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

## Question Paper Code: 33705

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 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. State the principle of transmissibility.
2. A vector of magnitude 10 units is directed 30º north of east. Represent graphically and determine its components due east and north.
3. State the parallelogram law of forces.
4. Define: concurrent and coplanar forces.
5. State the necessary and sufficient conditions of equilibrium for a rigid body. In particular, is the condition $\Sigma F = 0$ just necessary and sufficient as far as the equilibrium of a particle is concerned?
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. Define Limiting friction.
10. A Car traverses half of a distance with a velocity of 40 *kmph* and the remaining half of distance with a velocity of 60 *kmph*. Find the average velocity.

PART - B (5 x 16 = 80 Marks)

11. (a) The 70 *m* microwave transmission tower is steadied by three guy cables as shown in Fig 2. Cable *AB* carries a tension of 12 *kN*. Express the corresponding force on point *A* as a vector. (16)

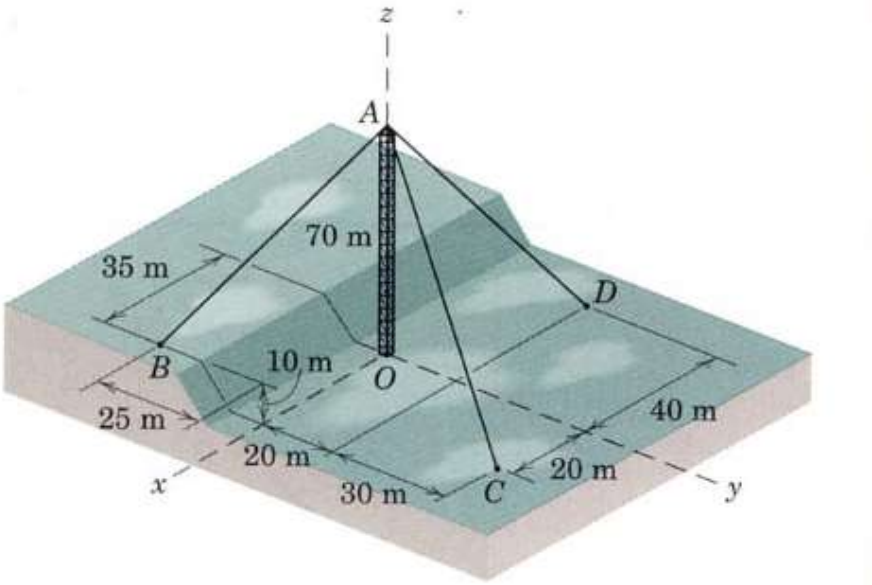
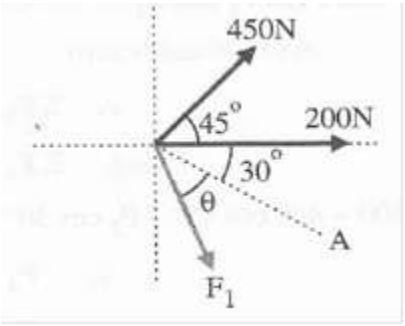



Fig.

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) A cylindrical roller has a weight of 10 *kN* and it is being pulled by a force which is inclined at 30˚ with the horizontal as shown in figure 3. While moving it comes across an obstacle of 10 *cm* height. Calculate the force required to cross this obstacle when the diameter of the roller is 70 *cm*. (16)

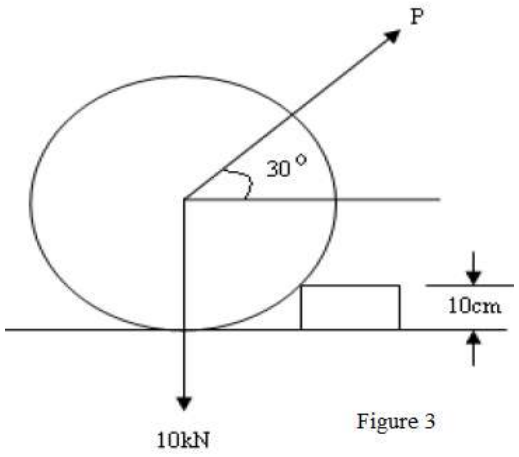
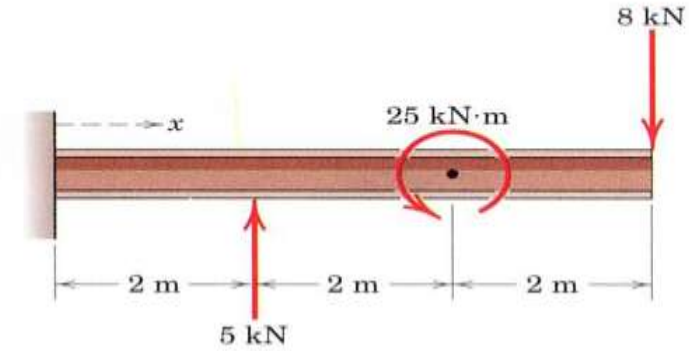


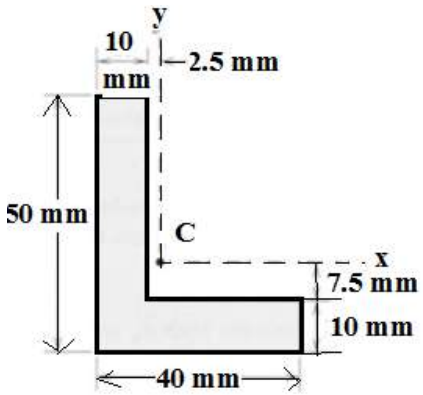

Figure 3

Or

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



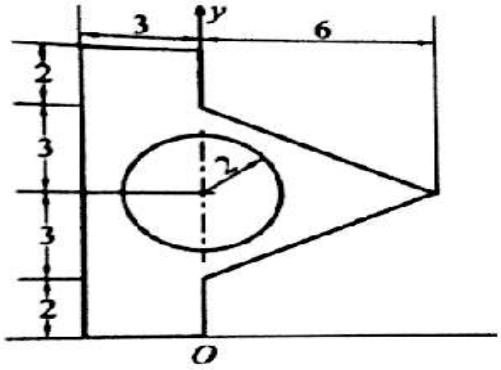

13. (a) Determine the orientation of the principal axes of inertia through the centroid of the angle section (Figure) and determine the corresponding maximum and minimum moments of inertia. (16)




Figure

Or

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




14. (a) The position of a particle which moves along a straight line is defined by the relation $x = t^3 - 6t^2 - 75t + 40$. Where x is in meter and t in sec.
Determine:
(a) The time at which the velocity will be zero.
(b) The position and distance travelled by particle at that time.
(c) The acceleration at that time.
(d) The distance travelled by particle from t = 4 sec to t = 6 sec (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 $\mu = 0.5$. (16)

Or

(b) A flywheel has an initial velocity of 15 *rad/sec* and a constant angular acceleration of 4 $rad/sec^2$. Determine the number of revolutions it must undergo to attain an angular velocity of 20 *rad/sec*. Also find the time required. (16)