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S.E. (Information Technology) (Semester- III) (Revised Course 2007-08)
 EXAMINATION Nov/Dec 2019
 Applied Mathematics - III

[Duration : Three Hours]

[Total Marks : 100]

Instructions:

- 1) Attempt any 5 questions, at least one from each Module.
- 2) Assume suitable data if necessary.
- 3) Use of statistical table is permitted.

MODULE 1

- Q.1** a) Define the following 3
- i) Hermitian matrix
 - ii) Skew Hermitian matrix
 - iii) Orthogonal matrix

- b) Reduce the following matrix to Normal form 5

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

- c) Solve the following system of equations & check if they are consistent 9
- $x + y - z = 0$, $2x - y + z = 3$ & $4x + 2y - 2z = 2$

- d) Show that the matrix is orthogonal and hence find A^{-1} 3
- $$A = \begin{bmatrix} \cos a & 0 & \sin a \\ 0 & 1 & 0 \\ -\sin a & 0 & \cos a \end{bmatrix}$$

- Q.2** a) Find the Eigen value & Eigen vectors of the following matrix 7
- $$A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$$

- b) Verify Cayley Hamilton theorem for the following matrix use it to find A^{-1} 7
- where $A = \begin{bmatrix} 2 & 2 & -3 \\ 1 & 2 & -1 \\ 3 & 2 & 1 \end{bmatrix}$

- c) Find $\sin A$ given $A = \begin{bmatrix} 1 & -2 \\ 1 & 4 \end{bmatrix}$ 6

MODULE 2

- Q.3**
- a) Find the Z- transform of the following 6
- i) $\frac{1}{n!}$ ii) $\frac{2}{(n+1)(n-1)}$
- b) Find the inverse Z-transform of $\frac{z^2}{(z+4)^2}$ 6
- c) Use the Z- transform to solve the difference equation 8
 $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$
- Q.4**
- a) The following regression equations & variances are obtained from a Correlation table 8
 $20x-9y-107=0$ & $4x-5y+33=0$ & variance of "x" is 9 them find
- i) The mean of x & y
 ii) Coefficient of correlation
 iii) Standard deviation of y
- b) The probability that an individual suffers a bad reaction taking a certain drug is 0.02. Determine 6
 the probability that out of 1000 individuals
- i) exactly 3 will suffer a bad reaction
 ii) more than 2 will suffer a bad reaction.
- c) Player A & B roll a pair of dice alternately. The player who rolls 10 first wins. If A stats find his 6
 chance of winning.

MODULE 3

- Q.5**
- a) Let X be a discrete random variable with probability distribution given by 6
 $P(X = 1) = \frac{1}{2}, P(X = 2) = \frac{1}{3}$ & $P(X = 3) = \frac{1}{6}$ Compute the mean & variance of X.
- b) In a game of poker 5 cards are drawn from pack of 52 well shuffled cards. Find the probability 8
 that
- i) 4 are aces & 1 is any card
 ii) 4 are aces & 1 is a king
 iii) 3 are tens & 2 are jacks
 iv) A nine, ten, jack, queen & a king are obtained in any order.
- c) Define Independent events. If A & B are independent events, then A^T & B^T are also independent 6
 events.
- Q.6**
- a) Calculate the moment generating function of the Binomial random variable X with probability 8
 mass function $P(X=r) = {}^n C_r p^r q^{n-r}$, $r=0,1,\dots,n$ where $0 < p < 1$ & $q=1-p$. hence compute its mean.

- b) An urn contains nine balls, two of which are red, three blue & four black. Three are drawn from the urn at random. What is the probability that the
- Three balls drawn are of different colour?
 - Three balls drawn are of same colour?
- c) A bag contains 50 tickets numbered 1 to 50, which 5 tickets are drawn randomly & arrange in ascending order $x_1 < x_2 < x_3 < x_4 < x_5$. What is the probability that $x_3 = 30$?

MODULE 4

- Q.7**
- Find the Laplace transform of the following
 - $e^{-t} \sinh t \cos 2t$
 - $\int_0^t e^{-2u} \cos u \, du$
 - $\frac{e^{-2t} - e^{-3t}}{t}$
 - State & prove Convolution theorem for Laplace Transform.
 - Using Laplace Transform method to solve the integral equation $y(t) = e^{3t} + \int_0^t y(u) \, du$
- Q.8**
- Find the Fourier Transform of $f(x) = e^{-|x|}$
 - Solve for $f(x)$ the integral equation $\int_0^\infty f(x) \cos ux \, dx = e^{-2x}$
 - Find the Fourier sine & cosine transform of $f(x) = x^{n-1}; n > 0$ and hence show that the function $f(x) = \frac{1}{\sqrt{x}}$ is self-reciprocal under Fourier Sine and Cosine transforms.