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Max. Marks: 75

[8]

[7]

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IV B.Tech II Semester Regular/Supplementary Examinations, April- 2015 ADVANCED STRUCTURAL ANALYSIS

(Civil Engineering)

Time: 3 hours

Answer any FIVE Questions All Questions carry equal marks

- 1 What is generalized Hooke's law? Establish the stress strain relationship for isotropic materials and hence the relation between the elastic constants. [15]
- 2 a) What is meant by stress tensor and strain tensor? [7]
 - b) From the fundamentals obtain the compatibility equation in plane stain [8] condition.
- 3 a) How do you solve 2D problems of elasticity using Airy's stress function? [7]

b) Prove that the displacements in the plane stress problem, in the absence of body forces, must satisfy

$$\frac{\partial^2 \mathcal{G}}{\partial x^2} + \frac{\partial^2 \mathcal{G}}{\partial y^2} + \left[\frac{1+r}{1-r}\right] \frac{\partial}{\partial y} \left[\frac{\partial u}{\partial x} + \frac{\partial \mathcal{G}}{\partial y}\right] = 0$$
[8]

- 4 a) Determine the stress distribution in a hollow cylinder subjected to internal and external pressures. Explain how the solution differs from that obtained by the elementary theory.
 - b) Determine the stress components in a curved bar subjected topure bending moment "M". The radius at the inner surface and outer surface are "a" and "b" respectively
- 5 a) Obtain the equation of motion for a un damped system. Explain degree of freedom.
 - b) Determine the natural frequency of the fixed beam shown in fig, carrying a concentrated weight W at its centre. Neglect the mass of the beam. [7]



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Set No. 1

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[8]

Code No: **R42019**

- 6 a) Discuss about critically damped, over damped and under damped systems.
 - b) A SDOF system consists of a mass with a weight of 386lb and a spring stiffness of K=3000lb/in. By testing the system it was found that a force of 100lb produces a relative velocity of 12in/sec. Find damping ratio, damped frequency of vibration, logarithmic decrement and ratio of 2 consecutive amplitudes.
- 7 a) Derive an expression for undamped forced vibration of SDOF subjected to harmonic force.
 - b) A machine of weight W=3860lb is mounted on a simple supported beam as shown in fig. A piston that moves up and down in the machine produces a harmonic force of magnitude $F_0 = 7000lb$ and frequency w=60rad/sec neglecting the weight of the beam and assuming 10% of the critical damping. Determine
 - i) Amplitude of motion of the machine
 - ii) Force transmitted to the beam supports
 - iii) The corresponding phase angle.



- 8 a) Explain the numerical evaluation of Duhamels integral for undamped system, [7]
 - b) Using impulsive triangular loading obtain the expression for dynamic load factor. [8]



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IV B.Tech II Semester Regular/Supplementary Examinations, April- 2015 ADVANCED STRUCTURAL ANALYSIS (Civil Engineering)

Time: 3 hours

Answer any FIVE Questions All Questions carry equal marks *****

- 1 a) What is meant by strain at a point, Explain? State Hooke's law. [8]
 - b) Find the natural frequency of cantilever spring mass system shown below

[7]



2	a)	What is meant by plane stress and plane strain, explain with examples.	[7]
	b)	Derive the differential equations of equilibrium from the fundamentals	[8]
3	a)	How do you solve 2D problems of elasticity using Airy's stress function?	[7]
	b)	Write the solution of bi-harmonic equation using Fourier series.	[8]
4	a)	Develop the biharmonic equations in polar coordinate system and explain the procedure to solve them.	[7]
	b)	Derive the stress equations for a thick cylindrical shell of inner radius "ri" and	
		outer radius "ro" subjected to internal pressure "P"	[8]



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Code No: **R42019**

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Set No. 2

5	a)	Explain the D 'Alembert's Principle. Find the natural frequency of cantilever mass system shown in fig(i)	[8]
	b)	A spring mass system m_1 and k_1 has a natural frequency f_1 ,calculate the value of k_2 which is another spring which when connected in parallel increases the frequency by 30%.	[7]
6	a)	Explain briefly about linear and non linear elastic systems.	[8]
	b)	A single degree of freedom system consists of a mass with a weight of 20KN and aspring of stiffness K=2000N/m. By testing the system it was found that a force of 150KN produces a relative velocity of 1.4m/sec. Find i) the damping ratio ii) logarithmic decrement6 iii) the ratio of two consecutive	
		amplitudes.	[7]
7	a)	Briefly explain the response of SDOF system subjected to undamped harmonic excitation.	[8]
	b)	An electric motor of total weight of 2 KN is mounted on a simply supported beam with overhand at a distance of 2m from its centre. An unbalance of the	
		800rpm.	[7]
8	a)	Explain the numerical evaluation of Duhamels integral for undamped system,	[8]
	b)	Using impulsive rectangular loading obtain the expression for dynamic load factor.	[7]



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Set No. 3

Max. Marks: 75

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IV B.Tech II Semester Regular/Supplementary Examinations, April- 2015 ADVANCED STRUCTURAL ANALYSIS (Civil Engineering)

Time : 3 hours

Answer any FIVE Questions All Questions carry equal marks *****

- 1 a) Obtain the relations between strain-displacements and shear stress and shear strain.
 - b) Determine the natural period for the system shown in fig. Assume that the beam and the springs supporting the weight W are massless. [7]



2	a)	What do you understand by plane strain? Give two examples and justify	
		examples.	[7]
	b)	Derive the governing differential equation for a plane strain problem in terms	
		of the stress function and the potential function.	[8]
3	a)	Obtain the equation for deflection of a simply supported beam of span '2L'	
		subjected to uniformly distributed load on its entire span.	[10]
	b)	Explain Saint Venant's principle with an example.	[5]
4	a)	Derive the expression for the stresses in a curved bar of rectangular section	
		with inner radius 'a' and outer radius 'b' and of unit thickness when it is	
		subjected to bending moment M.	[8]
	b)	State the stress function used to solve two dimensional problem in polar	
		coordinates.	[7]
5	a)	Distinguish between static and dynamic loads. Describe the various types of	
		dynamic loads acting on the structures.	[7]
	b)	What do you mean by discretization. Explain various methods of discritization	
	,	of structures subjected to dynamic loading.	[8]
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Set No. 3

6 a) Explain the term single degree of freedom system with at least two examples. Deduce the equation of motion. [8]
b) What is damping? What are the methods to evaluate damping? Explain any one method? [7]
7 a) Explain the evaluation of damping at resonance and response to support motion. [8]
b) An electric motor of total weight of 2 KN is mounted on a simply supported beam with overhand at a distance of 2m from its centre. An unbalance of the rotor is 25 kg-m. Find the amplitude of vertical vibration of motor for speed 800rpm.

- 8 a) Discuss impulse loading and Duhamel's integral. [8]
 - b) Using impulsive rectangular loading obtain the expression for dynamic load factor. [7]

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Set No. 4

IV B.Tech II Semester Regular/Supplementary Examinations, April- 2015 ADVANCED STRUCTURAL ANALYSIS (Civil Engineering)

T	ime	: 3 hours Max. Mark	/Iax. Marks: 75	
Answer any FIVE Questions All Questions carry equal marks *****				
1	a)	State and explain the generalized Hooke's Law.	[8]	
	b)	What is a stress function? State and explain different types of stress functions.	[7]	
2	a)	Derive the differential equations of equilibrium and compatibility equations?	[8]	
	b)	What is the importance of boundary condition for solving the elasticity problems	[7]	
3	a) b)	How do you solve two dimensional problems in rectangular coordinates? Explain. With the origin at the center of the free end of cantilever beam derive the expressions of stresses when the point load is acting at the free end using stress	[8]	
		function.	[7]	
4	a)	Develop the Biharmonic equations in polar coordinate system and explain the various steps involved to solve the elasticity 3D problem.	[8]	
	b)	Obtain the strain components in polar coordinates	[7]	
5	a)	Explain briefly the linear and non linear systems.	[8]	
	b)	A spring mass system has stiffness 'K'N/mm and mass 'W' N. It has natural frequency of vibration of 12 Hz. An extra 20N mass is coupled to 'W' and		
		natural frequency reduces by 2Hz. Find 'K' and 'W'.	[7]	

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Code No: **R42019**

- 6 a) Obtain the expression for the response of damped SDOF subjected to initial conditions
 - b) A single degree of freedom system consists of a mass with a weight of 20KN and a spring of stiffness K=3000N/m. By testing the system it was founded that a force of 100KN produces a relative velocity of 1.2m/sec. Find the damping ratio and logarithmic decrement
- 7 a) Obtain the expression for damped forced vibration under harmonic motion. [8]
 - b) An electric motor of weight w=1000lb is mounted at the centre of a simply supported beam shown in fig. The unbalance in the rotor =W'e = 1 lb .in.Determine the steady state ampiltude of vertical motion of the motor for a speed of 900 rpm.Assume damping in the system is 10% of critacal damping.Neglect the mass of the supporting beam.



- 8 a) Explain Duhamel's integral. Obtain the response of structure subjected to unit impulse. [10]
 - b) Using impulse triangular loading obtain the expression for dynamic load factor. [5]