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S.E.(Information Technology) (Semester- III) (Revised Course 2007-08) EXAMINATION MAY/JUNE 2019

Applied Mathematics - III

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

Please check whether you have got the right question paper.

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 I

Q.1 a) Define Hermitian matrix. Prove that the determinant of a Hermitian matrix is real. **05**

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

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

c) Define Linearly Dependent vectors. Test whether the following vectors are linearly independent or not. **08**
(2 2 7 -1) , (3 -1 2 4) and (1 1 3 1).

Q.2 a) State and Prove Cayley Hamilton Theorem. **06**

b) Find the eigen values and eigen vectors for the matrix. **07**

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

c) For the matrix A given below, find matrix P such that $P^{-1}AP$ is a diagonal matrix **07**

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

Module II

Q.3 a) Find the Z-transform of the following. **06**
i) $\frac{1}{n}$ ii) $\cos\left(\frac{n\pi}{2}\right)$

b) State and prove convolution theorem in Z-transform. **07**

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c) Solve the following difference equation using Z-transform. **07**

$$y_{n+2} - 5y_{n+1} + 6y_n = 4^n \quad \text{given} \quad y_0 = 0 \text{ and } y_1 = 0$$

Q.4 a) Define i) Exhaustive events ii) Independent events. If events A and B are exhaustive events and $P(A) = \frac{1}{2}$ $P(B) = \frac{3}{4}$ find $P(A \cap B)$ **06**

b) A student A can solve 75% of the problems given in a book and a student B can solve 70%. What is the probability that A or B can solve a problem chosen at random. **06**

c) Find the regression line sales on cost for the following data, hence find sales if cost 85, **08**

Cost	39	65	62	90	82	75	25	98	36	78
Sales	47	53	58	86	62	68	60	91	51	84

Module III

Q.5 a) Let X be a discrete random variable with the following probability distribution. **08**

X= n	1	2	3	4	5	6	7
P(X=n)	C	2C	2C	3C	C^2	$2C^2$	$(7C^2+C)$

i) Find the value of C
ii) Compute P(1<X<4)
iii) Find the mean of X.

b) The probability that an individual suffers a bad reaction from injection of a certain serum is 0.002. Determine the probability that out of 1000 individuals. **06**
i) Exactly 3 will suffer a bad reaction.
ii) More than 2 will suffer a bad reaction.

c) State and prove Baye's Theorem of probability. **06**

Q.6 a) Find the moment generating function of exponential random variable. Use it to find its mean. **05**

b) In a test of 2000 electric bulbs it was found that life of a particular bulb was normally distributed with an average life of 2040 hours and standard deviation as 60 hours. Estimate total number of bulbs likely to burn: **08**
1) More than 2150 hours
2) Less than 1950 hours
3) More than 1920 hours but less than 2160 hours.
(Given that the area under the normal curve at z=1.83 is 0.4664, at z=1.33 is 0.4082 and at z =2 is 0.4772)

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c) Let A and B be independent events. **07**

i) Show that A and $\bar{B}$ are independent.

ii) Show that $\bar{A}$ and B are independent.

iii) If A and B are not mutually exclusive then show that $\bar{A}$ and $\bar{B}$ are independent.

Module IV

Q.7 a) State and prove convolution Theorem for Laplace Transform. **06**

b) Using Laplace transform method, solve the integral equation. **07**

$$y(t) = e^{3t} + \int_0^t y(u)du$$

c) Find the Laplace transform of **07**

i) $t\ sin3t$ ii) $e^{-2t}cos2t + 2\sin^2 t$

Q.8 a) Find the Fourier transform of $f(x) = e^{-a^2x^2}$ **07**

b) By using Fourier Transform method, evaluate **07**

$$\int_0^\infty \frac{dx}{(x^2+4)(x^2+25)}$$

c) Find the Fourier cosine transform of **06**

$$f(x) = \begin{cases} \cos x & 0 < x < a \\ 0 & x > a \end{cases}$$