Combined First and Second Semester B.Tech. Degree Examination, May 2011
(2008 Scheme)
08 – 105 : ENGINEERING MECHANICS
(CMNPHEtarufb)

Time: 3 Hours

Max. Marks: 100

PART – A

Answer all questions under Part A. Each question carries 5 marks.

1. State and explain principle of transmissibility of a force.

2. Define the resultant and equilibrant of coplanar concurrent force system in space.

3. Define couple of a force and explain the properties of a couple.

4. Define moment of inertia of areas. How will locate the centroid of a semicircular area of radius R.

5. Explain the instantaneous centre of rotation. What is its usefulness in Kinematics?

6. Define relative velocity. How will you find out the relative velocity of two bodies moving away from a fixed point, their directions of motions being \( \perp \) to each other?

7. Explain the terms: 
   i) Free vibration and forced vibrations
   ii) Centrifugal force and centripetal forces.

8. Define simple harmonic motion and derive the relation existing there in between acceleration and displacement at any time.
PART – B

Answer any 2 questions from each Module. Each question carries 10 marks.

MODULE – I

9. Two identical rollers, each of weight 500 N, are supported by an inclined plane making an angle of 30° to the horizontal and a vertical wall. Assuming smooth surfaces, find the reactions at the supports.

10. A 5 m bar of negligible weight rests in a horizontal position on the smooth planes as shown in fig. Determine the load P and reactions at the supports.

11. A ladder 6 m long weighing 300 N is resting against a wall at an angle of 60° to the horizontal. A man weighing 750 N climbs the ladder. At what portion along the ladder from the bottom does he induce slipping? The coeff. of friction for both the wall and the ground with the ladder is 0.2.
12. Find the moment of inertia about the centroidal X-X and Y-Y axis of the given Z section.

13. In a crank and connecting rod mechanism, the crank and connecting rod are 30 cm and 150 cm long respectively. If the crank RPM is 300, find the velocity of piston when the crank is turned to 30° from inner dead centre.

14. Two bodies of weights 60 N and 40 N are connected to the two ends of a light inextensible string, which passes over a smooth pulley. The weight 60 N is placed on a smooth inclined plane of angle of inclination of 10°, while the weight 40 N is hanging free in air. Determine (i) acceleration of the system and (ii) tension in the string.

MODULE – III

15. An engine attains a velocity of 30 Km/h in 2 min from rest in a train of 200 KN weight on a level line. If the resistance is 5 N/KN, find the greatest horse power the engine is developing and also the greatest velocity, it can attain if this power is maintained.

16. Two masses of 120 kg and 50 kg are supported by a rope passing over the pulley. The mass of the pulley is 60 kg. Find the tensions in the rope of both sides and the linear acceleration. Neglect the weight of the rope and consider the pulley as solid disc.

17. At the ends of three successive seconds, the distances of the moving point with simple harmonic motion from its mean position measured in the same direction are 1 m, 5 m and 5 m. Find the period of oscillation.