Code No: R19BS1204 **R19** SET - 1

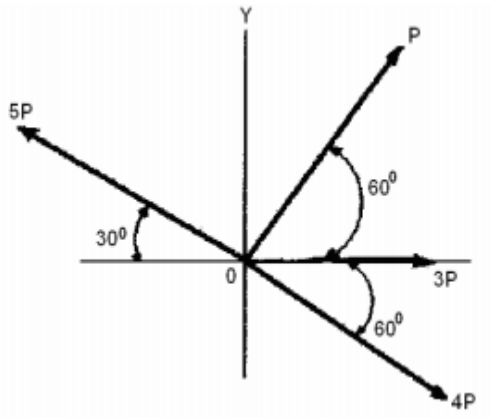
I B. Tech II Semester Supplementary Examinations, November - 2021
ENGINEERING MECHANICS
(Com. to ME, Chem. E, Pet E, Agri E)

Time: 3 hours Max. Marks: 75

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

UNIT-I

1. a) Find the magnitude and direction of the resultant R of four concurrent forces acting as shown in figure. (8M)



Figure

b) Four forces of magnitudes 10 N, 20 N and 30 N and 40 N are acting respectively along the four sides of a square ABCD with dimensions 500 mm × 500 mm as shown in Figure. Determine the magnitude and direction of the resultant force. (7M)

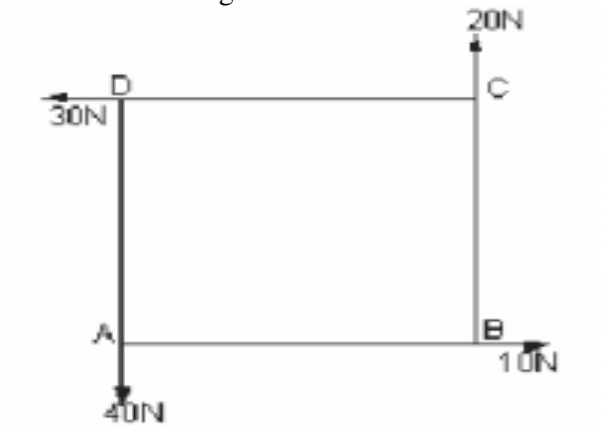
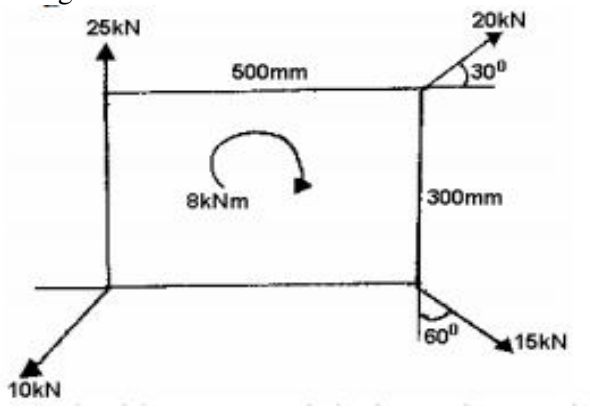


Figure
Or

2. a) A homogeneous ladder 6 m long and weighing 400N rests against a smooth wall. The angle between the ladder and the floor is 70^0. The coefficient of friction between the floor and the ladder is 0.25. How far up the ladder can a man weighing 80 kg walk before the ladder slips? (8M)

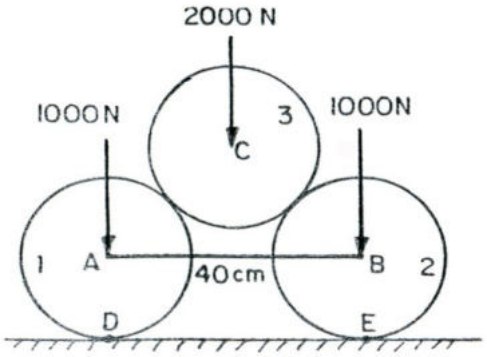
b) Determine the magnitude, direction and position of the resultant of the system of forces as shown in figure. (7M)



Figure

UNIT-II

3. a) Two smooth circular cylinders, each of weight W = 1000 N and radius 15cm, are connected at their centres by a string AB of length = 40cm and rest upon a horizontal plane, supporting above them a third cylinder of weight = 2000 N and radius 15cm as shown in figure. Find the force S in the string AB and the pressure produced on the floor at the points of contact D and E. (9M)

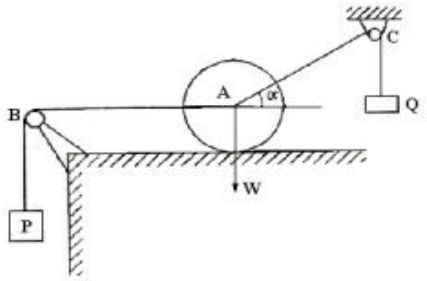


Figure

b) Write about the converse of the law of polygon of forces in detail? (6M)

Or

4. a) A ball of weight W rests upon a smooth horizontal plane and has attached to its center two strings AB and AC which pass over friction less pullies at B and C and carry loads P and Q, respectively, as shown in the figure. If the string AB is horizontal, find the angle α that the string AC makes with the horizontal when the ball is in a position of equilibrium. Also find the pressure R between the ball and the plane. (9M)

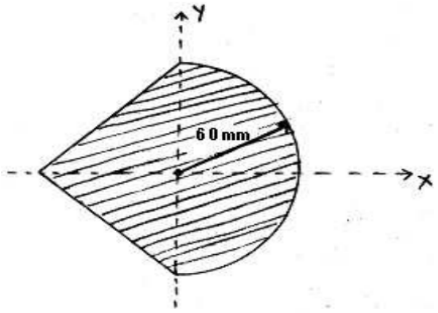


Figure

b) Explain the equations of equilibrium for spatial system of forces in detail. (6M)

UNIT-III

5. a) Locate the centroid of a shaded area as shown in figure. (10M)



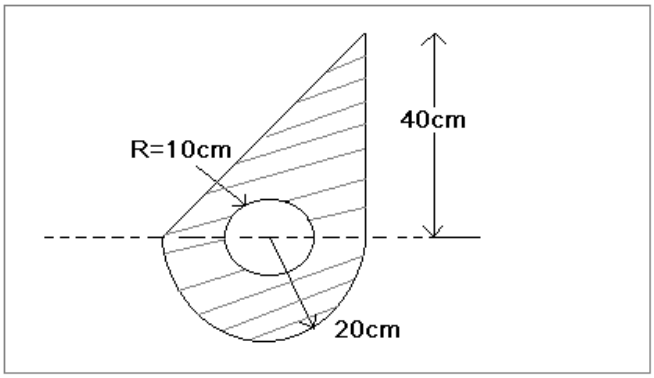
Figure

b) Write about Pappus theorem in detail? (5M)

Or

6. a) Determine mass moment of inertia of slender rod of length 'L' about its centroidal axis normal to the rod. (7M)

b) Find the moment of inertia about the horizontal centroidal axis for figure. (8M)



Figure

UNIT-IV

7. a) The acceleration of a particle is defined by the relation a =kt-4. Knowing that v=4m/s when t=2sec and v= 1m/s when t=1 sec, determine the constant 'k'. Write the equations of motion when x=0 at t=3secs. (7M)

   b) A small grinding wheel is attached to the shaft of an electric motor which has a rated speed of 3000r.p.m. When the power is turned on, the unit reaches its rated speed in 5secs and when the power is turned off, the unit comes to rest in 60secs. Assuming the acceleration to be uniform, find the number of revolutions that the motor executes (a) in reaching its rated speed and (b) to come to rest. (8M)

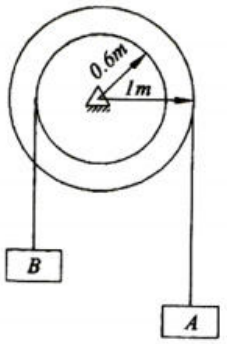
Or

8. a) A particle under a constant deceleration is moving in a straight line and covers a distance of 20m in first two seconds and 40m in the next 5 seconds. Calculate the distance it covers in the subsequent 3 seconds and the total distance covered, before it comes to rest. (8M)

   b) The acceleration of a particle in rectilinear motion is defined by the relation $a = 25 - 4s^2$ where 'a' is expressed in m/sec^2 and 's' is position coordinate in metres. The particle starts with no initial velocity at the position s = 0. Determine (i) the velocity when s = 3 metres (ii) the position where the velocity is again zero (iii) the position where the velocity is maximum. (7M)

UNIT-V

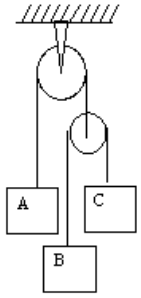
9. The step pulley shown in figure starts from rest and accelerates at $2rad/s^2$. What time is required for block A to move 20m? Find also the velocity of A and B at that time. (15M)



Figure

Or

10. If $W_a:W_b:W_c$ is in the ratio of 3:2:1, find the accelerations of the blocks A, B, and C. Assume that the pulleys are weightless as shown in Figure. (15M)



Figure