



GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING MECHANICS-STATICS

Course Code: GR15A1012
I Year I Semester

L:2 T:1 P:0 C:3

Prerequisites: A good working knowledge of calculus, vector algebra, General Physics is required.

Course Objectives: This is Engineering Applied Science-Statics Subject to Mechanical Branch of UG Engineering. At the end of the course student is expected to

- To have a firm understanding of basic principles describing the equilibrium of system of forces under static conditions.
- To become proficient in applying the concepts of centroid, moment of inertia, product of inertia & mass moment of inertia to practical problems.
- To have a firm understanding of analysis of trusses. Also to become proficient in applying the concepts of principle of virtual work to the static problems.

Course Outcomes: At the end of the course, the expected outcome from the students

- Students will be able to understand the basic physical concepts of statics.
- Students will be able to analyze the static behaviour of the mechanical components under loading.
- Students will be able to understand and apply the concepts of centroid, moment of inertia, product of inertia and mass moment of inertia in solving the practical problems under static behaviour.
- Students will be able to analyze the truss applications and will be able to apply the principle of virtual work to static problems.

Unit-I

Forces, Moments, Equilibrium: Introduction to Engineering Mechanics, Basic Concepts.

System of forces: Coplanar forces, concurrent forces, Resultant, Moment of forces and its application, Varignon's principle, Couples and resultant of force system.

Equilibrium of systems of forces: Free body diagrams, equations of equilibrium of coplanar systems, Lami's theorem, Graphical method for the equilibrium of coplanar forces, Converse of the law of triangle of forces, converse of the law of polygon of forces, conditions of equilibrium.



Unit-II

Friction: Introduction, Types of friction, Laws of Solid friction, definitions-coefficient of friction, Angle of friction, Angle of repose. Equilibrium of a body on horizontal rough plane-under horizontal & inclined force. Equilibrium of a body on a rough inclined plane- with force acting parallel to the plane and inclined to the plane.

Unit-III

Properties of surfaces and Solids: Determination of Areas and volumes, First moment of area and the centroid of sections- Rectangle, circle & triangle from method of integration, Composite sections: T-section, I-section, Angle Sections, Hollow Section by using standard formula.

Unit-IV

Moment of inertia: Second and product moments of plane area. Parallel Axis theorem, Perpendicular axis theorem, Moment of inertia of sections- rectangle, triangle, circle from method of integration, Composite Sections: T-Section, I section, Angle section, Hollow Section by using standard formula. Polar moment of inertia, moment of inertia about inclined axis, principal moments of inertia of plane areas, Principal axes of inertia.

Mass Moment of Inertia: Derivation of mass moment of inertia for rectangular section, circular section, prism, cylinder and sphere from first principles. Relation to area moments of inertia.

Unit-V

Analysis of Trusses: Introduction, Classification of trusses, Assumptions made in the analysis of perfect truss, Methods of analysis of Trusses- Method of Joints and Method of Sections.

Principle of Virtual Work: Equilibrium of ideal systems, efficiency of simple machines, stable and unstable equilibriums.

Teaching Methodology

Power point Presentations, Working models, white board & marker.

Text Books

1. Engineering Mechanics by A. Nelson, Tata-McGrawhill
2. Engineering Mechanics-Timoshenko & Young, Tata-McGrawhill
3. Engineering Mechanics-A.K Tayal, Uma Publications.



Reference Books

1. Engineering Mechanics by Shames L.H, prentice Hall.
2. Engineering Mechanics by Pakirappa, Durga publications.
3. Engineering Mechanics- R.S Khurmi, S Chand Publications
4. Engineering Mechanics- R.C. Hibbler, twelfth edition, Prentice hall.
5. Engineering Mechanics- Basudeb Bhattacharyya, Oxford University press