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Register Number
Name of the Candidate:

M.Sc. DEGREE EXAMINATION, May 2015

(ELECTRONIC SCIENCE)

(FIRST YEAR)

510: APPLIED MATHEMATICS AND NUMERICAL METHODS

Time: Three hours Maximum: 100 marks

SECTION-A **(5×4=20)**

Answer any FIVE questions

1. Show that

   i) $\operatorname{div}(r^n \bar{r})=(3+n)r^n$

   ii) $\operatorname{Curl}(r^n \bar{r})=0$

2. Show that the vectors (1,2,-3), (1,3,-2) and (2,-1,5) are linearly independent.
3. State and prove Cauchy –Riemann equation.
4. Show that $\Gamma(1-m)=\frac{\pi}{\sin m\pi}$
5. Find the Fourier Transform of $e^{-|t|}$
6. Find the Laplace transform of sin hat.
7. Explain the principle of least square.
8. Find the smallest positive root of the equation $x^3-2x+0.5=0$ by Newton's Raphson method.

SECTION-B **(5×16=80)**

Answer any FIVE questions

9. i) State and prove Green theorem in a plane.

   ii) Express the Laplacian operator ∇^2 in spherical co-ordinates.

10. i) State and prove Cayley-Hamilton theorem.

    ii) Find the Eigen values and Eigen vectors of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 1 \\ 3 & 1 & 1 \end{bmatrix}$

11. i) State and prove Cauchy's residue theorem.

    ii) Apply Calculus of residues to show that

$$\int_0^{2\pi} \frac{d\theta}{a+b\cos\theta} = \frac{2\pi}{\sqrt{a^2-b^2}}, \quad a>b>0$$

12. i) Derive the following recurrence formula for $P_n(x)$.

$nP_n(x)=(2n-1)xP_{n-1}(x)-(n-1)P_{n-2}(x)$

ii) Write down the partial differential equation for heat conduction in one dimension and find the solution.

13. Find the series of sines and cosines of multiples of x which represents f(x) in the interval $-\pi < x < \pi$ where

$f(x)=0$ when $-\pi < x < 0$

$= \frac{\pi x}{4}$ when $0<x\leq\pi$

and hence deduce $\frac{\pi^2}{4} = 1+\frac{1}{3^2}+\frac{1}{5^2}+.......$

14. i) State and prove convolution theorem in Laplace transforms.

ii) By using Laplace transform solve the differential equation

$$\frac{d^2x}{dt^2}-2\frac{dx}{dt}+2x=0\,; \quad x_0 = x_1=1$$

15. i) Solve the system of equations.

$8x-y+z-18=0$

$2x+5y-2z-3=0$

$x+y-3z+6=0$

Using Gauss Seidal iteration method.

ii) Evaluate $\int_0^1 e^{-x^2}dx$ by dividing the range of integration in to four equal parts using Simpson's rule.

16. Using modified Euler's method find y at x =0.1 and x= 0.2 given

$$\frac{dy}{dx}=y-\frac{2x}{y},\ y(0)=1$$

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