Maulana Azad National Urdu University
B.Tech. (Computer Science)
II year : IV-Semester Examination   May - 2015

Paper BT122 : Basic Engineering Mechanics

پرچہ BT122 : بیسک انجینئرنگ میکانکس
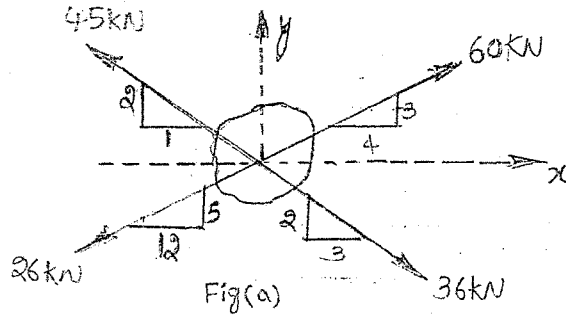
Time : 3 hours   Total Marks : 70

Answer any FIVE Questions
All Questions carry equal marks

1. (a) The body shown in figure (a) is acted by four forces. Determine the magnitude and direction of the resultant.

Fig(a)

(b) A horizontal beam PQRS is 12m long, where PQ=QR=RS=4m. Forces of 1000N, 1500N, 1000N and 500N act at point P, Q, R, &S respectively with the downward direction. The line of action of these forces makes angles 90°, 60°, 45° &30° respectively with PS. Find the magnitudes, direction and position of resultant.   [7+7]

2. (a) A semicircle area is removed from a rectangle shown in figure (b). Determine the centroid of the removing area.

Fig(b)
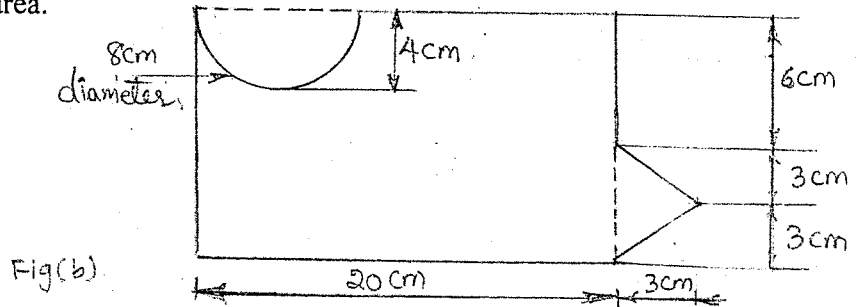
(b) Find the moment of inertia of T-section about the centroidal horizontal and vertical axis.

   Size of flange   60mm×8mm
   Size of web   45mm×8mm.   [7+7]

3. (a) Write about the laws of friction.

   (b) A ladder of 5m long weighing 200N leans against a smooth vertical wall at an angle of 60° with horizontal. A man weighing 700N stands at mid a height of ladder when it is about to slip. Calculate the coefficient of friction between the ladder and ground.   [7+7]

4. (a) The motion of a particle in rectilinear motion is defined by the relation

$$S = 2t^3 - 9t^2 + 12t - 10$$

where 's' is expressed in meter and 't' in seconds. Find
   i.   The acceleration of the particle when the velocity is zero.
   ii. The position and the total distance travelled when the acceleration is zero.

(b) The polar co-ordinates of particle are given by $r = 5 + 7t^2$ and $\theta = 6 + 3t^2$ where 'r' is in meter and 'θ'is in radian and 't' in seconds. Determine the magnitude of velocity and acceleration of the particle when t = 5 seconds.   [7+7]

5. (a) A lift, carrying 10 men each weighing 500N, starts moving towards from rest in a mine vertical shaft. The lift attains a speed of 12 m/s in 20 meter. Find the pressure exerted by each man on the floor of the cage .Take g = 9.8 m/s^2

(b) A wheel, rotating about a fixed axis at 20 r.p.m, is uniformly accelerated for 70 seconds, during which time it makes 50 revolutions, Find
   i.   Angular velocity at the end of this interval, &
   ii. Time required for the speed to reach 100 revolution per minutes.   [7+7]

6. (a) A block weighing 2500N rest on a horizontal plane for which co-efficient of friction is 0.20. This blocked is pulled by a force of 1000N.Which is acting at an angle of 30° to the horizontal. Find the velocity of the block after its makes 30 meter, starting from rest, using D'Alembert's principle.

(b) A Systems of parallel forces are acting on a rigid bar as shown in figure (c). Reduce this system to:
   i.   a single force.
   ii. a single force and a couple at A.
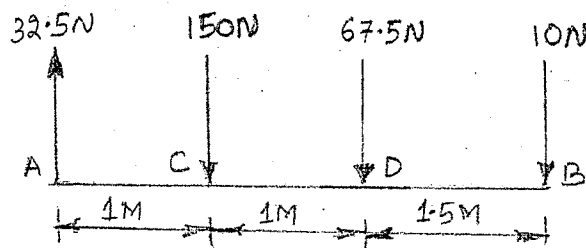   iii. a single force and a couple at B.   [7+7]

Fig. (c)

7. Write shorts note on any three of the following
   (i)   Law of parallelogram of forces
   (ii) Mass moment of Inertia
   (iii) Angle of friction
   (iv) Kinematics of rigid bodies   [14]