SUPPLEMENTARY/ BACKLOG EXAMINATION

COURSE NAME: BTech | SEMESTER: 2nd
BRANCH NAME: | SPECIALIZATION:
SUBJECT NAME: **ENGINEERING MECHANICS**
FULL MARKS: 50 | TIME: 2.5 Hours

- Answer All Questions.
- The figures in the right hand margin indicate Marks. *Symbols carry usual meaning.*

Any supplementary materials to be provided

Q1. Answer all Questions. **[2×5]**

a) If two forces P and Q, acting under the angle α, are applied to a body at A as shown in Figure 1, find formulas for calculating the magnitude of their resultant R and the angles β and γ which its line of action makes with those of the given forces. -CO1

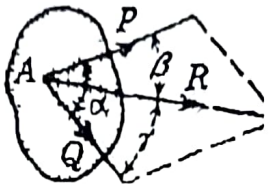

Figure 1

b) What is the relationship between each force, if three concurrent forces acting on a body according to Lami's theorem? -CO2

c) What is the difference between angle of repose and angle of friction? Explain. -CO3

d) How momentum is different than impulse. Explain with equations. -CO4

e) Calculate and compare the Moment of Inertia of hollow circular section about a central axis perpendicular to section with its Moment of Inertia about horizontal axis. -CO5

Q2. -CO1

What axial forces does the vertical load P induce in the members of the system shown in Figure 2. Neglect the weights of the members and assume an ideal hinge at A and a perfectly flexible string BC. **[8]**

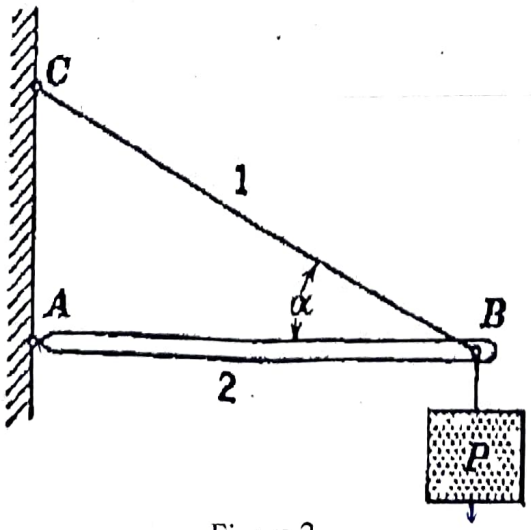

Figure 2

OR

A horizontal prismatic bar AB, of negligible weight and length l, is hinged to a vertical wall at A and supported at B by a tie rod BC that makes the angle α with the horizontal as shown in Figure 3. A weight P can have any position along the bar as defined by the distance x from the wall. Determine the tensile force S in the tie bar. **[8]**

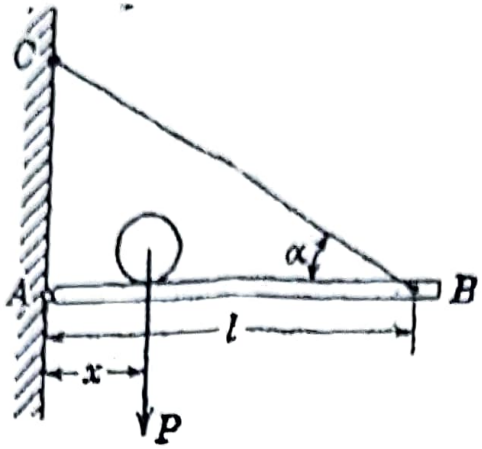

Figure 3

Q3. -CO2

Two rectangular blocks of weights W_1 and W_2 are connected by a flexible cord and rest upon a horizontal and an inclined plane, respectively, with the cord passing over a pulley as shown in Figure 4. In the particular case where $W_1 = W_2$ and the coefficient of static friction μ is the same for all contiguous surfaces, find the angle α of inclination of the inclined plane at which motion of the system will impend. Neglect friction in the pulley. **[8]**

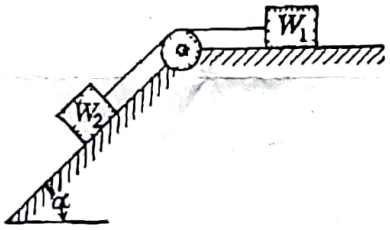

Figure 4

OR

Calculate the relation between the active forces P and Q for equilibrium of the system of bars shown in Figure 5 from the principle of virtual work. The bars are so arranged that they form three identical rhombuses. **[8]**

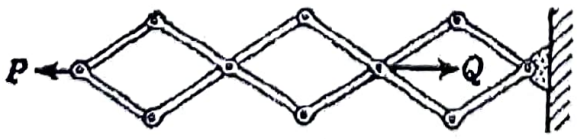

Figure 5

4. -CO3

Determine the force S in the bar AB of the simple truss supported and loaded as shown in the Figure 6. **[8]**

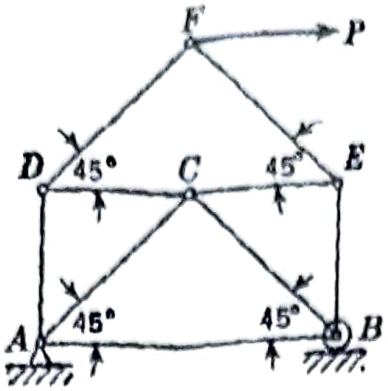

Figure 6

OR

Determine the forces in bars 1, 2, and 3 of the plane truss loaded and supported as shown in the Figure 7. **[8]**

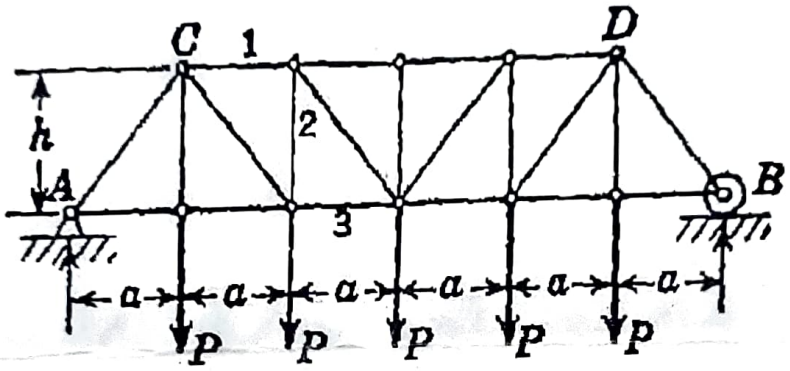

Figure 7

-CO4

Q5.

A small block of Weight W rests on an adjustable inclined plane as shown in Figure 8. Friction is such that sliding of the block impends when $\alpha = 30°$. What acceleration will the block have when $\alpha = 45°$? Neglect any difference between static and kinetic friction. **[8]**

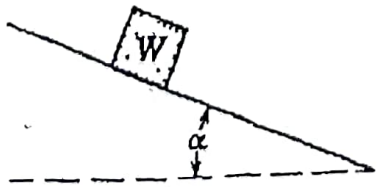

Figure 8

OR

Two equal weights W and a single weight Q are attached to the ends of a flexible but inextensible cord overhanging a pulley as shown in Figure 9. If the system moves with constant acceleration a as indicated by the arrows, find the magnitude of the weight Q. neglect air resistance and inertia of the pulley. **[8]**

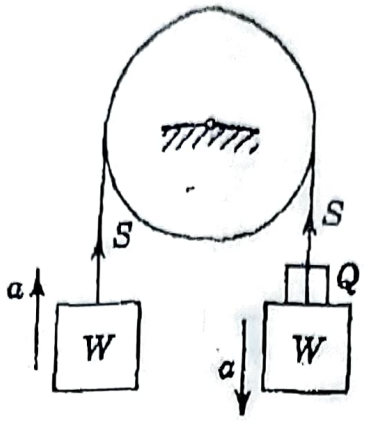

Figure 9

Q6. -CO5

For the two balls in Figure 10, find the velocities v_1' and v_2' after impact if $v_1 = v$, $v_2 = 0$, $W_2 = 3W_1$, and the coefficient of restitution $e = 1/2$. **[8]**

Figure 10

OR

A cannon fires its projectile with such an initial velocity u and at such an angle of elevation α that the range is r and the maximum height to which the projectile rises is h. Find the maximum range r_m that can be obtained with the same initial velocity. **[8]**