17350

15162

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 : **(10×2=20)**

a) Define a force and state it's S.I. Unit.

b) Define moment and state it's S.I. Unit.

c) Define equilibrant.

d) State Lami's theorem.

e) List two advantages of Friction.

f) State two Laws of Static Friction.

g) Define centroid and centre of gravity.

h) Show in sketch the C.G. of a quarter circle of radius 50 mm.

i) Define mechanical advantage and velocity ratio.

j) What is law of Machine and state it's use ?

k) Give the relation between E, G and K.

l) State Hook's law.

P.T.O.

Marks

2. Attempt **any four** of the following : **(4×4=16)**

a) A force of 80 N is acting on a body. Find its components such that one component has an angle of 30° with the force 80 N.

b) State four properties of couple with examples of each.

c) Explain principle of transmissibility.

d) Two forces acting at and away from the point have magnitudes of 20 kN and 25 kN respectively having an included angle of 60°. Find their resultant and direction.

e) Find the resultant of the force system shown in Fig. No. 1 (e) in magnitude and direction by analytical method.

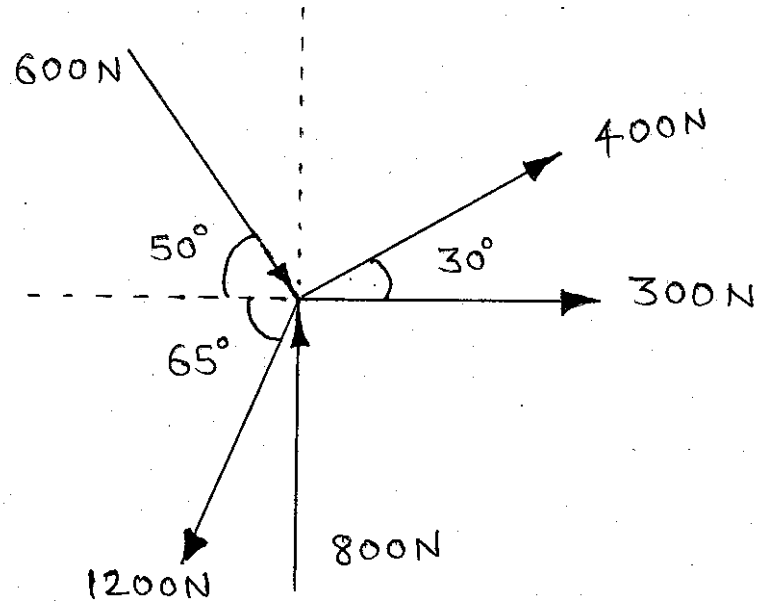

Fig. No. 1 (e)

f) Five parallel forces of 10 kN, 20 kN, 30 kN, 50 kN and 80 kN are acting on a beam distances of forces from 10 kN are 1 m, 2 m, 3 m and 5 m. Forces 20 kN and 50 kN are acting downwards and other pointing upwards. Find resultant in magnitude and direction and locate its position with respect to 10 kN force.

3. Attempt **any four** of the following : **(4×4=16)**

a) State any four types of beam with sketch.

b) A sphere of diameter 1.2 m and weighing 1800 N rests against two smooth planes inclined at 60° and 45° respectively. Determine reactions offered by the planes.

Marks

c) A weight of 200 N is attached by two strings. Calculate the tension in the string use Fig. No. 2 (c).

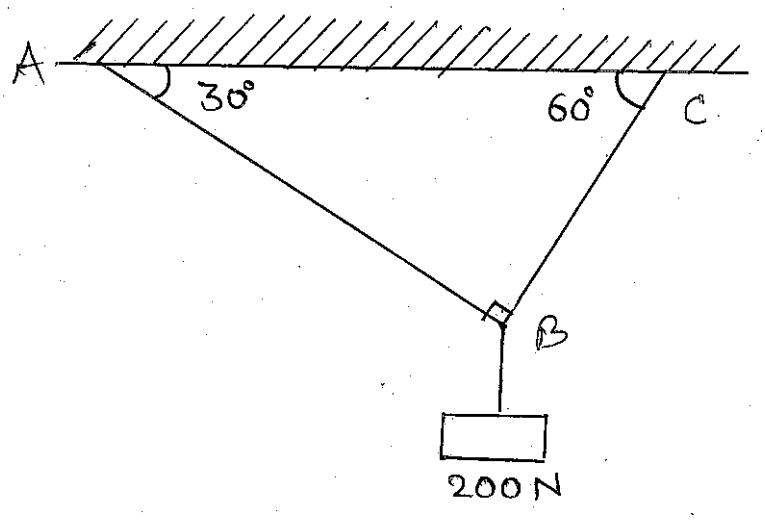

Fig. No. 2 (c).

d) A simply supported beam of span 8 m carries point loads of 2 kN, 3 kN, 4 kN and 5 kN at 1 m, 3 m, 5 m and 7 m from left hand support. Find the support reactions.

e) A body of weight 600 N is resting on a rough inclined plane. Inclined 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.

f) Define coefficient of friction and angle of friction.

4. Attempt **any four** of the following : **(4×4=16)**

a) A block of 500 N is kept on a horizontal surface. A horizontal force of 190 N is required to just move it. Find :

i) Normal reaction

ii) Frictional resistance

iii) Coefficient of friction.

b) A block having weight 1000 N resting on a horizontal plane requires a pull of 400 N to start its motion. When applied at an angle of 30° with horizontal. Find the coefficient of friction.

c) Define moment of inertia and calculate radius of gyration for circular section.

d) A T-section has a flange 200 x 20 mm and a web of 15×240 mm. Find the position of centroid.

e) Find the centroid of a channel section 2000 × 1000 × 200 mm.

f) A solid cone having base diameter 6 cm and height 6 cm is kept co-axially on a solid cylinder having 6 cm diameter and 10 cm height. Find C.G. of the combination.

Marks

5. Attempt **any four** of the following : **(4×4=16)**

a) A solid cone of base diameter 40 cm and height 100 cm is welded to a hemisphere of same diameter. Find the C.G. of the solid composite.

b) What is reversible machine ? State the condition for the machine to be reversible.

c) A certain machine has an efficiency of 48%. The velocity ratio of the machine is 200. Find the effort required to lift a load of 2 kN using this machine.

d) A machine has a V.R. = 20 and it has a law P = 0.05 W + 15 N. Calculate the load lost in friction when 200 N load is lifted.Calculate ideal effort.

e) A screw jack lifts a load of 30 kN by an effort of 400 N applied at the end of lever arm of length 750 mm. If the pitch of the screw is 6 mm. Calculate efficiency of the screw jack.

f) In double purchase crab, the two pinions have 12 teeth each and the two spur wheels have 72 teeth each. The diameter of the load drum is 22 cm and that of the effort wheel is 65 cm. Find the velocity ratio and ideal effort for a load of 5 kN.

6. Attempt **any four** of the following : **(4×4=16)**

a) Draw the diagram for differential axle and wheel and label the parts.

b) Define the terms :

i) Ductility

ii) Malleability

iii) Brittleness

iv) Creep.

c) Define Bulk modulus, Poisson's ratio volumetric strain and modulus of rigidity.

d) For a certain material E = 2.5 K calculate Poisson's ratio.

e) Find the required diameter of steel rod that has carry an axial pull of 50 kN if the permissible stress is 150 N/mm^2.

f) State four assumption in theory of pure torsion.
