Registration No:

Integrated Dual Degree (B.Tech and M.Tech)

23ES1004

2nd Semester Regular Examination: 2023-24
SUBJECT: Engineering Mechanics
BRANCH(S):
AEIE,AUTO,BIOMED,BIOTECH,CE,CHEM,CIVIL,CSE,CSEAI,CSEAIME,CSEDS,CST,ECE,
EEE,ELECTRICAL,ETC,MANUTECH,MECH,METTA,MINING,MME,PLASTIC,PT
Time: 3 Hour
Max Marks: 100
Q.Code: P467
Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two
from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)
 a) State the Lami's theorem.
 b) Two forces of 100 N and 150 N are acting simultaneously at a point. What is the resultant of these two forces, if the angle between them is 45°?
 c) State the Varignon's principle of moments.
 d) Name the methods, which are employed, for finding out the forces in a truss.
 e) Define coefficient of friction and limiting friction.
 f) Find the moment of inertia of a rectangular section 30 mm wide and 40 mm deep about X - X axis and Y - Y axis.
 g) State the first theorem of Pappus.
 h) State the D'Alembert's principle.
 i) Define the term 'conservation of energy'.
 j) Distinguish between the linear velocity of a point on a body rotating about a fixed axis and its angular velocity. Write the relation between them.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)   (6 × 8)
 a) Distinguish between resolution of forces and composition of forces with examples.
 b) Explain the advantages of drawing a free-body diagram with suitable example.
 c) What do you understand by the term friction? State the laws of friction.
 d) A load of 300 N is lying on an inclined plane, whose inclination with the horizontal is 30°. If the coefficient of friction between the load and the plane is 0.3, find the minimum and maximum horizontal force, which will keep the load in equilibrium.
 e) State and prove the theorem of perpendicular axis applied to moment of inertia.
 f) A body is projected upwards with a velocity of 30 m/s. Find (i) the time when its velocity will be 5 m/s, and (ii) the time when it will be 20 meters above the point of projection.
 g) Obtain an equation for the trajectory of a projectile, and show that it is a parabola.

h) From a circular area of diameter '2d', a smaller circle of diameter 'd' is removed as shown in Fig. 1. Locate the centroid of the remaining area.
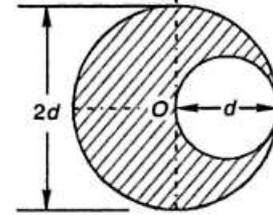

Fig. 1

i) An aircraft, moving horizontally at 108 km/hr at an altitude of 1000 m towards a target on the ground, releases a bomb which hits it. Estimate the horizontal distance of the aircraft from the target, when it released the bomb. Calculate also the direction and velocity with which the bomb hits the target. Neglect air friction.

j) A motor cycle starts form rest and moves with a constant acceleration of 2.25 m/s². What is its angular acceleration, if the diameter of the motor cycle wheels is 750 mm?

k) What do you understand by the term kinematics? Explain different types of plane motion of rigid bodies with suitable examples.

l) Define the following terms:
  (i) Work, (ii) Impulse, and (iii) Coefficient of restitution

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Fig. 2 shows a truss consisting of seven members each of 3 m length freely supported at its end points. The truss is loaded at B and C as shown. Find the forces in all the members of the truss, indicating whether the force is compressive or tensile. **(16)**
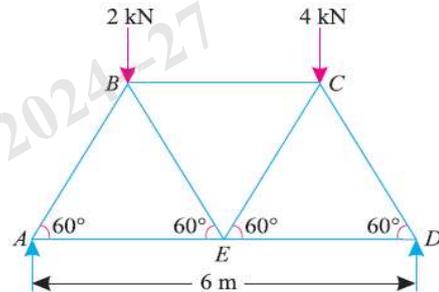

Fig. 2

Q4 Two blocks A and B of weights 1 kN and 2 kN respectively are in equilibrium position as shown in Fig. 3. If the coefficient of friction between the two blocks as well as the block B and the floor is 0.3, find the force (P) required moving the block B. **(16)**
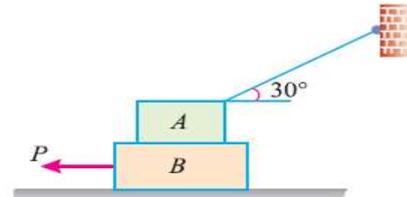

Fig. 3

Q5 An I-section is made up of three rectangles as shown in Fig. 4. Find the moment of inertia of the section about the horizontal axis passing through the centre of gravity of the section. **(16)**
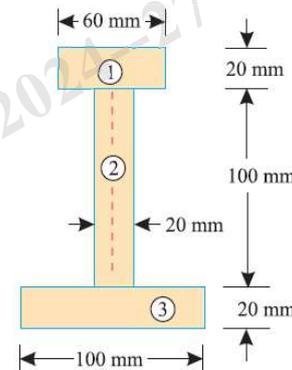

Fig. 4

Q6 A sphere of mass 1 kg, moving at 3 m/s, overtakes another sphere of mass 5 kg moving in the same line at 60 cm/s. Find the loss of kinetic energy during impact, and show that the direction of motion of the first sphere is reversed. Take coefficient of restitution as 0.75. **(16)**