Printed Pages : 8 EME-102

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 4301 Roll No. | | | | | | | | | | |

B. Tech.

(Semester-I) Theory Examination, 2012-13

ENGINEERING MECHANICS

Time : 3 Hours] *[Total Marks : 100*

Note : Attempt questions from each Section as per instructions. Assume missing data if any.

Section-A

Attempt *all* parts of this question. Each part carries 2 marks. 2×10=20

1. (a) With the help of neat sketch explain the principle of transmissibility.

   (b) What are the different types of parallel forces? Explain in brief.

   (c) State Varignon's theorem with mathematical equation.

(d) What are statically determinate and statically indeterminate beams?

(e) State parallel axis theorem and perpendicular axis theorem.

(f) What do you mean by polar moment of inertia?

(g) Differentiate between Kinematics and Kinetics.

(h) State D'Alembert's principle and its use.

(i) What do you understand by the term 'neutral axis and neutral surface'?

(j) State the assumptions made in theory of pure torsion.

Section-B

Attempt any *three* parts of this question. Each part carries 10 marks. $10 \times 3 = 30$

2. (a) (i) State and prove Varignon's theorem.

(ii) Determine the magnitude, direction and position of resultant force for a system of forces acting on 5 m square lamina as shown in Fig. 1.

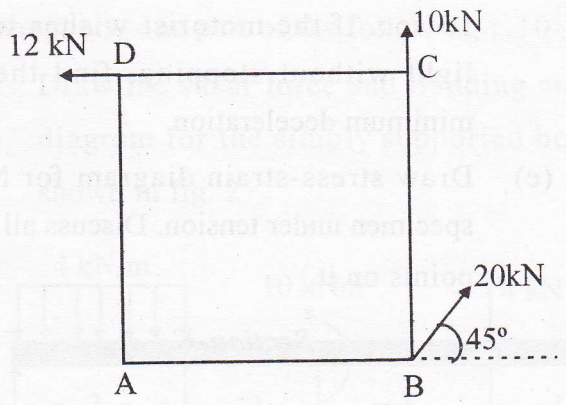

Fig. 1

(b) A man climbs on a 5 m long ladder. The ladder makes an angle of 60° from the horizontal. The other end of the ladder is supported on a vertical wall. The coefficient of friction between the ladder and wall is 0.2 and between the ladder and floor is 0.3. The weight of ladder and man are 150 N and 800 N. How far can the man climb on the ladder.

(c) Derive expression of mass moment of inertia for a sphere about its centroidal axis.

(d) A motorist is driving his car at 90 km/hr. He observes red light 200 m ahead turns red. The traffic light is timed to remain red for

15 sec. If the motorist wishes to pass the light without stopping, find the required minimum deceleration.

(e) Draw stress-strain diagram for Mild Steel specimen under tension. Discuss all significant points on it.

Section-C

Attempt *all* questions of this Section. Each question carries 10 marks. $10 \times 5 = 50$

3. Attempt any two parts of the following : $5 \times 2 = 10$

(a) The resultant of two forces when they act at an angle 60° is 14 N. If the same forces are acting at right angles their resultant is $\sqrt{136}$ N (square root). Determine the magnitude of the two forces.

(b) With neat sketch explain the different types of support reactions and different loading systems for beam.

(c) Find the power transmitted by belt running over a pulley of 600 mm diameter at 200 rpm. The coefficient of friction between belt and pulley is 0.25, angle of wrap is 160° and maximum tension in the belt is 2.5 kN.

4. Attempt any one part of the following : $10 \times 1 = 10$

(a) Draw the shear force and Bending moment diagram for the simply supported beam as shown in fig. 2

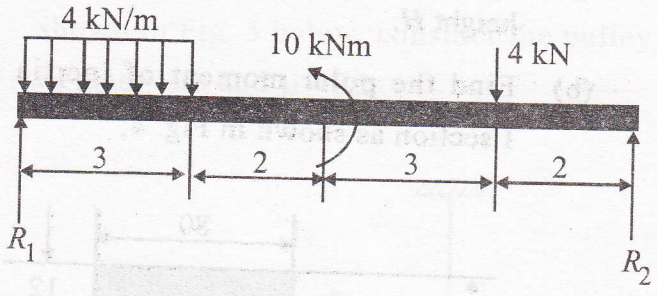

Fig. 2

(b) Find the forces in member AD, CD and AE of a truss as shown in Fig. 3 by method of section.

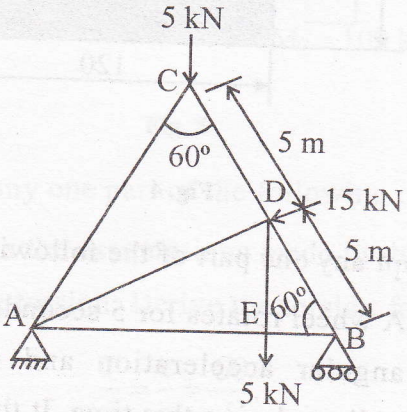

Fig. 3

5. Attempt any one part of the following : $10 \times 1 = 10$

(a) Derive an expression for mass moment of inertia of right circular solid cone about its axis of rotation having base radius R and height H.

(b) Find the polar moment of inertia for the I section as shown in Fig. 4.

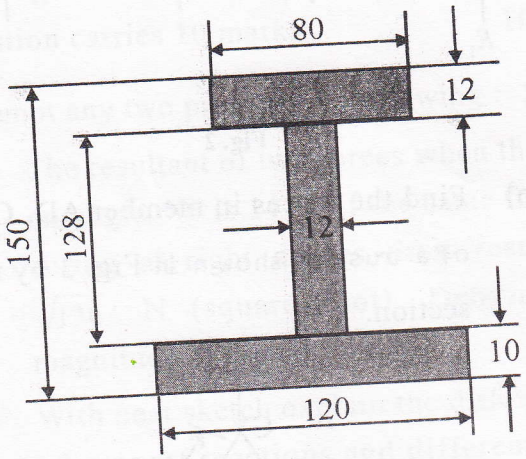

Fig. 4

6. Attempt any one part of the following : $10 \times 1 = 10$

(a) A wheel rotates for 5 seconds with constant angular acceleration and describes 100 radians during this time. It then rotates with

constant angular velocity and during next 5 seconds describes 80 radians. Find initial angular velocity and angular acceleration.

(b) Determine the acceleration of the blocks and tension in the string for system given shown in Fig. 5 below, consider the pulley as mass less and $\mu = 0.2$.

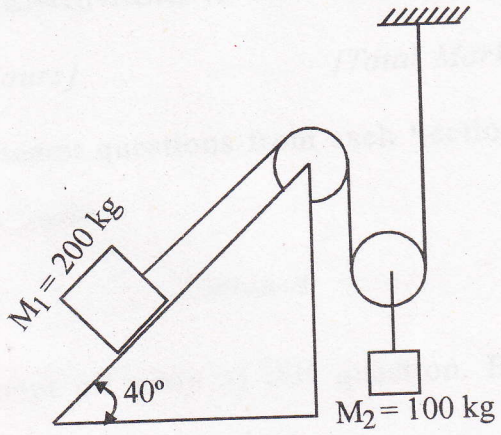

Fig. 5

7. Attempt any one part of the following : $10 \times 1 = 10$

(a) State the assumptions made in the theory of pure torsion. Derive the torsion formula :

$$\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{l}.$$

(b) A rectangular beam 300 mm deep is simply supported over a span of 4 meters. Determine the uniformly distributed load per meter which the beam may carry, if the bending stress should not exceed 120 N/ mm^2. Take $I = 8 \times 10^6 \, mm^4$.