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

Question Paper Code: 53705

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2019

Third Semester

Mechanical Engineering

01UME305 – ENGINEERING MECHANICS

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

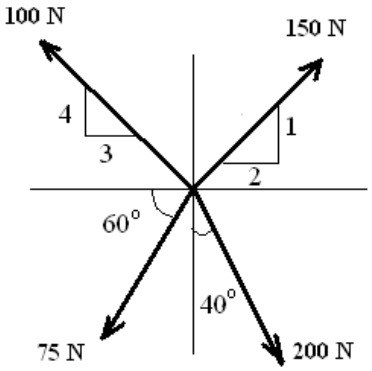
Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. A vector of magnitude 10 units is directed 30º north of east. Represent graphically and determine its components due east and north.
2. Find the magnitude and direction cosines of the resultant of two concurrent forces. $F_1 = 4i + 8j - 8k$ and $F_2 = 5i - 5j + 4K$
3. State the parallelogram law of forces.
4. Define: concurrent and coplanar forces.
5. State the theorem 1 of Pappus –Guldinus.
6. What is the relationship between area moment of inertia and mass moment of inertia?
7. State work-energy principle for a system of particles.
8. Differentiate kinematics and kinetics.
9. State laws of coloumb friction.
10. Define Limiting friction.

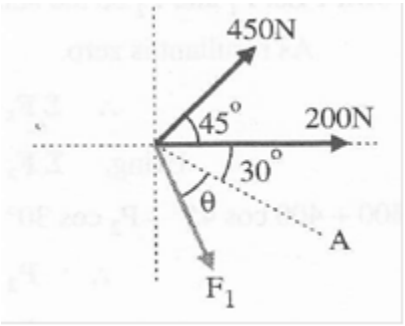
PART - B (5 x 16 = 80 Marks)

11. (a) For the system of four forces acting on a body shown in figure, determine the resultant force and its direction. (16)



Or

(b) Three forces act as shown in figure. Determine magnitude and direction θ of F, so that resultant is directed along axis A and has magnitude of 1 *kN*. (16)



12. (a) Blocks *A* and *B* of weight 200*N* and 100*N* respectively, rest on a 30° inclined plane and are attached to the post which is held perpendicular to the plane by force *P*, parallel to the plane, as shown in figure 4. Assume that all surfaces are smooth and that the cords are parallel to the plane. Determine the value of *P*. Also find the Normal reaction of Blocks *A* and *B*. (16)

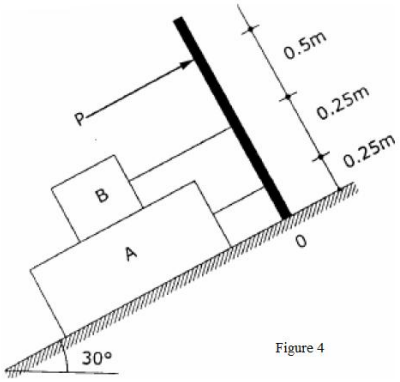
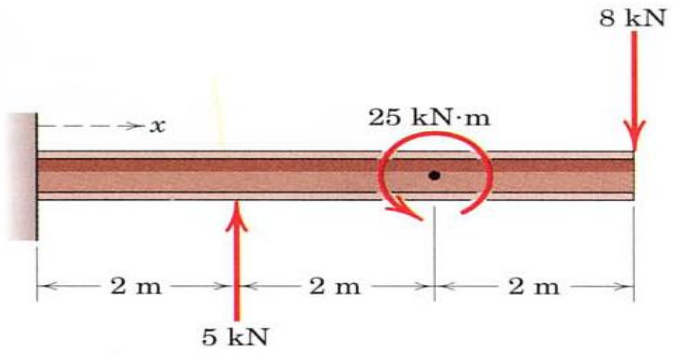


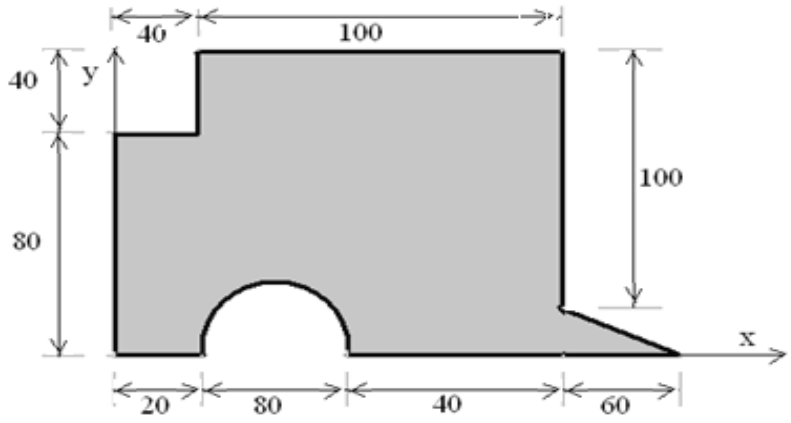
Figure 4

Or

(b) Determine and locate the resultant *R* of the two forces and one couple acting on the I-beam shown in Figure. (16)



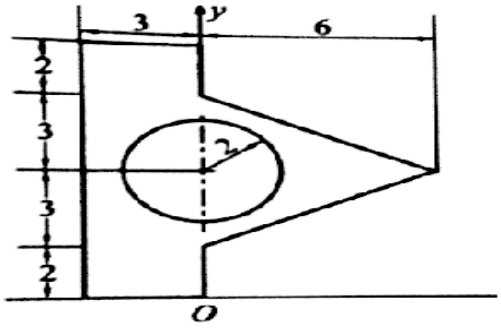
13. (a) Determine the centroid coordinates of the area shown in the figure, with respect to the shown x-y coordinate system. (16)



All dimensions are in mm

Or

(b) Locate the centroid and find the M.I about the base of the component. All Dimensions are in mm. (16)



14. (a) A bullet of mass 25 gram is moving with a velocity of 500 m/s and fired into a body of 12 kg, which is suspended by a string, fixed at top, 1 m long. The bullet gets embedded into the body and the unit (ie, bullet + body) swings through some angle. Find out the angle through which the unit swings. (16)

Or

(ii) A particle travels along a plane curve from a point *A* to a point *B*. The path length between *A* and *B* is 2 *m*. The speed of the particle is 4 *m/s* at *A* and 2 *m/s* at *B*. The rate of change of the speed is constant. (a) Find the tangential component of the acceleration when the particle is at *B*. (b) If the magnitude of the acceleration at *B* is 5 m/s^2, determine the radius of curvature of the path at *B*. (16)

15. (a) Find the force P inclined at an angle of 32° to the inclined plane making an angle of 25° with the horizontal plane to slide a block weighing 125 *kN* (i) up the inclined plane (ii) down the inclined plane, when μ = 0.5. (16)

Or

(b) Figure shows a four-bar mechanism. If the crank O_1A rotates with an angular velocity of 150 rpm in the clockwise direction, determine the angular velocities of links AB and O_2B for the position. (16)