Department of Civil Engineering

S V NATIONAL INSTITUTE OF TECHNOLOGY, SURAT

Supplementary & Backlog Examination Feb 2020

B.Tech. – I (Div –A to K)

ENGINEERING MECHANICS

Marks: 100	**17/02/2020**	**Time: 10.00 am to 01.00 pm**

Note: 1. Take g = 9.81 m/s^2

2. All parts of a Question must be together.

Q. 1 Define & Explain any four. **10**

(i) The Principle of Transmissibility.
(ii) Equilibrium of Two-Force Body and Three-Force Body.
(iii) Parallel-Axis Theorem for M.I. of an area.
(iv) Angle of Friction and Angle of Repose.
(v) Damped Vibrations and Undamped Vibrations
(vi) Laws of dry friction
(vii) Stability and Determinancy of Trusses
(viii) D' Alembert's Principle

Q.2 Answer any two **10**

Q.2A For the system shown in Figure-1, determine **05**
(i) the required value of α if resultant of three forces is to be vertical and
(ii) the corresponding magnitude of resultant.

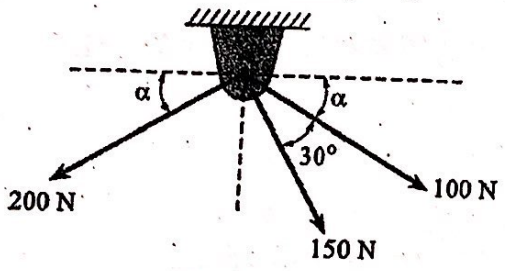


Figure: 1

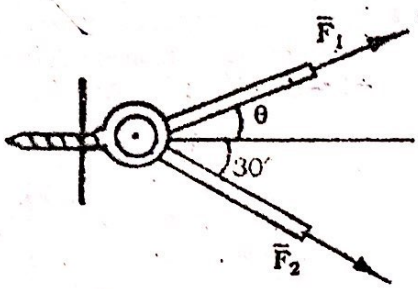


Figure: 2

Q.2B The hook shown in Figure-2 is subjected to two forces, F_1 and F_2. If it is required that the resultant force have a magnitude of 250 N and be directed horizontal towards right, determine **05**
(a) The magnitude of F_1 and F_2 provide $\theta = 50^0$
(b) The magnitude of F_1 and F_2 if F_1 is to be minimum.

Q.2C Two spheres A and B of weight 1000N and 750 N, respectively are kept as shown in the Figure-3. Determine the reactions at all contact points 1, 2, 3 and 4. Radius of A = 400 mm and Radius of B = 300 mm. **05**

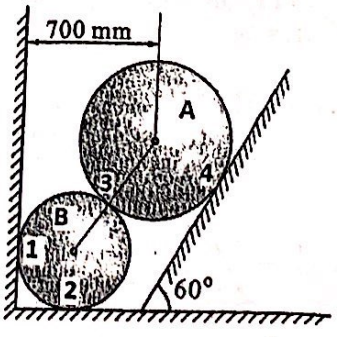
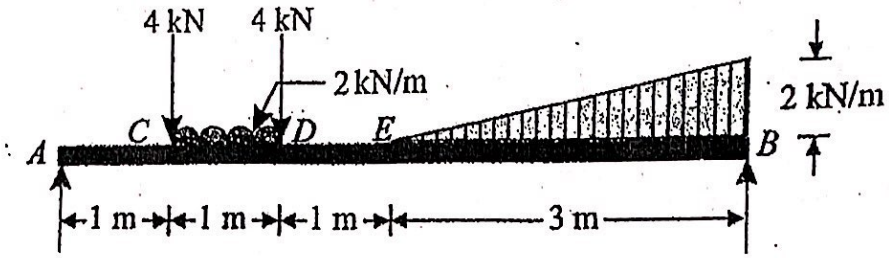
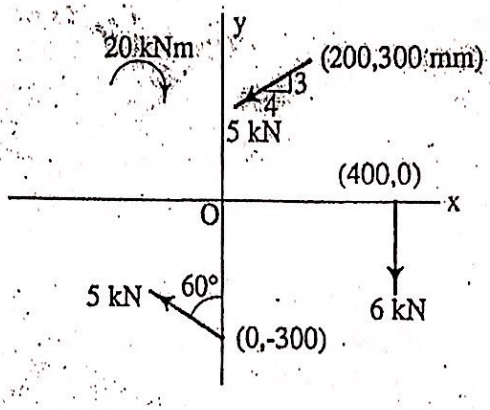


Figure :3

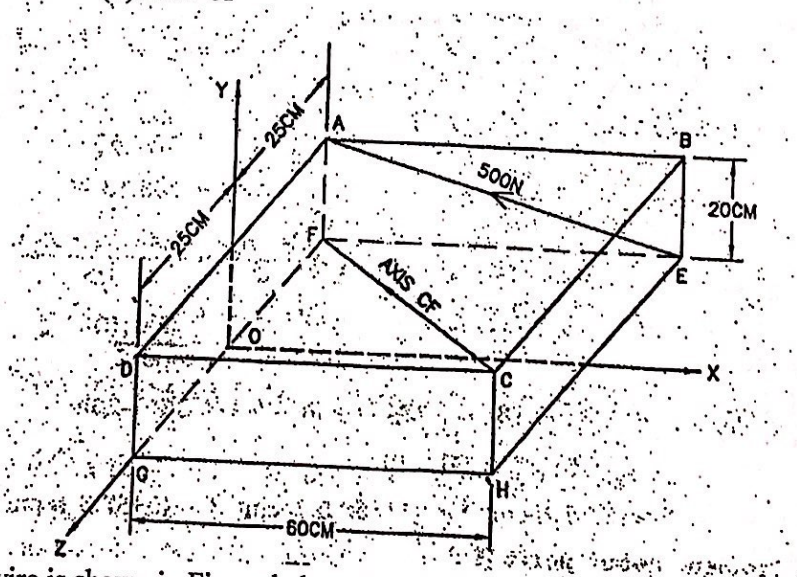
Q.3A A simply supported beam AB of 6 m span is subjected to loading as shown in Figure below. Find out reactions at point A and B. **05**



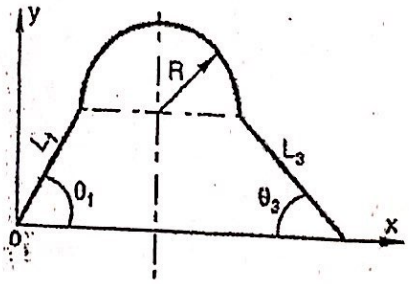
Q.3B Replace the force system as shown in Figure below, by a single force and a couple acting at the origin **05**



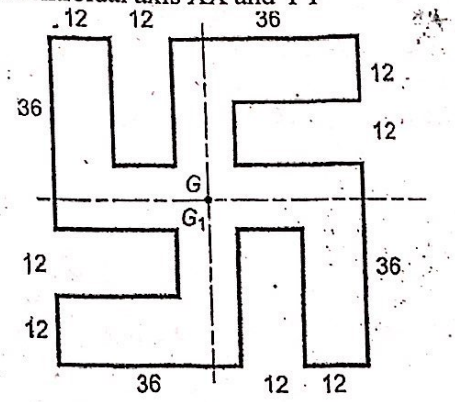
Q.4 A Parallelopiped as shown in Figure below. is acted upon by a force 500 N at E. Determine the moment of this force about **10**
(i) Point H (ii) Axis CF



Q.5A A bent wire is shown in Figure below. Locate the centroid of wire. **05**
L_1 =67 mm, θ_1 =60^0 ,R= 44 mm and θ_3 =45^0

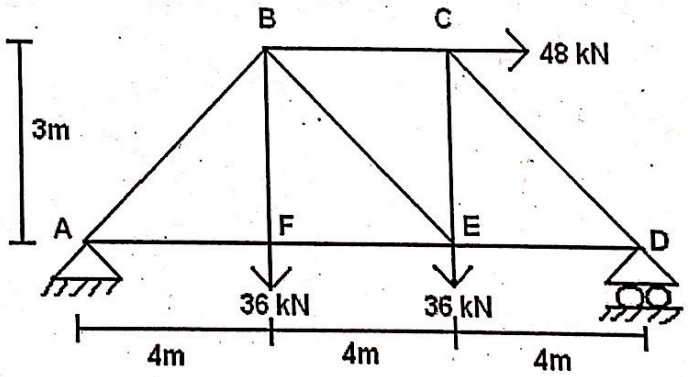


Q.5B A "Holy mark of Swastika" is shown in Figure below. below, Compute moment of inertia about both the centroidal axis XX and YY **05**



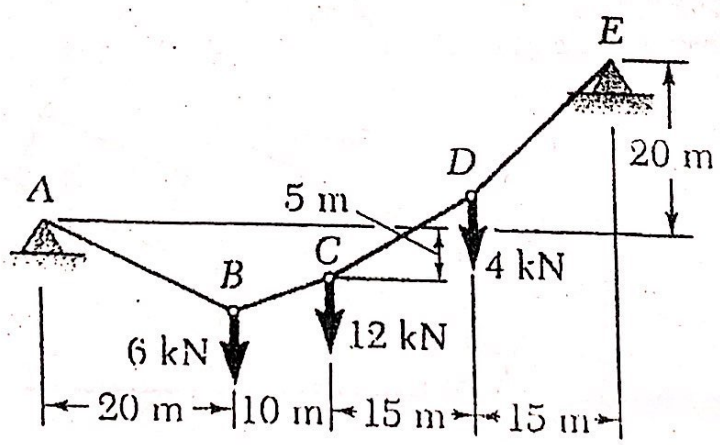
Q.6 A uniform ladder of 10 m length rests against a rough vertical wall with its lower end on a rough horizontal floor, the ladder being inclined at 45^0 to the horizontal. The coefficient of friction between ladder and the wall is 0.33 and that between ladder and floor is 0.5. A man whose weight equals one half of that of the ladder ascends up the ladder till the ladder slips. Determine at what length of the ladder the man will be able to ascend, before the ladder commences to slip. **10**

Q.7 Find reactions and forces in all members of the truss shown in figure below. **10**



Q.8 The cable AE supports three vertical loads from the points as indicated in Fig below. If point C is 5m below the left support, determine **10**

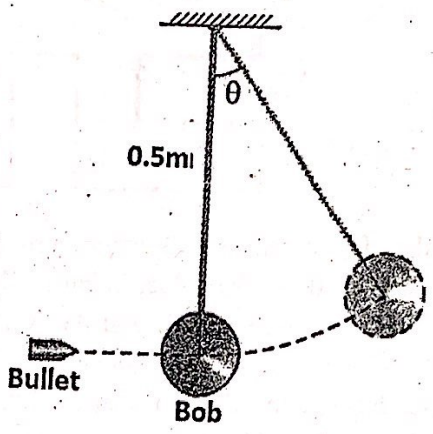
(a) The elevation of points B and D
(b) The maximum slope and the maximum tension in cable.
(c) Total length of the cable



Q.9 A bullet of mass 10 gm is moving with a velocity of 100 m/s and hits a 2 kg bob of a simple pendulum, horizontally as shown in Fig below .Determine the maximum angle θ through which the pendulum string 0.5 m long may swing if **10**

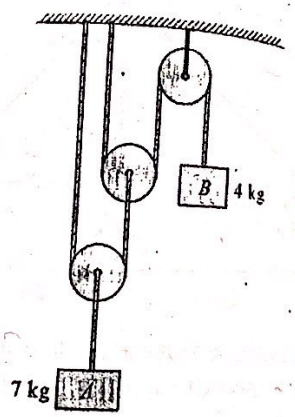
(i) The bullet gets embedded in the bob.

(ii) The bullet escapes from the other end of the bob with a velocity 10 m/s.

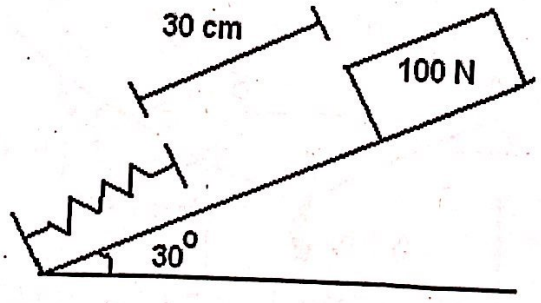


OR

Q.9 Determine the tension developed in the chords attached to each block and the acceleration of the blocks when the system shown in figure below. is released from rest. Neglect the mass of the pulleys and the chords. **10**



Q.10 A 100 N block released from rest along a 30^0 inclined plane as shown in Fig below. After moving 30 cm, it strikes a spring whose constant is 2500 N/m. if coefficient of friction between block and inclined surface is 0.2. Determine the maximum deformation of the spring and maximum velocity of the block. **10**



********** *All the Best* **********