Code No: **R42019** **R10** **Set No. 1**

IV B.Tech II Semester Regular/Supplementary Examinations, April/May - 2016

ADVANCED STRUCTURAL ANALYSIS

(Civil Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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1 a) Derive the governing differential equations in terms of stress function and potential function for plane stress problem. [8]
b) Explain Saint Venant's Principle. [7]

2 a) Derive the governing differential equations of equilibrium for 2-D Cartesian problem. [8]
b) Derive expressions for compatibility for a two dimensional problem. Under what conditions the compatibility equation does holds for the case of plane stress and plane strain problem. [7]

3 Given the following stress function

$$\phi = \frac{H}{\pi} z\left[\tan^{-1}\frac{x}{z}\right]$$

Determine the stress components σ_x , σ_y τ_{xz}. [15]

4 a) Derive governing equations of equilibrium in Polar coordinates in radial and tangential directions. [8]
b) Discuss various applications of polar coordinates and advantages of considering problem using polar coordinates. [7]

5 a) Describe types and characteristics of typical dynamic loading with examples and essential characteristics of dynamic problem. [10]
b) An oscillating system with a natural frequency of 4Hz start with an initial amplitude of 1.5cm and initial velocity of 20cm per sec. calculate
i) Natural frequency ii) Natural period iii) Amplitude of vibration
iv) Velocity v) Acceleration vi) Phase angle vii) Time at first peak [5]

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6 a) Derive general equation of motion for undamped free vibration of an single degree of freedom system. [10]

b) A vibrating system consists of a mass 10kg spring of stiffness 100N/m and frequency with damping coefficient of 5N-s/m. determine a) the damping factor b) natural frequency of the damped vibration, c) Logarithmic decrement d) the ratio of two successive amplitudes e) the number of cycles after which the initial amplitude is reduced to 15%. [5]

7 a) Discuss the variation of Deformation response factor with frequency ratio and discuss salient observations. [8]

b) Explain Displacement, Velocity and acceleration response factors and how they are related. [7]

8 a) Explain Duhamel Integral. [5]

b) An undamped single degree of freedom system is subjected to the forcing function shown in Figure 1. The equation of the forcing function is $F = (1 - \frac{t}{q})$

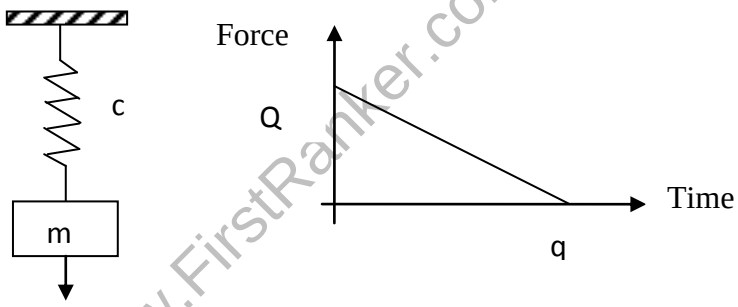

Figure 1

Obtain the response equation for t ≤ q. [10]

Code No: **R42019** **R10** **Set No. 2**

IV B.Tech II Semester Regular/Supplementary Examinations, April/May - 2016

ADVANCED STRUCTURAL ANALYSIS

(Civil Engineering)

Time: 3 hours **Max. Marks: 75**

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

1 a) Derive expressions for strain at a point in terms of stress components. [8]

b) The state of stress at a point is defined by

$$\tau_{ij} = C\begin{bmatrix} y^2+\upsilon(x^2-y^2) & -2\upsilon xy & 0 \\ -2\upsilon xy & x^2+\upsilon(y^2-x^2) & 0 \\ 0 & 0 & \upsilon(x^2+y^2) \end{bmatrix}$$

Where C is negligible body force. Does this represent true state of stress? [7]

2 a) Derive expressions for compatibility for a two dimensional problem. [8]

b) Derive the governing differential equations in terms of stress function for plane stress problem [7]

3 a) Explain Saint Venants Principal and its significance. [5]

b) Find the stress components for a simply supported beam having a narrow rectangular cross section of unit width subjected to a uniformly distributed load of intensity w/m run. [10]

4 Starting from general solution $\phi = A \log r + B r^2 \log r + C r^2 + D$, obtain the expressions for radial and hoop stresses in a thick cylinder subjected to internal fluid pressure. [15]

5 a) List out and explain different prescribed dynamic loadings with applications. [8]

b) An empty elevated water tank is pulled by a steel cable by applying a 50kN force. The tank is pulled horizontally by 5cm. The cable is suddenly cut and the resulting free vibration is recorded. At the end of five complete cycles the time is 25secs and the amplitude is 2cm. Determine the Damping ratio, Natural period of Undamped vibration, Effective stiffness, Effective weight and Damping coefficient for the given data. [7]

6 a) Under damped / Over damped / Critically damped systems with suitable examples. [10]

b) A single degree of freedom system is having a mass of 2.5kg is set into motion with viscous damping and allowed to oscillate freely. The frequency of oscillation is found to be 50Hz and measurement of the amplitude of vibration shows two successive amplitude to be 6mm and 5.5mm. Determine the viscous damping coefficient. [5]

7 a) Derive expression for response of an undamped SDOF system subjected to Harmonic excitation explaining salient features involved. [8]

b) Explain the response of single degree of freedom system to support motion. [7]

8 a) Explain Duhamel Integral. [5]

b) Derive expression for response of a structure to rectangular impulse. [10]

Code No: **R42019** **R10** **Set No. 3**

IV B.Tech II Semester Regular/Supplementary Examinations, April/May - 2016

ADVANCED STRUCTURAL ANALYSIS

(Civil Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

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1 b) Derive expressions for compatibility for a two dimensional problem. [8]

a) Derive the governing differential equations of equilibrium for 2-D Cartesian problem. [7]

2 a) Explain Saint-Venant's principle. [5]

b) Determine the stress components and sketch their variation in a region included in Z= 0 , Z= d, x= 0 on the side x positive for the problem if plane stress satisfied by the stress function $\phi = -\frac{3F}{4d}\left[xz - \frac{xz^3}{3d^2}\right] + \frac{pz^2}{2}$ [10]

3 a) Explain solution of a elasticity problems using Polynomials. [5]

b) Using polynomial derive expressions for bending of a cantilever beam subjected to a concentrated load at the free end. Sketch the stress variation. [10]

4 Starting from general solution ϕ = A log r +B r^2 log r +C r^2 +D, obtain the expressions for radial and hoop stresses in a thick cylinder subjected to external fluid pressure. [15]

5 a) Describe types and characteristics of typical dynamic loading with examples and essential characteristics of dynamic problem. [5]

b) Derive expression for equation of motion of single degree freedom systems from the following concepts. i) Dynamic equilibrium. ii) Stiffness, damping and mass components. [10]

6 a) Derive expression relating the decay of motion associated with damping. [8]

b) The successive amplitudes from a free vibration test for a structure are 1.00, 0.5, 0.25 and 0.15 units respectively. Determine the damping ratio (assuming it to be very small) of the system considering i) each cycle separately and ii) considering them all together. [7]

7 a) Derive expression for response of a damped SDOF system subjected to Harmonic excitation explaining salient features involved. [10]

b) Explain i) Resonance ii) situation of the structure at resonance. [5]

8 a) Explain Duhamel Integral. [8]

b) Derive expression for response of a structure to triangular impulse. [7]

Code No: **R42019** **R10** **Set No. 4**

IV B.Tech II Semester Regular/Supplementary Examinations, April/May - 2016

ADVANCED STRUCTURAL ANALYSIS

(Civil Engineering)

Time: 3 hours **Max. Marks: 75**

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

1 a) Explain Plane stress and Plane strain problem with applications. [8]

b) Derive the governing differential equations in terms of stress function and for plane stress problem. [7]

2 a) Derive expressions for strain at a point in terms of stress components. [8]

b) Investigate what problem of plane stress is solved by the stress function.

$$\varphi = \frac{3F}{4c}\left(xy - \frac{xy^3}{3c^2}\right) + \mathrm{Py}^2/2$$ [7]

3 a) Explain the concept of solution by Polynomials. [5]

b) Given the stress function

$$\phi = s\left(\frac{xy}{4} - \frac{xy^2}{4c} - \frac{xy^3}{4c^2} + \frac{ly^2}{4c} + \frac{ly^3}{4c^2}\right)$$

for providing solution for a cantilever (y = ± c, 0 < x < l) loaded by uniform shear along the lower edge, the upper edge and the ends x = l. being free from load. In what respects is this solution imperfect? [10]

4 Given the stress function $\phi = -\left(\frac{F}{d^3}xz^2(3d - 2z)\right)$ for providing solution of an elasticity problem. Determine the stress components and sketch their variation in a region included in Z=0, Z=d, x=0 on the side x positive. [15]

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5 a) Explain D'Allemberts Principal with examples. [5]

b) i) Single degree of freedom systems.
ii) Discuss force-displacement relation for linearly elastic and inelastic systems. [10]

6 a) Explain Under damped, Critically damped and Over damped systems with examples. [8]

b) A vibrating system consists of a mass 5kg spring of stiffness 120N/m and frequency with damping coefficient of 5N-s/m. determine
i) the damping factor
ii) natural frequency of the damped vibration,
iii) Logarithmic decrement
iv) the ratio of two successive amplitudes
v) the number of cycles after which the initial amplitude is reduced to 25%. [7]

7 a) Derive expression for response of a undamped SDOF system subjected to Harmonic excitation explaining salient features involved [10]

b) The damped frequency of a system is obtained as 9.8 Hz from a free vibration test during the forced vibration test with constant excitation force on the same system. The maximum amplitude of vibration is found to be at 9.6Hz. Find the damping factor for the system and its natural frequency. [5]

8 a) Explain Duhamel Integral. [5]

b) Derive expression for response of a structure to half Sine Wave impulse. [10]