22203

21222

3 Hours / 70 Marks Seat No. | | | | | | | | |

15 minutes extra for each hour

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any <u>FIVE</u> of the following: **10**

a) State any two effects of force on a body.

b) Define self locking machine and state the condition for it.

c) State Varignon's theorem of moment.

d) State the types of beam with sketch (any two).

e) State two advantages of friction.

f) Define centre of gravity.

g) Write the reactions at support when simply supported beam of span 'L' carrying a point load 'W' at the centre.

Marks

2. Attempt any THREE of the following: **12**

a) Define solar and vector quantities giving two examples of each.

b) In a simple lifting machine, a load of 1400 N is lifted by 50 N effort. While load moves up by 0.2 m, the point of application of effort moves by 6 m. Find MA, VR and efficiency and ideal effort.

c) State law of machine and it's use. Also give expression for maximum MA and maximum efficiency of a lifting machine.

d) State four laws of friction.

3. Attempt any THREE of the following: **12**

a) Find the magnitude and direction of the resultant force as shown in Fig. No. 1.

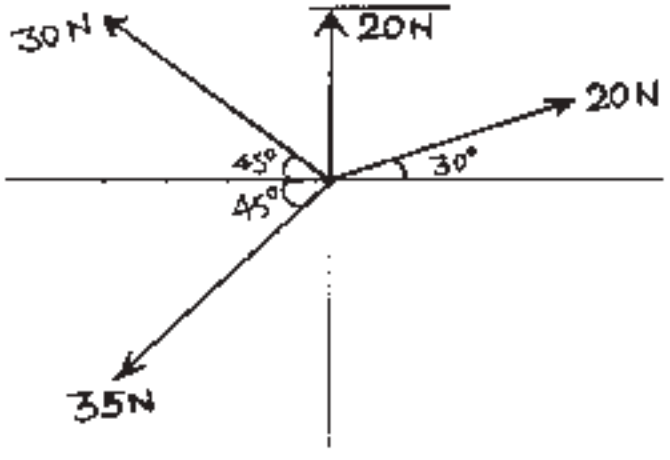

Fig. No. 1.

b) State four properties of couple.

c) In a differential axle and wheel, the diameter of the wheel is 40 cm and that of axles are 10 cm and 8 cm. If an effort of 50 N can lift a load of 1500 N, find the efficiency of the machine.

d) Certain machine follows the law P = (0.02 W + 14) N. When the load is lifted by 2 cm, the effort has to move 150 cm. State with reason, whether the machine is reversible or not.

Marks

4. Attempt any THREE of the following: **12**

a) A square ABCD of 2m side is subjected to forces as shown in Fig. No. 2. Find the magnitude, direction and position of the resultant with respect to A.

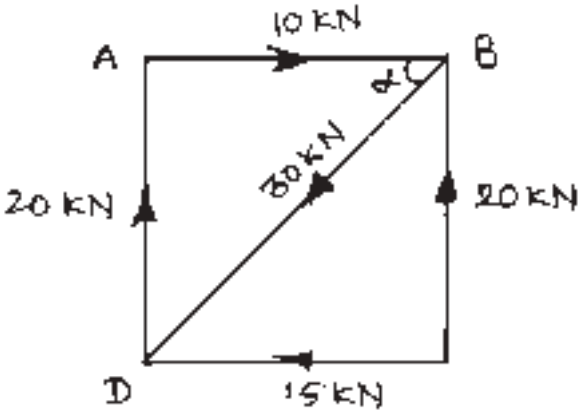

Fig. No. 2.

b) A cantilever is loaded as shown in Fig. No. 3. Find the support reaction.

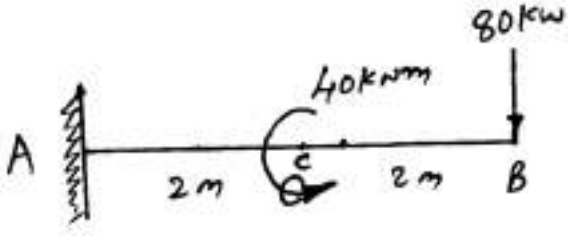

Fig. No. 3.

c) Calculate graphically the reactions of beam at the support as shown in Fig. No. 4.

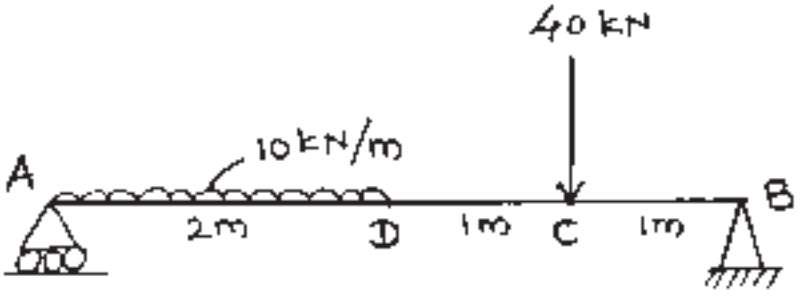

Fig. No. 4.

Marks

d) A body weighing 12 KN is lying on a horizontal plane for which μ = 0.70 as shown in Fig. No. 5. Determine normal reaction, limiting force of friction, horizontal force required to move it and angle of friction.

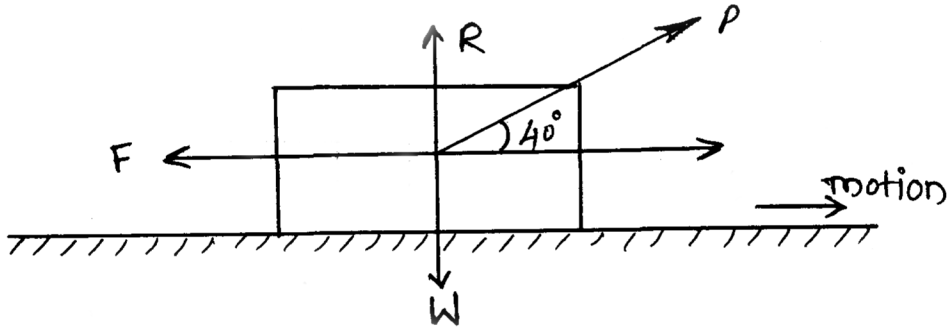

Fig. No. 5.

e) A body of weight 50 kN is hung by means of a string to the ceiling. Determine the pull required and tension in the string when string has an inclination 70° with the ceiling and pull is applied at 30° with the horizontal. Refer Fig. No. 6.

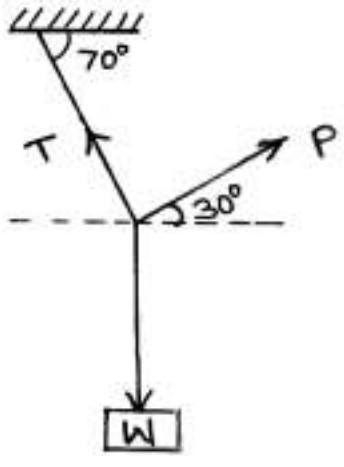

Fig. No. 6.

Marks

5. Attempt any TWO of the following: **12**

a) For a beam as shown in Fig. No. 7., calculate reaction at roller and hinge support by analytical method.

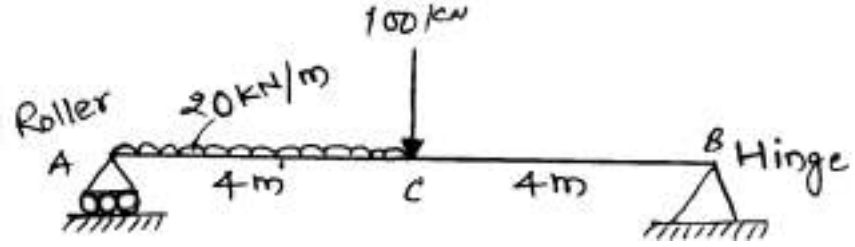

Fig. No. 7.

b) A body of weight 600 N is resting on a rough inclined plane at an angle of 40°. If coefficient of friction is 0.58, What force is required to prevent the body from falling down the plane.

c) Calculate the resultant and locate it's position w.r.t. point A for the force system shown in Fig. No. 8.

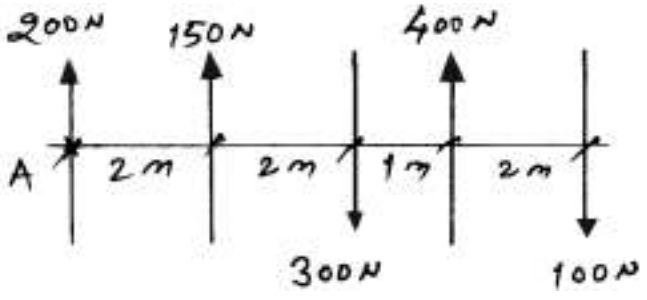

Fig. No. 8.

6. Attempt any TWO of the following: **12**

a) Find position of centroid for T-section as sown in Fig. No. 9.

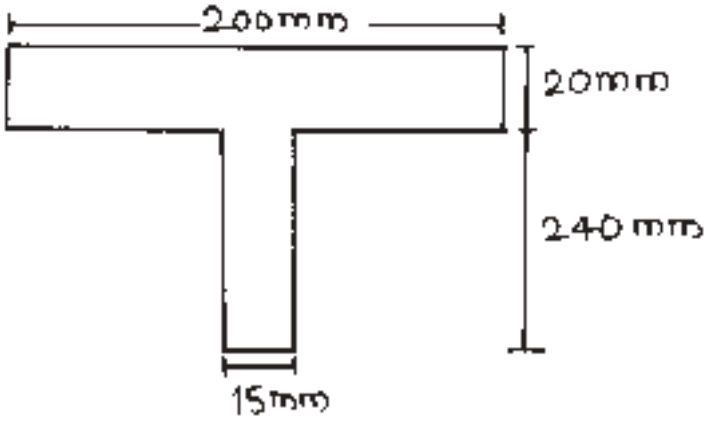

Fig. No. 9.

Marks

b) ABCD is a square plate of uniform thickness having each side of 300 mm. With A as centre and 300 mm as radius, a quarter circular portion ABD is removed as shown in Fig. No. 10. Locate the centroid of the remaining plate.

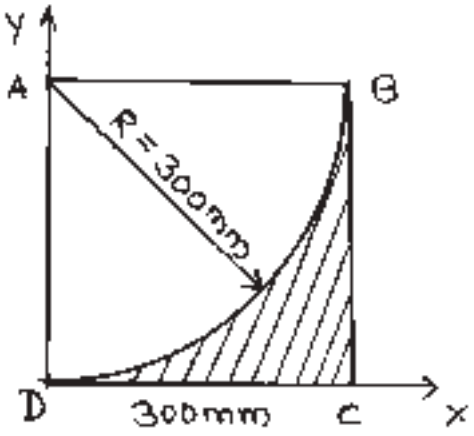

Fig. No. 10.

c) A solid sphere of 18 cm in diameter is placed on the top of a cylinder which is also 18 cm in diameter and 40 cm high such that their axes coincide. Find the centre of gravity of the combination. Refer Fig. No. 11.

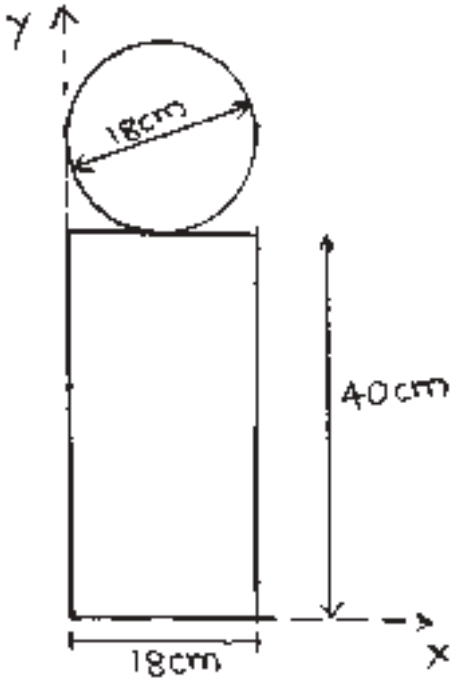

Fig. No. 11.