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10MAT31

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017

Engineering Mathematics – III

Time: 3 hrs.

Max. Marks:100

Note: Answer FIVE full questions, selecting at least TWO questions from each part.

PART – A

- 1 a. Obtain the Fourier series in $(-\pi, \pi)$ for $f(x) = x \cos x$. (07 Marks)
 b. Obtain the Fourier half range sine series,

$$f(x) = \begin{cases} \frac{1}{4} - x & \text{in } 0 < x < \frac{1}{2} \\ x - \frac{3}{4} & \text{in } \frac{1}{2} < x < 1 \end{cases}$$

(07 Marks)

- c. Obtain the constant term and the coefficients of the first cosine and sine terms in the Fourier expansion of y from the table. (06 Marks)

x	0	1	2	3	4	5
y	9	18	24	28	26	20

- 2 a. Find the Fourier transforms of $f(x) = \begin{cases} 1 - x^2 & \text{for } |x| < 1 \\ 0 & \text{for } |x| \geq 1 \end{cases}$ and hence evaluate

$$\int_0^{\infty} \frac{x \cos x - \sin x}{x^3} \cos \frac{x}{2} dx$$

(07 Marks)

- b. Find the Fourier sine transform of $e^{-|x|}$. (07 Marks)

- c. Find the inverse Fourier sine transform of $\hat{f}_s(\alpha) = \frac{e^{-a\alpha}}{\alpha}$, $a > 0$. (06 Marks)

- 3 a. Solve the wave equation $u_{tt} = c^2 u_{xx}$ given that $u(0,t) = 0 = u(2l,t)$, $u(x, 0) = 0$ and $\frac{\partial u}{\partial t}(x,0) = a \sin^3 \frac{\pi x}{2l}$ (07 Marks)

- b. Solve the boundary value problem $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ $0 < x < l$, $\frac{\partial u}{\partial x}(0,t) = 0$, $\frac{\partial u}{\partial x}(l,t) = 0$, $u(x, 0) = x$. (07 Marks)

- c. Obtain the D'Alembert's solution of the wave equation, $u_{tt} = C^2 u_{xx}$ subject to the conditions $u(x,0) = f(x)$ and $\frac{\partial u}{\partial t}(x,0) = 0$. (06 Marks)

- 4 a. Fit a parabola $y = a + bx + cx^2$ for the data: (07 Marks)

x	0	1	2	3	4
y	1	1.8	1.3	2.5	2.3

- b. Solve by using graphical method the L.P.P.

Minimize $z = 30x + 20y$

Subject to the constraints: $x - y \leq 1$

$x + y \geq 3$, $y \leq 4$

and $x \geq 0$, $y \geq 0$

- c. Maximize $z = 3x + 4y$

subject to the constraints $2x + y \leq 40$, $2x + 5y \leq 180$,

$x \geq 0$, $y \geq 0$ using simplex method.

PART – B

- 5 a. Find the fourth root of 12 correct to three decimal places by using regula Falsi method. (07 Marks)
 b. Solve $9x - 2y + z = 50$, $x + 5y - 3z = 18$, $-2x + 2y + 7z = 19$ by relaxation method obtaining the solution correct to two decimal places. (07 Marks)

- c. Find the largest eigen value and the corresponding eigen vector of, $\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ by using power method by taking initial vector as $[1 \ 1 \ 1]^T$. (06 Marks)

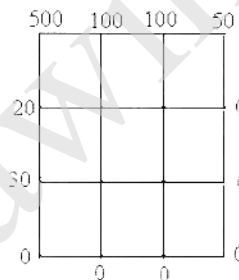
- 6 a. The table gives the values of $\tan x$ for $0.10 \leq x \leq 0.30$ (07 Marks)

x	0.10	0.15	0.20	0.25	0.30
tanx	0.1003	0.1511	0.2027	0.2553	0.3093

- b. Using Newton's forward and backward interpolation formula, calculate the increase in population from the year 1955 to 1985. The population in a town is given by, (07 Marks)

Year	1951	1961	1971	1981	1991
Population in thousands	19.96	39.65	58.81	77.21	94.61

- c. Evaluate $\int_0^1 \frac{dx}{1+x}$ taking seven ordinates by applying Simpson's $\frac{3}{8}$ rule. Hence deduce the value of $\log_e 2$. (06 Marks)
- 7 a. Solve the Laplace's equation $u_{xx} + u_{yy} = 0$, given that (07 Marks)



- b. Solve $\frac{\partial^2 u}{\partial t^2} = 4 \frac{\partial^2 u}{\partial x^2}$ subject to $u(0, t) = 0$; $u(4, t) = 0$; $u(x, 0) = x(4 - x)$. Take $h = 1$, $K = 0.5$ upto Four steps. (07 Marks)
- c. Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the condition $u(x, 0) = \sin \pi x$, $0 \leq x \leq 1$, $u(0, t) = u(1, t) = 0$ using Schmidt's method. Carry out computations for two levels, taking $h = \frac{1}{3}$, $K = \frac{1}{36}$. (06 Marks)

- 8 a. Find the z-transform of, (i) $\cosh n\theta$ (ii) $\sinh n\theta$ (07 Marks)
 b. Obtain the inverse z-transform of, $\frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4}$. (07 Marks)
 c. Solve the difference equation, $y_{n+2} + 2y_{n+1} + y_n = n$ with $y_0 = y_1 = 0$ using z-transforms. (06 Marks)

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