17204

13141

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

Instructions : (1) All Questions are *compulsory*.

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

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

Marks

1. Attempt any TEN of the following : 20

(a) Define Mechanical Advantages and Velocity Ratio.

(b) State relation between MA, VR and η%.

(c) Define load lost in friction and state its expression.

(d) Define a force and state its S.I. Unit.

(e) Enlist sub classification of coplanar force system.

(f) State law of parallelogram of forces.

(g) State significance of funicular polygon.

(h) State relation between resultant and equilibrant.

(i) State analytical conditions of equilibrium for Coplanar Force System.

(j) Define friction and limiting force of friction.

(k) State relation between coefficient of friction, angle of friction and angle of repose.

(l) Define centroid and centre of gravity.

2. Attempt any FOUR of the following : 16

(a) (i) State law of machine and state its significance.

(ii) Define self locking machine and state its condition.

(b) The law of a certain machine is $P = \frac{W}{50} + 8$ N and V.R. = 100. Find the maximum possible M.A. and maximum possible η%, while lifting a load of 600 N. What will be the efficiency ?

(c) Find the orthogonal components of forces

(i) 300 N acting due North-East

(ii) 400 N acting at 30º of East of North.

(d) State and explain Varignon's theorem of moment and state its significance.

(e) Resolve the force of 500º N at 20º either side of it.

(f) In a differential pulley block, a load of 1.8 kN is raised by an effort of 180 N. The number of teeth on larger and smaller blocks are 12 and 10 respectively. Find the V.R., M.A. and η %.

3. Attempt any FOUR of the following : 16

(a) Two forces acts at an angle of 120º. The bigger force is 40 N and resultant is perpendicular to the smaller force. Find the smaller force.

(b) A triangle ABC has its side AB = 30 cm along +ve x-axis and BC = 40 cm along –ve y-axis. Three forces of 30 N, 40 N and 50 N acts along the sides AB, BC & CD respectively. Determine magnitude and direction of resultant of such a system of forces. w.r.t. point A.

(c) Find the magnitude and direction of resultant force of 8 N, 12 N, 16 N and 20 N making an angle 30º, 120º, 210º and 330º with +ve x-axis measured in anticlockwise direction respectively.

(d) Solve Que. 3 (c) graphically.

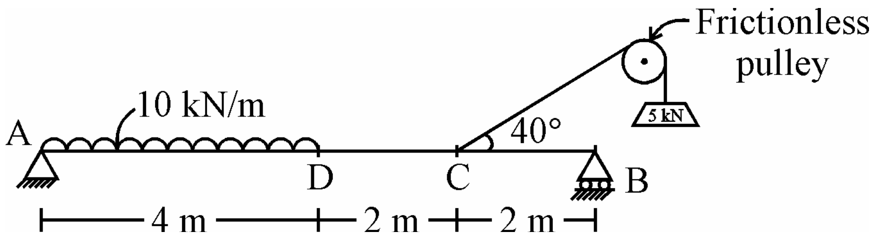
(e) Find magnitude and direction of resultant force, if 30 N, 40 N, 50 N and 60 N forces are acting along the line joining the centre of square to its vertices.

(f) Solve Que. 3 (e) by graphical method.

4. Attempt any TWO of the following : 16

(a) A light string A B C D E whose extremity 'A' is fixed, has W_1 and W_2 attached at 'B' and 'C'. It passes round a small pulley at 'D' carrying a weight of 300 N at free end 'E'. If in the equilibrium position BC is horizontal and AB and CD makes an angle 150º and 120º respectively with BC, find magnitudes of W_1 and W_2 .

(b) Determine support reactions for a simply supported beam loaded as shown in figure 4 (b).



(c) (i) Two men carry a weight of 2 kN by means of two ropes fixed to the weight. One rope is inclined at 45° and other at 30° with their vertices. Find the tension in each rope.

(ii) A simply supported beam carries a point load W at 'L_1' from left hand support. Span of beam is 'L'. Find support reactions.

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 as 0.3. Find the magnitude of the force which can move the body, while acting at an angle of 30° with horizontal.

(b) State four laws of static friction.

(c) A body of weight 500 N is lying on a rough plane inclined at an angle of 25° with the horizontal. It is supported by a force 'P' parallel to the plane. Determine minimum value of P, for which equilibrium can exist if the angle of friction is 20°.

(d) A force of 250 N pulls a body of weight 500 N up an inclined plane, the force being applied parallel to the plane. If the inclination of plane with horizontal is 15°, find the coefficient of friction.

(e) Define effort lost in friction and load loss in friction giving expressions of them.

(f) A screw jack having 5 mm pitch and has 300 mm as diameter of effort wheel is used to lift a load of 80 kN. Find the V.R. and effort required if efficiency of the m/c is 30%.

6. Attempt any FOUR of the following : 16

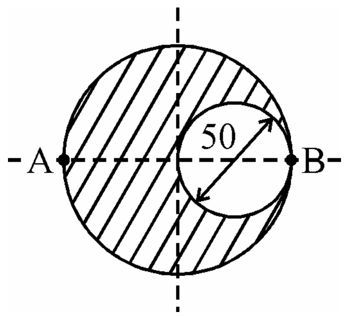
(a) Find the centre of gravity of a T section 100 mm × 100 mm × 10 mm

(b) Find the centre of gravity of a channel section 100 mm × 100 mm × 10 mm

(c) A solid body is formed by joining the base of a right circular cone of height 12 cm to the equal base of right circular cylinder of height 4 cm. Calculate the distance of centre of mass of the solid from its bottom face.

(d) A hemisphere of 60 mm diameter is placed on the top of cylinder having equal diameter. Find the common C.G. of the body from the base height of cylinder is 30 mm.

(e) A circular hole of 50 mm diameter is cut out from a circular disc of diameter 100 mm as shown in fig. Find the C.G. of the section from 'A'.



(f) In a simple screw jack, the pitch of the screw is 10 mm and length of handle is 450 mm. Find V.R. If an effort of 25 N is applied at the end of handle can lift the load of 3 kN, find the efficiency of jack. Also calculate the amount of effort wasted in friction.