R09

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech I - Semester Examinations, April/May-2012
MATHEMATICAL MODELING
(AEROSPACE ENGINEERING)

Time: 3hours   **Max. Marks: 60**

Answer any five questions
All questions carry equal marks
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1. Discuss the difference between a regular perturbation method and a singular perturbation method with an example. Discuss Prandtl's technique for the solution of the boundary value problem

$$\varepsilon y'' + y' + y = 0,$$
$$y(0) = \alpha \text{ and } y(1) = \beta$$

   using the method of asymptotic expansions.

2. Explain the differences between Newtonian Mechanics and Analytical Mechanics. Derive Euler-Lagrange equations for a conservative system using Hamilton's principle and illustrate with an example.

3. Describe cellular automata model for a gas and discuss through diagrams how FHP lattice gas operates in two dimensions with the help of triangular lattice.

4. Explain the fourth-order Runge-Kutta method for a system of first order ordinary differential equations, and discuss how the step size is chosen.

5. Define Discrete Fourier Transformation (DFT) and its corresponding inverse transform for n-dimensional data vector. Discuss the logic involved in enhancing the computing speed of DFT by Fast Fourier Transform (FFT).

6. Explain simulated annealing technique used in optimization and search problems. How is it different from Genetic algorithms?

7. Discuss with help of a diagram the procedure involved in building a mathematical model using artificial neural networks.

8. How is a Kalman filter different from a Weiner filter? Discuss the steps involved in Kalman filter for linear systems with the help of a schematic diagram.

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