Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs.

Note: Answer any FIVE full questions. Max. Marks: 100

1. a. List the basic infrastructure needed for a country.
   b. Explain the impact of infrastructure development on the socio-economic progress of a country.
   c. Explain the role of civil engineer in the economic development of a country. (04 Marks) (08 Marks) (08 Marks)

2. a. What are the requirements of a good building stone?
   b. What are the desirable properties and uses of good timber?
   c. What is meant by remote sensing? What are its applications? (06 Marks) (06 Marks) (08 Marks)

3. a. What are the basic principles of surveying?
   b. What is a total station? Explain its utility in surveying.
   c. Explain the following:
      i) Composite materials
      ii) Smart materials. (06 Marks) (08 Marks) (08 Marks)

4. a. Define the term, ‘force’ completely and state its characteristics.
   b. Distinguish between:
      i) Resolution and composition of force system
      ii) Resultant and equilibrant. (04 Marks) (06 Marks)
   c. Fig.Q4(c) shows a concurrent force system. The line joining these forces forms a regular pentagon. Find the magnitude and direction of the resultant of the force system. (10 Marks)

5. a. What is a free body diagram? Illustrate with two examples.
   b. Determine the reaction at points of contact between sphere and the container for the system as shown in Fig.Q5(b). Given the weight of the sphere as 1000 N. (06 Marks) (06 Marks)
   c. Find the support reactions for a beam loaded as shown in Fig.Q5(c). (08 Marks)
6. a. Distinguish between centroid and centre of gravity.  
   b. Determine the centroid of a triangle from first principles.  
   c. Find the centroid of the composite area as shown in Fig.Q6(c). All dimensions are in mm.  

   ![Fig.Q6(c)](image)

   (04 Marks)  
   (06 Marks)  
   (10 Marks)

7. a. Define the moment of inertia and the radius of gyration.  
   b. Obtain an expression for the moment of inertia for a rectangular section about horizontal centroidal X-axis.  
   c. Find the moment of inertia of the composite area as shown in Fig.Q7(c) about an axis AB. All dimensions are in mm.  

   ![Fig.Q7(c)](image)

   (06 Marks)  
   (06 Marks)  
   (08 Marks)

8. a. Define the following:  
   i) Co-efficient of friction  
   ii) Cone of friction  
   iii) Angle of repose.  
   b. Prove the relationship \( \mu = \tan \phi \) if \( \mu \) is the co-efficient of friction and \( \phi \) is the angle of limiting friction.  
   c. A ladder 5 m long rests on the floor and vertical wall as shown in Fig.Q8(c). The co-efficient of friction at the wall is 0.2 and at the floor is 0.4. The weight of the ladder is 200 N, which can be considered to be acting at the centre of the ladder. The ladder supports an additional load of 900 N at C, 1 m along the ladder from the top. Determine the lowest value of \( \theta \) between ladder and the floor at which the ladder may be placed without any slip.  

   ![Fig.Q8(c)](image)

   (06 Marks)  
   (04 Marks)  
   (10 Marks)

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2 of 2
First / Second Semester B.E. Degree Examination, June-July 2009
Elements of Civil Engineering

Time: 3 hrs.

Note: 1. Answer any FIVE full questions.
2. Supplement your answer with neat sketches.

Max. Marks: 100

1. a. Explain in detail the possible negative impact of an infrastructure development project on the economy of the country.
   b. What do you mean by alternate buildings materials? Differentiate them from conventional building material. Explain any two alternate building materials.

(10 Marks)

2. a. Explain the desirable properties of stones to be used for the facing work of a building.
   b. Differentiate reinforced concrete from plain concrete.
   c. What do you mean by smart materials? Explain with the help of an example.

(08 Marks)
(05 Marks)
(07 Marks)

3. a. What are the objectives of surveying? Explain.
   b. Explain the principle and use of total station.
   c. What is GIS? What are its applications? Explain.

(05 Marks)
(06 Marks)
(09 Marks)

4. a. Differentiate between:
   i) Resolution and composition of forces.
   ii) Uniformly distributed force and uniformly varying force.
   iii) Hinged support and Fixed support.
   b. Determine the resultant of the force system shown in Fig. Q4(b).

(09 Marks)
(11 Marks)

(04 Marks)
(06 Marks)
(10 Marks)
6  a. From the first principles, derive the expressions for horizontal and vertical centroidal distances for a right angled triangular lamina of base width 'B' and height 'H'. (08 Marks)
b. Calculate the polar moment of inertia of the area shown in Fig. Q.6(b) about an axis through 'A'. (12 Marks)

7  a. State and prove parallel axis theorem. (08 Marks)
b. Determine the resultant of a coplanar, non-concurrent force system shown in Fig. Q.7(b) with respect to point 'A'. (12 Marks)

8  a. Explain the following terms:
   i) Limiting friction.
   ii) Cone of friction.
   iii) Angle of repose. (09 Marks)
b. A ladder of length 5m and weight 80 N is placed against a smooth vertical wall and on a rough horizontal ground, at an inclination of 30° with the vertical. The ladder supports a man weighing 600 N on it at a height of 3m above the ground level in the limiting case. Determine the coefficient of friction between the ladder and the ground. (11 Marks)

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1. a. What do you mean by infrastructural development? Explain its importance. (06 Marks)
b. Explain the significance of planning and scheduling for a project. (06 Marks)
c. Describe the physical and mechanical properties of timber. (08 Marks)

2. a. What do you mean by R.C.C.? List its advantages. (06 Marks)
b. Write a note on smart materials. (06 Marks)
c. What is total station? Describe briefly the features of total station. (08 Marks)

3. a. Describe briefly the factors affecting the strength of concrete. (10 Marks)
b. What is remote sensing? Explain briefly the procedure involved in remote sensing. (10 Marks)

4. a. A body weighing 1500 N is suspended by two cables of length 2 m and 3 m attached to two points in the same horizontal line 4 m apart, as shown in figure Q4 (a). Find the tensions in the cables. (10 Marks)

![Fig. Q4 (a)]

b. The forces of 1, 2, 3, 4, 5 and 6 kN are acting along the sides of a regular hexagon of 2 m side length, taken in order. Find the magnitude, direction and position of resultant with respect to A as shown in figure Q4 (b). (10 Marks)

![Fig. Q4 (b)]

5. a. Two cylinders each of weight 100 N and 200 N rest on an inclined plane, which makes an angle of 70° with the vertical wall as shown in figure Q5 (a). Find the reactions at all contact points assuming the surfaces to be smooth. (10 Marks)

![Fig. Q5 (a)]

![Fig. Q5 (b)]

1 of 2
5  b. Find the reactions at the supports for the beam loaded as shown in figure Q5 (b). (10 Marks)

6  a. Find the co-ordinates of centroid of any triangle ABC. (08 Marks)
  b. Determine the co-ordinates of centroid for the lamina shown in figure Q6 (b). (12 Marks)

Fig. Q6 (b)

7  Determine the radii of gyration about the horizontal and vertical centroidal axes for the shaded area shown in figure Q7. (20 Marks)

Fig. Q7

8  a. For a block of weight 60 kN resting on an inclined plane of 30° shown in figure Q8 (a), find the horizontal force i) just barely to prevent the block from sliding down the plane and ii) to move the block up the plane with uniform velocity. Take the coefficient of friction between the sliding surfaces of 0.35. (10 Marks)

Fig. Q8 (a)

b. A ladder 5 m long, 400 N weight rests against a wall, the angle of inclination with the vertical wall being 30°. The coefficient of friction at both the wall and the ground is 0.3. Determine how high a man weighing 800 N can climb before the ladder slips. (10 Marks)

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2 of 2
First / Second Semester B.E. Degree Examination, Dec. 07 / Jan. 08

Elements of Civil Engineering

Note: 1. Answer any FIVE full questions.
2. Assume any missing data suitably.
3. Draw neat sketches wherever necessary.
4. Answers should be precise, brief and to the point.

Max. Marks: 100

1. a. How economy of a country is related to infrastructure development? Explain with examples. (10 Marks)
b. Explain role of civil engineer with respect to analysis and design. (05 Marks)
c. Briefly explain how cost overrun and time overrun can be checked in construction. (05 Marks)

2. a. List uses of timber in construction. (05 Marks)
b. Explain different types of mortar with related uses and advantages. (10 Marks)
c. List advantages of having smart materials in construction. (05 Marks)

3. a. What is geographic information system? Explain with examples from civil engineering spatial analysis uses. (10 Marks)
b. List principles of surveying. Explain importance of each of these principles. (10 Marks)

4. a. Explain the following with sketches and an examples in each case:
   i) Coplanar concurrent forces
   ii) Non-coplanar concurrent forces
   iii) Non-coplanar non-concurrent forces. (09 Marks)
b. Determine the magnitude and direction of a single force which keeps the system of forces shown in Fig.Q4(b) in equilibrium. (11 Marks)

   ![Fig.Q4(b)]

5. a. State the conditions of equilibrium of coplanar non-concurrent forces. (03 Marks)
b. With the aid of a neat sketch explain 'Free body diagrams'. (05 Marks)
c. Two identical cylinders of diameter 200 mm and weight 500 N each are placed as shown in Fig.Q5(c). Determine the reactions at points A, B and C. (12 Marks)

   ![Fig.Q5(c)]
6. A beam ABC is of length 12 m such that AB = 8 m and BC = 4 m, simply supported at A and B. The beam supports concentrated loads of magnitude 20 kN at 3 m from point 'A', 40 kN at point 'C', clockwise moment of 20 kNm at 5 m from 'A', and a udl of 20 kN/m over the entire span AB. Determine the reactions at supports A and B. (08 Marks)

b. Determine the coordinates of centroid of the composite reaction shown in Fig.Q6(b) with respect to the point 'P' shown in Fig.Q6(b). (10 Marks)

Fig.Q6(b)
All dimensions are in mm

c. Differentiate between center of gravity and centroid. (02 Marks)

7. a. State and prove perpendicular axis theorem. (05 Marks)

b. Determine the minimum radius of gyration of the section among x-x and y-y centroidal axes of the composite section shown in Fig.Q7(b). (15 Marks)

Fig.Q7(b)
All dimensions are in mm

8. a. A ladder of length 'l' rests on a wall which makes an angle of 45° with the wall. Coefficient of friction between ladder and floor is 0.6, and coefficient of friction between ladder and wall is 0.4. Show that a man whose weight is the same as that of ladder may ascend a distance of 0.855 L before the ladder begins to slip. (10 Marks)

b. The force ‘P’ is applied to the 50 kg block when it is at rest. Determine magnitude and direction of the friction force exerted by the surface on the block if i) P = 0, ii) P = 200 N and iii) P = 250 N iv) What value of ‘P’ is required to initiate motion up the incline? The static and kinetic coefficients of friction between the block and the incline are \( \mu_s = 0.25 \) and \( \mu_k = 0.2 \) respectively. (Refer Fig.Q8(b)). (10 Marks)

Fig.Q8(b)
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First / Second Semester B.E. Degree Examination, July 2007
Common to all Branches

Elements of Civil Engineering

[Max. Marks:100]

Time: 3 hrs.

Note: 1. Answer any FIVE full questions.
2. Assume any missing data suitably.
3. Draw neat sketches wherever necessary.

1. a. Explain briefly the role of civil engineer in the economic development of a country.
   (08 Marks)
   With reference to civil engineering projects, explain the importance of planning and scheduling.
   (06 Marks)
   c. What are the qualities of good building stones?
   (06 Marks)

2. a. What are composite materials? Describe briefly the properties and uses of composite materials.
   (06 Marks)
   b. What is mortar? Explain the properties of hardened mortar and green mortar.
   (06 Marks)
   c. As per Indian standard code how bricks are classified? List the properties of first class bricks.
   (08 Marks)

3. a. What is the importance and object of surveying? Write in brief the basic principles of surveying.
   (08 Marks)
   b. Define ‘remote sensing’. Describe briefly the various remote sensing systems.
   (06 Marks)
   c. Write a short note on electronic distance measurement (EDM) instruments.
   (06 Marks)

4. a. Explain the principle of transmissibility of forces and its limitations.
   (05 Marks)
   b. Explain the terms “Composition of forces” and “resolution of forces”.
   (04 Marks)
   c. Determine the magnitude of forces F1 and F2 if the system of forces shown in figure Q4 (c) is in equilibrium.
   (11 Marks)

5. a. Define Varignon’s theorem.
   (02 Marks)
   b. Determine the magnitude and direction of the resultant of the system of forces shown in figure Q5 (b). Locate its position with respect to origin ‘O’. Co-ordinates of the point of action of the forces are in ‘m’.
   (12 Marks)
   c. Explain the features of fixed support and roller support with sketches.
   (06 Marks)
6 a. Determine the reaction at point ‘A’ of the beam supported and loaded as shown in figure Q6 (a).

(10 Marks)

Fig. Q6 (a)

b. Locate the position of centroid for the composite section shown in figure Q6 (b).

(10 Marks)

Fig. Q6 (b)

7 a. State and prove parallel axis theorem.

(05 Marks)

b. Determine the radii of gyration of the section shown in figure Q7 (b) about the centroidal axes.

(15 Marks)

All the dimensions are in mm

8 a. State the laws of dry friction.

(04 Marks)

b. Differentiate between angle of friction and angle of repose.

(04 Marks)

c. A ladder shown in figure Q8(c) is 6 m long and is supported by a horizontal floor and vertical wall. The coefficient of friction between the floor and the ladder is 0.4 and between wall and ladder is 0.25. The weight of the ladder is 200 N. If the ladder has to support a vertical load of 900 N at C, which is at a distance of 5 m from A, determine the least value of the inclination θ of the ladder with the horizontal floor before the ladder slips.

(12 Marks)

Fig. Q8 (c)

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2002 SCHEME
Second Semester B.E. Degree Examination, Dec. 06 / Jan. 07
Common to All Branches
Elements of Civil Engineering

Note: Answer any FIVE full questions.
(Max. Marks:100)

1. a. Explain the various civil engineering infrastructures systems required for the socio-economic development of a country.
   (06 Marks)
b. Explain the term ‘grade of concrete’ and also explain the uses of RCC in civil engineering works.
   (06 Marks)
c. What are the three phases of project management? Explain the role of management in project execution.
   (08 Marks)

2. a. What are the alternate materials? Mention the alternate building materials and give their uses.
    (06 Marks)
b. What are the different types of mortars used in construction? State the composition of each.
    (06 Marks)
c. How do you classify smart materials? Explain the principle behind the working of smart materials.
    (08 Marks)

3. a. What are the various measurements made in surveying? Distinguish between horizontal control and vertical control in surveying.
    (06 Marks)
b. What is ‘total station’? Explain its utility in surveying.
    (06 Marks)
c. Define geographic information system. Explain the functional abilities of GIS.
    (08 Marks)

4. a. \( F_1 \) is a force in x-direction and \( F_2 \) is a force at angle \( \theta \) to x-direction. Determine the general expression for the resultant of the above two forces.
    (08 Marks)
b. Explain how the unit of force in MKS and SI system differ.
    (02 Marks)
c. The system of forces acting on a triangular plate is shown in fig.4(c). Determine the magnitude, direction and a point on the line of action of the resultant.
    (10 Marks)

5. a. A roller weighing 1200 N rests on an inclined bar weighing 600 N as shown in fig.5(a). Neglecting the weight of the bar AB, determine the reactions developed at supports C and D.
    (10 Marks)
b. Determine the reactions developed at supports A and B in the beam shown in Fig.5(b).

\[ \text{Fig.5(b)} \]

6 a. Locate the centroid of a quadrant of a circle from first principle.

6 b. Locate the centroid of the shaded area shown in Fig.6(b) with respect to the x and y axes as shown.

\[ \text{Fig.6(b)} \]

7 a. Derive the expression for moment of inertia of a circle of diameter 'd' about its diametral axis.

7 b. A semi circular cut is made in a rectangular wooden beam as shown in Fig.7(b). Determine the polar moment of inertia of the section about its centroidal axes.

\[ \text{Fig.7(b)} \]


8 b. Determine the force P required to start the wedge as shown in Fig.8(b). The angle of friction for all surfaces of contact is 15 degrees.