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
       A) Water  B) Soil  C) Air  D) All the above.

       (04 Marks)

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

       (04 Marks)

       iii) The part of civil engineering which deals with waste water and solid waste is called.

       (04 Marks)

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

       (04 Marks)

   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
       A) Least  B) Maximum  C) Any  D) None of the above.

       (04 Marks)

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

       (04 Marks)

       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.

       (04 Marks)

       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 O.

      (05 Marks)

Fig.Q.2(d).

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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) Equilibrant 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 \( \Sigma H = 0 \), 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)

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

   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)
PART - B

5. a. i) The necessary condition of equilibrium of a coplanar concurrent force system is algebraic sum of \[ \sum F = 0 \] 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 if \( \sum H = 0, \sum V = 0 \), 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) Equilibrant
   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 into two components
   C) To find the equilibrant
   D) None of the above.

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

   c. Determine the angle \( \theta \) for the system of strings ABCD in equilibrium as shown in 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.

   b. Explain different types of supports.

   c. Determine the reactions at the support for the beam shown in 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.  (04 Marks)
   c. Mention the laws of the friction.  (04 Marks)
   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 plane 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) \( \pi D^4/32 \)  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) \( b^4/12 \).  (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).]

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First/Second Semester B.E. Degree Examination, June / July 08
Elements of Civil Engineering and Engineering Mechanics
Time: 3 hrs.

Note: Answer any FIVE full questions, choosing at least two questions from each part.
Max. Marks: 100

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 $T_1 = 2 \text{kN}$ and $T_2 = 4 \text{kN}$ 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)

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 1 m. 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)

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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 equilibrium for the set of forces shown in Fig. Q5(b).

   ![Diagram](image)
   **Fig. Q 5(b)**

   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° 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)

   ![Diagram](image)
   **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°, 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. (05 Marks)
   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)

   ![Diagram](image)
   **Fig. Q 8(c)**

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