DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY

LONERE – RAIGAD - 402 103

End Semester Examination – December - 2017

Branch: B. Tech (Group A/Group B) **Semester: I**

Subject with Subject Code: Engineering Mechanics [ME102] **Marks: 60**

Date:- 13/12/2017 **Time: 3 Hrs.**

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Instructions to the Students

1. Each question carries 12 marks.
2. Attempt any five questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly

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(Marks)

Q.1. A) How will you add two forces? Explain the Parallelogram Law and Law of Triangle of forces. **(6M)**

B) Two ropes are tied together at C. If the maximum permissible tension in each rope is 3.5 kN, what is the maximum force P that can be applied and in what direction as shown in figure 1. **(6M)**

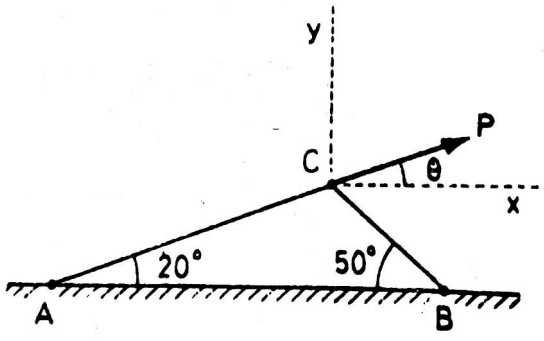

Figure 1

Q.2. A) What are various types of supports and support reactions? Explain with its free body diagram. **(4M)**

B) Using the method of joints, find the axial forces in all the members of a truss with the loading shown in the Figure 2. **(8M)**

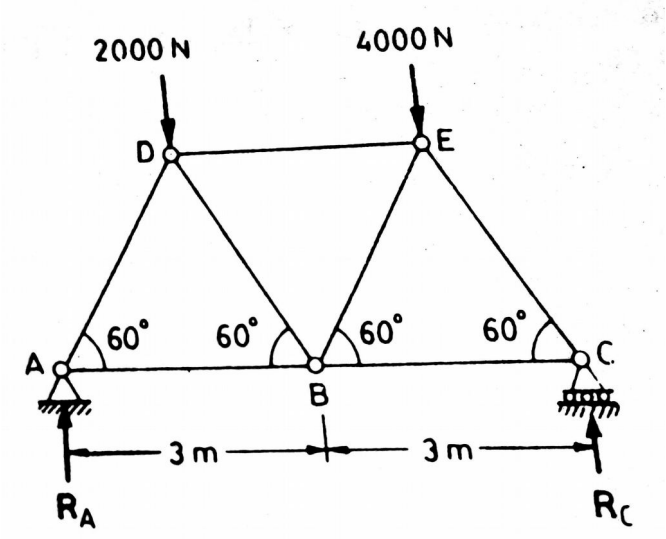

Figure 2

Q.3.

A) Locate the centroid of the shaded area obtained by removing a semicircle of diameter *a* from a quadrant of a circle of radius *a* as shown in Fig. 3.

(6M)

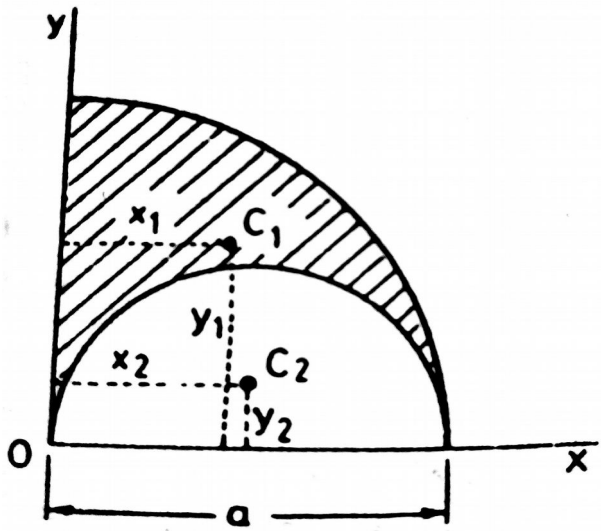

Figure 3

B) A 7m long ladder rests against a vertical wall, with which it makes an angle of 45°, and on a floor. If a man, whose weight is one half of that of the ladder, climbs it, at what distance along the ladder will he be, when the ladder is about to slip shown in Figure 4? The coefficient of friction between the ladder and the wall is 1/3 and that between the ladder and the floor is 1/2.

(6M)

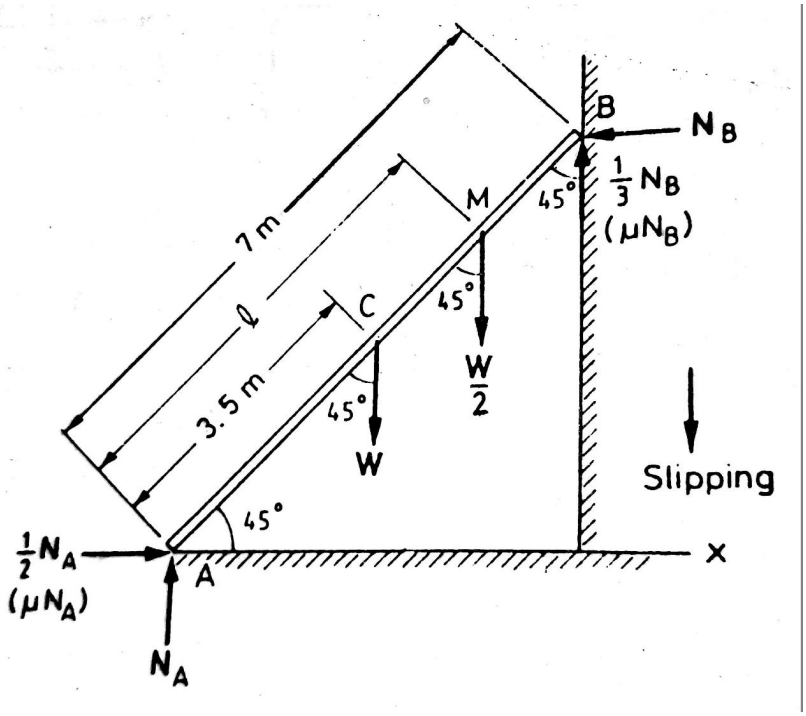

Figure 4

Q.4.

A) A trolley resting on a horizontal plane starts from rest and is moved to the right with a constant acceleration of 0.18 m/s^2 shown in Figure 5. Determine:

i) acceleration of the block B connected to the trolley and

ii) velocities of the trolley and the block after a time of 4 seconds and the distance moved by each of them. **(6M)**

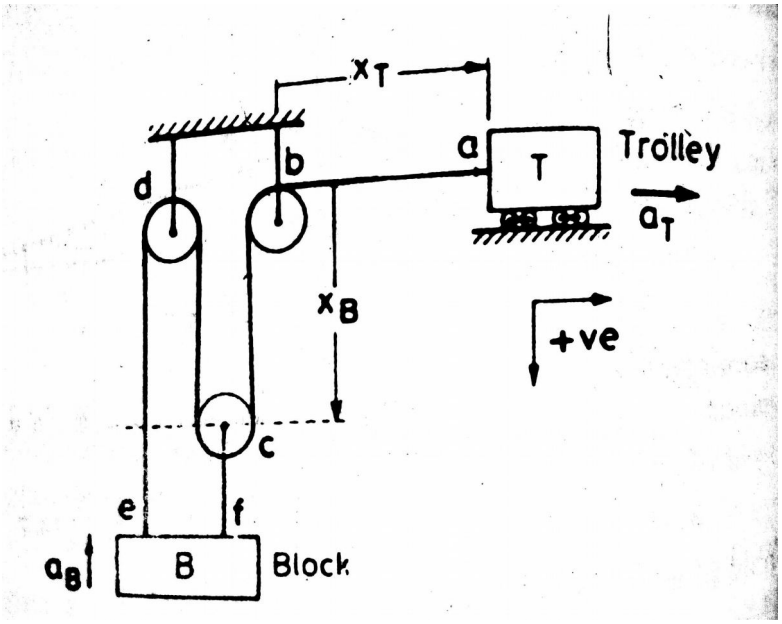

Figure 5

B) A passenger train passes a certain station at 60 km/hr and covers a distance of 12 km with this speed and then stops at the next station 15 km from the first with uniform retardation. A local train starting from the first station covers the same distance in double this time and stops at the next station. Determine the maximum speed of the local train which covers a part of the distance with uniform acceleration and the rest with uniform retardation. **(6M)**

Q.5.

A) Explain in detail: D'Alemberts principle and write the equations of dynamic equilibrium of the particle. **(4M)**

B) Two blocks of masses M1 and M2 are connected by a flexible but inextensible string as shown in the figure. Assuming the coefficient of friction between block M1 and horizontal surface to be μ find the acceleration of the masses and tension in the string as per figure 6. Assume M1= 10 kg and M2 = 5 kg, μ = 0.25. **(8M)**

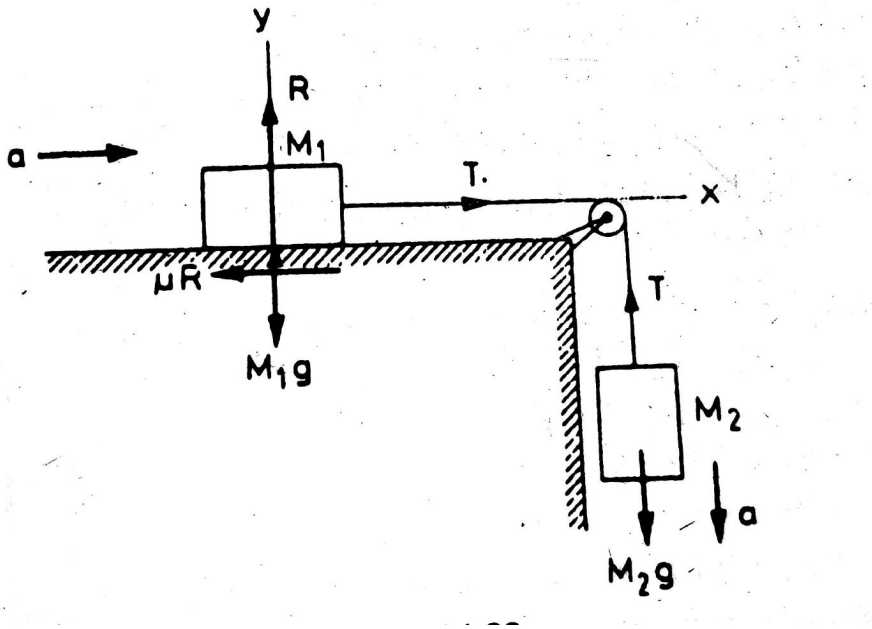

Figure 6

Q.6.

A) A spring of stiffness 1000 N/m is stretched by 10 cm from the undeformed position. Find the work of the spring force. Also find the work required to stretch it by another 10 cm. **(6M)**

B) What do you understand by direct central impact? Also explain the coefficient of restitution. **(6M)**