SE363

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

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

Instruction:-
Please check whether you have got the right question paper.
1) Attempt any five questions with at least one question from each module.
2) Assume suitable data if necessary.
3) Figures to the right indicate full marks.

Module - I

Q. 1 a) Prove that for any nonsingular square matrix A of order 'n' $|adj\ A| = |A|^{n-1}$ **04**

b) Find the rank of the matrix by reducing it to its normal form. **07**

$$\begin{bmatrix} 2 & -4 & 3 & 1 & 0 \\ 1 & -2 & 1 & -4 & 2 \\ 0 & 1 & -1 & 3 & 1 \\ 4 & -7 & 4 & -4 & 5 \end{bmatrix}$$

c) Solve the following system of linear equations. **06**

$$5x + 3y + 3z = 48$$
$$2x + 6y - 3z = 18$$
$$8x - 3y + 2z = 21$$

d) Prove that if A is orthogonal then $det\ (A) = \pm 1$ **03**

Q. 2 a) Verify Cayley Hamilton Theorem for the following matrix use it to find A^4. **07**

$$A = \begin{bmatrix} 9 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -4 & -3 \end{bmatrix}$$

b) Test whether the following vectors are linearly independent or dependent. **06**
$x_1 = (2,1,3,1)$, $x_2 = (1,2,1,-1)$, $x_3 = (2,-2,3,2)$ $and\ x_4 = (2,-1,3,4)$

c) Test whether the following matrix is diagonalizable or not. If yes, find the modal matrix 'p' which diagonalizes A. **07**

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

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Module – II

Q. 3 a) Find the Eigen values and Eigen vectors of the matrix **06**

$$A = \begin{bmatrix} 1 & 2 & -2 \\ 2 & 1 & -4 \\ -1 & -1 & -2 \end{bmatrix}$$

b) Find the minimal polynomial of the matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ -1 & -1 & 2 \end{bmatrix}$ **07**

State whether the matrix is derogatory or non-derogatory.

c) Determine the value of λ and μ. So that the following system of equations. **07**

$x + y + z = 6$

$x + 2y + 3z = 10$

$x + 2y + \lambda z = \mu$

Have,

(i) No solution

(ii) Unique solution

(iii) Infinitely many solutions

Q. 4 a) Find Fourier cosine series of $f(x) = x^2 \quad in \quad (0,\pi)$ **06**

b) Find Fourier series representation of $f(x) = x^2 \quad in\ (-\pi,\pi)$ and hence find the value of the series $1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \cdots$ **08**

c) Find half range Fourier sine series for the following function $f(x) = x - x^3$ in the interval$(0,1)$. **06**

Module – III

Q. 5 a) If $L[f(t)] = f(s)$ then prove that **06**

i) $L\left[\frac{f(t)}{t}\right] = \int_s^\infty f(u)du$

ii) $L[\int_0^t f(t)dt] = \frac{f(s)}{s}$

b) Find the Laplace Transform of the following. **06**

i) $t\, e^{-3t} sin2t$

ii) $\int_0^t e^{-2t} t^3 dt$

c) Use convolution theorem for Laplace Transform to find the inverse Laplace Transform of $\frac{s}{(s^2+9)^2}$ **08**

Q. 6 a) Find the Inverse Laplace Transform of the following. **08**

i) $\tan^{-1}\left(\frac{1}{s}\right)$

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ii) $\frac{s+2}{s^2(s^2+1)}$

b) Show that if $f(t)$ is a periodic function with period 't' then $L[f(t)] = \frac{1}{1-e^{-sp}}\int_0^p e^{-st} f(t)dt$ **06**

c) Solve using Laplace Transform method **06**
$y'' + 3y' + 2y = e^{-3t}$ give that $y'(0) = 0, y(0) = 0$

Module – IV

Q. 7 a) Find Fourier Transform of the function $f(x) = e^{-a^2x^2}$ **06**

b) Prove that **08**

i) $f_c\{x\, f(x)\} = \frac{d}{ds}\overline{f}_s(s)$

ii) $f_s\{x\, f(x)\} = -\frac{d}{ds}\overline{f}_c\,(s)$

Where $\overline{f}_s(s)$ and $\overline{f}_c(s)$ denote Fourier sine and cosine transform of $f(x)$ respectively.

c) Find the Fourier Transform of **06**

$$f(x) = \begin{cases} 1 & for\ |x| \le a \\ 0 & for\ |x| > a \end{cases}$$

Q. 8 a) Derive one dimensional wave equation. State all assumptions. **08**

b) Find the Z – transform of the following **06**

i) n^2

ii) $\frac{2n}{(n+1)(n-2)}$

c) Solve the following difference equation using Z – transform **06**

$y_{n+2} - 3y_{n+1} + 2y_n = 2^n$

$y_0 = 0, y_1 = 0$

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