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NME-102

B. Tech.

(SEM. I) (ODD SEM.) THEORY EXAMINATION, 2014-15

ENGINEERING MECHANICS

Time : 3 Hours]   [Total Marks : 100

1   Attempt any four parts :   5×4=20
   a)   State the following principle
        I.   Principle of Transmissibility
        II.   Principle of work and energy
   b)   A Particle is in equilibrium under the influence of forces as shown in Fig 1. Find the unknown forces using the Lami's theorem.
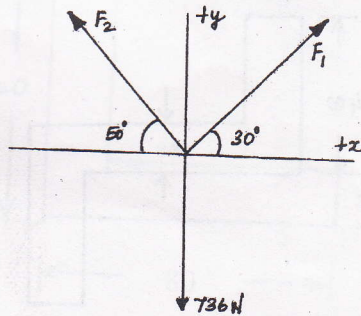

Fig 1

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c) Write short notes on free body diagram with an example
d) Determine the resultant action of a coplanar parallel force system in the given figure (Fig 2)
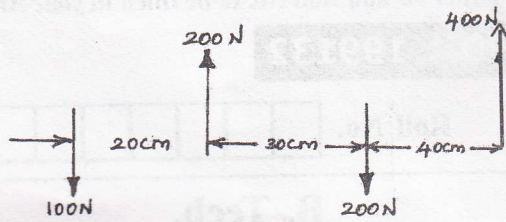

Fig 2

e) State the concept of impending motion (columb's law of dry friction)
f) What do you mean by the angle of repose? Prove the angle of repose is equal to the angle of friction.

2 Attempt any two parts :   10×2=20
a) Determine the moment of inertia of beam's cross sectional area as shown in Fig 3 about the XX and YY centroidal axes. All dimensions are in mm.
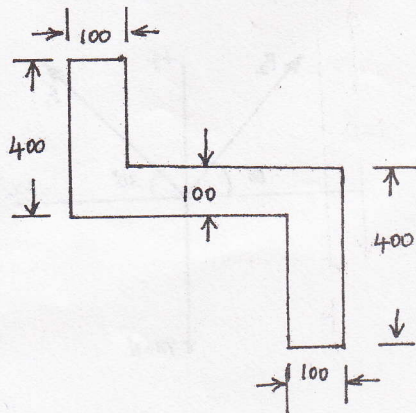

Fig 3

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b) Calculate the mass moment of inertia of the cylinder of radius 0.5 m, height 1 m and density 2400 kg/m³ about the centroidal axis. (Fig 4)

Fig 4
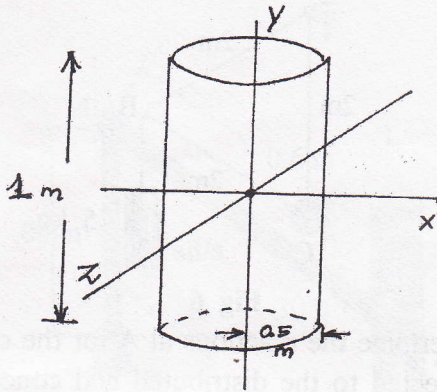
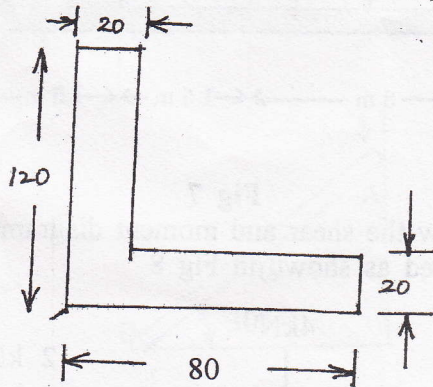c) Find out the centroid of an L - Section of 120 mm × 80 mm × 20 mm. (Fig 5)

Fig 5

3 Attempt any two parts : 10×2=20

a) Determine the force in each member of the simple equilateral truss. (Fig 6)
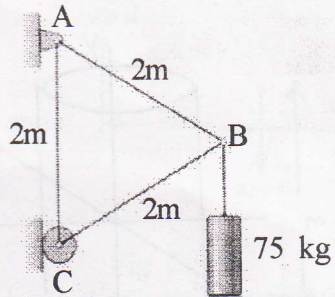

Fig 6

b) Determine the reactions at A for the cantilever beam subjected to the distributed and concentrated loads. (Fig 7)
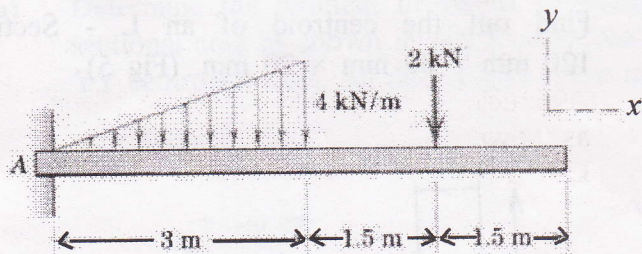

Fig 7

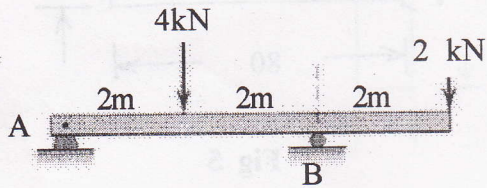c) Draw the shear and moment diagrams for the beam loaded as shown in Fig 8

Fig 8

4 Attempt any two parts :   10×2=20

a) If crank OA rotates with an angular velocity of ω = 12 rad/s , determine the velocity of piston B and the angular velocity of rod AB at the instant shown in the Fig 9

Fig 9
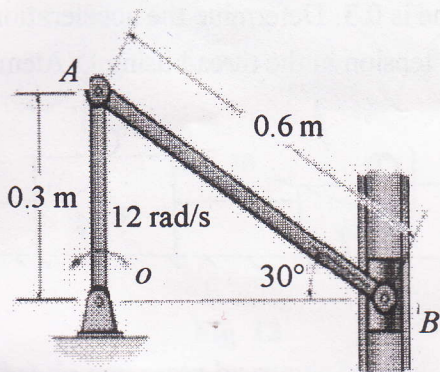
b) At a given instant the 5 kg slender bar has the motion shown in Fig 10. Determine the angular momentum about point G (V_A = 2 m/s)

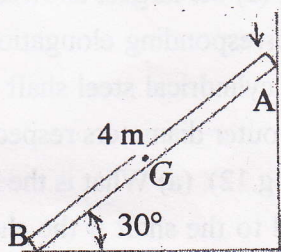**Fig 10**

c) Two bodies of masses 80 kg and 20 kg are connected by a thread along a rough horizontal surface under the action of a force 400 N applied to the first body of mass 80 kg as shown in Fig 11. The coefficient of friction between the sliding surfaces of the bodies and plane is 0.3. Determine the acceleration of two bodies and tension in the thread using D'Alembert's principle.
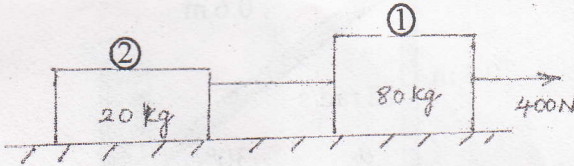

Fig 11

5   Attempt any two parts :   10×2=20

a)   An 80 m long wire of 5 mm diameter is made of a steel with E= 200 GPa and an ultimate tensile strength of 400 MPa. If a factor of safety of 3.2 is desired, determine (a) the largest allowable tension in the wire, (b) the corresponding elongation of the wire.

b)   A hollow cylindrical steel shaft is 1.5 m long and has inner and outer diameters respectively equal to 40 and 60 mm (Fig.12). (a) What is the largest torque that can be applied to the shaft if the shearing stress is not to exceed 120 MPa? (b) What is the corresponding minimum value of the shearing stress in the shaft?

60 mm

40 mm

1.5 m
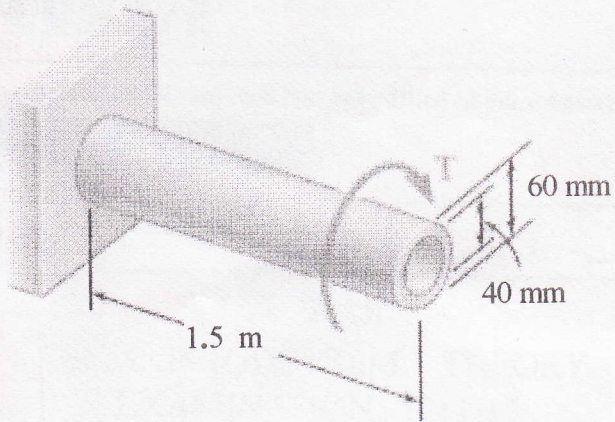
Fig 12

c) What do you mean by simple bending or pure bending?
What are the assumptions made in the theory of simple
bending ?

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0

s

e

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