G 605

(Pages : 6)

Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

First and Second Semesters

ENGINEERING MECHANICS

(Old Scheme—Prior to 2010 Admissions—Supplementary/Mercy Chance)

[Common for all Branches]

Time : Three Hours

Maximum : 100 Marks

Assumptions, if any, may be clearly indicated.

Part A

Answer **all** *questions.*
Each question carries 4 *marks.*

1. Differentiate concurrent, parallel and general system of forces.
2. State and prove Varignon's theorem.
3. Discuss the importance of centroid and moment of inertia in Engineering field.
4. Define (i) Angel of friction ; and (ii) cone of friction.
5. List the basic assumptions made in the analysis of pin jointed truss.
6. With the help of neat sketches, explain different types of supports used in plane trusses.
7. Derive an equation for the maximum height and total time of flight when a particle is projected vertically upward from the ground with an initial velocity u = 12 m /s.
8. Explain clearly centrifugal and centripetal forces.
9. Explain moment of mementum equation for a system of particles.
10. Explain the work-kinetic energy expressions based on centre of mass.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. (a) Reduce the force acting at A into a force-couple system at point B in Figure 1.

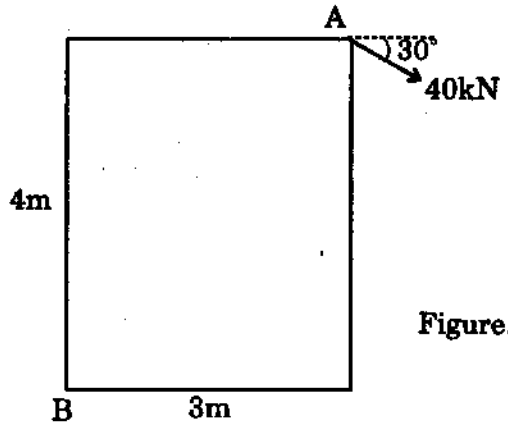


Figure. 1

(4 marks)

(b) Determine the magnitude, direction and position of the resultant of the forces acting on an equilateral triangle of side 20 cm shown in Figure 2. Locate the position with respect to the point A.

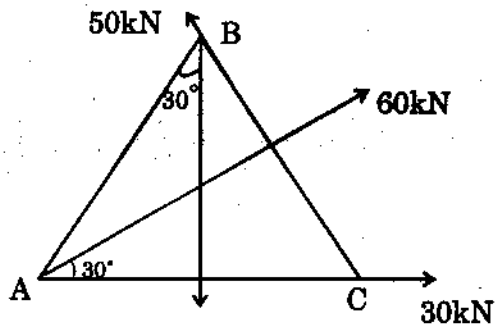


Figure. 2

(8 marks)

Or

12. (a) A concrete dam has rectangular cross-section of height h and width b and is subjected to a water pressure on one side. Determine the minimum width b of the dam if the dam is not to overturn about the point B when h = 4m. Assume density of water = 1000 kg/m^3 and the density of concrete = 2400 kg /m^3.

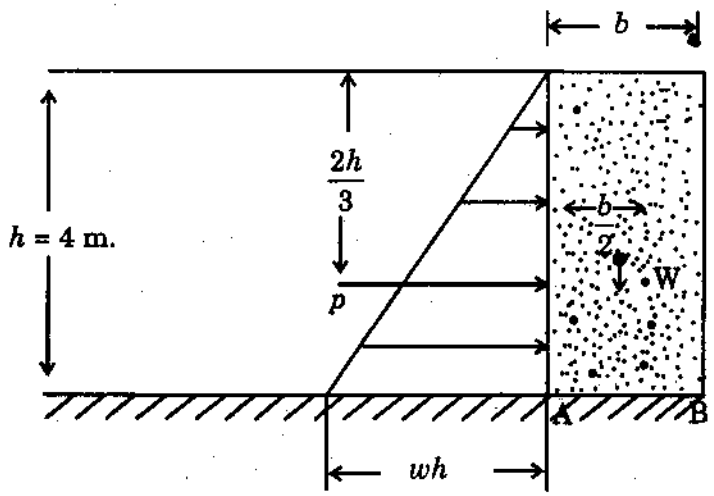


Figure. 3

(6 marks)

(b) The four coplanar forces are acting at a point as shown in Figure 4. Find the force P if the resultant of the force system is 500 N and is acting along x -axis.

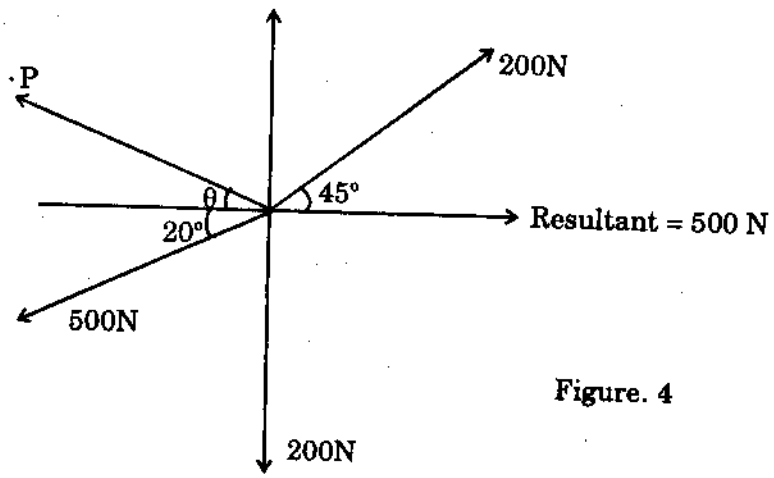


Figure. 4

(6 marks)

13. Determine the moment of Inertia of the composite section shown in Figure 5, about axis passing through the centroid.

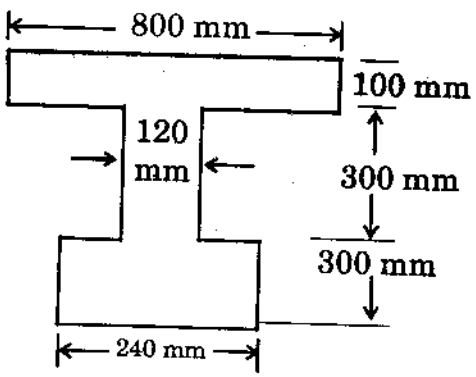


Figure. 5

Or

14. (a) For the block shown in Figure 6, determine the force P required to prevent the block moving down the plane. Take $\mu = 0.25$.

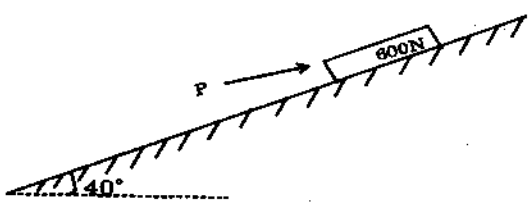


Figure. 6

(5 marks)

(b) A shaft of 5 cm diameter rests in a conical bearing of cone angle 60°. Calculate the frictional torque and the power required to rotate the shaft at 1000 r.p.m. if the axial load on the shaft is 5 kN and the coefficient of friction is 0.3. Assume the normal pressure to be uniform.

(7 marks)

15. Find the forces in the members of the truss shown in Figure 7. Indicate the nature of forces.

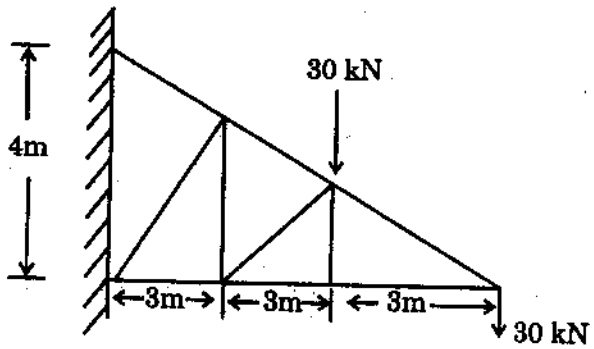


Figure. 7

16. Determine the reactions at supports for a beam as shown in Figure 8.

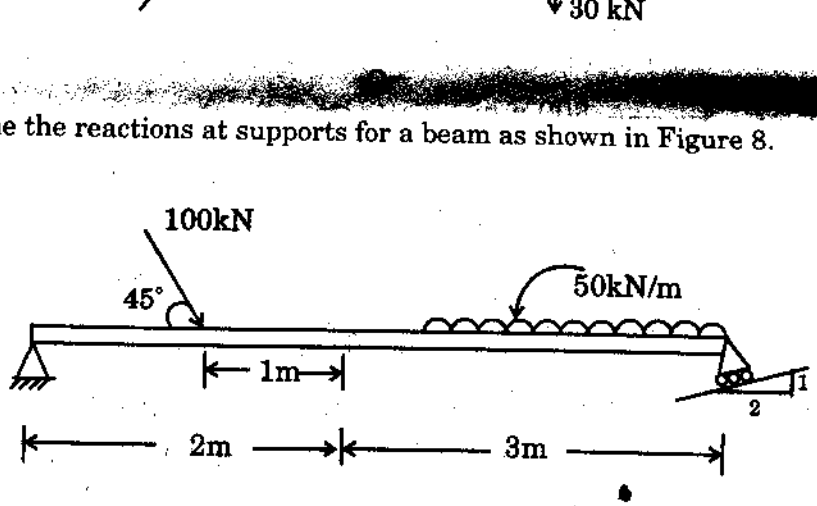


Figure. 8

17. (a) The motion of a particle moving in a straight line is given by $s = t^3 - 3t^2 + 2t + 5$, where s in meter and t is in seconds. Calculate :

(i) the velocity and acceleration after 3 sec.

(ii) maximum or minimum velocity.

(iii) time at which velocity is zero.

(6 marks)

(b) A vehicle weighing 10000 N is to turn a circular corner of radius 100m on a level road with a speed of 10m/s. The height of its CG above the road is 1 m and the distance between its wheels is 1.5 m. Find the reactions at the wheels.

(6 marks)

Or

18. (a) A curve in a speed track has a radius of 150 m. There was no lateral friction force exerted on the wheels of a car travelling at 135 km/h. Find the banking angle of the track. If a racing car stands skidding when travelling at the speed of 300 km/h, determine the coefficient of static friction between the tyres and the track.

(7 marks)

(b) A car of mass 1.2 tonnes is moving at 100 m/s. The restitution to motion is mainly due to air drag which is equal to $0.004\ v^2$. What distance will it travel before its speed is reduced to 50m/s ?

19. (a) A golf ball is dropped from a height of 10 m on a fixed steel plate. The coefficient of restitution is 0.89. Calculate the height to which the ball rebounds on the first and second bounces.

(5 marks)

(b) A man of mass 75 kg and a boy of mass 30 kg dive off the end of a boat of mass 20 kg so that their relative horizontal velocity with respect to the boat is 3m/s. Initially the boat is at rest. Find its final velocity if (i) the two dive off simultaneously ; (ii) the man dives first followed by the boy.

(6 marks)

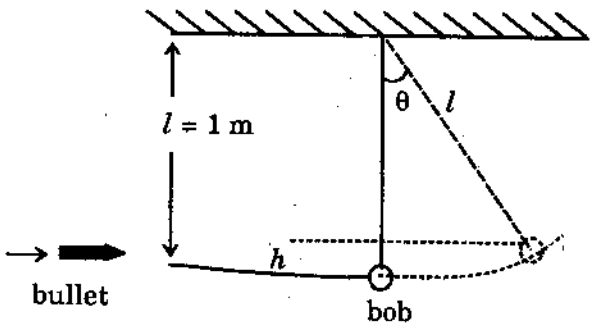
Or

20 A bullet A of mass 10 gm moving with a velocity of 100 m/s hits a bob B of a simple pendulum horizontally. Find the maximum angle through which the pendulum swings when :

(a) the bullet gets embedded in the bob.

(b) the bullet rebounds from the surface of the bob with a velocity of 20 m/s.

(c) the bullet escapes from the other end of the bob with a velocity of 20 m/s.



Assume the mass of the bob to be 1 kg. and the length of the pendulum to be 1m.

(3 × 4 = 12 marks)

[5 × 12 = 60 marks]