Registration No.: | | | | | | | | | | |

Total Number of Pages: 03 **Course: B.Tech**
Sub_Code: REM2B001

2nd Semester Back Examination: 2024-25
SUBJECT: Engineering Mechanics
BRANCH(S): AEIE, AUTO, BIOTECH, CHEM, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CSIT, CST, ECE, EEE, ELECTRICAL, ELECTRICAL & C.E, ELECTRONICS & C.E, ETC, IT, MANUTECH, MECH, METTA, MINING, MME, PLASTIC
Time: 3 Hours
Max Marks: 100
Q.Code: S465

Answer Question No.1 (Part-I) 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) If a number of forces are acting on a body, what are conditions of equilibrium, so that the body is in equilibrium?
b) Explain the statement "Two equal and opposite parallel forces produces a couple".
c) Define the term 'Free-body Diagram' with a suitable example.
d) List out the advantages of method of section over method of joints.
e) State the theorem of perpendicular axis.
f) State the Principle of virtual work.
g) An object of weight 100 N is kept in position on a plane inclined 30° to the horizontal by a horizontally applied force (F). If the coefficient of friction of the surface of the inclined plane is 0.25, determine the minimum magnitude of the force (F).
h) What do you mean by linear motion? Give two examples of linear motion.
i) What do you mean by circular motion? Give two examples of circular motion.
j) A ball is projected upwards with a velocity of 15 m/s at an angle of 25° with the horizontal. What is the horizontal range of the ball?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Explain the procedure of resolving a given force into two components at right angles to each other.
b) Two equal forces are acting at a point with an angle of 60° between them. If the resultant force is equal to $20 \times \sqrt{3}$ N, find magnitude of each force.
c) Differentiate between:
(i) Concurrent and non-concurrent forces,
(ii) Coplanar and non-coplanar forces,
(iii) Moment of a force and couple.

d) A circular roller of radius 5 cm and of weight 100 N rests on a smooth horizontal surface and is held in position by an inclined bar AB of length 10 cm as shown in Fig. 1. A horizontal force of 200 N is acting at B. Find the tension in the bar AB and the vertical reaction at C.

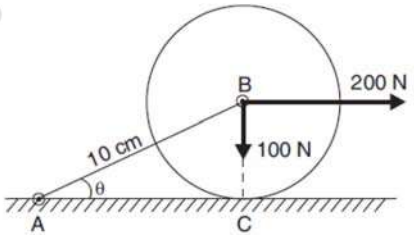

Fig. 1

e) A body of weight 70 N is placed on a rough horizontal plane. To just move the body on the horizontal plane, a push of 20 N inclined at 20° to the horizontal plane is required. Find the co-efficient of friction.

f) Find the forces in the members AB and BC of the truss shown in Fig. 2.

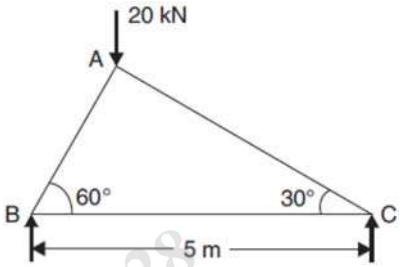

Fig. 2

g) Derive an expression for mass moment of inertia of a right circular cone of base radius R, height H, and mass M about its axis.

h) A projectile is fired with a velocity of 80 m/s at an elevation of 65°. Find its velocity and direction after 5 seconds of firing.

i) A stone is dropped from a height. After falling 5 seconds from rest, the stone breaks the glass pane and in breaking, the stone loses 20 % of its velocity. Find the distance travelled by the stone in the next second. Take g = 9.81 m/s^2.

j) Define and explain the Newton's Laws of motion for both linear and rotational motion.

k) A body is rotating with an angular velocity of 5 radians/s. After 5 seconds, the angular velocity of the body becomes 15 radians/s. Determine the angular acceleration of the body.

l) Define the terms: I) Work, II) energy, III) momentum, and IV) impulse.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four) **(16 x 2)**

Q3 An electric light fixture weighing 15 N hangs from a point C, by two strings AC and BC. AC is inclined at 60° to the horizontal and BC at 45° to the vertical as shown in Fig. 3. Using Lami's theorem, determine the forces in the strings AC and BC. **(16)**

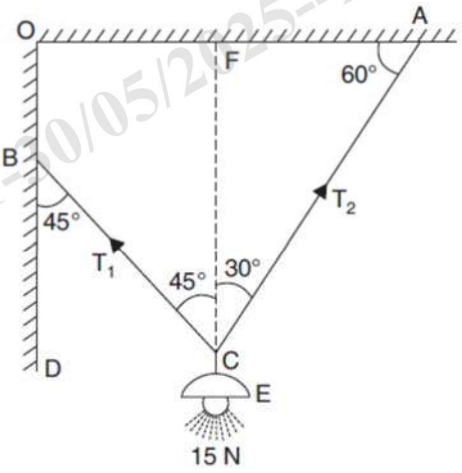

Fig. 3

Q4 A particle moves along a straight line with an acceleration described by the equation $a = -8\ s^{-2}$ where a is in m/s^2 and s in m. When t = 1 s, s = 4 m, and v = 2 m/s. Determine acceleration when t = 2 s. **(16)**

Q5 Find the moments of inertia about the centroidal XX and YY axes of the section shown in Fig. 4. **(16)**

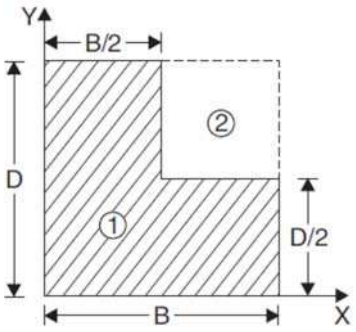

Fig. 4

Q6 Find the tension in the string and accelerations of blocks A and B weighing 200 N and 50 N respectively, connected by a string and frictionless and weightless pulleys as shown in Fig. 5. **(16)**

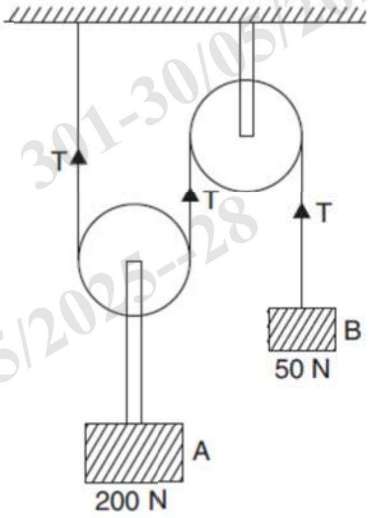

Fig. 5.