Total Number of Pages: 02   **Integrated Dual Degree (B.Tech and M.Tech)**
REM2B001

2nd Semester Back Examination: 2023-24
SUBJECT: Engineering Mechanics
BRANCH(S):
AE,AEIE,AERO,AG,AUTO,CHEM,CIVIL,CSE,CSEAI,CSEAIME,CSEDS,CSIT,CST,ECE,EEE,
EIE,ELECTRICAL,ELECTRICAL & C.E,ELECTRONICS &
C.E,ETC,IT,MANUTECH,MECH,MINING,MME,PLASTIC
Time: 3 Hour
Max Marks: 100
Q.Code : P468
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) What are the methods for finding out the resultant force for a given system of forces?
   b) How will you represent the moment of a force geometrically?
   c) What are different methods of studying the equilibrium of coplanar forces?
   d) Distinguish between centre of gravity and centroid.
   e) State the theorem of perpendicular axis.
   f) State the relationship between number of members (m) and number of joints (j) in a perfect truss.
   g) Distinguish between Inertial and Non-inertial frame of reference.
   h) State the law of conservation of momentum.
   i) State D' Alembert's Principle for a rigid body in plane motion.
   j) Define the coefficient of restitution.

Part-II

Q2   **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**   **(6 × 8)**
   a) Explain the term 'Force' and list its characteristics.
   b) What are the different types of parallel forces? Distinguish between like and unlike parallel forces.
   c) State and prove Lami's Theorem.
   d) Two men carry a weight of 2 kN by means of two ropes fixed to the weight. One rope is inclined at 45° and the other at 30° with their vertices. Find the tension in each rope.
   e) Explain the followings:
        (i) Laws of static friction
        (ii) Limiting angle of friction.
   f) State and prove Parallel axis theorem.
   g) Write short note on principle of virtual work.
   h) A ball is thrown vertically upwards with an initial velocity of 36 m/sec. After 2 seconds, another ball is thrown vertically upwards. What should be its initial velocity so that it crosses the first ball at a height of 30 m?
   i) A bomber is flying horizontally at an altitude of 2400 m with the uniform velocity of 1000 kmph to bomb a target. Where the bomb should be released to strike the target?
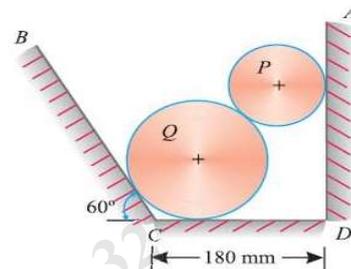
j) A man weighing 'W' Newton entered a lift which moves with an acceleration of 'a' m/sec^2. Find the force exerted by the man on the floor of lift when
(i) lift is moving downward
(ii) lift is moving upward

k) A particle, starting from rest, moves in a straight line, whose equation of motion is given by: $s = t^3 - 2t^2 + 3$. Find the velocity and acceleration of the particle after 5 seconds.

l) A wheel is rotating about its axis with a constant acceleration of 1 rad/sec^2. If the initial and final velocities are 50 rpm and 100 rpm, determine the time taken and number of revolution made during this period.

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

Q3 Two cylinders P and Q rest in a channel as shown in Fig. 1. The cylinder P has diameter of 100 mm and weighs 200 N, whereas the cylinder Q has diameter of 180 mm and weighs 500 N. If the bottom width of the box is 180 mm, with one side vertical and the other inclined at 60°, determine the pressures at all the four points of contact. **(16)**
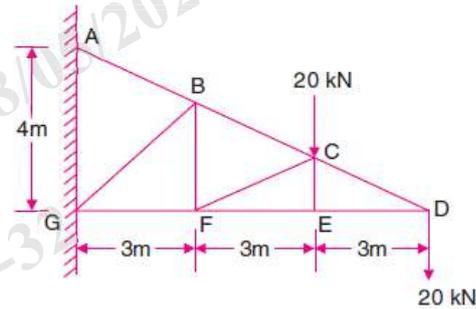

Fig. 1

Q4 Determine the forces in all the members of the truss shown in Fig. 2. **(16)**


Fig. 2

Q5 Two weights 800 N and 200 N are connected by a thread and they move along a rough horizontal plane under the action of a force of 400 N applied to the 800 N weight as shown in Fig. 3. The coefficient of friction between the sliding surface of the weights and the plane is 0.3. Using D' Alembert's principle determine the acceleration of the weight and tension in the thread. **(16)**
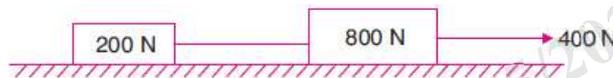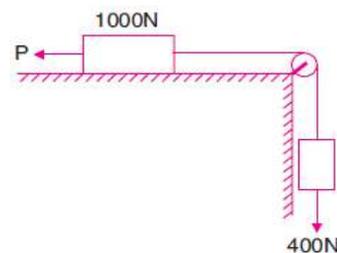

Fig. 3

Q6 The system shown in Fig. 4 has a rightward velocity of 4 m/sec, just before a force P is applied. Determine the value of P that will give a leftward velocity of 6 m/sec in a time interval of 20 sec. Take coefficient of friction = 0.2 and assume ideal pulley. **(16)**

Fig. 4