SE319

Total No. of Printed Pages:03

S.E. Computer (Sem-III) (Revised Course 2016-2017)
EXAMINATION NOV/DEC 2019
Applied Mathematics - III

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

Instructions:
1) Attempt **five** questions. **any two** questions each from **PART – A** and **PART – B** and **one** from **PART – C**.
2) Assume suitable data, if necessary.
3) Figures to the **right** indicate full **marks.**
4) Use of statistical tables allowed.

PART – A

Answer any TWO questions from the following. **2x20=40**

Q.1 a) Define symmetric and skew symmetric matrix. Express the following matrix A as the sum of a symmetric and skew symmetric matrix where **(6)**

$$A = \begin{bmatrix} 4 & 2 & -3 \\ 1 & 3 & -6 \\ -5 & 0 & -7 \end{bmatrix}$$

b) Test whether the vectors (2, 1, 3, 1), (1, 2, 1, -1), (2, -2, 3, 2) and (2, -1, 3, 4) are linearly independent or dependent. **(7)**

c) For any two events A and B, if P(A) = $\frac{3}{4}$, P(B) = $\frac{1}{5}$ and $P(A \cap B) = \frac{1}{20}$, find $P(A \cup B), P(A \cap \bar{B}), P(A|B), P(\bar{A}|\bar{B}), P(A|\bar{B}) and\ P(\bar{A}|B)$. **(7)**

Q.2 a) State Cayley Hamilton theorem. Verify the theorem for the given matrix A and hence find A^{-1}. **(7)**

$$A = \begin{bmatrix} 7 & -1 & 3 \\ 6 & 1 & 4 \\ 2 & 4 & 8 \end{bmatrix}$$

b) By expressing the following matrix in the normal form find its rank. **(7)**

$$A = \begin{bmatrix} 3 & 1 & 1 & 8 \\ 2 & -1 & 3 & 7 \\ 1 & 1 & 1 & 6 \\ 1 & -1 & 2 & 5 \end{bmatrix}$$

c) In a quiz contest of answering "Yes" or "No" what is the probability of guessing at least 6 answers correctly out of 10 questions asked? Also find the probability of the same if there are 4 options for a correct answer. **(6)**

Q.3 a) Prove that the inverse of an orthogonal matrix is orthogonal and its transpose is also orthogonal. **(4)**

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b) Find the value of constant k such that $f(x) = \begin{cases} k + \frac{x}{6} & 0 \le x \le 3 \\ 0 & elsewhere \end{cases}$ is a probability function. Also find its mean and variance. **(6)**

c) Test whether the following matrix A is diagonalizable or not. If yes, find the modal matrix P which diagonalizes matrix A. **(6)**

$$A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$$

d) In a certain town the duration of a shower is exponentially distributed with mean 5 minutes. What is the probability that a shower will last between 10 and 12 minutes? **(4)**

PART – B

Answer any **TWO** questions from the following. **2x20=40**

Q.4

a) Define Dirac delta function. δ. Also find the Laplace transform of the function $\cos h\,(3t)\delta(t-2)$. **(5)**

b) Find the Laplace transform of the following functions **(6)**
(i) $e^{2t}\cos^2 t$ (ii) $\frac{1-cos3t}{t}$

c) Using Laplace transform evaluate $\int_0^\infty e^{-t} t \sin^2 3t\, dt$. **(5)**

d) Find the inverse Laplace transform of $\cot^{-1}\left(\frac{s}{a}\right)$. **(4)**

Q.5

a) Find the Laplace transform of the full wave rectifier $f(t) = E\sin(\omega t), 0 < t < \frac{\pi}{\omega}$ having period $\frac{\pi}{\omega}$. **(6)**

b) Solve for *for(x)*, the following integral equation **(5)**
$\int_0^\infty f(x) cos\lambda x\, dx = e^{-\lambda}$

c) Obtain the inverse Z transform of **(9)**
(i) $\frac{3z^2+2z}{25z^2+5z-2}$ (ii) $z\log\left(\frac{z}{z+1}\right)$.

Q.6

a) Using Convolution theorem obtain the inverse Laplace transform of the function $\frac{s+2}{(s^2+4s+5)^2}$ **(7)**

b) Solve the differential equation $y'' + 4y' + 3y = e^{-t}$ with $y(0) = 1, y'(0) = 1$ using Laplace Transforms. **(7)**

c) Find the Fourier cosine transform of $e^{-ax}; a > 0$ and hence deduce the Fourier cosine transform of $xe^{-ax}; a > 0$. **(6)**

PART – C

Answer any **ONE** question from the following: **1x20=20**

Q.7 a) Find the regression coefficients and hence calculate coefficient of Correlation for the following data. **(8)**

X	6	2	10	4	8
Y	9	11	5	8	7

b) In a class 70% are boys and 30% are girls. 5% of boys, 3% of the girls are irregular to the classes. What is the probability of a student selected at random is irregular to the classes and what is the probability that the irregular student is a girl? **(6)**

c) Find the Z- transform of sin (3n+5). **(6)**

Q.8 a) Solve by using Laplace transforms **(8)**

$\frac{dx}{dt} - 2y = cos2t,\ \frac{dy}{dt} + 2x = sin2t;\quad x = 1, y = 0\ at\ t = 0.$

b) Find all the Eigen values and Eigen vectors of the matrix **(6)**

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

c) Show that $xe^{-x^{2/2}}$ is self – reciprocal under the Fourier sine transform. **(6)**

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