Reg. No. : | | | | | | | | | | |

Question Paper Code: 41735

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

Third Semester

Mechanical Engineering

14UME305 - ENGINEERING MECHANICS

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. If the resultant of two equal forces has the same magnitude as either of the forces, then the angle between the two forces is

   (a) 30^o (b) 60^o (c) 90^o (d) 120^o

2. Concurrent forces are those forces whose lines of action

   (a) lie on the same line (b) meet at one point
   (c) meet on the same plane (d) none of these

3. The resultant of the two forces P and Q is R. If Q is doubled, the new resultant is perpendicular to P. Then

   (a) $P = Q$ (b) $Q = R$ (c) $Q = 2R$ (d) none of these

4. How many reaction forces in the fixed support?

   (a) 1 (b) 2 (c) 3 (d) 4

5. The moment of inertia of a solid cylinder of mass 'm', radius 'r' and length 'l' about the longitudinal axis or polar axis is

   (a) $mr^2/2$ (b) $mr^2/4$ (c) $mr^2/6$ (d) $mr^2/8$

6. Moment of inertia of a circular section about an axis perpendicular to the section is

   (a) $\pi d^3/16$ (b) $\pi d^3/32$ (c) $\pi d^4/32$ (d) $\pi d^4/64$

7. The range of a projectile is maximum, when the angle of projection is

   (a) 30^o (b) 45^o (c) 60^o (d) 75^o

8. During elastic impact, the relative velocity of the two bodies after impact is _____ the relative velocity of the two bodies before impact.

(a) equal to (b) less than

(c) equal and opposite to (d) greater than

9. The maximum frictional force, which comes into play, when a body just begins to slide over the surface of the other body, is known as

(a) static friction (b) dynamic friction

(c) limiting friction (d) coefficient of friction

10. The linear acceleration (a) of a body rotating along a circular path of radius (r) with an angular acceleration of α rad / s^2, is

(a) $a = \alpha / r$ (b) $a = \alpha . r$ (c) $a = r / \alpha$ (d) none of these

PART - B (5 x 2 =10 Marks)

11. What is the difference between a resultant force and equilibrant force?

12. List out the steps to be followed to draw the free body diagram of a rigid body.

13. Define mass moment of inertia.

14. What is Impulse of force?

15. How do, at any given instant, the velocity and acceleration of different points of a rigid body vary when it undergoing translation?

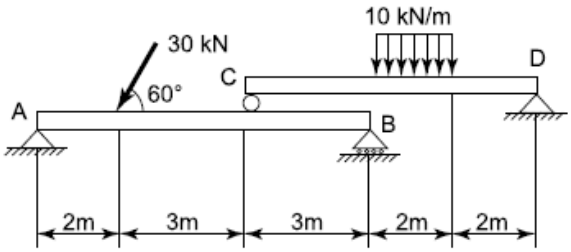
PART - C (5 x 16 = 80 Marks)

16. (a) Two forces equal to 2F and F act on a particle. If the first force be doubled and the second increased by 15 N, the direction of the resultant remains unaltered. Find the value of F. (16)

Or

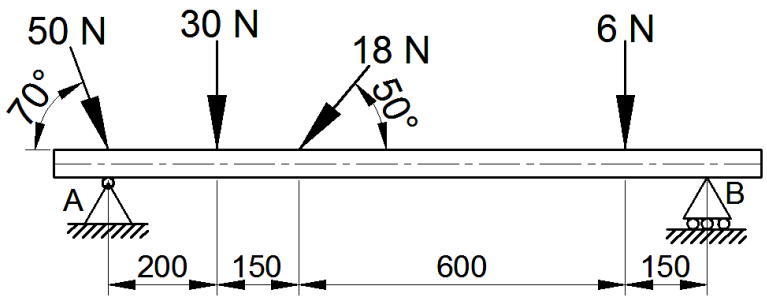
(b) Three forces are acting at point *A* (4, 6, -4). If *B* (3, 6, 2) is a point on the line of action of the force F_1 = 40 *kN*, *C* (-3, 4, -5) is a point on the line of action of the force F_2 = 50 *kN* and *D* (-5, -6, 8) is a point on the third force F_3 =60 *kN*, determine the resultant of the three forces. (16)

17. (a) Two beams AB and CD are shown in figure. A and D are hinged supports. B and C are roller supports. (i) Sketch the free body diagram of the beam AB and determine the reactions at the supports A and B. (ii) Sketch the free body diagram of the beam CD and determine reactions at the supports C and D. (16)



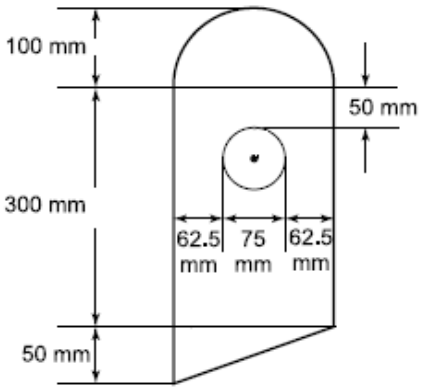
Or

(b) Find the pin reaction at *A* and the knife-edge reaction at *B*. (16)



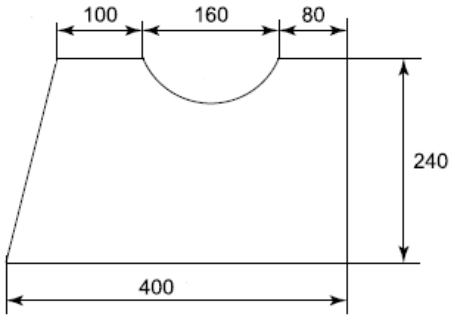
All Dimensions are in 'mm'

18. (a) Locate the centroid of the plane area shown in figure. (16)

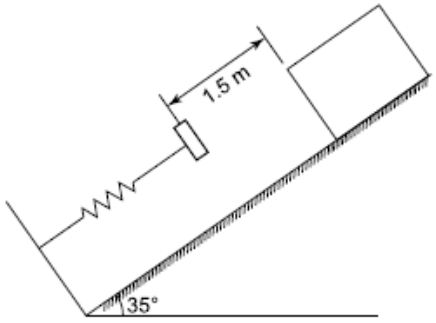


Or

(b) Find the moment of inertia of the section shown in figure, about the centroidal axes. (Dimensions in mm). (16)



19. (a) A block of mass 50 kg slides down in incline and strikes a spring 1.5m away from it as shown in figure. The maximum compression of the spring is 300mm, when the block comes to rest. If the spring constant is 1kN/m, find the coefficient of kinetic friction between the block and the plane. (16)

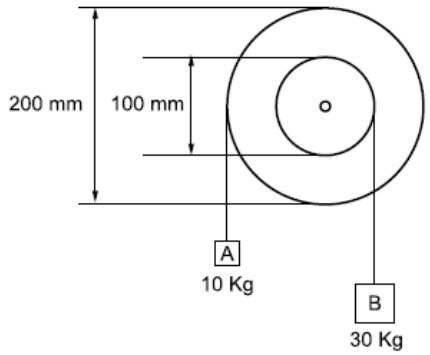


Or

(b) A ball of mass 2kg, moving with a velocity of 3m/s, impinges on a ball of mass 4kg moving with a velocity of 1m/s. The velocities of the two balls are parallel and inclined at 30^o to the line of joining their centre's at the instant of impact. If the coefficient of restitutions is 0.5, find (i) direction in which the 4kg ball will move after impact (ii) velocity of the 4kg ball after impact (iii) direction in which the 2kg ball will move after impact and (iv) velocity of the 2kg ball after impact. (16)

20. (a) Two masses of 30 kg and 10 kg are tied to the two ends of a light string passing over a composite pulley of radius of gyration as 70mm and mass 4kg as shown in figure. Find the pulls in the two parts of the string and the angular acceleration of the pulley.

(16)



Or

(b) A pull of 250N inclined at 30^o in the horizontal plane is required just to move a body kept on a rough horizontal plane. But the push required just to move the body is 300N. If the push is inclined at 30^o to the horizontal, find the weight of the body and the coefficient of friction. (16)