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B.Tech IV Year I Semester (R09) Supplementary Examinations June 2017 FINITE ELEMENT METHODS

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions All questions carry equal marks

- 1 (a) List the advantages and disadvantages of FEM over other traditional variational methods.
 - (b) State and explain the equilibrium equations for solving the solid mechanics problems.
- 2 Explain with the help of examples, the solution of a boundary value problem by:
 - (a) Rayleigh Ritz method.
 - (b) Weighted residual method.
- 3 Calculate the deflection at the centre and slopes at the ends of a simply supported beam of 2 m length subjected to a UDL of 50 kN/m throughout the length and a bending moment of 5000 N-m at the centre. Take EI = 700×10^3 N/mm².
- 4 (a) Explain what is meant by plane stress and plane strain condition with examples.
 - (b) Derive the constitutive relation matrix for plane stress and plane strain condition.
- 5 (a) Derive the load vector for the axi-symmetric triangular element with the variable surface load on the surface.
 - (b) What is the importance of natural coordinate system in solving the axi-symmetric element and derive the shape functions of the element.
- 6 Estimate the temperature profile in a pin fin of diameter 30 mm, whose length is 500 mm. The thermal conductivity of the fin material is 50 W/mK and heat transfer coefficient over the surface of the fin is 40 W/m²K at 30°C. The tip is insulated and the base is exposed to heat flux of 800 kW/m².
- 7 Derive equation for thermal stresses in case of two dimensional finite element formulation.
- 8 Obtain the Eigen values and Eigen vectors for the cantilever beam of length 2 m using consistent mass for translation DOF with E = 200 GPa, $\rho = 7500 kg/m^3$.
