Department Of Applied Mechanics

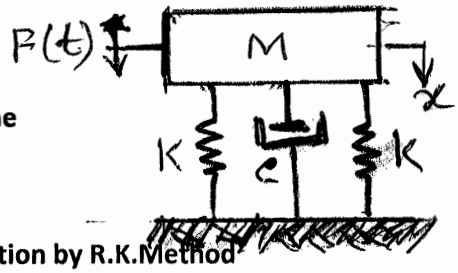
Major Examination

04/05/2010 **(Computational Mechanics AML-310)** **MM:150**

Q1) (a) A gas turbine engine shaft experiences combined loads due to axial, torsion and flexural bending. Establish a mathematical model to assess the critical stress.

(b) How one can mathematically model the geometric and material non linearities. Cite examples and show respective figures.

(c) How a grid convergence is achieved?



Q2) For the given model of impact measurement device develop the

(a) Equation of motion

(b) Give an algorithm to solve the above ordinary differential equation by R.K.Method

(c) Give a flow chart for the above algorithm

Q3) (a) Give an algorithm to transform "n" nonlinear simultaneous equations f1(x1,x2,.....xn)= 0.....to fn(x1,x2.....xn) = 0 into a system of linear simultaneous equations

(b) Solve $(x-4)^2 + (Y+4)^2 = 5$ $X^2 + Y^2 = 10$

Q4) (a) Give a speed up model for parallel processing considering various levels of degree of parallelism. (b) For finite element applications how parallel processing facilitates the assemblage of [M], [K] and {F} matrices (c) How scalability, granularity and efficiency contribute to parallel computing. (d) How parallel processing improves the computation of flow characteristics in a control volume.

Q5) (a) For a gas turbine engine shaft what boundary conditions are imposed? Justify the same.

(b) Show the following elements with nods, degree of freedom and give reasons to recommend usage.

(i) Truss element (ii) Beam element and (iii) Solid element (c) For what critical stresses typical truss members are checked and designed for.(d) Draw a finite difference grid for a diffuser, show equations and boundary conditions.