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B Tech Examination May-2014
NUMERICAL METHODS & SIMULATION IN ENGINEERING
Subject Code : AE–309
Paper ID:A0717

Time : 3 Hours ***Maximum Marks : 60***

Note :Section A is compulsory. *Attempt any four questions from Section-B and any Two Questions from Section-C*

SECTION-A (2 marks each)

1. (i) Which of these 0.30, 0.33 & 0.34 best approximates the number $\frac{1}{3}$.

(ii) State intermediate value property.

(iii) Give Gauss forward interpolation formula.

(iv) Show that $\nabla^2 y_8 = y_8 - 2y_7 + y_6$.

(v) Write Gauss integration formula when n = 2.

(vi) Find the inverse of the matrix $A = \begin{bmatrix} 5 & -2 & 4 \\ -2 & 1 & 1 \\ 4 & 1 & 0 \end{bmatrix}$

(vii) Obtain first approximation of $y^1 = x + y^2$ subject to y(0)=1, using Picards method.

(viii) Discuss advantages and limitations of system simulation.

(ix) Give 4 applications of monte carlo method, (Examples only).

(x) Differentiate between 'stochastic' and 'Random variables' and 'Discrete' and 'Continuous' variables.

SECTION-B (5 marks each)

2. Using method of iteration, Find a real root of the equations $x = 0.2x^2 + 0.8$ and $y = 0.3xy^2 + 0.7$ (Take $x_0 = y_0 = \frac{1}{2}$)

3. Show that ,
$$e^x\left[u_0 + x\Delta u_0 + \frac{x^2}{21}\Delta^2 u_0 + - - -\right] = u_0 + u_1 x + u_2\frac{x^2}{21} + - - -.$$

4. Evaluate $I = \int_0^1 \frac{1}{1+x}dx$, correct to three decimals, by simpson's $\frac{1}{3}$ rule.

(Take h= 0.5, 0.25 & 0.125).

5. Solve the system of equations:
$3x + y + 2z = 3$; $2x - 3y - z = -3$ & $x + 2y + z = 4$

6. Obtain value of π using monte carlo method.

SECTION-C (10marks each)

7. (a) The population of a town is given as follows:

Year :x	1891	1901	1911	1921	1931
Population :y (in thousands)	46	66	81	93	101

Estimate the population for the year 1925.

(b) Obtain $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x=1.2 from the table:

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

8. (a) Obtain the largest eigen value & the Corresponding eigen vector of the

matrix: $A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$.

(b) Find y(0.2)& y(0.4) using Runke kutta method,
given that $y^1 = 1 + y^2$ and $y(0) = 0$.

9. (a) Write a note on validation & Calibration of simulation models.

(b) Discuss features of simulation language 'SIMULA'.

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