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10MAT31

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019

Engineering Mathematics – III

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Find the Fourier series of $f(x)=\begin{cases}\pi+2x & \text{in } -\pi\le x\le 0\\ \pi-2x & \text{in } 0\le x\le\pi\end{cases}$. **(06 Marks)**

b. Obtain Fourier half range sine series of $f(x)=\begin{cases}\frac{1}{4}-x & ;\ 0<x<\frac{1}{2}\\ x-\frac{3}{4} & \frac{1}{2}<x<1\end{cases}$. **(07 Marks)**

c. Find the Fourier series of y upto second harmonics from the following table:

x:	0	2	4	6	8	10	12
y:	9	18.2	24.4	27.8	27.5	22	9

(07 Marks)

2 a. Find the Fourier transform of $f(x)=\begin{cases}1-x^2 & \text{for } |x|\le 1\\ 0 & \text{for otherwise}\end{cases}$ and hence deduce that $\int_0^\infty \frac{x\cos x-\sin x}{x^3}.dx=\frac{-\pi}{4}$. **(07 Marks)**

b. Find the inverse Fourier sine transform of $F_s(u)=\frac{1}{u}e^{-au}$, $a>0$. **(06 Marks)**

c. Find the Fourier cosine transform of $f(x)=\frac{1}{1+x^2}$. **(07 Marks)**

3 a. Obtain the various possible solutions of the Laplace's equation $u_{xx}+u_{yy}=0$ by the method of separation of variables. **(07 Marks)**

b. Solve the heat equation $u_t=c^2u_{xx}$ subject to the conditions, $u(0, t) = 0$, $u(10, t) = 0$ and $u(x, 0) = f(x)$ where $f(x)=\begin{cases}x & \text{in } 0\le x\le 5\\ 10-x & \text{in } 5\le x\le 10\end{cases}$. **(06 Marks)**

c. Obtain the D'Alembert's solution of the one dimensional wave equation. **(07 Marks)**

4 a. Fit a parabola of the form $y=ax^2+bx+c$ to the following data:

x:	0	1	2	3	4	5
y:	1	3	7	13	21	31

(06 Marks)

b. Minimize: $z = 5x + 4y$ subject to the constraints $x + 2y \ge 10$, $x + y \ge 8$, $2x + y \ge 12$, $x \ge 0$, $y \ge 0$ by graphical method. **(07 Marks)**

c. Maximize $z = 6x + 9y$ subject to the constraints $2x + 2y \le 12$, $x + 5y \le 44$, $3x + y \le 30$, $x \ge 0$, $y \ge 0$ by applying simplex method. **(07 Marks)**

PART – B

5 a. Using Regula-falsi method find the real root of $\tan x + \tanh x = 0$, which lies between 2 and 3 carryout three iterations. **(06 Marks)**

b. Apply Gauss-Seidel method to solve equations $12x + y + z = 31$, $2x + 8y - z = 24$, $3x + 4y + 10z = 58$. Perform four iterations. **(07 Marks)**

c. Using Rayleigh power method find the largest eigen value and the corresponding eigen vector of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ use $[1 \quad 0 \quad 0]^T$ as initial vector, carry out six iterations. **(07 Marks)**

6 a. From the following data, estimate the number of students who have scored less than 70 marks:

Marks:	0-20	20-40	40-60	60-80	80-100
No. of students:	41	62	65	50	17

(06 Marks)

b. Use Lagrange's interpolation formula to fit a polynomial for the data:

x:	0	1	3	4
y:	-12	0	6	12

Hence estimate y at x = 2. **(07 Marks)**

c. Evaluate, $\int_0^{0.3} \sqrt{1-8x^3}\, dx$ by using Simpsons 3/8th rule, taking six equal parts. **(07 Marks)**

7 a. Solve $\frac{\partial^2 u}{\partial t^2} = 4\frac{\partial^2 u}{\partial x^2}$ subject to $u(0, t) = 0$, $u(4, t) = 0$, $u(x, 0) = x(4 - x)$ by taking $h = 1$, $k = 0.5$ upto four steps. **(07 Marks)**

b. Solve $\frac{\partial^2 u}{\partial x^2} = 32\frac{\partial u}{\partial t}$ subject to $u(0, t) = 0$, $u(1, t) = t$ and $u(x, 0) = 0$ upto $t = 5$ by Bendre-Schmidt process taking $h = \frac{1}{4}$. **(07 Marks)**

c. Solve $u_{xx} + u_{yy} = 0$ in the following square region with the boundary conditions as indicated in the figure: **(06 Marks)**

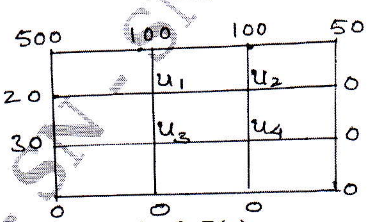

Fig.Q.7(c)

8 a. Find the Z-transforms of $\sinh n\theta$ and $\cosh n\theta$. **(06 Marks)**

b. If $\bar{u}(z) = \frac{2z^2 + 5z + 14}{(z-1)^4}$. Find the values of u_0, u_1, u_2 and u_3. **(07 Marks)**

c. Solve the difference equation $u_{n+2} + 4u_{n+1} + 3u_n = 3^n$ with $u_0 = 0$ and $u_1 = 1$ by using z-transform. **(07 Marks)**

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