M.Tech. Civil - Sem I
Structural Dynamics -

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.

library
21/11/15

End Semester Exam
November 2015

Max. Marks: 100 Duration: 4 Hours

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

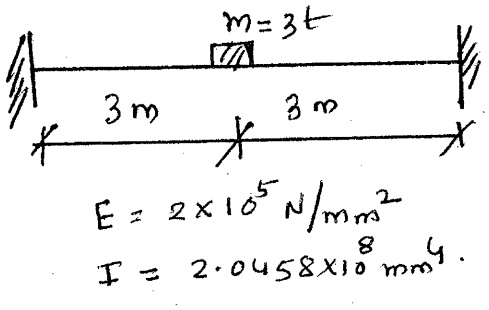
Name of the Course: Structural Dynamics Course Code : MTST102

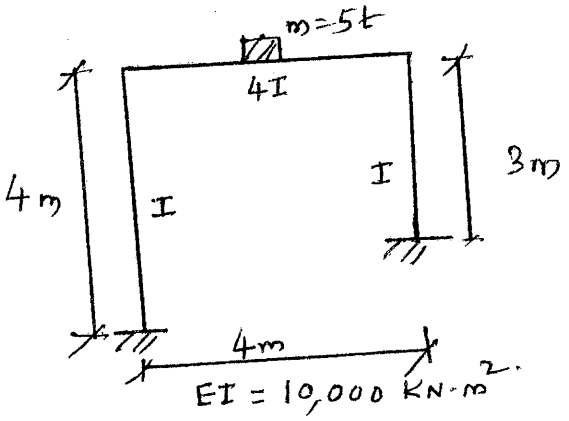
Instructions:

1 Attempt any Five questions out of Seven questions
2. Answers to all sub questions should be grouped together.
3. Figures to the right indicate full marks.
4. Assume suitable data and state the same clearly

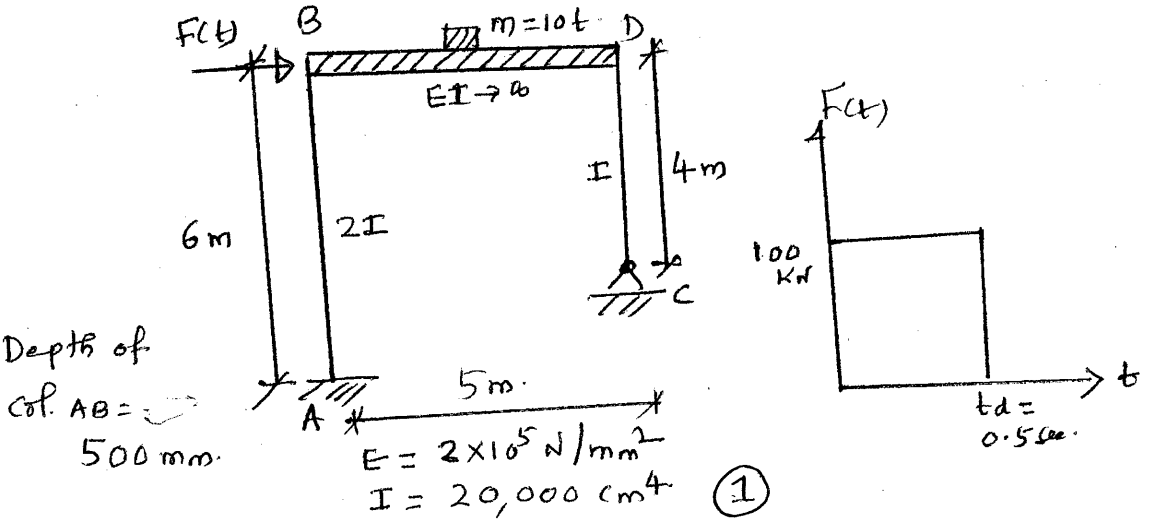
Master file.

Question No			Maximum Marks
Q1 (a)	(i)	Define Dynamic load. Distinguish between Prescribed and Random dynamic loads	3
	(ii)	State the different methods for writing the equation of motion	2
(b)		For the structural systems shown in figure compute the natural frequency of vibration	7





(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.	8



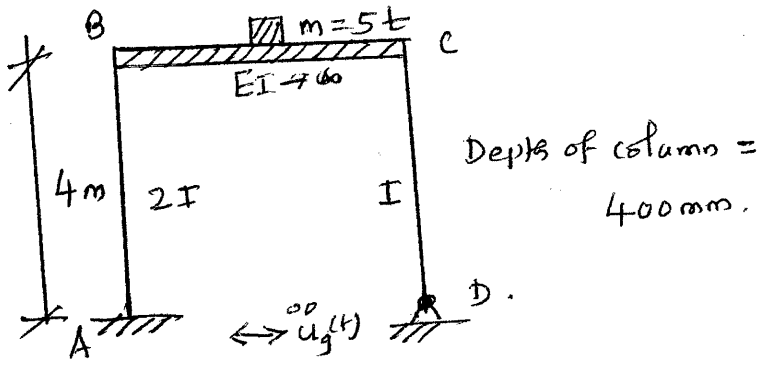
(1)

M-Tech. Civil - Sem I
Structural Dynamics - Dt. 21/11/15

Q2 (a) A platform weighing 1000 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 2.50 mm. Damping is 5%. Determine the following : **7**

(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 2.50 mm to 0.25 mm.

(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. **7**

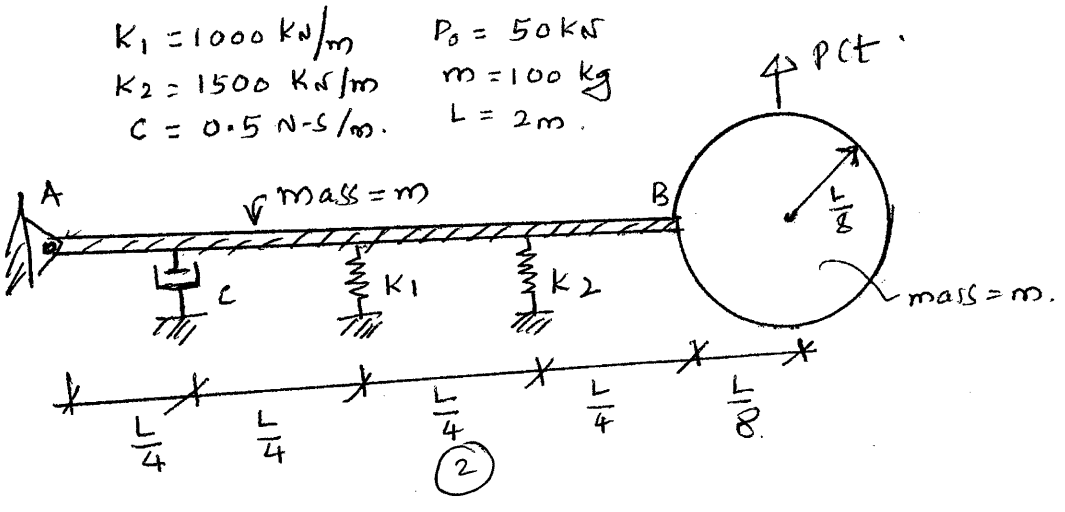


(c) A machine weighing 30 KN exerts harmonic force 3000 N amplitude, at 10 Hz at its supports. After installing the machine on a spring type isolator, the force exerted on the support is reduced to 300 N. Determine the Transmissibility Ratio TR and spring stiffness K. Assume damping ratio $\xi = 10\%$ **6**

Q3 (a) For the rigid body system shown in figure taking θ (t) at A as generalized co-ordinate: **20**

(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

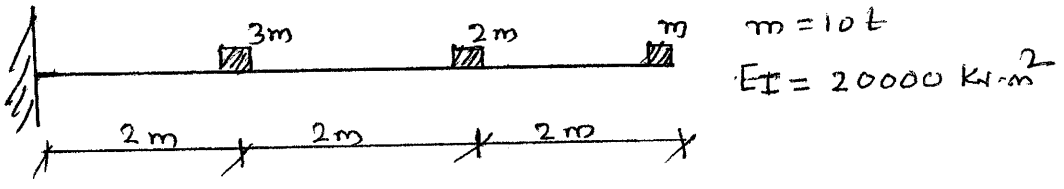
Evaluate the maximum response u(x)



M-Tech · Civil - Sem I

Structural Dynamics - Dt. 21/11/15

Q4 (a) For the cantilever beam with lumped masses as shown in figure, calculate the natural frequencies and mode shapes. **16**



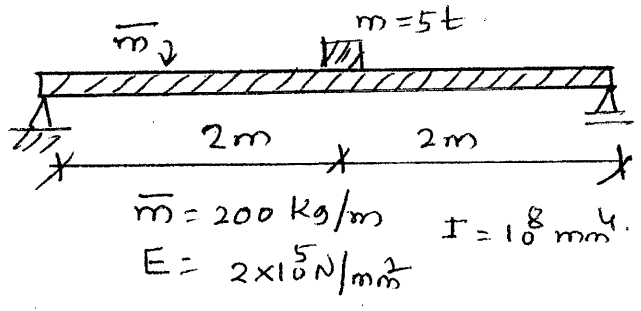
Q4 (b) State and prove Orthogonality principle. Explain the importance of Orthogonality principle. **4**

Q 5 (a) Explain the concept involved in carrying out modal analysis of structure subjected to dynamic load. **5**

Q5 (b) A three storey frame with free vibration characteristics as given below is subjected to a harmonic force with amplitude **100 KN** and at frequency of 10 rad/sec. at the 3rd floor level. Calculate maximum displacements of each storey. Take damping ratio =5% **15**

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	25	18.7	1.58	-1.157	2.58

Q6 (a) For the beam shown in figure calculate the fundamental frequency using Rayliegh's Method. **10**



Q6 (b) A simply supported beam of 6m span, 300 mm wide 600 mm deep carries a harmonic force of amplitude 100 KN and frequency 30 rad/sec applied at mid span. 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**

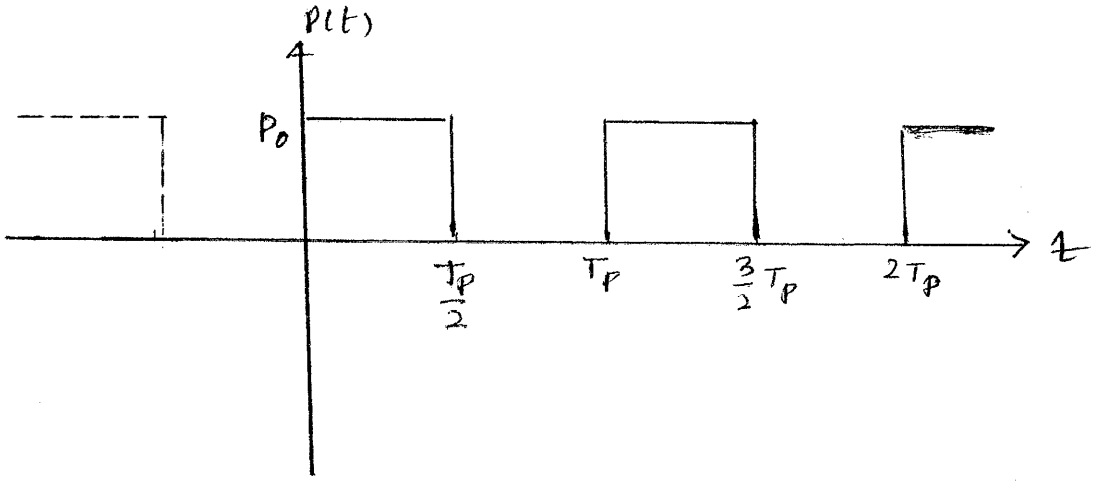
(3)

M.Tech. civil - Sem I
Structural Dynamics - Dt. 21/11/15

Q 7 (a) What is transmissibility of a system? Briefly explain how vibration isolation can be achieved **5**

(b) Explain the following in connection with random process **5**
(i) Random process (ii) Random variable(discrete and continuous)
(iii) Probability distributions (iv) Power spectral density functions (v) Auto correlation functions

(c) Determine the Fourier Representation of the periodic load shown in figure (response calculation is not required) **10**



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M Tech Civil - Sem I

Non Linear Analysis.

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri(West), Mumbai 400 058

End Semester Exam
November 2015

Max. Marks : 100 Duration : 4 Hours

Class: MTech Semester: I Program: MTech (Civil Engineering) with Structural Engineering Courses

Name of the Course: **Non Linear Analysis** Course Code : **MTST 103**

- 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.

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Q.1 (a) Write a note on effect of shear force on plastic moment capacity of a flexural member. (08)

Q.1 (b) Explain St. Venant's torsion and warping torsion. (06)

Q.1 (c) Write a note lateral buckling of beams (06)

Q.2 (a) A steel beam of rectangular cross section bxd, has a plastic moment capacity of Mp It is subjected to a bending moment of 0.7 Mp. Find the depth of elastic core. (10)

Q.2 (b) Find the shape factor of an unsymmetrical I section with the following data. (10)

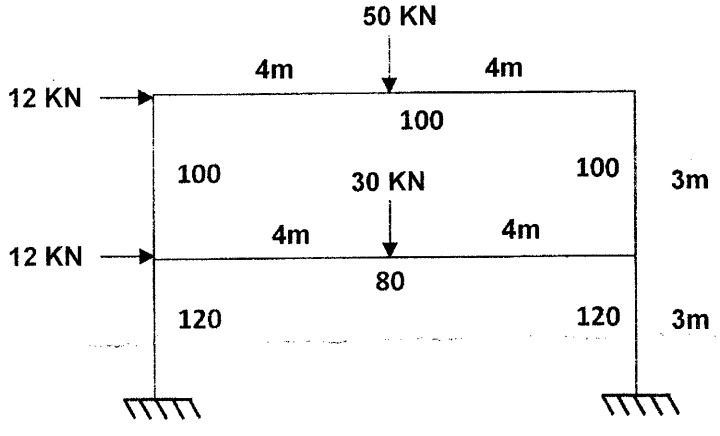
Top flange - width = 400 mm, thickness = 16 mm
Bottom flange - width = 250 mm, thickness = 12 mm
Depth of web = 300 mm, thickness = 14 mm.

M.Tech. Civil - Sem I
Non Linear Analysis Dt. 24/11/15

Q.3 (a) A propped cantilever of span 8m is subjected to two point loads of 30KN and 50KN at 2m and 5m respectively from the fixed support. Find the moment capacity of the beam. Take load factor=1.5. (10)

Q.3 (b) A three span continuous beam ABCD (Support A is hinged, supports B, C and D are on roller support) where AB= 5m, BC=6m, CD=8m. It carries a udl of 12 KN/m on span AB, a central point load of 60 KN on span BC and a point load of 50 KN at 3m to the right of support C. If the beam is to have uniform section throughout, find the plastic moment capacity of the section required. (10)

Q.4 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)



Q.5 (a) A simply supported column of length 4L 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)

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

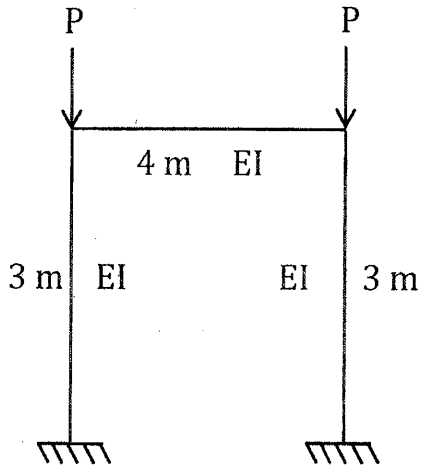
$= 2EI_0 \quad L \le x \le 3L$

$= EI_0 \quad 3L \le x \le 4L$

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

M.Tech · civil - Sem I
Non Linear Analysis · Dt · 24/11/15

Q.6 (a) Determine the critical load for the frame shown in figure. (15)



Q.6 (b) How is a solid section different from a thin walled open section when subjected to axial load? Explain (05)

Q.7 (a) Derive the governing differential equation for the torsional buckling of column with doubly symmetrical cross- section. (14)

Q.7 (b) 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. (06)

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M.E. (Structures) Sem I.
Advanced Structural Analysis.

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

Total Marks : 100 | Duration : 4 Hours

CLASS/SEM : ME (Structures) SEM I | SUBJECT : Advanced Structural Analysis

- 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.

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Q.1(a)	State and explain principle of virtual work. How it is useful in analysis of indeterminate structures.	[08]
Q.1(b)	Explain the concept of geometric stiffness matrix.	[06]
Q.1(c)	Explain the use of β matrix.	[06]
Q.2	Analyse the frame as shown in figure 1 using stiffness matrix method and draw BMD and deflected shape.	[20]
Q.3	Analyse the frame as shown in figure 2 using flexibility matrix method and draw BMD and deflected shape.	[20]
Q.4	Analyse the truss as shown in figure 3 using stiffness matrix method and tabulate member forces developed.	[20]
Q.5	Analyse the frame as shown in figure 4 using stiffness matrix method and draw BMD and deflected shape. Use static condensation with sway displacement as secondary variables	[20]
Q.6	For the truss as shown in figure 5, determine the buckling load P	[20]
Q.7	Analyse the beam as shown in figure 6, using stiffness matrix method and draw BMD and deflected shape	[20]

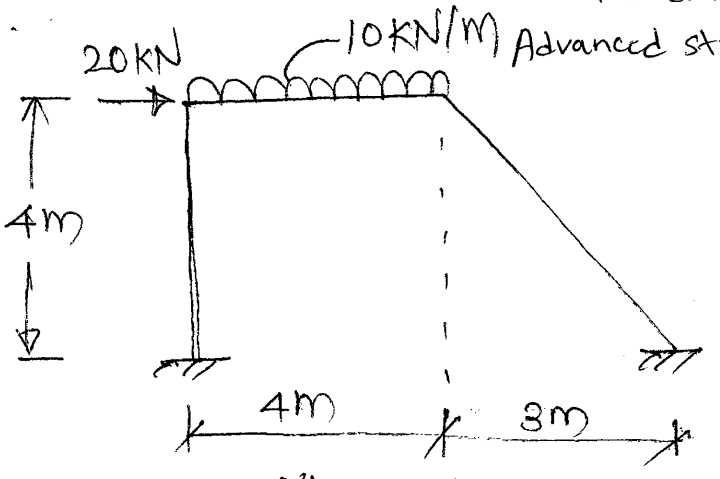


Figure -1

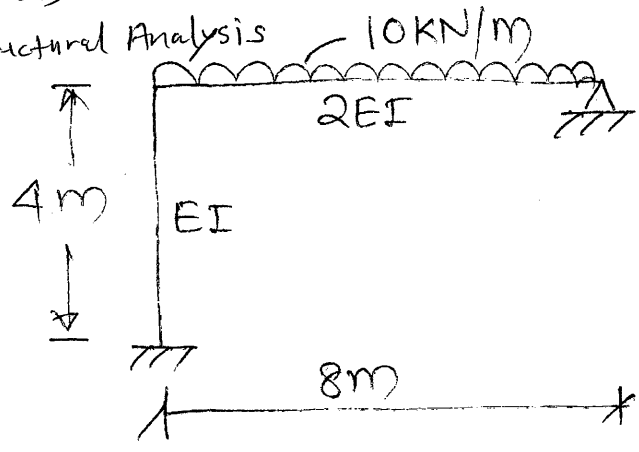


Figure · 2

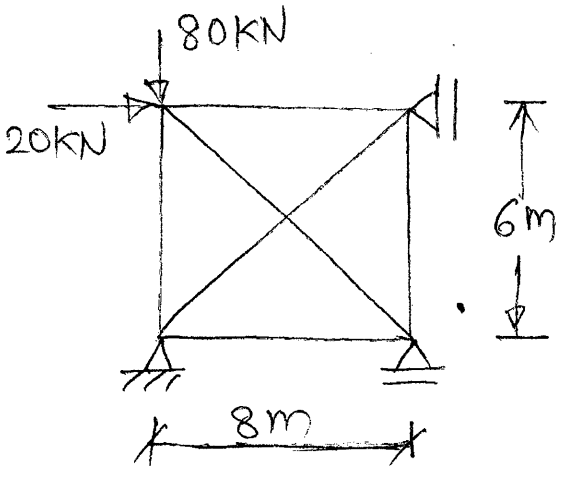


Figure-3

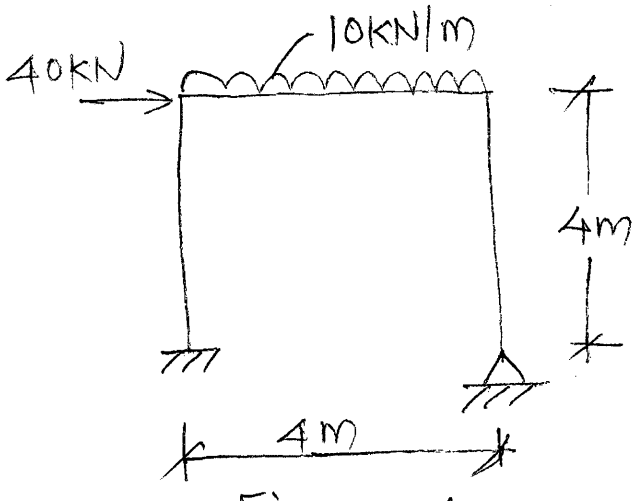


Figure-4.

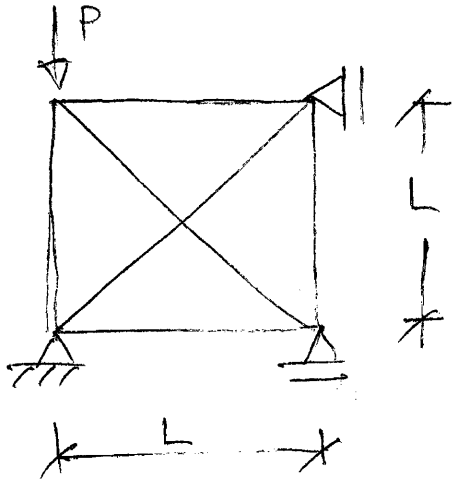
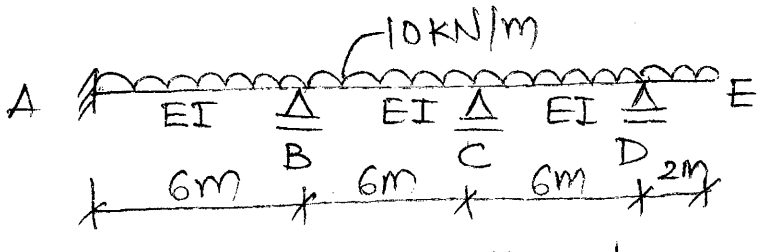


Figure-5



Support B settles down by 20 mm & Support C & D by 10 mm

Take $EI = 15000 KN\text{-}m^2$

M.E. (Struct. Engg.) Sem I.
Analysis of composite structure.

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.

End Semester Exam
November 2015

Max. Marks: 100 | Duration: 4hrs
Class: ME (Structural Engineering) | Semester: I
Program: CIVIL | Course Code : MTST 106
Name of the Course: ANALYSIS OF COMPOSITE STRUCTURE

Master file.

Instructions:

1. Question No 1 is compulsory.
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary

Question No		Maximum Marks
Q1(a)	What are the assumptions considered in micromechanical analysis?	(5)
(b)	What are the different types of laminate. Write with examples.	(5)
(c)	What is inter-laminar stress? Explain delamination.	(5)
(d)	Explain Intelligent materials?	(5)
Q2(a)	Describe the manufacturing process of metal matrix composites?	(10)
(b)	What is strain transformation and why is it required? Derive the relationship among the strains in on-axis and off-axis systems.	(10)
Q3(a)	Derive the expression for [A], [B], [D] matrices for laminate with constant properties in each lamina. Also, define each element of the matrices.	(10)
(b)	Determine [A], [B], [D] matrices for an anti-symmetric angle-ply [-45/45/-45/45] laminate. Each ply has the same thickness of 0.25mm. The material properties are E_1= 138GPa, E_2= 9GPa, E_6 = 6.9 GPa, υ_{12} = 0.3.	(10)
Q4	Using "Rule of Mixture" find the values of longitudinal young's modulus, transverse young's modulus, shear modulus and Poisson's ratio.	(20)
Q5	Briefly explain the different types of failure theories for a lamina.	(20)
Q6(a)	A carbon/epoxy unidirectional lamina is subjected to a stress system of Fig.(1). The ply properties are E_1= 150 kN/mm^2,GPa, E_2= 12 kN/mm^2, E_6 = 6 kN/mm^2, υ_{12} = 0.3, F_{1T} = 1550 N/mm^2, F_{1C} = 1150 N/mm^2, F_{2T} = 60 N/mm^2, F_{2C} = 240 N/mm^2, F_6 = 75 N/mm^2. Based on different failure theories check the safety.	(20)

M.E. (Struct & Engg.) Sem I.
Analysis of composite structure. Dt. 28/11/15

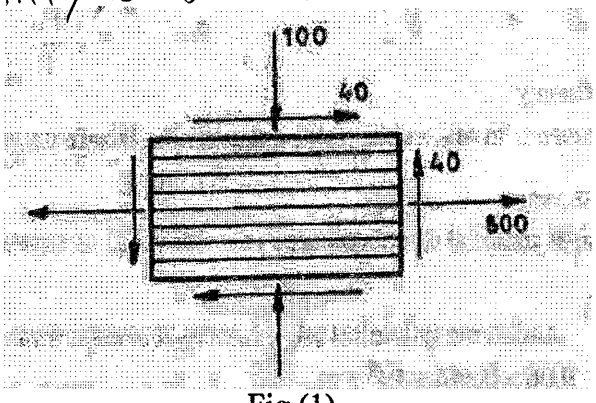


Fig.(1)

Q7(a) Explain the hygro-thermal effect on composite laminate? Find the value of coefficient of thermal expansion using micromechanics. (10)

(b) What are the Kirchhoff's theory assumptions? Derive briefly the reduced stiffness matrix for three-dimensional anisotropic to isotropic material? (10)

M.Tech, (Civil) sem I.
Structural Dynamics.

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— Re-Exam

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.

End Semester Re- Exam

December 2015

Duration: 4 Hours

Max. Marks: 100

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

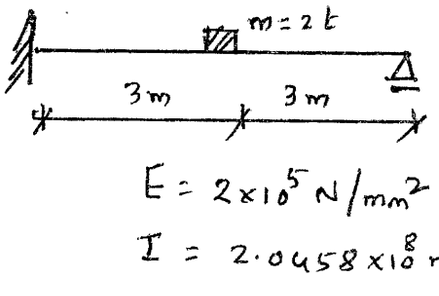
Name of the Course: Structural Dynamics Course Code : MTST102

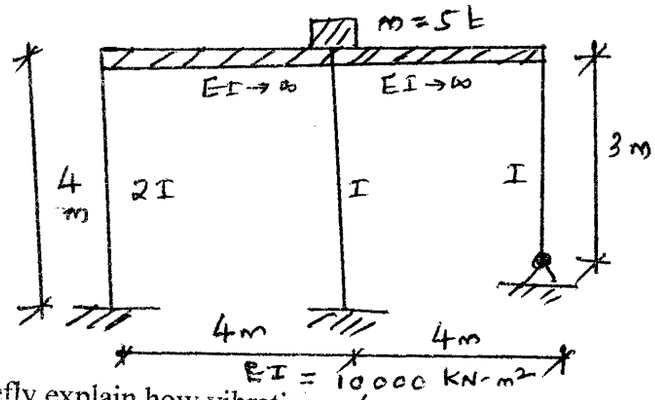
Master file.

Instructions:

1 Attempt any Five questions out of Seven questions
2. Answers to all sub questions should be grouped together.
3. Figures to the right indicate full marks.
4. Assume suitable data and state the same clearly

Question No			Maximum Marks
Q1 (a)	**(i)**	Define Dynamic load. Distinguish between Prescribed and Random dynamic loads	**3**
	(ii)	Explain clearly, the difference between static and dynamic analysis of structure	**2**
(b)		For the structural systems shown in figure compute the natural frequency of vibration	**7**





(c)		What is transmissibility of a system? Briefly explain how vibration isolation can be achieved	**8**
Q2 (a)		The stiffness and damping properties of a mass spring system are to be determined by free vibration test. The mass is given as **200 kg.** In this, the mass is displaced by **10 mm** by a hydraulic jack and then suddenly released. At the end of **4 cycle**, the time is **1 seconds** and the amplitude is **5 mm.** Determine: (i) Damped frequency (ii) Damping ratio (iii) Damping coefficient (iv)Un damped natural frequency (v) Stiffness coefficient	**7**
(b)		An SDOF system has a mass of 50 kg a damping ratio of 0.1, a natural frequency of 10 rad/sec and is subjected a harmonic excitation of amplitude 2500 N and frequency of 15 rad/sec. Determine the steady	**7**

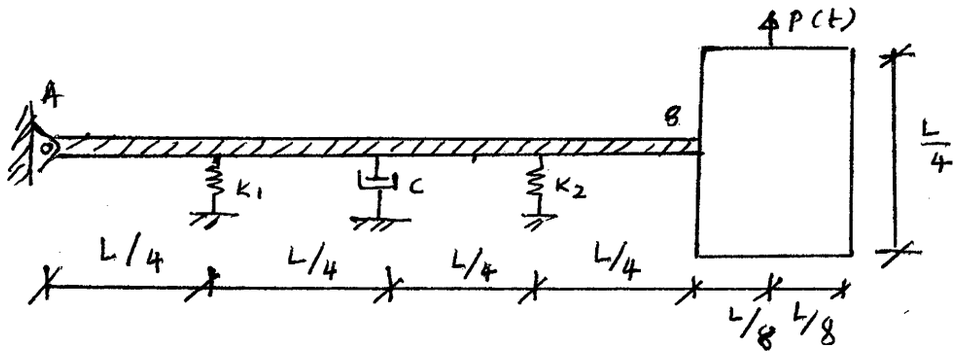
M.Tech. (civil) sem I.
Structural Dynamics. Dt. 05/01/16.

state amplitude.

(c) A machine weighing 50 KN exerts harmonic force 3000 N amplitude, at 5 Hz at its supports. After installing the machine on a spring type isolator, the force exerted on the support is reduced to 300 N. Determine the Transmissibility Ratio TR and spring stiffness K. Assume damping ratio ξ = 10% **6**

Q3 (a) For the rigid body system shown in figure taking θ (t) as generalized co-ordinate: **20**

(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
Evaluate the maximum response u(x)



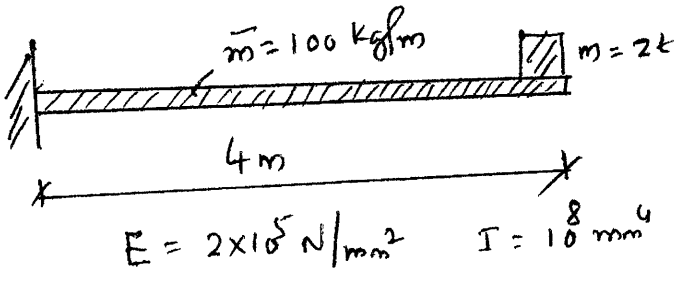
Q4 (a) A three storey single bay frame has storey height of **4 m.** each. All columns are **250 mm** wide **X 600 mm** deep& beams are very stiff. The mass on each and floor is **30 t.** **E = 20000 Mpa**. Calculate natural frequencies & mode shapes. **20**

Q 5 (a) Explain the concept involved in carrying out modal analysis of structure subjected to dynamic load. **5**

Q5 (b) A three storey frame with free vibration characteristics as given below is subjected to a suddenly applied constant load of 100KN at 3rd floor level. Calculate maximum displacements of each storey. **15**

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

Q6 (a) For the beam shown in figure calculate the fundamental frequency using Rayliegh's Method. **10**

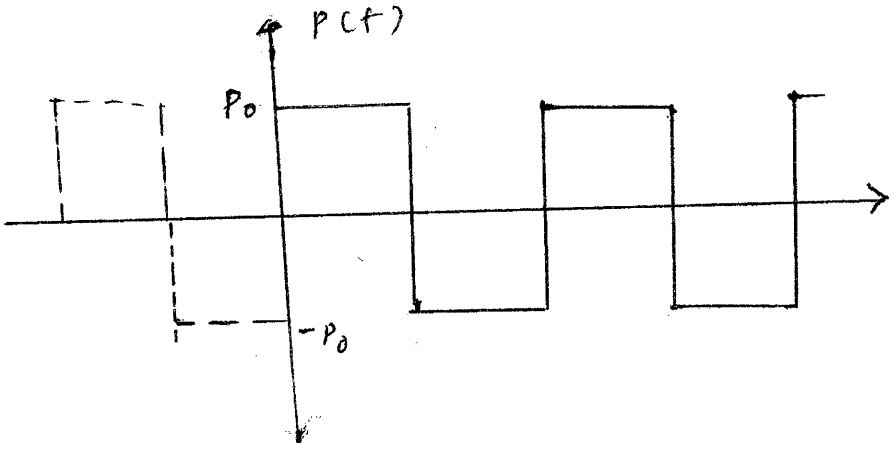


Q6 (b) Starting from first principle, derive the expression for frequency of vibration of a simply supported beam of span L, flexural rigidity EI and uniform mass m kg/m. **10**

Q 7 (a) Explain clearly how the dynamic analysis for Random dynamic load is done **5**

(b) Explain the following in connection with random process **5**
(i) Random process (ii) Random variable(discrete and continuous)
(iii) Probability distributions (iv) Power spectral density functions (v) Auto correlation functions

(c) Derive the expression for steady state response of damped SDOF system subjected Sinusoidal force **10**



M.E.(Structural Engg.) Sem I.
Analysis of composite structure.

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Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.

End Semester Exam (KT)

January 2016

Max. Marks: 100 | Duration: 4hrs
Class: ME (Structural Engineering) | Semester: I
Program: CIVIL | Course Code : MTST 106
Name of the Course: ANALYSIS OF COMPOSITE STRUCTURE

Master file.

Instructions:

1. Question No 1 is compulsory.
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary

Question No		Maximum Marks
Q1(a)	Differentiate among macromechanical and micromechanical analysis.	(5)
(b)	What are the Kirchhoff's theory assumptions?	(5)
(c)	Briefly describe how to design a laminated composite.	(5)
(d)	Do the composites have distinct advantage over metal? Explain.	(5)
Q2(a)	What is Composite? What are the advantages and limitations of Composites? How are Composites classified? Describe the manufacturing process of polymer matrix composites?	(12)
(b)	Derive briefly the reduced stiffness matrix for three-dimensional anisotropic to isotropic material?	(8)
Q3(a)	Derive the expression for [A], [B], [D] matrices for laminate with constant properties in each lamina.	(10)
(b)	Determine [A], [B], [D] matrices for a four layered symmetric cross-ply laminate. Each ply has the same thickness of 0.25mm. The material properties are E_1= 138GPa, E_2= 9GPa, E_6 = 6.9 GPa, υ_{12} = 0.3.	(10)
Q4	Find the values of elasic moduli using "Rule of Mixture".	(20)
Q5	Briefly explain the different types of failure theories for a lamina.	(20)
Q6	Explain the hygro-thermal effect on composite laminate? Derive hygro-thermal stress-strain relationship for a lamina. Find the value of coefficient of thermal expansion using micromechanics.	(20)
Q7	Write short notes on: (i)Inter-laminar stress (ii)Delamination (iii) Intelligent materials (iv) Stress transformations	(20)