

Total No. of Questions : 6]

[Total No. of Printed Pages : 4

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F. E. (Semester - II) Examination - 2010

ENGINEERING MECHANICS

(June 2008 Pattern)

Time : 2 Hours]

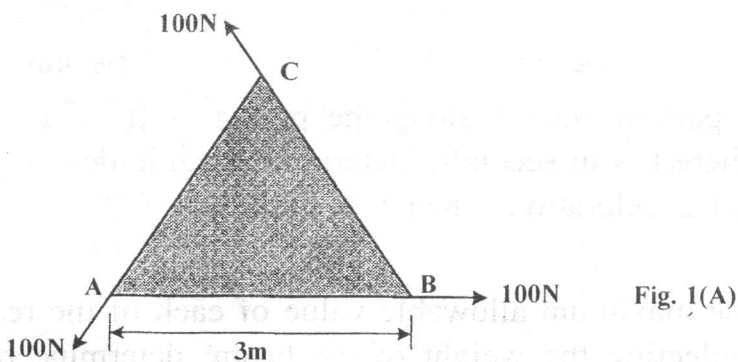
[Max. Marks : 50

Instructions :

- (1) Attempt Q. 1 or Q. 2, Q. 3 or Q. 4 and Q. 5 or Q. 6.
- (2) Answer should be written in **one answer book**.
- (3) Figures to the right indicate full marks.
- (4) Neat diagram must be drawn wherever necessary.
- (5) Use of cell phone is prohibited in the examination hall.
- (6) Use of electronic non-programmable pocket calculator is allowed.
- (7) Assume suitable data, if necessary.

Q.1) (A) Three forces of magnitude 100N each are acting along the sides of an equilateral triangle as shown in **Fig. 1(A)**. Determine resultant in magnitude and direction with reference to point A. [06]

(B) A sphere is fired into a medium with an initial velocity of 27 m/s. If it experiences a deceleration $a = (-6t) \text{ m/s}^2$, where t is in second, determine distance travelled before it stops. [06]

OR
1

- Q.2) (A)** Determine position of the centroid C of the shaded area which is part of the circle having a radius r . Refer **Fig. 2(A)**. [06]
- (B)** Block A of weight 100N is resting on block B of weight 150N. The coefficients of static and kinetic frictions at all contact surfaces are $\mu_s = 0.4$ and $\mu_k = 0.3$ respectively. Determine acceleration of each block, if block A is pushed horizontally with a force : (a) $F = 30\text{N}$, (b) $F = 250\text{N}$. [06]

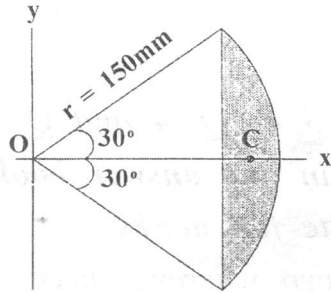


Fig. 2(A)

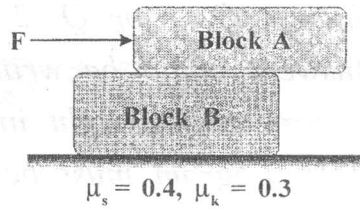


Fig. 2(B)

- Q.3) (A)** If rope BC fails when the tension becomes 50 kN, determine greatest vertical load F that can be applied to the beam AB. Also determine reaction components at A. Refer **Fig. 3(A)**. [06]
- (B)** The uniform concrete slab has a weight of 5500N. Determine tension in each of the three parallel supporting cables when the slab is held in horizontal plane as shown in **Fig. 3(B)**. [07]

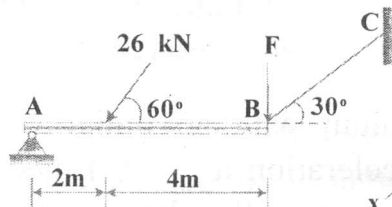


Fig. 3(A)

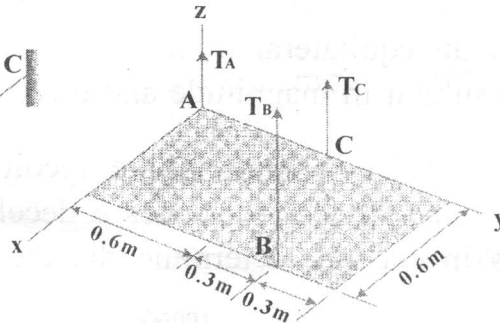


Fig. 3(B)

- (C)** A particle moves along the path $\mathbf{r} = \{(8t^2)\mathbf{i} + (t^3 + 5)\mathbf{j}\}$ m, where t is in seconds. Determine magnitudes of particle velocity and acceleration when $t = 3\text{s}$. [06]

OR

- Q.4) (A)** The maximum allowable value of each of the reactions is 360N neglecting the weight of the beam; determine range of values of distance ' d ' for which the beam is safe. Refer **Fig. 4(A)**. [07]

- (B) The cable exerts forces $F_{AB} = 100\text{N}$ and $F_{AC} = 120\text{N}$ on the ring at A as shown in **Fig. 4(B)**. Determine magnitude of the resultant force acting at A. [06]

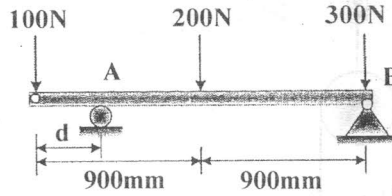


Fig. 4(A)

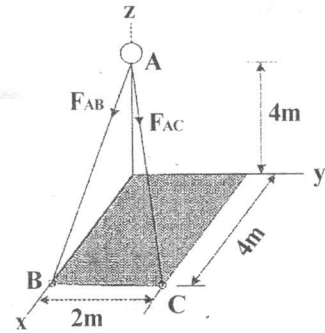


Fig. 4(B)

- (C) The bob of a 2m pendulum describes an arch of a circle in a vertical plane. If the tension in the cord is 2.5 times the weight of the bob for the position shown in **Fig. 4(C)**, find velocity and acceleration of the bob in that position. [06]

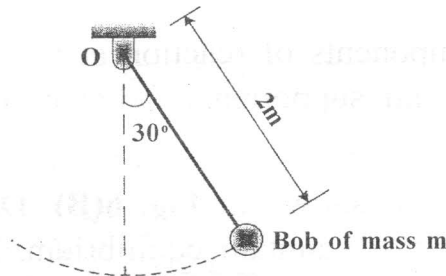


Fig. 4(C)

- Q.5** (A) Identify zero force members and determine forces in the members of the truss as shown in **Fig. 5(A)**. [07]

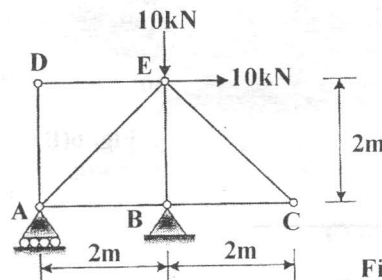


Fig. 5(A)

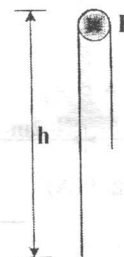


Fig. 5(B)

- (B) A cord having weight of 0.5 N/m and a total length of 10m is supported over a peg P as shown in **Fig. 5(B)**. If the coefficient of static friction between the peg and cord is $\mu_s = 0.5$, determine longest length h which one side of the suspended cord can have without causing motion. Neglect size of peg and length of cord draped over it. [06]

- (C) Block A has a weight of 300N and block B has a weight of 50N. Determine distance block A must descend from rest before it obtains a speed of 2.5 m/s. Neglect mass of pulleys and cord. [06]

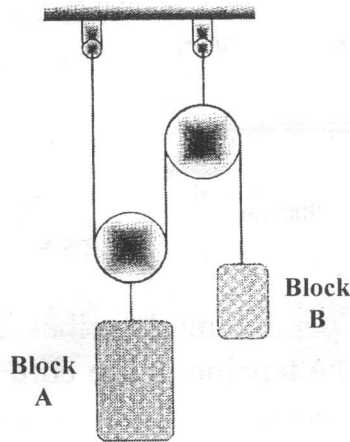


Fig. 5(C)

OR

- Q.6) (A) Determine components of reaction at pin C for the pin jointed frame loaded and supported as shown in **Fig. 6(A)**. [06]
- (B) A block of mass 150 kg is resting on a plane inclined at 30° with horizontal as shown in **Fig. 6(B)**. Determine range of an external force P to maintain equilibrium. Assume $\mu_s = 0.25$. [07]
- (C) Disk A has a mass of 250 g and is sliding on a smooth horizontal surface with an initial velocity of 2 m/s. It makes a direct collision with disk B, which has a mass of 175 g and is originally at rest. If both the disks are of the same size and the collision is perfectly elastic, determine velocity of each block just after collision. [06]

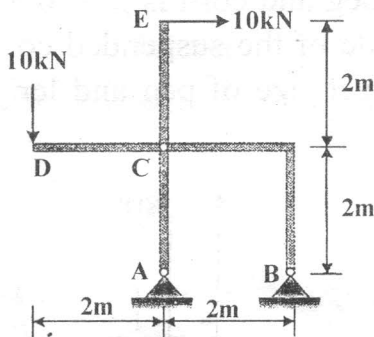


Fig. 6(A)

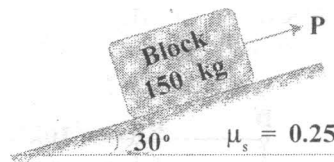


Fig. 6(B)