Total No. of Questions : 4]

SEAT No. :

P7

[Total No. of Pages : 3

FE/INSEM/APR-7
F.E. (All) (Semester - II)
101011 : ENGINEERING MECHANICS
(2019 Pattern)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates :

1) ***Answer Q.1 or Q.2, Q.3 or Q.4.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data, if necessary.***
4) ***Use of electronic pocket calculator is allowed in the examination.***
5) ***Use of cell phone is prohibited in the examination hall.***

Q1) a) The resultant of two forces P and Q is 1400 N vertical. Determine the force Q and the corresponding angle θ for the system of forces as shown in Fig. 1 a. **[6]**

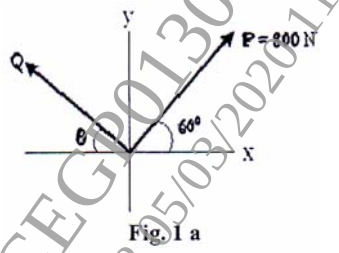

Fig. 1 a

b) Points A & B are mid points of sides of rectangle. Replace the given force F acting at A by equivalent force-couple system at point B as shown in Fig. 1 b. **[6]**

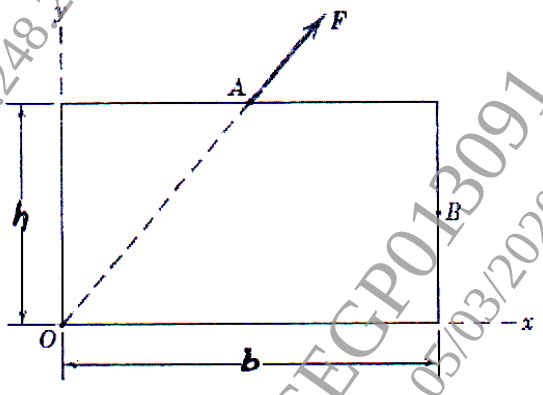

Fig. 1 b

c) State Varignon's theorem and principle of transmissibility. **[3]**

OR

P.T.O.

Q2) a) The eyebolt supports four forces as shown in Fig. 2 a. If the resultant of these forces is 3 kN directed along x - axis, determine the angle 0 and force T. (2 kN, T kN, 1.2 kN, 1.8 kN) **[6]**

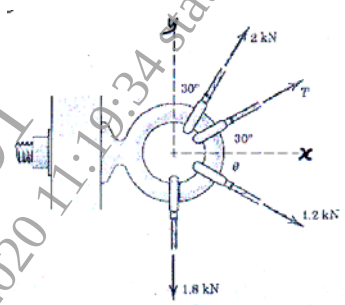

Fig. 2 a

b) Determine moment of 200 N about point 'A' and about 'B' for the bracket as shown in Fig. 2 b. **[6]**

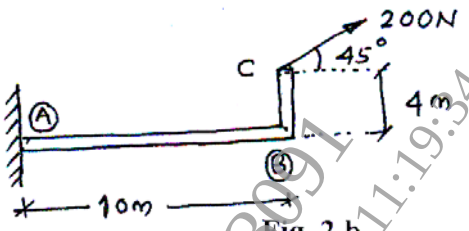

Fig. 2 b

c) Differentiate moment and couple with a sketch. **[3]**

Q3) a) Locate the position of centroid for the shaded lamina as shown in Fig. 3 a, with respect to origin O. **[6]**

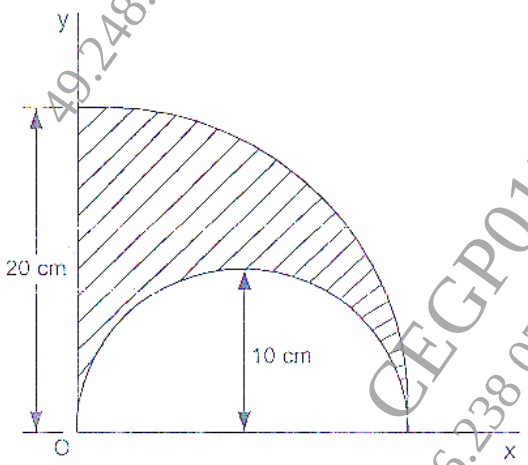

Fig. 3 a

b) A cable is passing over the disc of belt friction apparatus as shown in Fig. 3 b. If coefficient of static friction is 0.25 and the weight of block is 500 N, determine the range of force P to maintain equilibrium. **[5]**

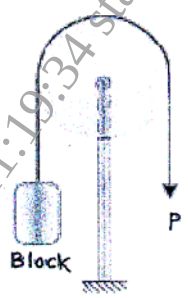

Fig. 3 b

c) Explain angle of repose and angle of friction with sketch. **[4]**

OR

Q4) a) Define moment of inertia and determine the M. I. of the composite Figure, if a = 40 mm with respect to x - axis as shown in Fig. 4 a. **[8]**

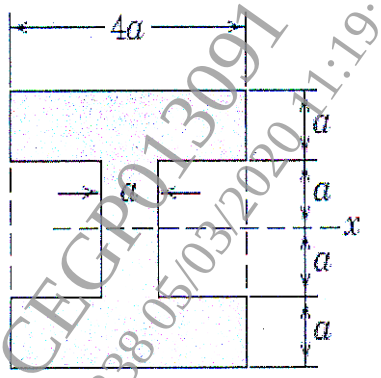

Fig. 4 a

b) A block of mass 10 kg rest on an incline plane as shown in Fig. 4 b. If the coefficient of static friction between the block and plane is μ_s = 0.25, determine the maximum force P required to maintain equilibrium. **[7]**

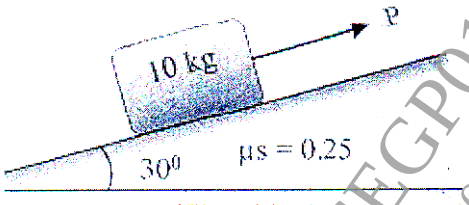

Fig. 4 b

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Total No. of Questions : 8]

SEAT No. :

P6491

[Total No. of Pages : 7

[5868]-108
F.E. (All) (Semester I & II)
ENGINEERING MECHANICS (101011)
(2019 Pattern)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data, if necessary.***
4) ***Use of electronic pocket calculator is allowed in the examination.***
5) ***Use of cell phone is prohibited in the examination hall.***

Q1) a) A ball of weight W = 53.4 N rests in a right angled trough as shown in Fig. 1a. Determine the forces exerted on the sides of the trough at D & E. Assume all surfaces are perfectly smooth. **[6]**

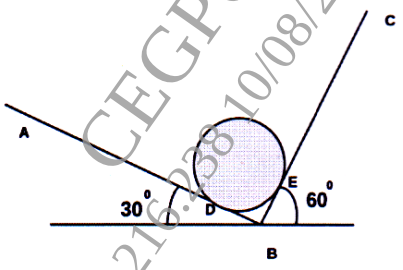

Fig. 1a

b) Three rods meeting at point A as shown in Fig. 1b. Find magnitude of the tension developed in each rod AB, AC and AD. **[6]**

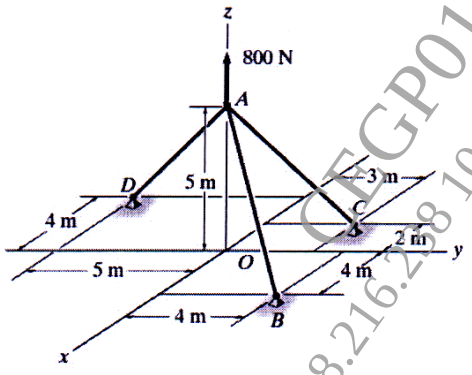

Fig. 1b

P.T.O.

c) Determine the support reaction of beam loaded and supported as shown in Fig.1c. **[6]**

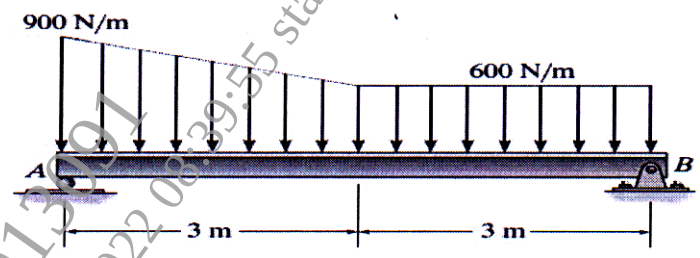

Fig. 1c

OR

Q2) a) A joist of length 4m and weighing 200N is raised by pulling a rope shown in Fig. 2a. Determine the tension T induced in the rope and reaction at end A of joist. **[6]**

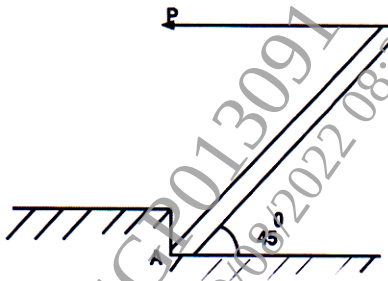

Fig. 2a

b) The rectangular 3m × 10m, steel plate subjected to four forces, as shown in Fig.2b. Determine the resultant force in magnitude and direction w.r.to 'O'. **[6]**

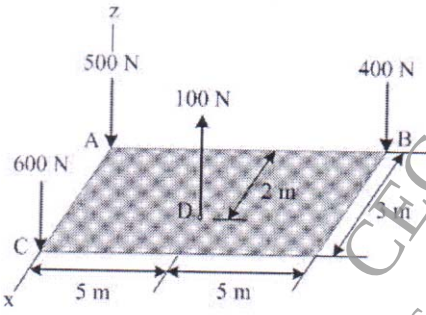

Fig. 2b

c) The I joist supports 20 kN and 40 kN on bean AB of span 7.5 m, as shown in Fig. 2c. Determine the support reactions at hinge B and roller D. **[6]**

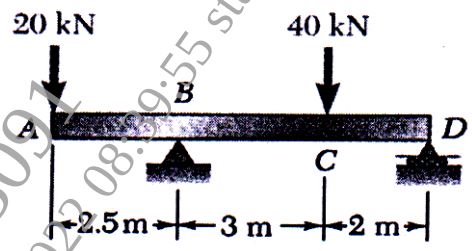

Fig. 2c

Q3) a) Determine the forces in all members of a truss loaded and supported as shown in Fig. 3a. **[6]**

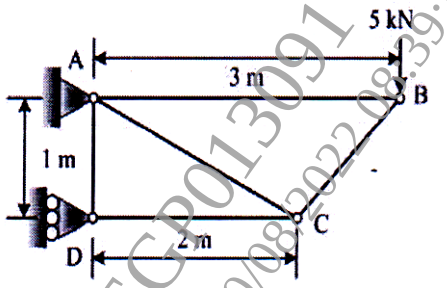

Fig. 3a

b) Cable ABCD is loaded and supported as shown in the Fig. 3b. If $d_c = 0.75$ m and $d_b = 1.125$ m, determine the component of reaction at A & maximum tension in the cable. **[5]**

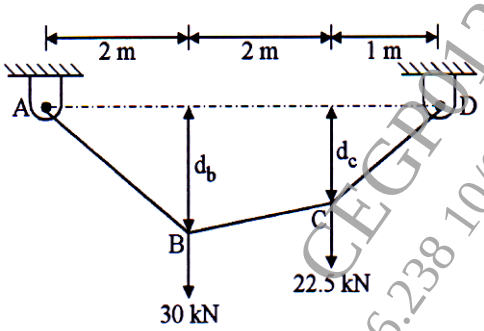

Fig. 3b

c) Determine the components of all forces acting on member ABE for the frame loaded with 2400N at D of the frame as shown in Fig. 3c. **[6]**

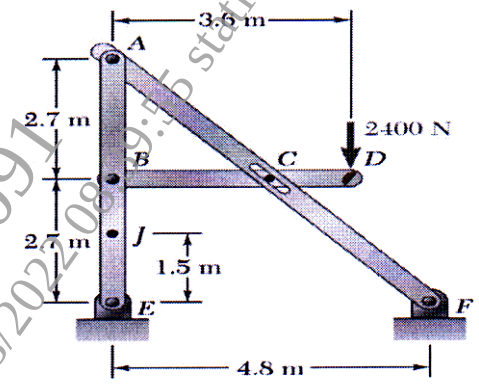

Fig. 3c

OR

Q4) a) Determine the forces in the members AB, AC and DC of the truss loaded and supported as shown in the Fig. 3a. Use method of section. **[6]**

b) Cable ABCDE supports two loads 6kN and 10 kN at B and C, as shown in Fig.4b. If the 'h_B'= 1.8 m, determine 'h_C' and reaction components at A and D. **[5]**

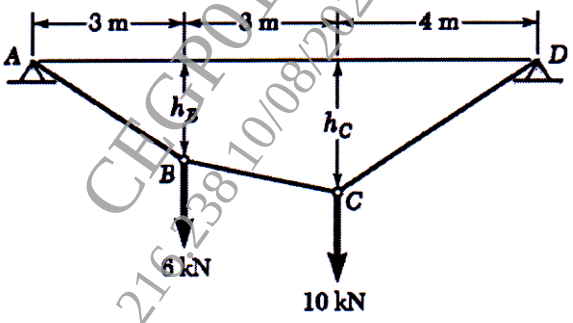

Fig. 4b

c) Determine the pin reactions at A, B and roller D for the frame members ABCand BD meeting at B as shown in Fig. 4c. **[6]**

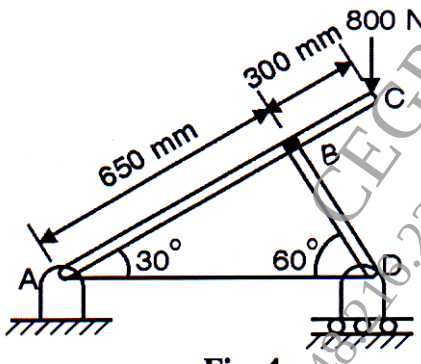

Fig. 4c

Q5) a) The acceleration of particle in rectilinear motion is given by $a = (3t^2+2)$. Initial velocity and displacements are 2m/s & 3m respectively. Find Position, velocity & acceleration of the particle at t = 2s. **[6]**

b) A projectile fired from the edge of a 150 m high cliff with an initial velocity of 180 m/s at an angle of elevation of 30° with the horizontal. Neglecting air resistance find : **[6]**

i) The greatest elevation above the ground reached by the projectile;

ii) Horizontal distance from the gun to the point, where the projectile strikes the ground

c) A car starts from rest and with constant acceleration achieves a velocity of 15 m/s when it travels a distance of 200 m. Determine the acceleration of the car and the time required to attain the velocity. **[6]**

OR

Q6) a) A ball is thrown vertically upward with an initial speed of 80m/s from the base of 50m high tower. Determine the distance 'h' by which the ball clear the top of tower. Also determine the time of travel when it reaches to base again. **[6]**

b) An outdoor track is 126 m in diameter. A runner increases her speed at a constant rate from 4.2 m/s to 7.2 m/s over a distance of 28.5 m. Determine the total acceleration of the runner 2s after she begins to increases her speed. **[6]**

c) A stone is dropped from the top of a tower 50 m high, At the same time another stone is thrown up from the foot of the tower with a velocity of 25 m/s. At what distance from the top & after how much time the two stones cross each other? **[6]**

Q7) a) A 30 kg block is dropped from a height of 2 m onto the 10 kg pan of a spring scale as shown in Fig. 7a. Assuming the impact to be perfectly plastic, determine the maximum deflection of the pan. The constant of the spring is k = 20 kN/m. **[6]**

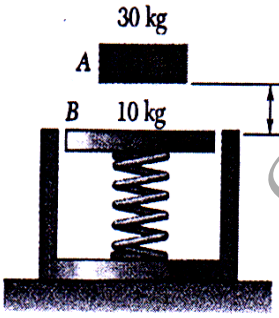

Fig. 7a

b) The bottle rests at a distance of 1 m from the center of the horizontal platform as shown in Fig. 7b. If the coefficient of static friction between the bottle and the platform is $\mu_s = 0.3$ determine the maximum speed that the bottle can attain before slipping. Assume the angular motion of the platform is slowly increasing. **[5]**

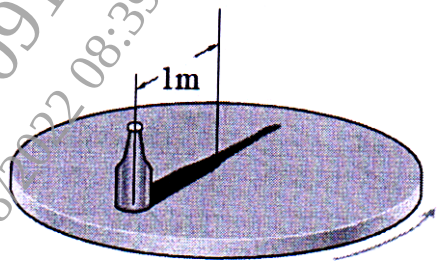

Fig. 7b

c) A ball is dropped from a height $h_0 = 2$ m on a smooth floor. Knowing that the height of the first bounce is $h_1 = 1.2$ m, determine (i) coefficient of restitution, and (ii) expected height h_2 after the second bounce. **[6]**

OR

Q8) a) Ball 'A' of 20 N and initial velocity 6 m/s rightwords collides with ball 'B' of 10 N and initial velocity 8 m/s leftwords before impact. If the coefficient of restitution is 'e' is 0.6, then determine the velocities of balls 'A' and 'B' after impact. **[5]**

b) Calculate the velocity v of the 50-kg crate, as shown in Fig. 8b, when it reaches the bottom of the chute at B, if it is given an initial velocity of 4 m/s down the chute at A. The coefficient of kinetic friction is 0.30. **[6]**

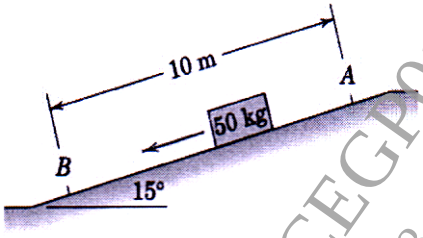

Fig. 8b

c) The 2kg pendulum bob 1.5m, is released from rest when it is at A as shown in Fig.8c. Determine the speed of the bob, using work energy principle, when it passes at a position 60 degrees down from A. **[6]**

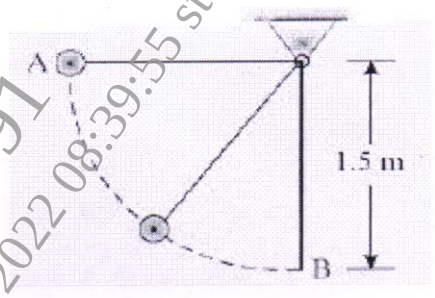

Fig. 8c

Total No. of Questions : 8]

SEAT No. :

P3923

[Total No. of Pages : 7

[6001]-4007
F.E. (Common)
ENGINEERING MECHANICS
(2019 Pattern) (Semester - I/II) (Credit System) (101011)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary and clearly state.***
5) ***Use of cell phone is prohibited in the examination hall.***
6) ***Use of electronic pocket calculator is allowed.***

Q1) a) Determine the force 'P' need to pull over the 50 kg smooth roller over the step of 50 mm as shown in Fig. 1 a. Calculate the contact reactions at B if radius of roller is 300 mm. Take $\theta = 30^{\circ}$. **[6]**

b) The square plate has mass of 1800kg with mass center at 'G'. Calculate the tension in each of the three cables with which the plate is lifted while remaining horizontal as shown in Fig. 1 b. **[8]**

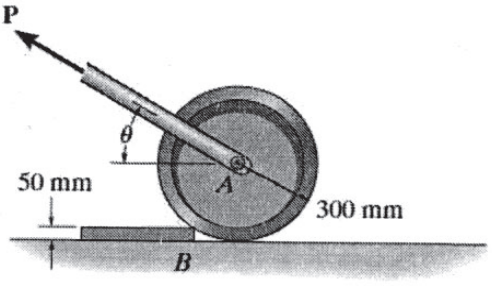

Fig. 1 a

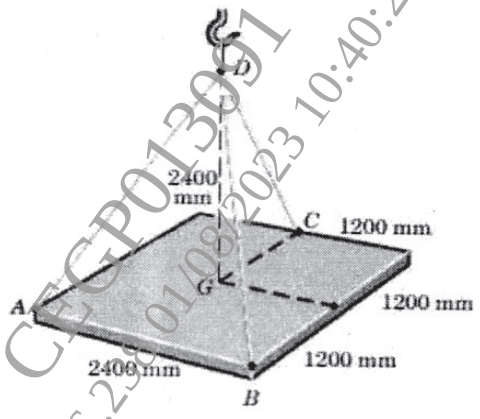

Fig. 1 b

P.T.O.

c) Explain Simple, Roller, Hinge and Fixed support with number of reactions developed at each support with sketch. **[4]**

OR

Q2) a) Determine the support reactions at fixed end A for a beam loaded with 6 kN/m UVL and 3 kN/m UDL as shown in Fig. 2 a. Neglect the weight of 3 m span beam. **[6]**

b) A uniform steel plate of 20 cm × 20 cm weighing 750 N is suspended in horizontal plane by three vertical wireas as shown in Fig. 2 b. Calculate the tension in each wire at A, B and C. **[6]**

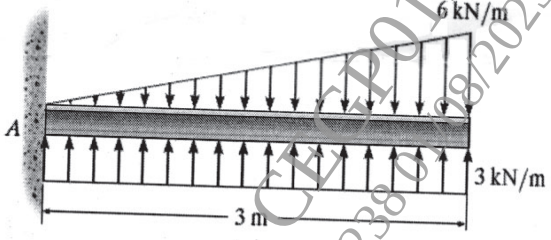

Fig. 2 a

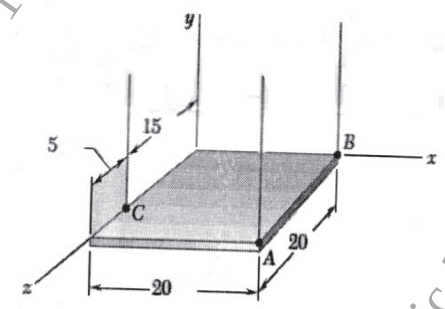

Fig. 2 b

c) Explain how uniformly distributed load (UDL) and uniformly varying load (UVL) is converted in to a point load with sketch. **[6]**

Q3) a) Determine the force in all members of the truss loaded with 3 kN and 4 kN forces at D and B respectively with supports hinge at A and Roller at B, as shown in Fig. 3 a. Take $\theta = 30^{\circ}$. **[6]**

b) Determine the *x* and *y* components of forces acting at joint B and D on the member BD for a frame loaded and supported as shown in Fig. 3 b. **[7]**

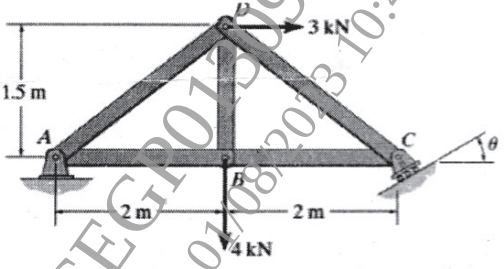

Fig. 3 a

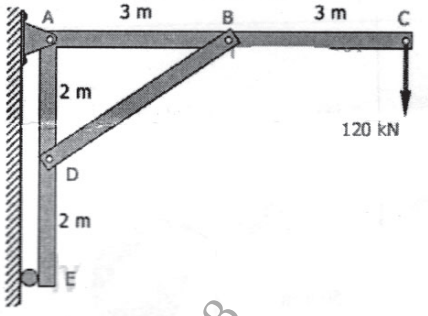

Fig. 3 b

c) Define zero force members in truss and what are the conditions to identify them, with a sketch? **[4]**

OR

Q4) a) Determine the forces in the members AD, BD and BC for the truss loaded and supported as shown in Fig. 3a. **[6]**

b) Knowing that lamp attached at D is, $m_F = 20$ kg, determine the tension in each segment of the cable loaded and supported as shown in Fig. 4b. **[5]**

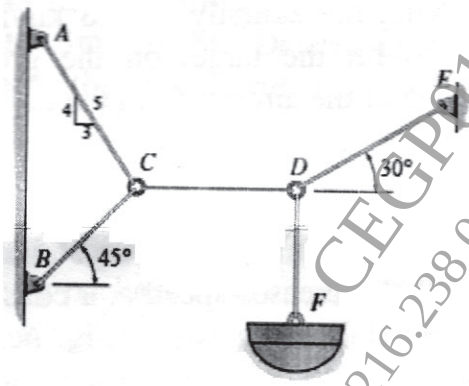

Fig. 4 b

c) Explain 2.j –3 <m; 2.j – 3 = m; 2.j –3 > m with sketch. **[6]**

Q5) a) The motion of a particle is given by : $a = t^3 - 3t^2 + 5$ where 'a' is the acceleration in m/s^2 and 't' is the time in seconds. The velocity of the particle, at t = 1 second is 6.25 m/sec and the displacement is 8.8 m. Calculate the displacement and velocity at t = 2 seconds. **[6]**

b) A ball thrown vertically upward with a velocity of 10 m/s from a window located 20 m above the ground. Knowing that the acceleration of the ball is cosntant and equal to 9.81 m/s^2 downward, determine **[6]**

i) the highest elevation reached by the ball and the corresponding value of t;

ii) velocity with which it hit the ground.

c) A golf player hits the ball from point A with a velocity 45 m/s as shown in Fig. 5c at an angle of 20° with horizontal. Determine the maximum height it reaches and the horizontal distance it falls w.r. to A. Consider ground to be horizontal. **[6]**

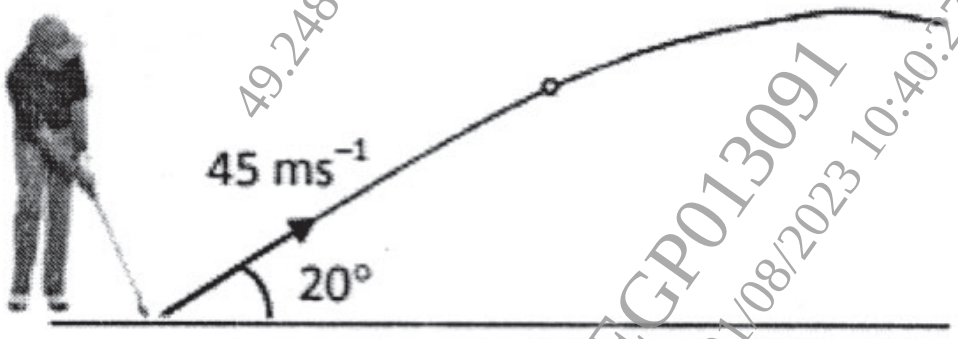

Fig. 5c

OR

Q6) a) The acceleration of a particle is given by an expression, $a = k.t^2$. At t=0, velocity of the particle is – 12 m/s. Knowing that $v = 0$ and $x = 15$ m when t = 4 s, write the equation of motion of a particle. **[6]**

b) An aircraft, moving horizontally at 108 km/hr at an altitude of 1000 m wants to hit the target on the ground. 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. **[6]**

c) A motorist starts from rest at point A on a circular ramp of 150 m radius when t = 0 s, increases speed at a constant rate and enters the highway at point B as shown in **Fig. 6c**. Knowing that her speed increases with same rate till it reaches to 100 km/h at point C, determine the speed at point B. **[6]**

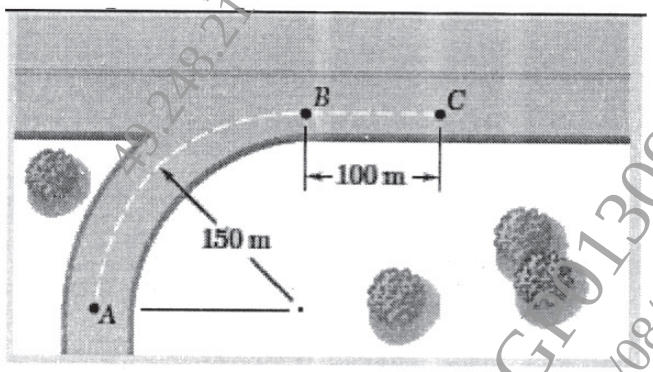

Fig. 6 c

Q7) a) If the coefficient of kinetic friction between the 50-kg crate and the ground is $\mu_k = 0.3$, determine the distance the crate travels when its velocity reaches to 8 m/s. Assume crate starts from rest, and P = 200 N, for crate shown in Fig. 7a. Use work-Energy principle. **[6]**

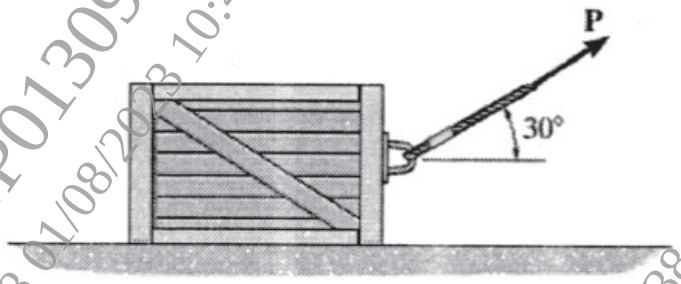

Fig. 7 a

b) A racing car travels around the horizontal circular track of radius 100m. If the car starts from rest and accelerates with tangential acceleration of 7 m/s^2 for some time. Determine the time and velocity when the total acceleration of the racing car reaches to 8 m/s^2. **[6]**

c) A ball of mass 1 kg dropped from 5m height on a horizontal floor rebounds back to 3m height. Determine the coefficient of restitution between the floor and ball. Also Determine its renounce height after falling from 3m again. **[5]**

OR

Q8) a) The conveyor belt is designed to transport packages of various weights. Each 10-kg package has a coefficient of kinetic friction $\mu_k = 0.15$. If the speed of the conveyor is 5 m/s, and then it suddenly stops, determine the distance the package will slide on the belt before coming to rest. **[6]**

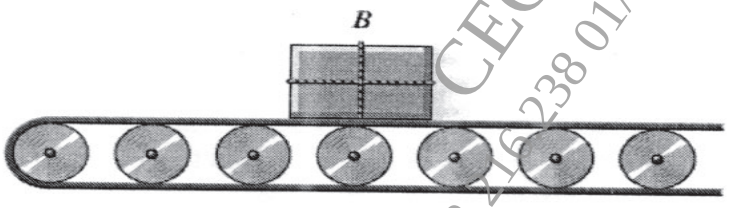

Fig. 8 a

b) Cylinder A of 0.5 kg is dropped from 2.4 m onto pan B of 2.5 kg, which is at a resting on a spring constant k = 3kN/m. Assuming the impact to be perfectly plastic, determine the compression of the spring after impact. **[6]**

c) Ball 'A' of 5 kg moving with 10m/s rightwards, strikes with ball 'B' of 1 kg which is at rest. If after the impact the velocity of the ball 'B' is 10 m/s rightwards. Determine, the velocity of the ball 'A' after impact. Also determine coefficient of restitution 'e'. **[5]**

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Total No. of Questions : 8]

SEAT No. : ____

P4935

[Total No. of Pages : 6

[5667]-1002
F.E. (Common)
ENGINEERING MECHANICS
(2019 Pattern)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates :

1) ***Attempt Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6 and Q. 7 or Q. 8.***
2) ***Neat diagram must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary and clearly state.***
5) ***Use of cell phone is prohibited in the examination hall.***
6) ***Use of electronic pocket calculator is allowed.***

Q1) a) The weight of the cycle is 500 N which act at center of gravity G as shown in Fig. 1 a. Determine the normal reaction at A and B when the cycle is in equilibrium. **[7]**

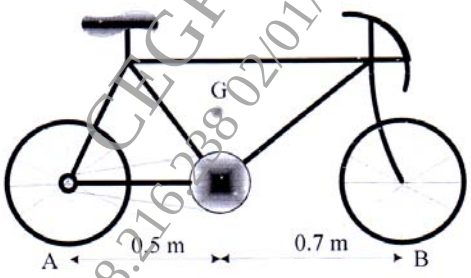

Fig. 1 a

b) Pole OA is kept in vertical position using three guy-wires AB, AC and AD as shown in Fig. 1 b. Calculate the tension in each wire, if the weight of the pole is 5000 N. **[8]**

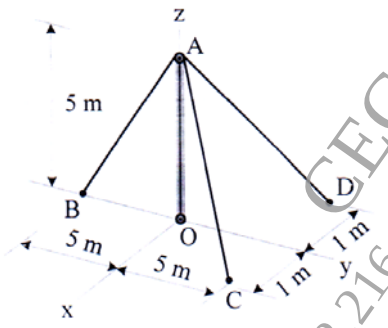

Fig. 1 b

P.T.O.

c) Explain hinge, roller and fixed support with maximum number of reaction exerted on it with suitable sketches. **[3]**

OR

Q2) a) Find the reaction exerted at A and B on the sphere of 200 N kept in a trough as shown in Fig. 2 a. **[8]**

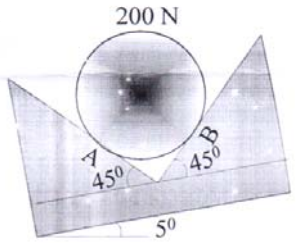

Fig. 2 a

b) A square mat foundation supports four column as shown in Fig. 2 b. Determine the magnitude and point of application of the resultant with respect to origin. **[7]**

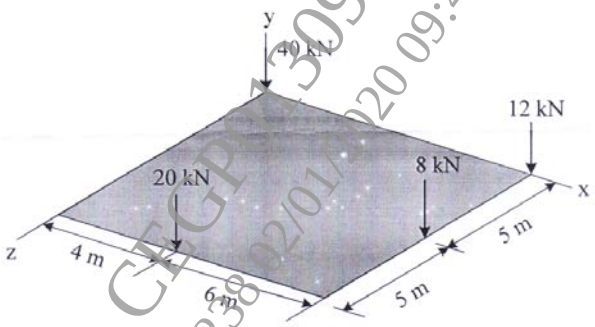

Fig. 2 b

c) State the equation of equilibrium for concurrent, parallel and general force system. **[3]**

Q3) a) Determine the forces in all members of the truss loaded and supported as shown in Fig. 3 a. **[7]**

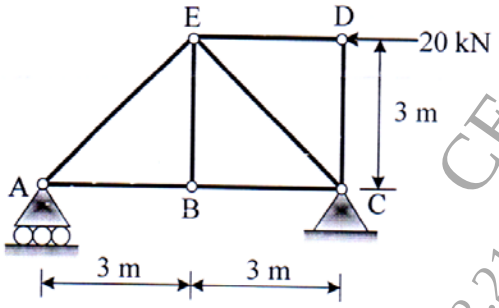

Fig. 3 a

b) Determine the x and y components of forces acting at joint B on the horizontal member BD for a frame loaded and supported as shown in Fig. 3 b. **[8]**

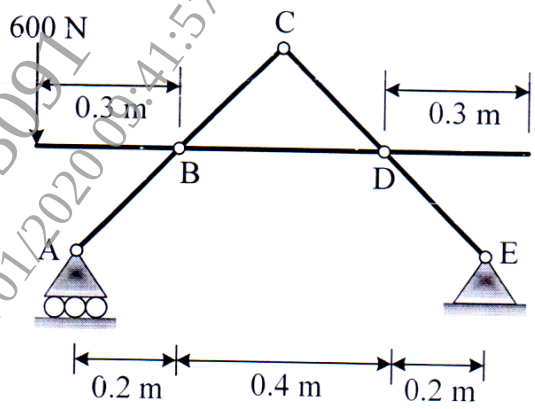

Fig. 3 b

c) Define two force and multi force members. **[2]**

OR

Q4) a) Determine the forces in the members DE, CE and BC for the truss loaded and supported as shown in Fig. 3 a. **[7]**

b) Determine the reactions at support A and B for the cable loaded and supported as shown in Fig. 4 b. **[7]**

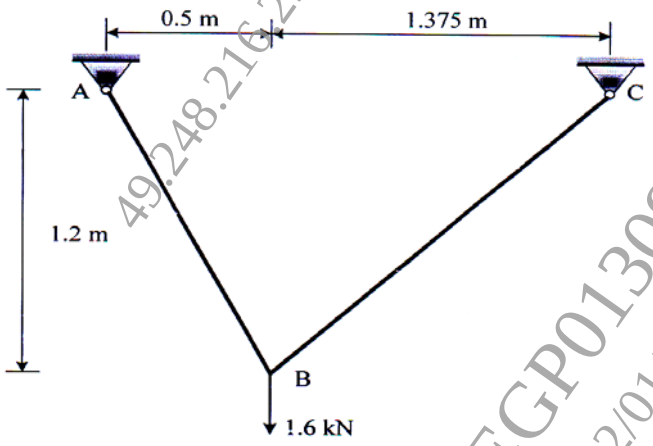

Fig. 4 b

c) Explain imperfect, perfect and redundant truss with a sketches. **[3]**

Q5) a) Automobile A and B are traveling in adjacent lane at t = 0 and have the position and speed as shown in the Fig. 5 a. Knowing that automobile A has a constant acceleration of 0.6 m/s^2 and B has constant deceleration of 0.4 m/s^2, determine when and where A will overtake B. Also determine the speed at that time. **[8]**

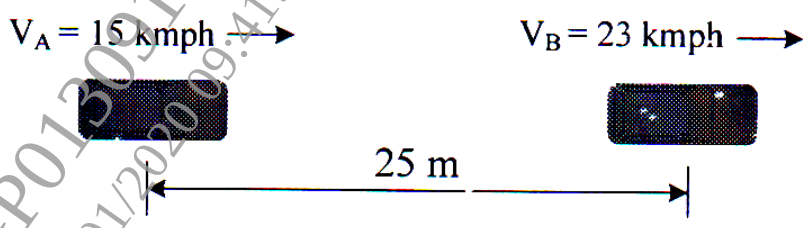

Fig. 5 a

b) A stone thrown vertically upward comes back to ground in 8 s. Determine its velocity of projection and maximum height attained by the stone. **[4]**

c) A ball is thrown by a player from 5 m above ground level, clears the 25 m high wall placed 100 m ahead of the player. If the angle of projection of the ball is 60°, determine the velocity of projection of the ball. **[6]**

OR

Q6) a) A car comes to complete stop from an initial speed of 50 m/s in a distance of 100 m. With the same constant acceleration, what would be the stopping distance s from an initial speed of 70 m/s. **[6]**

b) A golfer hits the golf ball from point A with an initial velocity of 50 m/s at an angle of 25° with the horizontal shown in Fig. 6 b. Determine the horizontal distance AB and maximum height it attain. **[6]**

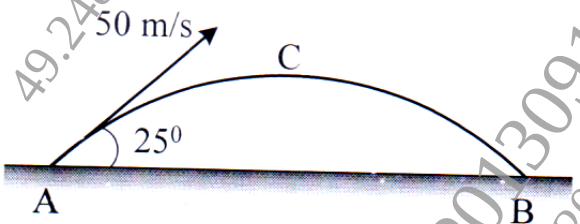

Fig. 6 b

c) A train enters a curved horizontal section of track at a speed of 100 km/h and slows down with constant deceleration to 50 km/h in 12 seconds. An accelerometer mounted inside the train records a horizontal acceleration of 2 m/s^2 when the train is 6 seconds into the curve. Calculate the radius of curvature ρ of the track for this instant. **[6]**

Q7) a) The conveyor belt is designed to transport packages of various weights. Each 10 kg package has a coefficient of kinetic friction $\mu_k = 0.15$. If the speed of the conveyor is 5 m/s and then it suddenly stop, determine the distance the package will slide on the belt before coming to rest. Refer Fig. 7 a. **[6]**

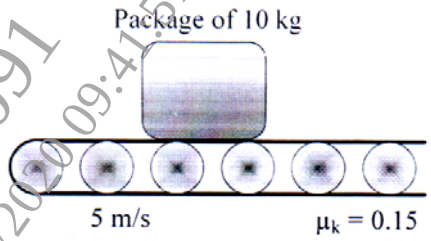

Fig. 7 a

b) The pendulum bob has a mass m, length 1 m and is released from rest as shown in Fig. 7 b when $\theta = 0°$. Determine the tension in the cord as function of the angle of descent θ. Neglect the size of bob. **[6]**

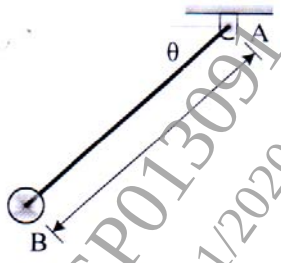

Fig. 7 b

c) A 20 Mg railroad car moving with 0.5 m/s speed to the right collides with a 35 Mg car which is at rest, if the coefficient of restitution between the two cars is e = 0.65 determine the speed of the cars after the collision. **[5]**

OR

Q8) a) Block A has a weight of 40 N and block B has a weight of 30 N. They rest on a surface for which the coefficient of kinetic friction is $\mu_k = 0.2$. If the spring has a stiffness of k = 300 N/m, and is compressed 0.05 m, determine the acceleration of each block just after they are released. **[6]**

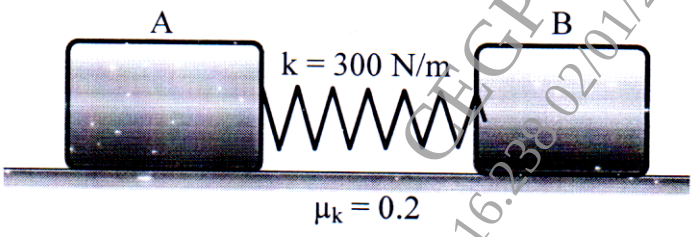

Fig. 8 a

b) The man has a mass of 80 kg and sits 3 m from the center of the rotating platform. If the coefficient of static friction between the clothes and the platform is $\mu_s = 0.3$ and tangential component of acceleration is 0.4 m/s^2, determine the time required to cause him to slip. **[6]**

c) The velocities of two identical steel blocks of mass 0.6 kg before impact are $v_A = 4m/s$ rightward and $v_B = 2$ m/s leftward. After impact the velocity of block B is observed to be 2.5 m/s to the right, determine the coefficient of restitution between the blocks. **[5]**

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Total No. of Questions : 4]

SEAT No. :

P-5374

[Total No. of Pages : 4

[6185]-57

F.E. (All) (Insem)

ENGINEERING MECHANICS

(2019 Pattern) (Semester - I) (101011)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Answer Q. 1 or Q. 2, Q. 3 or Q. 4.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data, if necessary.***
4) ***Use of electronic pocket calculator is allowed in the examination.***
5) ***Use of cell phone is prohibited in the examination hall.***

Q1) A) Resultant force R = 5000 N has two component forces 'P' = 3600 N and 'Q' = 1500 N as shown in Fig. 1A. Determine direction of component forces 'P' and 'Q' w. r. to resultant force 'R'. **[5]**

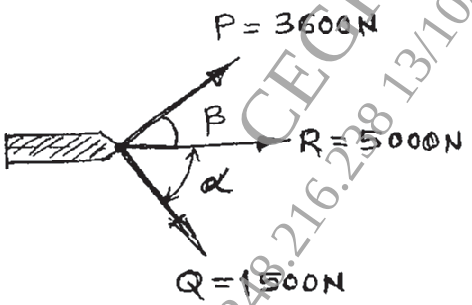


Fig. 1A

B) Force 'P' is acting on the plate which is divided in to squares of 0.1 m as shown in Fig. 1B. The moment of force 'P' about point 'A' is 30 Nm clockwise. Determine the magnitude of force 'P'. **[5]**

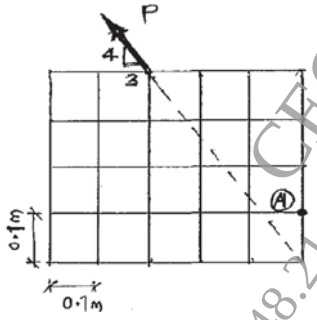


Fig. 1B

P.T.O.

C) State and explain "Law of Parallelogram" of forces with sketch. **[2+3]**

OR

Q2) A) Determine magnitude of the resultant for the force system as shown in Fig. 2A, w.r. to 'B'. Also determine the horizontal distance from point 'B', where the resultant cuts the line ABC. Comment on whether it cuts on right hand side or left hand side of point 'B'. **[6+2+2]**

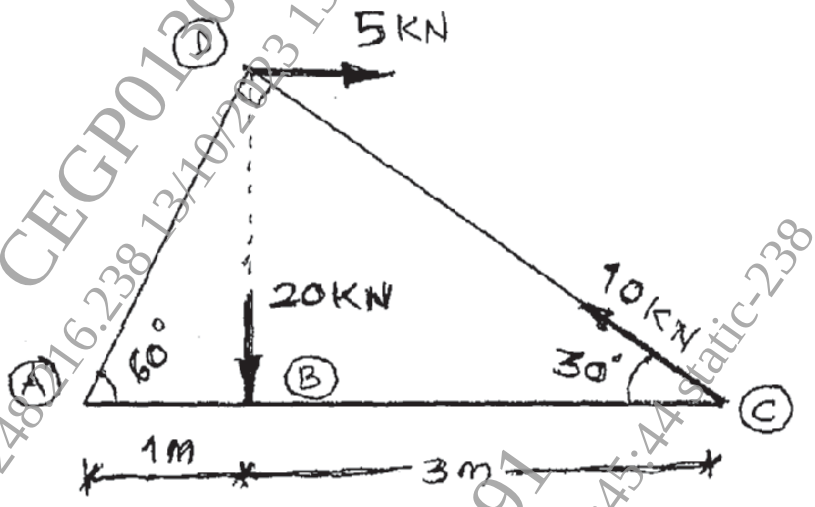


Fig. 2A

B) What is Couple? Give any three characteristics of couple with sketch. **[5]**

Q3) A) Define centroid and center of gravity. Analyze and locate the position of centroid for the plane lamina as shown in Fig. 3A, w.r.to 'A'. **[2+7]**

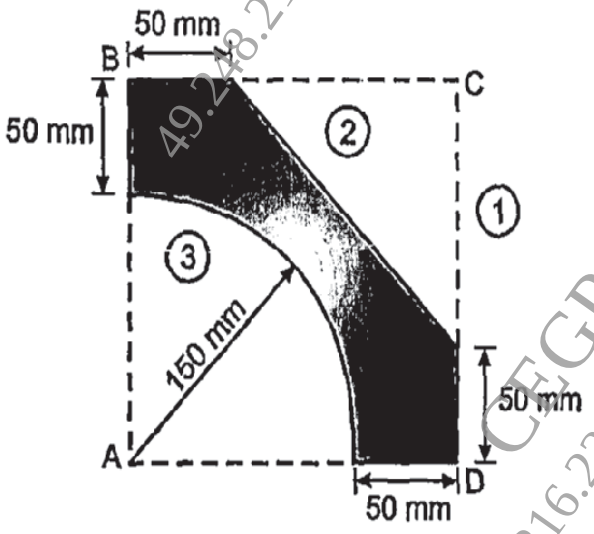


Fig. 3A

B) The uniform ladder AB has a length of 6 m and a mass of 16 kg resting at 54° with horizontal floor. End A of ladder is resting on rough horizontal floor and end B rests against a smooth vertical wall as shown in Fig. 3B. A man of mass 65 kg has to climb this ladder. At what position from the base will he induce slipping? Take coefficient of static friction μ_s 0.34 between horizontal floor and ladder. **[6]**

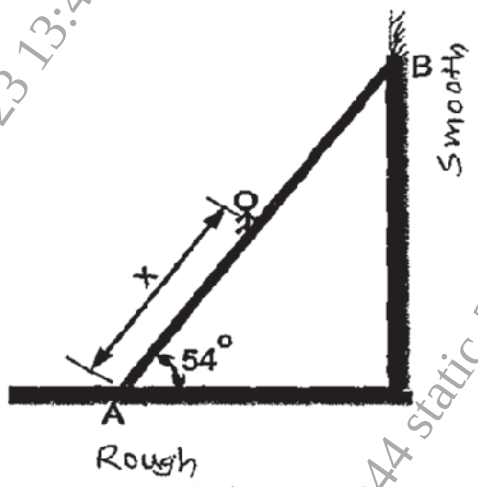


Fig. 3B

OR

Q4) A) Analyze and locate the position of centroid for the plane lamina as shown in Fig. 4A, w.r. to 'O'. Also determine the moment of inertia of the shaded portion with respect to y-y axis (vertical) passing through the centroid. **[8]**

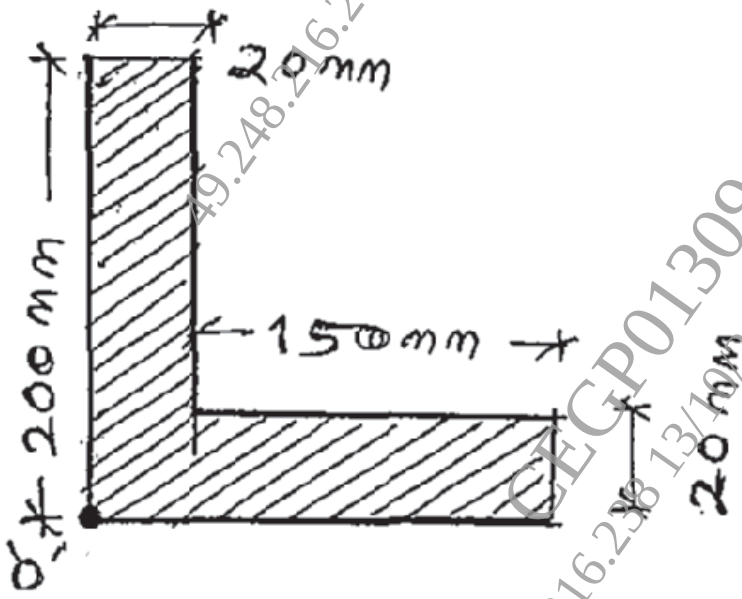


Fig. 4A

B) A block of 20kg hanging through a inextensible cable and kept in rest by applying a force of magnitude 'F = 1.5 kg' on other side of the cable, which is passing through the rough pulley as shown in the Fig. 4B. Determine (i) the lap angle between cable and pulley required to keep the block in rest; (ii) the number of turns required to wound the cable on pulley. Take coefficient of static friction $\mu_s = 0.30$ between pulley and cable. **[7]**

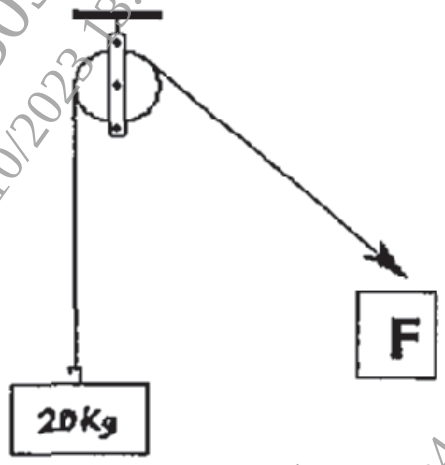


Fig. 4B

Total No. of Questions : 4]

SEAT No. :

P1275

[Total No. of Pages : 4

OCT/FE/Insem-8
F.E.
ENGINEERING MECHANICS
(2019 Pattern)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Answer Q. 1 or Q. 2, Q. 3 or Q. 4.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data, if necessary.***
4) ***Use of electronic pocket calculator is allowed in the examination.***
5) ***Use of cell phone is prohibited in the examination hall.***

Q1) a) Determine resultant of the force system as shown below w.r.to A. [Forces acting are 50, 20, 30 N] **[6]**

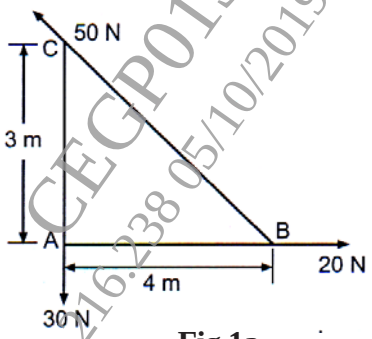


Fig.1a

b) Resultant force R = 400 N has two component forces P = 240 N and Q = 200 N as shown. Determine direction of component forces P and Q w.r.t. resultant force R. **[4]**

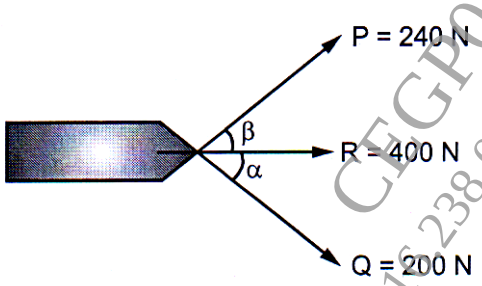


Fig.1b

P.T.O.

c) State and explain Law of Parallelogram of forces with sketch. **[5]**

OR

Q2) a) If the resultant moment about point A is 4800 Nm clockwise, determine the magnitude of F_3, if F_1 = 300 N and F_2 = 400 N. **[5]**

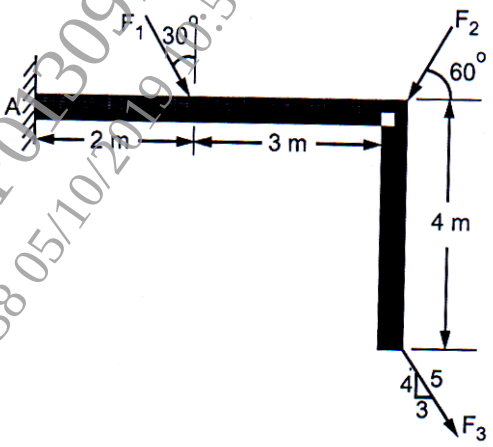


Fig.2a

b) Find value of 'α' if resultant of given three forces is parallel to the inclined plane. Also find corresponding magnitude of the resultant. **[5]**

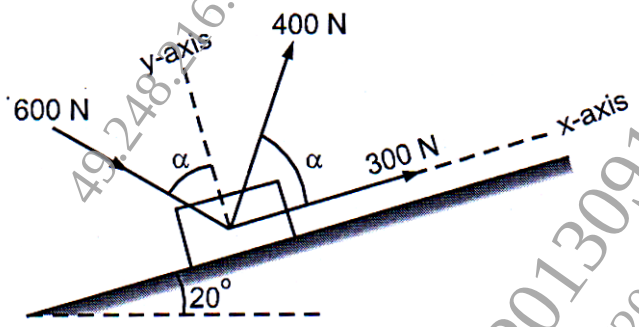


Fig.2b

c) What is Couple? Give its any three characteristics with sketch. **[5]**

Q3) a) Analyze and locate the position of centroid for the plane lamina as shown in Fig. 3a, w.r.to 'A'. **[6]**

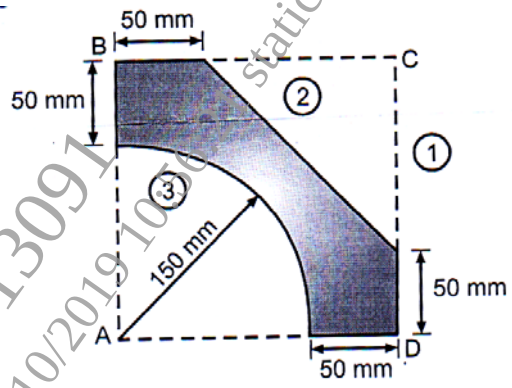


Fig.3a

b) The uniform ladder AB has a length of 8 m and a mass of 24 kg. End A is on rough horizontal floor and end B rests against a smooth vertical wall. A man of mass 60 kg has to climb this ladder. At what position from the base will he induce slipping? $\mu_s = 0.34$ at floor. **[5]**

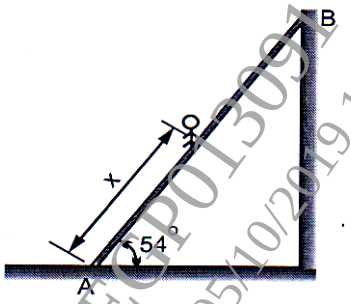
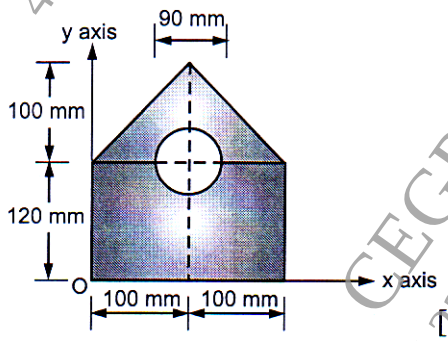


Fig.3b

c) What is Friction? Explain with a neat sketch any two properties of Friction. **[4]**

OR

Q4) a) Define Moment of Inertia. Determine the M.I. of the composite shape as shown below with respect to X axis. **[1+7 = 8]**



[Circle of Φ = 90 mm]

Fig.4a

b) Two cylinders are connected by a rope that passes over two fixed circular rods as shown. Knowing that the coefficient of static friction between the rope and the rods is 0.40, determine the maximum value of 'm' for equilibrium. **[7]**

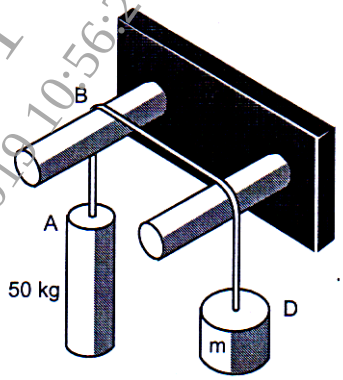


Fig.4b

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Total No. of Questions : 4]

SEAT No. :

PA-2679

[Total No. of Pages : 3

[5931]-1008
F.E. (All)
ENGINEERING MECHANICS
(2019 Pattern) (Semester - I) (101011)

Time : 1 Hour] ***[Max. Marks : 30***

Instructions to the candidates:

1) ***Answer Q.1 orQ.2, Q.3orQ.4***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data, if necessary.***
4) ***Use of electronic pocket calculator is allowed in the examination.***
5) ***Use of cell phone is prohibited in the examination hall.***

Q1) a) Determine magnitude of the resultant for the force system as shown in **Fig. 1A**, w.r. to 'A'. Also determine the horizontal distance from point 'A', where the resultant cuts the line ABC. Comment on whether it cuts on right hand side or left hand side of point 'A'. **[6+2+2]**

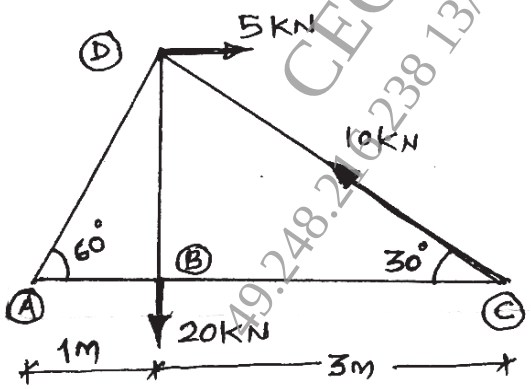

Fig. 1A

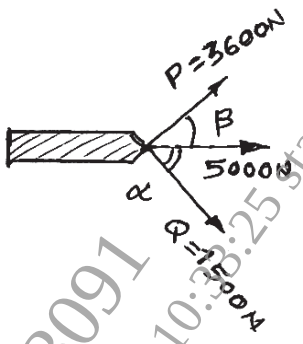

Fig. 1B

b) Resultant force R = 5000 N has two component forces 'P' = 3600 N and 'Q' = 1500 N as shown. Determine direction of component forces 'P' and 'Q' w.r. to resultant force 'R'. **[5]**

OR

P.T.O.

Q2) a) State Varignon's theorem and determine the magnitude and sense of a horizontal force 'P' to be applied at 'B' which will keep the vertical rod ABCD in equilibrium as shown in **Fig. 2A**. Take length AB = BC = CD = 1.8 m. **[2+5]**

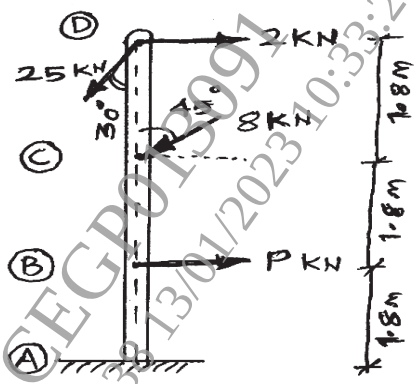

Fig. 2A

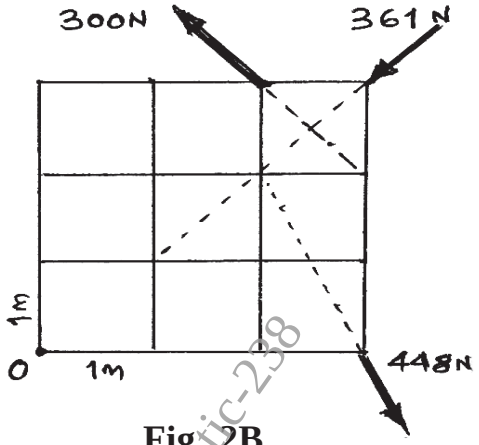

Fig. 2B

b) Determine the magnitude, direction and position of the resultant force for the given three forces acting as shown in **Fig.2B**, w.r. to 'O'. **[2+2+2+2]**

Q3) a) Analyze and locate the position of centroid for the plane lamina as shown in **Fig. 3A**, w.r.to 'A'. Also determine the moment of inertia of the shaded portion with respect to x-x axis (horizontal) passing through the centroid. **[5+4]**

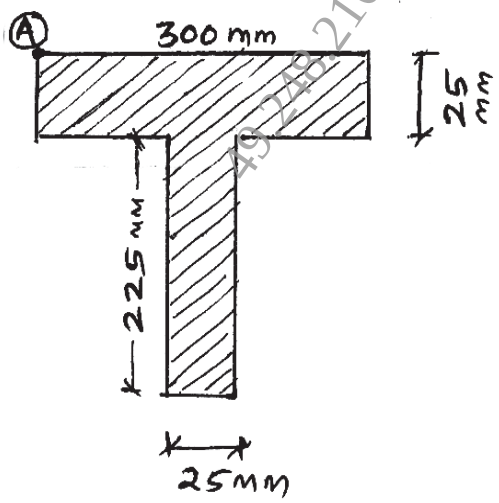

Fig. 3A

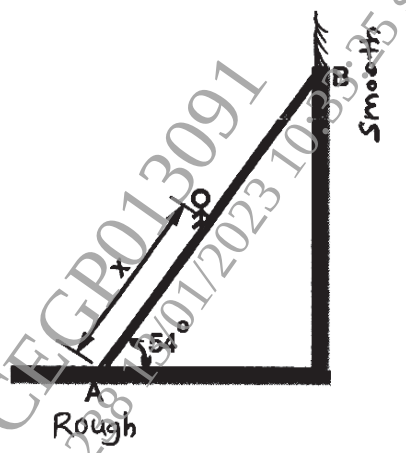

Fig. 3B

b) The uniform ladder **AB** has a length of 6 m and a mass of 16 kg resting at 54° with horizontal floor. End **A** of ladder is resting on rough horizontal floor and end **B** rests against a smooth vertical wall as shown in **Fig. 3B**. A man of mass 65 kg has to climb this ladder. At what position from the base will he induce slipping? Take coefficient of static friction $\mu_s = 0.34$ between horizontal floor and ladder. **[6]**

OR

Q4) a) Analyze and locate the position of centroid for the plane lamina as shown in **Fig. 4A**, w.r.to 'O'. Also determine the moment of inertia of the shaded portion with respect to y-y axis (vertical) passing through the centroid. **[4+5]**

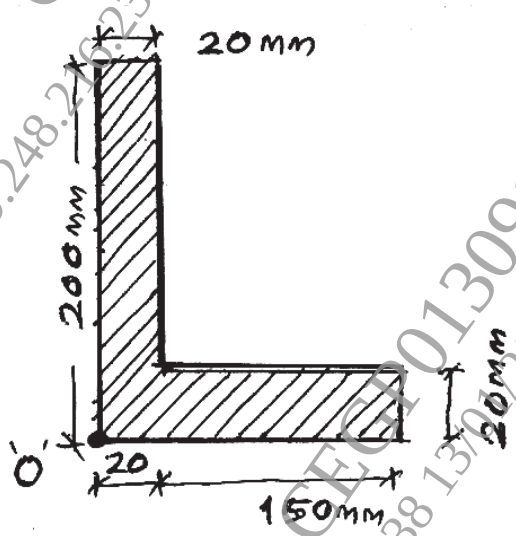

Fig. 4A

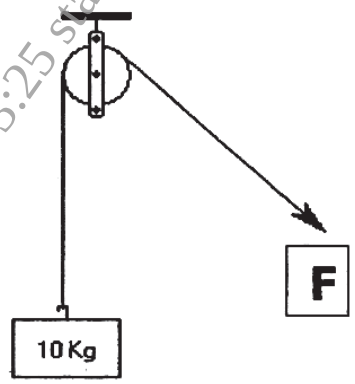

Fig. 4B

b) A block of 10kg hanging through a inextensible cable and kept in rest by applying a force of magnitude 'F = 1.5 kg' on other side of the cable, which is passing through the rough pulley as shown in the **Fig. 4B** Determine (i) the lap angle between cable and pulley required to keep the block in rest; (ii) the number of turns required to wound the cable on pulley. Take coefficient of static friction $\mu_s = 0.30$ between pulley and cable. **[6]**

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