Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B. Tech. / M. Tech. / Ph.D.

Branch	**:EE**	**Semester**	**: II**
Title of the Course	**: Engineering Mechanics**	**Course Code**	**: MEL102**

Time: 3 Hours **Maximum Marks: 50**

Note: **The question paper has been divided into three sections A, B and C.**
Section A: Carry only one (01) question of 10 parts of 01 mark each and all parts are compulsory.
Section B: Contains Five (05) questions of 5 marks each and any four (04) are to be attempted.
Section C: Contains Three (03) questions of ten (10) marks each and any two (02) are to be attempted.

Section A:

Q.1

(a) What is the difference between stress and pressure?

(b) Define the term momentum and how it is related to force?

(c) If a ball is travelling in a circle of diameter 10 m with velocity of 20 m/s, find the angular velocity.

(d) Classified the different types of truss.

(e) What is the difference between uniform acceleration and variable acceleration?

(f) The loss of kinetic energy during elastic impact is zero. True or false?

(g) How will you distinguish between static friction and dynamic friction?

(h) Fill in the blank. The center of gravity of an equilateral triangle with each side of length ***a*** is ..... from any of the three sides.

(i) Define the terms: Velocity of projection and angle of projection.

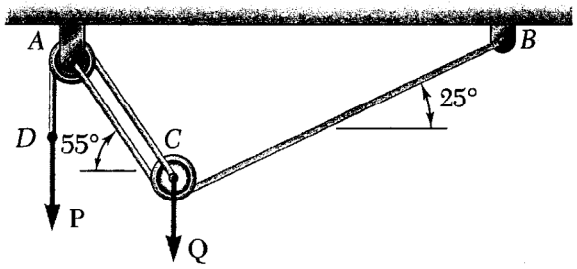
(j) Explain the theorem of transmissibility of a force. What is the limitation of the theorem?

Section B:

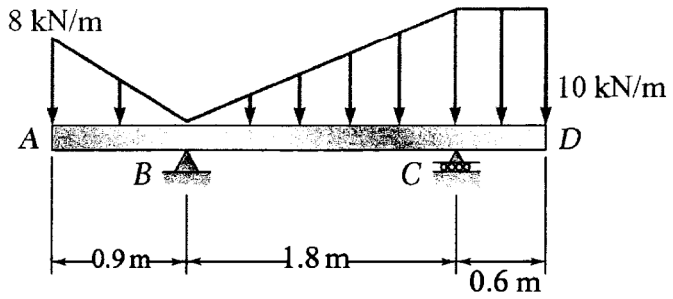
Q.2 (a) Obtain an equation for the trajectory of a projectile, and show that it is a parabola. Also derive an expression for the maximum height and range of a projectile traversed by a stone, thrown with an initial velocity of u and an inclination of α.

Q.2(b) A monkey is sitting on the top of a tree 10 m high. With what velocity should a person standing at a distance of 25 m from the tree, throws a guava at an angle of 30° with the horizontal so as to reach the monkey.

Q.3 An 1800-N load Q is applied to the pulley C, which can roll on the cable ACB. The pulley is held in the position shown by a second cable CAD, which passes over the pulley A and supports a load P. Determine (a) the tension in cable ACB, (b) the magnitude of load P.



Q.4 Determine the reactions at the beam supports for the given loading.

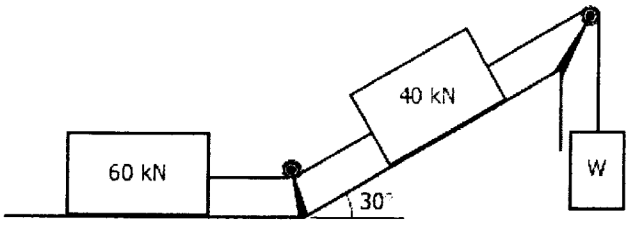


Q.5 A car moves along a straight line whose equation of motion is given by $\mathbf{s=12t+3t^2-2t^3}$, where (s) is in meters and (t) is in seconds. calculate

(i) velocity and acceleration at start, and

(ii) acceleration, when the velocity is zero

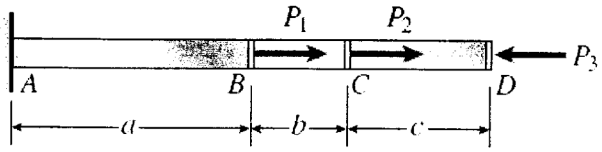
Q.6 What weight W is necessary to start the system of blocks shown in below Figure moving to the right? The coefficient of friction is 0.10 and the pulleys are assumed to be frictionless.



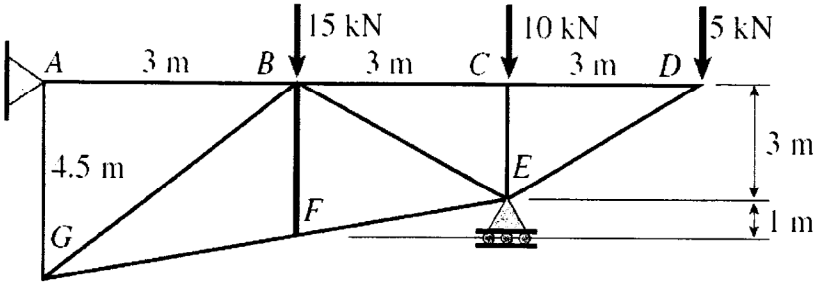
Section C:

Q.7 (a) Draw the stress-strain curve for brittle material. Explain each and every points in details.

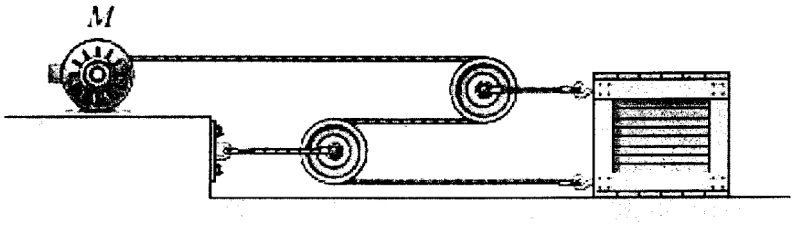
Q.7 (b) A brass rod (E=110 GPa) with cross sectional area of 250 mm^2 is loaded by forces P_1=15 kN, P2=10 kN, and P_3 =8 kN. Segment lengths of the bar are a =2.0 m, b =0.75 m, and c =1.2 m. Find out the change in length of the bar.



Q.8(a) Find the force in member *FE* of the plane truss shown in below figure.

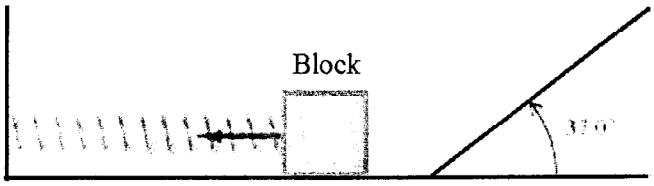


Q.8(b) The crate has a mass of 150 kg and rest on a surface for which the coefficient of static and dynamic friction are 0.3 and 0.2 respectively. If the motor M supplies a cable force of $(8t^2+20)$ N, where t is in seconds. Determine the power output developed by motor when t=5 sec.



Q.9 (a) Explain the conservation of energy and momentum concept. Consider a 42,000 kg train car travelling at 10 m/s toward another train car. After the two cars collide, they couple together and move along at 6 m/s. What is the mass of the second train car?

Q.9 (b) A 2.00 kg block is pushed against a spring with negligible mass and force constant k = 400 N/m, compressing it 0.220 m. When the block is released, it moves along a frictionless, horizontal surface and then up a frictionless incline with slope 37.0 degrees.



(i) What is the speed of the block as it slides along the horizontal surface after having left the spring? (ii) How far does the block travel up the incline before starting to slide back down?