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CS/M.Tech(ME-O)/SEM-1/MM(ME)-101/2012-13 2012

ADVANCED ENGINEERING MATHEMATICS

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Attempt any five questions.

 $5 \times 14 = 70$

1. a) Given that the mode of the following frequency distribution of 70 students is 58.75. Find the missing frequencies f_1 and f_2 .

Class interval	52 - 55	55 - 58	58 - 61	61 - 64
Frequency	15	f_1	25	f_2

b) Determine the constants a and b by the method of least squares such that $y = ae^{bx}$ fits the following data :

X	2	4	6	8	10
y	4.077	11.084	30.128	81.897	222.62

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- 2. a) If r be the correlation coefficient for a set of bivariate data, prove that $-1 \le r \le 1$. Discuss the cases $r = \pm 1$.
 - b) For two variables x and y, the two regression lines are x + 4y + 3 = 0 and 4x + 9y + 5 = 0. Identify which one is of y on x. Find means of x and y. Find the correlation coefficient between x and y. Estimate the value of x when y = 1.5.

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- 3. a) Obtain an estimate of error in polynomial interpolation.
 - b) Using Lagrange's interpolation formula, find the form of the function y(x) from the following table :

X	0	1	3	4
y	- 12	0	12	24

7 + 7

4. a) Solve the following System by Gauss-Seidel method corrected up to two decimal places :

$$28x + 4y - z = 32$$

$$x + 3y + 10z = 24$$

$$2x + 17y + 4z = 35$$

b) Determine the largest eigenvalue and the corresponding eigenvector of the matrix

$$\begin{bmatrix} 4 & 1 & 0 \\ 1 & 20 & 1 \\ 0 & 1 & 4 \end{bmatrix}$$
 correct to two decimal places using

power method.

5. a) Discuss how the nodes (x_k) and the weights (λ_k) are determined in Gauss-Legendre integration formula

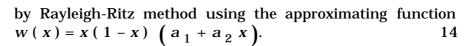
$$\int_{1}^{1} f(x) dx = \sum_{0}^{n} \lambda_{k} f(x_{k}).$$

b) Solve the following system of equations, correct to 2 decimal places, by Newtow-Raphson method with (1, 2) as initial approximation:

$$x + y = 3x^2$$
, $y^3 - 2 = 4x^3$. $7 + 7$



$$y'' + 2y = x$$
, $0 < x < 1$
 $y(0) = 0$, $y(1) = 0$.



- 7. a) State Fourier intergal theorem.
 - b) Find the Fourier sine transform of $f(x) = \frac{1}{xe^x}$
 - c) A homogeneous rod of conducting material of length 100 cm has its ends kept at zero temperature and the initial temperature is

$$u(x, 0) = x,$$
 $0 \le x \le 50$
= $100 - x,$ $50 \le x \le 100.$

Find the temperature u (x, t) at any time t by the method of separation of variables. 2 + 5 + 7

8. a) A string is stretched and fixed between two points x = 0 and x = L. Motion is initiated by displacing the string in the form

$$u = a \sin \frac{\pi x}{L}$$

and released from rest at t = 0. Find the displacement of any point on the string at any time t by using integral transform technique.

b) Find the steady state temperature distribution in a large rectangular plate, the flat surfaces of which are insulated, when the temperature is prescribed by f(x) along one edge of the plate and tends to zero along each of the other edges. 7 + 7
