



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

**PAPER ID : 199119**

Roll No.

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## B. Tech.

(SEM. I) (ODD SEM.) THEORY  
EXAMINATION, 2014-15  
ENGINEERING MECHANICS

Time : 3 Hours]

[Total Marks : 100

- Note :
- (1) This question paper consists of 3 sections. Section –A carries 20 marks, Section –B carries 30 marks and Section –C carries 50 marks.
  - (2) Attempt all questions. Marks are indicated against each question.
  - (3) Assume missing data suitably if any.

### SECTION - A

1. Answer all the following parts: 10×2=20
  - (a) State Newton's second law of motion and establish mathematical relationship.

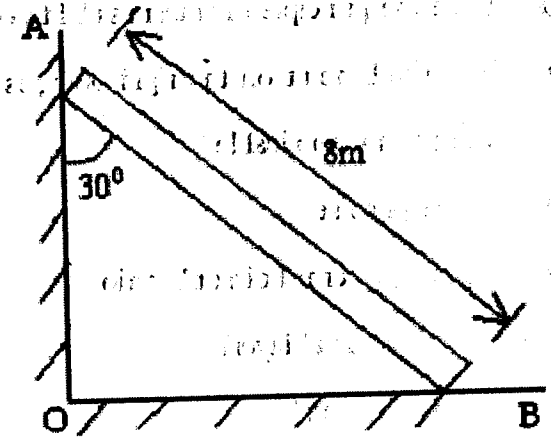
- (b) Define static equilibrium of a body.
- (c) What is meant by coefficient of static friction?
- (d) What do you mean by angle of repose?
- (e) State the principle of transmissibility of a force.
- (f) For which point on the rigid body, is the Newton's second law applicable?
- (g) Define impulse.
- (h) Define the term Poisson's ratio.
- (i) What is neutral layer?
- (j) Define "Torsion".

### SECTION - B

2 Attempt any Three parts of the following  $3 \times 10 = 30$

- (a) An 8m long uniform ladder weighing 500N is resting on a rough horizontal floor and inclined at an angle of  $30^\circ$  with a vertical wall. A man weighing 750N climbs the ladder. At what position will he induce slipping?

The coefficient of friction between the ladder and the wall is 0.3 and that between the ladder and the floor is 0.2.



- (b) A simply supported beam of 16 m effective span carries the concentrated loads of 4 kN, 5kN and 3kN at distances 3m, 7m, and 11m respectively from the left support. Draw the Shear force and bending moment

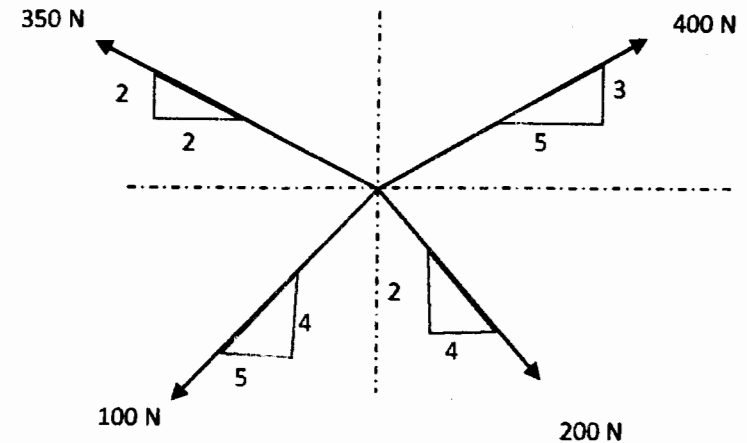
diagrams.

- (c) From a rectangular sheet of metal ABCD, in which  $AB = 40$  cm and  $BC = 60$  cm, a triangular piece ABX is removed, such that  $AX = BX = 25$  cm. Calculate the distance of center of gravity of the remainder.

- (d) A horizontal bar 1.5 m long and of small cross section rotates about vertical axis through one end. It accelerates uniformly from 1200 rpm to 1500 rpm in an interval of 5 seconds. What is the linear velocity at the beginning and end of the interval? What are normal and tangential components of acceleration of the mid point of the bar after 5 seconds after the acceleration begins?
- (e) The extension of a bar uniformly tapering from " $d_1$  to  $d_2$ " in a length  $L$ . Calculate by treating it as a bar of uniform cross section of average diameter " $d$ ". What is the percentage error?

## SECTION - C

3. Attempt any TWO parts of the following:  $2 \times 10 = 20$
- (a) Determine the resultant of four forces concurrent at the origin as shown in figure.



- (b) Two forces equal to  $2P$  and  $P$  act on a particle. If the first force be doubled and the second force is increased by 12 kN, direction of their resultant remain unaltered. Find the value of  $P$ .
- (c) A body weighing 300 N is resting on a rough horizontal table. A pull of 100 N is applied at an angle of  $15^\circ$  with the horizontal to just cause the body to slide over the table. Find normal reaction and the coefficient of friction.

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

- (a) A horizontal beam AB of length 8 m is simply supported at A and B. It carries UDL of 3 kN/m over the entire span and a clockwise moment of 12 kNm is applied in the plane of beam at a point C, 5 m from A. Determine the position and magnitude of maximum bending moment.
- (b) State and explain the Method of Joints to calculate the forces in each member of a truss.

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

- (a) Derive an expression for mass moment of inertia of a circular lamina about the centroidal axis.
- (b) Derive an expression for mass moment of inertia of a circular disc of radius R and thickness 't' about its centroidal axis.

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

- (a) Two ships leave a port at the same time. The first moves in North-West direction at 50 km/hr and second at  $35^\circ$  South of West at 40 km/hr. Find the relative velocity of second ship with respect to first. Also find distance between them after 25 minutes. After what interval of time will they be 40 km apart?
- (b) A shot is fired at  $50^\circ$  elevation with velocity 100 m/s. Determine the horizontal range, vertical range and radii of curvature at the starting point as well as at highest point.