# DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE Hay bhose. End Semester Examination – Winter 2018

Course: B. Tech.

Subject Name: Engineering Mechanics

Max Marks: 60

Date: 17/12/2018

Sushant Semester: I
Subject Code: EM1203

Duration: 3 Hrs.

#### Instructions to the Students:

1. All the questions are compulsory.

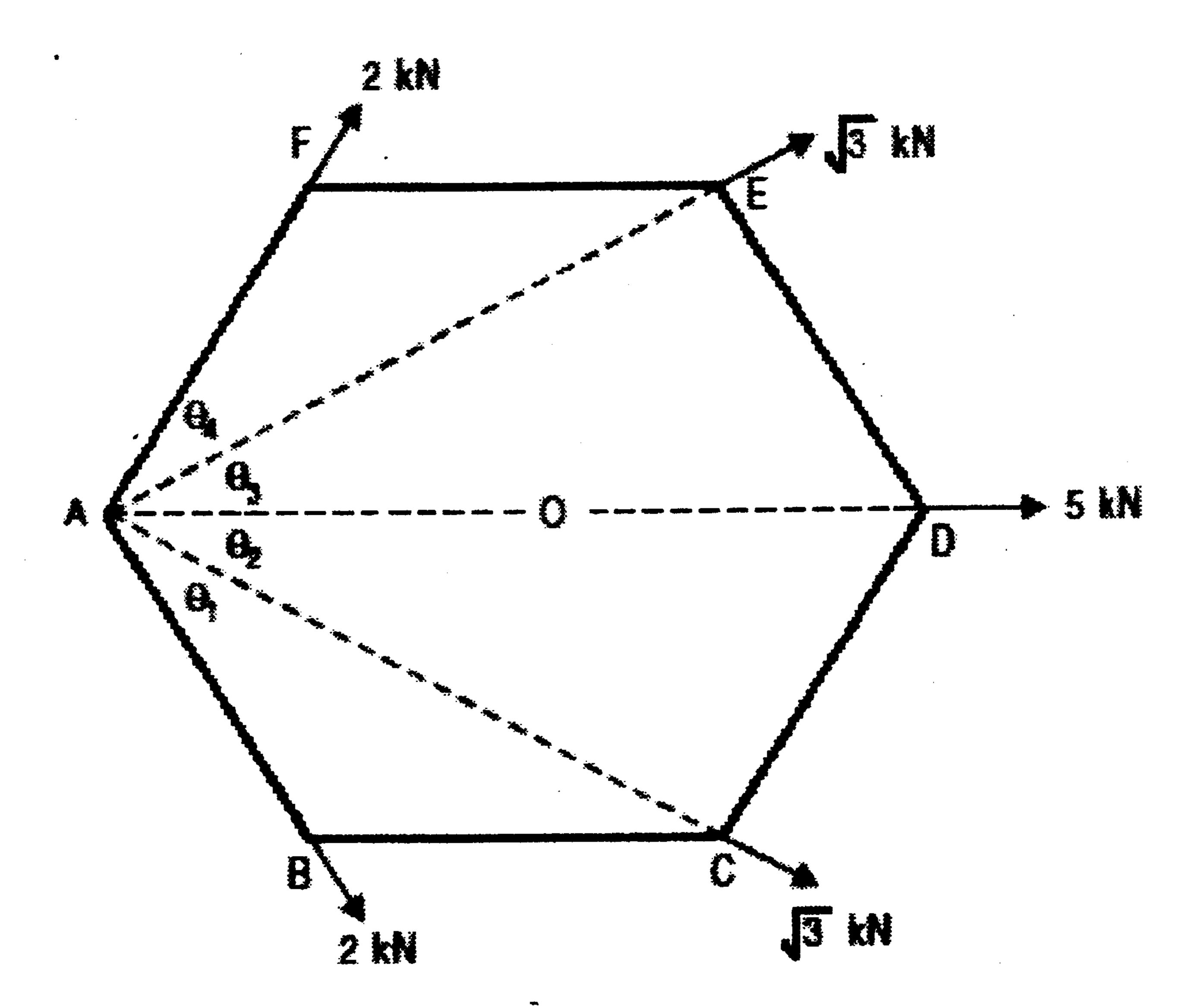
2. Use of non-programmable scientific calculators is allowed.

3. Assume suitable data wherever necessary and mention it clearly.

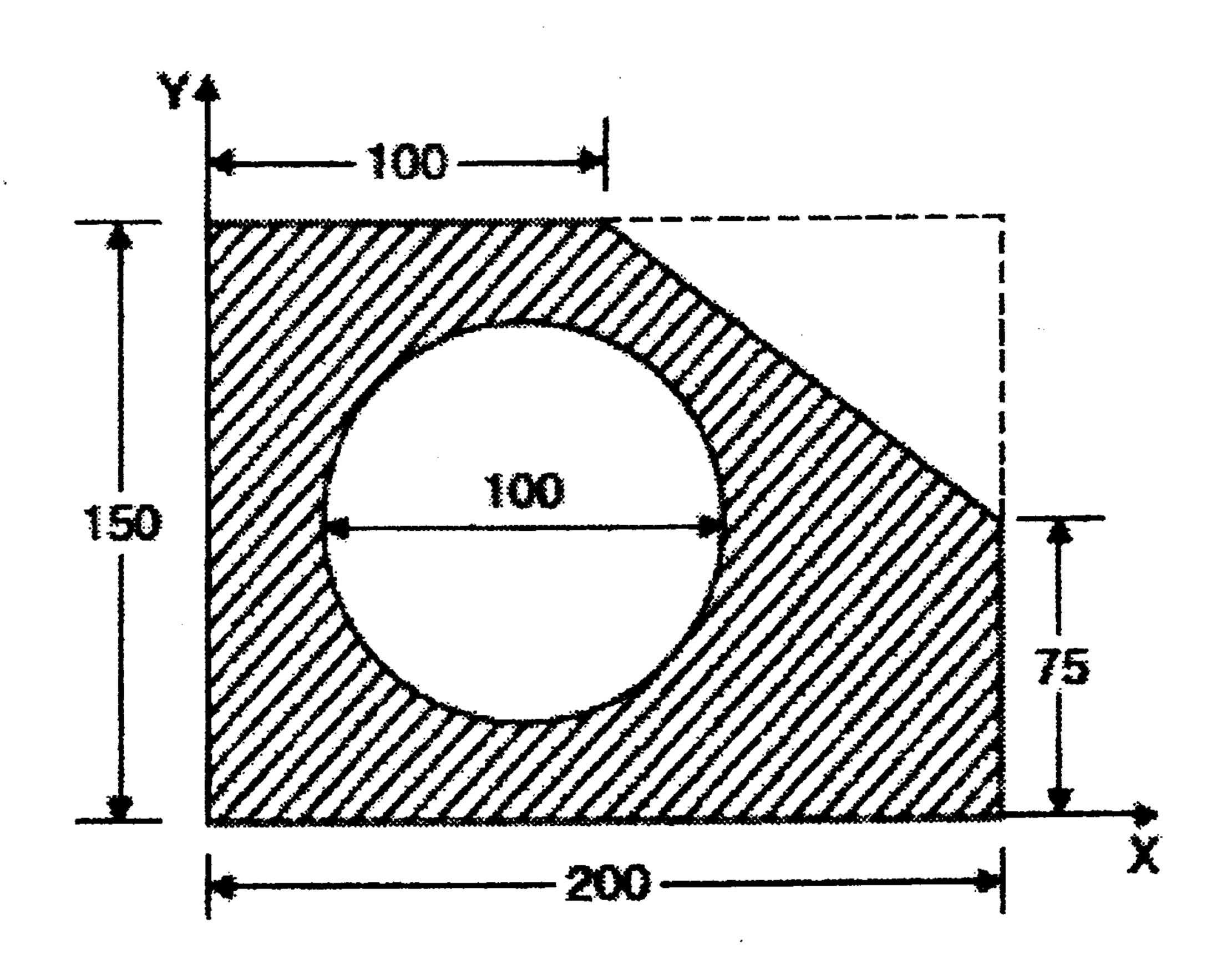
Marks

#### Q. 1 Solve any two of the following.

- A) Define the following: Coplanar forces, Coplanar non-concurrent forces, and Non-coplanar non-concurrent forces.
- B) Forces  $2,\sqrt{3}$ ,  $5,\sqrt{3}$ , and 2 kN respectively act at one of the angular points of a regular hexagon towards five other angular points. Determine the magnitude and direction of the resultant force. (6)



C) Determine the coordinates  $x_c$  and  $y_c$  of the centre of a 100 mm diameter circular hole cut in a thin plate so that this point will be the centroid of the remaining shaded area shown in figure (All dimensions are in mm).



## Q.2 Solve the following.

A) Write down the conditions of equilibrium for a space structure.

(4

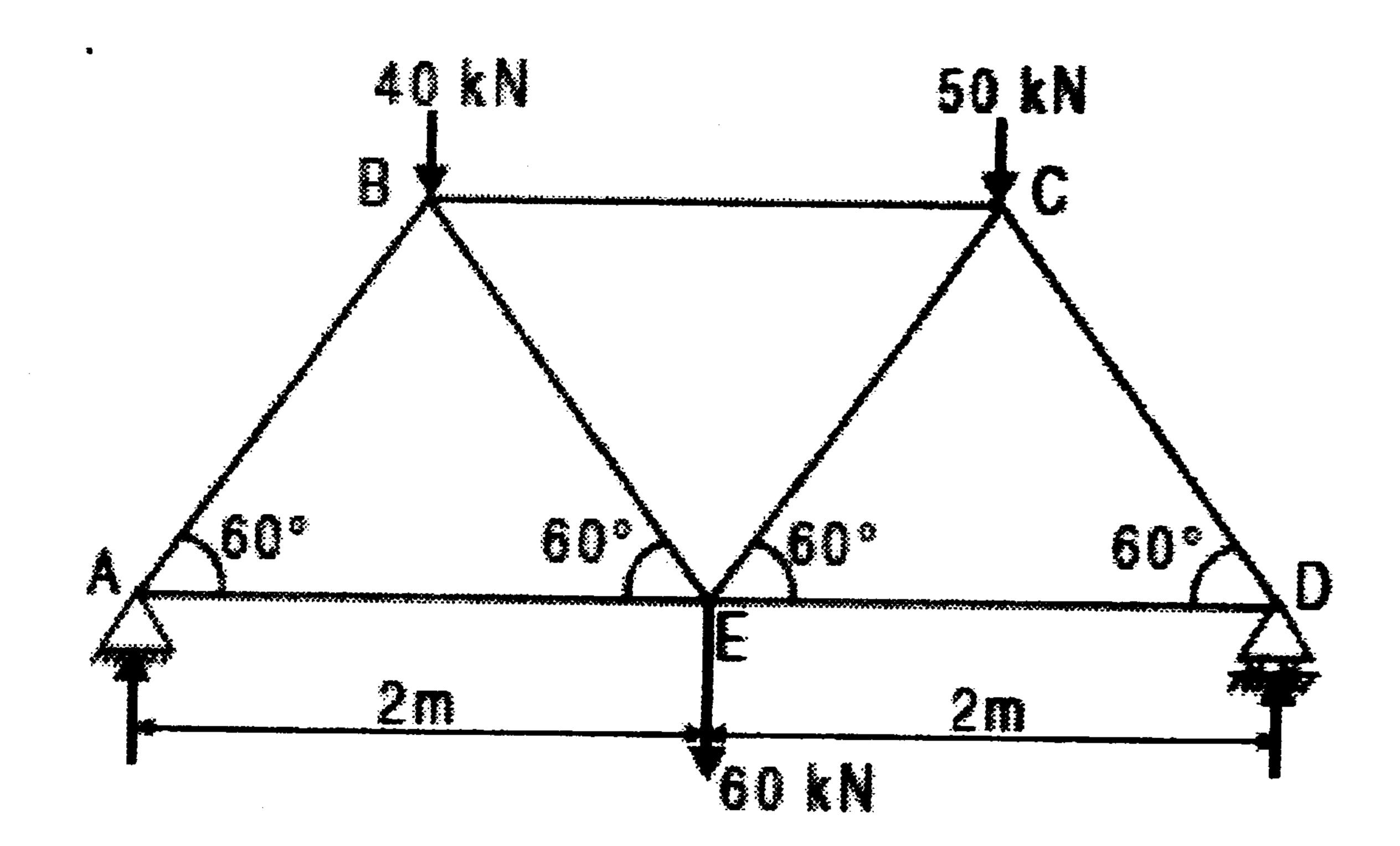
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A) A body of weight 500 N is lying on a rough plane inclined at an angle of 25° with the horizontal. It is being pulled by an effort P. The effort P is acting up and parallel to the inclined plane. Determine the minimum and maximum values of P, for which the equilibrium can exist, if the angle of friction is 20°.

(4)

B) Determine the forces in all the members of the truss shown in figure and indicate the magnitude and nature of forces on the diagram of the truss. All inclined members are at 60° to horizontal and length of each member is 2 m.

**(8)** 



## Q. 3 Solve the following.

A) Motion of a particle along a straight line is given by the acceleration-time relation:

4)

 $a = t^2 - 2t + 2$ . After 1 second, the distance traveled by the particle and the velocity of the particle were found to be 14.75 m and 6.33 m/s, respectively. Find after 2 seconds distance traveled, and velocity.

4

B) A train is moving at 48 kmph and a person sitting in it feels rain coming down at 60° to the vertical. However, a person standing in a field outside feels the rain to be vertical. Find the actual velocity of the rain.

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C) A body is projected at such an angle that the horizontal range is three times the greatest height. Find the angle of projection.

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# Q.4 Solve the following.

Ay State and explain in brief D'Alembert's principle.

(6)

B) A flywheel is made up of steel ring 40 mm thick and 200 mm wide plate with mean diameter of 2 metres. If initially the flywheel is rotating at 300 r.p.m., find the time taken by the wheel in coming to rest due to frictional couple of 100 N-m. Take mass density of the steel as 7900 kg/m<sup>3</sup>. Neglect the effect of the spokes.

(6) 12

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#### Q. 5 Solve any two of the following.

- A) An army truck of mass 5 tonnes (t) has tractive resistance of 150 N/t. Find the power required to propel the truck at a uniform speed of 36 km.p.h. (a) up an incline of 1 in 100; (b) on a level track; and (c) down an incline of 1 in 100.
  - (6)

**(6)** 

C) A sphere of mass 1 kg, moving at 3 m/s, overtakes another sphere of mass 5 kg moving in the same line at 60 cm/s. Find the loss of kinetic energy during impact, and show that the direction of motion of the first sphere is reversed. Take coefficient of restitution as 0.75.

A truck of mass 15 tonnes travelling at 1.6 m/s impacts with a buffer spring, which

compresses 1.25 mm per kN. Find the maximum compression of the spring.

\*\*\* End \*\*\*