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22/11/17

M.Tech. Civil - sem I.

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058.

November 2017

Max. Marks: 100 Duration: 3 Hour

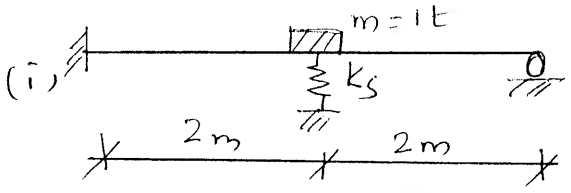
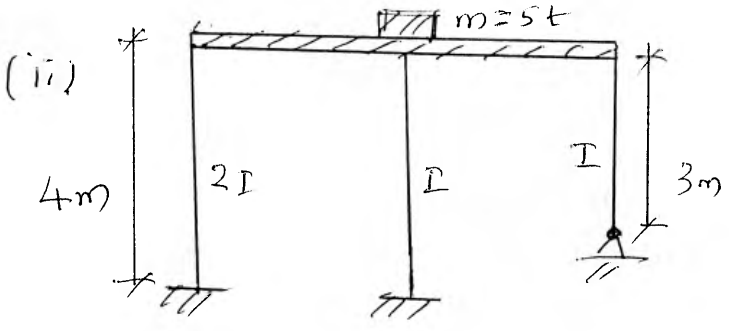
Class: M.Tech. Semester: I Program: Civil Engineering with Structural Engineerin

Name of the Course: Structural Dynamics Course Code : MTST102

Master file.

Instructions:

- 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.

Question No		Max. Marks	Course Outcome No.	Module No.
Q 1 (a)	**(i)** Define Dynamic load. Distinguish between Prescribed and Random dynamic loads	3	1	1
	(ii) Define Damping and state the effects of damping.	2	1	2
Q 1(b)	For the structural systems shown in figure compute the natural frequency of vibration (i)  K_s = 1000 kN/m EI = 10,000 kN-m² (ii)  E = 2×10⁵ N/mm² I = 20,000 cm⁴	7	2	2

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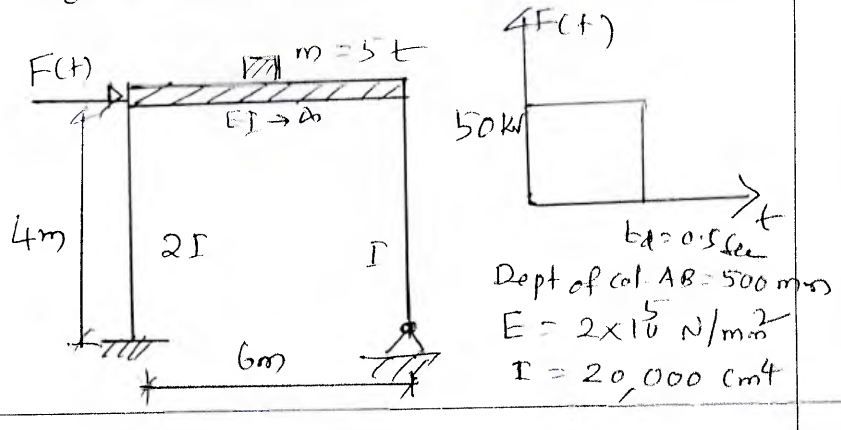
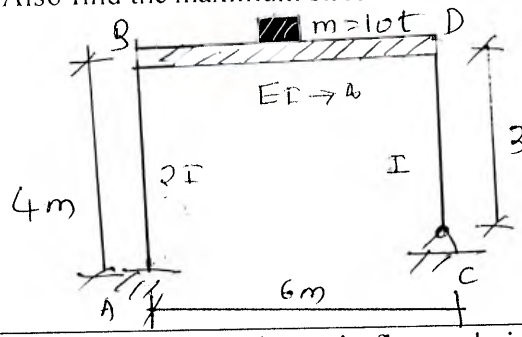
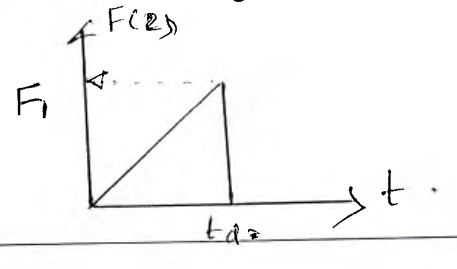
Q 1 (c).	The frame shown in figure is subjected to a rectangular pulse type load as shown in figure at girder level. Calculate the maximum horizontal displacement at girder level and maximum bending moment in column AB.  Dept of col AB = 500 mm. E = 2×10^5 N/mm^2 I = 20,000 cm^4	8	2	2
Q 2 (a)	A platform weighing 1500 N is supported on four columns. The columns are identical and clamped at both ends. It has been determined experimentally that a force of 250 KN horizontally applied to platform produces a displacement of 3.0 mm. Damping is 5%. Determine the following : (i) Stiffness of structure (ii) Damped frequency (ii) Damping coefficient (iii) Logarithmic decrement (iv)Number of cycles and time required for the amplitude of motion to be reduced from initial of 3.0 mm to 0.3 mm	5	2	2
Q2 (b)	A rigid steel frame shown in figure is subject to harmonic ground motion with amplitude of ground acceleration 0.2g and frequency 0.9 times the frequency of structure. Assuming the ratio as 2%, determine the maximum displacement at girder level. Also find the maximum stresses in each column.  E = 2×10^4 N/mm^2 col size 600 deep X 300 wide for both columns.	8	2	2
Q2 (c)	For the pulse type force shown in figure, derive the expression for DLF. 	7	2	2

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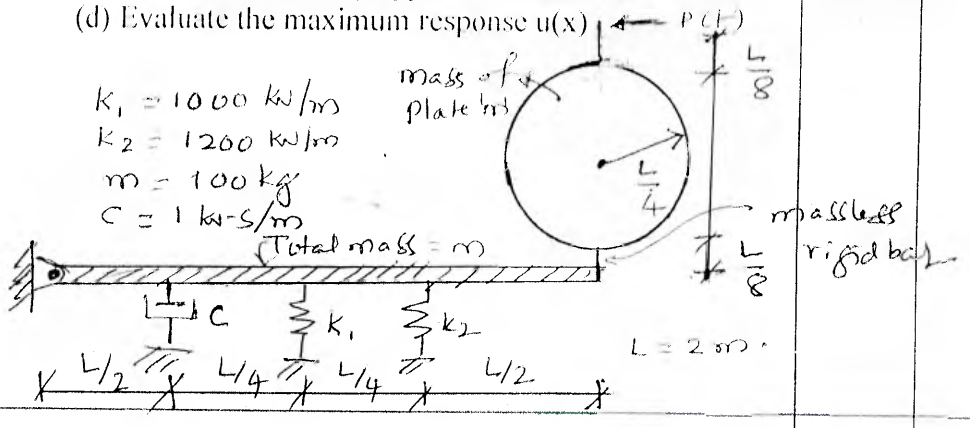
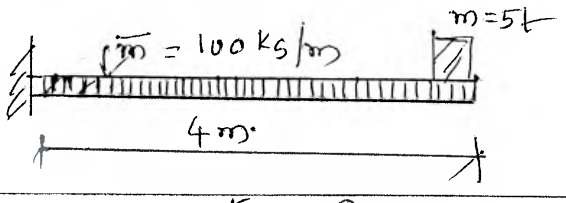
Q3	For the rigid body system shown in figure: (a) Formulate the equation of motion (b) Determine the natural frequency and damping ratio (c) Determine the displacement response u(x, t) due to p(t)= P_0, a suddenly applied constant load (d) Evaluate the maximum response u(x) 	20	2	4
Q 4	A three storey single bay frame has storey height of **4 m.** each. All columns are **230 mm** wide **X 600 mm** deep& beams are very stiff. The mass on each and floor is **20 t.** **E = 20000 Mpa.** Calculate natural frequencies & mode shapes	20	2	5
Q 5 (a)	State and prove orthogonality principle. Also state the significance of orthogonality principle in dynamic analysis	5	2	5
Q 5 (b)	A three storey frame with free vibration characteristics as given below is subjected to a suddenly applied constant load of **50 KN** at 2nd floor level and **100 KN** at the 3rd floor level. Calculate maximum displacements of each storey.	15	2	6

Storey No.	Mass No.	Mass (t)	ω rad/sec	Mode shapes		
				Φ_{i1}	Φ_{i2}	Φ_{i3}
1	1	30	4.92	0.336	0.759	1.0
2	2	30	13.45	-2.46	-0.804	1.0
3	3	30	18.7	1.58	-1.157	2.58

Q 6(a)	For the beam shown in figure calculate the fundament frequency using Rayleigh's Method. 	10	2	2

$E = 10^5 N/mm^2$

$I = 10^8 mm^4$

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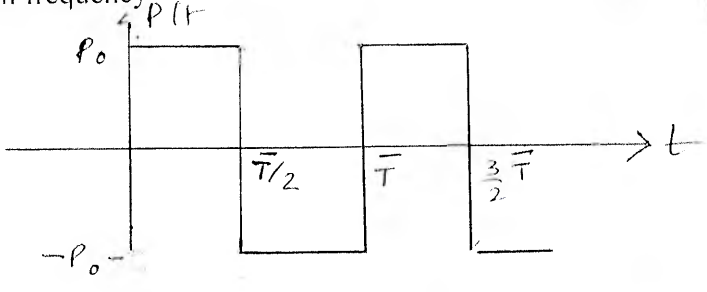
Q 6(b)	A simply supported beam of 6m span, 300 mm wide 600 mm deep carries a suddenly applied force of 100KN at centre. Calculate the maximum displacement and bending moment responses at mid span and shear force at left support. E= $2x10^4$ Mpa. and density of material = 2500 kg/m^3. Take contribution from the four lowest contributing modes	10	2	7
Q 7(a)	Briefly explain the frequency domain method for analysis for dynamic response	5	3	3
Q 7(b)	SDOF system having natural frequency ω is subjected to square wave excitation as shown in figure. Determine the steady state response of the un damped system. Take $\omega=5\varpi$, where ϖ is excitation frequency 	10	2,3	3
Q 7(c)	What is transmissibility of a system? Briefly explain how vibration isolation can be achieved	5	2	3

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M.Tech. (Struct) Sem I

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.
End Semester Exam
November 2017

Q. P. Code:
Duration: 3hrs
Program: Civil
Course Code : MTST101

Max. Marks: 100
Class: M. Tech (struct) Semester: I
Name of the Course: Advanced Solid Mechanics

Master file.

Instructions:
Attempt any five questions

Question No		Maximum Marks	Course Outcome Number
Q1(a)	Write equations for plane stress and plane strain problem in terms of stress σx and σy when body forces are zero.	(05)	1
(b)	For a stress at a point in a body determine normal strains in X Y and Z directions if E =2 x 10^4 N/mm^2 and ν =0.3	(15)	1

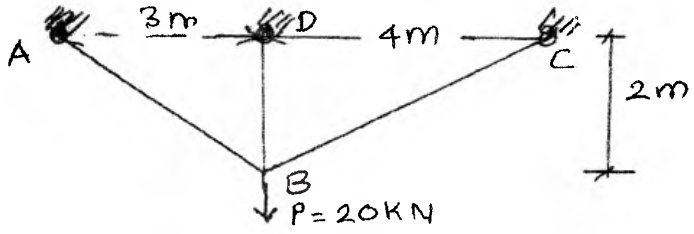
$$\sigma = \begin{bmatrix} 20 & 30 & -50 \\ 30 & 40 & 60 \\ -50 & 60 & 40 \end{bmatrix} \text{ MPa}.$$

Q2	The State of stress at a point in a body relative to XYZ coordinate system is given by determine Principal stresses and direction cosine associated with maximum principal stress. Determine Maximum shear stress at a point.	(20)	1

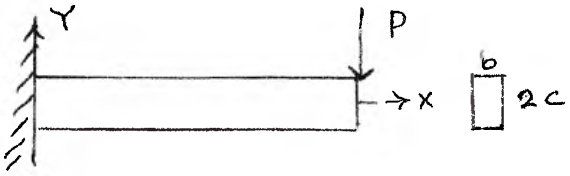
$$\sigma = \begin{bmatrix} 20 & 10 & 10 \\ 10 & 20 & 10 \\ 10 & 10 & 20 \end{bmatrix} \text{ MPa}$$

M.Tech. (Struct) Sem I

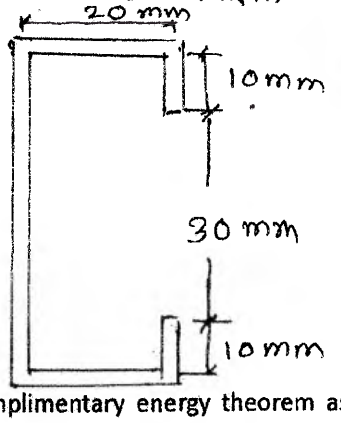
Q3(a)	Derive equilibrium equations for state of stress in 3D with body forces.	(10)	2
(b)	Draw shear flow due to torsion in circular section, thin tubular section, equilateral triangular section, I section and thin tubular section with cut. Explain which section is structurally most effective to transmit Torque.	(10)	3
Q4(a)	Derive Bi-harmonic equation for Airy's function in polar co-ordinates	(12)	2
(b)	Calculate forces in each cable and vertical displacement of joint B . Effective area of each member is 100mm2, P= 20Kn and E= ~~2x10⁵ N/mm2~~ 2×10^5 N/mm2	(08)	3



Q5	For the beam shown if stress field is given as $\sigma_x = -\frac{M_z y}{I_z}$ $\tau_{xy} = \frac{P}{2 I_z}(c^2 - y^2)$ Determine u(x,y) and v(x,y).	(20)	2



Q6 (a)	Determine location of shear centre "e" for the cross section shown. Wall Thickness = 4mm	(16)	3



(b)	Explain use of complimentary energy theorem as compared to Castigliano's first theorem.	(04)	3
Q7(a)	For the circular cross section determine maximum shear stress and angle of twist per unit length for following data, Diameter of section 50 mm, E= 200 GPa and v =0.3 Torque = 10000 N-mm	(10)	3
(b)	Derive equation for radial stress for concentrated force on flat boundary. (Flament solution)	(10)	2

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Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

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Munshi Nagar, Andheri (West), Mumbai – 400058.

End Semester Exam

November 2017

Max. Marks: 100 Duration: 3 Hours
Class: M.Tech Semester: I Program: M.Tech (Civil) with Structural Engineering Courses
Name of the Course: Non Linear Analysis

Course Code : MTST 103

Master file.

Instructions:

- 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.

Question No		Max Marks	Course Outcome Number	Module No.
Q.1 (a)	What are the advantages and disadvantages of plastic analysis over elastic analysis?	(05)	1	1
Q.1 (b)	What are different methods of buckling analysis? Explain	(05)	3	4
Q.1 (c)	Explain the modes of buckling in case of a symmetrical I section.	(05)	4	6
Q.1 (d)	In case of lateral buckling of rectangular beam in pure bending, write the expression for critical stress and explain the terms involved in the expression.	(05)	4	7
Q.2 (a)	Find the length of the plastic hinge for a simply supported beam of rectangular cross section and span L, subjected to a uniformly distributed load of w / m length on the entire span.	(10)	1	1
Q.2 (b)	Find the shape factor of an unsymmetrical I section with following details: Top flange width = 250 mm & thickness = 20 mm Bottom flange width = 400 mm & thickness = 30 mm Depth of web = 300 mm and thickness of web = 25 mm	(10)	1	1

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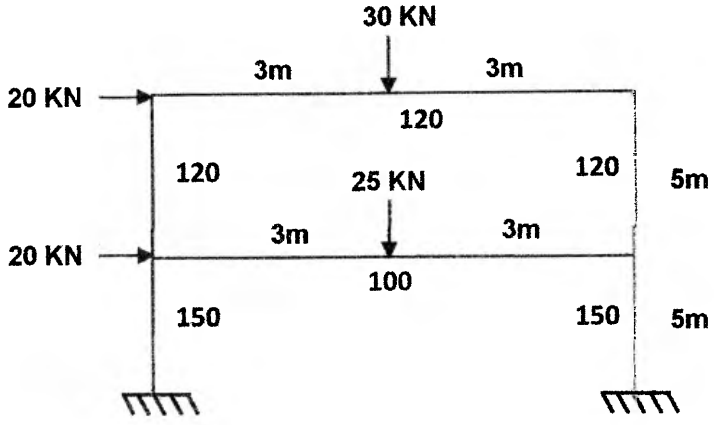
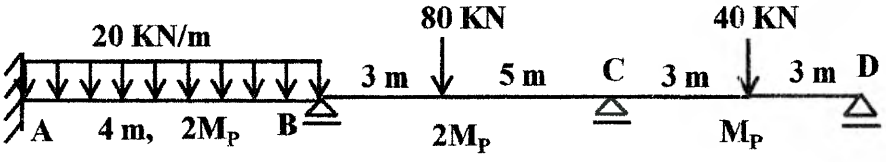
Q.3 For the frame shown in figure below, find the collapse load factor. Loads shown in the figure are working loads and the plastic moment capacity of each member in KN-m is also shown in the figure. (20) 1 2



Q.4 (a) A continuous beam is subjected to working loads as shown in figure below. If $M_P = 60$ kN-m, calculate the (true) load factor for the beam. (10) 1 1



Q.4 (b) Write a note on effect of axial force on plastic moment capacity of a flexural member. (10) 2 3

Q.5 (a) A simply supported column of length L is under the action of a compressive load P. Find the critical load by finite difference method if the flexural stiffness of the member varies according to (10) 3 4

$EI(x) = EI_0 \quad 0 \le x \le L/4$

$= 2EI_0 \quad \frac{L}{4} \le x \le \frac{3L}{4}$

$= EI_0 \quad \frac{3L}{4} \le x \le L$

Q.5 (b) Use energy method and find the critical load of the column given in Question No 5 (a) above. (10) 3 4

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Q.6 (a)	What is a beam column? Explain	(05)	3	5
Q. 6 (b)	For a beam column with simple supports at the end, derive the expression for transverse deflection at any section when subjected to a transverse load of W at the mid span and an axial load of P at its both ends. Also determine the maximum deflection and maximum bending moment.	(10)	3	5
Q. 6 (c)	The buckling load obtained by energy approach is less than that obtained by exact analysis. Is this statement true? Explain.	(05)	3	4
Q.7 (a)	How is a solid section different from a thin walled open section when subjected to axial load? Explain	(05)	4	6
Q.7 (b)	Write a note lateral buckling of beams. What are the factors on which the lateral buckling of a beam depends?	(10)	4	7
Q.7 (c)	Explain St. Venant's torsion and warping torsion	(05)	4	6

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Sardar Patel College of Engineering

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Munshi Nagar, Andheri (West), Mumbai – 400058

END SEMESTER

NOVEMBER 2017

Program: Prestressed Concrete **Date :** 29/11/17

Course code : MTST 109 **Duration : 3hr**

Semester : I **Maximum Marks : 100**

Master file.

Name of the Course : M.Tech (Civil) - Structure

Instructions:

1. Figures to the right indicate marks for the questions.
2. Solve **Any Four main Questions** (total marked allocated to all main questions are equal).
3. Draw neat sketches (Diagrams) where ever required.
4. State the assumptions made (if any) in the solution.
5. Consider – density of concrete as 25kN/m^3 and Modulus of Elasticity of Steel as 2 x 10^5 MPa.
6. Mobile phone, IS Codes and other programmable electronic devices are not permitted, calculator is allowed.

Q. No.	Questions	Marks	Course Outcome	Module Number
Q.1	a) Explain the method of design of End Zone (Anchorage) in a typical Post tensioned concrete girders as per IS:1343-1980. Explain how the bursting force is resisted by means of various reinforcements at the end zone.	10	3	7
	b) A pre-tensioned concrete beam having a rectangular section, 150mm wide and 350mm depth, has an effective cover of 50mm. If M-40 grade concrete and f_p = 1600MPa, is used with area of prestressing steel Ap as 470sqmm, calculate the ultimate flexural strength of the section using IS:1343-1980 code provisions. Use following table from code.	15	3	7

$\frac{A_p f_p}{b d f_{ck}}$	Stress in Tension as a Proportion of the Design Strength $\frac{f_{pu}}{0.87 f_p}$		Ratio of the Depth of Neutral Axis to that of the Centroid of the Tendon in the Tension Zone x_u/d	
	Pre-tensioning	Post-tensioning with effective bond	Pre-tensioning	Post-tensioning with effective bond
(1)	(2)	(3)	(4)	(5)
0.025	1.0	1.0	0.054	0.054
0.05	1.0	1.0	0.109	0.109
0.10	1.0	1.0	0.217	0.217
0.15	1.0	1.0	0.326	0.316
0.20	1.0	0.95	0.435	0414
0.25	1.0	0.90	0.542	0.488
0.30	1.0	0.85	0.655	0.558
0.40	0.9	0.75	0.783	0.653

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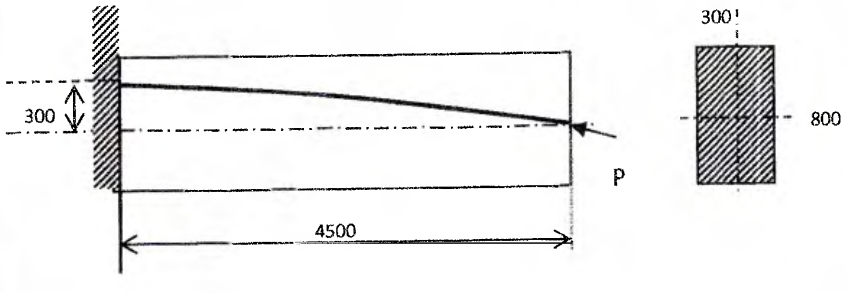
Q.2)	a) A prestressed concrete beam 150mm wide x 300mm depth, 6.5m long is subjected to a single moving point load of 65Kn. Grade of Concrete used is M-40, the cover provided to tensile reinforcement bars is equal to 50mm. The compressive prestress at the centroidal axis is 6.25 MPa. b) Estimate Shear Stress Variation (across depth) at Support and at Mid Span considering moving load only c) Estimate the Principle Tensile stress at fiber located at 50mm from top face at support (longitudinal components of prestress is 7MPa) d) Design suitable Shear Reinforcement for this beam considering Mild Steel (fy = 250 MPa) as per guidelines of IS:1343 and un-cracked section. Note, $V_c = 0.67.b_w.h.(f_t^2 + 0.8\, f_{cp}.f_t)^{1/2}$ $f_t = 0.24\ (f_{ck})^{1/2}$ (Consider Load Factor = 1.5)	20	3	7
	b) Explain the difference between shear resistance of a PSC beam as compared to RCC beam. (considering effect on principle tension and cable geometry)	5	3	7
Q.3)	a) Write a short-note on "hyper-static', 'para-static' and 'tertiary' moments generated in a continuous prestressed concrete beam.	12	1	5
	b) A Post tensioned 'I' girder, 17.5m length, is post tensioned using 3 straight cables (each containing 7 wires of 15.2mm dia each). The allowable stress in each cable is 1650MPa. The eccentricity of cable at mid-span is 100mm. Cross sectional area of the Girder is 5×10^5 mm^2, and the Section modulus is $Z_{top} = 90 \times 10^6$ mm^2 and $Z_{bottom} = 75 \times 10^6$ mm^2. During transportation to site, the beam is lifted at distance 4m from both ends. Determine the stresses during Transfer of pre-stress and handling.	13	2	5
Q.4)	a) A post-tensioned Concrete Cantilever Beam 300x800mm Depth, 4500mm long (in the form of cantilever) is stressed from free end with a curved cable profile (arc of a circle) as shown below. The cable consists of 7wires of 15.2mm Dia. Initial stress in Pre-stressing steel is 1450MPa.  Considering $\mu = 0.25$, $\alpha = 3.43°$ (as radius of cable is very high), K = 0.03, g = 25 Kn/m3 I. Determine Loss of Prestress due to Friction II. Determine Stress Variation at Support at Transfer	12	2	6

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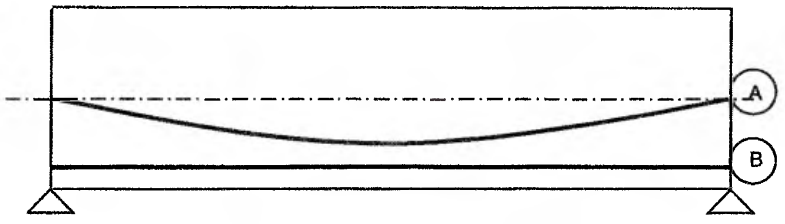
	b) A post tensioned concrete Girder, 7250mm long, 400 x 7500mm Depth is stressed with two cables, each carrying 700sq.mm area of HT wire with initial stress of 1500 MPa. Cable (A) is parabolic and stressed first, followed by stressing of Cable (B). Cable (B) is straight located at 150mm from soffit of the beam, cable (A) is located at eccentricity of 200mm from soffit of the beam at center, and coincides with Center line at the support. 	13	2	6
Q.5)	a) Explain the load balancing concept of the PSC beam (in Tabular format) considering – horizontal cable Profile, Parabolic cable Profile, incline cable with kink at center of the beam, incline cable with two kinks along the length of the beam. Explain how the equivalent BM, Shear Force, Load and Camber is determined.	15	2	5
	b) Write a short note on the design of a hollow rectangular box section subjected to Torsion and as per IS:1343 code. Explain how reinforcement detailing is done to take care of torsion.	10	3	7

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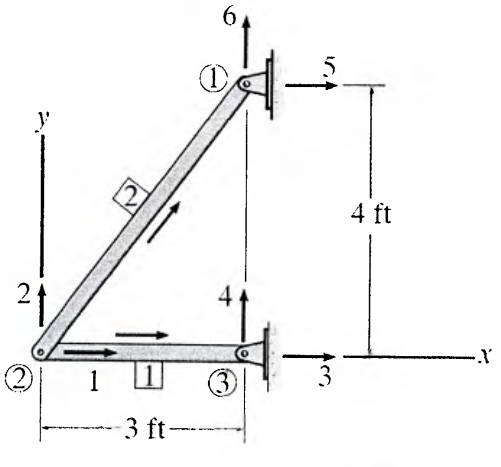
Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.
End Semester – II
November 2017

Max. Marks: 100 Q. P. Code:
Class: M.Tech Semester: I Duration: 03 Hours
Name of the Course: Advanced Structural Analysis Program: Civil Engineering with Structural Engineering
Course Code : MTST104

Master file.

Instructions:
Attempt any five questions out of seven.
Figures to the right indicate full marks
Assume suitable data if necessary and state the same clearly.

Question No		Maximum Marks	Course Outcome Number
Q.1 a	What is mean by static condensation? List the benefits and drawbacks of the same	05	02
Q.1 b	Derive the displacement transformation matrix, $\mathbf{R}_T$ for a truss element.	05	02
Q.1 c	State Betti's theorem and derive the relationship of Betti's theorem.	05	01
Q.1 d	What is the difference between Euler's and Timoshenko beam?	02	01
Q.1 e	Write the conditions for accounting the shear deformations in the analysis?	03	03
Q.2	Derive the member stiffness matrix for a shear wall element.	20	04
Q. 3	Derive the condensed stiffness equation using the method of static condensation.	20	05
Q. 4	Determine the structure stiffness matrix, $\mathbf{S}_J$ for the truss as shown below: 	20	02

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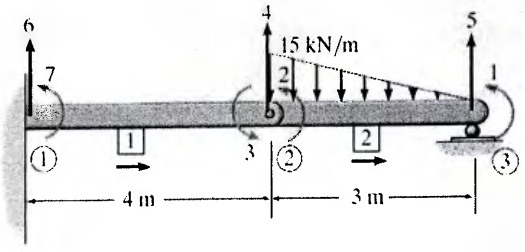
Q. 5	Determine the structure stiffness matrix, $\mathbf{S_J}$ for the beam as shown below:  	20	02
Q. 6	Derive the global flexibility equation using principles of superposition	20	06
Q. 7	Explain different types of geometric and material behavior of structures	20	07

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M.Tech. Civil. Sem I.

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

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Munshi Nagar, Andheri (West), Mumbai – 400058

End Semester Exam
Nov 2017

Program: Construction Management
M. Tech.
Course code: MTCM103
Name of the Course: Advanced Construction Techniques
Semester: I

Duration: 3 hr
Maximum Marks: 100

Master file.

Instructions:

1. **Question number one is compulsory.**
2. **Out of question no. 2 to question no.7 attempt any four questions.**
3. **Neat diagrams must be drawn wherever necessary.**
4. **Figures to the right side indicate full marks.**
5. **Assume Suitable data if necessary and state it clearly**

Que. No.		Max. Marks	Course Outcome Number	Module No.
Q1 (a)	Mass Concreting is required for dam, state the type concrete you will use along reasons and precautions to be taken during concreting.	10	CO1& CO3	4
(b)	In Mumbai city tunneling is to be carried out for laying of sewer line. State method of tunneling to be used for the same along with advantage s and disadvantages.	10	CO3	2
Q2 (a)	Discuss the purpose of soil Exploration with special emphasis on Dam Construction site.	10	CO1	1
(b)	Explain method of tunneling in hard rock using TBM	10	CO1	2
Q3 (a)	Discuss the need of underpinning along with sketch.	6	CO1	3
(b)	Discuss low cost road and their construction with special emphasis on use of fly ash.	8	CO1	5
(c)	Describe the application of sprayed concrete	6	CO1	4
Q4 (a)	Define PEBs along with the advantages and their suitability	8	CO2	6
(b)	Discuss the working of hot mix plant	6	CO1	5
(c)	Discuss the need of recycled aggregates along with the properties.	6	CO2	6
Q5(a)	Discuss different types of slip form along with care to be taken during slip form.	10	CO1	4
(b)	Explain in detail soil stabilization along with methods of soil stabilization..	10	CO1	1

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Q6 (a)	Explain cofferdam along with sketch.	8	CO1	3
(b)	State the need of sustainable construction and discuss the various materials to be used in sustainable construction	8	CO2	6
(c)	Discuss various anti- liquefaction methods	4	CO1	1
Q7 (a)	Differentiate conventional steel building and PEBs	8	CO2	6
(b)	Discuss pretensioning and post tensioning along with their advantages and applications	8	CO1	4
(c)	Brief about methods of dewatering.	4	CO1	2