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Register Number: **2013**

Name of the Candidate:

M.SC. DEGREE EXAMINATION – 2010

(ELECTRONIC SCIENCE)

(FIRST YEAR)

(PAPER – I)

110. APPLIED MATHEMATICS AND NUMERICAL METHODS

May) (*Time: 3 Hours*

Maximum: 100 Marks

Part - A (5x4=20)

Answer any FIVE questions.

1. With suitable examples, explain linearly dependant and linearly independent vectors.
2. Find the rank of the matrix:

$$\begin{pmatrix} 1 & 3 & 4 & 3 \\ 3 & 9 & 12 & 3 \\ 1 & 3 & 4 & 1 \end{pmatrix}$$

3. Sate and prove Cauchy's integral theorem.
4. Evaluate (i) $J_{1/2}(x)$ (ii) $J_{-1/2}(x)$
5. Find the Fourier Transform of $f(x) = e^{-x^2}$
6. State and prove the Convolution theorem of Laplace Transform.
7. Find the real positive root of the equation 3x-cosx-1 = 0 by Newton – Raphson method correct to six decimal places.
8. Given y' = – y and y (0) = 1 determine the values of y at x= 0.1, 0.2, 0.3, 0.4 by Euler's method.

Part - B (5x16=80)

Answer any FIVE questions

9. (a) State and prove Stokes' theorem.
   (b) Verify Stokes' theorem for the vector

   $\vec{F} = (2x-y)\vec{i} - yz^2\vec{j} - y^2z\vec{k}$, where S is the upper half surface of the sphere $x^2+y^2+z^2=1$ and C is its boundary.

10. Find the eigen values and the normalized eigen vectors of the Hermitian matrix

$$\begin{pmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{pmatrix}$$

Verify that

(i) Sum of the eigen values = Trace of the matrix
(ii) Product of the eigen values = Determinant of the matrix
(iii) the eigen vectors are orthogonal to each other.

11. (a) Explain Gram - Schmidt orthogonalization process.
(b) Using Gram – Schmidt orthogonalization procedure, construct an orthogonal base from the following vectors:
$(1, -1, 0)$ $(1, 2, 1)$ $(0, 1, 1)$

12. (a) Find the residue of $f(z) = z^4 / (z-1)^4 (z-2)(z-3)$ at $z = 1$.
(b) Evaluate using Cauchy's residue theorem

$$\int_0^{2\pi} e^{\cos\theta} \cos(\sin\theta - n\theta)\, d\theta, \quad n > 0$$

13. (a) Obtain the power series solution of Laguerre's Differential Equation.

(b) Show that $\int_{-\infty}^{+\infty} H_n(x)\, H_m(x)\, dx = 2^n \sqrt{n}\; n!\, \delta_{nm}$

14. (a) Obtain the Fourier series of the function f(x) defined as follows:

$$f(x) = 0 \text{ when } -\pi < x \leq 0$$
$$= \pi x/4 \text{ when } 0 < x \leq \pi$$

(b) A string is stretched at two fixed points (0,0) and (1,0) and released from rest from the position $u = \lambda \sin \pi x$. Deduce the formula for its subsequent displacement $u(x,t)$.

15. (a) Find the Laplace Transform of $\{ \sin \sqrt{t} \}$
(b) Using Laplace Transform, solve the Differential equation
$y'' + 2y' + y = 0$; $y(0) = 0$ and $y'(0) = 3$.
Verify that your solution satisfies both the differential equation and boundary conditions.

16. (a) Solve the following system of equations by Gauss- Seidel method:

$$8x - 3y + 2z = 20$$
$$4x + 11y - z = 33$$
$$6x + 3y + 12z = 35$$

(b) The table below gives the velocity 'v' of a moving particle at time 't' seconds. Find the distance covered by the particle in 12 seconds.

t (sec)	0	2	4	6	8	10	12
v (m/s)	4	6	16	34	60	94	136

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