – resonance and its effects – degree of freedom – Derivation of frequency and amplitude of free vibrations without damping and single degree of freedom system (simple problems) – Types of pendulum – Use of simple and compound pendulum. |
| **Textbooks****&****Reference books** | **TEXTBOOKS:**1. A. K. Tayal, *“Engineering Mechanics”* Umesh Publications, 14th edition, 2008.
2. R.K. Bansal, *“A Textbook of Engineering Mechanics”* Laxmi Publications, 8th edition, 2015.
3. S. Timoshenko, D.H. Young, J V Rao and Sukumar *“Engineering Mechanics”* McGraw Hill Education, revised 4th edition.

**REFERENCE BOOKS:**1. J .L .Meriam, L. G. Kraige and J.N.Bolton, *“Engineering Mechanics”* Wiley Publishers, 2017.
2. Irving. H. Shames, G. Krishna Mohana Rao, *“Engineering Mechanics-Statics and Dynamics”* Pearson Publishers, 4th edition.
3. P.B. Beer & E. R. Johnston, *“Mechanics of Materials”* McGraw Hill Series.
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**CO-PO Mapping:** 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - - Not Mapping

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| CO 1 | 3 | 1 | 3 | 2 | 1 | - | - | 1 | 2 | 2 | 2 | 3 |
| CO2 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 3 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 3 |
| CO4 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 |
| CO 5 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| CO 6 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 |