M. E. (Civil) Structural Engineering Sem-II

4b
5/5/14

Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING
(An Autonomous Institution Affiliated to the University of Mumbai)

MASTER

May-14
Total Marks: 100 Duration: 4 hours

CLASS/SEM: M.E. SEM 2 SUBJECT : BRIDGE ENGINEERING

Attempt any Five Questions Figures to the right indicate full marks

Use of codes IRC 5,6,18,21,78 is allowed

I) 20
Design a slab bridge for 12 m clear span with a width for two lane carriage way and footpath of 1.5 m width on either side. The bridge carries class A loading. Check two sections, one at mid span and one at support.
Show sketches of the cross section of the bridge,including the bridge general items and the critical live load position.
Show detail sketches of the reinforcement provided as per the bending moment at centre. Check for critical shear

II) 20
A R C girder bridge has a 18m clear span with a width for two lane carriage way and footpath of 1.5 m width on either side. Design the bridge for Class 70 R track loading
Design for the moment and shear at external girder.
Show sketches of the cross section of the bridge,including the bridge general items and the critical live load position.
Show detail sketches of the reinforcement provided in the girder as per the bending moment at centre.
Check for critical shear and provide shear reinforcement.

III) A girder bridge has 28 m clear span, with a width for two lane carriageway and 1.5m footpath on either side. 20
The bridge carries 70 R track loading. Design the bridge as a prestressed concrete girder system with RC deck slab arrangement with thickness 0.24m. Depth of the girder = 2.2m and web thickness = .028m
Assume suitable prestressing arrangment.
Check the external girder for
stresses at various stages of construction and at service stage at midspan, against ther permissible values

Properties of the girder may be assumed as
1) girder - A=0.788 m2, I = 0.414 m4 Zt=0.376 m3 Zb= 0.376 m3, Yt=1.1m, Yb=1.1m
2) composite section - A=1.472 m2, I = 0.963 m4 Zt= 1.244(slab top) Zt=1.804(slab bot) Zb= 0.578 m3
Yt=0.773m Yb=1.666m

IV) Write short notes explaining the types and usage 20

a) Expansion Joints
b) Bearings

V) Discuss the factors considered for selection of a bridge site. 20

VI) Design a well foundation system for the bridge in problem III for seismic transverse loading combination assuming Ah =0.1 20
Pier cap level = 10.0m
Bed level = 0.0 m
Seismic scour level= -6.0 m
Founding level = -14 m
Bearing capacity = 100 t/m2
a)Assume a suitable diameter well and find the pressure at base of the well foundation
No tension is allowed at the base.
b) Draw suitable sketches to explain your design

M. E. (Civil) Structural Engineering Sem-II
Bridge Engineering 05/05/2014.

VII) Design a pile foundation system for the bridge in problem III for seismic transverse loading combination assuming Ah =0.1 20

Pier cap level = 10.0m

Bed level = 0.0 m

Pile fixity level= -8.0 m

Founding level = -14.0 m

a)Assume 4 piles of 1.2 m diameter piles and find the load and moment for pile design

b) Draw suitable sketches to explain your design

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M.E (C) Sem II Str. Engg.

Jun-14

Total Marks: 100 Duration: 4 hours

CLASS/SEM: M.E. SEM 2 SUBJECT : BRIDGE ENGINEERING
RE- exam

Figures to the right indicate full marks

Use of codes IRC 5,6,18,21,78 is allowed

I) Write short notes explaining the types and usage (any 3) 30

a) Expansion Joints
b) Bearings
c) Railings and crash barrier
d) Wearing coarse

II) Answer in brief (any 3)

a) Explain the concept, design and construction aspects of prestressed concrete I girder bridges. 45

b) Discuss the factors considered for selection of a bridge site.

c) State the classification of bridges based on their structural arrangement. Explain their suitability w.r.t. the span ranges in bridges.

d) What are the types of bridge foundations?
State the factors where you would recommend their usage.

III) Attempt any one of the following 25

a) Design a R.C. solid slab bridge superstructure for 10 m clear span. The vehicular carriageway width is 7.5m with crash barriers at the edge.
The bridge carries class A loading. (For the purpose of ease of calculation assume two wheel loads of 11.4t per lane). Show the checks for two sections, one at midspan and one near support.(for shear)
Draw a suitable sketch for showing the detailing of reinforcement.

b) Design the R.C. girder brige with R.C. deck slab for a three girder bridge deck ,given the following data
Effective span = 20m, carriageway width =7.5, footpath=1.5 m on either side, spacing of the girder =2.7m
The provisions shall be made for the Crash barrier and Precast Hand rail.
The bridge carries class AA track loading
Check the external girder at midspan for bending and support for shear
Draw a suitable sketch for showing the detailing of reinforcement.

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SARDAR PATEL COLLEGE OF ENGINEERING

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MAY 2014

Total Marks : 100 | Duration : 4 Hours

CLASS/SEM : ME CIVIL SEM II (With Structural Engg. Subjects) | SUBJECT : EARTHQUAKE ENGINEERING

MASTER

- Attempt any FIVE questions out of SEVEN questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.
- Assume suitable data if necessary and state the same clearly.

Q.1 **a.** Answer the followings:

(i) What is dynamic Load? How it differs from static Load? Explain various types of dynamic Loads. 3

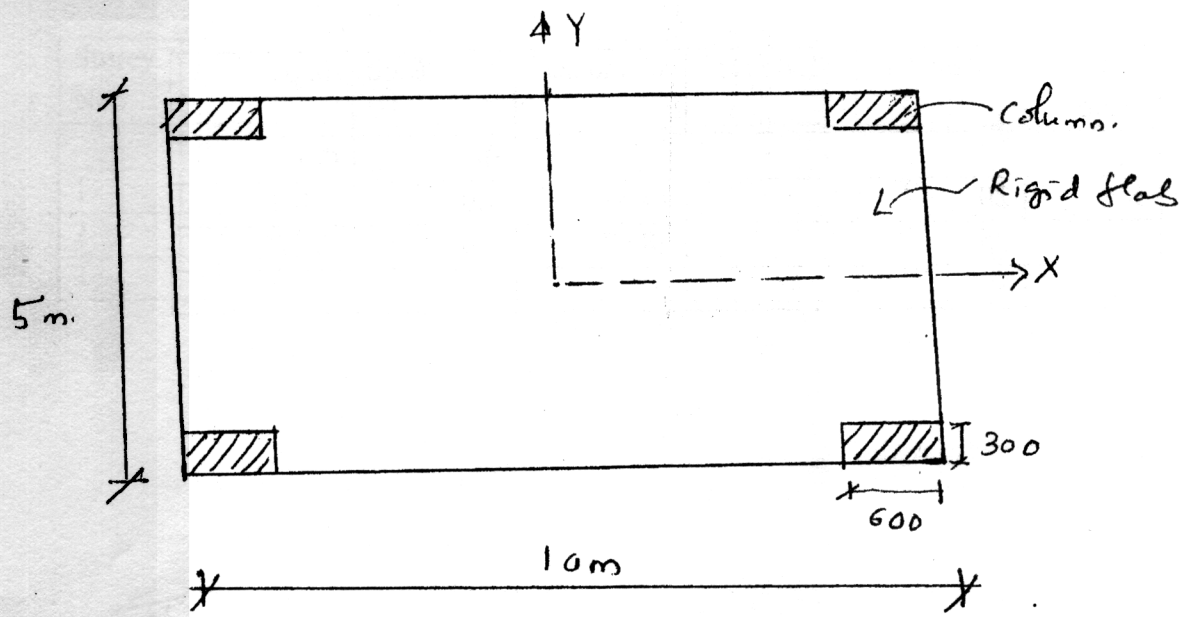
(ii) What is an earthquake? How the earthquakes are classified based on their causes? 2

(iii) Explain the different types of seismic waves and their characteristics 4

(iv) What is damping? Also explain the meaning of critical damping 3

b. i) A single storey structure with rigid slab is supported on four corner columns as shown in figure. The height of structure is 6.0 m. In general what will be the degrees of freedom for this structure? And specify these dof. Calculate the natural frequency of the structure for excitation in X and Y direction separately. 4

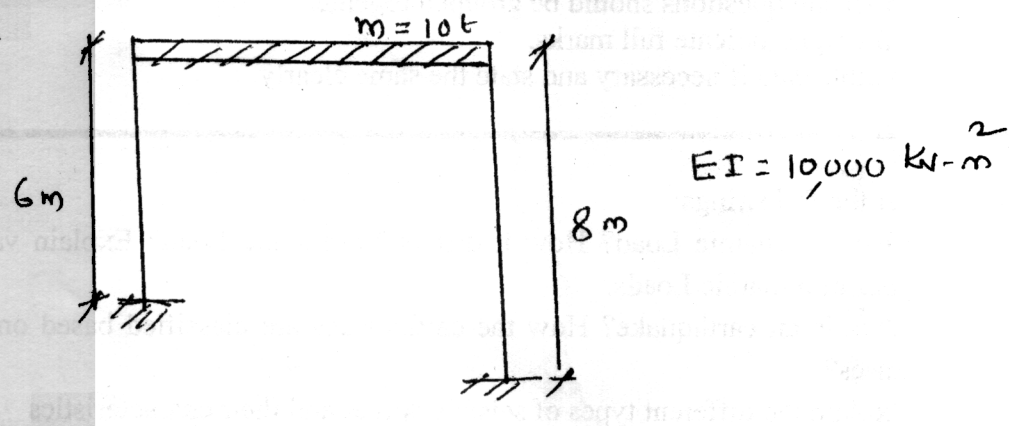
(ii) If the system is subjected to harmonic force with amplitude of 100 KN and excitation frequency of 20 rad/sec at slab level in X direction, evaluate the maximum lateral displacement of the slab. The weight on slab is 100Kg/m^2, uniformly distributed. Assume ξ = 5% and E= 2x10^4 N/mm^2. 4



M. E. (Civil) with Structural Engineering Sem-II
Earthquake Engineering 07/05/2014.

Q.2 a. (i) A single storey frame with rigid girder as shown in figure below is to be designed for ground motion, the response spectrum of which is shown in figure1. Determine the design value of lateral deformation and bending moments in the columns. 4

(ii) If the columns of the frame are hinged at base, determine the design values of lateral deformation and bending moments in columns. Comment on the influence of base fixity on the design deformation and bending moments 4



b. A free vibration test is conducted to determine the dynamic properties of a one storey building. The mass of the building is 10t. Initial displacement of the building is 60 mm. Maximum displacement on the first cycle is 40 mm and period of displacement cycle is 1.5 sec. Determine: 5

(i) Effective weight (ii) Un damped frequency (iii) Logarithmic decrement
(iv) Damping ratio (v) Damping coefficient (vi) Damped frequency and
(vii) Amplitude after 6 cycles.

c. A two storey frame has the following free vibration characteristics. The frame is to be designed for the ground motion $\ddot{u}_g = \ddot{u}_{g0} \sin \bar{\omega} t$ where $\ddot{u}_{g0} = 0.4g$ and $\bar{\omega} = 25.0$ rad/sec. Calculate maximum displacements of each storey. Assume damping ratio $\xi = 5\%$ 7

Floor No.	Mass (t)	Mode No.	ω, rad/sec	Mode shapes	
				Φ_{i1}	Φ_{i2}
1	20	1	14.58	1.0	1.481
2	25	2	38.07	1.0	-0.822

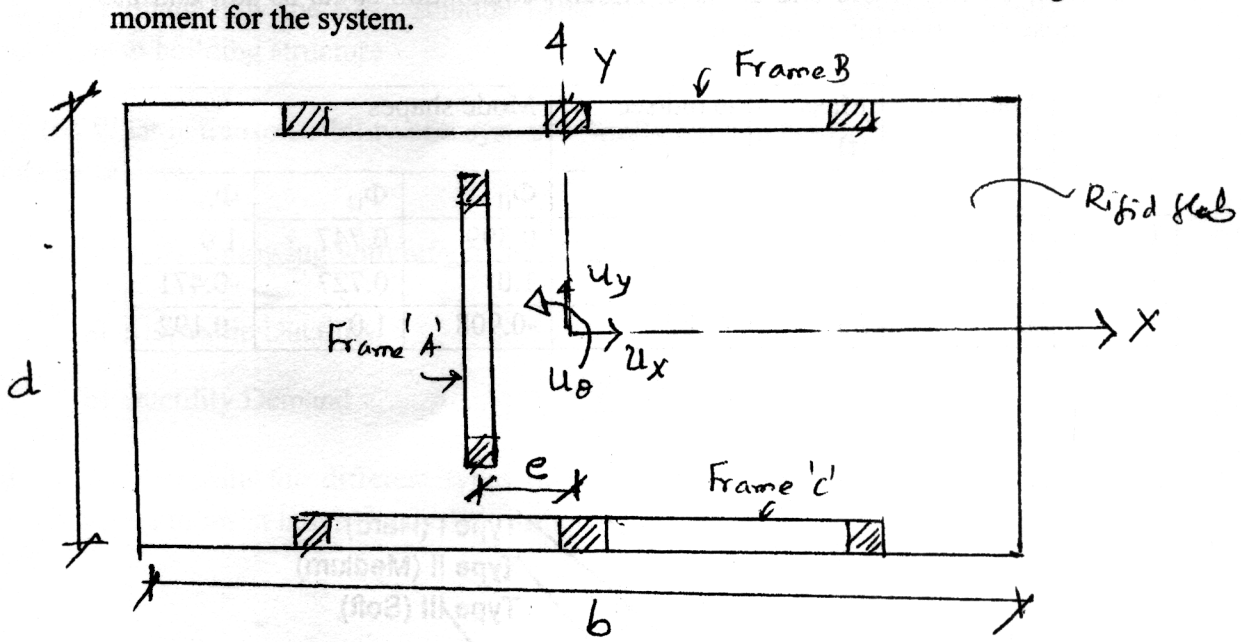
M. E. (Civil) with Structural Engineering Sem. II
Earthquake Engineering 07/05/2014.

Q.3 The plan of one storey building is as shown in figure. The structure consists of a roof idealized as a rigid diaphragm, supported on three frames A, B, and C as shown. The roof weight is uniformly distributed and has magnitude 200 Kg/m^2. The lateral stiffness are K_y = 16000 KN/m for frame A and K_x =25000 KN/m for frames B and C. The plan dimensions are b= 30 m d=20m and e=3.0m. The height of building is 10m. 20

(i) Determine the natural frequencies and modes of vibrations of the structure

(ii) If the structure is subjected to ground motion $\ddot{u}_{gy}$ only in y direction. write down the equations of motion for the system

(iii) As a special case, if e= 0, and the system is subjected to the ground motion only in Y direction, the response spectrum of which is shown in figure1. Determine the design value of lateral deformation, base shear and bending moment for the system.



Q.4 A three storey frame with free vibration characteristics as given below is subjected to a ground motion characterized by the design spectrum given in the figure 1 but scaled to peak ground acceleration of **0.4g**. Calculate the design values of lateral deformation of floors. 20

Storey No.	Mass No.	Mass (t)	ω rad/sec	Mode shapes		
				Φ_{i1}	Φ_{i2}	Φ_{i3}
1	1	36	4.92	0.336	0.759	1.0
2	2	36	13.45	-2.46	-0.804	1.0
3	3	36	18.7	1.58	-1.157	2.58

M. E. (Civil) with Structural Engineering Sem-II
Earthquake Engineering 07/05/2014.

Q.5 **a.** Explain the following :

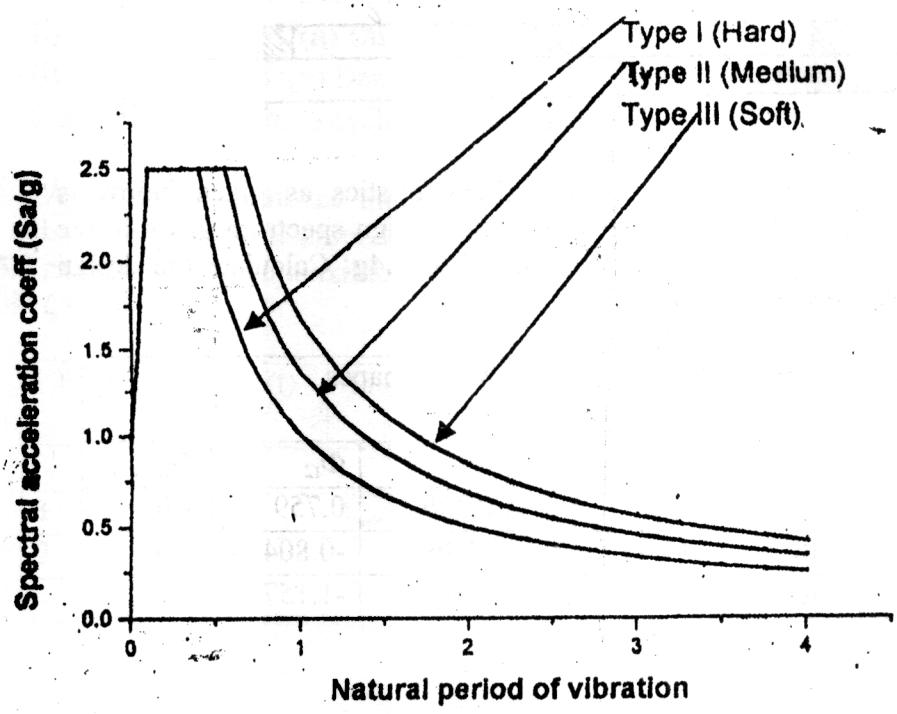
(i) Various types of Irregular Buildings as per IS 1893-2002 2

(ii) Different methods of seismic analysis as per IS 1893-2002 2

(iii) Structure of Earth 2

b. Using response spectrum method, calculate the seismic force on each floor of the frame, whose free vibration characteristics are as given below. Use the following additional data: 14
Z=0.24, I =1.5, R=3.0 and ξ = 5%. Assume foundation strata as soft and use response spectrum given in figure.

Storey No.	Mass No.	Mass (t)	ω rad/sec	Mode shapes		
				Φ_{i1}	Φ_{i2}	Φ_{i3}
1	1	20	15.73	0.399	0.747	1.0
2	2	20	49.85	1.0	0.727	-0.471
3	3	20	77.82	-0.908	1.0	-0.192



Response Spectrum as per IS 1893-2002 for 5 % Damping

M. E. (Civil) with Structural Engineering Sem. IV
Earthquake Engineering 07/05/2014.

Q.6 **a.** What is response spectrum? Explain the response spectrum characteristics. 4

b. Explain the procedure to construct elastic response spectrum for estimated peak ground motion parameters. 6

c. Explain the important provisions of IS 13920 for

(i) Beams (ii) Shear walls. 10

Q.7 **a.** What is ductility of a structure? Explain the importance of ductility in seismic resistant structures 4

b. (i) Explain how the base isolation helps in reducing the earthquake induced response in building structure 5

(ii) What is transmissibility of a system? Briefly explain how vibration isolation can be achieved. 4

c. -Explain the following with reference to SDOF systems: 4

(a) Allowable Ductility

(b) Ductility Demand

d. Briefly explain the different types of structural systems used in a building structure to resist lateral loads due earthquake 3

M. E. (Civil) with Structural Engineering Semester
Earthquake Engineering 07/05/2014.

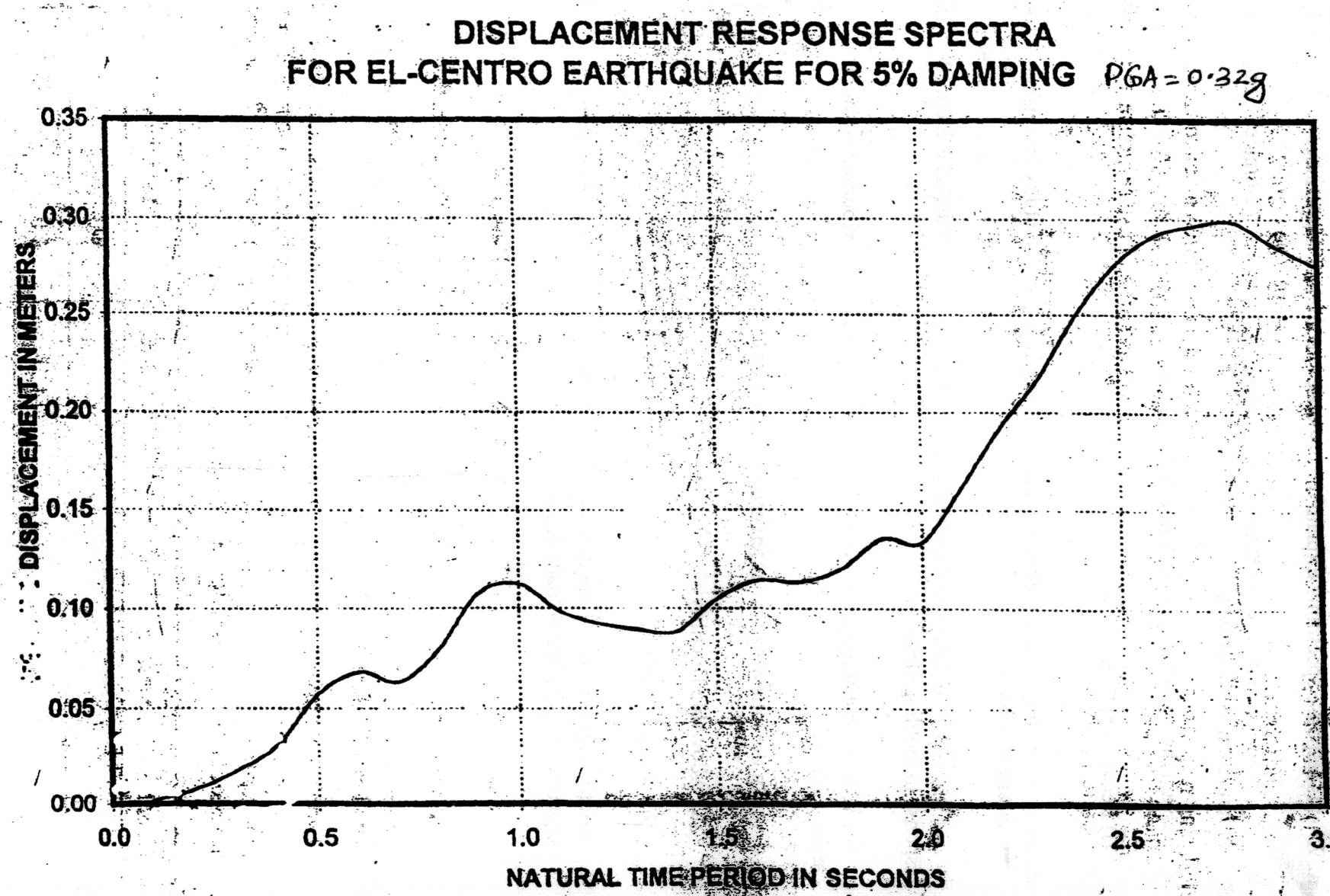


Figure 1. Q No. 2 (a), Q No. 3 & Q No. 4

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SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

JUNE 2014

Total Marks : 100 Duration : 4 Hours

CLASS/SEM : ME CIVIL SEM II SUBJECT : EARTHQUAKE ENGINEERING

(With Structural Engg. Subjects)

- Attempt any FIVE questions out of SEVEN questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.
- Assume suitable data if necessary and state the same clearly.

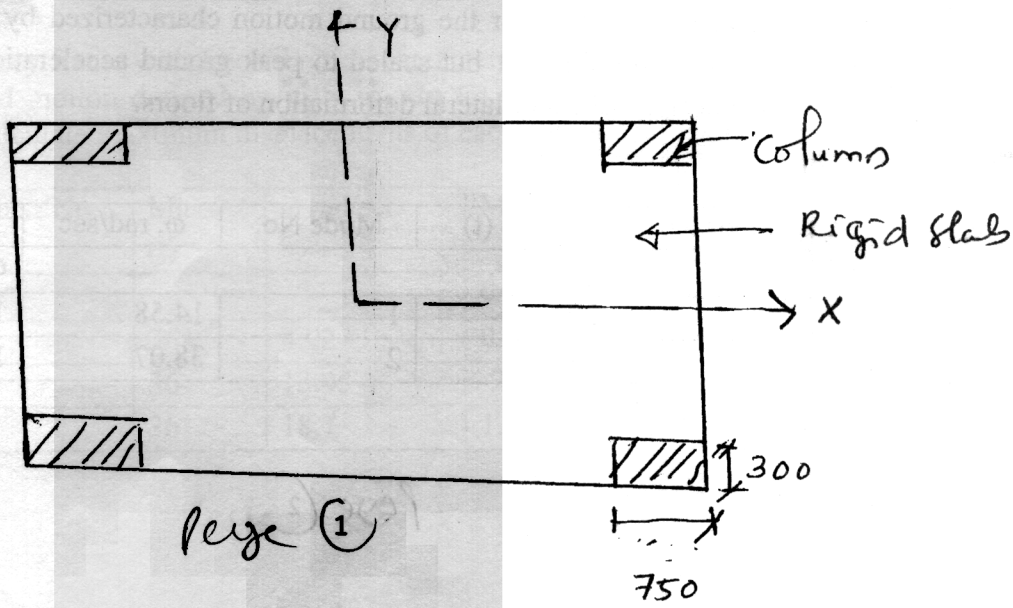
Q.1 **a.** Answer the followings:

(i) Explain clearly, the difference between static and dynamic analysis of structure 3

(ii) What is an earthquake? How the earthquakes are classified based on their causes? Briefly explain the Elastic Rebound Theory of an earthquake occurrence 5

(iii) Explain the different types of seismic waves and their characteristics 4

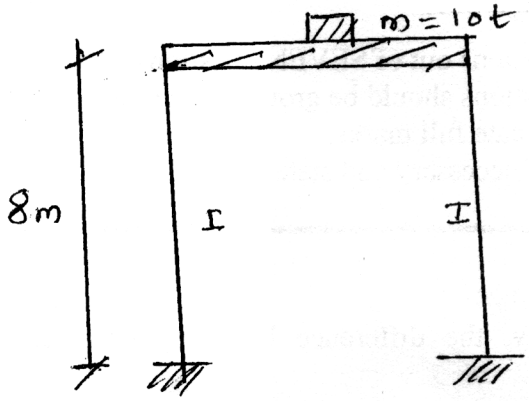
b. A uniform rigid slab of total mass 25 t is supported by four columns of height 6.0 m. rigidly connected to the top of slab and fixed at bottom. Each column is rectangular section of 750 mm x 300 mm as shown if figure. If the system is subjected to harmonic ground motion of amplitude 0.2g at frequency of 10 rad/sec in X direction only, calculate the maximum lateral displacement of slab in X direction. $\zeta = 5\%$ and $E = 20,000$ MPa. 8



M.E(C) with Str. Engg Sem II Earthquake Engg. 19/6/14

Q.2 a. (i) A single storey frame with rigid girder as shown in figure below is to be designed for ground motion, the response spectrum of which is shown in figure1. Determine the design value of lateral deformation and bending moments in the columns. 4

(ii) If the columns of the frame are hinged at base, determine the design values of lateral deformation and bending moments in columns. Comment on the influence of base fixity on the design deformation and bending moments 4



b. A machine weighing 2500 N is mounted on a supporting system consisting of four springs and four dampers. The vertical deflection of the supporting system under the weight of the machine is measured as 25 mm. The dampers are designed to reduce the amplitude of vertical vibration to one-eighth of the initial amplitude after two complete cycles of free vibrations. Find the following properties of the system: 5

(i) undamped natural frequency (ii) damping ratio and (iii) damped natural frequency.

c. A two storey frame has the following free vibration characteristics. The frame is to be designed for the ground motion characterized by the design spectrum given in the figure 1 but scaled to peak ground acceleration of **0.4g**. Calculate the design values of lateral deformation of floors. 7

Floor No.	Mass (t)	Mode No.	ω, rad/sec	Mode shapes	
				Φ_{i1}	Φ_{i2}
1	20	1	14.58	1.0	1.481
2	25	2	38.07	1.0	-0.822

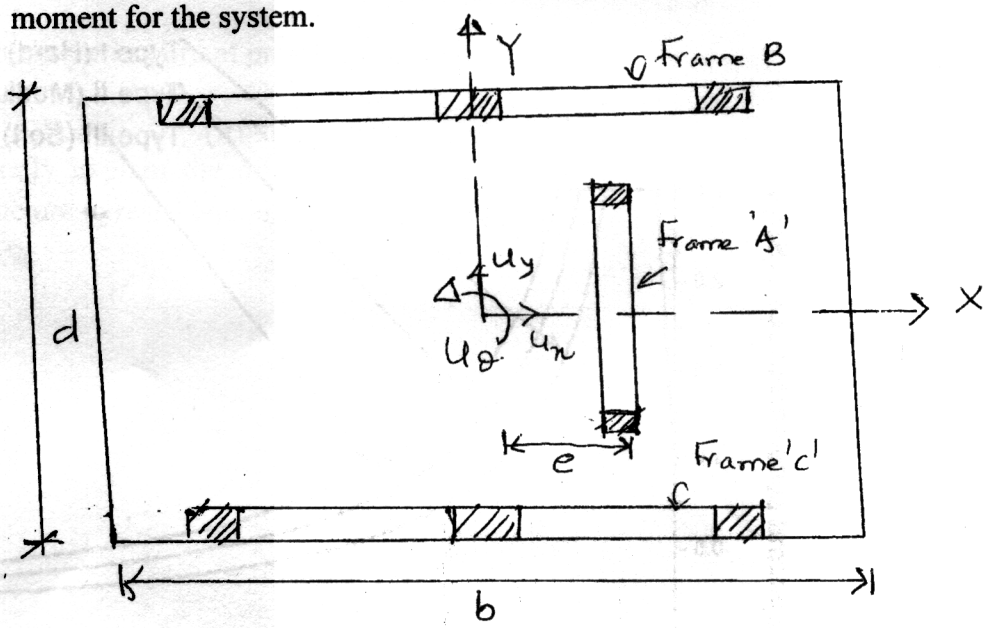
M.E(C) with Str. Engg. Sem II Earthquake Engg. 19/6/14

Q.3 The plan of one storey building is as shown in figure. The structure consists of a roof idealized as a rigid diaphragm, supported on three frames A, B, and C as shown. The roof weight is uniformly distributed and has magnitude 200 Kg/m^2. The lateral stiffness are K_y = 20000 KN/m for frame A and K_x =30000 KN/m for frames B and C. The plan dimensions are b= 30 m d=20m and e=3.0m. The height of building is 10m. 20

(i) Determine the natural frequencies and modes of vibrations of the structure

(ii) If the structure is subjected to ground motion $\ddot{u}_{gy}$ only in y direction, write down the equations of motion for the system

(iii) As a special case, if e= 0, and the system is subjected to the ground motion only in Y direction, the response spectrum of which is shown in figure1. determine the design value of lateral deformation, base shear and bending moment for the system.



Q.4 A three storey frame with free vibration characteristics as given below is subjected to a ground motion defined by $\ddot{u}_g = \ddot{u}_{g0} \sin \bar{\omega} t$ where $\ddot{u}_{g0}$ = **0.3g** and $\bar{\omega}$ = **10.0** rad/sec. Calculate maximum displacements of each storey. 20

Storey No.	Mass No.	Mass (t)	ω rad/sec	Mode shapes		
				Φ_{i1}	Φ_{i2}	Φ_{i3}
1	1	36	4.92	0.336	0.759	1.0
2	2	36	13.45	-2.46	-0.804	1.0
3	3	36	18.7	1.58	-1.157	2.58

M-Tech Civil Str. Engg. Sem II Earthquake Engg. 19/6/14

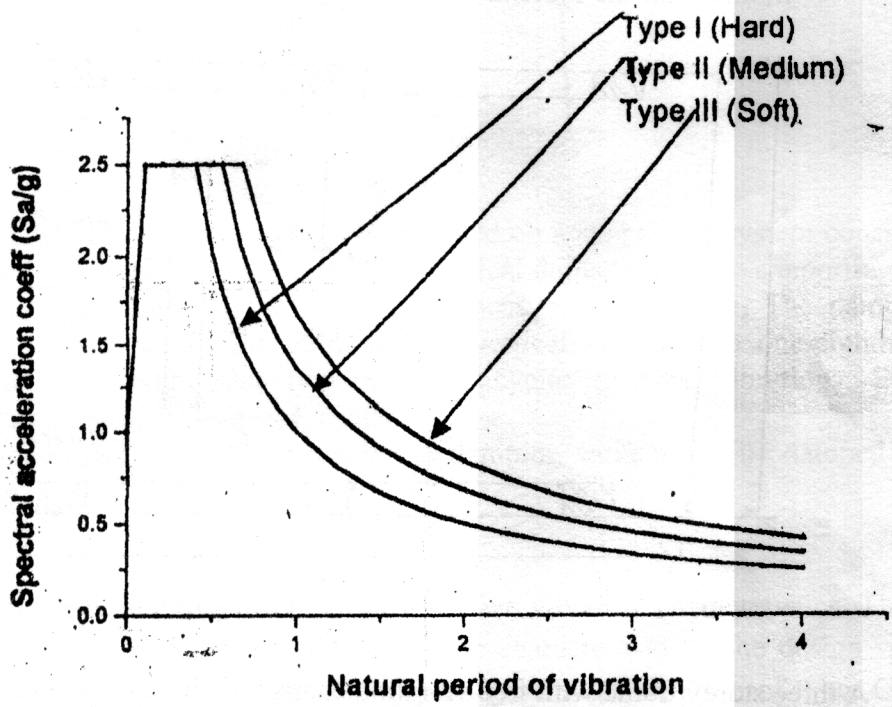
Q.5 **a.** Explain the following :

(i) Structure of Earth 2

(ii) Magnitude and intensity of an earthquake 2

(iii) Different methods of seismic analysis as per Is 1893-2002 2

b. Using response spectrum method, calculate the seismic force on each floor of the frame referred in Q.No.4. Use the following additional data: 14
Z=0.24, I =1.5, R=4.0 and ξ = 5%. Assume foundation strata as soft and use response spectrum given in figure.



Response Spectrum as per IS 1893-2002 for 5 % Damping

Q.6 **a.** What is response spectrum? Explain the response spectrum characteristics. 4

b. Explain the procedure to construct elastic response spectrum for estimated peak ground motion parameters 6

1 of 4

M.E(C) with Str. Engg Sem II Earthquake Engg 19/6/14

c. (i) Explain how the base isolation helps in reducing the earthquake induced response in building structure. 5

(ii) Explain the following with reference to SDOF systems: 5

(a) Allowable Ductility

(b) Ductility Demand

Q.7 **a.** What is ductility of a structure? Explain the importance of ductility in seismic resistant structures 4

b. Explain the important provisions of IS 13920 for 12

(i)Beams (ii) Shear walls

c. Briefly explain the different types of structural systems used in a building structure to resist lateral loads due earthquake 4

M.E.(C) with Str. Engg. Sem II Earthquake Engg 19/6/14

DISPLACEMENT RESPONSE SPECTRA FOR EL-CENTRO EARTHQUAKE FOR 5% DAMPING

PGA = 0.32g

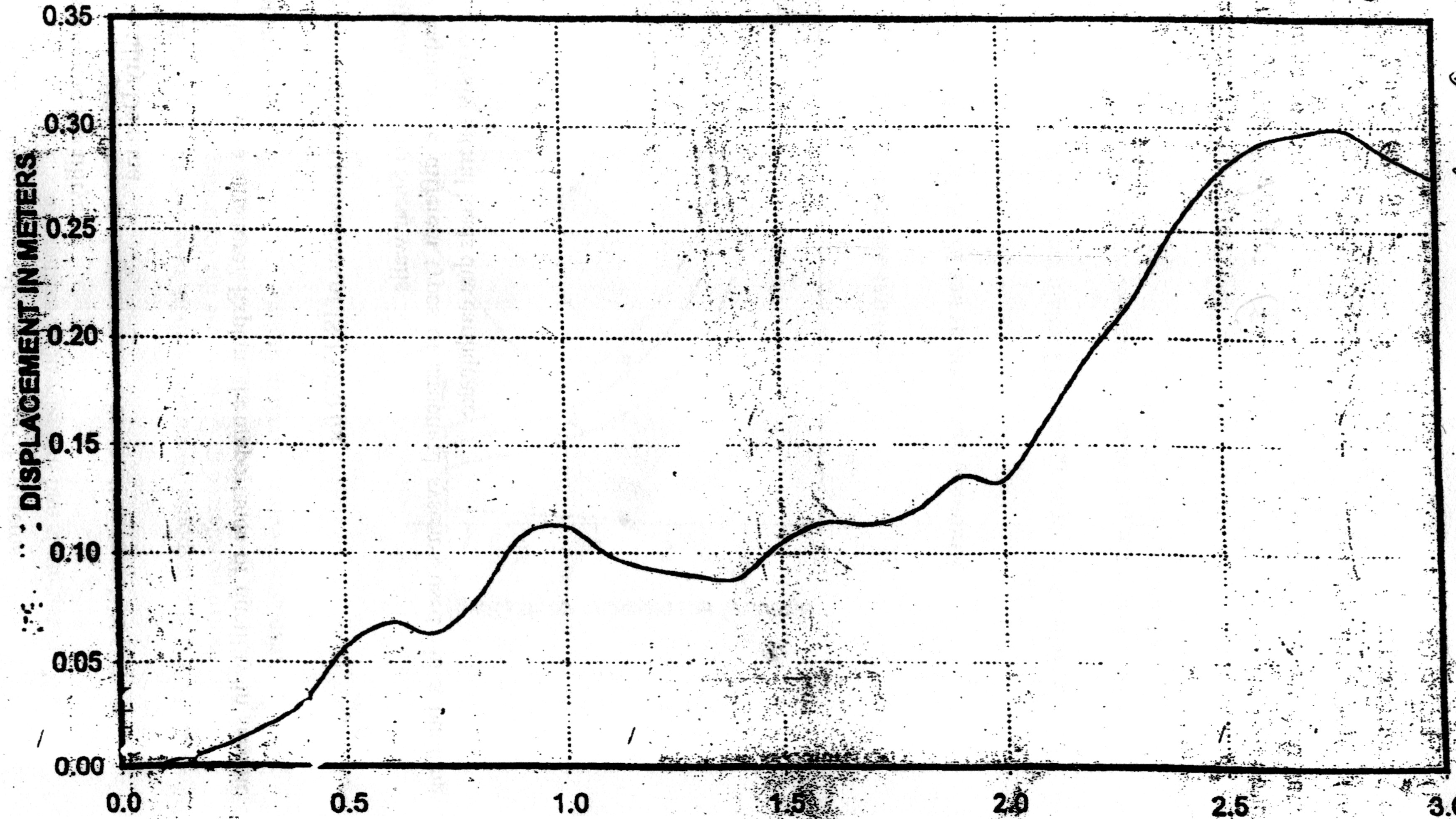


Figure-1. Q.No. 2a, 2c, Q.No 3

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SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

Total Marks : 100 Duration : 4 Hours

CLASS/SEM : ME (TRUCTURES) SEM II SUBJECT : FINITE ELEMENT ANALYSIS

MASTER

- Attempt any FIVE questions out of SEVEN questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.
- Assume suitable data if necessary and state the same clearly.

Q.1	a.	Explain the process of discretization in finite element analysis.	08
	b.	Explain C^0, and C^1 continuity	06
	c.	Explain the convergence and compatibility requirements	06
Q.2		Figure 1 shows a pin jointed frame. Determine	20
	a.	Element stiffness matrices	
	b.	Structure stiffness matrix	
	c.	Load vector	
	d.	Displacement vector	
	e.	Element forces	
	f.	Element stresses	
Q.3		Analyse the rigid jointed frame shown in figure 2 using Finite Element procedure	20
Q.4		Analyse the beam shown in figure 3 using Finite Element procedure	20
Q.5		Determine the first three frequencies of a fixed beam idealized with four elements and lump masses.	20
Q.6	a.	Derive the shape functions for a 8-noded Lagrange element	10
	b.	Derive the stiffness matrix for a constant strain triangular element of a plane stress problem	10
Q.7	a.	Explain the Jacobian matrix	06
	b.	Determine the buckling load of the cantilever column using finite element approach.	

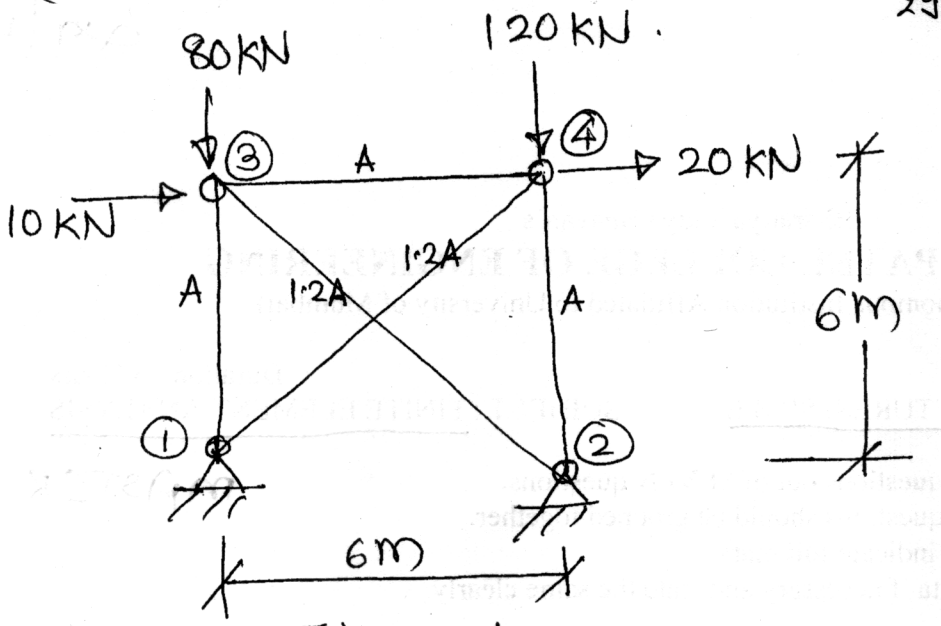

Figure-1

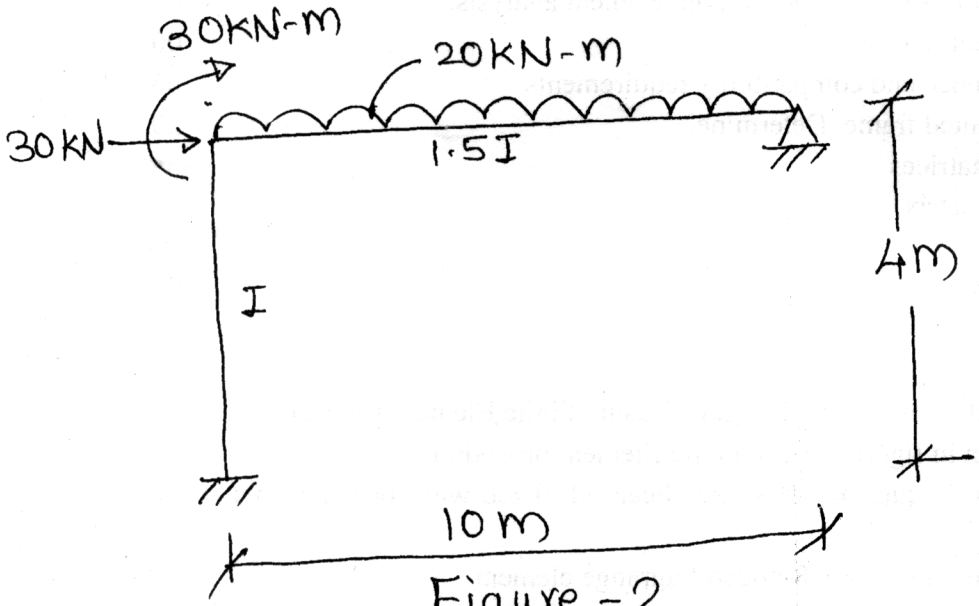

Figure-2

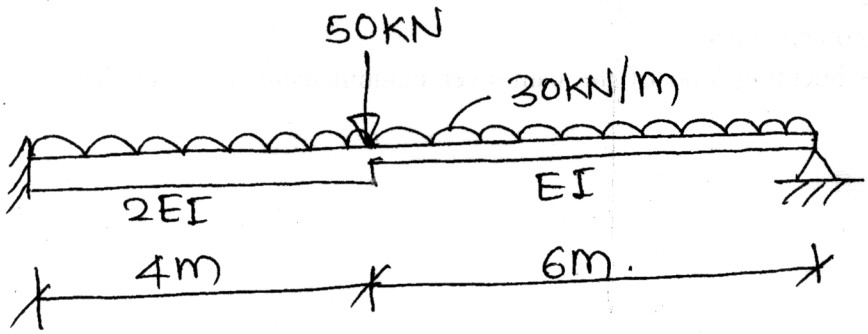

Figure-3

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SARDAR PATEL COLLEGE OF ENGINEERING

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Total Marks : 100 Duration : 4 Hours

CLASS/SEM : ME (STRUCTURES) SEM II SUBJECT : FINITE ELEMENT ANALYSIS

MASTER

- Attempt any FIVE questions out of SEVEN questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.
- Assume suitable data if necessary and state the same clearly.

Q.1 a. Explain the step by step procedure of analysis of Rigid jointed frames using finite element analysis. 08

b. Explain the convergence and compatibility requirements 06

c. Explain the use of shape functions in finite element analysis 06

Q.2 A pin jointed frame consist of four nodes A(0,0), B(6,0), C(14,0) and D(6,6) and three members AD, BD, and CD. The cross section area of all the members is 1500 mm^2. The material used is steel having modulus of elasticity as 200 GPa. The frame is subjected to load of 100 kN in the downward direction and 40 kN towards right, both acting at point D. Joints A, B and C are hinged supports. Determine, 20

a. Element stiffness matrices
b. Structure stiffness matrix
c. Load vector
d. Displacement vector
e. Element forces
f. Element stresses

Q.3 A rigid jointed frame consist of three nodes A(0,0), B(0,6) and C(8,6) and two members AB and BC. The moment of inertia of all the members is 10000 cm^4. The material used is steel having modulus of elasticity as 200 GPa. The frame is subjected to a udl of intensity 30 kN per meter in the downward direction over the member BC and a point load of 40 kN towards right, acting at point B. Joints A and C are fixed supports. Analyse the rigid jointed frame using Finite Element procedure 20

16/6/14

M.E.T.C. with Specialisation. Sem II Finite Element Analysis

Q.4	A beam consist of three nodes A(0,0), B(6,0) and C(14,0) and two members AB and BC. The moment of inertia of all the members is 10000 cm^4. The material used is steel having modulus of elasticity as 200 GPa. The frame is subjected to a udl of intensity 30 kN per meter in the downward direction over the member AB and BC and a point load of 40 kN acting at point B. Joints A is fixed and C is hinged. Joint B is supported over a spring with stiffness 1000 kN/m. Analyse the beam using Finite Element procedure		20
Q.5	Determine the fundamental frequency of a fixed beam idealized with two elements and distributed masses. What is the error associated if lumped mass is considered?		20
Q.6	a.	Derive the shape functions for a 9-noded Lagrange element	10
	b.	Derive the stiffness matrix for a constant strain triangular element of a plane strain problem	10
Q.7	a.	Derive the shape function for the four noded rectangular element starting from the first principle.	08
	b.	What is geometric stiffness matrix? Determine the buckling load of the cantilever column using finite element approach.	12

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SARDAR PATEL COLLEGE OF ENGINEERING
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MASTER

PRESTRESSED CONCRETE

Total Marks : 100 M.E.(Civil) Sem II: May 2014

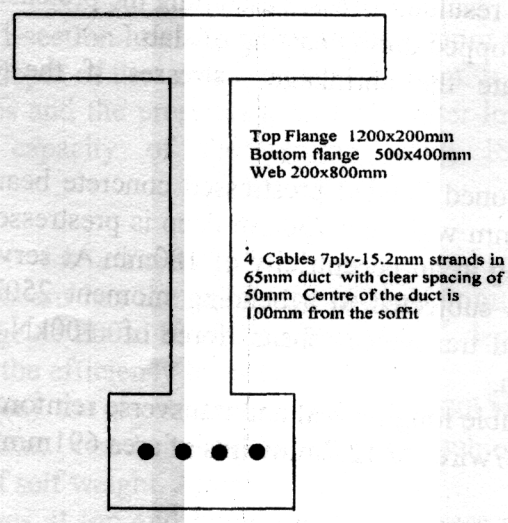
Duration 4hrs.

NOTE: 1) Question No 1 is compulsory. Answer any 4 from the remaining
2) Use of IS1343-1980, IRC-6, 18, 20 is permitted.
3) Assume the data wherever required and state it clearly

Q 1 A post tensioned prestressed concrete **bridge girder** of type 1 is shown in the figure. 20

1) Span of the girder is 25m.
2) f_p=1860MPa.
3) f_{ck}=45MPa. f_{ci}=35MPa.
4)4 cables7K-15 i.e. 7strands of 15.2mm diameter
From IS-6006-1983, area of single strand is 140mm^2. f_{pe}=.85f_p
5) DL. Bending moment=3000kNm and Shear force=375kN
6) LL. Bending moment=850kNm and Shear force=100kN

Check the ultimate flexural strength, ultimate shear strength (cracked section) and If y_{po}=112.5mm and y_o=450mm design the end block. Stress at centroidal axis due to prestress is 5MPa.



page (1)

M. E. (Civil) Sem-II Prestressed Concrete.
09/05/2014

Q 2 a Derive the equation for deflection for a PSC beam with parabolic cable having eccentricity of e_1 towards the soffit at centre of the span and eccentricity e2 towards the top at the support section. Also determine the ratio of these eccentricities for zero deflection due to prestress 06

b A simply supported PSC beam of 4m span is 150mm wide and 300mm deep. The beam is prestressed by straight cable to 1200MPa using 6wires of 7mm diameter steel at an eccentricity of 60mm.The service load is 8.5kN/m The modulus of rupture is 4MPa,E_s=210GPa and E_c=35GPa.Calculate the maximum deflection of the beam at following stages: 14
1)Prestress + self weight of the beam
2)Prestress + self weight of the beam + service load
3)cracking load
4)1.5 times the service load
5)1.8times the service load

Q 3 a State the advantages of Composite construction of prestressed concrete 04

b A composite bridge has a cast in situ 120mm thick slab and symmetrical precast pretensioned beams having flanges 200x110, the web is 75mm and the overall depth of I-section is 500mm.The beams have a span of 12m and are spaced at 750mm.E_c for prestressed beam is 30GPa and that for the cast in situ slab is 25.5GPa.The composite unit supports a live lad of 5kN/m^2.If the prestressing force of 390kN is applied through the bottom kern point. Calculate the resultant stresses assuming the pretensioned beam is (a) propped and (b) un-propped during casting of slab. 16
Also calculate the shrinkage stresses if the differential shrinkage is .0001units,

Q 4 A post tensioned bonded prestressed concrete beam of rectangular concrete section 350mm wide and 750mm deep is prestressed by an effective force of 175kN acting at an eccentricity of 180mm.At service condition a section of the beam is subjected to a bending moment 250kNm,torsional moment of 100kNm and transverse shear force of 100kN.f_{ck}=40MPa,f_y=415MPaand f_p=1600Mpa. 20
Design suitable longitudinal and transverse reinforcement in the section. Steel provided is 7wires of 12.7mmwires of area 691mm^2

M. E. (Civil) Sem-II Prestressed Concrete.

09/05/2014.

Q 5 a A post tensioned prestressed beam has got geometrical properties as given below and it is prestressed with three cables, two cables have 4nos of 7ply of 12.7mm diameter and one cable has 7nos of 7 ply strand at 12.7mm. The seven strand cable has parabolic profile with ends at 850mmfrom the soffit and at middle 320mm from the soffit. The other two cables run straight at 120mm from the soffit for full length of the beam. The parabolic cable is stressed with a force of 900kN followed by 2straight cable with a force of 514.4kN.The force are transferred after concrete has attained its 28day strength. Evaluate the losses due to 10

a)elastic deformation b)friction and wobble effect c) shrinkage

Properties of section:

$A_g=47.25x10^4\ mm^2$ $A_n=44x10^4\ mm^2$ $I_n=4.374x1010mm^4$

$y_b=505.48mm$ $y_t=494.52mm$ $m=6$ $\mu=0.25$ $k=.0035/m$

Cable 1-7strands $98.7mm^2$ each Cable 2&3 4strands $98.7mm^2$ each

b A two span continuous beam ABC has AB=10m and BC=15m is 250x600mm. The beam is prestressed by a parabolic cable concentric at the end supports and having 150mm towards the soffit of the beam at centre of the spans and 250mm towards the top of the beam at mid support B. The effective prestress is 600kN. a) State whether the cable is concordant if not then draw the stress diagram at B. b)locate the pressure line if it is subjected to live load of 6.25kN/m. 10

Q 6 a A prestressed concrete beam of 8m span and rectangular section 150mmx300mm is axially prestressed by tendon carrying an effective force of 200kN It is subjected to a UDL of 7.5kN/m including self weight. Determine the principal stress and if M35 grade of concrete is used is the section safe in tension? 08

b An un symmetrical I-section has top flange 1000x150mm and web is 200mm thick and effective depth of the cross section is 900mm. It is prestressed with 48nos of 8mm wires and the prestress is 900MPa after losses determine the ultimate moment capacity of the section using IS1343.f_p=1500MPa f_{ck}=40MPa 12

Q 7 a Derive the equation for efficiency for a prestressed concrete beam. A prestressed precast beam has the top flange 600x110mm the web is 75mm wide , bottom flange is 200x110mm and the overall depth of I-section is 500mm. Determine the efficiency the section. 10

b For the beam Q 7(a) the prestressing force of 1000kN is applied at an eccentricity of 150mm. The beam is 4m long and subjected to a UDL of 50kN/m inclusive of self weight. At centre of the span 10

determine the stresses at top and bottom using a) Stress concept b)Strength concept and c)load balancing method

2016/14
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Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING
(An Autonomous Institution Affilliated to University of Mumbai)

PRESTRESSED CONCRETE

Total Marks : 100 M.E.(Civil) Sem II: Old JUNE 2014

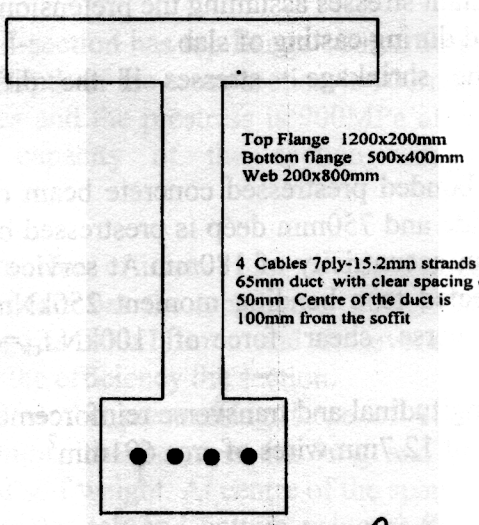
Duration 4hrs.

M.E(C) with Str. Engg. Sem II MASTER

NOTE: 1) Question No 1 is compulsory. Answer any 4 from the remaining
2) Use of IS1343-1980, IRC-6, 18, 20 is permitted.
3) Assume the data wherever required and state it clearly

Q 1 A post tensioned prestressed concrete **bridge girder** of type 1 is shown in the figure. 20

1) Span of the girder is 25m.
2) f_p=1860MPa.
3) f_{ck}=45MPa. f_{ci}=35MPa.
4)4 cables7K-15 i.e. 7strands of 15.2mm diameter
From IS-6006-1983, area of single strand is 140mm^2. f_{pe}=.85f_p
5) DL. Bending moment=3000kNm and Shear force=375kN
6) LL. Bending moment=850kNm and Shear force=100kN
Check the ultimate flexural strength, ultimate shear strength (cracked section) and If y_{po}=112.5mm and y_o=450mm design the end block. Stress at centroidal axis due to prestress is 5MPa.



Page 1

M.E(Civil) with Str. Engg. Sem II Prestressed Concrete
2016/17

Q 2 a		Derive the equation for deflection for a PSC beam with parabolic cable having eccentricity of e_1 towards the soffit at centre of the span and eccentricity e2 towards the top at the support section. Also determine the ratio of these eccentricities for zero deflection due to prestress	06
	b	A simply supported PSC beam of 4m span is 150mm wide and 300mm deep. The beam is prestressed by straight cable to 1200MPa using 6wires of 7mm diameter steel at an eccentricity of 60mm.The service load is 8.5kN/m The modulus of rupture is 4MPa,E_s=210GPa and E_c=35GPa.Calculate the maximum deflection of the beam at following stages: 1)Prestress + self weight of the beam 2)Prestress + self weight of the beam + service load 3)cracking load 4)1.5 times the service load 5)1.8times the service load	14
Q 3 a		State the advantages of Composite construction of prestressed concrete	04
	b	A composite bridge has a cast in situ 120mm thick slab and symmetrical precast pretensioned beams having flanges 200x110, the web is 75mm and the overall depth of I-section is 500mm.The beams have a span of 12m and are spaced at 750mm.E_c for prestressed beam is 30GPa and that for the cast in situ slab is 25.5GPa.The composite unit supports a live lad of 5kN/m^2.If the prestressing force of 390kN is applied through the bottom kern point. Calculate the resultant stresses assuming the pretensioned beam is (a) propped and (b) un-propped during casting of slab. Also calculate the shrinkage stresses if the differential shrinkage is .0001units,	16
Q 4		A post tensioned bonded prestressed concrete beam of rectangular concrete section 350mm wide and 750mm deep is prestressed by an effective force of 175kN acting at an eccentricity of 180mm.At service condition a section of the beam is subjected to a bending moment 250kNm,torsional moment of 100kNm and transverse shear force of 100kN.f_{ck}=40MPa,f_y=415MPaand f_p=1600Mpa. Design suitable longitudinal and transverse reinforcement in the section. Steel provided is 7wires of 12.7mmwires of area 691mm^2	20

Page 2

M.E(C) with Str. Engg. Sem II Prescribed Course 20/6/14

Q 5 a A post tensioned prestressed beam has got geometrical properties as given below and it is prestressed with three cables, two cables have 4nos of 7ply of 12.7mm diameter and one cable has 7nos of 7 ply strand at 12.7mm. The seven strand cable has parabolic profile with ends at 850mmfrom the soffit and at middle 320mm from the soffit. The other two cables run straight at 120mm from the soffit for full length of the beam. The parabolic cable is stressed with a force of 900kN followed by 2straight cable with a force of 514.4kN.The force are transferred after concrete has attained its 28day strength. Evaluate the losses due to 10

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b A two span continuous beam ABC has AB=10m and BC=15m is 250x600mm. The beam is prestressed by a parabolic cable concentric at the end supports and having 150mm towards the soffit of the beam at centre of the spans and 250mm towards the top of the beam at mid support B. The effective prestress is 600kN. a) State whether the cable is concordant if not then draw the stress diagram at B. b)locate the pressure line if it is subjected to live load of 6.25kN/m. 10

Q 6 a A prestressed concrete beam of 8m span and rectangular section 150mmx300mm is axially prestressed by tendon carrying an effective force of 200kN It is subjected to a UDL of 7.5kN/m including self weight. Determine the principal stress and if M35 grade of concrete is used is the section safe in tension? 08

b An un symmetrical I-section has top flange 1000x150mm and web is 200mm thick and effective depth of the cross section is 900mm. It is prestressed with 48nos of 8mm wires and the prestress is 900MPa after losses determine the ultimate moment capacity of the section using IS1343.f_p=1500MPa f_{ck}=40MPa 12

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b For the beam Q 7(a) the prestressing force of 1000kN is applied at an eccentricity of 150mm. The beam is 4m long and subjected to a UDL of 50kN/m inclusive of self weight. At centre of the span determine the stresses at top and bottom using a) Stress concept b)Strength concept and c)load balancing method 10

Page B

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

Subject : Theory of Plates

CLASS: ME (STRUCT) SEM II

Date: / /2014

Total Marks : 100

Duration : 4 Hour

M. E. (Structures) Sem - II Theory of plates MASTER

- Figures to the right indicate full marks.
- Assume suitable data if necessary and state the same clearly.
- Solve any **Five** questions.

Q.1 (a) Derive relationship for a strain energy of rectangular plate subjected to bending moment Mx and My (14)

(b) What are the assumptions of classical plate theory? Discuss limitations of classical plate theory in detail. (06)

Q.2 For a circular plate of radius ***a*** simply supported on edges is uniformly loaded of load intensity ***q*** over the inner portion of plate bounded by circle of radius ***c***, derive equation for moment M*r* and M*t* (20)

Q.3 Derive non-homogeneous Biharmonic plate equation for rectangular plate using equilibrium conditions and hence derive value of Qx and Qy in terms of operator delta (20)

Q.4(a) Write mathematical expressions for different boundary conditions: (10)

a) Simply supported
b) Free edge
c) Partially fixed edge
d) Elastic support
e) Elastic support and restraint

(b) A solid circular plate of radius 0.45m with its outer edge simply supported is subjected to UDL of 5.0 MPa. If allowable stress in plate is limited to 50 MPa calculate (i) Thickness of plate. And (ii) maximum deflection. (10)
E= 2 x 10^4 N/mm2 and υ = 0.3

Q.5 For a square plate of size 5 m x 5 m simply supported on all edges and having thickness as 150 mm determine maximum deflection of plate and bending moment , if it is subjected to UDL of 15 N/ m2 E= 2 x 10^4 N/mm2 and υ = 0.3 . Use **finite difference** method. (20)

Q.6(a) A square plate with two opposite edges simply supported and other two edges clamped is subjected to a partially sinusoidal load. Determine maximum deflection and maximum positive bending moment using Levy's method. (15)

(b) Explain difference between Levy's method and Navier's method. (05)

Q.7 For a simply supported rectangular plate of size ***a*** x ***2a*** subjected to UDL of intensity ***q*** derive value of maximum deflection, maximum moment M*x* and M*y* and reactive edge forces at *x*=0 and at *y*=0 . Use Navier's method. (20)

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Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

Subject : Theory of Plates

CLASS: ME (STRUCT) SEM II (Re-exam) Total Marks : 100

Date: /06/2014 Duration : 4 Hour

MASTER

- Figures to the right indicate full marks.
- Assume suitable data if necessary and state the same clearly.
- Solve any **Five** questions.

Q.1 (a) Explain in detail difference between Lavy's method and Navier's method for plate analysis. (12)

(b) Explain the importance of Finite difference method in detail. (08)

Q. 2 A simply supported circular plate of radius "a" is subjected to point load P acting at centre of plate. Derive expression for deflection and bending moment. Calculate value of maximum deflection. (20)

Q. 3 For a square plate of size 5 m x 5 m simply supported on all edges and having thickness as 150 mm determine maximum deflection of plate and bending moment , if it is subjected to UDL of 10 KN/ m2 E= 2 x 10^4 N/mm2 and υ = 0.3 . Use **finite difference** method. (20)

Q. 4 A Rectangular plate of size a x a is simply supported on opposite edges . It is subjected to a UDL of intensity "q" over entire surface. Determine maximum bending moment and deflection for the plate using Levy's method. (20)

Q. 5 Explain why the corners of a simply supported laterally loaded square plate is subjected to a reactive force R. Derive expression for R . Calculate R for a plate of size 3.5 m x 2.5 m x0.12 m which carries UDL of 4.0 Kn. /M^2 (20)

Q. 6 (a) A solid circular plate of radius 0.40m with its outer edge completely restrained is subjected to UDL of 6.0 MPa. If allowable stress in plate is limited to 50 MPa calculate (i) Thickness of plate. And (ii) maximum deflection. (12)
E= 2 x 10^4 N/mm2 and υ = 0.3

(b) Derive relationship between twisting moment and twist of the surface of bent rectangular plate. (08)

Q. 7 A square plate with edges simply supported is subjected to uniformly varying load of Maximum intensity as P_0. Determine maximum deflection and maximum positive bending moment using Navier's method. (20)

Page 1