B.E. / B.Tech. / B.Text. First & Second Semester (Common for All) (New) Summer 2022

Engineering Mechanics

1 A 3 / 2 SCT 3

P. Pages : 5 **AY - 2972**

Time : Three Hour Forty Five Minutes * 0 0 0 7 * Max. Marks : 80

Notes : 1. Answer **three** question from Section A and **three** question from Section B.
2. Assume suitable data wherever necessary.
3. Illustrate your answer necessary with the help of neat sketches.
4. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION - A

1. a) Explain resolution of single force into its two non-perpendicular components. **4**

b) On a bar AB of length 6m, two forces are acting as shown. Determine the components of forces along the bar and perpendicular to the bar. (Refer fig. 1). **4**

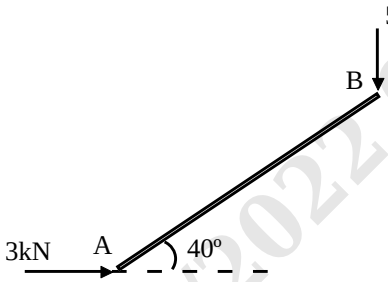


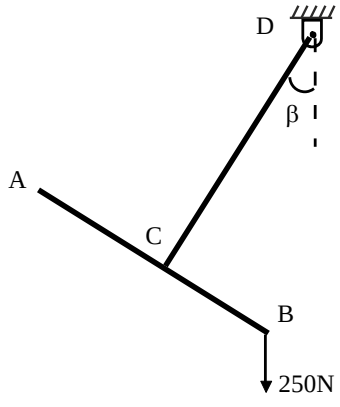
Fig.1

c) If the given forces are acting at a point as - **5**
i) 20 N inclined at 25º towards North of East
ii) 25 N towards North
iii) 30 N towards North West
iv) 35 inclined at 40º towards South of West then determine the resultant & locate it.

OR

2. a) Explain uniformly distributed load (UDL) and uniformly varying load (UVL). **4**

b) A rigid T made up of metal bar AB & CD is suspended in a vertical plane. When a load 250 N is applied at B, it takes a position as shown in fig. 2. **9**
Compute angle 'β' required for equilibrium (consider - ℓ(AB) = ℓ(CD) = 1.2 m)
(Weight of bar AB & CD are 4 kN and 3 kN respectively)



3. a) State the assumptions made in analysis of a perfect truss. **4**

b) The truss shown in fig. 3 is symmetric about Y-Y axis. Analyse it and tabulate the results. **10**

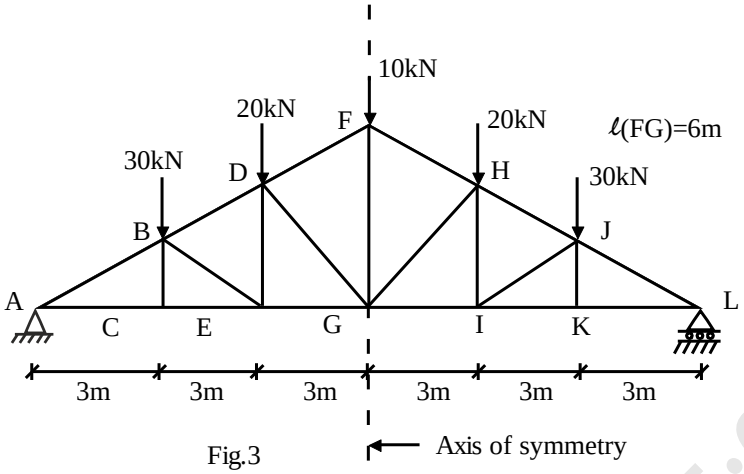


Fig.3

OR

4. a) Explain cone of friction with sketch. **4**

b) State laws of dry friction. **2**

c) Block A of 600 N is connected to weight W by means of cord passes over a drum by making 1.25 turns as shown in fig. 4. Calculate the value of w, which impends the block to right. **8**

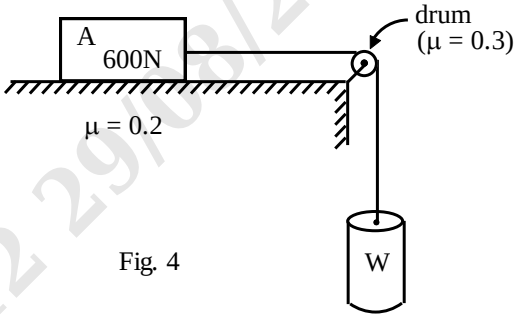


Fig. 4

5. a) Locate the centroid of the triangle using first principle. **5**

b) Compute the product of inertia of the triangular area shown in fig. 5 with respect to given x and y axes. **8**

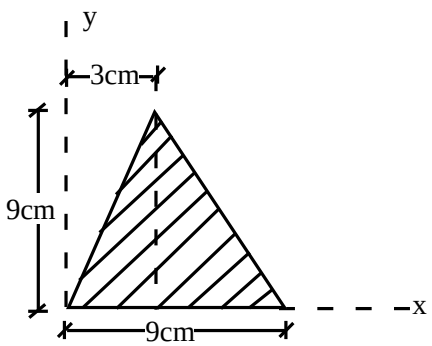


Fig.5

OR

6. a) Define the terms – **6**
i) Product of Inertia
ii) Radius of Gyration
iii) Centroid

b) Locate the centroid of shorted area shown in fig. 6 with respect to the given axes. **7**

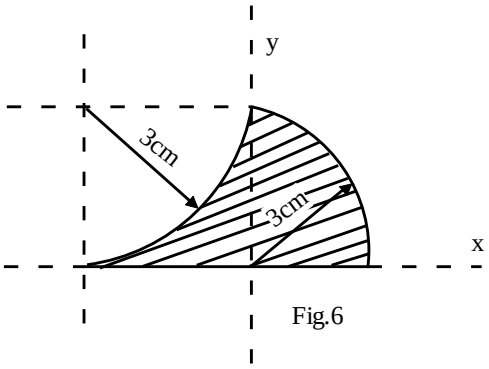


Fig.6

SECTION – B

7. a) A particle moves in X-Y plane, its position is given by - $\bar{r} = (3t)i + (4t - 3t^2)j$. Find out the radius of curvature of its path when it crosses X-Axis. **6**

b) A bullet is fired from a height of 120 m at a velocity of 360 kmph at an angle of 30º upwards. Find - **8**
i) Total time of flight
ii) horizontal range of the bullet
iii) maximum height reached by the bullet
iv) final velocity of the bullet while touching ground (Refer fig. 7)

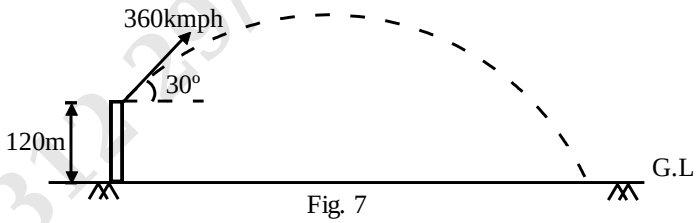


Fig. 7

OR

8. a) The velocity of a particle moving along the x-axis is defined by $V = kx^3 - 4x^2 + 6x$ where V is in m/sec & x is in meters compute the value of the acceleration when x = 2 meters and constant k = 1. **6**

b) A body is thrown vertically upwards from the ground with an initial velocity of u m/sec find out - **8**
i) Time taken to reach the maximum height
ii) The maximum height reached
iii) The time required for descending
iv) Velocity when it strikes the ground

9. a) State D'Alemberts Principle. **3**

b) Define inertia force. **2**

c) Determine the acceleration of each body in fig. 9 assuming the pulleys to be frictionless and of negligible weight. The inclined plane is smooth. **8**

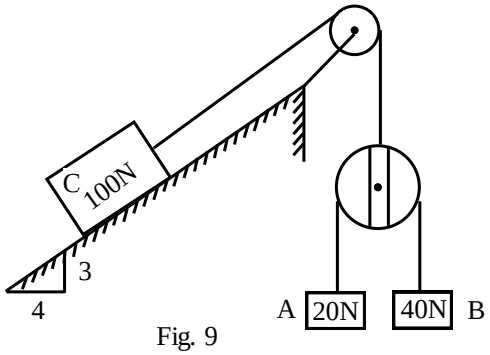


Fig. 9

OR

10. a) State general equations of kinetics for - **4**
i) Curvilinear translation ii) Rotation

b) A 2.8 m bar is bent into a right angles as shown in fig. 10. The length YZ is 1.2 m compute the acceleration of the bar, if the bar is freely pinned at X in order to maintain the bar at the given position (weight of the bar is w N/m) **9**

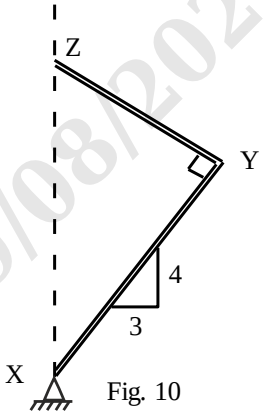


Fig. 10

11. a) The stiffness of spring is 2500 N/m. Determine the force required to compress it by an amount 500 mm. **3**

b) In fig. 11, assume the pulleys to be frictionless and of negligible weight. Find the velocity of body B after it has moved 3.2 m from rest. Also determine acceleration of body A. **10**

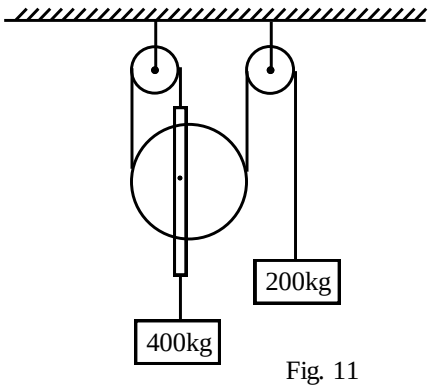


Fig. 11

OR

12. a) A bullet weighing 0.3 N moving at 600 m/sec penetrates 40 N body as shown in figure 12 (a) and emerges out with a velocity of 190 m/sec. How far and how long the block move, if the coefficient of friction $\mu_k = 0.3$. **6**

Fig. 12 (a) $\mu_k = 0.3$

b) The system shown in fig. 12 (b) is moving leftward at a velocity of 4 m/s. When a constant horizontal force P is applied as shown. Determine the value of P that will give the system a rightward velocity of 9.5 m/s in a time interval of 12 sec. **7**

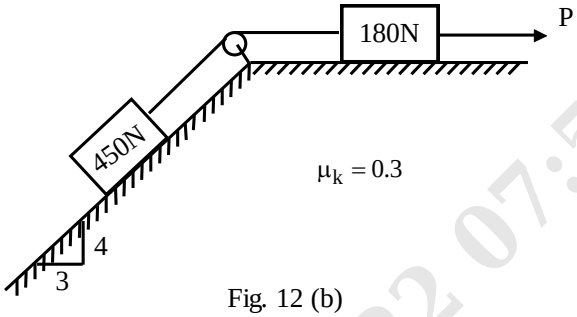


Fig. 12 (b)

****