Ref:- EX/CSE/EM/ME/T/122A/2017

B.E. Computer Science and Engineering Ist Year - 2nd Semester , 2017

Engineering Mechanics

Full marks 100

Time – 03 Hrs

Answer any FIVE questions taking at least TWO from each group

Group A

Q1(a) Find the reaction force and moment at **A** for the beam supported and loaded as shown in Fig 1(a). <10>

(b) A force **F** = (15i -30j + 20k) N is acting at point having coordinate (1, -2, 5) m . Find the moment of the force about an axis 1-2 joining point 1 (3, 2, -5) m and point 2 (5, 2, -1) m . <10>

Q2(a) Justify Couple is a free vector <08>

(b) Two forces and a couple are shown in Fig 2(b). The couple is position in plane Z-Y plane. Find the resultant of the system at point **O**. <12>

Q3(a) Referring to Fig3(a), find the tension **S** induced in tie rod AB of the frame ABC supported and loaded as shown <10>

(b) A hand brake is shown in Fig 3(b). If μ_d **= 0.4** , what is the resisting torque when the shaft is rotating. <10>

Q4(a) Find the coordinates of the centroid of the lamina shown in Fig 4(a) as in coordinate axes given. <10>

(b) Find I_{xx} of the T section as shown in Fig 4(b) <10>

GROUP-B

Q5(a) A particle moves along the positive branch of the curve **$y = 1 + (x^2 / 10)$** with its x coordinate is controlled as a function of time according to **$x = 2t^3/3$** where x and y are in meters and t in seconds. Compute the magnitude of the acceleration of the particle and its position when t=2 sec. <10>

(b) A pin is confines to move in a parabolic slot in a fixed plate. The pin is also guided by the vertical slot which is given a constant horizontal velocity to the right of **0.1 m/sec.** Determine the velocity and acceleration of the pin for the position **x=0.1 m.** (Fig 5(b)) <10>

Q6(a) A jet plane flying at a constant velocity **v** at an altitude **h**=8 km is being tracked by radar located at O shown in fig 6(a). if the angle **θ** is decreasing at a rate of **0.025 rad/sec** when **$\Theta = 60^0$** . , determine the value of $\ddot{r}$ at this instant and the velocity of the plane. <10>

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Q6(b). A particle moves with a speed **of 3 m/sec** and the rate of change of speed is **3m/sec^2** along the curvilinear path **$y = 3x^2$** in a x-y coordinate system. What is the acceleration of the particle at **x=1.5 m** in (n-t) and (x-y) co ordinate systems. <10>

Q7(a) A small rocket propelled vehicle with total mass of 100 kg starts from rest A and moves with negligible friction along the track in the vertical plane shown in fig 7(a). If the rocket exerts a constant thrust **T=2kN** from A to B where it is shut off, determine the distant S which the vehicle rolls up the incline before stopping. <10>

(b) A high speed land racer is moving at a speed of 100m/sec. The resistance to the motion is primarily due to aerodynamic drag which is approximated as **$0.2V^2$** with V in m/sec. If the vehicle has a mass of 4000kg, what distance will it coast when the engine stops before its speed reduced to 70 m/ sec. <10>

Q8(a) Starting from Newton's 2nd law , derive work- energy principle <10>

(b) A bead of mass 0.25 kg is released from rest at A and slides down and around the fixed smooth wire. Determine the force **N** between the wire and the bead as it passes the position B (Fig 8(b)) <10>

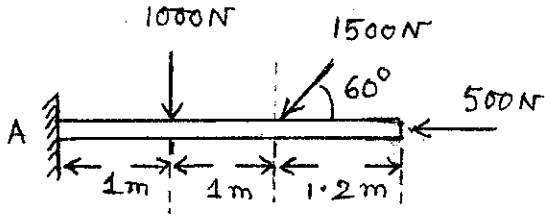

Fig 1 (a)

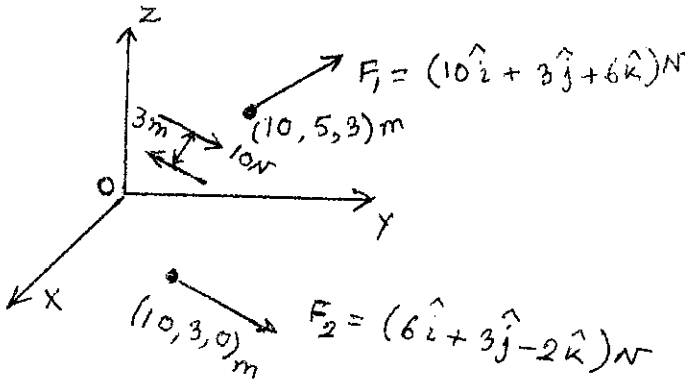

Fig 2 (b)

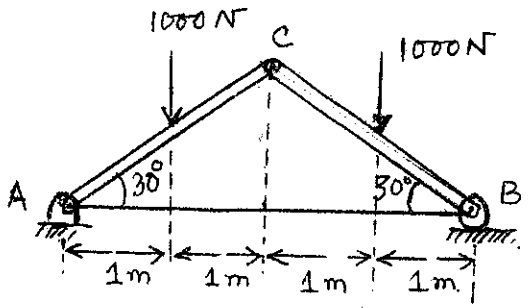

Fig 3 (a)

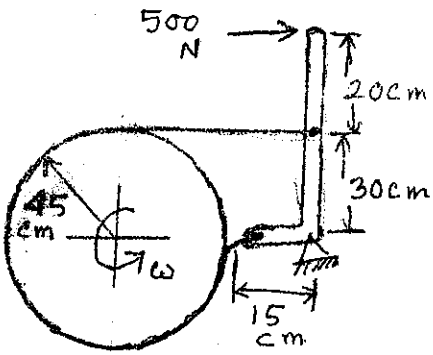

Fig 3 (b)

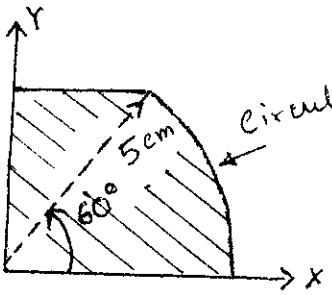

Fig 4 (a)

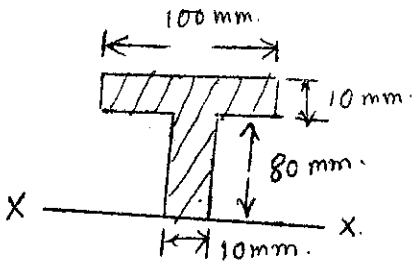

Fig 4 (b)

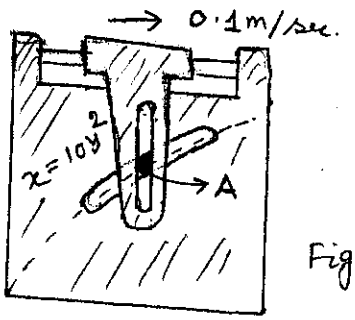

Fig 5 (b)

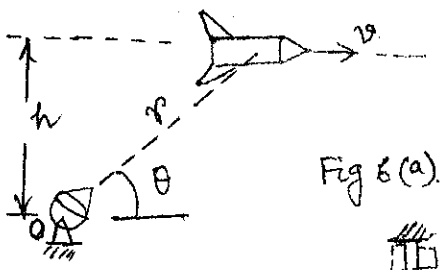

Fig 6 (a)

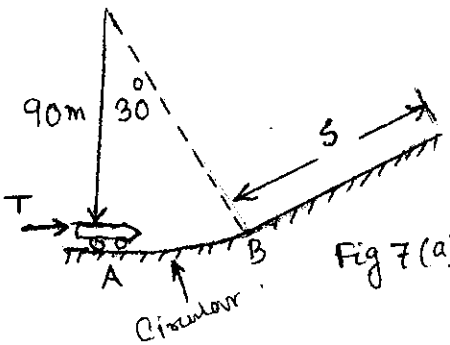

Fig 7 (a)

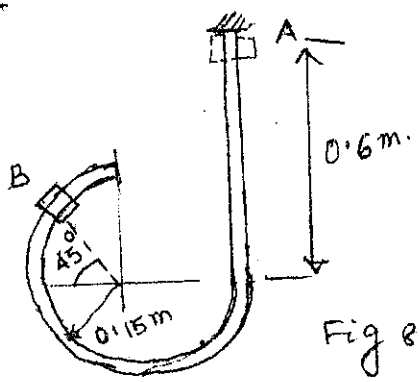

Fig 8 (b)