MODEL QUESTION PAPER

EN010 104 – ENGINEERING MECHANICS

Duration: 2 Hrs Marks: 100

Part A

(Answer all questions in two or three sentences)
(Each question carries 3marks)

1. What are the conditions of equilibrium of rigid bodies? (5x3=15marks)
2. Explain the principle of virtual work
3. Define static indeterminacy
4. Define instantaneous centre of zero velocity
5. State D'Alembert's principle

Part B

(Answer all questions)
(Each question carries 5 marks)

6. State and prove Varignon's theorem (5x5=25marks)
7. Derive the expression for the centroid of right angled triangle.
8. State laws of dry friction
9. Derive the expression for natural frequency of undamped free vibration.
10. A car of weight 20kN moving at a speed of 0.5m/s to the right collides with a car of weight 35kN which is at rest. If after the collision the second car is observed to move to the right at a speed of 0.3m/s. Determine the coefficient of restitution between the two cars.

Part C

(Each question carries 12 marks) (5x12=60marks)

11. A rigid bar AB is acted by forces as shown in Fig 1. Reduce the system into (i) a single force, (ii) Force moment system at A (iii) Force moment system at D

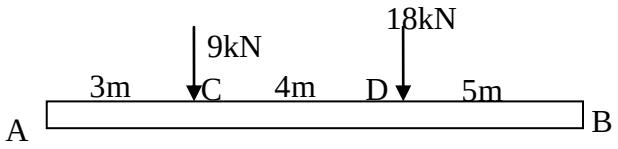

Fig 1

OR

12. A post is held vertical in position by three cable AB, AC,AD as shown in Fig2. If tension in cable AB is 40N, calculate the required tension in AC and AD so that the resultant of three forces applied at A is vertical.(Using Vector Approach)

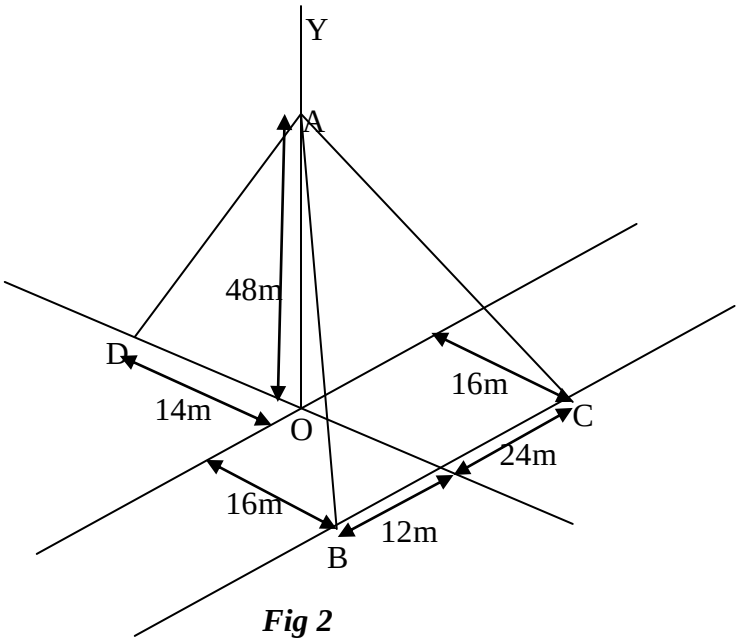

Fig 2

13. Find the moment of inertia of shaded area shown in fig 3 about centroidal axes.

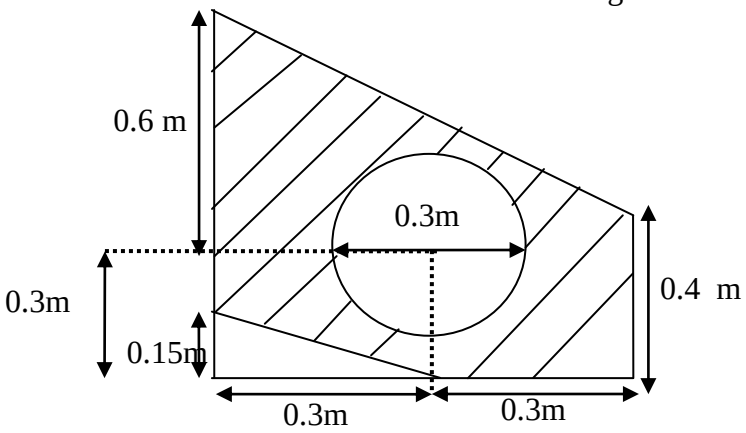

Fig 3

OR

14. A simply supported beam AB of span 10m is loaded as shown in fig 4. Calculate the reactions at A and B using principle of virtual work.

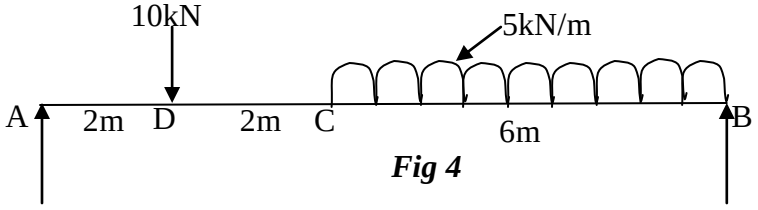

Fig 4

15. Determine the force in each member of truss as shown in fig 5.

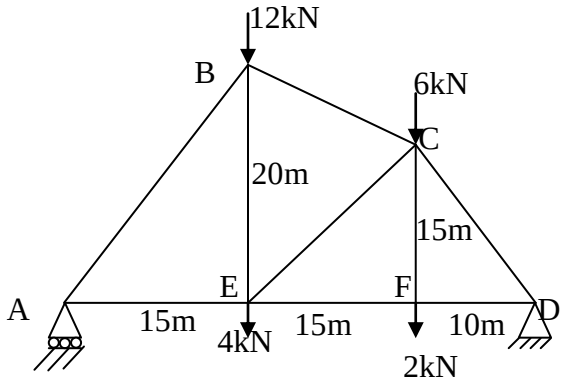

Fig 5

OR

16. Determine the support reaction at A and B in fig 6

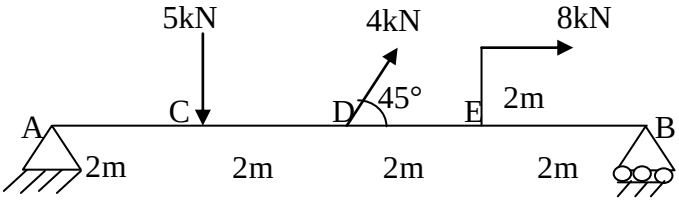

Fig 6

17. A police officer observes a motorist who is approaching at a uniform speed of 80kmph. He, in his patrol car, starts chasing it as it just crosses him. After accelerating for 8seconds at a constant rate, he attains his top speed of 120kmph. How long does it take to overtake the motorist and at what distance?

OR

18. A body of mass 50kg is suspended by two springs of stiffness 4kN/m and 6kN/m as shown in figure 7(a) , (b) and (c). The body is pulled 50mm down from its equilibrium position and released. Calculate (i) frequency of oscillation (ii)maximum velocity (iii) maximum acceleration.

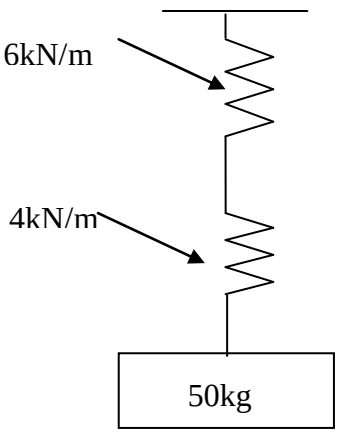

Fig 7a

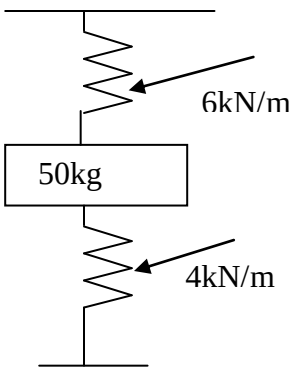

Fig 7b

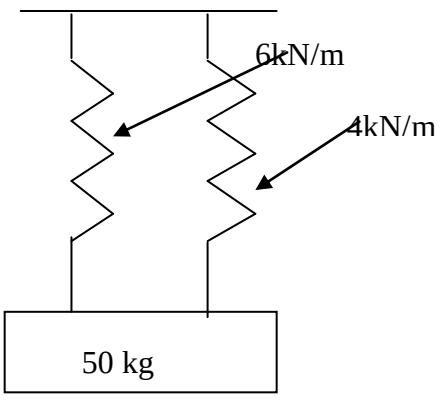

Fig 7c

19. A hammer of mass 400kg, falls through a height of 3m on a pile of negligible mass. If it drives the pile 1m into the ground, determine the average resistance of the ground per penetration.

OR

20. A train of mass 250 $x10^3$ kg starts from rest and accelerates uniformly to a speed of 81kmph in 20 seconds. The frictional resistance to motion is 20kN. Determine (i) maximum power required and (ii) the power required to maintain speed of 81 kmph.