Total No. of Questions : 6]

SEAT No. :

PF-12255

[Total No. of Pages : 8

[6624]-607
F.E. (Common)
ESC-104-CVL : Engineering Mechanics
(2024 Pattern) (Semester - I/II) (Theory)

Time : 2½ Hours] *[Max. Marks : 60*

Instructions to the candidates:

1) *All questions are compulsory.*
2) *Neat sketches must be drawn whenever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary and mention it clearly.*
5) *Use of electronic pocket calculator is allowed.*
6) *Use of cell phone is prohibited in the examination hall.*

Q1) **Write the correct option for the following multiple choice questions :**

i) The two concurrent forces having magnitude 10 KN and 20 KN, what will be angle between them if magnitude of resultant is 22.36 KN? **[2]**

a) 60 b) 30

c) 90 d) None of the above

ii) A Cantilever beam of span 10 m is loaded with point load of 10 KN in downward direction at free end, what is the moment produced at fixed end of cantilever? **[2]**

a) 10 KN m b) 5 KN m

c) 100 KNm d) None of the above

iii) A belt with coefficient of friction 0.3 can transmit a tension ratio of 1.6, The minimum angle of contact required (in degrees) is: **[2]**

a) 0 b) 90

c) 30 d) 60

iv) A car is travelling along curve that has a radius of 100 m, if its speed is 20 m /sec, what will be magnitude of normal component of acceleration? **[2]**

a) 4 b) 0.20

c) 5 d) 0.25

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v) A 1 kg ball moving at 10 m/s strikes a wall and rebounds at 6 m/s in the opposite direction, the magnitude of impulse experienced by the ball is **[2]**

a) 4 b) 10

c) 16 d) None of the above

Q2) **Solve any Two of the following :**

a) Find magnitude and direction of the resultant force with respect to origin 'O' for the concurrent force system as shown in Fig. 2 a **[5]**

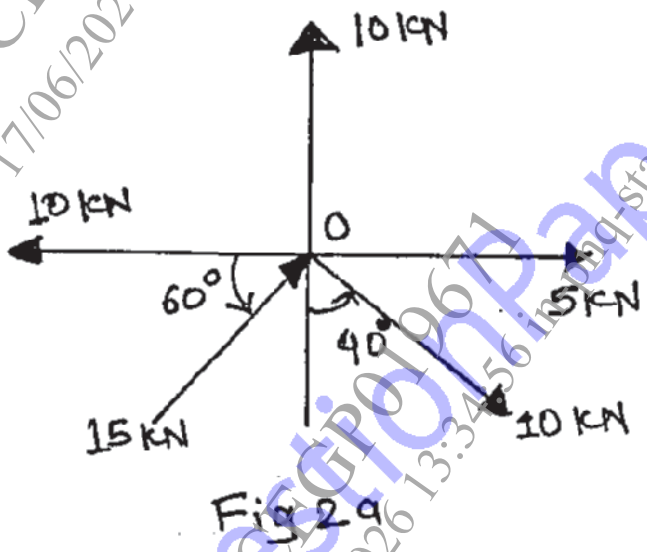


Fig 2a

b) Determine magnitude, direction and point of application of the resultant with respect to Point P for the force system shown in the Fig. 2 b **[5]**

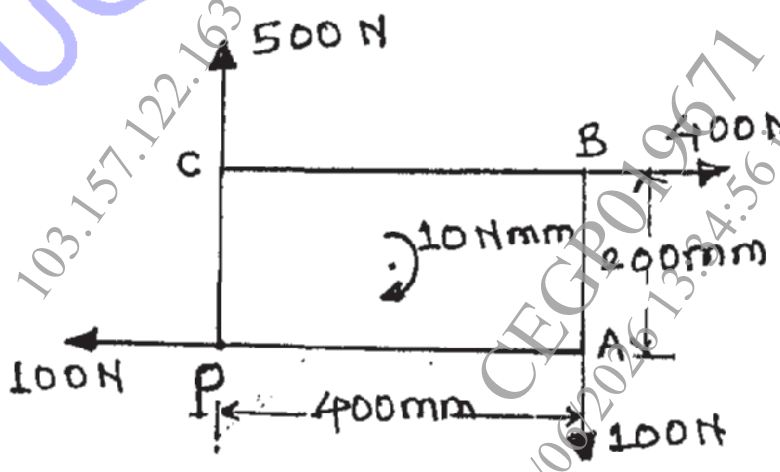


Fig 2b

c) Determine the X and Y coordinate of centroid of the shaded area as shown in Fig, 2 c **[5]**

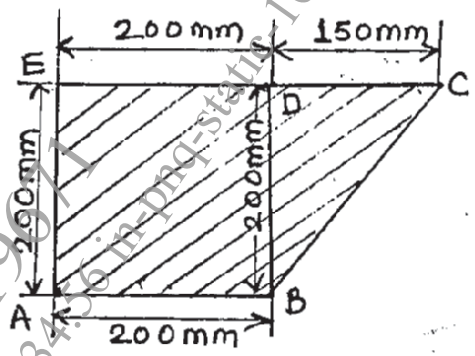


Fig 2 c

d) Determine the moment of Inertia of T section as shown in Fig. 2 d about centroidal X-X and Y-Y axis. **[5]**

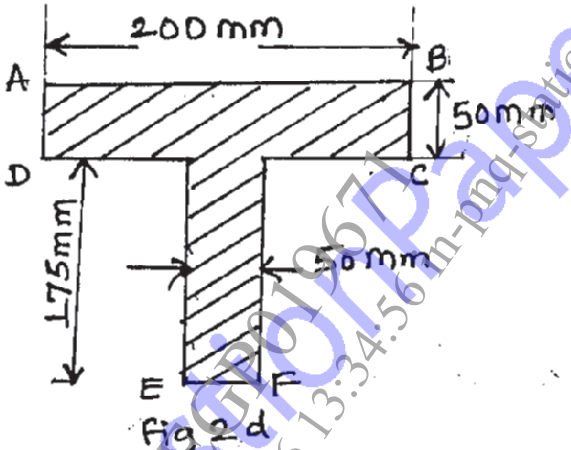


Fig 2 d

Q3) **Solve any Two of the following :**

a) An electric light fixture weighing 100 N hangs from point C by two strings AC and BC as shown in Fig 3 a , string AC is inclined at angle 60 degree to horizontal at A and string BC is at 40 degree with vertical at point C, determine forces in the string AC and BC. **[5]**

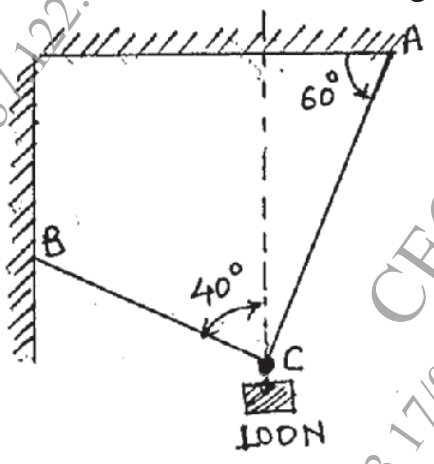


Fig. 3 a

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b) A sphere weighing 1000 N is placed as Shown in Fig. 3 b Find the reactions at the point of contacts. **[5]**

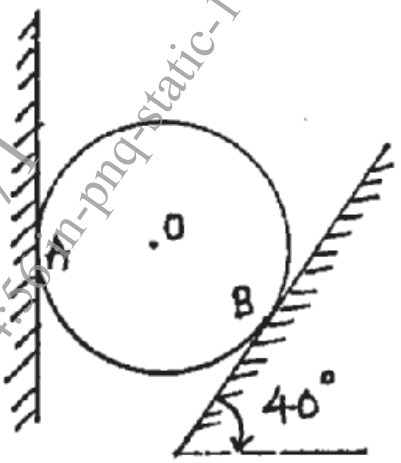


Fig. 3 b

c) Determine Support Reactions for beam loaded and supported as shown in the Fig, 3 c. **[5]**

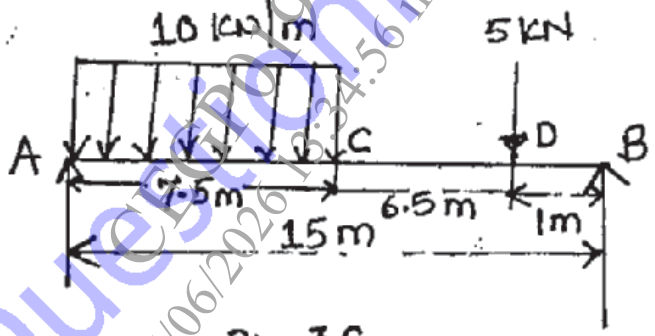


Fig 3C

d) A joist of length 5 m and weighing 100 N is raised by pulling a rope as shown in Fig. 3 d. Determine tension T induced in the rope and reaction at end A of joist. **[5]**

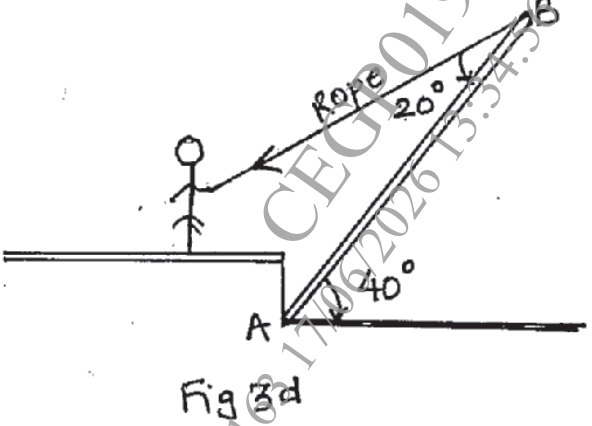


Fig 3d

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Q4) **Solve any Two of the following :**

a) Calculate force in the members FE, BE , BC of truss shown in Fig. 4 a **[5]**

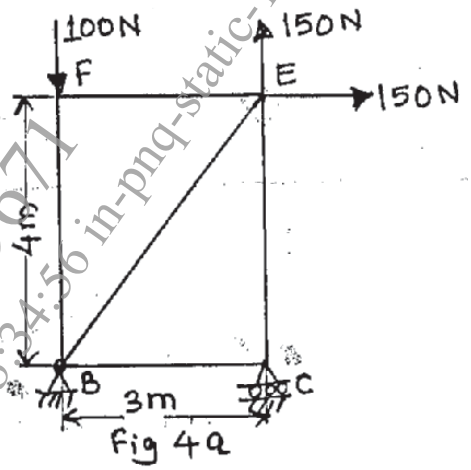


Fig 4a

b) The rod having weight 10 kg and length 5m is supported at its ends A and B as shown in Fig. 4 b, where the coefficient of static friction is 0.3 at both the ends , determine the greatest angle at end A with respect to horizontal so that rod does not slip. **[5]**

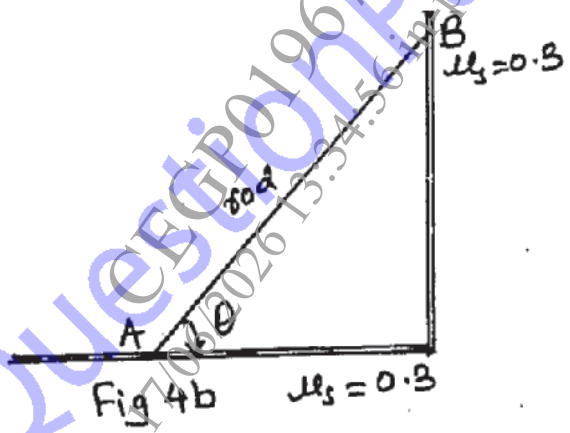


Fig 4b

c) A crate weighing 900 N is kept on horizontal plane surface and Force P making an angle of 45 degree with horizontal applied to just move the crate horizontally as shown in Fig 4 c. Find magnitude of force P required if coefficient of static friction is 0.35. **[5]**

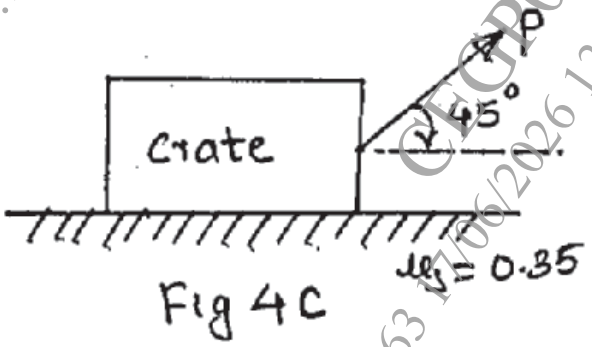


Fig 4C

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d) Analyze the Truss shown in Fig. 4 d by method of joints. **[5]**

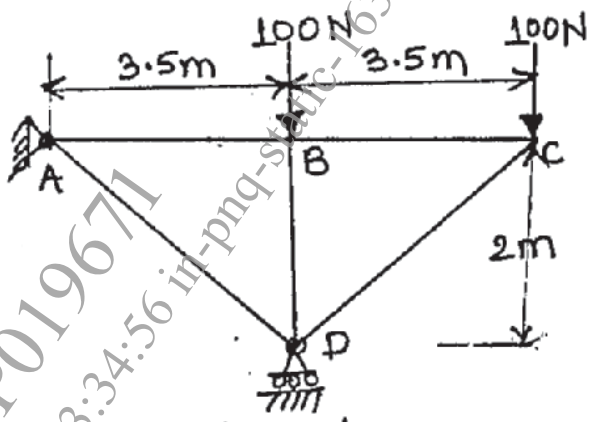


Fig 4d

Q5) **Solve any Two of the following :**

a) The motion of a particle moving along, a straight line is defined by the relation $x = 20t + 6t^2 - 12t^3$ where x is in meters and t is in second. Find **[5]**

i) The time when the particle reaches its maximum velocity.

ii) Maximum velocity of the particle.

b) A metal ball is released from top of tower having height 'h' m, it covers a vertical distance of (h/5) during its last 1.5 sec decent, find height of tower. **[5]**

c) A garden sprinkler sprays water horizontally from a nozzle at a height of h = 1.5 m above the ground. The water leaves the nozzle with a speed of 8 m/s, calculate How far (horizontal distance) the water travels before hitting the ground and also calculate the time the water is in the air. **[5]**

d) An outdoor running track 150 m in diameter, a runner increases his speed at constant rate from 5 m/sec to 8 m/sec over a distance of 25 m, determine the total acceleration of the runner 2 sec after he begins to increase his speed. **[5]**

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Q6) **Solve any Two of the following :**

a) A small block of mass 1 kg is kept on a rotating disc at a radial distance of 10mm from center of rotation as shown in Fig 6 a, If the coefficient of friction between the block and surface of disc is 0.3. Find the rotational speed 'ω' at which block will slide. **[5]**

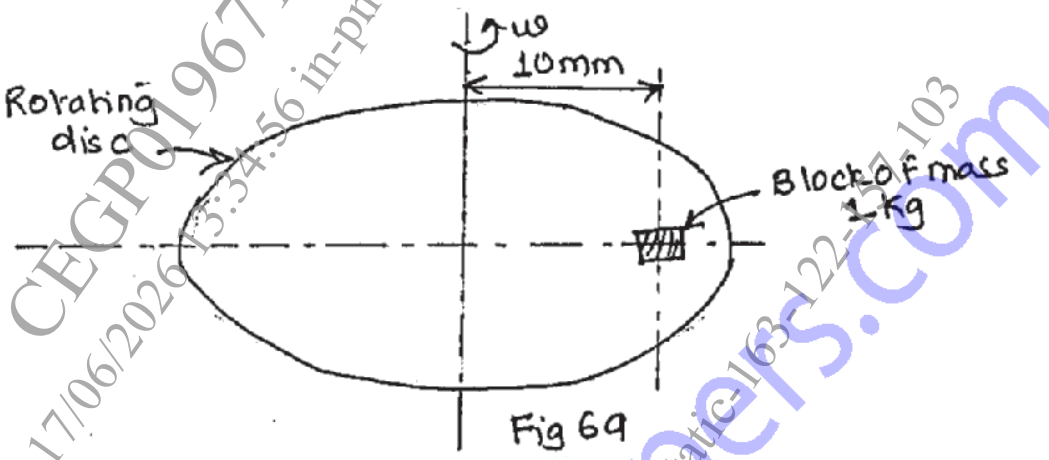


Fig 6a

b) The 100 Kg crate rest on inclined plane as shown in Fig. 6 b, which has coefficient of kinetic friction is 0.2. If the crate does not tip over when it is subjected to a 500 N force. Determine the velocity of the crate in 10 sec starting from rest. **[5]**

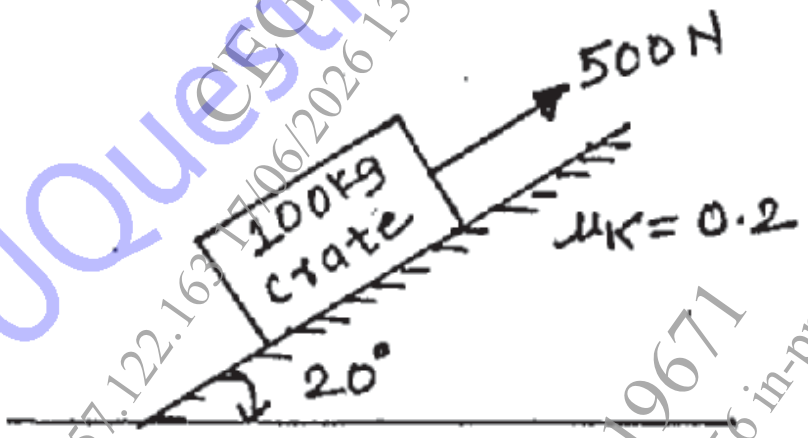


Fig 6b

c) A man having 70 kg mass standing in an elevator which has downward acceleration of 8 m/sec^2 starting from rest determine work done by man's weight and work of normal force which floor exert on man when elevator descends by 10 m. **[5]**

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d) Two blocks approaching each other along smooth surface along the same line as shown in Fig 6 d, After impact velocity of B is observed to be 3 m/sec towards right determine coefficient of restitution. **[5]**

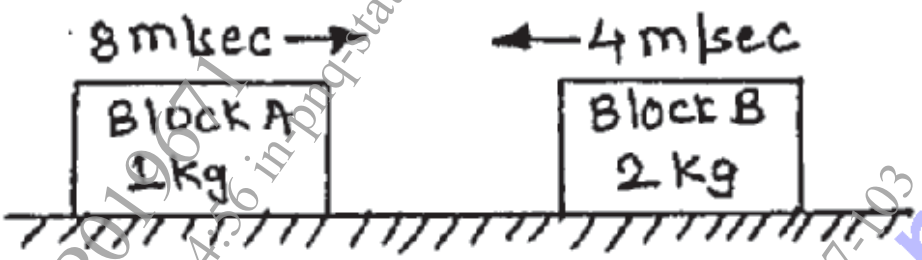


Fig 6d

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