

Code.No: R05010302

R05

SET-1

I B.TECH – EXAMINATIONS, DECEMBER - 2010
ENGINEERING MECHANICS
(COMMON TO ME, MCT, MMT, MEP, AE, AME)

Time: 3 hours**Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

- - -

- 1.a) Explain the following terms:
 i) Mass, ii) Continuum, iii) Rigid body, iv) Particle.
- b) If three concurrent forces are acting on a body which are in equilibrium, then prove that the resultant of the two forces should be equal and opposite to the third force. [8+8]
- 2.a) What is a wedge? Explain how a wedge is used to raise heavy loads.
- b) A square threaded screw jack has a pitch of 1 cm and a mean diameter of 7.5 cm. The mean diameter of the bearing surface between the cap and the screw is 9 cm. The coefficient of friction between all surfaces is 0.10. What force is required at the end of a lever 90 cm long to raise a load of 40 kN? [6+10]
- 3.a) Derive an expression for the ratio of belt tensions for a flat belt passing over a pulley when it is just on the point of slipping.
- b) Find the maximum power transmitted and initial tension in a flat belt 8 mm thick and 100 mm wide. The belt transmits power between two pulleys running at 31.67 m/s. The angle of lap of smaller pulley is 165° and the coefficient of friction between the belt and pulley is 0.3. Mass of the belt is 0.9 kg per m length, and the maximum permissible stress in the belt is 2 MN/m^2 . [8+8]
- 4.a) Compare the location of the centroids of an arc of a circle and a sector of a circle subtending the same angle at the centre of the circle.
- b) From a circular area of diameter $2d$, a smaller circle of diameter d is removed. The centre of the smaller circle is at a distance of $d/2$ from that of the larger circle. Find the centroid of the remaining area. [8+8]
- 5.a) What should be the length to radius ratio, i.e. l/r of a solid cylinder such that the moments of inertia about its longitudinal and transverse axes are equal.
- b) Determine the moment of inertia of a hollow sphere of radii R_1 and R_2 , and determine the radius of gyration of a solid sphere. [8+8]
- 6.a) Classify the following motions as translation, rotation, plane motion, or space motion:
 - (i) An aeroplane banked and taking a steady turn
 - (ii) A spinning top in unsteady motion
 - (iii) A cone sliding on a flat surface
 - (iv) A compound pendulum oscillating about the fulcrum
 - (v) A spherical ball rolling down an incline.
 - (vi) A door being shut by turning about the hinges
 Justify your answer with suitable explanation in each case.

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- b) A pulley weighs 500 N and has a radius of 0.75 m. A block weighing 400 N is supported by an inextensible wire wound round the pulley. Determine the velocity of the block 2 seconds after it is released from rest. Assume the motion is under constant acceleration. [10+6]
- 7.a) Define “Work”, “Power”, and “Energy”.
- b) A mine cage weighs 12 kN and can carry a maximum load of 20 kN. The average frictional resistance of the side guides is 500 N. What constant cable tension is required to give a loaded cage an upward velocity of 3 m/s from rest in a distance of 3 m? [6+10]
- 8.a) Differentiate between simple pendulum and compound pendulum.
- b) A solid Aluminium sphere of 50 cm diameter is attached to the lower end of a 10 m long Aluminium rod of 5 cm diameter, the upper end of which is fixed. Find the period of this pendulum. Take $G = 24 \times 10^9 \text{ N/m}^2$ and $\rho = 27000 \text{ kg/m}^3$ for Aluminium. [6+10]

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