3rd SEM MEC/IEM

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06MAT31

Third Semester B.E. Degree Examination, June/July 2011
Engineering Mathematics

Time: 3 hrs. Max. Marks:100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Find a Fourier series to represent $f(x) = x - x^2$ from $x = -\Pi$ to $x = \Pi$ and deduce that $\frac{\Pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots\ldots\ldots$ **(07 Marks)**

b. If $f(x) = \begin{cases} x & 0 < x < \Pi/2 \\ \Pi - x & \Pi/2 < x < \Pi \end{cases}$

show that i) $f(x) = \frac{4}{\Pi}\left[\sin x - \frac{1}{3^2}\sin 3x + \frac{1}{5^2}\sin 5x - \ldots\ldots\right]$

ii) $f(x) = \frac{\Pi}{4} - \frac{2}{\Pi}\left[\frac{1}{1^2}\cos 2x + \frac{1}{3^2}\cos 6x + \frac{1}{5^2}\cos 10x + \ldots\ldots\right]$ **(07 Marks)**

c. Obtain the Fourier series neglecting the terms higher than first harmonic.

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

(06 Marks)

2 a. Find the Fourier transform of the function $f(x) = \begin{cases} x, & |x| \le \propto \\ 0 & |x| > \propto \end{cases}$ where '$\propto$' is a positive constant. **(06 Marks)**

b. Solve the integral equation $\int_0^\infty f(\theta)\cos \propto \theta d\theta = \begin{cases} 1-\propto & 0 \le \propto \le 1 \\ 0 & \propto > 0 \end{cases}$

Hence evaluate $\int_0^\infty \frac{\sin^2 t}{t^2} dt$ **(08 Marks)**

c. Find the finite Fourier sine transform of $f(x) = 2x$ in $0 \le x \le 4$. **(06 Marks)**

3 a. Form the Partial Differential equation by eliminating the arbitrary function from the equation $F(xy + z^2, x + y + z) = 0$ **(06 Marks)**

b. Solve: $xp - yq = y^2 - x^2$. **(07 Marks)**

c. Solve $py^3 + qx^2 = 0$ by the method of separation of variable. **(07 Marks)**

4 a. Derive one dimensional heat equation. **(07 Marks)**

b. Find the deflections of a vibrating string of unit length fixed ends with initial velocity zero and initial deflections $f(x) = k(\sin x - \sin 2x)$. **(06 Marks)**

c. Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ subject to the conditions

$u(0, y) = u(l, y) = u(x, 0) = 0$ and $u(x, a) = \sin\frac{n\Pi x}{l}$. **(07 Marks)**

PART – B

5 a. Find the real root of the equation $xe^x = 2$ correct to three decimal places using Newton-Raphson method. **(07 Marks)**

b. Employ Gauss-Siedel iteration method to solve:

$20x + y - 2z = 17$

$2x - 3y + 20z = 25$

$3x + 20y - z = 18$

Carryout 3 iterations. **(07 Marks)**

c. Using Power method find the dominant eigen value and the corresponding eigen vector of the matrix $A = \begin{bmatrix} 4 & 1 & -1 \\ 2 & 3 & -1 \\ -2 & 1 & 5 \end{bmatrix}$ **(06 Marks)**

6 a. Using suitable interpolation formula, find the number of students who obtained marks between 40 and 45. **(07 Marks)**

Marks	30-40	40-50	50-60	60-70	70-80
No. of students	31	42	51	35	31

b. Using divided difference formula to find f(x) given data hence find f(4). **(07 Marks)**

x	0	2	3	6
f(x)	-4	2	14	158

c. Using Simpson's $\frac{1}{3}$rd Rule to find $\int_0^{0.6} e^{-x^2} dx$ by taking seven ordinates. **(06 Marks)**

7 a. State and prove Euler's equation. **(07 Marks)**

b. Solve the variation problem $\sigma \int_0^1 (y^2 + x^2 y^1) dx = 0, y(0) = 0, y(1) = 1.$ **(06 Marks)**

c. Find the path in which a particle in the absence of friction will slide from one point to another in the shortest time under the action of gravity. **(07 Marks)**

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

b. Find the inverse z-transform of $\frac{z^3 - 20z}{(z-3)^2(z-4)}$. **(07 Marks)**

c. Solve: $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$ using z-transform. **(07 Marks)**

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