

# Bharatiya Vidya Bhavan's SARDARPATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

January 2016

## KT Examination

Total Marks : 100

Duration : 3 Hours

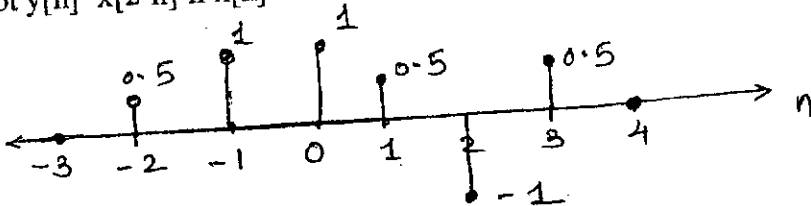
CLASS/SEM: SE/IV

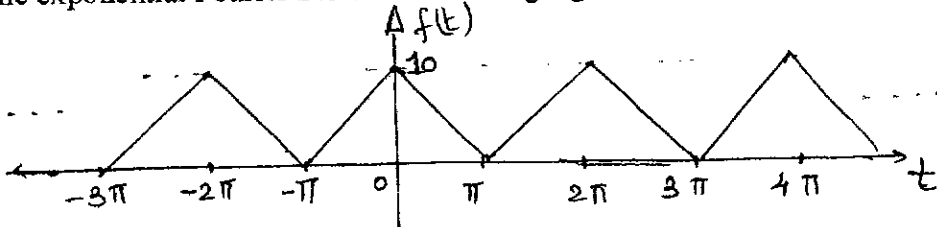
Subject code: EE255

SUBJECT: Signals and System

- Question no. One is **Compulsory**.
- Attempt any Four question out of remaining SIX questions
- Answers to all sub questions should be grouped together
- Figures to the right indicate full marks
- In the absence of any data, make suitable assumptions and justify the same.

Master file.

Q.1)	<p>a) Plot <math>y[n]=x[2-n]</math> if <math>x[n]</math> is</p>  <p>b) State and explain initial and final value theorem for continuous time systems. Calculate initial and final value of <math>H(s) = \frac{10s+20}{s(s^2+4s+15)}</math>.</p> <p>c) Find Z- Transform of <math>x(n)=n u(n)</math>.</p> <p>d) Classify following system as static/dynamic, linear/non-linear, time-variant/invariant, causal/non-causal and stable/unstable, <math>y(n) = x(-n+12)</math>.</p>	<p>05 05 05 05</p>
Q.2)	<p>a) Consider a LTI system with frequency response <math>H(j\omega) = \frac{j\omega + 2}{(j\omega + 15)(j\omega + 7)}</math>. Determine its impulse response. For a given input <math>x(t) = e^{-4t} u(t)</math> evaluate <math>y(t)</math>.</p> <p>b) Calculate DTFT of <math>\{1, 5, -1, -2, 10\}</math></p>	<p>10 10</p>
Q.3)	<p>a) State and prove any four properties of Fourier Transform.</p>	<p>10</p>

	<p>b) Find the inverse Laplace Transform of <math>X(s) = \frac{(s+10)}{(s+1)(s+5)}</math> if the convergence regions are</p> <p>i) <math>-5 &lt; \text{Re}(s) &lt; -1</math>                      ii) <math>\text{Re}(s) &gt; -1</math>                      iii) <math>\text{Re}(s) &lt; -5</math></p>	10
Q.4)	<p>a) Consider a system described by the difference equation</p> $y[n] = y[n-2] + 2y[n-1] + 10x[n] + 4x[n-1].$ <p>Find the response of the system to the input <math>x[n] = (0.5)^n u[n]</math>. Initial conditions in the system are <math>y[-1] = 10</math> and <math>y[-2] = 1</math>.</p> <p>b) Determine inverse Z-transform of <math>X(z) = \frac{z-5}{(z-2)(z-3)(z-1)}</math>.</p>	10
Q.5)	<p>a) In an electrical network the relation between input voltage <math>x(t)</math> and output voltage <math>y(t)</math> is given by <math>4\ddot{y}(t) + 5\dot{y}(t) + y(t) = x(t)</math> where <math>x(t) = \sin(20t)u(t)</math>. Determine the output voltage <math>y(t)</math> if initial conditions in the network are <math>y(0) = -1</math> and <math>\dot{y}(0) = 1</math>.</p> <p>b) Calculate the value of <math>e^t u(t) * e^{-t} u(t)</math> using continuous time linear convolution.</p>	10
Q.6)	<p>a) Obtain Direct form I and Direct form II realization of a system with transfer function <math>H(z) = \frac{2z^2 + 12z + 7}{z^2 + 21z - 2}</math>.</p> <p>c) Find the exponential Fourier Series of following signal.</p> 	10
Q.7)	<p>a) Determine inverse Fourier transform of a Discrete signal <math>x[n]</math> if</p> <p>i) <math>X(e^{j\omega}) = \frac{100}{100 - 9e^{-2j\omega}}</math>                      ii) <math>X(e^{j\omega}) = \frac{1 + 3e^{-3j\omega}}{1 + \frac{1}{4}e^{-j\omega}}</math></p> <p>b) State and prove any four properties of Z-Transform.</p>	10

# SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

JAN 2016

Total Marks: 100

Duration: 3 Hours

CLASS/SEM: S.E (ELECTRICAL)/IV (KT-EXAMINATION)

SUBJECT: ENGINEERING MATHEMATICS IV

- Question no.1 is compulsory.
- Attempt any **FOUR** questions out of remaining **SIX** questions.
- answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.

Master file.

Q1.a) If  $A = \begin{bmatrix} 2+i & 3 & -1+3i \\ -5 & i & 4-2i \end{bmatrix}$  Show that  $A^*A$  is a Hermitian matrix, where  $A^*$  is the conjugate transpose of A. 06

Q1.b) A drug is given to 10 patients and increments in their blood pressure were recorded to be 3, 6, -2, 4, -3, 4, 0, 0, 2, 6. Is it reasonable to believe that the drug has no effect on change of blood pressure? 06

Q1.c) A drawer contains 50 bolts and 150 nuts. Half of the bolts and half of the nuts are rusted. If one item is chosen at random, what is the probability that it is rusted or is a bolt? 08

Q2.a) If the mean of a binomial distribution is 3 and the variance is  $\frac{3}{2}$ , find the probability of obtaining atleast 4 success. 06

Q2.b) If  $A = \frac{1}{3} \begin{pmatrix} 1 & 2 & a \\ 2 & 1 & b \\ 2 & -2 & c \end{pmatrix}$  is orthogonal find a, b and c. 06

Q2.c) Find non-singular matrices P, Q so that PAQ is a normal form where 08

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

Q3.a) A square matrix A is defined by  $A = \begin{bmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{bmatrix}$ . Find the modal matrix P and the resulting diagonal matrix D of A. 06

Q3.b) A radioactive source emits particles at a rate of 10 per minute in accordance with Poisson 06

①

law. Each particle emitted has a probability of  $\frac{2}{5}$  being recorded. Find the probability that atleast 4 particles are recorded in a 2 minute period.

- Q3.c) In an experiment on pea - breeding mendel obtained the following frequencies of seeds. 08
- 315 Round and Yellow
  - 101 Wrinkled and Yellow
  - 108 Round and Green
  - 32 Wrinkled and Green

According to his theory of heredity the numbers should be in population 9:3:3:1. Is there any evidence to doubt the theory at 5% Los?

- Q4.a) Find if matrix  $A = \begin{bmatrix} -1 & 0 & 0 \\ 1 & -1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$  is derogatory. 06

- Q4.b) Find  $4^A$  where  $A = \begin{bmatrix} 3/2 & 1/2 \\ 1/2 & 3/2 \end{bmatrix}$  06

- Q4.c) A crv X has PDF defined as  $f(x) = \begin{cases} A+Bx, 0 \leq x \leq 1 \\ 0, elsewhere \end{cases}$  08

If the mean of the distribution is  $1/3$ . Find A & B.

- Q5.a) Compute spearman's rank coorelation coefficient for the following data 06

X	10	12	18	18	15	40
Y	12	18	25	25	50	25

- Q5.b) Find the characteristic equation of the matrix  $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ . Verify Cayley - Hamilton 06

theorem and hence evaluate the matrix equation.

$$A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 - 8A^2 + 2A - I$$

- Q5.c) In an examination marks obtained by students in mathematics, physics and chemistry are normally distributed with means 51,53 and 46 with standard deviations 15,12,16 respectively. Find the probability of securing total marks (i) 180 or more (ii) 90 or below 08

- Q6.a) The heights of six randomly chosen sailors are in inches;63,65,68,69,71 & 72. The heights of ten randomly chosen soldiers are;61,62,65,66,69,69,70,71,72&73. Discuss in the light of this data that the soldiers on an average are taller than sailors 06

Q6.b) Find the eigen values and eigenvectors of the matrix  $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$  06

Q6.c) Find the correlation coefficient for the following 08

X (Height of father)	165	160	170	163	173	158	178	168	173	170	175	180
Y (Height of Sons)	173	168	173	165	175	168	173	168	180	170	173	178

Q7.a) Fit a binomial distribution for the following data and compare the theoretical frequencies with the actual ones: 06

X	0	1	2	3	4	5
f(x)	2	14	20	34	22	8

Q7.b) For what values of  $\lambda$  and  $\mu$  the equations 06

$$\begin{aligned} x + y + z &= 6 \\ x + 2y + 3z &= 10 \\ x + 2y + \lambda z &= \mu \end{aligned}$$

Have

- i) No solution
- ii) A unique solution
- iii) Infinite number of solutions

Q7.c) Express the matrix  $A = \begin{bmatrix} 1+i & 2+i & 3+i \\ 1 & 2 & 3 \\ 2-3i & 3-4i & 4+5i \end{bmatrix}$  as the sum of Hermitian matrix and skew - Hermitian matrix. 08

