USN | | | | | | | | | | |

NEW SCHEME

I/II Semester B.E. Degree Examination, Dec. 06 / Jan. 07
Common to All Branches
Elements of Civil Engineering and Engineering Mechanics

(1)

Time: 3 hrs.] [Max. Marks:100

Note : ***Answer any FIVE full questions.***

1 a. List the various civil engineering amenities covered under infrastructural development. **(06 Marks)**

b. What are the different bases under which the dams are classified? **(08 Marks)**

c. Write short notes on :
   i) Shoulders
   ii) Kerbs **(06 Marks)**

2 a. State the Newton's three laws of motion. **(06 Marks)**

b. State and explain principle of transmissibility of forces. **(04 Marks)**

c. A force of 200 N is acting on a block as shown in Fig.2(c), find the components of forces along the horizontal and vertical axes. **(05 Marks)**

d. Find the moment of force F = 600 N about 'a' as shown in Fig.2(d). **(05 Marks)**

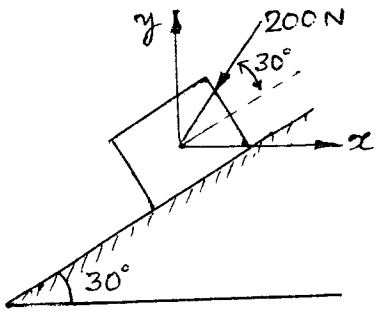


Fig.2(c)

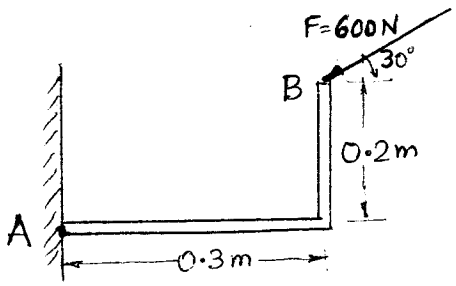


Fig.2(d)

3 a. State and explain parallelogram law of forces. **(05 Marks)**

b. Determine the resultant force acting on the structure at point 'O' both in magnitude and direction. Refer Fig.3(b)

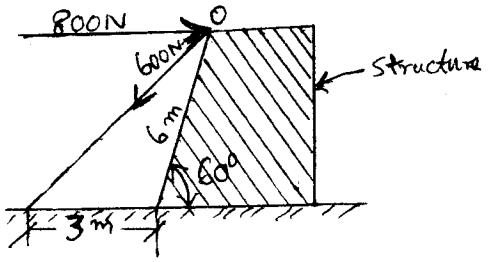


Fig.3(b) **(07 Marks)**

Contd.... 2

c. Determine the magnitude, direction of the resultant force for the force system shown in Fig.3(c). Locate the resultant force with respect to point 'D'.

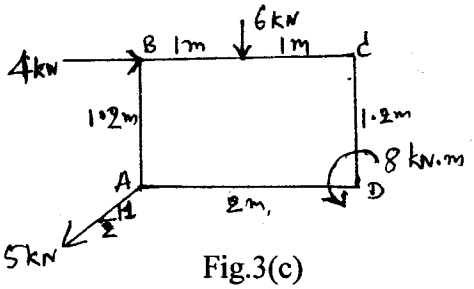


Fig.3(c) **(08 Marks)**

4 a. Define centroid and centroidal axis. **(04 Marks)**

b. Derive an expression for the co-ordinates for the position of centroid of rectangle. **(08 Marks)**

c. Determine the position of centroid with respect to '0'

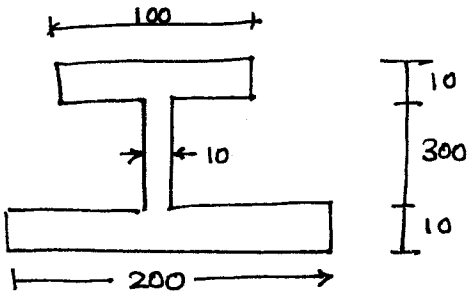


Fig.4(c) All dimensions are in mm **(08 Marks)**

5 a. Define :

i) Free body diagram

ii) Action and reaction at a point of contact of bodies in equilibrium. **(04 Marks)**

b. Compute the tensions in the strings AB, BC and CD shown in Fig.5(b).

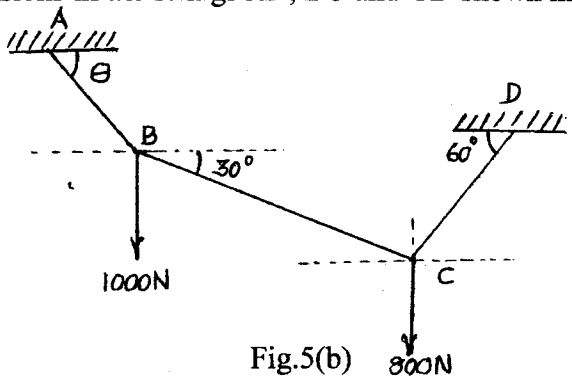


Fig.5(b) **(06 Marks)**

c. Two spheres each of radius 100 mm and weight 5 kN is in a rectangular box as shown in Fig.5(c). Calculate the reactions at all the points of contact.

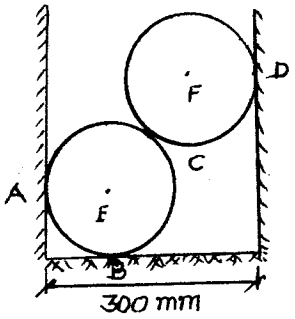


Fig 5(c) **(10 Marks)**

Contd.... 3

6 a. Determine the distance x such that the reactions R_A an R_B are equal, for the beam shown in Fig.6(a).

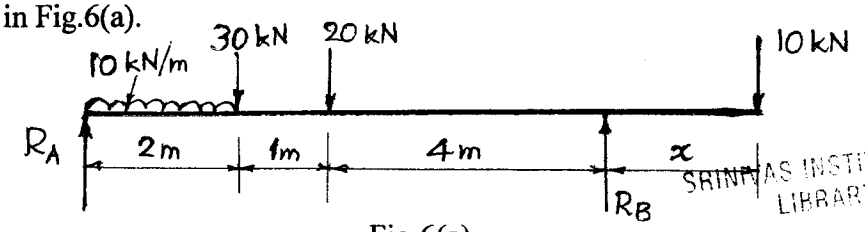


Fig.6(a) **(08 Marks)**

b. Determine the support reactions of the overhanging beam shown in Fig.6(b).

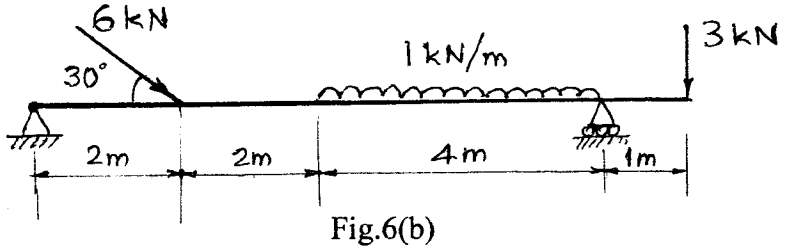


Fig.6(b) **(12 Marks)**

7 a. Distinguish between
   i) Dry friction and fluid friction
   ii) Static friction and kinetic friction. **(08 Marks)**

b. Determine the force P required to start the movement of the wedge as shown in Fig.7(b). The angle of friction for all surfaces of contact is 15^0.

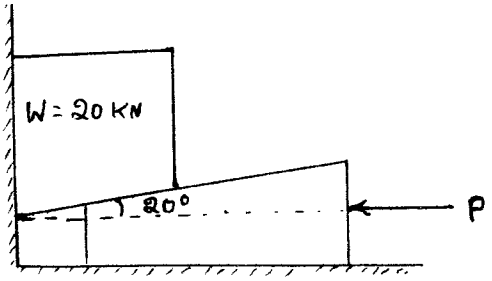


Fig.7(b) **(12 Marks)**

8 a. Determine the moment of inertia of a circle about its diametral axis by the method of integration. **(06 Marks)**

b. Determine the moment of inertia and radii of gyration of the area shown in Fig.8(b) about the base AB and the centroidal axis parallel to AB.

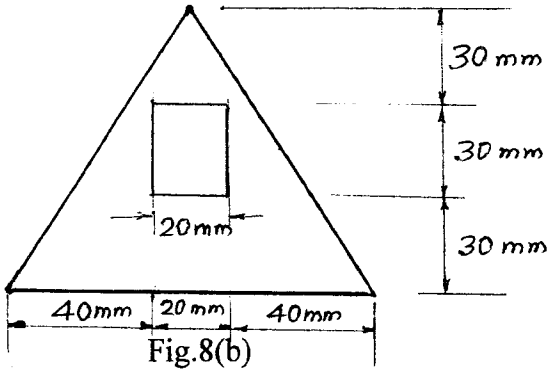


Fig.8(b) **(14 Marks)**

*****

06CIV13/23

USN

First / Second Semester B.E. Degree Examination, July 2007
Common to all Branches
Elements of Civil Engg. and Engineering Mechanics

Time: 3 hrs.] [Max. Marks:100

Note : ***Answer any FIVE full questions choosing atleast two questions from each part.***

Part A

1 a. Discuss briefly the impact of civil engineering infrastructural developments on the national economy and environment. **(09 Marks)**

b. Draw a neat sketch of divided highway in urban areas. **(05 Marks)**

c. Write short notes on kerbs and shoulders. **(06 Marks)**

2 a. Explain the following terms :
i) Rigid body. ii) Point source. **(04 Marks)**

b. Explain the different types of force systems giving an example for each one of them. **(06 Marks)**

c. The moment of a certain force F is 180 kN-m clockwise about 'O' and 90 kN-m counter clockwise about B. If its moment about 'A' is zero, determine the force 'F'. **(10 Marks)**

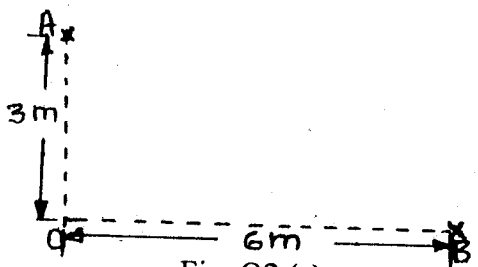


Fig. Q2 (c)

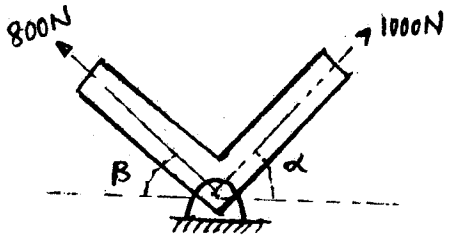


Fig. Q3 (b)

3 a. State and explain principle of resolved parts. **(05 Marks)**

b. Forces are transmitted by two members as shown in figure Q3 (b). If the resultant of these forces is 1400 N directed vertically up, determine the values of angles α and β. **(07 Marks)**

c. ABCD is a square whose sides are 2 m each. Along AB, BC, CD and DA, the forces equal to 1, 2, 8 and 5 and along AC and DB forces equal to $5\sqrt{2}$ and $2\sqrt{2}$ act respectively. Find the resultant of the force system. All the forces are in kN. **(08 Marks)**

4 a. Explain the method of moments for determining the position of centroid. **(03 Marks)**

b. Distinguish between centroid and centre of gravity. **(04 Marks)**

c. Determine the position of the centroid of the plane shown if figure Q4 (c) with respect to the base. **(13 Marks)**

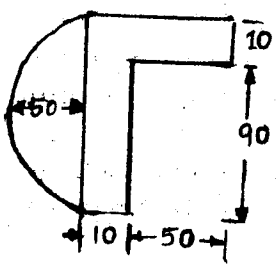


Fig. Q4 (c)

Contd....2

II. 12

Part B

5 a. State and prove Lami's theorem. **(05 Marks)**

b. Draw the freebody diagram of sphere shown in figure Q5 (b) and determine the reactions at the points of contact using Lami's theorem. **(05 Marks)**

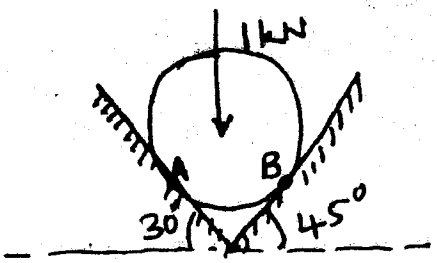


Fig. Q5 (b)

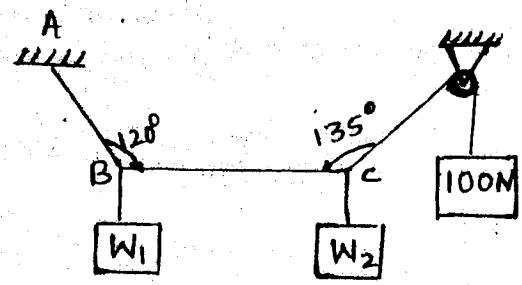


Fig. Q5 (c)

c. In the figure Q5 (c) the portion BC of the string is horizontal and pulley is frictionless. Determine tension in different parts of the string. Also find ω_1 and ω_2 **(10 Marks)**

6 a. Explain the types of loading on the beams. **(05 Marks)**

b. Determine the distance 'x' of the load 'P' from the support A, if the reaction R_A is twice as great as reaction R_B. Take P = 2 kN, Q = 1 kN. **(05 Marks)**

c. A simply supported beam of length 10 m, carries the uniformly distributed load and two point loads as shown in figure Q6(c). Calculate the reactions R_A and R_B. **(10 Marks)**

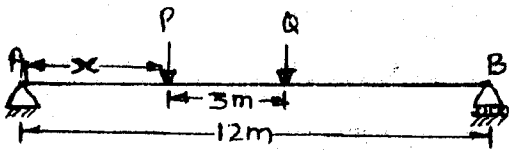


Fig. Q6 (b)

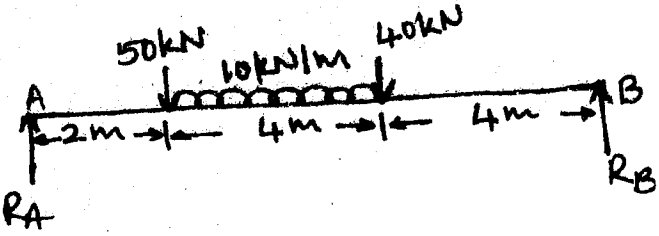


Fig. Q6 (c)

7 a. Explain the terms : i) Angle of repose. ii) Cone of friction. **(06 Marks)**

b. What is the value of 'P' in the system shown in figure Q7 (b) to cause the motion to impend? Assume the pulley is smooth and the coefficient of friction between the other contact surface is 0.2. **(14 Marks)**

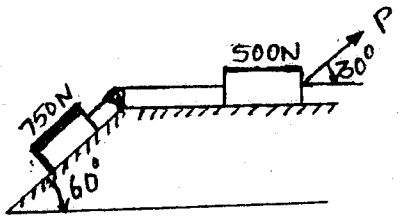
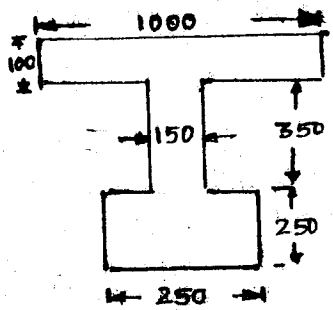


Fig. Q7 (b)



All dimensions in mm

Fig. Q8 (b)

8 a. State and prove parallel axes theorem of moment of inertia. **(06 Marks)**

b. The cross section of the prestressed concrete beam is as shown in figure Q8 (b). Calculate the moment of inertia of this section about the centroidal axes parallel to the top edge and perpendicular to the plane of cross section. Also determine the radius of gyration. **(14 Marks)**

*****

USN | | | | | | | | | | |

06CIV13/23

First /Second Semester B.E. Degree Examination, Dec. 07 / Jan. 08
Elements of Civil Engineering and Engineering Meachnics

Time: 3 hrs. Max. Marks:100

Note : ***Answer any FIVE full questions, selecting at least two questions from each part.***

PART - A

1 a. Explain briefly the role of civil engineer in the infra-structural development of a nation. **(05 Marks)**

b. Explain briefly the scope of civil engineering in –
i) Water resources engineering, ii) Geotechnical engineering. **(08 Marks)**

c. Explain different types of roads. **(07 Marks)**

2 a. Explain briefly the rigid body concept. **(04 Marks)**

b. Distinguish between – i) Resolution and composition, ii) Moment and couple,
iii) Force and force system. **(06 Marks)**

c. State and explain principle of transmissibility of a force. What are its limitations? **(05 Marks)**

d. Replace the force–couple system by a single force with respect to AB and CD shown in Fig.Q 2(d). **(05 Marks)**

3 a. State and prove Varignon's theorem. **(05 Marks)**

b. Determine the force F and its inclination α required, so as to lift a block of weight 500 N as shown in Fig. Q 3(b). **(05 Marks)**

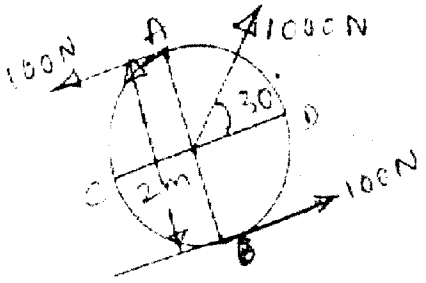


Fig. Q 2(d)

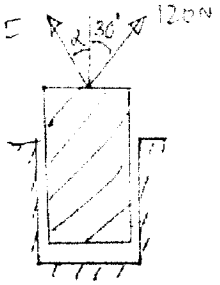


Fig. Q 3(b)

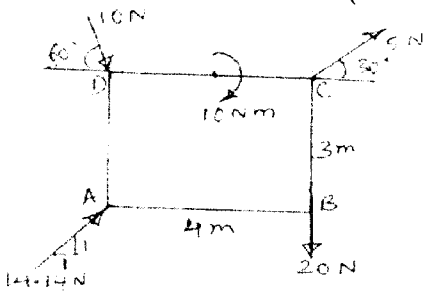


Fig. Q 3(c)

c. Determine the resultant of the force system acting on the plate as shown in Fig. Q 3(c) with respect to AB and AD. **(10 Marks)**

4 a. Distinguish between centroid and centre of gravity. **(04 Marks)**

b. Determine the centroid for the quarter circular area from first principles. **(06 Marks)**

c. Determine the position of the centroid for the shaded area with respect to the axes as shown in Fig.Q 4 (c). **(10 Marks)**

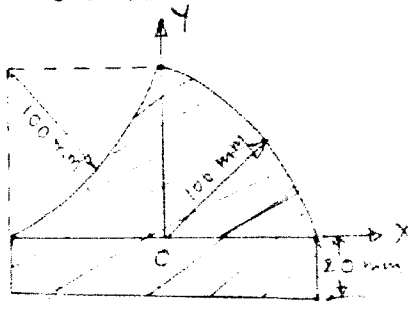


Fig. Q 4(c)

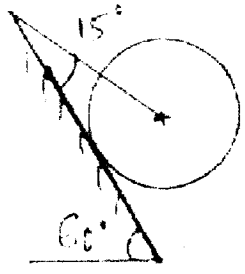


Fig. Q 5(b)

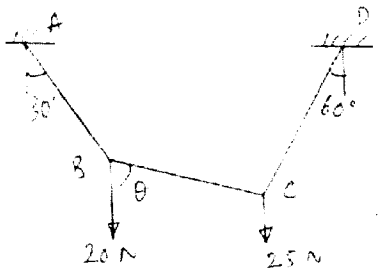


Fig. Q 5(c)

PART - B

5 a. What is meant by equilibrium of a rigid body? State the conditions of static equilibrium for coplanar non – concurrent force system? **(05 Marks)**

b. Determine the tension in the string and the reaction at the contact surface for the cylinder of weight 1000N placed as shown in Fig.Q5 (b). **(05 Marks)**

c. Determine angle θ for the system of strings ABCD in equilibrium as shown in Fig. Q 5(c). **(10 Marks)**

6 a. Define statically determinate beams. **(02 Marks)**

b. Distinguish between – i) hinged support and roller support. **(04 Marks)**

c. Determine the position of 10 N load on the beam such that the reactions at the supports are equal for the beam loaded as shown in Fig. Q 6(c).

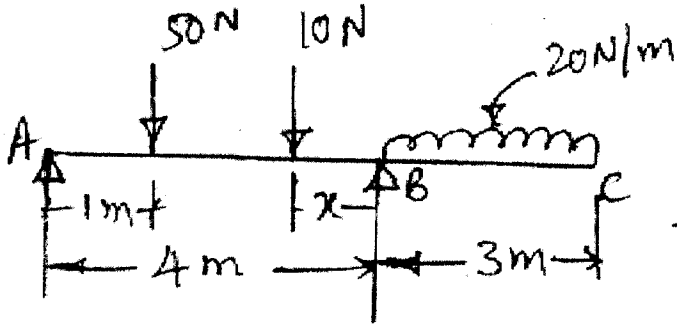


Fig. Q 6(c) **(05 Marks)**

d. Determine the reactions at the supports for the beam loaded as shown in Fig. Q 6(d).

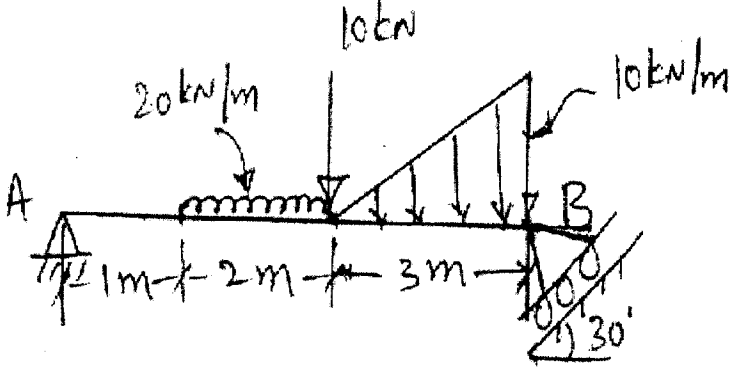


Fig. Q 6(d) **(09 Marks)**

7 a. Define –

i) Angle of fraction

ii) Cone of friction. **(04 Marks)**

b. A ladder 5 m in length is resting against a smooth vertical wall and a rough horizontal floor. The ladder makes an angle of 60^0 with the horizontal. When a man of weight 800 N is at the top of the rung, what is the coefficient of friction required at the bottom of the ladder and the floor such that the ladder does not slip? Take the weight of ladder as 200N. **(08 Marks)**

c. Determine the force P required to cause motion of blocks to impend. Take the weight of A as 90 N and weight of B as 45 N. Take the coefficient of friction for all contact surfaces as 0.25 as shown Fig. Q 7(c), consider the pulley being frictionless. **(08 Marks)**

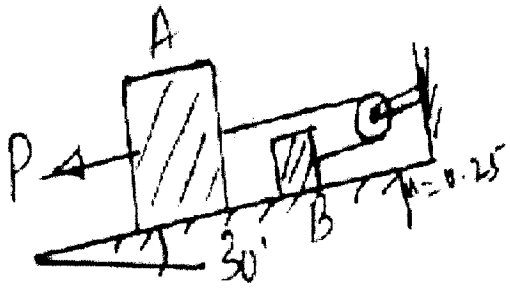


Fig. Q 7(c)

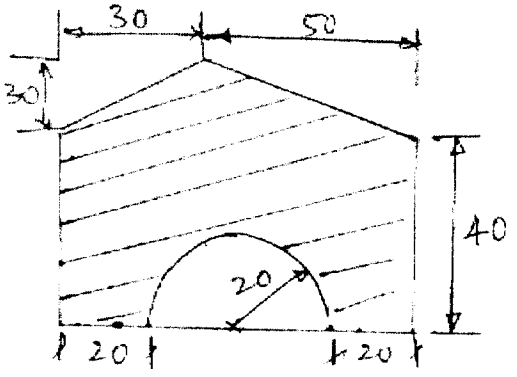


Fig. Q 8 (b)

8 a. State and explain parallel axis theorem. **(06 Marks)**

b. Determine the second moment of the area about the horizontal centroidal axis as shown in Fig. Q 8(b). Also find radius of gyration. **(14 Marks)**

*****

USN | | | | | | | | | | |

06CIV13/23

(9)

First/Second Semester B.E. Degree Examination, June / July 08
Elements of Civil Engineering and Engineering Machanics

Time: 3 hrs. Max. Marks:100

Note : ***Answer any FIVE full questions, choosing atleast two questions from each part.***

PART - A

1 a. Explain in brief the scope of civil engineering. **(08 Marks)**

b. Write a note on impact of infrastructural development on the economy of the country. **(06 Marks)**

c. Explain any two types of dams with neat figures. **(06 Marks)**

2 a. Define the following :
i) Particle ii) Rigid body iii) Continuum iv) Force. **(10 Marks)**

b. Explain transmissibility of force.

c. Two cables which have known tensions $T_1 = 2$ kN and $T_2 = 4$ kN are attached at the point B of a mast AB. A third cable BC is used as a guy wire and is attached at B. Determine the required tension in cable BC, so that the resultant of the forces exerted by the three cables will be vertical. Also find the magnitude of the resultant. Refer Fig. Q 2(c). **(10 Marks)**

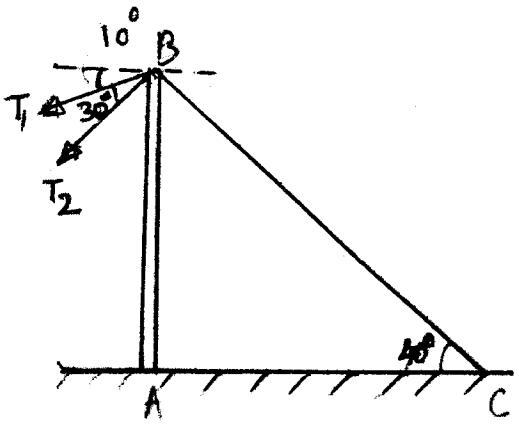


Fig. Q 2(c)

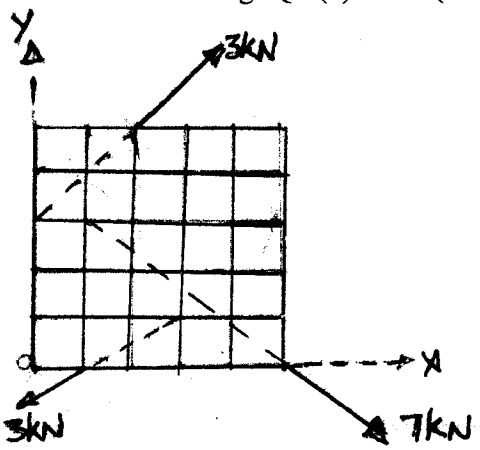


Fig. Q 3(b)

3 a. State and prove :
i) Parallelogram law of forces ii) Varignon's theorem. **(10 Marks)**

b. The coplanar forces are acting on a lamina as shown in Fig. Q 3(b), where the side of each square is 1m. Find the magnitude and position of the resultant. **(10 Marks)**

4 a. Define : i) Centre of gravity ii) Centroid iii) Axis of symmetry. **(03 Marks)**

b. Determine the centre of gravity of a semicircle by method of integration. **(05 Marks)**

c. Find the coordinates of centroid of the lamina, shown in Fig.Q4(c) with respect to point A. **(12 Marks)**

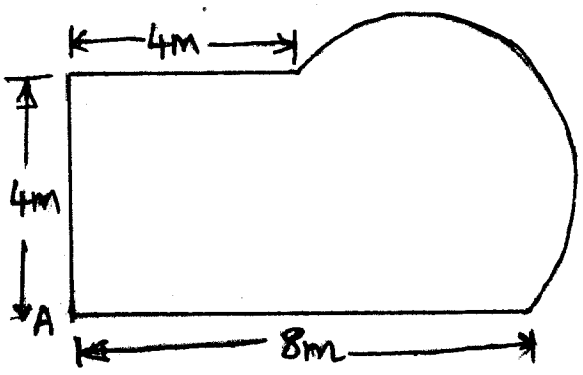


Fig. Q 4(c)

PART – B

5 a. Define the conditions of equilibrium for coplanar non concurrent force system. **(10 Marks)**

b. Find the magnitude and position of the equilibriant for the set of forces shown in Fig.Q5(b).

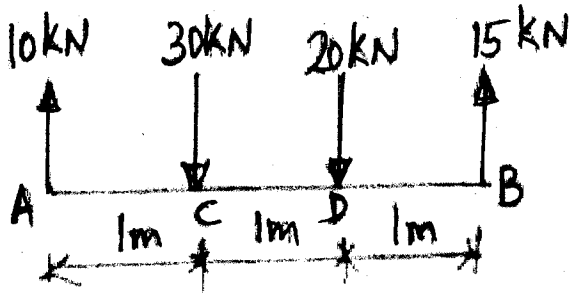


Fig. Q 5(b)

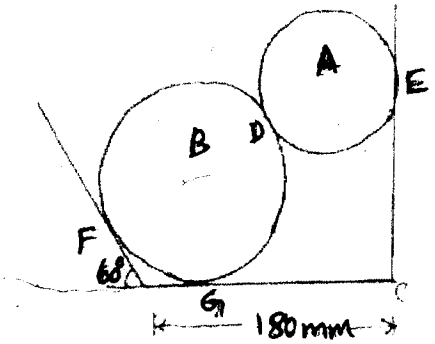


Fig. Q 5(c)

c. Two cylinders A and B rest in a channel as shown in Fig. Q 5(c). A has a diameter of 100 mm and weighs 20 kN, B has a diameter of 180 mm and weights 50 kN. The channel is 180 mm wide at bottom with one side vertical and the other side at 60^0 inclinations. Find the reactions at contact points. **(10 Marks)**

6 a. Explain different types of supports and reactions. **(08 Marks)**

b. Determine the reactions at the ends of the beams AB and CD as shown in Fig. Q 6(b). Neglect the self weight of the beams. **(12 Marks)**

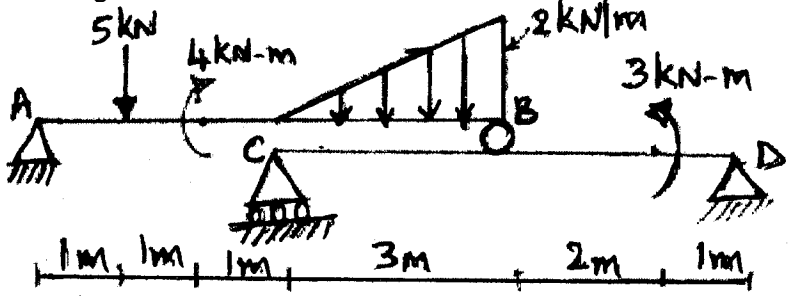


Fig. Q 6(b)

7 a. Mention the laws of static friction. **(05 Marks)**

b. Define angle of friction and angle of repose. **(05 Marks)**

c. A uniform ladder of length 20 m, rests against a vertical wall with which it makes an angle of 45^0, the coefficient of friction between the ladder and the wall and ground respectively being $\frac{1}{3}$ and $\frac{1}{2}$. If a man, whose weight is one half that of the ladder, ascends the ladder, how high will he be, when the ladder slips? **(10 Marks)**

8 a. State and prove parallel axis theorem. **(05 Marks)**

b. Derive an expression for moment of inertia of a triangle about the base using method of integration.

c. Find the moment of inertia of the section shown in Fig. Q 8(c) about horizontal centroidal axis and also find the radius of gyration about the same axis. **(10 Marks)**

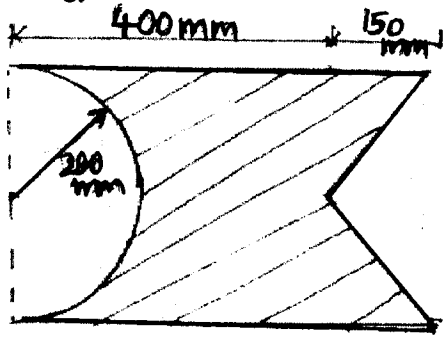


Fig. Q 8(c)

*****

USN | | | | | | | | | | |

06CIV13/23

First and Second Semester B.E. Degree Examination, Dec.08/Jan.09
Elements of Civil Engineering and Engineering Mechanics.

Time: 3 hrs. Max. Marks:100

Note : *1. Answer any FIVE full questions selecting at least two questions from each part.*
2. Answer all objective type questions only in first and second writing pages.
3. Answer for Objective type questions shall not be repeated.
4. Missing data if any may suitably assumed and indicated.

PART - A

1 a. i) Geotechnical Engineering involves the study of **(04 Marks)**
A) Water B) Soil C) Air D) All the above.

ii) By – pass road is constructed
A) Inside the city B) Over the main road C) Around the city D) None of the above.

iii) The part of civil engineering which deals with waste water and solid waste is called.
A) Water supply Engineering B) Geotechnical Engineering C) Sanitary Engineering D) Structural Engineering.

iv) A bascule bridge is a
A) Floating bridge B) Arch bridge C) Suspension bridge D) Movable bridge.

b. Write a note on role of civil Engineer in infrastructural development. **(10 Marks)**

c. Name the different types roads. **(06 Marks)**

2 a. i) Moment of a force can be defined as the product of force and ---------- distance from the line of action of force to the moment center.
A) Least B) Maximum C) Any D) None of the above.

ii) Effect of force on a body depends on
A) Direction B) Magnitude C) Position D) All the above.

iii) The forces which meet at one point have their line of action in different plane are called.
A) Coplanar concurrent forces B) Non coplanar concurrent forces C) Non coplanar non concurrent forces D) None of the above.

iv) Couple means two forces acting parallel.
A) Equal in magnitude and in the same direction B) Not equal in magnitude but in the same direction C) Equal in magnitude but opposite in direction D) None of the above. **(04 Marks)**

b. State the Newton's three laws of the motion. **(06 Marks)**

c. Define force and state its characteristics. **(05 Marks)**

d. Replace the horizontal 600 N force acting on the lever as shown Fig.Q.2(d). by an equivalent system consisting of a force and a couple at 0. **(05 Marks)**

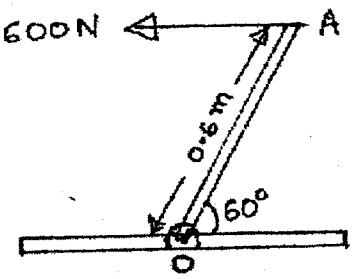


Fig.Q.2(d).

3 a. i) The technology of finding the resultant of a system of forces is called
A) Resultant B) Resolution C) Composition D) None of the above.

ii) Equilibriant is nothing but a resultant
A) Equal in magnitude and in the same direction B) Equal in magnitude but opposite in direction C) Not equal in magnitude but in the same direction, D) Not equal in magnitude and opposite in direction.

iii) If two forces P and Q (P > Q) act on the same straight line but in opposite direction their resultant is
A) P + Q B) P/Q C) Q – P D) P – Q.

iv) In coplanar concurrent force system if $\sum H = 0$, then the resultant is
A) Horizontal B) Vertical C) Moment D) None of the above. **(04 Marks)**

b. State and prove Verignon's theorem of the moments. **(06 Marks)**

c. Determine the magnitude, direction of the resultant force for the force system shown in Fig.Q.3(c). Determine the X intercepts of the resultant force with respect to the point O. **(10 Marks)**

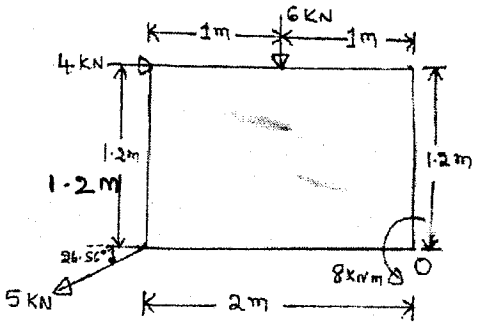


Fig.Q.3(c).

4 a. i) Moment of total area about its centroided axis is **(04 Marks)**
A) Twice the area B) Three times the area C) Zero D) None of the above.

ii) The centroid of a semi circle of Radius R about its centroidal axis parallel to its diametric axis is
A) $3R/4\pi$ B) $3R/8\pi$ C) $4R/\pi$ D) $4R/3\pi$.

iii) An axis over which one half of the plane figure is just mirror of the other half which is
A) Bottom most axis of the figure B) Axis of symmetry C) Un symmetrical axis D) None of the above.

iv) Centroid of a rectangle of a triangle with base b and depth d is
A) b/3 and d/3 B) b/2 and d/2 C) b/4 and d/4 D) None of the above.

b. Determine the centroid of a triangle by the method of integration. **(06 Marks)**

c. Locate the centroid of an area shown in Fig.Q.4(c). With respect to OX and OY. All dimensions are in mm. **(10 Marks)**

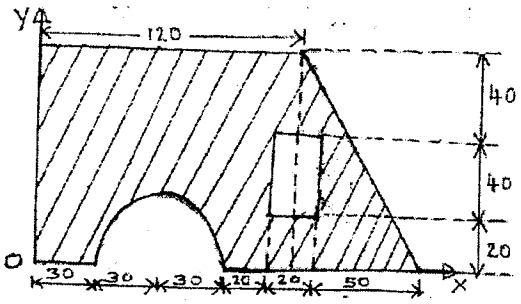


Fig.Q.4(c).

PART – B

5 a. i) The necessary condition of equilibrium of a coplanar concurrent force system is algebric sum of ---------- must be zero
A) Horizontal and vertical forces B) Moments of forces C) Horizontal, vertical and moments of forces D) None of the above.

ii) In nonconcurrent force system it $\Sigma H = 0$, $\Sigma V = 0$, then the resultant is
A) Horizontal B) Vertical C) Moment D) Zero.

iii) The force which is equal and opposite to the resultant is
A) Resultant force B) Force C) Equilibriant D) None of the above.

iv) The procedure of resolution is
A) To find the resultant of the force system B) To break up an inclined force in to two components C) TO find the equilibriant D) None of the above.

(04 Marks)

b. Determine the reactions at the point of contact for the sphere shown in Fig.Q.5(b). **(06 Marks)**

c. Determine the angle θ for the system of strings ABCD in equilibrium as shown in Fig.Q.5(c). **(10 Marks)**

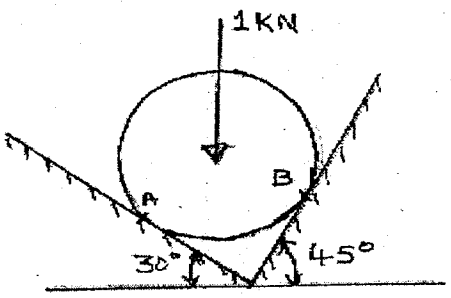


Fig.Q.5(b).

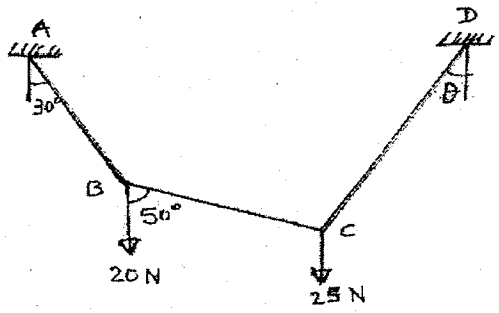


Fig.Q.5(c).

6 a. i) Statically determinate beams are
A) The beams which can be analyzed completely using static equations of equilibrium B) The beams which can be analyzed without using static equations of equilibrium C) Fixed beams D) None of the above.

ii) Fixed beams are - A) One end is fixed and the other is simply supported B) Both ends are fixed C) Both ends are roller support D) One end is fixed and the other is free.

iii) The number of reaction components at fixed end of a beam are
A) 2 B) 3 C) 4 D) None of the above.

iv) U.d.l. stands for
A) Uniform dead load B) Uniform distributed load C) Uniform door load D) All the above.

(04 Marks)

b. Explain different types of supports. **(06 Marks)**

c. Determine the reactions at the support for the beam shown in Fig.Q.6(c). **(10 Marks)**

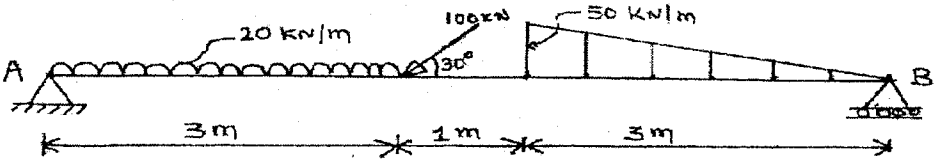


Fig.Q.6(c).

7 a. i) Angle of friction is angle between
A) The incline and horizontal B) The normal reaction and Friction force C) The weight of the body and the friction force D) Normal reaction and the resultant.

ii) The force of friction developed at the contact surface is always
A) Parallel to the plane and along the direction of the applied force B) Perpendicular to the plane C) Parallel to the plane and opposite to the direction of the motion D) All the above.

iii) The maximum inclination of the plane on which the body free from external forces, can repose is called.
A) Cone friction B) Angle of friction C) Angle of repose D) None of the above.

iv) The force of friction depends on
A) Area of contact B) Roughness of the surface C) Both area of contact and roughness of the surfaces D) None of the above. **(04 Marks)**

b. Distinguish between static friction and kinetic friction. **(04Marks)**

c. Mention the laws of the friction. **(04Marks)**

d. A ladder 6m long weighing 300N is resting against a wall at an angle of 60° to the horizontal ground as shown in Fig.Q.7(d). A man weighing 750N climbs the ladder. At what position along the ladder from bottom does he induce slipping. Take $\mu = 0.2$ for all surfaces. **(08 Marks)**

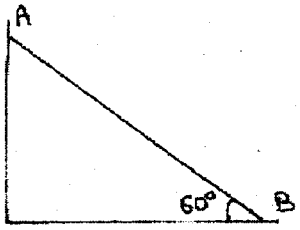


Fig.Q.7(d).

8 a. i) The unit of Radius of gyration is
A) mm B) mm^2 C) mm^3 D) mm^4

ii) The moment of Inertia of an area about an axis which is in a aplane perpendicular to the area is called
A) Radius of Gyration B) Polar moment of Inertia C) Second moment of area D) None of the above.

iii) The moment of Inertia of a circle with 'd' as its diameter about its centroidal axis
A) $\pi D^2/32$ B) $\pi D^2/64$ C) $\pi D^4/32$ D) $\pi D^4/64$.

iv) The moment of Inertia of a square of side 'b' about an axis through its centroid is
A) $b^4/12$ B) $b^4/8$ C) $b^4/36$ D) $b^3/12$. **(04 Marks)**

b. State and prove Parallel axis theorem. **(06 Marks)**

c. Determine the Radius of gyration of the area shown in Fig.Q.8(c). about its base AB. All dimensions are in mm. **(10 Marks)**

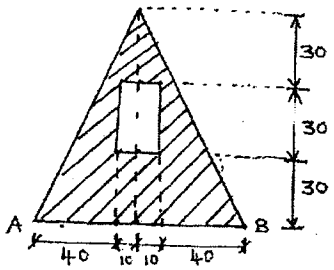


Fig.Q.8(c).

*****

USN | | | | | | | | | | |

06CIV13/23

First/Second Semester B.E. Degree Examination, June-July 2009
Elements of Civil Engineering & Engineering Mechanics

Time: 3 hrs. Max. Marks:100

Note : 1. ***Answer any Five full question, choosing at least two from each part.***
2. ***Answer all objectives type questions only in OMR sheet page 5 of the Answer Booklet.***
3. ***Answer to the objective type questions on sheets other than OMR will not be valued***

PART - A

1 a. i) A branch of civil engineering dealing with the technical measures to use and protect the components of environment is
A) Transportation engineering B) Hydraulics engineering
C) Geotechnical engineering D) Environmental engineering
ii) Composite material consisting of cement concrete and steel used in civil engineering structural construction is
A) Prestressed concrete (PSC) B) Reinforced cement concrete (RCC)
C) Fibre reinforced concrete (FRC) D) Plain cement concrete(CC)
iii) Highways which are superior to National Highways and are provided wherever volume of traffic is very high are
A) State Highways B) Roadways C) airways D) Expressways
iv) A bridge constructed at some angle to river flow is
A) Skew bridge B) Square bridge C) Steel bridge D) Lift bridge **(04 Marks)**

b. Bring out briefly scope of following specialization of civil engineering :
i) Structural engineering ii) Transportation engineering **(08 Marks)**

c. Write a brief note on role of civil engineering in infrastructure development. **(08 Marks)**

2 a. i) Forces whose lines of action lie along the same line are
A) Coplanar parallel forces B) Collinear forces
C) Coplanar concurrent forces D) Coplanar non-concurrent forces.
ii) An object regarded as only mass but no size in mechanics is
A) Point force B) Rigid body C) Deformable body D) Particle
iii) Moment of a force about a moment centre is the measure of its
A) Translatory effect B) rotational effect C) Both a & b D) None of the above
iv) The translatory affect of a couple on the rigid body is
A) Positive B) Negative C) Zero D) None **(04 Marks)**

b. State and explain basic idealizations in mechanics. **(06 Marks)**

c. Find moment of force about A and B for the 30 KN force shown in fig.2(c).

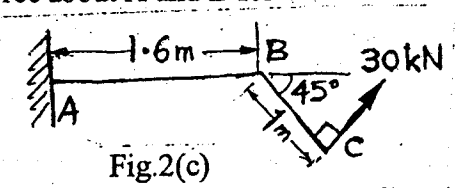


Fig.2(c) **(05 Marks)**

d. A door needs 7500 N-mm to open it. Mr.X applies the force at the edge of the door shutter which is at a distance of 750 mm from hinge and Mr. Y applies it at a distance of 500 mm from the hinge. What forces have they to apply to open the door? **(05 Marks)**

3 a. i) Component of a force at rt-angles to its line of action is
A) Zero B) Positive C) Negative D) None of the above
ii) If two concurrent forces each of P act at right angles to each other, their resultant is
A) 2P B) P C) $P\sqrt{2}$ D) $2\sqrt{P}$

iii) The resultant force of two concurrent forces become maximum and minimum if angle between them is

A) 0^0 and 180^0 B) 0^0 and 90^0 C) 90^0 and 0^0 D) None

iv) A rigid body acted upon by coplanar non-concurrent forces system has

A) Both translatory and rotary motion

B) Translatory motion in one direction and rotary motion about itself

C) Under rest completely

D) All of the above **(04 Marks)**

A truck is to be pulled along a straight road as shown in Fig.3(b).

b. i) If the force applied along rope A is 5 kN inclined at 30^0, what should be the force in the rope B, which is inclined at 20^0, so that vehicle moves along the road?

ii) If force of 4 KN is applied in rope B at what angle rope B should be inclined so that the vehicle is pulled along the road?

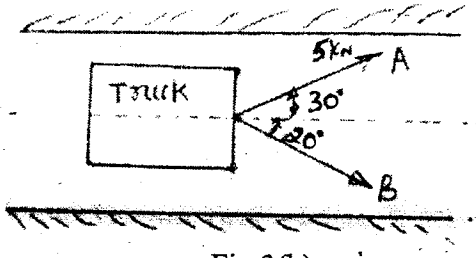


Fig.3(b)

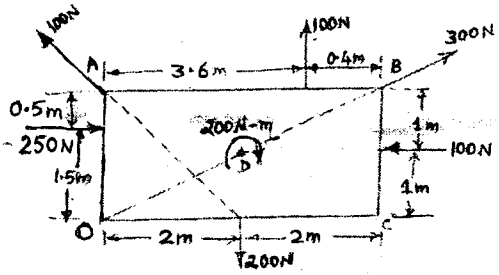


Fig.3(c) **(06 Marks)**

c. Determine the magnitude, direction and point of application of the resultant force for the system of coplanar forces shown in Fig.3(c). Locate position w.r.t. 'O'. **(10 Marks)**

4 a. i) Centroid of plane is the point at which

A) Volume of body concentrated B) surface area is assumed to be concentrated

C) Weight of the body assumed to be concentrated D) All the above

ii) Centroid of quarter of circular lamina lies from diameter line at a distance of

A) $\frac{2R}{3\pi}$ B) $\frac{3R}{3\pi}$ C) $\frac{4R}{3\pi}$ D) $\frac{5R}{3\pi}$

iii) Centroid of trapezim of height 'h' and parallel sides 'a' and 'b'. measured from base b is at a distance of

A) $\frac{h}{2}\left(\frac{b+2a}{a+b}\right)$ B) $\frac{h}{2}\left(\frac{b-2a}{a+b}\right)$ C) $\frac{h}{3}\left(\frac{b+2a}{a+b}\right)$ D) $\frac{h}{3}\left(\frac{b-2a}{a+b}\right)$

iv) The centroid of a triangular lamina of height 'h' is situated at a distance ___ from its apex.

A) $h/3$ B) $2h/3$ C) $h/2$ D) $h/4$ **(04 Marks)**

b. Locate centriod of quadrant of circular lamina from first principle. **(06 Marks)**

c. Locate centroid of lamina shown in Fig,4(c). with respect to point A.

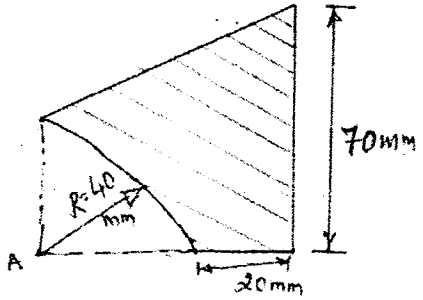


Fig.4(c) **(10 Marks)**

PART - B

5 a. i) A rigid body is in equilibrium if the resultant force of concurrent force system is
A) Positive B) Negative C) Zero D) None of these

ii) A system of force that possesses resultant force move in
A) the direction of line of action of resultant
B) opposite to the direction of line of action of resultant
C) perpendicular to the direction of line of action of resultant
D) none of the above

iii) Lamis theorem valid for
A) Two concurrent forces in equilibrium B) Four concurrent forces in equilibrium
C) Three concurrent forces in equilibrium D) None of the above

iv) For a smooth spherical surface reaction acts
A) Horizontal to the plane of contact B) Inclined to the plane of contact
C) Perpendicular to the plane of contact D) None of the above. **(04 Marks)**

b. Investigate whether the given system of forces shown in Fig.5(b)(i) and (ii) are in equilibrium or not. If not state the type of motion that exist.

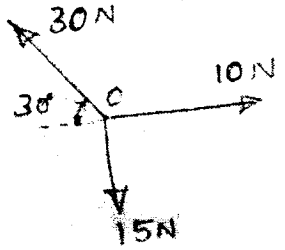


Fig.5(b) (i)

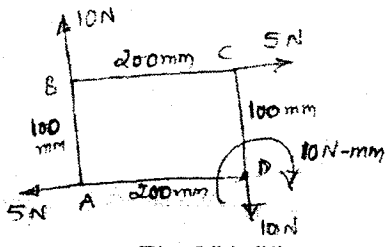


Fig.5(b) (ii)

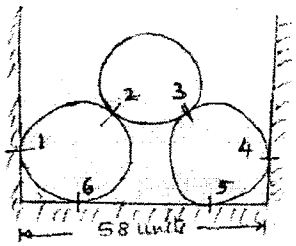


Fig.5(c)

(06 Marks)

c. Three cylinders weighing 500N each 24 units in diameter are placed in channel as shown in Fig.5(c). Determine reactions at all contact points. Take cylinders are smooth. **(10 Marks)**

6 a. i) Reaction line at roller support with respect to plane of contact is
A) Oblique B) Obtuse C) Perpendicular D) None

ii) Support reactions for statically determined beams can be determined by applying
A) Conditions of static equilibrium B) Lamis theorem
C) Varignons principle D) None of the above

iii) When load acts at constant rate over given length of beam it is called
A) Point load B) u d l C) u v l D) None

iv) A beam having one end hinged support and other roller support subjected to vertical loading can be regarded as
A) Fixed beam B) Cantilever beam
C) Simply supported beam D) None of the above **(04 Marks)**

b. With sketch, explain different types of supports and mark reaction line. **(06 Marks)**

c. A beam ABCDE has a flexible link BC as shown in Fig.6(c). Determine the support reaction at A, D and E.

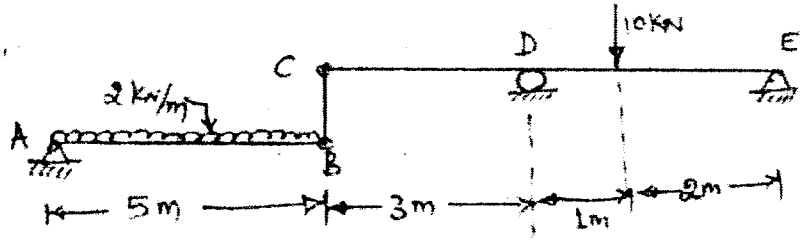


Fig.6(c)

(10 Marks)

7 a. i) The maximum frictional force developed when a body just begins to slide over the surface of an another body is

A) Sliding friction B) Rolling friction C) Limiting friction D) None

ii) The angle which an inclined surface makes with the horizontal when a body placed on it is in the verge of moving down, is called

A) angle of repose B) angle of friction C) angle of inclination D) None

iii) Frictional force is independent of

A) coefficient of friction B) angle of friction

C) shape and size of surface of contact D) none of the above

iv) Compared to static friction, Kinetic friction is

A) Greater B) Smaller C) Very large D) Zero **(04 Marks)**

b. Briefly explain : i) Angle of friction ii) Angle of repose and iii) Cone of friction **(06 Marks)**

c. A uniform bar AB 5m long weighing 280N is hinged at B, rest upon 400N block at A as shown in Fig.7(c). If coefficient of friction is 0.4 for all contact surfaces, find the horizontal force P required to move the 400N block.

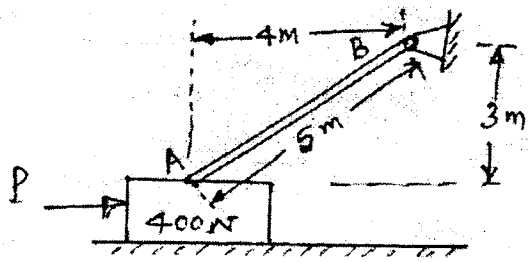


Fig.7(c) **(10 Marks)**

8 a. i) Moment of inertia is a

A) First moment of area B) Second moment of area

C) Third moment of area D) None of the above

ii) M.I. of circular section about centroidal axis is

A) $\frac{\pi D^4}{48}$ B) $\frac{\pi D^4}{32}$ C) $\frac{\pi D^4}{64}$ D) $\frac{\pi D^4}{128}$

iii) M.I. of triangular section about base having base 'b' and heigh 'h' is

A) $\frac{bh^3}{36}$ B) $\frac{bh^3}{12}$ C) $\frac{bh^3}{64}$ D) none

iv) M.I. of hollow circular section whose external diameter is 8mm and internal diameter 4mm about centroidal axis is

A) 437.5 mm^4 B) 337.5 mm^4 C) 237.5 mm^4 D) 137.5 mm^4 **(04 Marks)**

b. State and prove Perpendicular axis theorem. **(06 Marks)**

c. Compute Moment of Inertia of the shaded area about centroidal axis shown in Fig.8(c).

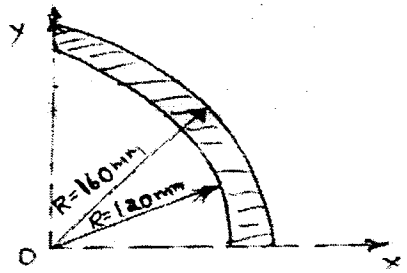


Fig.8(c) **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

06CIV13/23

First/Second Semester B.E. Degree Examination, Dec.09/Jan.10

Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, choosing at least two from each part.*
2. Answer all objective type questions only in OMR sheet page 5 of the Answer Booklet.
3. Answer to objective type questions on sheets other than OMR will not be valued.

PART – A

1 a. i) The part of civil engineering which deals with design of slabs, beams, columns, footings etc is called :
A) Transportation engineering B) Structural engineering
C) Geotechnical engineering D) Water supply engineering

ii) The science of map making is known as :
A) Estimation B) Surveying C) Town planning D) Construction technology

iii) The structure which provides passage over the obstacles like valley, river without closing the way under neath is :
A) Dam B) Bridge C) Harbour D) Airport

iv) Pick up a structure in which an inspection gallery is formed :
A) Gravity dam B) Bridge C) Harbour D) Airport **(04 Marks)**

b. Explain different types of dams, with neat sketches. **(08 Marks)**

c. Explain briefly the scope of civil engineering in :
i) Structural engineering ii) Transportation engineering **(08 Marks)**

2 a. i) Principle of transmissibility of forces states that, when a force acts upon a body, its effect is :
A) Minimum if it acts at the C.G. of the body
B) Maximum if it acts at the C.G. of the body
C) Same at every point on its line of action
D) Different at different points on its line of action

ii) Two parallel forces equal in magnitude and opposite in direction and separated by a definite distance are said to form :
A) Moment B) Couple C) Resultant D) Equilibriant

iii) Effect of a force on a body depends upon its :
A) Direction B) Position C) Magnitude D) All of these

iv) The forces which pass through a single point and lie in the same plane are :
A) Collinear forces B) Coplanar non-concurrent forces
C) Coplanar concurrent forces D) None of these **(04 Marks)**

b. Explain briefly : i) force and its characteristics ii) Couple and its characteristics. **(06 Marks)**

c. A force $F_1 = 1200$ N is acting vertically on an incline [Refer Fig.Q2(c)]. Find its components along X and Y axes. **(05 Marks)**

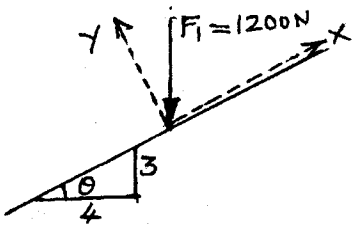


Fig.Q2(c)

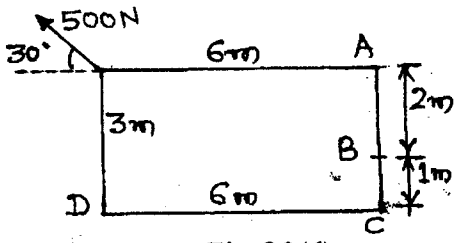


Fig.Q2(d)

d. Find the moment of 500 N force about the points A, B, C, D as in Fig.Q2(d). **(05 Marks)**

3 a. i) The single force which will have the same effect as the system of forces is :
A) Couple B) Resultant C) moment D) Force

ii) If two forces M and N (M > N) act on the same straight line but in opposite direction, their resultant is :
A) (M + N) B) M/N C) (N - M) D) (M - N)

iii) If the resultant of coplanar concurrent force system acts along horizontal X-axis, then :
A) $\Sigma Fx = 0$ B) $\Sigma Fx = R$ C) $\Sigma Fy = R$ D) None of these.

iv) The resultant of force system shown in Fig.Q3(a)(iv) :
A) 65 N B) 40 N
C) 76.32 N D) 32.76 N

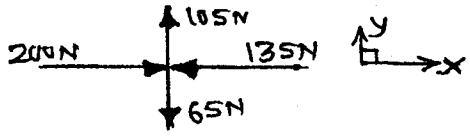


Fig.Q3(a)(iv) **(04 Marks)**

b. Three forces acting on a hook are as shown in Fig.Q3(b). Find the direction of the fourth force of magnitude 100 N such that the hook is pulled in X-direction only. Find the resultant force. **(08 Marks)**

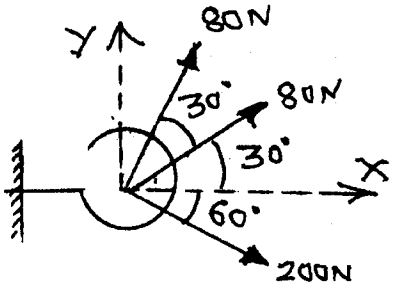


Fig.Q3(b)

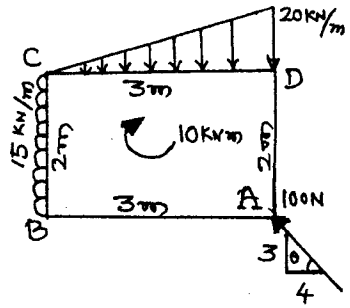


Fig.Q3(c)

c. Find magnitude and direction of the resultant force; also find X and Y intercepts of resultant force with respect to point A. [refer Fig.Q3(c)] **(08 Marks)**

4 a. i) The centroid of a triangle of height "h" is located at a --- distance from its base:
A) $h/2$ B) $2h/3$ C) $h/3$ D) h

ii) An axis over which one half of the plane figure is just mirror image of the other half, is :
A) Axis of symmetry B) Unsymmetrical axis C) Bottom most axis D) None of these

iii) If the given plane figure is symmetrical about vertical Y-Y axis, the centroid lies on :
A) X axis B) Vertical Y-Y axis C) Bottom D) Top

iv) The centriod of a plane lamina will not be at its geometrical center if it is a :
A) Rectangle B) Circle C) Right angled triangle D) Square **(04 Marks)**

b. Find C.G. of the shaded area, Fig.Q4(b) with respect to given X and Y axes.

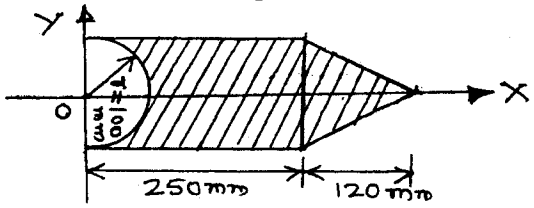


Fig.Q4(b)

(06 Marks)

c. Find C.G. of the shaded area, Fig.Q4(c) with respect to given X and Y axes.

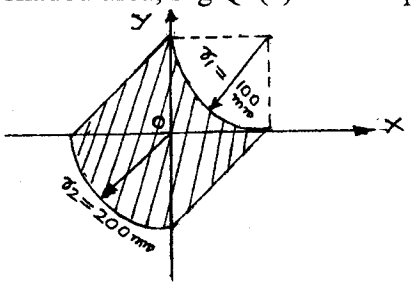


Fig.Q4(c)

(10 Marks)

PART – B

5 a. i) The force which is equal and opposite to resultant is :
A) Force B) Equilibriant C) Moment D) None of these

ii) The Lame's equation can be applied when number of unknown forces are :
A) Two B) Three C) Five D) None of these

iii) The necessary condition of equilibrium of co-planar concurrent force system is :
A) $\Sigma Fy = \Sigma Fx$ B) $\Sigma Fx = 0, \Sigma Fy = 0$ C) $\Sigma M = 0$ D) $\Sigma Fx - \Sigma Fy = 1$

iv) A system that possesses a resultant :
A) Will be in equilibrium B) Will be under rest
C) Will not be in equilibrium D) None of these **(04 Marks)**

b. Find the tension in the string and reaction at the contact surface for the cylinder of Wt = 1000 N placed as shown in Fig.Q5(b). Solve by Lame's theorem. **(06 Marks)**

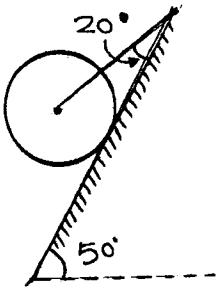


Fig.Q5(b)

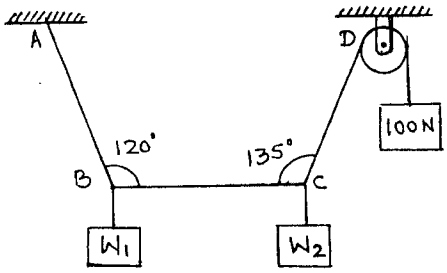


Fig.Q5(c)

c. In the Fig.Q5(c) shown, the portion BC is horizontal. Pulley is frictionless. Find tension in each part of the string and also find W_1 and W_2 using equations of equilibrium only. **(10 Marks)**

6 a. i) The number of reaction components at an hinged end of a beam are :
A) 0 B) 2 C) 3 D) 1

ii) UDL stands for :
A) Uniform dead load B) Uniform door load C) Uniformly distributed load D) None

iii) A cantilever beam is one in which :
A) Both ends are fixed B) Both ends are hinged
C) One end is fixed and other is free D) One end is fixed and other is simply supported

iv) At the fixed end of cantilever, number of unknown reaction components are :
A) 1 B) 2 C) 3 D) 4 **(04 Marks)**

b. Find reactions for a cantilever beam, shown in Fig.Q6(b) **(04 Marks)**

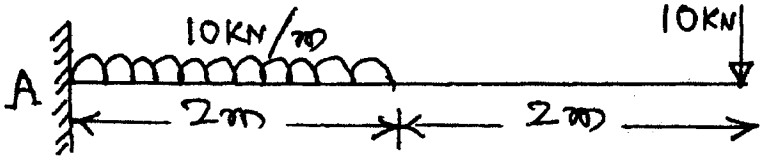


Fig.Q6(b)

c. Find reactions at A and B for beam shown in Fig.Q6(c). **(12 Marks)**

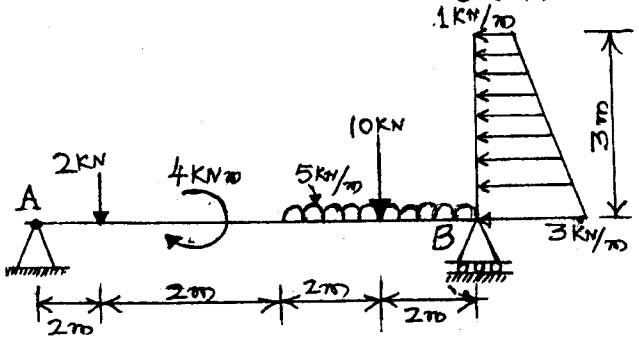


Fig.Q6(c)

7 a. i) Coefficient of friction (μ) is given by:

A) $\mu = F.R$ B) $\mu = \frac{F}{R}$ C) $\mu = \frac{R}{F}$ D) $\mu = F^2$

ii) If ϕ = angle of friction and μ = coefficient of friction, then which equation is valid?

A) $\tan\phi = \mu$ B) $\tan\phi = 1/\mu$ C) $\sin\phi = \mu$ D) $\cos\phi = \mu$

iii) If ϕ = angle of friction and α = angle of repose then which relation is correct?

A) $\phi = \frac{1}{\alpha}$ B) $\phi = \alpha$ C) $\phi = \tan\alpha$ D) $\alpha = \tan\phi$

iv) Force of friction developed at contact surface is :

A) Opposite to the direction of motion B) Along the direction of motion

C) Perpendicular to plane D) All of these **(04 Marks)**

b. State the laws of friction. **(04 Marks)**

c. A small block of weight = 1000 N is placed on a 30° incline with coefficient of friction = 0.25 as shown in Fig.Q7(c). Find the horizontal force P required to be applied for :

i) Impending motion down the plane ii) Impending motion up the plane **(12 Marks)**

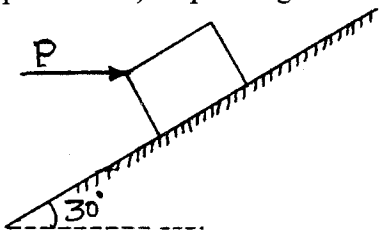


Fig.Q7(c)

8 a. i) The unit of moment of inertia of an area is :

A) m^3 B) m^2 C) m^4 D) N/m^2

ii) The moment of inertia of a square of side "b" about the centroidal axis is :

A) $b^4/8$ B) $b^4/36$ C) $b^4/12$ D) $b^3/12$

iii) The moment of inertia of a triangle of base "b" and height "h" about its base is :

A) $\frac{bh^3}{36}$ B) $\frac{bh^4}{36}$ C) $\frac{hb^3}{12}$ D) $\frac{bh^3}{12}$

iv) The polar moment of inertia of a circular section of diameter "D" about its centroidal axis is :

A) $\frac{\pi}{64}D^4$ B) $\frac{\pi}{32}D^4$ C) $\frac{\pi}{32}D^3$ D) $\frac{\pi}{16}D^4$ **(04 Marks)**

b. Derive the equation of moment of inertia of rectangular section about its centroidal axis from the first principles. **(04 Marks)**

c. Find the polar moment of inertia of the section shown in Fig.Q8(c), about an axis passing through its centroid and hence find polar radius of gyration. **(12 Marks)**

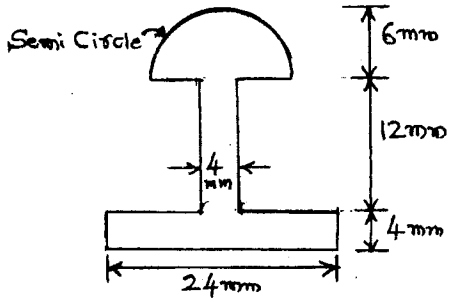


Fig.Q8(c)

* * * * *

USN | | | | | | | | | | |

06CIV13/23

First/Second Semester B.E. Degree Examination, May/June 2010
Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, choosing at least two from each part.*
2. Answer all objective type questions only in OMR sheet page 5 of the Answer Booklet.
3. Answer to objective type questions on sheets other than OMR will not be valued.

PART – A

1 a. i) Studying the properties of soil in assessing safe bearing capacity is called as
A) Transportation engg. B) Building materials
C) Estimation D) Geotechnical engg.

ii) Building tanks & dams and carrying stored water to field is known as
A) Structural engg. B) Environmental engg.
C) Water resources & irrigation engg. D) Construction technology

iii) Kerbs are the components of
A) Roads B) Bridges C) Building D) Dam.

iv) Reinforced cement concrete (RCC) comes under
A) Architecture & town planning B) Hydraulics
C) Surveying D) Structural engineering **(04 Marks)**

b. Briefly explain the role of civil engineers in the infrastructure development. **(06 Marks)**

c. With the help of the neat sketches, briefly explain the cross sections of road and dam. **(10 Marks)**

2 a. i) To define a force completely, the following characteristics should be specified.
A) Magnitude and direction B) Point of application
C) Line of action D) All of these.

ii) The net force that results from a number of individual forces acting on an object is the vector sum of the individual forces. This is termed as the
A) principle of superposition B) principle of transmissibility
C) moment of forces D) principle of physical independence

iii) Forces co-exist on a plane and all the forces act-helter-skelter over the body. These are
A) Coplanar non-concurrent forces B) Coplanar concurrent forces
C) Coplanar parallel forces D) Non-coplanar non-concurrent forces

iv) The principle of transmissibility states that, when a force acts upon a body, its effect is
A) maximum, if it acts at the centre of gravity of the body
B) different at different points on its line of action
C) same at every point on its line of action
D) minimum if it acts at the CG of the body. **(04 Marks)**

b. What is the moment of a force? What are the various moments encountered in practice? Explain them. **(05 Marks)**

c. Determine the equivalent system of force and couple at 'A' for the system of loading as shown in Fig.Q2(c) on next page. **(11 Marks)**

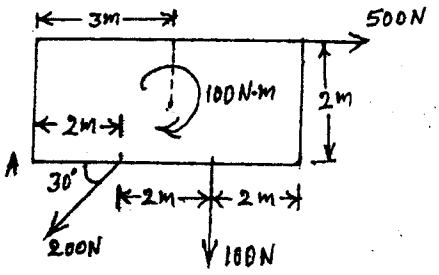


Fig.Q2(c)

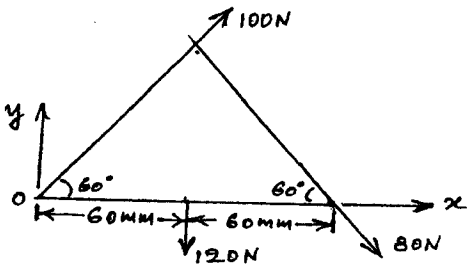


Fig.Q3(c)

3 a. i) The simplest resultant of a parallel force system is always
A) a wrench B) a force C) a moment D) a force and a moment

ii) The purpose of replacing a number of forces acting on a body simultaneously is
A) to find resolution B) to find transmission
C) to find resultant D) to find moment of forces.

iii) If two forces act at an angle of 120°, the greater force is 50 N and their resultant is perpendicular to the smaller force, the smaller force is
A) 20 N B) 25 N C) 30 N D) 43.33 N

iv) If two forces P and Q (P > Q) act on the same straight line but in opposite direction, their resultant is
A) P + Q B) P / Q C) Q – P D) P – Q **(04 Marks)**

b. State and prove Varignon's theorem of moments. **(06 Marks)**

c. The system of forces acting on a triangular plate is as shown in Fig.Q3(c). Determine the magnitude, direction of the resultant and its position with respect to 'O' **(10 Marks)**

4 a. i) The centroid of a lamina
A) must be a point on the lamina
B) is a point which can be made to lie on or outside the lamina by changing the co-ordinates system
C) is a fixed point in space regardless of the orientation of the lamina
D) is a unique point fixed with respect to the lamina

ii) The centroid of a triangle of height 'h' is located at a distance from its apex, which is
A) h/2 B) h/3 C) 2h/3 D) h

iii) Centroid conveys some clue about
A) the orientation of a surface B) centre of a body
C) shape and disposition of the area D) area of cross-section

iv) An axis over which one half the plane figure is just the mirror of the other half is
A) reference axis B) axis of symmetry
C) unsymmetrical axis D) None of these **(04 Marks)**

b. Determine the centroid of a quadrant circle by the method of integration. **(06 Marks)**

c. For a shaded area shown in Fig.Q4(c), find 'a' so that centroid is at 'O'. **(10 Marks)**

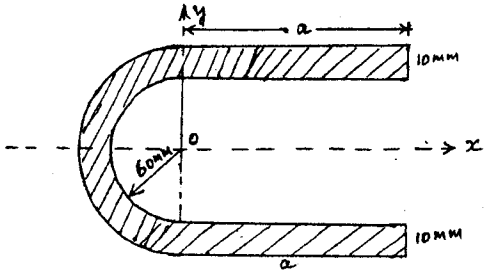


Fig.Q4(c)

PART – B

5 a. i) A rigid body is in equilibrium under the action of three forces. It implies that the forces must be such that the

A) resultant is zero B) equilibriant is zero C) Both A and B D) None of these

ii) Lami's theorem

A) relates the forces with the sines of angles
B) relates the action of three concurrent forces and sines of angles
C) may be applied to consider relationship between forces
D) may be applied for a body which may or may not be in equilibrium.

iii) If sum of all the forces acting on a body is zero, it may be concluded that the body

A) must be in equilibrium B) cannot be in equilibrium
C) may be in equilibrium provided the forces are concurrent
D) may be in equilibrium provided the forces are parallel.

iv) The necessary condition of equilibrium of concurrent force system is

A) the algebraic sum of horizontal and vertical forces must be zero
B) the algebraic sum of moments of forces must be zero
C) the algebraic sum of horizontal, vertical and moments of forces must be zero
D) all the above.

(04 Marks)

b. Define free body diagram. Describe types of forces acting on a body. Explain them in brief. **(06 Marks)**

c. A wire rope is fixed at two points A and D as shown in Fig.Q5(c). Weights 20 kN and 30 kN are attached to it at B and C respectively. The weights rest with portions AB and BC inclined at 30° and 50° respectively, to the vertical as shown. Find the tension in segments AB, BC and CD of the wire .Determine the inclination of the segment CD to vertical (θ). **(10 Marks)**

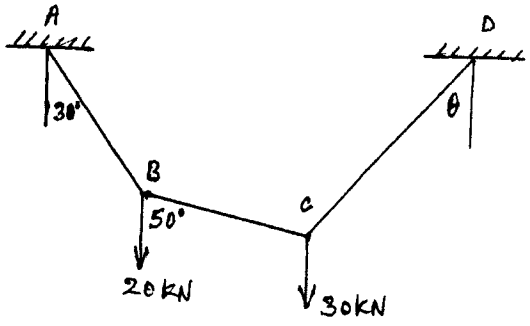


Fig.Q5(c)

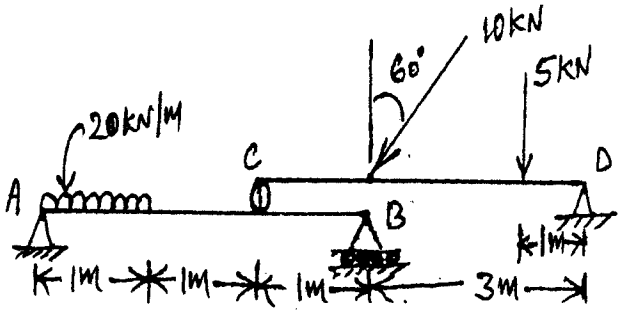


Fig.Q6(C)

6 a. i) A beam is said to be determinate, if

A) the reactions can be determined using the equations of equilibrium.
B) the reactions cannot be determined using the equations of equilibrium.
C) the reactions can be determined by using the force equilibrium conditions.
D) the reactions can be determined by using the moment equilibrium condition only.

ii) The beam is neither permitted to move in any direction nor allowed to rotate in the case of

A) hinged support B) fixed support C) roller support D) simple support

iii) uvl stands for

A) uniform vertical load B) uniform velocity load
C) uniform vague load D) uniformly varying load

iv) A thin rigid beam hinged at one end and roller-supported at its mid-point is said to be

A) a simply supported beam B) a overhanging beam
C) a cantilever beam D) a fixed beam

(04 Marks)

b. Differentiate between resultant and equilibriant. **(04 Marks)**

c. Determine the reactions at the supports for the system shown in Fig.Q6(C). **(12 Marks)**

7 a. i) The frictional force is independent of
A) the area of contact B) the coefficient of friction
C) the normal reaction D) the angle of friction

ii) Once a body just begins to slide, it continues to slide because
A) the body has inertia B) inertia force acts on the body
C) the body accelerates D) the frictional force becomes less.

iii) The coefficient of friction between two surfaces is the constant of proportionality between the applied tangential force and the normal reaction
A) at the instant of application of the force B) at any instant when the body is at rest
C) at the instant of impending motion D) at an instant after the motion takes place.

iv) the angle of friction is angle between
A) the incline & the horizontal B) the normal reaction & frictional force
C) the weight of the body & the friction force D) the normal reaction & the resultant
(04 Marks)

b. Define coefficient of friction. Show that the coefficient of friction is tangent of the angle of friction. **(04 Marks)**

c. In the Fig.Q7(C), determine the minimum value of P, just required to lift 3000 N up. The angle of friction between block and the wall is 15° and for other surfaces it is 18°. **(12 Marks)**

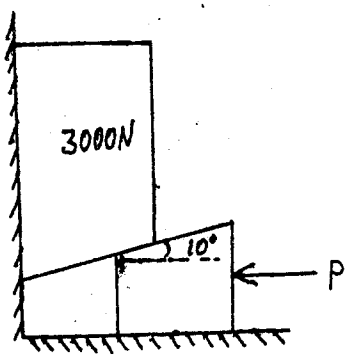


Fig.Q7(C)

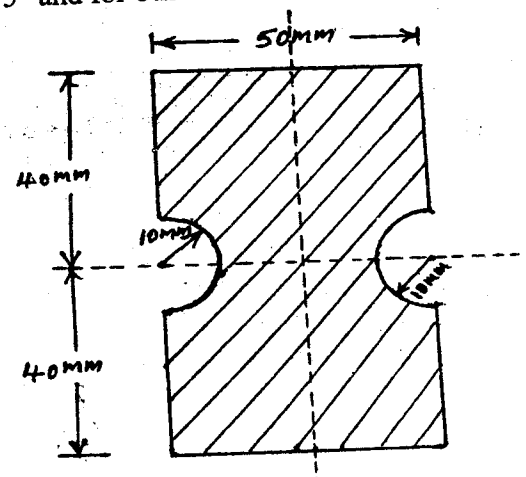


Fig.Q8(d)

8 a. i) The moment of inertia of a rectangular lamina of sides 'b' and 'h' about its neutral axis parallel to the sides 'b' is given by
A) $\frac{bh^3}{12}$ B) $\frac{bh^3}{36}$ C) $\frac{hb^3}{12}$ D) $\frac{hb^3}{36}$

ii) The unit of radius of gyration of an area is
A) N/m B) N/m^2 C) m^3 D) m

iii) The value of moment of inertia depends upon
A) type of material B) weight of material
C) density of material D) cross-sectional dimensions

iv) Moment of inertia is a
A) first order term B) second order term
C) fourth order term D) third order term
(04 Marks)

b. State the parallel axis theorem **(02 Marks)**

c. Explain the polar moment of inertia and the radius of gyration. **(04 Marks)**

d. Find the moment of inertia of the area shown in Fig.Q8(d) about its centroidal axis parallel to the coordinate axis. **(10 Marks)**

* * * * *