

Register Number:

Name of the Candidate:

**M.Sc. DEGREE EXAMINATION, 2011****(ELECTRONIC SCIENCE)****(FIRST YEAR)****(PAPER-I)****510. APPLIED MATHEMATICS AND NUMERICAL METHODS**

May)

(Time: 3 Hours)

Maximum: 100 Marks

**PART-A****(5×4=20)***Answer any FIVE questions*

1. If  $\nabla \phi = i yz + j zx + k xy$ , find  $\phi$ .
2. Show that the eigenvectors corresponding to two distinct eigen values of an unitary matrix are orthogonal to each other.
3. State and prove Cauchy's integral theorem.
4. Plot the graph of gamma function  $\Gamma(n)$  for  $0 \leq n < 4$ .
5. Show that
  - i)  $x J_n'(x) = nJ_n(x) - J_{n+1}(x)$
  - ii)  $\left(\frac{2n}{x}\right)J_n(x) = J_{n-1}(x) + J_{n+1}(x)$
6. Find the Fourier sine transform of the function  $e^{-ax}/x$
7. Find the Laplace transform of
  - i)  $t \sin at$
  - ii)  $t \cos at$
8. Derive an expression for the truncation error in Trapezoidal rule.

**PART-B****(5×16=80)***Answer any FIVE questions*

9.
  - a) State and prove Stoke's theorem.
  - b) Show that  $r^n \cdot \vec{r}$  is an irrotational vector for any value of 'n' but is solenoidal only if  $n=-3$  [ $\vec{r}$  is the position vector of a point].
10. Find the eigenvalues and the normalized eigen vectors of the matrix.

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

Verify i) sum of the Eigen values =  $T_r A$ ii) Product of the Eigen values =  $|A|$ 

11.
  - a) Distinguish between Linear dependence and linear independence of vectors.

b) Using Gram-Schmidt process construct an orthonormal set of vectors from  $(0, 1, -1)$ ,  $(1+i, 1, 1)$ ,  $(1-i, 1, 1)$

12. Using the method of Contour integration evaluate

$$\int_0^{2\pi} \left[ \frac{\cos 2\theta}{5 + 4 \cos \theta} \right] d\theta$$

13. a) Show that

$$\int_{-\infty}^{+\infty} e^{-x^2} H_n(x) H_m(x) dx = 2^n n! \sqrt{\pi} \delta_{nm}$$

b) Establish the recurrence relation  $n p_n(x) = (2n-1)x P_{n-1}(x) - (n-1)P_{n-2}(x)$ .

14. a) Arrive at the complex representation of Fourier series.

b) Apply Fourier series to analyse the output wave from a full wave rectifier when the input wave is of the form  $E = E_0 \sin \omega t$ .

15. a) Find an iterative formula for estimating  $\sqrt{N}$  (where  $N$  is a positive number) and hence find  $\sqrt{5}$

b) Find the inverse Laplace transform of  $\frac{1}{(s+1)(s^2+1)}$

16. a) The table below gives the velocity 'v' (m/s) of a particle at time 't' (sec). Find the distance covered by the particle in 12 sec by Simpson's rule.

t	0	2	4	6	8	10	12
v	4	6	16	34	60	94	136

b) By the method of least squares, find the best fitting straight line to the data given below:

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

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