

Duration: 3hrs

[Max Marks: 80]

**Instructions:**

- (1) Question No 1 is Compulsory.
- (2) Answer any **three** questions out of the remaining five.
- (3) Each full question carries **20** marks.
- (4) Use of IS 1893(Part -1) - 2016 is permitted.

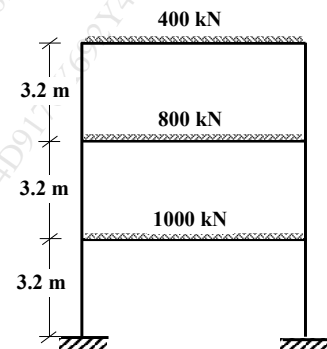
**1 Answer any FOUR**

- a What are faults? Explain the types of faults with diagrams. **05M**
- b Explain strong motion characteristics of an earthquake **05M**
- c Differentiate between seismogram and accelerogram. **05M**
- d What is earthquake design spectrum and inelastic spectra? **05M**
- e Discuss about Time History method of seismic analysis. **05M**

- 2 a List out and discuss the four virtues of good earthquake resistant design. **10M**
- b Explain the influence of building configuration and architectural aspects on the seismic behaviour of a structure. **10M**

- 3 A hospital building located in Delhi is designed as a special moment resisting frame (without infill panels). Hard soil strata is available at site. The dynamic properties for vibration based on free vibration analysis are given in the table below. Calculate the design seismic forces using dynamic analysis. Show the distribution of lateral forces along the height of the building. **20M**

Modes	Natural period(sec)	Roof	2 <sup>nd</sup> floor	1st floor
Mode 1	15.61	1.00	0.800	0.440
Mode 2	10.80	1.00	-0.560	-1.250
Mode 3	3.85	1.00	-2.250	1.800



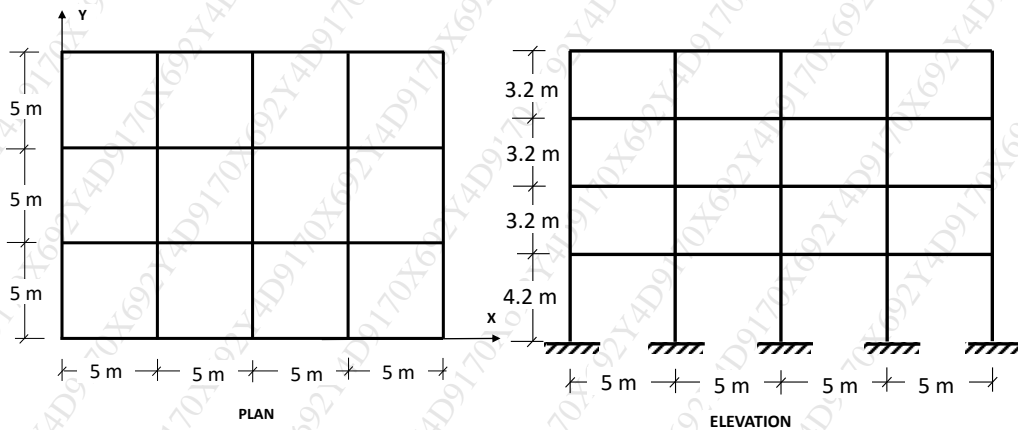
- 4 a Explain the concept of capacity design in earthquake resistant design. Briefly explain strong column weak beam design philosophy. **10M**
- b Define mode shape. What are factors affecting mode shape? **05M**
- c Briefly explain Elastic Rebound theory. **05M**

5 a A multi-storied building has following data:

15M

- (i) Plan dimension = 20 m x 15 m
- (ii) Number of bays in X-direction = 4 @ 5 m each
- (iii) Number of bays in Y-direction = 3 @ 5 m each
- (iv) Number of storeys = 4 Nos.
- (v) Total height of building = 13.8 m
- (vi) Size of columns and beams = 300 mm x 600 mm
- (vii) Slab thickness = 150 mm
- (viii) LL = 3 kN/m<sup>2</sup>
- (ix) R.C.C. frame infill with brick masonry
- (x) Seismic zone = IV
- (xi) Hard strata

Calculate the total base shear and the distribution of the seismic forces at each floor level.



b Write a short note on performance-based design in earthquake engineering.

05M

6 a Explain the design philosophy for earthquake resistant structures.

05M

b Write a short note on prominent past Indian earthquakes.

05M

c Define intensity of earthquake. How it is measured?

05M

d Briefly explain base isolation.

05M

Time: 3 hours

Max. Marks: 80

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- Note:** 1]. Question Number one is compulsory.  
2]. Attempt any three questions from remaining five.  
3] Assume any other data needed suitably, if not given. However, justify the same.  
4] Figures to the right indicate full marks.  
5] IRC 6, IRC 112 is permitted.

**Q.1 Solve any Four of the following. (20)**

- Between Dadar to Panvel for new road alignment need to provide bridge, which factor you will consider for construction of new site for bridge and why?
- What are the different types of bearings used to restrained and permit various movements in the bridges? Explain in brief any one fixed type bearings.
- Sketch the incremental launching methods and explain in which sequence you will proceed of girder launching for bridge.
- Write short note on Hendry- Jaegar Method
- Mention the various advantages of reinforced concrete box culvert in comparison with other types of cross drainages works adopted in highway structures.
- Differentiate reinforced concrete and prestressed concrete slab/ girder bridges.

**Q.2 A.** Design slab section of steel trussed bridge for the warren truss of 30 m span with 6 panels of 5 m each. Cross girders are provided at 5 m intervals joining the nodal points. The stringers are spaced at 1.875 m centers. Roadway- 7.5 m (two lane) , kerbs – 600 mm, loading- IRC Class AA tracked vehicle with two tracks of 3.6 m long and 0.85 m wide carrying a load of 350 kN. (Assume Impact factor is 25 % ), Thickness of deck slab- 200 mm, weight of wearing coat- 100 mm. **(15)**

**B.** What methods do you follow for analyzing the forces in the various truss members due to IRC loading on the highway. **(05)**

**Q.3** Determine design bending moment and shear force on longitudinal girder of a 25 m span bridge, due to IRC Class AA tracked vehicle and self-weight of the bridge superstructure. Clear carriage width is 8 m, footpath on either side is 1.3 m and cross girders are provided at 4 m c/c. Thickness of deck slab is 225 mm thickness of wearing coat is 100 mm. Area of cross girder is 70% of the area of a longitudinal girder. **(20)**

**Q.4 A.** How will you analyse stability of abutments explain along with example also, mention forces acting on abutments. **(10)**

**B.** Write short note, **(10)**

- Bridge inspection
- Erection Techniques

- Q.5** A) Design a steel rocker bearing for transmitting a vehicle reaction of 1000 kN and a horizontal reaction of 80 kN at the support of a bearing girder assuming a following data,  
Permissible compressive stress in concrete bed block =  $4 \text{ N/mm}^2$   
Permissible bending stress in steel plate =  $160 \text{ N/mm}^2$   
Permissible bearing stress in steel plate =  $185 \text{ N/mm}^2$   
Permissible shear stress in steel =  $105 \text{ N/mm}^2$  **(10)**
- B) What are the different types of foundations used in bridges? How different factors influence type of foundation? **(05)**
- C) What factors need to consider for design of design of reinforced concrete bearings. **(05)**
- Q.6** Write Short note on any four of the following **(20)**
- IRC Bridge loading standards
  - Expansion Joints
  - Pile and well foundation
  - Courbon's Method
  - Rehabilitation Techniques
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Question no 1 is compulsory

Attempt any three question out of five remaining questions.

All questions carry equal marks

Q.1 Attempt any Five out of Six [20 marks]

- a) Outline the functions of Human Resource Management.
- b) Write a note on Total Quality Management.
- c) Outline any four major trade union in India.
- d) Write a note on Politics at workplace.
- e) Write a note on Human resource development.
- f) Write a note on Organizational behavior.

Q.2

- a) Write a note on Trade Union act and shop and establishment act. [10]
- b) Explain the principle and techniques of employee compensation. [10]

Q.3

- a) Explain Leadership styles and contemporary issues in leadership [10]
- b) Explain Assessment of Personality Traits for Increasing Self Awareness [10]

Q.4

- a) Explain different type of methods of Performance Appraisal Systems. [10]
- b) Explain Need, purpose, objective and role of information system in HR. [10]

Q.5

- a) Discuss “Intracompany cultural difference in employee motivation “ [10]
- b) Describe the Applications in HRD in various industries [10]

Q.6

- a) Discuss the effect of perception on Individual Decision making, Attitude and Behavior. [10]
- b) Write a note on Job-enrichment and Job empowerment [10]

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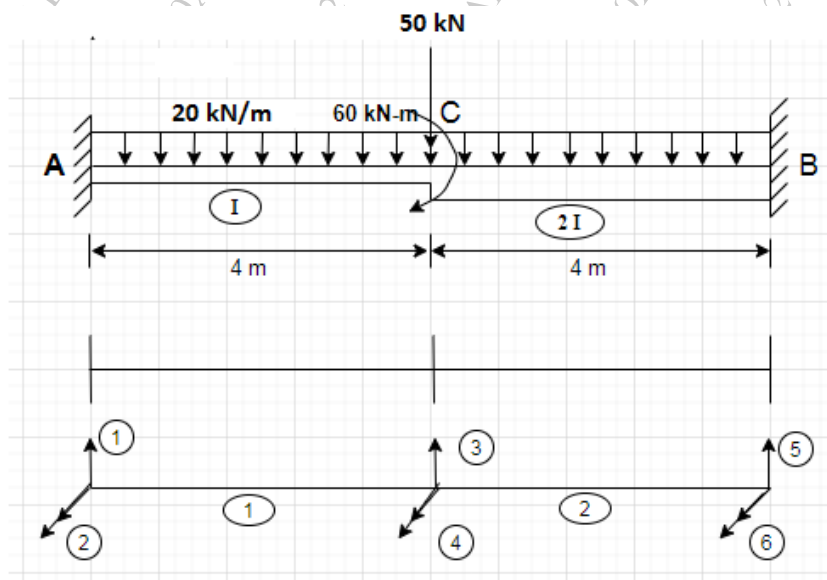
Notes :

1. Question No ONE is Compulsory.
2. Answer any THREE from the remaining.
3. Draw FIGURES wherever necessary. The figures to the right indicate full marks.
4. WRITE proper question/sub-question numbers on the left margin allotted in the answer sheet.
5. Each Question carries EQUAL marks.
6. ASSUME any additional data if necessary and state it clearly.

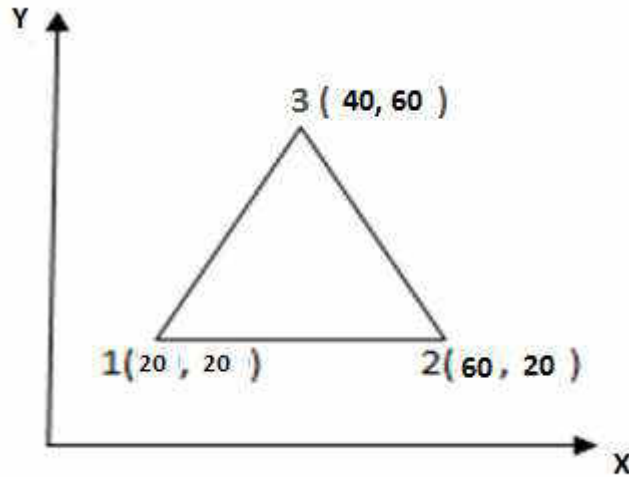
Q.No.1 Solve any FOUR Questions out of SIX (05) marks each

- a) Explain the Pascal Triangle for two dimensional element
- b) Discuss about the software's used to evaluate the problems in FEM
- c) Differentiate between the terms lumped loads & consistent loads
- d) Discuss the various points to be considered while discretizing a structure for finite element analysis
- e) Write step by step procedure of finite element method
- f) Explain the terms  $C^0$ ,  $C^1$  &  $C^2$  type continuity

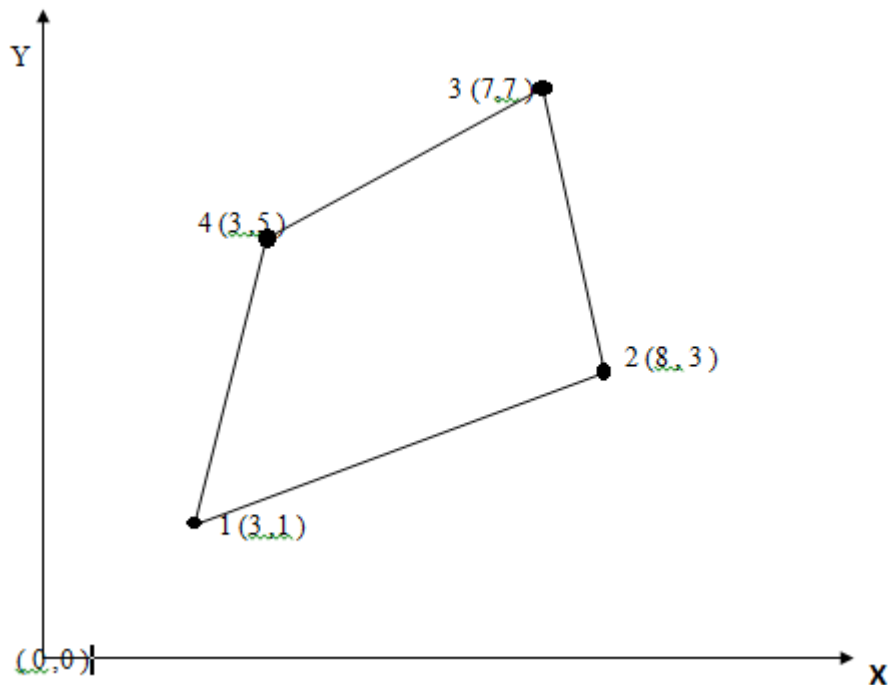
Q.No.2. Analyse the structure as shown in fig by using Finite Element Method ,draw shear force ,Bending Moment and elastic curve (20)



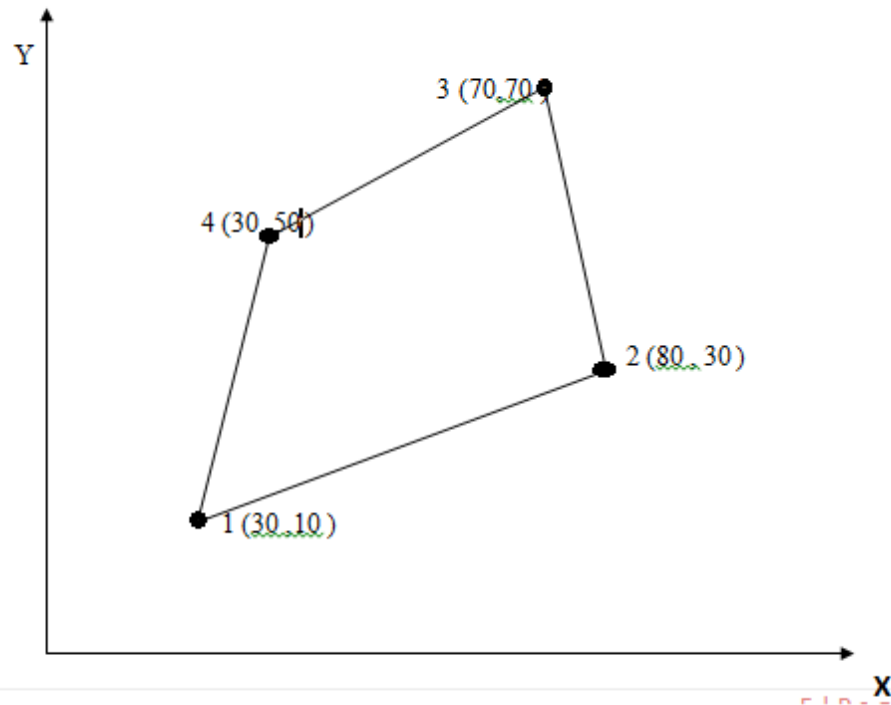
- Q.No.3 a) Calculate the stiffness matrix for the element (CST) shown in figure? Co-ordinates are given in mm. Assume plane stress conditions. Take  $E=2.1 \times 10^5$  N/mm<sup>2</sup>,  $\nu=0.25$ ,  $t=15$ mm. Co-ordinate are in millimeter (15)



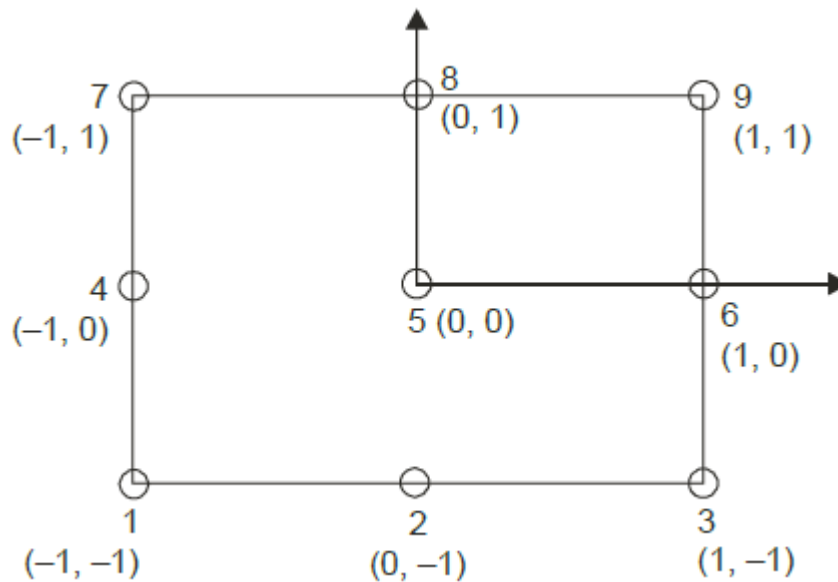
- b) Determine Cartesian co-ordinate of point whose  $\zeta=0.5$  and  $\eta=0.6$  in natural co-ordinate system (5)



- Q.No. 4 a) Assemble Jacobin matrix and strain displacement matrix corresponding to the gauss point ( 0.57735 , 0.57735 ) for the element as shown in the figure ( 13)



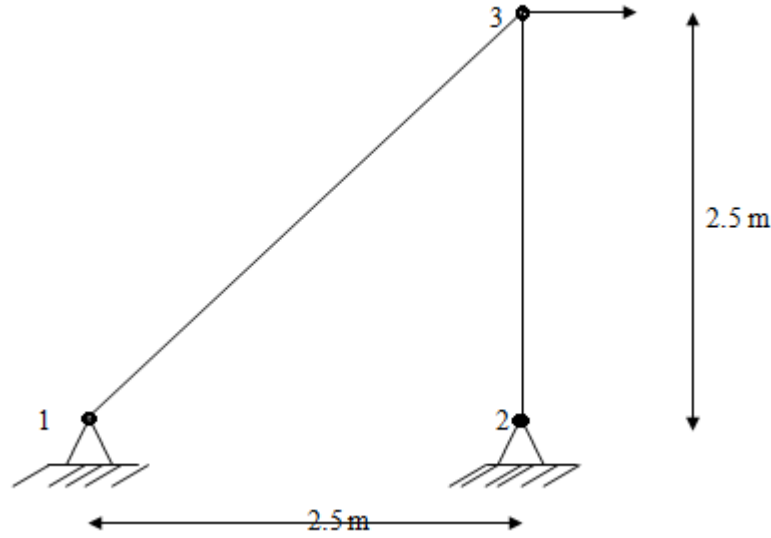
- b) Using Lagrange functions write shape functions for the nine noded rectangular element shown in Fig. (07)



- Q.No.5 a) Find the natural frequencies and mode shapes for simply supported beam. (10)  
 b) Starting with shape function relationship derive Geometric stiffness matrix for a 2-noded beam element. (10)



Q.No.6 a) Determine the buckling load for pin jointed plane frame as shown in figure (15)



b) Determine the value of following integral using Gaussian quadrature with 2x2 and 3x3 Gauss points (05)

$$\int_{-1}^{+1} t \cos t$$

Time: 3 Hours

Total Marks : 80

- N.B.** (1) Question No. 1 is Compulsory.  
 (2) Solve **any three** questions out of remaining Five questions.  
 (3) Figures to right indicate full marks.  
 (4) Assume suitable data if needed but justify the same.
- Q.1 Attempt any four of the following
- (a) Distinguish between a Plate and a Shell Structure. **05**
  - (b) Explain the term 'Surface Revolution'. **05**
  - (c) With the help of a sketch explain the free body diagram of a plate element representing lateral loads, moments and shear. **05**
  - (d) Illustrate the membrane theory of a shell. **05**
  - (e) State the difference between Navier's and Levy's Method. **05**
- Q.2 (a) For a Cylindrical Shell, derive the Schorer form of differential Equation. **15**  
 (b) Explain geometrical and statical boundary conditions for the types of support **05**
- i Clamped
  - ii Simply supported.
- Q.3 (a) A simply supported circular plate of diameter 4000 mm is subjected to UDL of  $130\text{KN/m}^2$ . Determine the thickness of the plate if maximum deflection is limited to 2.7 mm. Also calculate the maximum moments and bending stresses. Take  $\mu = 0.3$  and  $E = 68\text{ GPa}$ . **10**  
 (b) Derive relation between bending moments and Curvature in pure bending of Plates. **10**
- Q.4 (a) Derive the biharmonic equation for slightly bent thin plate. **10**  

$$\nabla^4 w = q/D$$
  
 (b) Classify thin shell into various types based on shell geometry & Curvature. **10**
- Q.5 (a) Why bending theory is essential in cylindrical shell. **05**  
 (b) Explain the theory of thin plates with small deflections. **05**  
 (c) Derive the expression for deflection in a slightly bent simply supported rectangular plate subjected to uniformly distributed load over entire plate. Use Navier's method. **10**
- Q.6 (a) Derive the governing differential equation for circular plate under axisymmetric loading. **10**  
 (b) Determine the membrane forces in a hemispherical shell subjected to self-weight only. **10**

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