Reg. No. : E N G G T R E E . C O M

Question Paper Code : 30253

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third Semester

Automobile Engineering

ME 3351 – ENGINEERING MECHANICS

(Common to Civil Engineering/Industrial Engineering/Industrial Engineering and Management/Materials Science and Engineering/Mechanical Engineering/Mechanical Engineering (Sandwich)/Mechanical and Automation Engineering/Mechatronics Engineering/Production Engineering/Robotics and Automation/Safety and Fire Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. The guy wire of a electric pole shown in Figure 1 makes 30° to the pole and is applying a force of 12 kN. Find the horizontal and vertical component of the force. Express it in the vector form taking horizontal direction as x-axis and vertical as y-axis.

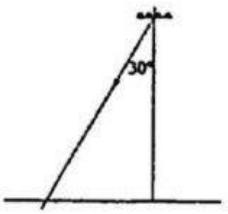


Fig. 1

2. Draw the free body diagram for the given Figure 2.

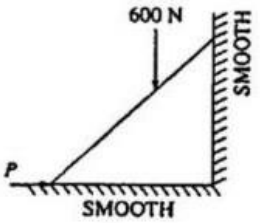


Fig. 2

3. Determine the moment of 400 N force acting at B in $x-y$ plane about point A, as shown in Figure 3.

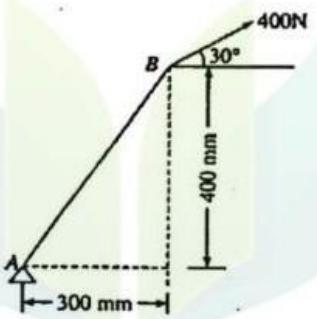


Fig. 3

4. Define Sliding Vector.

5. Derive Centroid of a Semicircle.

6. Derive Moment of inertia of a triangle about the base.

7. List out the laws of Coloumb Friction.

8. Define Angle of Friction.

9. The motion of a particle moving in a straight line is given by the Expression $s = t^3 - 3t^2 + 2t + 5$, where, s is the displacement in metres and t is the time in seconds. Determine velocity and acceleration after 4 seconds.

10. A body weighing 300 N is pushed up a 30° plane by a 400 N force acting parallel to the plane. If the initial velocity of the body is 1.5 m/s and coefficient of kinetic friction is $\mu = 0.2$, what velocity will the body have after moving 6 m?

PART B — (5 × 13 = 65 marks)

11. (a) Three cables are connected at A, where the forces P and Q are applied as shown in Figure 11(a). Knowing that Q = 0, find the value of P for which the tension in cable AD is 305 N. (13)

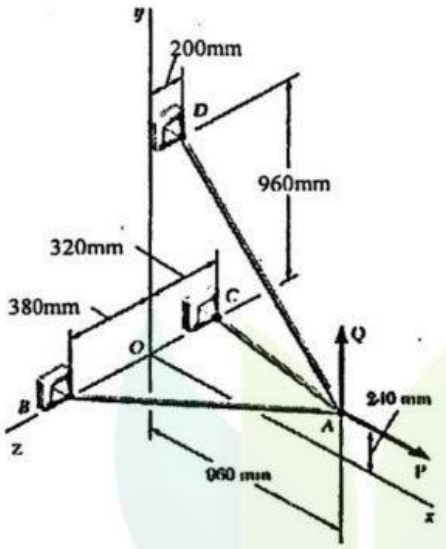
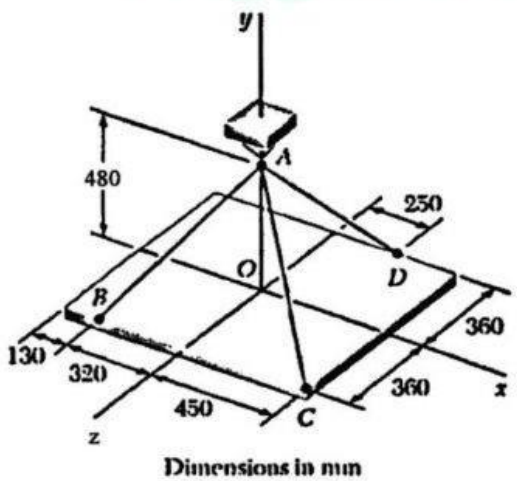


Fig. 11(a)

Or

(b) A rectangular plate is supported by three cables as shown in Figure 11(b). Knowing that the tension in cable AC is 60 N, determine the weight of the plate. (13)



Dimensions in mm

Fig. 11(b)

12. (a) Two parallel 40 N forces are applied to a lever as shown in Figure 12(a). Determine the moment of the couple formed by the two forces (i) by resolving each force into horizontal and vertical components and adding the moments of the two resulting couples, (ii) by using the perpendicular distance between the two forces, (iii) by summing the moments of the two forces about Point A. (13)

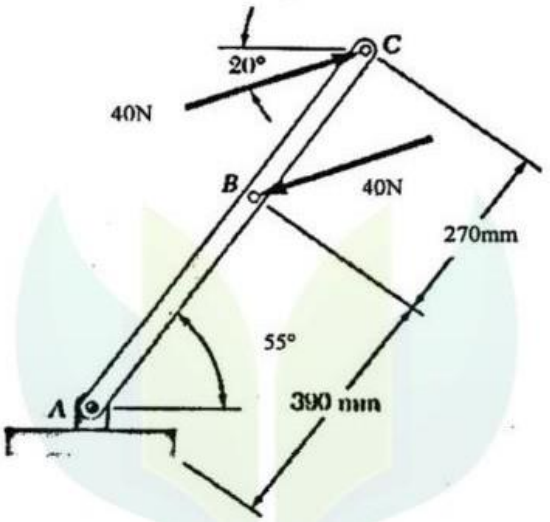


Fig. 12(a)

Or

(b) A rectangular plate is acted upon by the force and couple shown in Figure 12(b). This system is to be replaced with a single equivalent force. (i) For $\alpha = 40°$, specify the magnitude and the line of action of the equivalent force. (ii) Specify, the value of α if the line of action of the equivalent force is to intersect line CD 300 mm to the right of D. (13)

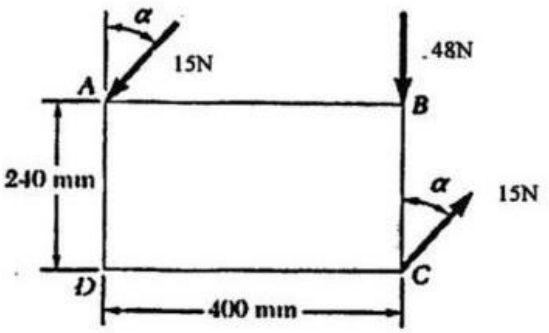


Fig. 12(b)

13. (a) Find moment of inertia of the shaded area shown in Figure 13(a) about axis AB. (13)

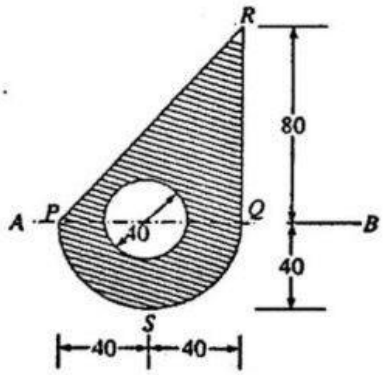


Fig. 13(a)

Or

(b) For the machine element shown in Figure 13(b), locate the x coordinate of the center of gravity. (13)

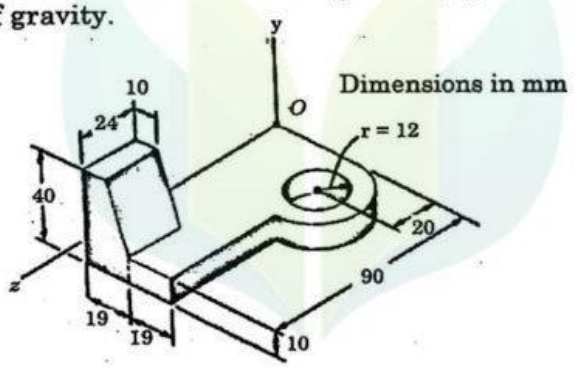


Fig. 13(b)

14. (a) Block A weighing 1000 N rests over block B which weighs 2000 N as shown in Figure 14(a). Block A is tied to wall with a horizontal string. If the coefficient of friction between A and B is 1/4 and between B and the floor is 1/3, what should be the value of P to move the block B if (i) P is horizontal? (ii) P acts 30° upwards to horizontal? (13)

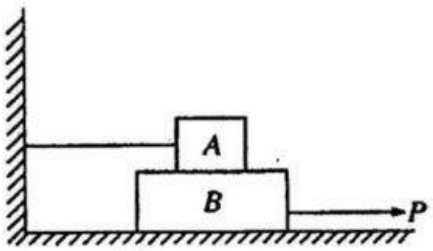


Fig. 14(a)

Or

(b) A 6.5-m ladder AB leans against a wall as shown in Figure 14(b). Assuming that the coefficient of static friction μ_s is the same at A and B, determine the smallest value of μ_s for which equilibrium is maintained. (13)

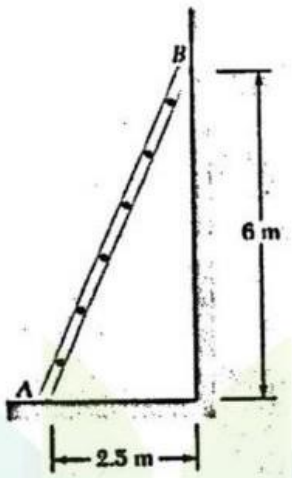


Fig. 14(b)

15. (a) Two stations P and Q are 5.2 km apart. An automobile starts from rest from station P and accelerates uniformly to attain a speed of 48 kmph in 30 seconds. This speed is maintained until the brakes are applied. The automobile comes to rest at station Q with a uniform retardation of one metre per second. Determine the total time required to cover the distance between these two stations. (13)

Or

(b) Two rough planes inclined at 30° and 60° to horizontal are placed Back to back as shown in Figure 15(b). The blocks of weights 50 N and 100 N are placed on the faces and are connected by a string running parallel to planes and passing over a frictionless pulley. If the coefficient of friction between planes and blocks is 1.3, find the resulting acceleration and tension in the string. (13)

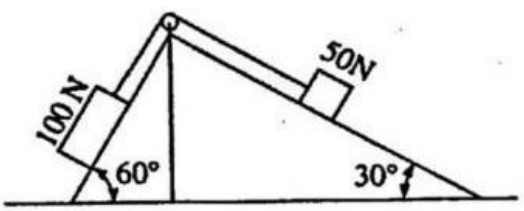


Fig. 15(b)

PART C — (1 × 15 = 15 marks)

16. (a) When they are 18 m apart, two blocks A and B are released from rest on a 30° incline. The coefficient of friction under the upper block A is 0.2 and that under the lower block B is 0.4 [Figure 16(a)]. In what time does block A reach the block B? After they touch and move as a single unit, what will be the contact force between them? Weights of the block A and B are 100 N, and 80 N respectively. (15)

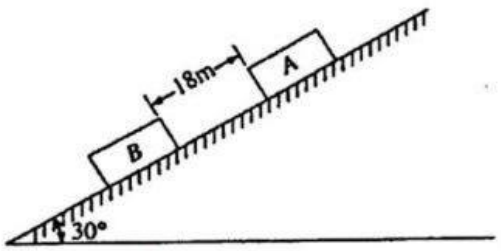


Fig. 16(a)

Or

(b) A 500-N concrete block is to be lifted by the pair of tongs shown in Figure 16(b). Determine the smallest allowable value of the coefficient of static friction between the block and the tongs at F and G. (15)

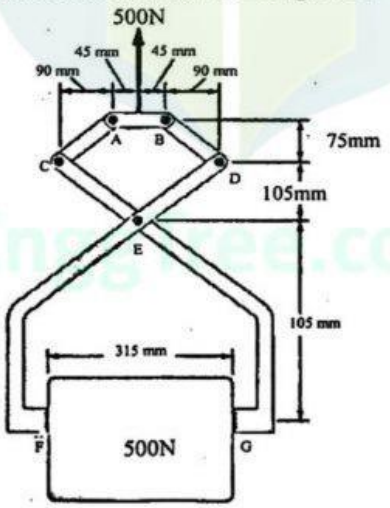


Fig. 16(b)

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Question Paper Code : 70146

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Third Semester

Civil Engineering

ME 3351 — ENGINEERING MECHANICS

(Common to B.E. Automobile Engineering/B.E. Industrial Engineering/ B.E. Industrial Engineering and Management/B.E. Materials Science and Engineering/B.E. Mechanical Engineering/B.E. Mechanical Engineering (Sandwich)/B.E. Mechanical and Automation Engineering/B.E. Mechatronics Engineering/B.E. Production Engineering/B.E. Robotics and Automation/B.E. Safety and Fire Engineering)

(Regulations 2021)

Time : Three hours **Maximum : 100 marks**

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Resultant force.
2. What is meant by coplanar concurrent forces?
3. Write the principle of transmissibility.
4. State Varignon's theorem.
5. Write the theorem of pappus-Guldinus.
6. Recall Parallel axis theorem.
7. Define coefficient of friction.
8. Write any two laws of friction.
9. What is meant by coefficient of restitution?
10. State Impulse and Momentum principle.

PART B — (5 × 13 = 65 marks)

11. (a) Three coplanar forces are acting at a point as shown in fig Q 11(a). Determine the magnitude and the direction of the resultant force.

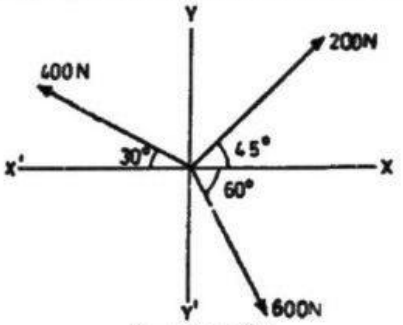

fig Q 11(a)

Or

(b) A block weighing 5kN is suspended from the ceiling by a chain. It is dragged aside by a horizontal chord until the chain makes 60° with the ceiling as shown in Fig.Q.11(b). Find the tension in the chain and in the chord.

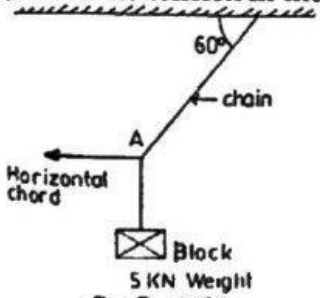

fig Q 11(b)

12. (a) Four forces of magnitude and direction acting on a square ABCD of side 2m are shown in fig Q 12(a). Calculate the resultant in magnitude and direction and also locate its point of application with respect to the sides AB and AD.

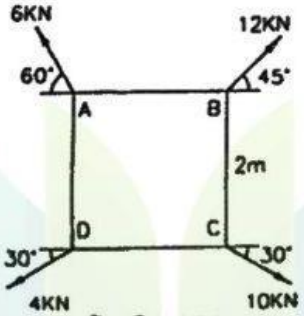

fig Q 12(a)

Or

(b) Determine the support reactions of the beam shown in fig Q 12(b) below

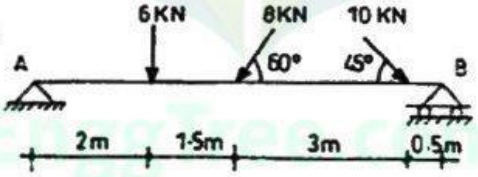

fig Q 12(b)

13. (a) Locate the center of gravity of a bullet, 1 cm diameter with a cone on the front and a hemisphere cut from the back as shown in fig Q 13(a) below. Assume the material to be homogeneous.

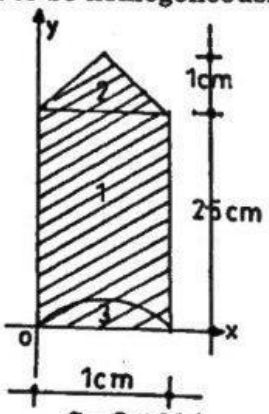

fig Q 13(a)

Or

(b) Calculate the moment of inertia of L section shown in fig Q 13(b) below about the horizontal axis passing through the C.G.

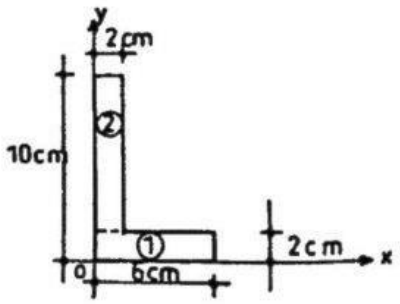

fig Q 13(b)

14. (a) What should be the value of the angle θ so that motion of the 390N block as shown in Fig.Q.14(a) impends down the plane? The coefficient of friction for all surfaces is 1/3.

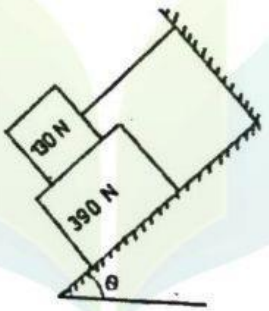

fig Q 14(a)

Or

(b) A 7m long ladder rest against a vertical wall, with which it makes an angle of 45° and on a floor. If a man whose weight is one half that of ladder climbs it, at what distance along the ladder will he be, when the ladder us about to slip? Take coefficient of friction between the ladder and the wall is 1/3 and that between the ladder and the floor is 1/2.

15. (a) Two weights 80 N and 20 N are connected by a thread and more along a rough horizontal plane under the action of a force 40 N, applied to the first weight of 80 N as shown in Fig Q 15 (a). The coefficient of friction between the sliding surface of the weights and the plane is 0.3. Determine the acceleration of the weight and the tension in the thread using work energy equation.

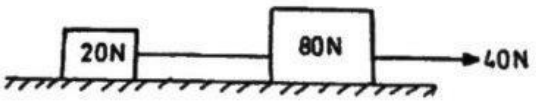

Fig Q 15 (a)

Or

(b) Two blocks of weight 150 N and 50 N are connected by a string, passing over a frictonless pulley as shown in Fig.Q 15 (b). Determine the velocity of 150 N block after 4 seconds. Use Impulse Momentum method.

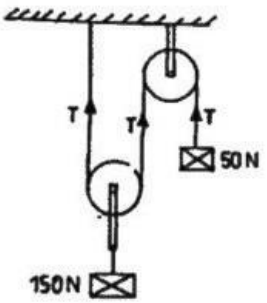

Fig Q 15 (b)

PART C — (1 × 15 = 15 marks)

16. (a) For the section shown in Fig.Q.16 (a) below, determine the moment of inertia about 1-1 and 2-2 axis.

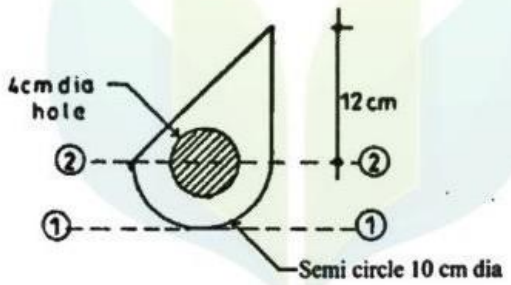

Fig.Q.16 (a)

Or

(b) A ball of mass 500 g, moving a velocity of 1 m/sec impinges on a ball of mass 1 kg, moving with a velocity of 0.75 m/sec. At the time of impact, the velocities of the balls are parallel and inclined at 60° to the line joining their centers. Determine the velocities and directions of the balls after impact. Take e = 0.6.

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Question Paper Code : 21293

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Third Semester

Civil Engineering

ME 3351 — ENGINEERING MECHANICS

(Common to Automobile Engineering/Industrial Engineering/Industrial Engineering and Management/Materials Science and Engineering/Mechanical Engineering/Mechanical Engineering (Sandwich)/Mechanical and Automation Engineering/Mechatronics Engineering/Production Engineering/Robotics and Automation/Safety and Fire Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. A force of 100 N is acting at a point making an angle of 30° with the horizontal as shown in Fig.1. Determine the components of this force along X and Y directions.

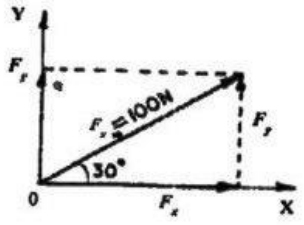

Fig.1

2. Two concurrent forces of 12 N and 18 N are acting at an angle of 60°. Find the resultant force.

3. State the principle of transmissibility of forces with simple sketch.

4. A 500 N vertical force is applied to a 60 cm long bar OA hinged at O and inclined at 60° to the horizontal as shown in Fig.2 Determine the moment of the 500 N force about O.

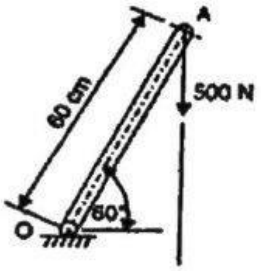

Fig.2

5. Locate the centroid of the lamina shown inFig.3.

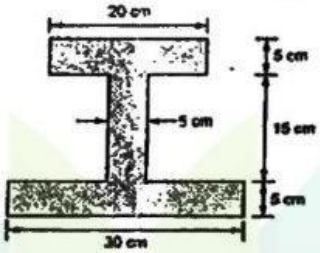

Fig.3

6. State parallel-axis theorem.

7. A body of weight 100 N is placed on a rough horizontal plane, and pushed by a force of 45 N, to just cause sliding over the horizontal plane. Determine the co-efficient of friction.

8. Define "Angle of repose".

9. A train running at 80km/h is brought to halt after 50 seconds. Find the retardation and the distance travelled by the train before it comes to a halt.

10. State the principle of work and energy.

PART B — (5 × 13 = 65 marks)

11. (a) Find the X and Y components of force system shown in Fig.4. Also find the resultant of the given forces in magnitude and direction.

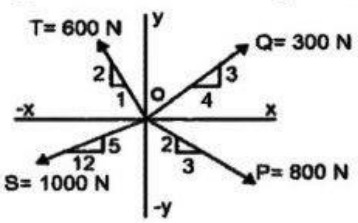

Fig.4

Or

(b) A gusset plate of roof truss is subjected to forces as shown in Fig.5. Determine the magnitude of the resultant force and its orientation measured counter clockwise from the positive x-axis.

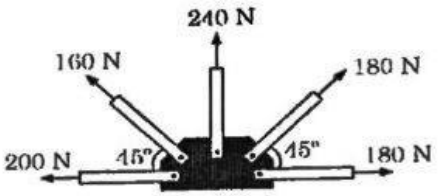

Fig.5

12. (a) A system of parallel forces 32.5N, 150N, 67.5N and 10N are acting on a rigid bar as shown in Fig 6. Reduce this system to:

(i) a single force

(ii) a single force and a couple at A

(iii) a single force and a couple at B.

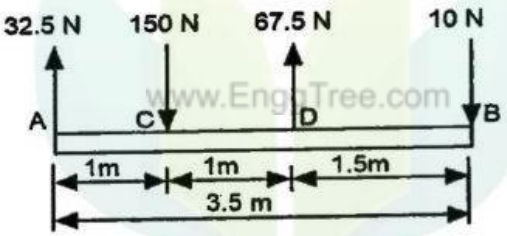

Fig.6

Or

(b) Two smooth spheres each of radius 100 mm, and weight 100 N, rest in a horizontal channel having vertical walls, the distance between the walls being 360 mm. Find the reactions at the points of contacts A, B, C and D as shown in Fig.7.

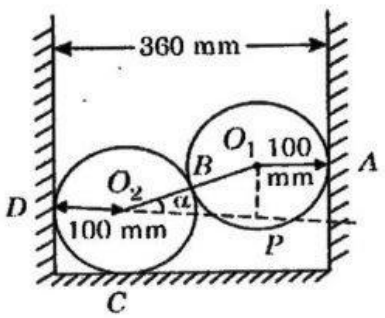

Fig.7

13. (a) Find the moment of inertia for the shaded area shown in Fig.8 about the lines AA' and AB'.

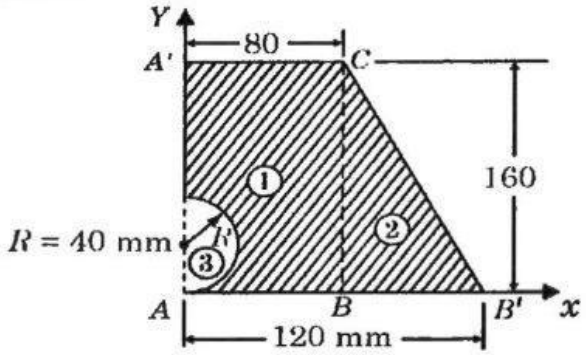

Fig.8

Or

(b) Find the moment of inertia of the area shown in Fig.9 about line AB parallel to the centroidal axis.

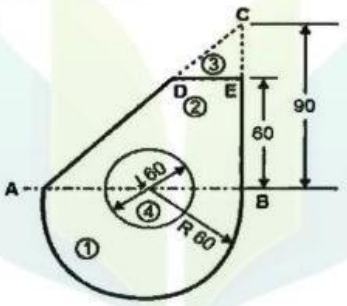

Fig.9

14. (a) A uniform ladder of weight 1000N and of length 4m rests on a horizontal ground and leans against a smooth vertical wall. The ladder makes an angle of 60° with horizontal. When a man of weight 750N stands on the ladder at a distance of 3m from the top of the ladder, the ladder is at the point of sliding. Determine the co-efficient of friction between the ladder and the floor.

Or

(b) Block A weighing 1000N rests over block B, which weighs 2000N. Block A is tied to wall with a horizontal string as shown in Fig 10. Find the value of P to move Block B if the coefficient of friction between A and B is 0.5 and the coefficient between B and the floor is 0.33.

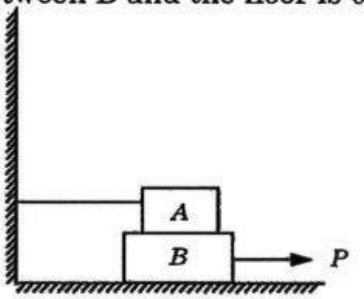

Fig.10

15. (a) Two masses $m_1 = 40$ kg and $m_2 = 30$ kg are interconnected with a pulley system as shown in the Fig.11. Neglecting inertial and frictional effect of pulleys and cord, find the acceleration of 40 kg mass.

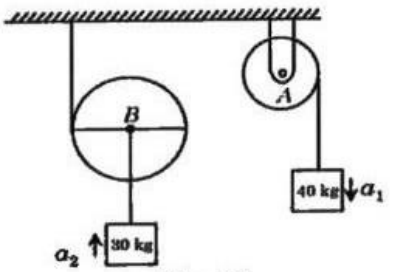

Fig.11

Or

(b) Weights 800N and 400N are connected by a thread and move along a rough horizontal plane under the action of a force of 500N applied to 800N weight as shown in Fig 12. The coefficient of friction between the sliding surface of the weights and the plane is $\mu = 0.25$. Determine the acceleration of the weights and tension in the thread, using work-energy equation.

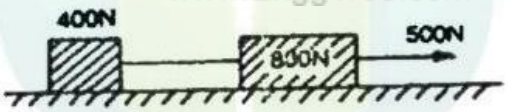

Fig.12

PART C — (1 × 15 = 15 marks)

16. (a) (i) A block placed over a 10° wedge on a horizontal floor and leaning against a vertical wall as shown in Fig 13, and weighing 1500N is to be raised by applying a horizontal force to the wedge. Assuming co-efficient of friction between all the surfaces in contact to be 0.3, Determine the minimum horizontal force to be applied to raise the block. (8)

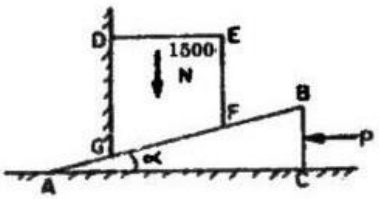

Fig.13

(ii) The four coplanar forces are acting at a point as shown in Fig.14. One of the forces is unknown and its magnitude is shown by P. The resultant is having a magnitude of 500N and is acting along x-axis. Determine the unknown force P and its inclination with x-axis. (7)

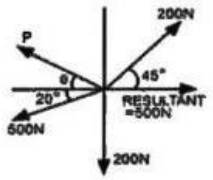

Fig.14

Or

(b) Determine the constant force P that will give the system of bodies shown in Fig.15., a velocity of 3m/s after moving 4.5 m from rest. Coefficient of friction between the blocks and the plane is 0.3. Pulleys are smooth. Use work-energy method.

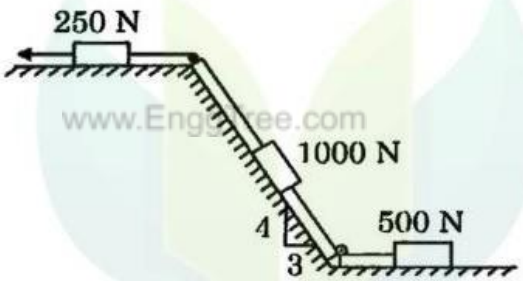

Fig.15

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Question Paper Code : 40044

B.E. DEGREE EXAMINATION, APRIL/MAY 2018

Second Semester

Aeronautical Engineering

GE 8292 : ENGINEERING MECHANICS

(Common to Agriculture Engineering/Automobile Engineering/B.E. Civil Engineering/Environmental Engineering/Industrial Engineering/ Industrial Engineering and Management/Manufacturing Engineering/Marine Engineering/Material Science and Engineering/Mechanical Engineering/ Mechanical Engineering (Sandwich) /Mechanical and Automation Engineering/ Mechatronics Engineering/Production Engineering/Robotics and Automation Engineering)

(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

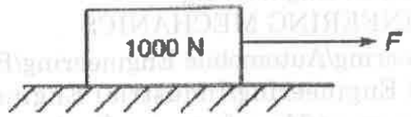
PART – A (10×2=20 Marks)

1. Determine the resultant of the three concurrent forces $F_1 = 2i + 3j - 2.5k$, $F_2 = -i + 5j - 3k$, and $F_3 = 7i - 7j + 6k$. The forces are in Newton.
2. State the parallelogram law of forces.
3. Mention the required equilibrium conditions of a body applied with a system of non-concurrent, coplanar forces.
4. A force F = 6N i – 4j – 5N k is acting at a point P whose position vector from the origin O of the coordinate axes is 8 mm i + 6 mm j – 4 mm k. Find the moment of this force about the origin.
5. What is moment of inertia of triangular lamina (b × h) about its horizontal centroidal axis ?
6. State the parallel axis theorem.

7. Define coefficient of restitution.

8. State the work and energy principle.

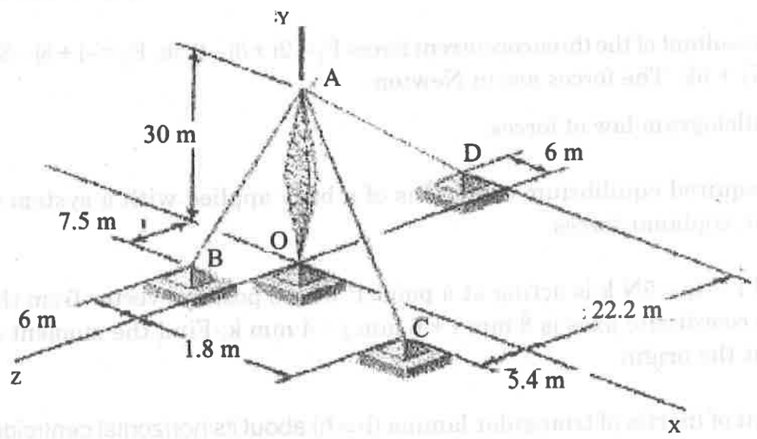
9. What is the force F required to just initiate the block shown in figure to slide if the coefficient of friction between the surfaces in contact is 0.4 ?



10. A fan rotating at 50 rpm is being switched off and it will come to rest in 20 s. How many revolutions it has made before it comes to rest ?

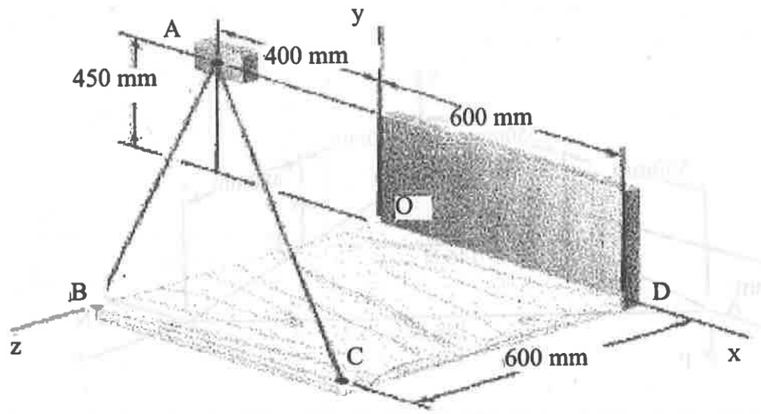
PART – B **(5×13=65 Marks)**

11. a) A transmission tower is held by three guy wires attached to a pin at A and anchored by bolts at B, C, and D. If the tension in wire AB is 3.6 kN, determine the vertical force P exerted by the tower on the pin at A. **(13)**

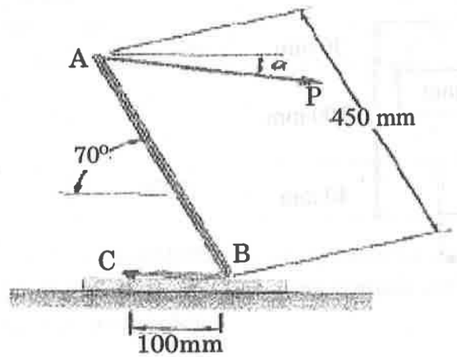


(OR)

b) Knowing that the tension is 1020 N in cable AB and 850 N in cable AC, determine the magnitude and direction of the resultant of the forces exerted at A by the two cables. **(13)**

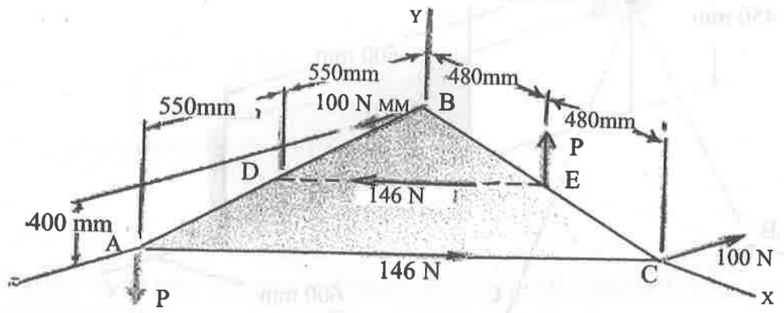


12 a) It is known that a vertical force of 800 N is required to remove the nail at C from the board. As the nail first starts moving, determine (a) the moment about B of the force exerted on the nail, (b) the magnitude of the force P which creates the same moment about B if $\alpha = 10°$, (c) the smallest force P which creates the same moment about B. **(13)**

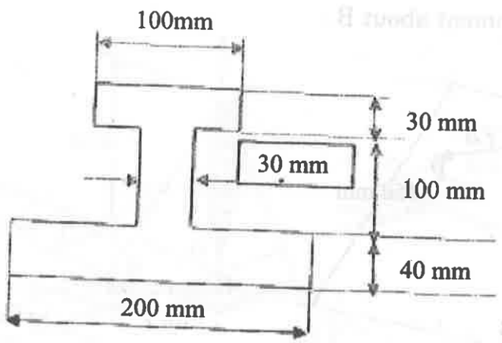


(OR)

b) Knowing that P = 210 N, replace the three couples with a single equivalent couple, specifying its magnitude and the direction of its axis. **(13)**

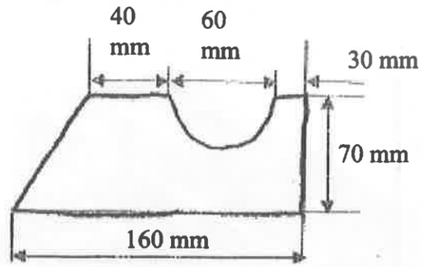


13. a) Determine the center of gravity of the unsymmetrical I section shown in Figure. **(13)**

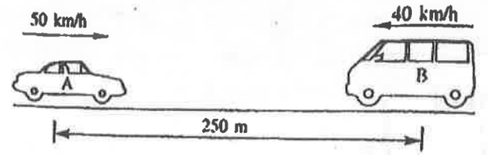


(OR)

b) Find the moments of inertia about the centroidal axes for the section shown in figure. **(13)**



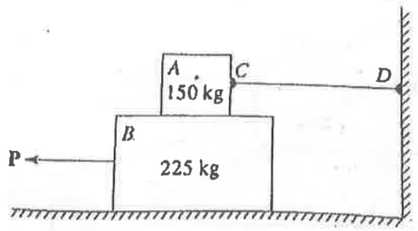
14. a) Two vehicles approach each other in opposite lanes of straight horizontal roadway as shown in Figure. At time t = 0, the vehicles have the speeds and positions shown in the figure. Find the time and positions at which the vehicles meet if both continue to move with constant speed. **(13)**



(OR)

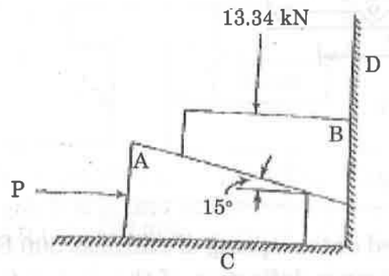
b) A steel ball of weight 60N is dropped onto a spring of stiffness 500 N/m from a height of 100 mm. Find the maximum deflection of the spring (use the work-energy principle). **(13)**

15. a) Determine the smallest force P required to move the block B if (a) block A is restrained by cable CD as shown in figure. (b) Cable CD removed. Take the coefficients of frictions as $\mu_s = 0.30$, $\mu_k = 0.25$ between all surfaces of contact **(13)**



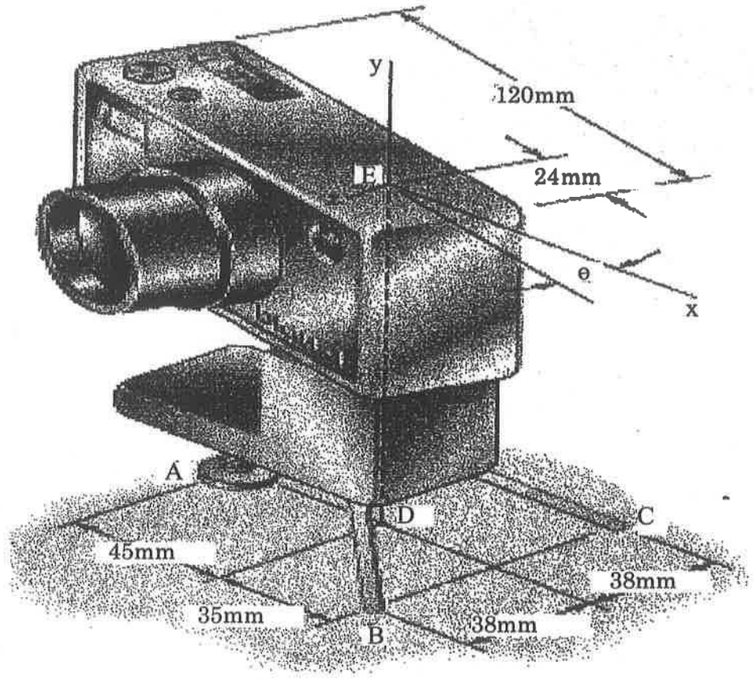
(OR)

b) Determine the smallest force P required to lift the 13.34 kN load shown in figure. The coefficient of static friction between A and C and B and D is 0.3 and that between A and B is 0.4. **(13)**



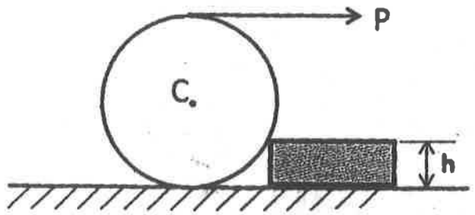
PART – C **(1×15 = 15 Marks)**

16. a) A camera of mass 240 g is mounted on a small tripod of mass 200 g. Assuming that the mass of the camera is uniformly distributed and that the line of action of the weight of the tripod passes through D, determine
a) the vertical components of the reactions at A, B and C when $\theta = 0$
b) the maximum value of θ if the tripod is not to tip over. **15**



OR

b) A roller or radius r = 304.8 mm and weight = 2225 N is to be pulled over a curb of height h = 152.4 mm by a horizontal force P applied to the end of a string wound around the circumference of the roller (Fig. 16(b). Find the magnitude of P required to start the roller over the curb.



(b) The magnitudes and directions of the velocities of two identical smooth balls before they strike each other are as shown in fig. 14(b). Assuming e = 0.6, determine the magnitude and direction of velocity of each ball after impact.

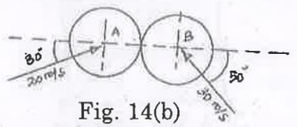


Fig. 14(b)

15. (a) A body resting on a horizontal plane required a pull of 200N inclined at 40° to the plane to initiate the motion. It was also found that a push of 250N inclined at 40° to the plane, just moved the body as shown in fig 15(a). Determine weight of the body and Co- efficient of friction.

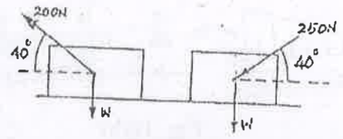


Fig. 15(a)

Or

(b) A block of weight 1600N is in contact with a place incline 30° to horizontal. A force 'P' parallel to the plane and acting up the plane $\mu = 0.2$. Find

(i) The value pf 'P' to just cause the motion.
(ii) The value of 'P' to prevent motion
(iii) The magnitude and direction of frictional force.

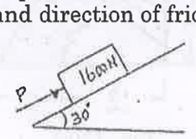


Fig. 15(b)

PART C — (1 × 15 = 15 marks)

16. (a) Derive the expression for mass moment of inertia of sphere of radius R, about y axis.

Or

(b) Figure 16(b) shows configuration of an engine mechanism. The dimensions are the Crank OA = 200 mm; Connecting rod AB = 600 mm ; distance of centre of mass from crank end, AD = 200 mm. At the instant, the crank has an angular velocity of 50 rad/s clockwise and an angular acceleration of 800 rad/s². Calculate the

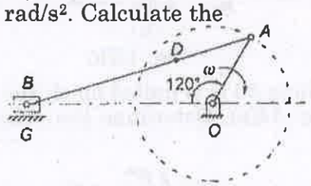


Fig. 16(b)

(i) velocity of D and angular velocity of AB
(ii) Acceleration of D and angular acceleration of AB
(iii) Point on the connecting rod which has zero acceleration at this instant.

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Question Paper Code : 80179

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Second/Third Semester

GE 8292 — ENGINEERING MECHANICS

(Common to : Aeronautical Engineering/Aerospace Engineering/ Agriculture Engineering/Automobile Engineering/Civil Engineering/ Environmental Engineering/ Industrial Engineering/ Industrial Engineering and Management/Manufacturing Engineering/ Marine Engineering/Material Science and Engineering/Mechanical Engineering/ Mechanical Engineering (Sandwich)/Mechanical and Automation Engineering/ Mechatronics Engineering/Petrochemical Engineering/Production Engineering/ Robotics and Automation Engineering/Petrochemical Technology/ Petroleum Engineering)

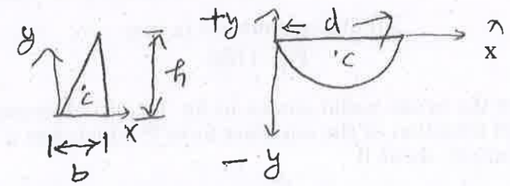
(Regulation 2017)

Time : Three hours Maximum : 100 marks

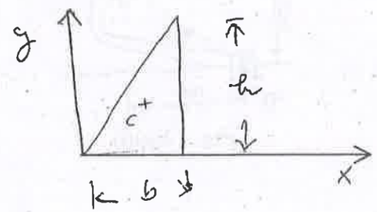
Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the principle of transmissibility with an example.
2. Give two practical applications, from where the concept of cross product evolved.
3. Hinged support has two reactions —Justify.
4. Find the moment of a force $\overline{F} = (200i + 100j)N$ acting at a point 'A' $(2i + 3j)m$ from the origin.
5. Locate the centroid of the given shapes.



6. Using parallel axis theorem find the area moment of inertia of a given area about x axis.



7. (a) Carom board players employ _____ principle while playing.
   (b) Snow bowling game employs _____ principle.
8. Write the Newton's laws of motion for downward motion.
9. Define angle of repose.
10. What do you mean by general plane motion?

PART B — (5 × 13 = 65 marks)

11. (a) A disabled automobile is pulled by means of two ropes as shown. Knowing that the tension in rope AB is 3750 N, Determine by trigonometry the tension in rope AC and the value of α, so that the resultant force exerted at A is a 6000N force directed along the axis of the automobile.

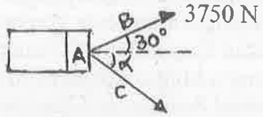
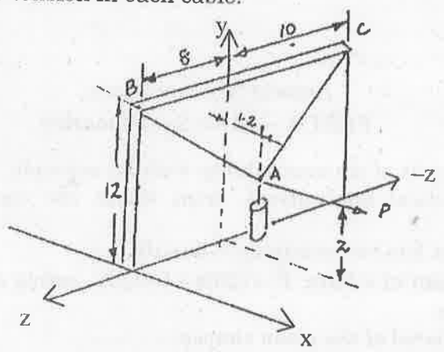


Fig. 11(a)

Or

(b) A 200 kg cylinder is hung by means of two cables AB and AC, which are attached to the top of a wall. A horizontal force P perpendicular to the wall holds the cylinder in the position shown. Determine the magnitude of P and the tension in each cable.



All dimensions are in mm.

Fig. 11(b)

12. (a) (i) For the brake pedal shown in fig. 12(a)(i), determine the magnitude and direction of the smallest force P which has a 104 Nm clockwise moment about B.

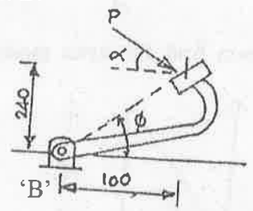


Fig. 12(a)(i)

(ii) A 300 N force is applied at A as shown in fig 12(a)(ii). Determine
   (1) The moment of force about D
   (2) The smallest force applied at B, which creates same moment.

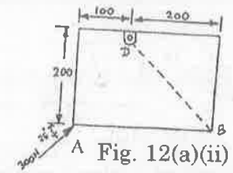


Fig. 12(a)(ii)

Or

(b) Find the reaction at A and B for the beam loaded as shown in fig. 12(b).

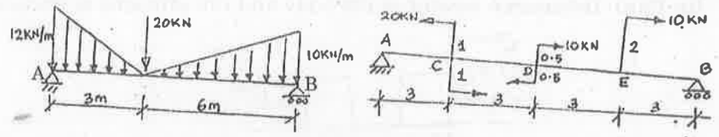


Fig. 12(b)

13. (a) Find the centroid of the shaded area shown in fig. 13(a) about X and Y axes.

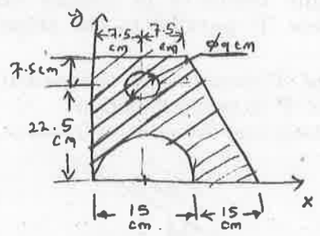


Fig. 13(a)

Or

(b) Find second moment of area of the shaded section shown in fig. 13(b) about its centroidal axes.

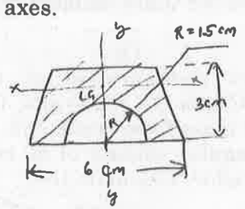


Fig. 13(b)

14. (a) An object weighing 80 N is pulled up on the smooth plane by a 75 N force as shown in fig. 14(a). Determine the velocity of the object after it has moved 4m.

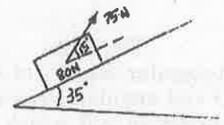


Fig. 14(a)

Or

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Question Paper Code : 90283

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Second/Third Semester

Civil Engineering

GE 8292 : ENGINEERING MECHANICS

(Common to Aeronautical Engineering/Aerospace Engineering/Agriculture Engineering/Automobile Engineering/Environmental Engineering/Industrial Engineering/Industrial Engineering and Management/Manufacturing Engineering/Marine Engineering/Material Science and Engineering/Mechanical Engineering/Mechanical Engineering (Sandwich)/Mechanical and Automation Engineering/Mechatronics Engineering/Petrochemical Engineering/Production Engineering/Robotics and Automation Engineering/ Petrochemical Technology/ Petroleum Engineering)

(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. State Newton's first law of motion.

2. Find out the force system on which the following belong to :

   i) Forces acting on a moving bus

   ii) Forces on a rod resting against a wall

3. State the concept of equilibrium of connected bodies.

4. Find the moment of 100 N force acting at B about point A as shown in Fig 4.

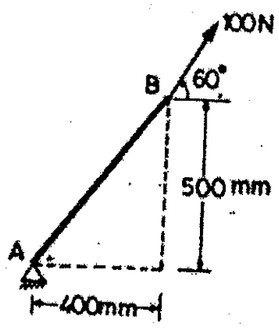

Fig. 4

5. What are principal axes ? What are principal axes of inertia of an area ?

6. When a lamina possesses axes of symmetry, what does it indicate ?

7. Indicate the concept involved the following games.

   i) Billiards

   ii) Boxing

8. Distinguish Power and Energy.

9. What is rolling resistance ?

10. How ladder friction varies from a wedge friction ?

PART – B **(5×13=65 Marks)**

11. a) A roller of weight 10 kN rests on a smooth horizontal floor and is connected to the floor by the bar AC as shown in Fig. 11 (a). Determine the force in the bar AC and reaction from floor, if the roller is subjected to a horizontal force of 5 kN and an inclined force of 7 kN as shown in the figure.

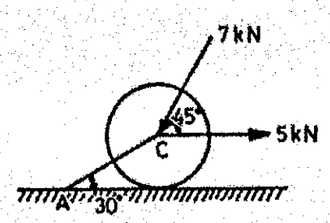

Fig. 11 (a)

(OR)

b) A rope AB, 4.5 m long is connected at two points A and B at the same level 4m apart. A load of 1500 N is suspended from a point C on the rope 1.5 m from A as shown in Fig. 11 (b). What load connected at a point D on the rope. 1 m from B will be necessary to keep the position CD level ?

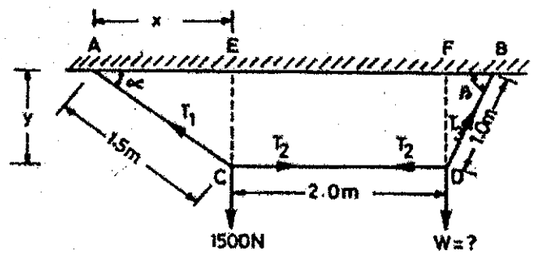

Fig. 11 (b)

12. a) The system of forces acting on a bell crank is shown in Fig. 12 (a). Determine the magnitude, direction and the point of application of the resultant.

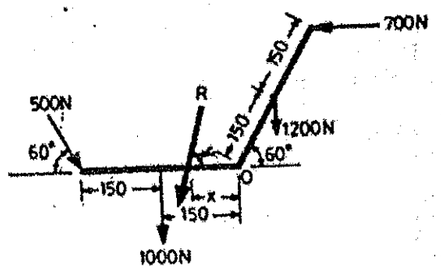

Fig. 12 (a)

(OR)

b) Determine the reactions at A and B of the over-hanging beam shown in Fig. 12 (b).

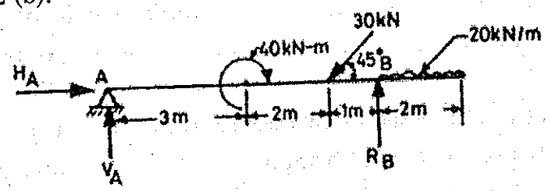

Fig. 12 (b)

13. a) From a semicircular lamina of radius r, a circular lamina of radius (r/2) is removed as shown in Figure 13 (a). Find the position of centre of gravity of the remainder.

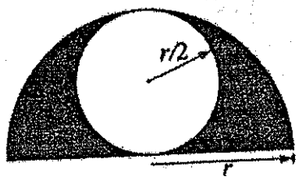

Fig. 13 (a)

(OR)

b) Find the moment of inertia of a hollow rectangular plane shown in Figure 13 (b) about x-axis and y-axis through the centroid.

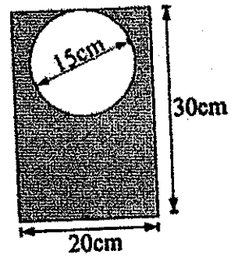

Fig. 13 (b)

14. a) An insect crawls at a constant speed u along the spoke of a bicycle wheel (Fig. 14 (a)), which is rotating with a constant angular velocity ω. Find the acceleration of insect in radial and perpendicular directions to the spoke.

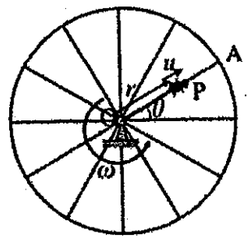

Fig. 14 (a)

(OR)

b) A package of mass 60 kg, moving with velocity 2.5 m/s on a surface of friction μ_k hits a spring of constant 20 kN/m and compressed initially by 12.0 cm. If block compresses the spring further to the maximum of 4.0 cm and the block is initially 60 cm away from end of spring, determine μ_k and velocity of block when it just starts pressing spring (see Figure 14.b).

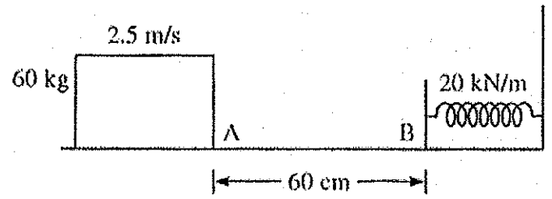

Fig. 14(b)

15. a) A body weighing 700 N rests on a rough horizontal surface. If $\mu_s = 0.4$,

a) Will the body move if a pull of 200 N is applied to it at 30° to the horizontal ?

b) If this force is increased to 300 N, investigate the condition of the body.

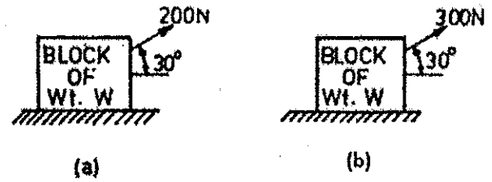

Fig. 15 (a)

(OR)

b) i) Explain absolute and relative velocity of particles of rigid body in plane motion. **(8)**

ii) Explain instantaneous centre of zero velocity in plane motion. **(5)**

PART – C **(1×15=15 Marks)**

16. a) Find the moment of inertia of circular plate of radius R and thickness t about its centroidal axis.

(OR)

b) A pole is held in place by three cables. If the force of each cable acting on the pole is shown, determine the position (x, y, 0) for fixing cable DC so that the resultant force exerted on the pole is directed along its axis.

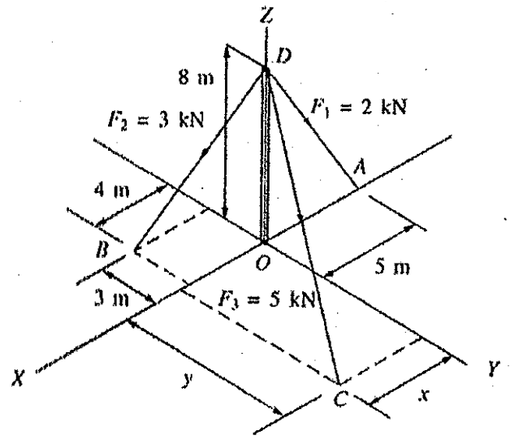

Fig 16(b)

(b) Two blocks 'A' and 'B' of masses m_A = 280 kg and m_B = 420 kg are joined by an inextensible cable as shown in Fig. 4(b). Assume that the pulley is frictionless and μ = 0.30 between block 'A' and the surface. The system is initially at rest. Determine (i) acceleration of block A: (ii) velocity after it has moved 3.5 m; and (iii) velocity after 1.5 seconds.

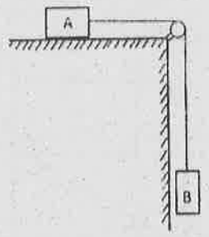

Fig. 14 (b)

15. (a) A 100 N force acts on a 300N block placed on an inclined plane as shown in Fig. 15(a). The coefficients of friction between the block and the plane are μ_s = 0.25 and μ_k = 0.20. Determine whether the block is in equilibrium, and find the value of the friction force.

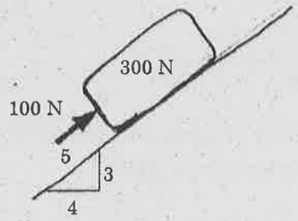

Fig. 15 (a)

Or

(b) A wheel is attached to the shaft of an electric motor of rated speed of 2000 rpm. When the power is switched on, the wheel attains the rated speed in 10 seconds and when the power is switched off, the unit comes to rest in 100 seconds. Assume uniformly accelerated motion and determine the number of revolutions the unit turns (i) to attain the rated speed and (ii) to come to rest.

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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 71945

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Second Semester

Civil Engineering

GE 6253 – ENGINEERING MECHANICS

(Common to Mechanical Engineering (Sandwich), Aeronautical Engineering, Agriculture Engineering, Automobile Engineering, Civil Engineering, Environmental Engineering, Geoinformatics Engineering, Industrial Engineering, Industrial Engineering and Management, Manufacturing Engineering, Marine Engineering, Materials Science and Engineering, Mechanical Engineering , Mechanical and Automation Engineering, Mechatronics Engineering, Petrochemical Engineering, Production Engineering, Robotics and Automation Engineering, Chemical Engineering, Chemical and Electrochemical Engineering, Fashion Technology, Food Technology, Handloom and Textile Technology, Petrochemical Technology, Petroleum Engineering, Pharmaceutical Technology, Plastic Technology, Polymer Technology, Textile Chemistry, Textile Technology, Textile Technology(Fashion Technology))

(Regulations 2013)

Time : Three hours , Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the principle of transmissibility.
2. Find the resultant and direction of Force $\vec{F} = 3i - 4j$.
3. Differentiate between moment and couple.
4. A uniform ladder of weight 'W' leans against a vertical wall. Assuming the contact surfaces as rough, draw the free body diagram of the ladder with necessary assumptions.
5. Differentiate between center of gravity and centroid.
6. State parallel axis theorem as applied to area Moment of Inertia.
7. The displacement of a particle is given by $S = 3t^2 + 2t$ meters. Where 't' is in seconds? Find the velocity and acceleration when t = 10 seconds.
8. State the principle of work-energy.

9. What is dry friction?

10. What is general plane motion? Give one example.

PART B — (5 × 16 = 80 marks)

11. (a) Two cylinders C, F of diameter 60mm and 30mm. weighing 160 N and 40 N respectively are placed as shown in Fig. 11(a). Assuming all the contact surfaces to be smooth, find the reactions at A, B and C.

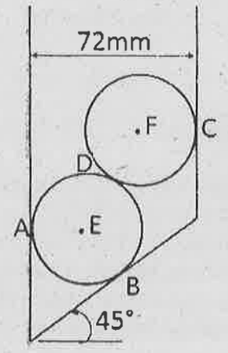

Fig. 11(a)

Or

(b) Forces 32 kN, 24 kN, 24 kN and 120 kN are concurrent at origin (0,0,0) and are respectively directed through the points whose coordinates are A(2, 1, 6). B(4, –2, 5), C(–3, –2, 1) and D(5, 1, –2). Determine resultant of the system.

12. (a) Four tug boats are used to bring a large ship to its pier. Each tug boat exerts a 5000N force in the direction as shown in Fig. 12(a). Determine the equivalent force-couple system at point 'O', and the point on hull where a single more powerful tugboat should push to produce the same effect as the original four tugboats.

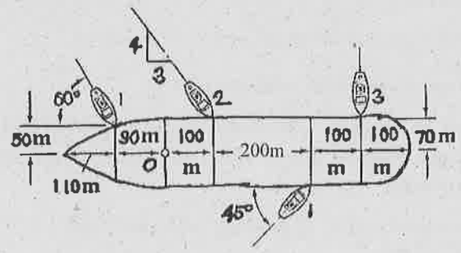

Fig. 12(a)

Or

(b) A light bar AD is suspended from a cable BE and supports a 50 kg block at C as shown in Fig. 12(b). The ends A and D of the bar are in contact with frictionless vertical walls. Determine the tension in cable BE and the reactions at A and D.

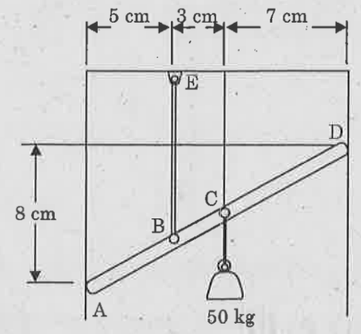

Fig. 12(b)

13. (a) Determine the location of centroid for the right angle triangle from the first principles and find the volume of cone using Pappus-Guldinus theorem.

Or

(b) Calculate the moment of inertia of the section shown in Fig. 13(b) about "x" and "y" axes through the centroid.

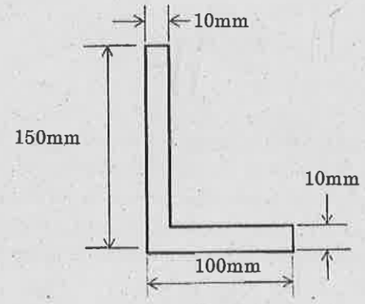

Fig. 13(b)

14. (a) A body moving with uniform acceleration is observed to travel 33 m in 8th second and 53 m in 13th second of its travel. Calculate the velocity at start and uniform acceleration.

Or

b) Find the moments of inertia of the hatched area shown in Fig. 13(b) about AA and BB. **(16)**

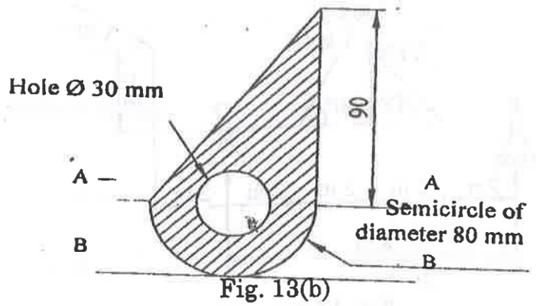

Fig. 13(b)

14. a) A block and pulley system is shown in Fig. 14(a). The horizontal plane and the pulley are frictionless. Determine the acceleration of the blocks and the tension in the cable when the system starts from rest. Use principle of impulse and momentum. **(16)**

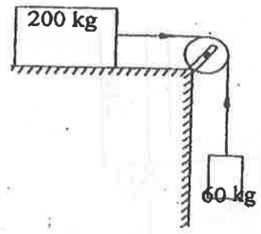

Fig. 14 (a)

(OR)

b) A person stands on the edge of a cliff 500 m above the ground and throws a stone horizontally with an initial speed of 18 m/s. Determine the time taken by the stone to hit the ground. Also find the speed with which it hits the ground. **(16)**

15. a) A pull of 250 N inclined at 25° to the horizontal plane is required just to move a body kept on a rough horizontal plane. But the push required just to move the body is 300 N. If the push is inclined at 25° to the horizontal, find the weight of the body and the co-efficient of friction. **(16)**

(OR)

b) A block weighing 1000 N is kept on a rough plane inclined at 40° to the horizontal. The coefficient of friction between the block and the plane is 0.4. Determine the least force inclined at 15° to the plane required just to move the block up the plane. **(16)**

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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 41184

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018

Second Semester

Civil Engineering

GE 6253 – ENGINEERING MECHANICS

(Common to : Mechanical Engineering (Sandwich)/Aeronautical Engineering/ Agriculture Engineering/Automobile Engineering/Environmental Engineering/ Geoinformatics Engineering/Industrial Engineering/Industrial Engineering and Management/Manufacturing Engineering/Marine Engineering/Materials Science and Engineering/Mechanical Engineering/ Mechanical and Automation Engineering/Mechatronics Engineering/Petrochemical Engineering/Production Engineering/Robotics and Automation Engineering/Chemical Engineering/ Chemical and Electrochemical Engineering/Fashion Technology/Food Technology/ Handloom and Textile Technology/Petrochemical Technology/ Petroleum Engineering/Pharmaceutical Technology/Plastic Technology/Polymer Technology/ Textile Chemistry/Textile Technology/Textile Technology (Fashion Technology) (Regulations 2013)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. State the different characteristics of a force.
2. State the conditions of equilibrium.
3. Differentiate simply supported beam, cantilever beam and fixed beam
4. What are the different types of loads ?
5. Define centre of gravity .
6. State parallel axis theorem .
7. What is meant by angle of projection ?
8. What is meant by linear momentum ?
9. Give two examples of general plane motion.
10. What is meant by angle of repose ?

PART – B (5×16=80 Marks)

11. a) A tripod supports a load of 2kN as shown in Fig. 11 (a). The ends P, Q and R are in x-z plane. Find the forces in the three legs of the tripod. **(16)**

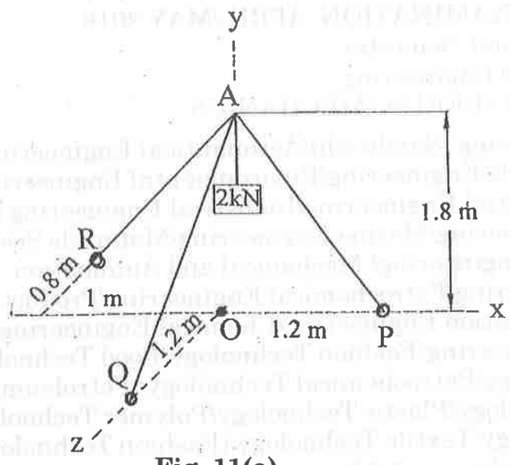

Fig. 11(a)

(OR)

b) A weight of 8kN is suspended by means of three cables as shown in Fig. 11 (b). Determine the forces in the cables PA, PB and PC. **(16)**

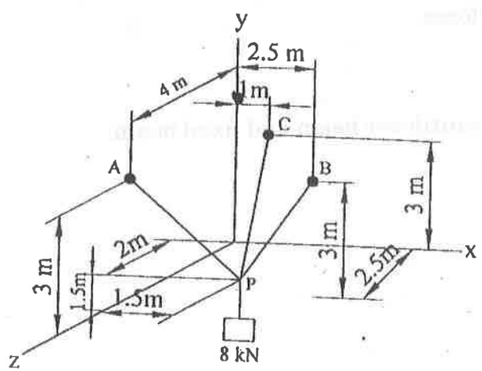

Fig. 11(b)

12. a) A simply supported beam is loaded as shown in Fig. 12(a). Find the reactions at P and Q. **(16)**

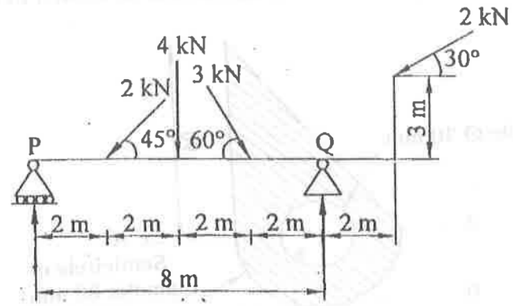

Fig. 12(a)

(OR)

b) A channel of mass 800 kg is supported as shown in Fig. 12(b). Find the reactions at P and Q. **(16)**

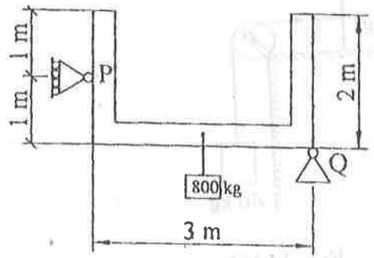

Fig. 12(b)

13 . a) Locate the centroid of the shaded area shown in Fig. 13 (a).The dimensions are in 'mm'. **(16)**

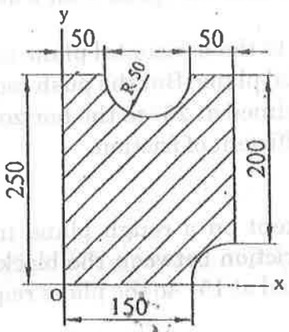

Fig. 13 (a)

(OR)

(b) Find the area moment of inertia of the T section, shown in Fig. 13.b. (16)

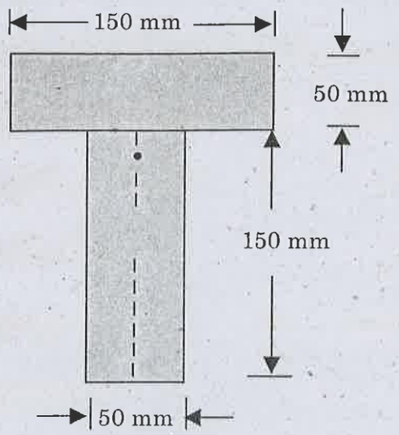

Fig. 13.b

14. (a) A bullet of mass is fired horizontally with a velocity of 300 m/s, from a gun carried in a carriage; which together with the gun has a mass of 100 kg. The resistance to sliding of the carriage over the ice on which it rests is 20 N. Find (i) Velocity, with which the gun recoils. (ii) Distance, in which it comes to rest (iii) Time taken to come to rest. (16)

Or

(b) A mass 10kg travelling towards right with a speed of 25 m/s collides with another mass 20 kg travelling in the same direction with a speed of 9 m/s. If the co-efficient of restitution is 0.6, find the velocities of masses after collision and loss in kinetic energy. What is the impulse on either mass? (16)

15. (a) A load of 1.5 kN, resting on an inclined rough plane, can be moved up the plane by a force of 2 kN applied horizontally or by a force 1.25 kN applied parallel to the plan. Find the inclination of plane and coefficient of friction. (16)

Or

(b) A ladder 5m long rests on a horizontal ground and leans against a smooth vertical wall at an angle 70° with the horizontal. The weight of the ladder is 900 N and acts at the middle. The ladder is at the point of sliding, when a man is weighing 750 N stands on a rung 1.5 m from the bottom of the ladder. Calculate the coefficient of friction between the ladder and the floor. (16)

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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 80506

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Second Semester

Civil Engineering

GE 6253 — ENGINEERING MECHANICS

(Common to Mechanical Engineering (Sandwich) Aeronautical Engineering, Agriculture Engineering, Automobile Engineering, Civil Engineering, Environmental Engineering, Geoinformatics Engineering, Industrial Engineering, Manufacturing Engineering, Industrial Engineering and Management, Marine Engineering, Materials Science and Engineering, Mechanical Engineering, Mechanical and Automation Engineering, Mechatronics Engineering, Petrochemical Engineering, Production Engineering, Robotics and Automation Engineering, Chemical Engineering, Chemical and Electro Chemical Engineering, Fashion Technology, Food Technology, Handloom Technology, Petrochemical Technology, Petroleum Engineering, Pharmaceutical Technology, Plastic Technology, Polymer Technology, Textile Chemistry, Textile Technology, Textile Technology (Fashion Technology)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Lami's theorem.
2. Define the principle of transmissibility of force.
3. Differentiate between couple and moment.
4. Write the equations of equilibrium of a rigid body in two dimensions.
5. Define 'centroid of a plane area'.
6. What do you understand by mass moment of inertia?
7. Define linear momentum and angular momentum.
8. Give the equation of work energy for a rectilinear motion.
9. Distinguish between dry and fluid friction.
10. What is general plane motion?

PART B — (5 × 16 = 80 marks)

11. (a) A horizontal line PQRS is 12 m long, where PQ = QR = RS = 4m. Forces of 1000 N, 1500 N, 1000 N and 500 N act at P, Q, R, S respectively in downward direction. The line of action of these forces makes angle of 90°, 60°, 45° and 30° respectively with PS. Find the magnitude, direction and position of resultant force. (16)

Or

(b) A light string ABCDE whose extremity A is fixed, has weights W_1 and W_2 attached to it at B and C. It passes round a small smooth peg at D carrying a weight of 300 N at the free end E as shown in Fig. 11.b. If in the equilibrium position, BC is horizontal and AB and CD make 150° and 120° with BC, find (i) Tensions in the portion AB, BC and CD of the string and (ii) Magnitudes of W_1 and W_2. (16)

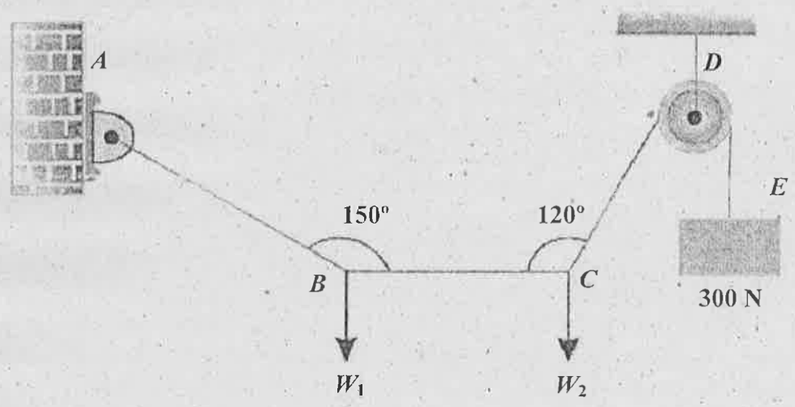

Fig. 11.b

12. (a) A fixed crane (Fig. 12.a) has a mass of 1000 kg and it is used to lift a 2400 kg weight. It is held in place by a pin at A and a rocker at B. The centre of gravity of the crane is located at G. Determine the components of reaction at A and B. (16)

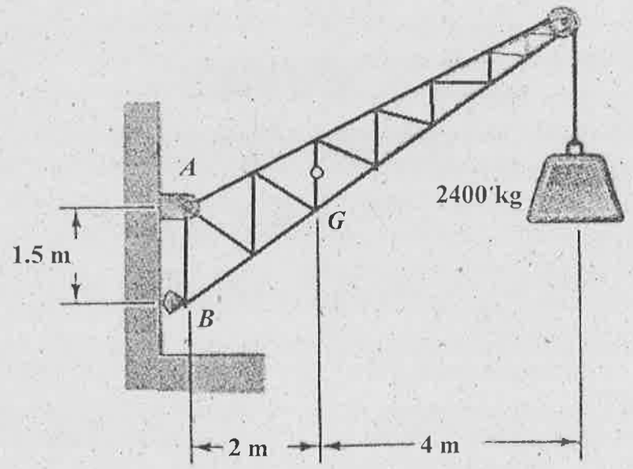

Fig. 12.a

Or

(b) The frame (Fig. 12.b) supports the part of the roof of a small building. The tension in the cable is 150 kN. Determine the reaction at the fixed end E. (16)

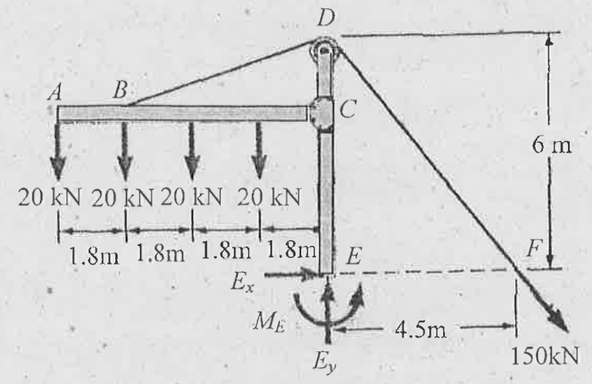

Fig.12.b

13. (a) A uniform lamina shown in Fig. 13.a. consists of a rectangle, a semi-circle and a triangle. Determine the centroid of the lamina. (16)

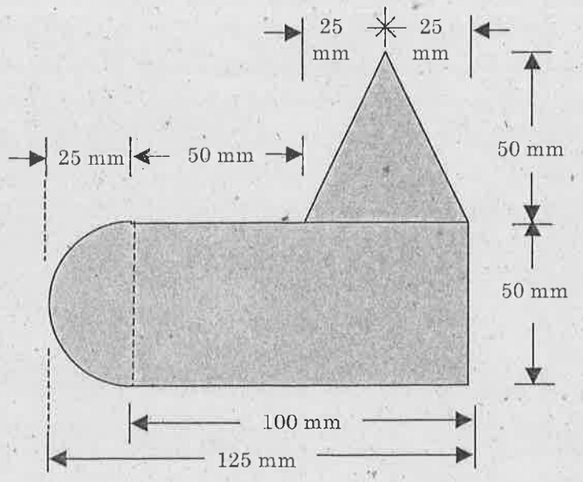

Fig.13.a

Or

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Reg. No.: | | | | | | | | | | | | |

Question Paper Code : 50655

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017

Second Semester

Civil Engineering

GE 6253 – ENGINEERING MECHANICS

(Common to Mechanical Engineering (Sandwich), Aeronautical Engineering, Agriculture Engineering, Automobile Engineering, Environmental Engineering, Geoinformatics Engineering, Industrial Engineering, Industrial Engineering and Management, Manufacturing Engineering, Marine Engineering, Materials Science and Engineering, Mechanical Engineering, Mechanical and Automation Engineering, Mechatronics Engineering, Petrochemical Engineering, Production Engineering, Robotics and Automation Engineering, Chemical Engineering, Chemical and Electrochemical Engineering, Fashion Technology, Food Technology, Handloom and Textile Technology, Petrochemical Technology, Petroleum Engineering, Pharmaceutical Technology, Plastic Technology, Polymer Technology, Textile Chemistry, Textile Technology, Textile Technology (Fashion Technology)

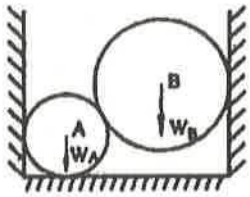
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A (10×2=20 Marks)

1. State the polygon law of forces.
2. State the principle of transmissibility.
3. State and prove Varignon's theorem.
4. Sketch the free body diagram for the cylinder B shown in figure.



5. By using Pappus theorem, determine the volume of sphere having radius r.

6. State the relationship between the second moment of area and mass moment of inertia for a uniform plate.

7. Equation of motion of a body is $s = 5t^3 + 4t^3 + 3t + 2$. Find velocity and acceleration.

8. Define Instantaneous velocity.

9. Define Rolling Resistance.

10. Define Coefficient of Friction.

PART – B **(5×16=80 Marks)**

11. a) Three links PQ, QR and RS connected as shown in Fig. 11 (a) support loads W and 50 N. Find the weight W and the force in each link if the system remains in equilibrium.

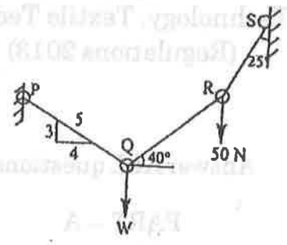


Fig. 11 (a)

(OR)

b) Two identical rollers each of weight 2.5 kN rest in between an inclined wall and a vertical wall as shown in Fig. 11 (b). Determine the reactions at the points of contact P, Q and R. Assume the wall surfaces to be smooth.

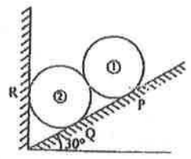


Fig. 11 (b)

12. a) Reduce the given system of forces acting on the beam AB in figure, 12 (a) to (i) an equivalent force couple system at A (ii) an equivalent force couple system at B.

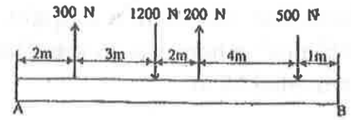


Fig. 12 (a)

(OR)

b) Find the pin reaction of A and the Roller reaction at B. For the beam shown in Fig. 12 (b).

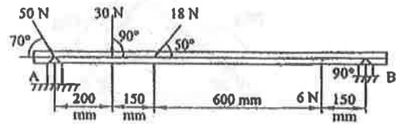


Fig. 12 (b)

13. a) Determine the second moment of area of a triangle about its base and along the axis passing through the centre of gravity.

(OR)

b) Find the mass moment of inertial of the rectangular block shown in figure 13 (b), about the vertical y axis. A cuboid of 20 mm × 20 mm × 20 mm has been removed from the rectangular block as shown in figure. The mass density of the material of the block is 7850 kg/m^3.

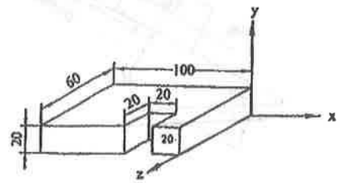


Fig. 13 (b)

(b) Find the centroid of the lamina shown in fig. 13(b). (16)

All dimensions are in cm.

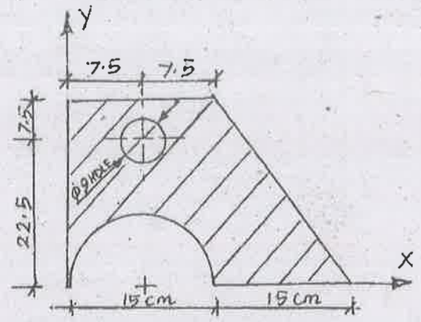


Fig. 13(b)

14. (a) A stone is thrown vertically upwards with a velocity of 19.6 m/s from the top of a tower 24.5 m high. Calculate,

(i) Time required for the stone to reach the ground

(ii) Velocity of the stone in its downward travel at the point in the same level as the point of projection

(iii) The maximum height to which the stone will rise in flight. (16)

Or

(b) A 50 N block is released from rest on an inclined plane making an angle of 35° to the horizontal. The block starts from A slides down a distance of 1.2 m and strikes a spring with a stiffness of 8 kN/m. The μ between block and plane is 0.25. Determine

(i) The amount the spring gets compressed and

(ii) Distance the block will rebound up the plane from the compressed position. (16)

15. (a) A ladder of weight 390 N and 6 m long is placed against a wall at an angle of 30° with respect to wall. The μ between the ladder and the wall is 0.25 and that between ladder and floor is 0.38. Find how high a man of weight 1770 N ascend, before the ladder begins to slip. (16)

Or

(b) A block over lying a 10° wedge on a horizontal floor and leaning against a vertical wall and weighing 1500 N is to be raised by applying a horizontal force to the wedge. Assuming co-efficient of friction between all the surfaces in contact to be 0.3, determine the minimum horizontal force to be applied to raise the block. (16)

08/12/18

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 20631

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Second Semester

Mechanical Engineering

GE 6253 — ENGINEERING MECHANICS

(Common to All Branches)

(Regulations 2013)

(Also common to : PTGE 6253 – Engineering Mechanics for B.E. (Part-Time) First Semester – Mechanical Engineering Regulations – 2014)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish particle and rigid body.

2. State the principle of transmissibility of force with simple sketch.

3. When is moment of force zero about a line?

4. Write the equilibrium equations of a rigid body in 2D.

5. State pappus-guldinus theorem for finding surface area.

6. Differentiate centroid and centre of gravity.

7. Define instantaneous centre of rotation.

8. Define co-efficient of restitution.

9. What is uniform motion?

10. Why kinetic friction is lesser than static friction?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Four coplanar forces are acting at a point. Three forces have magnitude of 20 N, 50 N and 20 N at angles of 45°, 200° and 270° respectively with respect to $+x$ axis. Fourth force is unknown. Resultant force has a magnitude of 50 N and acts along x-axis at an angle of 0° with respect to $+x$ axis. Determine the unknown force and its direction or angle from $+x$-axis. (8)

(ii) A lamp of mass 1 kg is hung from the ceiling by a chain and is pulled aside by a horizontal chord until the chain makes an angle of 60° with the ceiling. Find the tension in the chain and chord. (8)

Or

(b) A 200 kg cylinder is hung by means of two cables AB and AC, which are attached to the top of a wall. A horizontal force P perpendicular to the wall holds the cylinder in the position shown. Determine the magnitude of P and the tension in each cable. (16)

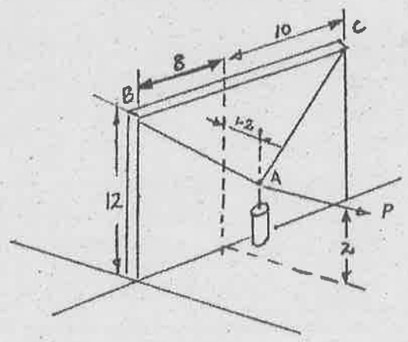


Fig. 11(b)

12. (a) (i) A bar ABCD is hinged at A and supported by a cable, at BC, passing over a frictionless pulley at P above it. Determine the tension in the cable and the reaction at A for a load of 500 N hanging at D. (8)

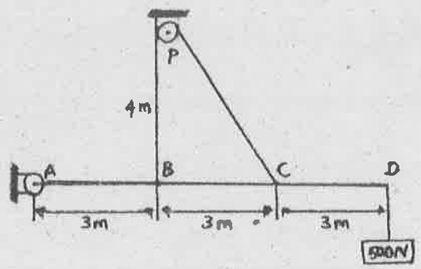


Fig. 12(a)(i)

(ii) Three forces are applied to an angle bracket as shown in Fig. 12(a)(ii). Determine the magnitude and direction of the resultant and the distance from 'O' to the line of action of the resultant. (8)

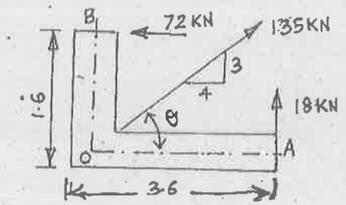


Fig. 12(a)(ii)

Or

(b) The boom of a crane is shown in Fig. 12(b). If the weight of the boom is negligible compared with the load W = 60 kN, find the compression in the boom and also the limiting value of the tension T when the boom approaches the vertical position. (16)

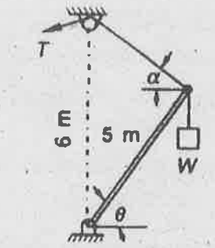


Fig. 12(b)

13. (a) Determine the polar moment of inertia about centroidal axis of the I-section shown in the Fig. 13(a). Also determine the radii of gyration with respect to x–x and y–y axis. (16)

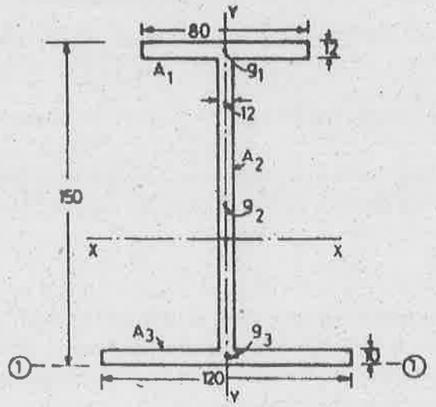


Fig. 13(a)

Or

15. a) The two blocks of mass 20 kg and 40 kg are connected by a rope passing over a friction less pulley as shown in Fig. 15(a). Assuming co-efficient of friction as 0.3 for all contact surfaces. Find the tension in the string, acceleration of the system. Also compute the velocity of the system after 4 second starting from the rest. **(16)**

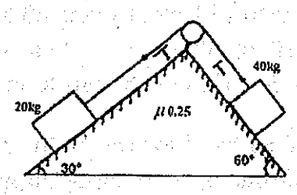


Fig. 15(a)

(OR)

b) An inextensible string passing over a smooth pulley as shown in Fig. 15(b) joining two blocks. If the blocks are released simultaneously from rest, determine the velocity of block A after it has moved over 2 m and the tension in the string. Assume the co-efficient of friction at the contact surface is 0.2. Use energy principle. **(16)**

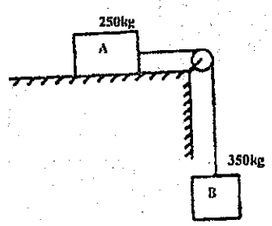


Fig. 15(b)

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Reg. No. :

Question Paper Code : 91663

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019
Second Semester
Civil Engineering
GE 6253 – ENGINEERING MECHANICS
(Common to All Branches)
(Regulations 2013)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. A vector $\vec{F}$ starts at point (2, –1, 2) and passes through the point (–1, 3, 5). Find its unit vector.

2. State the principle of transmissibility.

3. Give the different types of support in beams.

4. State Varignon's theorem.

5. Define 'centroid of a plane area'.

6. What do you understand by mass moment of inertia ?

7. A train running at 80 km/h is brought to a standing halt after 50 seconds. Find the retardation.

8. What is dynamic equilibrium ?

9. What is dry friction ?

10. What is general plane motion ? Give one example.

PART – B (5×16=80 Marks)

11. a) A horizontal line PQRS is 12 m long, where PQ = QR = RS = 4m. Forces of 1000 N, 1500 N, 1000 N and 500 N act at P, Q, R, S respectively in downward direction. The line of action of these forces makes angle of 90°, 60°, 45° and 30° respectively with PS. Find the magnitude, direction and position of resultant force. **(16)**

(OR)

b) A light string ABCDE whose extremity A is fixed, has weights W_1 and W_2 attached to it at B and C. It passes round a small smooth peg at D carrying a weight of 300 N at the free end E as shown Fig. 11 b. If in the equilibrium position, BC is horizontal and AB and CD make 150° and 120° with BC, find (i) Tensions in the portion AB, BC and CD of the string and (ii) Magnitudes of W_1 and W_2. **(16)**

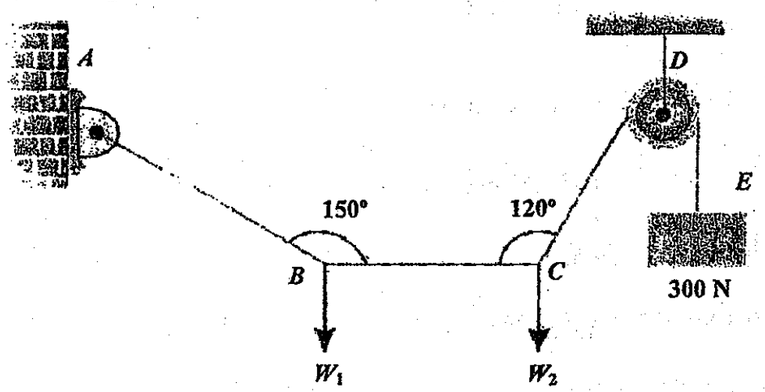

Fig. 11(b)

12. a) A roller of radius 30 cm weighs 2.5 kN. It is to be pulled over a rectangular obstruction of height 10 cm by a horizontal force F passing through the centre of the roller. Find the magnitude, if the force F required just to turn the roller over the corner of the obstruction. Also find the magnitude and direction of the minimum force required for the same. **(16)**

(OR)

b) i) A body of mass 900 kg is suspended by two cables PR and PQ making an angle of 40° and 50° respectively with the ceiling. Find the tension in the cables PQ and PR. **(8)**

ii) A father and his son carry a block of mass 50 kg by using a uniform bar of length 3 m and mass 16 kg. The son can bear only half the load carried by the father. Find the location of the block on the bar. **(8)**

13. a) Determine the location of centroid for the right angle triangle from the first principles and find the volume of cone using Pappus-Guldinus theorem. **(16)**

(OR)

b) Calculate the moment of inertia of the section shown in Fig. 13(b) about "x" and "y" axes through the centroid. **(16)**

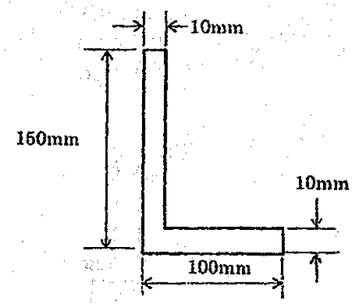

Fig. 13(b)

14. a) Two stones A and B are projected from the same point at inclinations of 45° and 30° respectively to the horizontal. Find the ratio of the velocities of projection of A and B if the maximum height reached by them is the same. **(16)**

(OR)

b) A block and pulley system is shown in fig. 14(b). The coefficient of kinetic friction between the block and the plane is 0.25. The pulley is frictionless. Find the acceleration of the blocks and the tension in the string when the system is just released. Also find the time required for 100 kg block to come down by 2 m. **(16)**

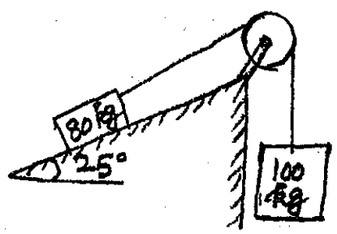

Fig. 14(b)