Code: 13A54102

R13

B.Tech I Year (R13) Regular & Supplementary Examinations May/June 2015

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) Define rank of a matrix.

(b) Define a Skew-Hermitian matrix with example.

(c) Develop an algorithm using Newton-Raphson method, to find the square root of a positive number N.

(d) Write Newton-Gregory forward and backward interpolation formula.

(e) Write Milne's predictor-Corrector formulae to solve the ODE $\frac{dy}{dx} = f(x,y) with\ y(x_0) = y_0$.

(f) Write Dirichlet conditions for the expansion of $f(x)$ in Fourier series.

(g) Define finite Fourier sine and cosine transforms and their inversion formulae in $0 < x < L$.

(h) State initial and final value theorems for Z-transform.

(i) Derive the partial differential equation by eliminating the constants a and b from the equation $z = a\,x^2 + by^2$.

(j) Form partial differential equation by eliminating the arbitrary functions from $z = f(x) + e^x\, g(x)$.

Part – B

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

UNIT - I

2 (a) Determine the values of λ for which the following system of equations has non-trivial solutions. Find them:

$(\lambda-1)x + (3\lambda+1)y + 2\lambda z = 0$

$(\lambda-1)x + (4\lambda-2)y + (\lambda+3)z = 0$

$2x + (3\lambda+1)y + 3(\lambda-1)z = 0.$

(b) Prove that the Eigen values of Hermitian matrix are real.

OR

3 Find the Eigen vectors of the matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 3 & -1 \\ 0 & -1 & 3 \end{bmatrix}$ and hence reduce the quadratic form $x_1^2 + 3x_2^2 + 3x_3^2 - 2x_2\,x_3$ to a 'sum of squares'. Also write its nature.

UNIT - II

4 (a) Determine the root of $x\,e^x - 2 = 0$ by method of false position.

(b) Using Lagrange's formula, express the function $\frac{x^2+6x-1}{(x^2-1)(x-4)(x-6)}$ as a sum of partial fractions.

OR

5 (a) Fit a least squares quadratic curve $y = a_0 + a_1 x + a_2 x^2$ to the following data

x	1	2	3	4
y	1.7	1.8	2.3	3.2

Estimate $y(2.4)$.

(b) Evaluate $\int_0^{0.6} e^{-x^2}\,dx$ by using Simpson's $\frac{1}{3}$ rd rule taking seven ordinates.

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UNIT - III

6 (a) Obtain Picard's second approximate solution of the initial value problem $\frac{dy}{dx}=\frac{x^2}{y^2+1}$, $y(0)=0. Find\ y(1)$.

(b) Given that $\frac{dy}{dx}=2+\sqrt{xy}$, $y(1)=1$. Find $y(2)$ in steps of 0.2 using the Euler's method.

OR

7 Find the two half –range expansions of the function:

$$f(x)=\begin{cases}\frac{2k}{L}x & if\ 0<x<\frac{L}{2}\\ \frac{2k}{L}(L-x) & if\ \frac{L}{2}<x<L\end{cases}$$

UNIT - IV

8 (a) Express the function $f(x)=\begin{cases}1 & for\ |x|\le 1\\ 0 & for\ |x|\ge 1\end{cases}$ as a Fourier integral.

Hence evaluate $\int_0^\infty \frac{\sin\lambda\cos\lambda x}{\lambda}d\lambda$.

(b) Find: (i) $Z\{\cos\theta+i\ sin\theta)^n\}$. (ii) $Z^{-1}\left\{\frac{z^2}{(z-a)(z-b)}\right\}$ by using convolution theorem.

OR

9 (a) Find the Fourier transform of $e^{-a^2x^2}$, $a>0$. Hence deduce that $e^{-\frac{x^2}{2}}$ is self reciprocal in respect of Fourier transform.

(b) Using the Z-transform solve the difference equation:
$u_{n+2}+4u_{n+1}+3u_n=3^n\ with\ u_0=0, u_1=1$.

UNIT - V

10 Solve the wave equation $\frac{\partial^2 y}{\partial t^2}=c^2\frac{\partial^2 y}{\partial x^2}$ under the conditions

$$y(0,t)=0, y(L,t)=0\ for\ all\ t;\ y(x,0)=f(x)\ and\ \left(\frac{\partial y}{\partial t}\right)_{t=0}=g(x), 0<x<L.$$

OR

11 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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