DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,
LONERE - RAIGAD - 402 103
Summer Semester Examination, May - 2018

Branch: B.Tech | Semester: I

Subject with Subject Code: Engineering Mechanics (ME102) | Marks: 60

Date: 03 / 05 / 2018 | 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.

Q.1. Attempt the following: (06X2=12)

a) State and explain law of Triangle of forces.

Two forces of 50 N and 100 N act away from a point. If the angle between the forces is 30° and first force 50 N will be at an angle of 15° to the ground level. Find the magnitude and direction of the resultant.

b) The rectilinear motion of a particle has its position defined by the relation $X=t^3-3t^2-9t+12$.

Determine i) Position, time and acceleration of the particle when its velocity becomes zero.

Q.2. Attempt the following (06X2=12)

a) State and define free body diagram with few types of supports and support reactions.

b) A beam is supported and located as shown in the figure 1. Find the reactions at A and B.

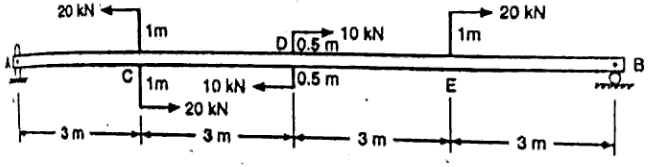

Figure 1

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Q.3. Attempt the following (06X2=12)

a) Three spherical balls of mass 2 kg, 6 kg and 12 kg are moving in the same directions with velocities 12m/s, 4m/s and 2m/s respectively. If the ball of mass 2 kg impinges with the ball of mass 6 kg which in turn impinges with the ball of mass 12 kg prove that the balls of masses 2 kg and 6 kg will be brought to rest by the impact. Assume the balls to be perfectly elastic.

b) What do you understand by trusses and frames? How will you determine the axial forces in the members? Explain method of Joints and method of sections.

Q.4. Attempt the following (06X2=12)

a) Two cylinders A and B rest in a horizontal channel as shown in figure 2. The cylinder A has a weight of 1000 N and radius of 9cm. The cylinder B has weight of 400 N and a radius of 5 cm. the channel is 18 cm wide at the bottom with one side vertical. The other side is inclined at an angle 60° with the horizontal. Find the reactions at the points L, N and P.

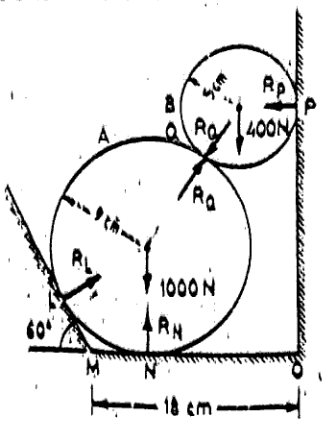

Figure 2

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

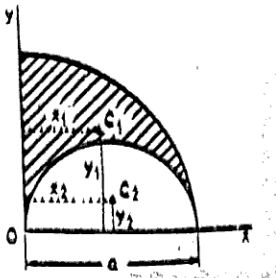

Figure 3

Q.5. Attempt the following (06X2=12)

a) What is meant by impulse of a force and momentum? State and prove the principle of impulse and momentum.

b) A elevator has an upward acceleration of $1m/s^2$ what pressure will be transmitted to the floor of the elevator by man weighing 600N travelling in the elevator? What pressure will be transmitted if the elevator has downward acceleration of $2m/s^2$? Also find the upward acceleration of the elevator which would cause the man to exert a pressure of 1200N on the floor.

Q.6. Attempt the following (06X2=12)

a) Define and explain the Coulomb's law of friction. Block A weighing 1000N is to be raised by means of a 15° wedge B weighing 500N. Assuming the coefficient of friction between all contact surfaces to be 0.2. Determine what minimum horizontal force should be applied to raise the block.

b) Explain and prove D'Alembert's principle. How will you explain the concept of dynamic equilibrium?

END OF QUESTION PAPER