Total No. of Pages: 2

Register Number: **6013**

Name of the Candidate:

M.Sc. DEGREE EXAMINATION - 2010

(ELECTRONIC SCIENCE)

(FIRST YEAR)

(PAPER – I)

510. APPLIED MATHEMATICS AND NUMERICAL METHODS

December) (*Time: 3 Hours*

Maximum: 100 Marks.

SECTION – A

Answer any FIVE questions. (5 × 4 = 20)

1. 1. Prove that div(curl A) = 0.
2. 2. Find the inverse of the matrix.

$$\begin{pmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$$

3. State and prove Cauchy's residue theorem.
4. Plot the graph of $\Gamma(n)$for $0 \le n \le 4$.
5. Establish (i) change of scale property and (ii) Shifting property of Fourier Transform
6. Find the Laplace Transform of sin h(at) sin (at)
7. Fit a straight line to the following data by the method of least squares.

x	5	10	15	20	25
y	15	19	23	26	30

8. Derive second order Runge-Kutta formula for solving first order differential equation.

SECTION – B

Answer any FIVE questions. (5 × 16 = 80)

9. (a) Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $x^2 + y^2 - z=3$ at the point (2 , –1, 2)

   (b) If $A = 2xz^2\, i - yz\, j + 3xz^3\, k$, find curl [curl A].

10. Define basis and dimension of a linear vector space.
Construct an orthogonal base from the vectors (1,1,1) , (1,0,1) , (0,0,1) by Gram – Schmidt process.

11. Diagonalise the symmetric matrix

$$\begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}$$

using an *orthogonal matrix.*

12. (a) Derive Cauchy - Riemann equations in polar form.
(b) Show that the function $u = \frac{1}{2} \log (x^2 + y^2)$ is harmonic and determine its conjugate.

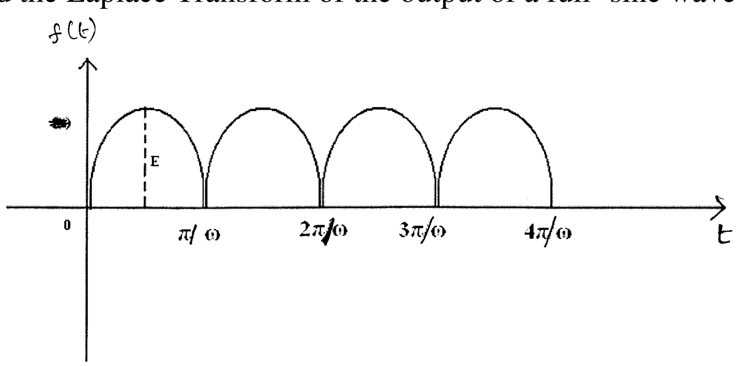
13. (a) Obtain the power series solution of Legendre's differential equation.
(b) Evaluate using Beta or Gamma function.

$$\int_0^{\pi/2} \{\sqrt{\tan\theta}\}\ d\theta$$

14. (a) Expand the function $f(x) = x \sin x$ as a Fourier series in the interval $-\pi < x < \pi$.
(b) Find the temperature u(x,t) in a bar of length 'L' perfectly insulated, and whose ends are kept at temperature zero while the initial temperature is given by

$$F(x) = \begin{cases} x, & 0 < x < L/2 \\ L - x, & L/2 < x < L \end{cases}$$

15. (a) Find the inverse Laplace transform of $(2s + 1)/(s^2 - 5s + 6)$
(b) Find the Laplace Transform of the output of a full- sine wave rectifier given below:



16. (a) Evaluate the integral $\int_{0.2}^{1.4} (\sin x - \log x + e^x)\, dx$ using Simpson's (1/3) rule. Verify your result by direct calculation.
(b) Solve the differential equation y' = x + y ; y(0) = 1 , for x = (0.0) , (0.2) , (0.4) , (0.6) by Fourth order Runge-Kutta method . Compare your result with the exact solution.

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