17204

11718

3 Hours / 100 Marks Seat No. | | | | | | | | |

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 TEN of the following : **20**

(a) Define Simple Machine.

(b) Define Mechanical Advantage.

(c) Define Ideal Effort.

(d) Define Statics and Dynamics.

(e) Define force and write its S.I. unit.

(f) State principle of transmissibility of forces.

(g) State Bow's Notation. Where is it used ?

(h) Define free body and free body diagram.

(i) List the conditions of equilibrium for co-planer non-concurrent forces.

(j) Define Angle of Repose.

(k) Define cone of friction.

(l) The pitch of a double start square threaded screw is 10 mm. Determine the velocity ratio.

2. Attempt any FOUR of the following : **16**

(a) State Reversibility of a machine. Define self locking machine. State conditions for reversibility and self locking.

(b) A Weston differential pulley consists of a lower block and an upper block. The upper block has two pulleys, one of which has a radius of 125 mm and the other has a radius of 115 mm. If the efficiency of the machine is 40%, calculate the effort required to raise a load of 1500 N.

(c) A double Purchase Crab used in a laboratory has following dimensions :

Diameter of load drum = 160 mm

Length of the handle = 360 mm

No. of teeth on pinions = 20 and 30

No. of teeth on spur wheel = 75 and 90

When tested it was found that an effort of 90 N was required to lift a load of 1800 N and an effort of 135 N was required to lift a load of 3150 N. Determine :

(i) Law of the machine

(ii) Probable effort to lift a load of 4500 N.

(d) Resolve the force of 120 N acting from origin to point (–3, 4), along X and Y axis.

(e) Three forces 40 N, 60 N and 80 N act along three sides of an equilateral triangle of sides 100 mm each taken in order. Find the magnitude and position of resultant force.

(f) Define moment of force. State its SI unit. Define couple and write its types.

3. Attempt any FOUR of the following : **16**

(a) State Parallelogram law of forces and write equations for magnitude and direction of resultant force.

(b) Forces of 2, 4, 6 and 8 kN act on regular Pentagon as shown in Fig. No. 1. Find analytically the resultant in magnitude and direction.

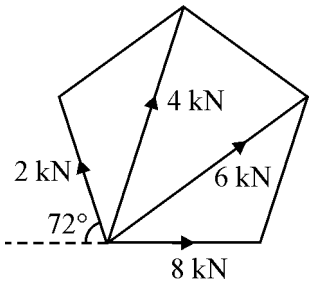

Fig. No. 1

(c) A concurrent force system is shown in Fig. No. 2. Find graphically the resultant of this force system.

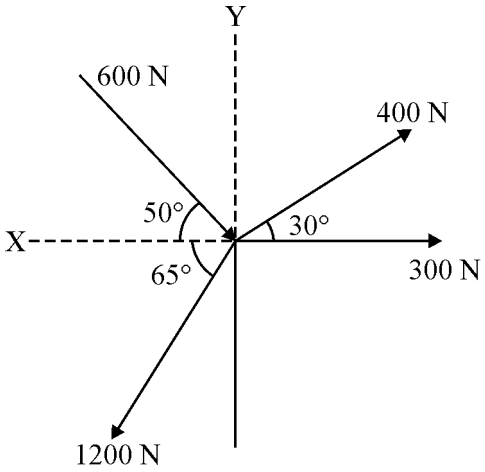

Fig. No. 2

(d) The resultant of a system of forces as shown in Fig. No. 3 is 500 N and acts along X-axis towards the right. Find analytically the unknown force 'P' and its inclination with X-axis.

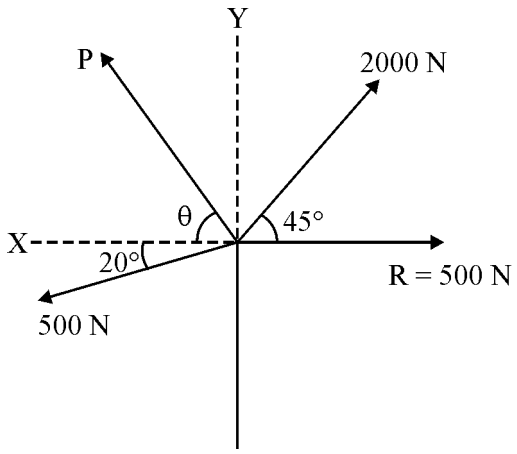

Fig. No. 3

(e) Locate graphically the position of resultant for the parallel force system as shown in Fig. No. 4 with respect to Point 'A'.

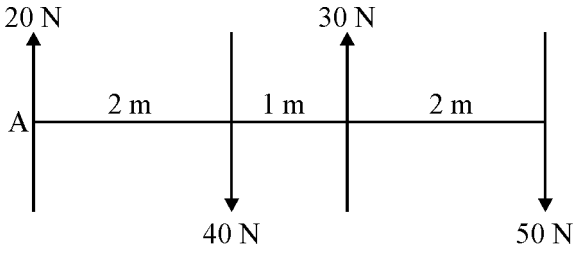

Fig. No. 4

(f) A set of four parallel forces of magnitude 4 N, 6 N, 3 N and 2 N are acting in upward direction. The distance between first two forces is 2 m and that between last two forces is 2 m. The distance between forces 6 N and 3 N is 1m. Find analytically the resultant and show its positon on sketch with respect to 4 N force.

4. Attempt any FOUR of the following : **16**

(a) Differentiate equilibrant from resultant.

(b) State and explain Lami's theorem. List limitations of Lami's theorem.

(c) Enlist three types of end supports of beam with types of reactions they offer with help of a neat sketch.

(d) Find analytically the reactions at supports as shown in Fig. No. 5.

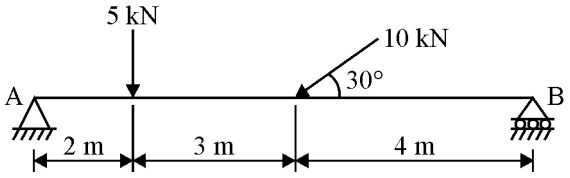

Fig. No. 5

(e) An electric light fixture weighing 15 N hangs from point 'C' by two strings AC and BC. The string AC is inclined at 60° to the horizontal and BC at 45° to the vertical as shown in Fig. No. 6. Using Lami's theorem determine forces in string AC and BC.

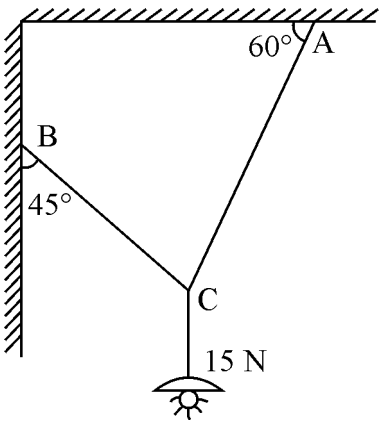

Fig. No. 6

(f) A simply supported beam of 4 m span is loaded with an u.d.l. of 5 kN/m for 2 m from left end and a point load of 30 kN at 1 m form right end. Find the support reactions using graphical method.

P.T.O.

5. Attempt any FOUR of the following : **16**

(a) A body of weight 300 N is lying on a rough horizontal plane having a coefficient of friction 0.3. Find the magnitude of force which can move the body, while acting at an angle of 25° with the horizontal.

(b) A body of weight 150 N is resting on a rough horizontal plane and can be just moved by a force of 50 N applied horizontally. Find the coefficient of friction. Also find magnitude and direction of resultant reaction.

(c) Draw a neat sketch of ladder resting against smooth wall. Show all active and reactive forces. Elaborate notations used.

(d) A heavy stone of mass 500 kg is on a hill slope of 60° incline. If the coefficient of friction between ground and stone is 0.4, Is the stone stable ? Justify.

(e) For a certain machine the law is P = (0.08W + 5) N. Calculate the effort required to lift a load of 5 kN. Also calculate maximum M.A. and identify the type of machine. V.R. of the machine is 20.

(f) The screw jack has a pitch of 3 mm & efficiency 28%. Find the effort required at the end of arm 360 mm to lift the load of 5 kN.

6. Attempt any FOUR of the following : **16**

(a) Find centroid of ISA 90 × 60 × 8 mm.

(b) Find the centroid of plate shown in Fig. No. 7.

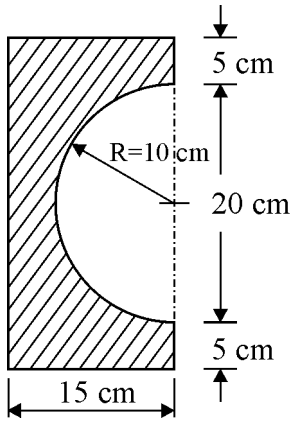

Fig. No. 7

(c) State and explain Varignon's theorem of moments.

(d) Compare the terms centroid and centre of gravity.

(e) A solid sphere of 18 cm in diameter is palced on the top of cylinder which is also 18 cm in diameter and 40 cm high such that their axes coincide. Find C.G. of the combination.

(f) The frustum of a cone has top diameter 30 cm and bottom diameter 60 cm with height 18 cm. Find the centre of gravity of frustum.
