Roll No. .....

22707

P.G. Open Elective Courses and Foundation Elective (For CBCS PG Programmes) 2nd Semester Examination – May, 2025

BUILDING MATERIALS

Paper : 22MTSE22F1

Time : Three hours] *[Maximum Marks : 40*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting ***one*** question from each Section Question No. 1 is ***compulsory***. All questions carry equal marks. Assume missing data, if any suitably.

1. Describe the following :
   (a) Characteristics of green building
   (b) Uses of terracotta
   (c) Seasoning of timber
   (d) Fire protection requirement for building

SECTION – A

2. What are the basics of civil engineering ? Describe the impact of Civil Engineering on the society.

3. (a) Describe the classification of lime in detail.

   (b) What is the composition of cement ? Also describe different tests of cement.

SECTION – B

4. (a) What is brick masonary ? Describe various terms used in brick masonary

   (b) What are the requirements of a good structural stone ? Explain in detail the dressing of stone and seasoning of stone.

5. Describe the following :

   (a) Bonds in brick work

   (b) Manufacturing of tiles

SECTION – C

6. (a) Define defects in timber. What are the different preservatives used for treatment.

   (b) Describing seasoning of timber and fire proofing of timber.

7. (a) Describe the characteristics of a good paint.

   (b) What are the constituents of varnishes ? Also explain different types of varnishes.

SECTION – D

8. What is dampness and its causes ? Explain with neat sketches the method of providing DPC in buildings.

9. Describe the following :

   (a) Water proofing treatment roof

   (b) Fire resisting construction

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22707

M. Tech. 2nd Semester (Open Elective & Foundation Elective (For CBCS Prog.) Examination – May, 2024

BUILDING MATERIALS

Paper : 22MTSE22F1

Time : Three Hours] *[Maximum Marks : 40*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting ***one*** question from each Unit. Question No. 1 is ***compulsory***. All questions carry equal marks. Assume missing data, if any, suitably.

1. Describe the following :

   (a) Mortars for masonary and plastering.

   (b) Advantages of plywood and fiber boards.

   (c) Terms used in brick masonary.

   (d) Dampness and its causes.

UNIT – I

2. What are the basics of civil engineering ? Describe the economic and environmental impact of civil engineering on the society.

3. (a) What are the different types of lime ? Describe their characteristics in detail.

   (b) What is the composition of cement ? Describe the storage and different testing of cement.

UNIT – II

4. (a) What is brick masonary ? Describe the different types of bonds used in brick with neat sketch.

   (b) What do you mean by dressing of stone ? Describe in detail the prevention and seasoning of stone.

5. Describe the following :

   (a) Requirement of a good structural stone

   (b) Terracotta, its types and uses

UNIT – III

6. (a) Describe in detail the structure and classification of timber.

   (b) Describing the phenomenon of Seasoning of timber, Fire proofing of timber.

7. (a) Describe the characteristics and types of varnishes.

   (b) What are the basic constituents of a good paint ?

UNIT – IV

8. (a) What is Fire protection ? Describe the basic fire protection requirement for building.

   (b) Explain with neat sketches the method of providing DPC in buildings.

9. Describe the following :

   (a) Prevention for dampness and material used

   (b) Water proofing treatment of roofs

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22709

Open Elective 2nd Semester Examination – May, 2025

STABILIZATION OF SOIL

Paper : 22MTSE22O1

Time : Three hours] *[Maximum Marks : 80*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : There are ***nine*** questions in all. Students are required to attempt ***five*** questions in all including one ***compulsory*** question and four more questions selecting one from each Section. All questions carry equal marks. Assume missing data, if any suitably.

1. Describe the following :

(a) Classification of soil stabilization

(b) Mechanical stabilization

(c) Necessity of dewatering

(d) Electrical method of dewatering

(e) Uses of grouting

(f) Components of ground anchors

(g) Different grouting materials

(h) Criteria for cement stabilization

SECTION – A

2. (a) Describe in detail the objectives of soil stabilization techniques. What are the considerations in the selection of the best stabilization technique ?

(b) What do you mean by impact loading ? Differentiate dynamic compaction and consolidation of soil stabilization.

3. Describe the following :

(a) Vibro-floatation

(b) Preloading and surcharge fills

(c) Procedure of sand compaction piles

(d) Uses of stone columns

SECTION – B

4. (a) With the neat sketches, explain the working of "Electo-osmosis" and "Deep well drainage" methods of dewatering ?

(b) Describe the Single and multi-stage well point systems for dewatering.

5. (a) What are the different methods of dewatering ? Explain the vacuum method of dewatering in detail with neat sketches.

(b) Write short note on open sumps and ditches method of dewatering.

SECTION – C

6. (a) Describe in detail the chemical stabilization and uses of admixtures for soil improvement.

(b) Describe the application of tar, fly ash and asphalt used in soil stabilization.

7. Write a short note on the following :

(a) Bituminous stabilization

(b) Lime stabilization

(c) Stone column

(d) Cement stabilization

SECTION – D

8. (a) What is Necessity of earth reinforcement ? Describe the principles and basic mechanism of reinforced earth.

(b) Describe in detail the construction sequence of soil nailing. Also describe the applications ground anchors.

9. (a) What do you mean by grout monitoring ? Explain briefly the grouting and its effects.

(b) What are the types and components ground anchors ? Describe its applications.

Roll No. .....

22709

M. Tech. 2nd Semester (Open Elective & Foundation Elective (For CBCS Prog.) Examination – May, 2024

STABILIZATION OF SOIL

Paper : 22MTSE2201

Time : Three Hours] *[Maximum Marks : 80*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting ***one*** question from each Unit. Question No. **1** is ***compulsory***. All questions carry equal marks. Assume missing data, if any, suitably.

1. Describe the following :

(a) Objectives of soil stabilization

(b) Impact loading

(c) Characteristics of open sumps and ditches for dewatering

(d) Sand compaction piles

(e) Uses of admixtures

(f) Necessity of earth reinforcement

(g) Types of grouting

(h) Advantages of chemical stabilization

UNIT – I

2. (a) Describe in detail the classification of soil stabilization techniques. Explain briefly the selection criteria for the best soil stabilization technique.

(b) What do you mean by mechanical stabilization ? Describe briefly dynamic compaction and consolidation.

3. Describe the following :

(a) Vibro-floatation

(b) Preloading ant pre compression

(c) Sand drains

(d) Stone columns

UNIT – II

4. (a) With the neat sketches, explain the working of "Electo-osmosis" and "Deep well drainage" methods of dewatering.

(b) Describe the Single and multi- stage well point systems for dewatering.

5. (a) What are the different methods of dewatering ? Explain different stages of well point system with neat sketches.

(b) Write short note on Electrical and Thermal methods of dewatering.

UNIT – III

6. (a) Describe in detail the chemical stabilization and grouting.

(b) How the tar or asphalt used in soil stabilization ? Also explain stabilization using fly ash.

7. Write a short note on the following :

(a) Bituminous stabilization

(b) Lime stabilization

(c) Stone column

(d) Cement stabilization

UNIT – IV

8. (a) What is earth reinforcement ? Describe the principles and basic mechanism of reinforced earth.

(b) Describe in detail the construction sequence and methods of installation of soil nailing.

9. (a) What are the types and components ground anchors ? Describe its applications.

(b) What are the different grouting materials ? Explain briefly grouting procedure and grout monitoring.

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23812

M. Tech. 2nd Semester (Civil) (Structural Engg.) Examination – May, 2025

FINITE ELEMENT METHOD IN STRUCTURAL ENGINEERING

Paper : 24MTSE22C1

Time : Three Hours] *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Question No. 1 is ***compulsory.*** Attempt ***one*** question from each Section. All questions carry equal marks. Assume missing data, if any, suitably.

1. ***Compulsory Questions :*** $2.5 \times 8 = 20$

   (a) State the principle of minimum potential energy.

   (b) What is meant by the Direct Stiffness Method ?

   (c) What are interpolation functions in FEM ?

   (d) What is numerical integration in FEM ?

(e) What is mesh generation in pre-processing ?

(f) What is the significance of nodal data in FEM software ?

(g) Define strain in terms of nodal displacements.

(h) What is a three-dimensional element in FEM ?

SECTION – A

2. (a) What are advantages and disadvantages of FEM ? 10

(b) Explain plain stress and plain strain with examples. 10

3. (a) State and explain the principle of minimum potential energy. How is this principle used in deriving finite element equations ? 10

(b) Explain the process of assembling the global stiffness matrix from individual element matrices. Why is proper node numbering and connectivity important ? 10

SECTION – B

4. Derive the following :

(a) Element stiffness matrix

(b) Element load vector by direct method for one dimensional bar element. 20

5. (a) Explain the Method of Weighted Residuals in the context of FEM. Derive the weak form of the governing equation using this method. 10

(b) Apply the Galerkin method to derive the finite element equations for a 1D structural bar under axial load. Include boundary conditions. 10

SECTION – C

6. (a) Express the interpolation function of a field variable for three node triangular element. 10

(b) Discuss the advantages of using isoparametric elements in finite element analysis. How are shape functions and Jacobians defined in this context ? 10

7. (a) Explain Gaussian and Newton-Cotes quadrature and evaluate the integrals : 10

(i) $I = \int_{-1}^{1} \left[x^2 + \cos(x/2)\right] dx.$

(ii) $I = \int_{-1}^{1} (3^x - x)\, dx$ using three-point.

(b) Describe the formulation of a Constant Strain Triangle (CST) element for plane stress problems. What are its strengths and weaknesses ? 10

SECTION – D

8. Describe the role of pre-processing in Finite Element Analysis (FEA). What are the typical steps and tools used during this stage ? 20

9. (a) Explain the advantages and limitations of using commercial FEA software for solving engineering problems. Provide examples of commonly used FEA tools. 10

   (b) Describe how boundary conditions and loads are defined during the pre-processing stage of FEM. Why is this step critical ? 10

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23778

M. Tech. 2nd Semester (Structural Engg.) Examination – May, 2025

FEM IN STRUCTURAL ENGINEERING

Paper : 22MTSE22C1

Time : Three hours] *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. **1** is *compulsory*. All questions carry equal marks.

1. Explain the following : $4 \times 5 = 20$

   (a) Spring and Bar Elements

   (b) Nodal Load Vector

   (c) Axi-Symmetric Elements

   (d) 2D Truss Elements

   (e) Direct Stiffness Method

UNIT – I

2. Discuss in detail the Principle of Minimum Potential Energy in the context of linear elastic structures. Explain how this principle is used to determine the equilibrium configuration of a system and why it is considered a variational principle. Illustrate your explanation with a relevant example from structural mechanics. 20

3. In a two-dimensional Cartesian coordinate system, derive the strain-displacement relations for plane stress and plane strain conditions. Show how the strain tensor simplifies under each assumption. 20

UNIT – II

4. Explain the concept of the Natural Coordinate System used in finite element methods. Why is it preferred over global coordinates when formulating shape functions and performing numerical integration ? Illustrate with a 2D isoparametric quadrilateral element. 20

5. Discuss the implications of using Lagrange vs. Serendipity elements in a finite element mesh for solving a 2D elasticity problem. Consider aspects such as mesh refinement, computational cost, accuracy and element distortion sensitivity in your analysis. 20

UNIT – III

6. In a 1D finite element how is Gauss quadrature used to evaluate the element stiffness matrix and force vector ? 20

7. Discuss the challenges in computing the stiffness matrix for nonlinear isoparametric elements in Finite Element Analysis. How does the material nonlinearity and geometric nonlinearity affect the stiffness matrix computation ? Provide an example of how the stiffness matrix is updated in each iteration for a nonlinear problem. 20

UNIT – IV

8. Explain the role of the pre-processing and post-processing phase in FEA software. 20

9. Explain the following : 20

   (a) Analysis of framed structures.

   (b) Plane stress and plane strain analysis of Triangular Element.

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23778

M. Tech. 2nd Sem. (Structural Engg.) Examination – May, 2024

FINITE ELEMENT METHOD IN STRUCTURAL ENGINEERING

Paper : 22MTSE22C1

Time : Three Hours] *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting ***one*** question from each Section. Question No. 1 is ***compulsory***. All questions carry equal marks. Assume suitable data.

1. (i) What is meant by discretization ? $4 \times 5 = 20$

   (ii) What is meant by boundary condition ?

   (iii) What is axisymmetric element ? What are the conditions for a problem to be axisymmetric ?

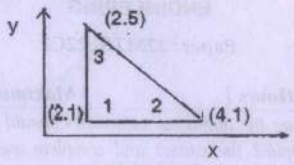
   (iv) What are the advantages of Gauss quadrature numerical integration for isoperametric element ?

   (v) Derive the load vector for UDL in beam.

SECTION – A

2. Discuss the history and applications of finite element method in Structure Analysis. 20

3. For the plane strain elements as shown in figure, the nodal displacement are given as u_1 = 0.005 mm, v_1 = 0.002 mm, u_2 = 0.0, v_2 = 0.0, u_3 = 0.005 mm, v_3 = 0.30 mm. Determine the element stresses and the principal angle. Take E = 70 GPa and Poisson's ratio = 0 and use unit thickness for plane strain. All coordinators are in mm. 20



SECTION – B

4. Define shape function ? Derive shape function in terms of Cartesian Coordinates. 20

5. Derive the strain displacement matrix of two dimensional four noded iso-parametric elements. 20

SECTION – C

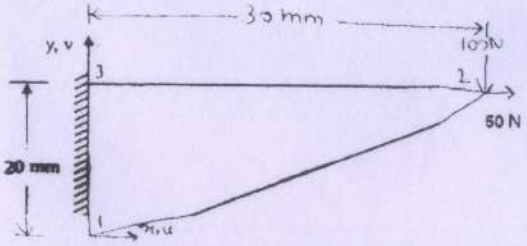
6. Derive the strain displacement matrix of two dimensional four noded iso-parametric elements. 20

7. Evaluate the integral by two- and three-point gauss quadrature rule. 20

$$I = \int_{-1}^{1} x^3 - 2x^2 + 5x - 7dx$$

SECTION – D

8. Calculate displacements and stress in a triangular plate, fixed along one edge and subjected to concentrated load at its free end. Assume E = 70,000 MPa, t = 10 mm and v = 0.3. 20



9. Explain the steps involved in analysis of beams using computer implementation with the help of a simple example. Explain how boundary conditions are applied. 20

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23814

M. Tech. 2nd Semester (Civil) (Structural Engg.) Examination – May, 2025

SOIL STRUCTURE INTERACTION

Paper : 24MTSE22D1

Time : Three Hours] *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Question No. **1** is ***compulsory***. Attempt ***one*** question from each Section. All questions carry equal marks. Assume missing data, if any, suitably.

1. ***Compulsory Questions :*** $2.5 \times 8 = 20$

(a) What is meant by soil-structure interaction and why is it important in foundation design ?

(b) State one key limitation of conventional foundation design methods when dealing with complex soil conditions.

(c) Mention two differences between the Finite Element Method (FEM) and the Finite Difference Method (FDM) in soil analysis.

(d) Define relaxation in the context of soil-structure interaction problems.

(e) What is the significance of modeling non-linear stress-strain characteristics in stratified soil analysis ?

(f) What are the main assumptions of the theory of sub-grade reaction used in foundation analysis ?

(g) Define negative skin friction in piles and mention one condition under which it occurs.

(h) What is meant by pullout resistance in anchor piles and how is it determined ?

SECTION – A

2. (a) Explain Terzaghi's Bearing capacity theory in detail with neat sketch. 10

(b) Explain the settlement of clay or cohesive soil and that of granular or non-cohesive soil or sand. 10

3. (a) Explain the idealization of the supporting soil medium and discuss the analysis of soil structure interaction. 10

(b) Compare and contrast FEM and FDM in the context of foundation design and soil-structure interaction modeling. 10

SECTION – B

4. (a) Explain the concepts of relaxation (time-dependent deformations) and interaction effects between soil and structure. 10

(b) Analyze how different types of structures respond to various loading in the context of SSI. 10

5. Explain the coupled behaviour of soil and frame superstructure when resting on layered soils, considering both elastic and plastic stages of soil deformation. How does this influence seismic response ? 20

SECTION – C

6. (a) A rectangular footing of length 4.2 m with 2.0 m and depth 380 mm carries a concentrated load of 600 KN at centre. The modulus of subgrade reaction of the soil underneath the footing is 20,000 KN/m3, and the grade of footing concrete is M20. Draw the profile of deflection and moments along the length of the beam taking suitable number of points to get smooth curves. Treat it as a beam on elastic foundation problem. 10

(b) Compare the Winkler and Pasternak models for soil behaviour in the context of subgrade reaction theory ? 10

7. Outline the procedural steps for analyzing a raft foundation by elastic plate method. 20

SECTION – D

8. (a) Explain the classification of piles based on a load criteria. 10

(b) Explain the elastic analysis of single pile. 10

9. (a) Explain Reese and Matlock's generalized solution for grouped piles. 10

(b) Write short notes on : 10

(i) Anchor Piles

(ii) Pullout Resistance

(iii) Negative Skin Friction

(iv) Pile Capacity

Roll No. .....

23780

M. Tech. 2nd Sem. (Structural Engg.) Examination – May, 2024

SOIL STRUCTURE INTERACTION

Paper : 22MTSE22D1

Time : Three hours] *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting one question from each Section Question No. **1** is ***compulsory***. All questions carry equal marks. Assume suitable data whenever necessary.

1. Write short note on the following : $4 \times 5 = 20$

(a) What is soil structure interaction ?

(b) What do you understand by Winkler foundation ?

(c) Explain the design method of foundation design.

(d) What are the factors that controls modulus of elasticity.

SECTION – A

2. Explain the nature of complexity of soil structure interaction. 20

3. What are the assumptions and limitations of Winkler's model ? Write down the expression of intensity of load versus the surface displacement in a Winkler's model. 20

SECTION – B

4. Explain the soil structure with different types of loading condition. 20

5. Demonstrate and describe about the interaction between two elastic bodies. Discuss about detrimental effects of soil structure interaction. 20

SECTION – C

6. Explain the theory of sub grade reaction for footing. 20

7. A continuous footing of width 2 m and length 5 m having a thickness of 0·36 m is subjected to a load of 500 kN acting at 4 m from the left end of the footing. Draw a neat diagram of the soil foundation system. Draw deflection, moment and shear force diagram acting on the footing. Modulus of subgrade reaction = 10000 kN/m^3. The footing will be casted by M25 concrete. Treat it as a beam on elastic foundation problem. Solve using Computer Programme. 20

SECTION – D

8. Draw the general deflected shape of a pile and the soil resistance due to lateral force and moment at the ground surface. 20

9. Explain the pile foundation and its types in details. 20

Roll No. .....

23813

M. Tech. 2nd Semester (Civil) (Structural Engg.) Examination – May, 2025

STRUCTURAL DYNAMICS

Paper : 24MTSE22C2

Time : Three Hours] *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Question No. **1** is ***compulsory***. Attempt ***one*** question from each Section. All questions carry equal marks. Assume missing data, if any, suitably.

1. (a) What are the main objectives of vibration analysis in structural dynamics ?

(b) Define 'exciting force and give two examples commonly encountered in structural systems.

(c) Differentiate between free and forced vibration of a single degree of freedom system.

(d) What is Duhamel's Integral and what type of loading is it used for ?

(e) Write the basic idea behind the Newmark Method for numerical integration of equations of motion.

(f) What is meant by a 'generalized SDOF system' ? Give one example.

(g) State the steps involved in the inverse iteration method for finding natural frequencies.

(h) Mention two structural scenarios where dynamic effects due to moving loads are significant.

$2.5 \times 8 = 20$

SECTION – A

2. (a) Explain the objectives and importance of vibration analysis in structural engineering. How does it aid in the design and maintenance of civil engineering structures ? 10

(b) Derive the equation of motion for damped single degree of freedom system with forced vibration. 10

3. (a) A mass-spring-damper system has a mass of 10 kg, stiffness of 3000 N/m, and a damping coefficient of 30 Ns/m. Determine : 10

(i) The damping ratio

(ii) Natural frequency

(iii) Damped natural frequency

(iv) Logarithmic decrement

(b) Explain : 10

(i) Degree of freedom system

(ii) Harmonic Excitation

(iii) Simple harmonic motion

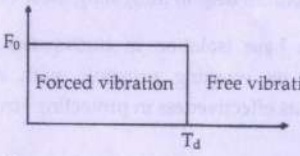
(iv) D' Alemberts principle

SECTION – B

4. (a) Discuss the advantages and limitations of numerical methods in structural dynamics. 10

(b) Derive the Wilson-θ method and explain its significance in vibration analysis. 10

5. (a) Determine the response of SDOF system subjected to rectangular pulse load. 10



(b) Briefly explain orthogonal properties of normal modes. 10

SECTION – C

6. Derive the equation of motion for three degree of freedom system in matrix form and also derive the solution for the equation. 20

7. (a) A 2DOF system has masses of 2 kg and 1 kg connected by springs of stiffness 1000 N/m and 500 N/m. Formulate the mass and stiffness matrices and calculate the natural frequencies. 10

   (b) Describe the Inverse Iteration Method for determining natural frequencies and mode shapes. Apply the method to a simple 2DOF system and explain the convergence criteria. 10

SECTION – D

8. (a) Differentiate between fixed-base and base-isolated structures in terms of dynamic behavior. Discuss the advantages and limitations of base isolation systems. 10

   (b) Explain the dynamic effects of wind loading on high-rise buildings. How does structural dynamics help in mitigating these effects ? 10

9. What is base isolation in earthquake engineering ? Explain its working principle with a sketch, and discuss its effectiveness in protecting structures. 20

Roll No. .....

23779

M. Tech. 2nd Semester (Structural Engg.) Examination – May, 2024

STRUCTURAL DYNAMICS

Paper : 22MTSE22C2

Time : Three Hours] *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting ***one*** question from each Section. Question No. **1** is ***compulsory***. All questions carry equal marks.

1. Explain the following : $5 \times 4 = 20$

(i) Explain about lumped mass and continuous mass system.

(ii) Briefly explain oscillatory motion.

(iii) Explain "Logarithmic Decrement".

(iv) Dynamic magnification Factor.

(v) Active control systems.

SECTION – A

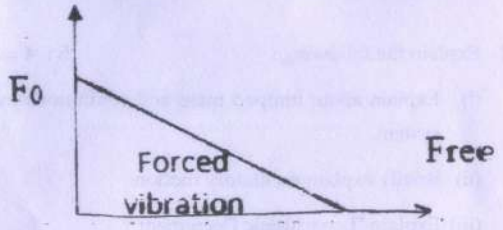
2. (a) Define dynamic and analyze the structure to a dynamic loading. 10

(b) How the deterministic loadings are classified and explain them. 10

3. Derive expression for response of a SDOF system subjected to damped free vibration. Draw the plot showing response of the structure to damped free vibration explaining salient features involved. 20

SECTION – B

4. Determine the response of SDOF system subjected to rectangular pulse load by any suitable method. 20



5. Derive the equation of motion for two degree of freedom system in matrix form and also derive the solution for the equation. 20

SECTION – C

6. Find the first three vibration frequencies and modes of an uniform beam clamped at one end and free at the other. Sketch the mode shapes. 20

7. What do you mean by Forced Vibration Analysis of MDOF systems ? Explain in detail. Also explain *Mode Superposition Method.* 20

SECTION – D

8. List out and explain different prescribed dynamic loadings with applications. Also discuss dynamic effect of moving load and blasting. 20

9. Describe the dynamic analysis procedure as per IS 1893:2002 for a high rise building with 4 stories. Indicate how the mass is lumped and the seimic force is distributed along the height. Distinguish between CQC and SRSS procedures given in the code. 20
