APPLIED MECHANICS
BEG158CI

Year: I Semester: II

Teaching Schedule Hours/Works			Examination Scheme				
L	P	T	Final		Internal Assessment		Total
			Theory	Practical	Theory	Practical	
3	-	1	80	-	20	-	100

COURSE OBJECTIVES: To develop an understanding of mechanical equilibrium and of Newton's laws of motion by application to a wide range of problems of engineering interest.

Course Details:

1.0 General Principles of Statics **(1 Hr)**
1.1 Concept of equilibrium of particles
1.2 Fundamental quantities of length, time and mass
1.3 SI system of units
1.4 Significant figures for calculations

2.0 Vectors **(1 Hr)**
2.1 Force and position vectors
2.2 Vector operations: addition, subtraction, dot product, cross product, scalar and triple product, unit vectors.

3.0 Equilibrium of a particle **(2 Hrs)**
3.1 Condition of equilibrium
3.2 Free-body diagrams
3.3 Coplanar force systems; transmissibility, force resultant
3.4 Three-dimensional force systems

4.0 Force System Resultants **(2 Hrs)**
4.1 Cross products
4.2 Moment of a force - scalar and vector representation
4.3 Moment of a couple - scalar and vector representation
4.4 Reduction of systems of forces and moments to a single force and couple
4.5 Resultant force and moment for a system of forces

5.0 Equilibrium of a Rigid Body **(3 Hrs)**
5.1 Conditions for equilibrium
5.2 Equilibrium in two dimensions; equations, two and three force members
5.3 Equilibrium in three dimensions; equations, constraints for rigid bodies

6.0 Friction **(2 Hrs)**
6.1 Laws of friction, static and dynamic coefficients of friction, friction angle
6.2 Application to static problems

7.0 Planar Trusses, Frames and Mechanisms **(3 Hrs)**
7.1 Simple trusses
7.2 Types of frames; determinate and indeterminate
7.3 Degrees of freedom; structure or mechanism
7.4 Internal forces from equilibrium; examples for trusses, frames and mechanisms

8.0 Beams **(4 Hrs)**
8.1 Classification of beams, loads and supports

8.2 Determining internal shear force, axial force and bending moment at a section

9.0 Fluid Statics (2 Hrs)
9.1 Distribution of pressure on submerged surfaces
9.2 Centre of pressure and resultant force

10.0 Centre of Gravity and Centroid (2 Hrs)
10.1 Centers of gravity
10.2 Centroids of lines, areas and volumes
10.3 Second moment of area

11.0 Moments of Inertia (3 Hrs)
11.1 Moments of inertia by integration
11.2 Parallel axis theorem
11.3 Moments of inertia of composite areas

12.0 Kinematics of a particle (3 Hrs)
12.1 Rectilinear and curvilinear motion
12.2 Uniformly accelerated motion
12.3 Projectile motion
12.4 Rectangular, normal and tangential components of acceleration

13.0 Kinetics of a Particle (3 Hrs)
13.1 Newton's laws and equations of motion
13.2 Applications using rectangular or normal and tangential components
13.3 Principle of work and energy
13.4 Work, power and efficiency
13.5 Linear impulse and momentum
13.6 Angular impulse and momentum

14.0 Planar Kinematics of a Rigid Body (4 Hrs)
14.1 Translation, rotation and general plane motion
14.2 Relative velocity and acceleration analysis
14.3 Applications: rigid bodies, simple mechanisms and linkages

15.0 Force Analysis for Rigid Bodies (4 Hrs)
15.1 Equations of motion
15.2 Need for moment of inertia
15.3 Translation, pure rotation and general plane motion
15.4 Constrained motion in a plane

16.0 Principle of Work and Energy for Rigid Bodies (3 Hrs)
16.1 Kinetic energy
16.2 Potential energy; gravitational forces and elastic elements
16.3 Conservative and non-conservative systems
16.4 Work by external forces; applied loads, frictional force

17.0 Linear and Angular Impulse and Momentum for Rigid Bodies (3 Hrs)
17.1 Conservative of linear and angular momentum
17.2 Impulse motion and eccentric impact

Reference Books:

1.0 F. P. Beer & E. R. Johnson, "Vector Mechanics for Engineers, Statics and Dynamics", Third Edition, McGraw-Hill
2.0 R. C. Hibbeler, "Engineering Mechanics, Statics and Dynamics", Fifth Edition, MacMillan Publishers, New York.
3.0 F. P. Beer & E. R. Johnson, "Mechanics of Materials", McGraw Hill, 1981.