**Code: 13A54102** **R13**

B.Tech I Year (R13) Supplementary Examinations June 2017

## MATHEMATICS - II

(Common to EEE, ECE, EIE, CSE & IT)

Time: 3 hours Max. Marks: 70

### PART - A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Find the Eigen values of the matrix.

$$A=\begin{pmatrix}3&1&4\\0&2&6\\0&0&5\end{pmatrix}$$

(b) If $A=\begin{pmatrix}2+i&3&-1+3i\\-5&i&4-2i\end{pmatrix}$, show that AA* is a Hermitian matrix, where A* is the conjugate transpose of A.

(c) Find the real root of the equation $x^3-2x+5z=0$ by the method of false position correct to three decimal places.

(d) Find the positive root of $x^2-x=10$ correct to three decimal places, using Newton-Raphson method.

(e) Find the value of y for $x=0.1$ by Picard's method, given that $\frac{dy}{dx}=\frac{y-x}{y+x}\;\; y(0)=1.$

(f) Use Runge-Kutta method of order 4, find y(0.2) given that $\frac{dy}{dx}=3x+\frac{1}{2}y,\ y(0)=1$ taking $h=0.1.$

(g) If $F(s)$ is the complex Fourier transform of $f(x)$ them prove that $F(f(ax)=\frac{1}{a}\,F\left(\frac{S}{a}\right), a\neq 0.$

(h) State and prove convolution theorem for Fourier transforms.

(i) Form the partial differential equation (by eliminating the arbitrary constants) from

$$Z=(x+y)\,\phi\,(x^2-y^2)$$

(j) Using the method of separation of variables solve, $\frac{\partial u}{\partial x}=2\frac{\partial u}{\partial y}+u$, where $u(x,0)=6e^{-3x}$.



### PART - B

(Answer all five units, 5 X 10 = 50 Marks)

**UNIT - I**

2 (a) Verify Cayley-Hamilton theorem for the matrix $A=\begin{pmatrix}1&4\\2&3\end{pmatrix}$ and find its inverse.

(b) Find the Rank of the matrix.

$$A=\begin{pmatrix}1&2&3\\1&4&2\\2&6&5\end{pmatrix}$$

**OR**

3 (a) Find the Eigen values and Eigen vectors of the matrix $\begin{pmatrix}1&1&3\\1&5&1\\3&1&1\end{pmatrix}$.

(b) Find the matrix P which transforms the matrix $A=\begin{pmatrix}1&1&3\\1&5&1\\3&1&1\end{pmatrix}$ to the diagonal form. Hence calculate $A^4$.

Contd. in page 2

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**UNIT - II**

4 (a) Using Newton's forward formula, find the value of $f(1.6)$, if

| $x$ | 1 | 1.4 | 1.8 | 2.2 |
|---|---|---|---|---|
| $f(x)$ | 3.49 | 4.82 | 5.96 | 6.5 |

(b) Compute the value of $\int_{0.2}^{1.4}(sinx - logx + e^x)dx$. Using Simpson's 3/8th rule.

**OR**

5 (a) Use Lagrange's interpolation formula to find the value of y when $x = 10$, if the following values of $x$ and y are given;

| $x$ | 5 | 6 | 9 | 11 |
|---|---|---|---|---|
| $f(x)$ | 12 | 13 | 14 | 16 |

(b) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using trapezoidal rule taking $h = \frac{1}{4}$.

**UNIT - III**

6 (a) Apply Milne's method, to find a solution of the differential equation $y^l = x - y^2$ in the range $0 \le x \le 1$ for the boundary conditions $y = 0$ at $x = 0$.

(b) Employ Taylor's method to obtain approximate value of y at $x = 0.2$ for the differential equation $\frac{dy}{dx} = 2y + 3e^x,\ y(0) = 0$.

**OR**

7 If $f(x) = \begin{cases} 0, & -\pi \le x \le 0 \\ sinx & 0 \le x \le \pi \end{cases}$

Prove that $f(x) = \frac{1}{\pi} + \frac{sinx}{2} - \frac{2}{\pi}\sum_{n=1}^{\infty}\frac{cons2n\,x}{4n^2-1}$.

Hence show that $\frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - - - - - - \infty = \frac{1}{4}(\pi - 2)$.

**UNIT - IV**

8 (a) Find the Fourier integral representation for

$f(x) = \begin{cases} 1 - x^2, & for\ |x| \le 1 \\ 0, & for\ |x| \le 1 \end{cases}$

(b) Find the Fourier sine and cosine transform of $x^{n-1}, n > 0$.

**OR**

9 (a) If $Z(u_n) = U(z)$ then prove that

$Z(u_{n-k}) = Z^{-k}\ U(z) \qquad (k > 0)$.

(b) If $U(z) = \frac{2Z^2+5Z+14}{(Z-1)^4}$, evaluate $u_2$ and $u_3$.

**UNIT - V**

10 (a) Solve by the method of separation of variables $\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 0$.

(b) A tightly stretched string with fixed end points $x = 0$ and $x = l$ is initially at rest in its equilibrium position. If it is vibrating by giving to each of its points a velocity $\lambda x(l - x)$, find the displacement of the string at any distance $x$ from one end at any time t.

**OR**

11 Solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$ where $u(x,0) = 6e^{-3x}$.

A bar AB of length 10 cm has its ends A and B kept at $30^0$ and $100^0$ temperatures respectively, until steady-state condition is reached. Then the temperature at A is lowered to $20^0$ and that at B to $40^0$ and these temperatures are maintained. Find the subsequent temperature distribution in the bar.

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