Paper / Subject Code: SE363 / Applied Mathematics - III

SE363

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S.E. (Electronics & TC/Electronics & Comm Engg) Semester- III (Revised Course 2007-08)
EXAMINATION Aug/Sept 2019
Applied Mathematics-III.

[Duration : Three Hours] **[Max. Marks: 100]**

Instructions:
1. Attempt five questions atleast one from each module.
2. Assume necessary data if required.

MODULE – I

Q1 a) Find inverse of the following matrix by using elementary row transformation **7**

$$A = \begin{bmatrix} 2 & -2 & 3 \\ 3 & -1 & 2 \\ 1 & 2 & -1 \end{bmatrix}$$

b) Show the adj(AB)=adjBadjA, where A and B are non-singular matrices. **5**

c) For what values of λ and μ the system **8**

$$2x + 3y + 5z = 9$$
$$7x + 3y - 2z = 8$$
$$2x + 3y + \lambda z = \mu \text{ has}$$

i) No solution ii) A unique solution iii) Infinitely many solutions

Q2 a) Examine whether the following vectors are linearly independent or dependent. **8**

$$X_1 = (1, 2, -1, 0), \quad X_2 = (1, 3, 1, 2)$$
$$X_3 = (4, 2, 1, 0), \quad X_4 = (6, 1, 0, 1)$$

and find a relation between them, if they are dependent.

b) Show that every square matrix can be expressed as a sum of symmetric and skew-symmetric matrices. **7**

c) Find the rank of the matrix **5**

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

Module -II

Q3 a) Obtain the Fourier series representation of **8**

$f(x) = x^2 \quad if \; -\Pi < x < \Pi$

Hence obtain $\sum_{n=1}^{\infty} \frac{1}{n^4}$

b) Show that similar matrices have same eigen values. **5**

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c) Using Cayley – Hamilton theorem find the inverse of the matrix 7

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}_{3\times3}$$

Q4 a) Find Fourier cosine series of $f(x) = (x-1)^2$ is the interval $(0, 1)$ 5

b) Diagonalize The matrix 8

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}_{3\times3}$$

c) Find the Fourier series expansion for the function 7

$$f(x) = \begin{cases} \Pi + x, & -\Pi \le x \le -\Pi/2 \\ \Pi/2, & -\Pi/2 < x \le \Pi/2 \\ \Pi - x, & \Pi/2 < x \le \Pi \end{cases}$$

Module III

Q5 a) Find the Laplace transform of the functions 6

i) $f(t) = \frac{Sin\ \sqrt{\epsilon}}{\sqrt{\epsilon}}$ (ii) $t^2.e^{-2t}.\cos t$

b) Let $L\{f(t)\} = F(s)$, then Prove that 9

i) $L\{t^n.f(t)\} = (-1)^n \frac{d}{ds^n} F(s)$

ii) $L\{f''(t)\} = S^2 F(S) - Sf(0) - f'(0)$

iii) $L\left\{\int_0^t f(4)dx\right\} = \frac{F(S)}{S}$

c) State and prove convolution Theorem for Laplace transform. 5

Q6 a) Find Inverse Laplace transform of the following 6

i) $\frac{S^2-1}{(S^2+1)(S+2)}$ ii) $\log\left(\frac{S^2+9}{S^2-4}\right)$

b) Use convolution theorem to find inverse Laplace transform of 5

$$\frac{1 \times S}{(S^2+4)(S^2-9)}$$

c) Using Laplace transform methods solve the initial value problem 9

$$y'' + 3y'(t) - 4y(t) = 2t$$

With $y(0) = 0, y'(0) = 1$

Module IV

Q.7 a) Find the Fourier transform of the function **8**

$$f(x)\begin{cases} a-|x|, & |x| \leq a \\ 0, & |x| > a \end{cases}$$

and hence find the value of the integral

$$\int_0^\infty \frac{\sin^4 t}{t^4}\,dt$$

b) Solve the integral equation **5**

$$\int_0^\infty f(x) Cos\, sx dx = e^{-s}$$

c) Evaluate the following integral using Fourier transform Methods **7**

$$\int_0^\infty \frac{s^2}{(S^2+4)(S^2+9)}\,ds$$

Q8 a) State and Prove convolution Theorem for Z-transform. **6**

b) Use z-transform to solve the difference equation **7**

$$y_{n+2} + 6y_{n+1} + 9y_n = 2^n$$
$$\text{with } y_0 = y_1 = 0$$

c) Derive an expression for one dimensional wave equation by making suitable assumptions. **7**