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Question Paper Code: U2602

M.E. DEGREE EXAMINATION, APRIL / MAY 2025

Second Semester

Structural Engineering

21PSE202-STRUCTURAL DYNAMICS

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 20 = 100 Marks)

1. (a) Derive the equation of motion for a spring-mass-damper system using Newton's Second Law. CO1- App (20)
Or
(b) Using Duhamel's integral, determine the response of an undamped SDOF system subjected to a unit step force. CO1- App (20)
2. (a) Compute the mode shapes and natural frequencies for a three-story shear building model with given mass and stiffness values. CO1- App (20)
Or
(b) Show that orthogonality conditions hold for the mode shapes of an MDOF system. CO1- App (20)
3. (a) Use Rayleigh's method to estimate the fundamental frequency of a cantilever beam. CO1- App (20)
Or
(b) Solve for the forced response of a continuous beam subjected to harmonic loading. CO1- App (20)
4. (a) A steel frame model is subjected to a ground acceleration of 5 m/s^2 . Compute the response history using the Newmark method with a time step of 0.05s. CO3- Ana (20)

Or

- (b) Compute the displacement and velocity response of a damped SDOF system using direct integration (finite difference method) for a time step of 0.02s. CO3- Ana (20)
5. (a) Explain the working principle of base isolation and compute the effective damping ratio of a base-isolated system with a rubber bearing of stiffness 200 kN/m and damping coefficient 500 Ns/m. CO4- Ana (20)
- Or
- (b) Derive the governing equation for a base-isolated building and compute its seismic response reduction for a damping ratio of 25% and isolation frequency of 2 Hz. CO4- Ana (20)