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END SEMESTER REGULAR / RETEST EXAMINATION, JULY– 2023

Branch : (Common)

Semester : 2nd

Subject Code : ME-201

ENGINEERING MECHANICS

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

Instructions :

(i) *All* questions of PART – A are compulsory.

(ii) Answer any *five* questions from PART – B.

PART – A
Marks – 25

1. Answer the following Multiple Choice Questions by writing the correct options.　　1×10

   (a) The unit of work or energy in S. I. unit is

   　(i) Newton　　　(ii) Kilogram meter

   　(iii) Watt　　　(iv) Joule

[Turn over

(b) Forces are called concurrent when their lines of action meet in

(i) one point   (ii) two points

(iii) plane   (iv) perpendicular planes

(c) The algebraic sum of the resolved parts of a number of forces in a given direction is equal to the resolved part of their resultant in the same direction. This is as per the principle of

(i) forces

(ii) independence of forces

(iii) dependence of forces

(iv) resolution of forces

(d) The weight of a body is due to

(i) centripetal force of earth

(ii) gravitational pull exerted by the earth

(iii) forces experienced by body in atmosphere

(iv) force of attraction experienced by particles

(v) gravitational force of attraction towards the centre of the earth.

(e) Maximum mechanical advantage of a lifting machine is

(i) $1/m$ (ii) $1+m$

(iii) $1-m$ (iv) m

(f) Unit of moment of inertia in S.I system is

(i) m^5 (ii) m^4

(iii) Nm^2 (iv) Nm^3

(g) Angle between the resultant of normal reaction and frictional force is called

(i) angle of friction

(ii) angle of repose

(iii) cone of friction

(iv) angle of inclination

(h) Centre of gravity of a triangle lies at the point of intersection of

(i) diagonals   (ii) medians

(iii) altitudes   (iv) bisector of angles

(i) Two non-collinear parallel equal forces acting in opposite direction

    (i) balance each other

    (ii) constitute a moment

    (iii) constitute a couple

    (iv) constitute a moment of couple

(j) Which of the following is not a Scalar Quantity ?

    (i) Time   (ii) Mass

    (iii) Volume   (iv) Acceleration.

2. Fill in the blanks : $1 \times 10 = 10$

(a) Resultant of two unlike parallel forces F_1 and F_2 is _____.

(b) Static friction is _____ than dynamic friction.

(c) Centre of gravity is the point at which the whole _____ of a body is supposed to be concentrated.

(d) A large force acting on a body for a short time is called _____.

(e) Moment of inertia of a square of side 'd' about X-X axis is _____.

(f) The resultant of two unlike and equal parallel forces whose lines of action are same is _____.

(g) The opposing force which acts at the point of contact of the two bodies which slides over another is called _____.

(h) Moment of a force is a _____ quantity.

(i) A simple machine is said to be Self-locking if its efficiency is _____.

(j) The axis about which a plane figure is symmetrical on both of its sides is called _____.

3. State whether the following sentences are True or False : 1×5=5

(a) A resultant is a single force which can replace two or more forces and produce the same effect on the body as the given system of forces.

(b) Geometrically the moment of a force about a point, taken as the vertex of a triangle is equal to half the area of the triangle.

(c) Sliding friction is a type of dynamic friction.

(d) If the velocity of a body increases, its momentum will decrease.

(e) The distance through which a screw thread advances axially in one revolution is called pitch.

PART – B

Marks – 45

4. (a) State the principle of resolution of forces.

(b) Two forces 100N and 60N act a point : if the angle between the lines of action of the two forces is 60°, find the magnitude and direction of the resultant. 2+7=9

5. (a) State Lami's theorem.

(b) A simply supported beam AB of 8m is subjected to point loads of 5kN, 1kN and 2kN at distances of 2m, 4m, 6m from the left hand support. Also an uniformly distributed load of 2.5 kN/m runs for a length of 2m from the left-hand support. Find the reactions at the two supports. 2+7=9

6. (a) Define parallel Axis theorem.

   (b) Determine the moment of inertia of an 'I' section about X-X and Y-Y axis passing through c.g. of the section whose dimensions are :   2+7=9

   Top flange :   10 cm × 2 cm

   Web :   8 cm × 2cm

   Bottom flange :   12 cm × 4 cm.

7. (a) Define Static friction and Dynamic friction.

   (b) A body of weight 40 kN rests in limiting equilibrium on a rough plane whose slope is 30°. The plane is raised to a slope of 60°. What force applied to the body parallel to the inclined plane will support the body on the plane ?   2+7=9

8. A particle starts from a point O with an uniform velocity of 4 m/sec. After 2 sec another particle leaves O in the same direction with a velocity of 5 m/sec and with an acceleration of 3 m/sec². Find when and where it will overtake the first particle .   9

9. (a) Define mechanical advantage and velocity ratio of a simple lifting machine.

(b) In a lifting machine, an effort of 15N lifts a load of 300N and an effort of 20N lifts a load of 500N. Establish the law of the machine and calculate the effort required to lift a load of 700N.   2+7=9