



## GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

### ENGINEERING MECHANICS-DYNAMICS

Course Code: GR15A1020  
I Year II Semester

L:3 T:1 P:0 C:4

**Prerequisites:** A good working knowledge of calculus, vector algebra, General Physics & Engineering Mechanics-statics is required.

**Course Objectives:** This is Engineering Applied Science-Dynamics 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 motion of particles and rigid body under accelerating conditions.
- To become proficient in applying the principles of dynamic behaviour to practical problems.
- To have a firm understanding of concepts of impulse, momentum of particles and rigid bodies. Also to become proficient in applying the concepts of vibrations to the problems associated with dynamic behaviour.

**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 dynamics.
- Students will be able to understand and relate the kinematics of particles and rigid bodies to the solution of dynamic problems in straight and curvilinear motions.
- Students will be able to understand and apply Newton's Laws to particles and rigid bodies to solve problems related to dynamic behaviour.
- Students will be able to apply the concepts of impulse, momentum and vibrations to the rigid bodies associated with dynamic behaviour.

#### Unit-I

**Kinematics of Particles- Rectilinear Motion:** Introduction- Rectilinear motion of a particle, displacement, velocity and acceleration. Rectilinear motion along X-axis, Determination of motion of particle using methods of differentiation and integration. D'Alembert's Principle.

**Uniformly accelerated motion:** velocity-time, displacement-time & velocity-displacement relationship. Motion curves- graphical representation of motion of particles. Motion along vertical Y-axis. Motion of the particle projected horizontally in air.



**Kinematics of Particles-curvilinear Motion:** Introduction, curvilinear motion of a particle, rectangular components of velocity, acceleration components of particle-tangential & normal acceleration components, radial & transverse components of acceleration. Projectile motion, Projectile on Inclined Plane.

### Unit-II

**Kinetics of Particle:** Introduction-Definitions of Matter, body, particle, mass, weight, inertia, momentum. Newton's law of motion. Relation Between force & mass. Motion of a particle in rectangular coordinates. Motion of Lift. Motion of body on an inclined plane. Motion of connected Bodies.

**Work Energy method:** law of conservation of Energy, Application of Work Energy Method to particle motion and connected system.

### Unit-III

**Impulse and Momentum:** Introduction- Impact, Momentum, Impulse & Impulsive forces, Units. Law of conservation of Momentum, Newton's law of collision of elastic bodies- coefficient of Restitution. Recoil of Gun. Impulse Momentum Equation, Non-Impulsive Forces, Impact of jet on a stationary perpendicular flat plate, Impact of jet on a Moving Perpendicular Flat plate.

### Unit-IV

**Kinematics & Kinetics of Rigid Body:** Kinematics of Rigid Bodies: Types of Rigid body motions- Motion of translation, Motion of Rotation, & General Plane Motion. Rotational motion about a fixed axis- Angular displacement, Angular Velocity, Angular acceleration. Equations of circular motion-Rotational motion with constant Angular Acceleration & angular Velocity. Relation between linear & angular acceleration.

**Kinetics of Rigid Bodies:** Definitions- Force & Translation, Moment of couple & rotation, Torque & rotation. Newton's Law of Rotation. Relation between torque & Moment of inertia. Motion of bodies tied to a string and passing over a pulley.

### Unit-V

**Mechanical Vibrations:** Introduction-simple harmonic motion, Definitions. Equations of Simple Harmonic Motion, Motion of a body attached to a spring, springs in series & in parallel, Horizontal Motion of a block attached to a spring. Simple pendulum, seconds pendulum, gain & loss of oscillations due to change in gravity ( $g$ ) & length ( $l$ ) of a simple pendulum, compound pendulum, torsional pendulum.

### 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

### **Reference Books**

1. Engineering Mechanics by Pakirappa, Durga publications.
2. Engineering Mechanics- R.S Khurmi, S Chand Publications
3. Engineering Mechanics- R.C. Hibbler, twelfth edition, Prentice hall.
4. Engineering Mechanics- A.K Tayal, Uma Publications.
5. Engineering Mechanics- Basudeb Bhattacharya, Oxford University Press