

**FACULTY OF ENGINEERING**

B.E. 2/4 (EEE) II - Semester (Old) Examination, Nov. / Dec. 2016

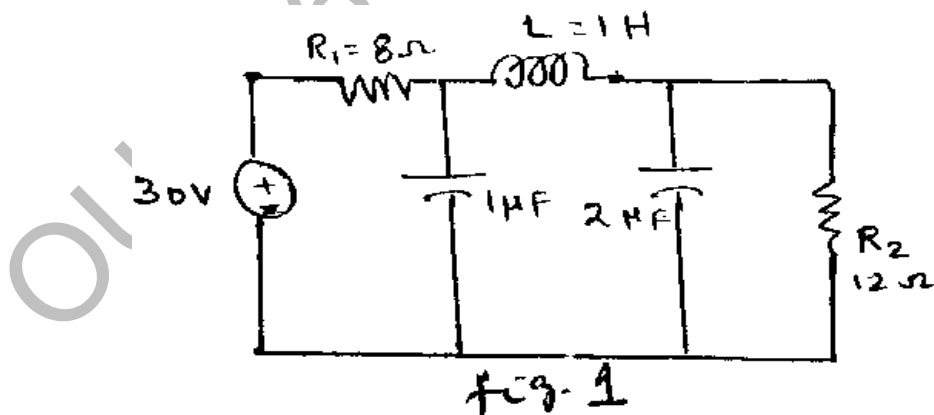
Subject : Electrical Circuits – II

Time : 3 hours

Max. Marks : 75

**Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.****PART – A (25 Marks)**

- 1 A series RL circuit is excited by a unit-step voltage. Find the circuit response  $i(t)$  in the circuit.
- 2 If the unit step response of a network is  $(1 - e^{-\tau t})$ . What will be its unit impulse response?
- 3 List the properties of positive real function.
- 4 State the final value theorem.
- 5 Define unit ramp function.
- 6 For the circuit shown in fig.1, determine the steady state voltages and currents,  $V_{R1}$ ,  $V_{R2}$ ,  $i_{R1}$ ,  $i_{R2}$ .

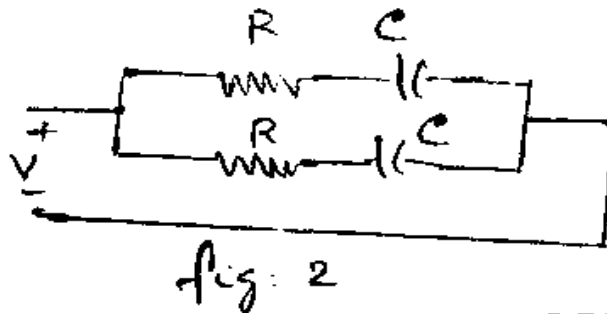


- 7 Write the Fourier series expansion of an even function with half wave symmetry.
- 8 Define the term network synthesis.
- 9 The Laplace transform of the function  $i(t)$  is

$$I(s) = \frac{10s + 4}{s(s+1)(s^2 + 4s + 5)}$$

What will be its final value?

10 What is the time constant of the circuit shown in fig.2?

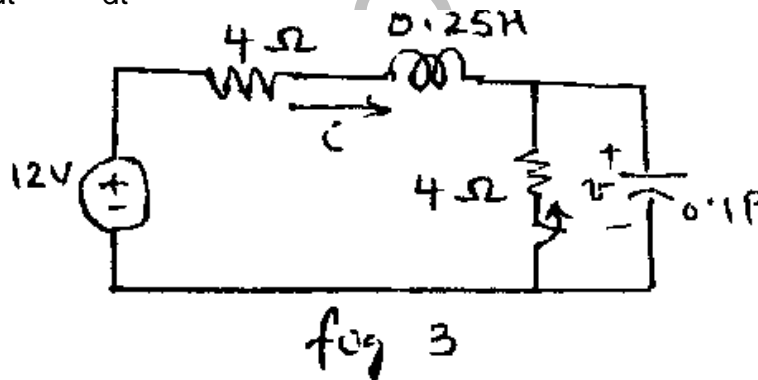


**PART - B (50 Marks)**

11 In the circuit shown below the switch was closed for a long time and opened at  $t = 0$ . Find the following :

$$i(0^+), v(0^+), \frac{di}{dt}(0^+), \frac{dv}{dt}(0^+), i(\infty), \text{ and } v(\infty).$$

10



12 a) In the circuit shown with no initial energy storage, determine (by using the transfer function concept) the output voltage  $v_2(t)$  when the circuit is excited, at  $t = 0$ , by an input voltage.  $V_1(t) = 20v$ .

5

b) Find the inverse Laplace transform of

5

$$\frac{(2S+1)}{(S+1)(S^2+2S+2)}$$

13 State and prove any five properties of Laplace transform.

10

14 a) From the transfer function given below make an s-plane plot of finite poles and zeros.

$$G(s) = \frac{3s^2 + 9s + 6}{2s^3 + 14s^2 + 24s}$$

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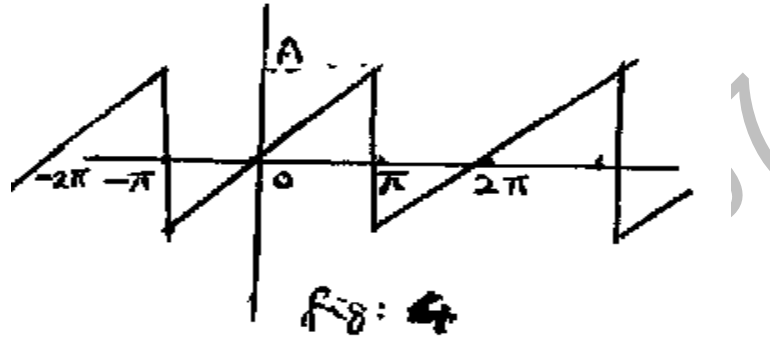
b) Provide a list of restrictions on location of poles and zeros in driving point functions.

5

...3

15 a) Find the Fourier series of the waveform shown in fig.4.

5



b) Write a few comparison between Laplace transform and Fourier transform.

5

16 a) Synthesize the impedance function using first form of Cauer Network.

5

$$Z(s) = \frac{s(s^2 + 3)(s^2 + 5)}{(s^2 + 2)(s^2 + 4)}$$

b) Synthesize the forster II form network when its admittance function is given as

5

$$Y(s) = \frac{(s^2 + 4)(s^2 + 16)}{s(s^2 + 10)}$$

17 a) State and prove the convolution theorem of Laplace transforms.

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b) Using the convolution theorem find the inverse Laplace transform of

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

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## FACULTY OF ENGINEERING

B.E. 2/4 (EEE) II-Semester (New) (Suppl.) Examination, November / December 2016

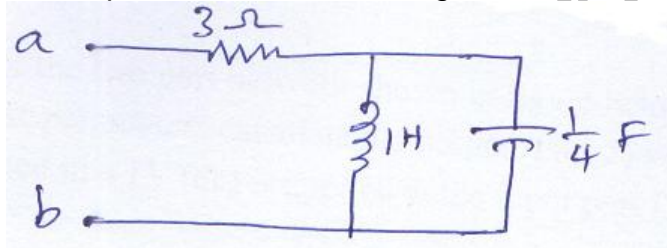
Subject : Electrical Circuits - II

Time : 3 Hours

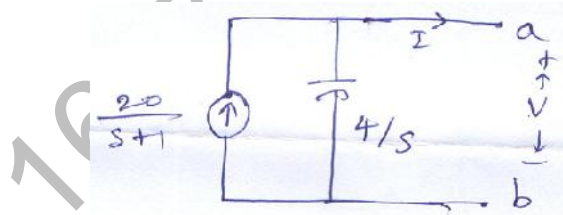
Max. Marks: 75

**Note: Answer all questions from Part-A and answer any five questions from Part-B.****PART – A (25 Marks)**

- 1 Draw the equivalent circuit of capacitance at  $t = 0^+$  and  $t = \infty$ . (3)
- 2 What is unit impulse function? (3)
- 3 Determine the Laplace impedance of the following circuits. (3)



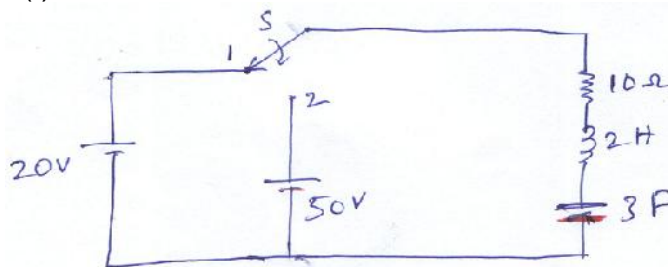
- 4 Convert the current source in the following circuit to a voltage source in S-domain. (4)



- 5 For a two port bilateral network, the three transmission parameters are given by  $A = 6/5$ ,  $B = 17/5$ , and  $C = 1/5$  what is the value of  $D$ ? (3)
- 6 What do you mean by driving point impedance? (3)
- 7 What is time shifting property of Fourier transform? (3)
- 8 What are the difference between Fosters method and Caueer method of network synthesis? (3)

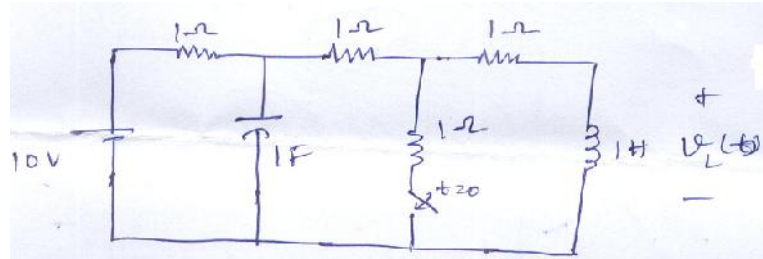
**PART – B (50 Marks)**

- 9 In the network shown in figure below, the switch is moved from position 1 to position 2 at  $t = 0$ . The switch is in position 1 for a long time. Determine the current expression  $i(t)$ . (10)

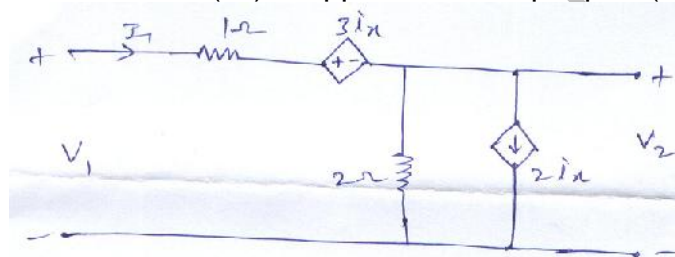


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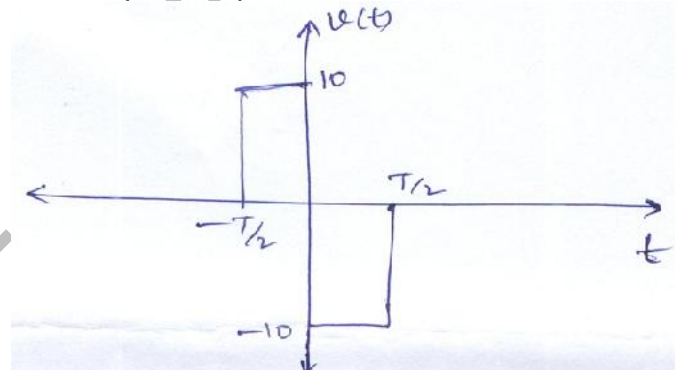
- 10 The circuit in figure below was in DC steady state at  $t = 0$ . The switch in the circuit closes at  $t = 0$  introducing a new  $1 \Omega$  into the circuit. Determine the voltage across the inductor as a function of time. (10)



- 11 For the two port network shown in figure below, determine the h-parameters. Using these parameters calculate the output (port 2) voltage,  $V_2$ , when the output port is terminated in a  $1V$  (dc) is applied at the input port ( $V_1 = 1V$ ). (10)



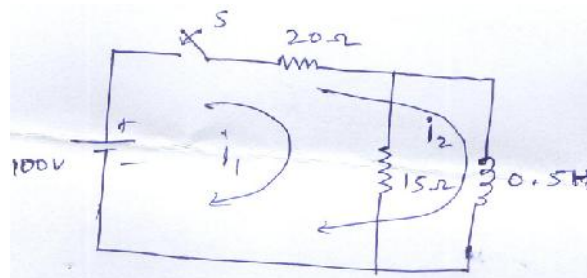
- 12 Obtain the magnitude and phase spectrum of the waveform shown in figure. (10)



- 13 Find the two cauer realization of driving point function given by

$$Z(s) = \frac{10s^2 + 12s^2 + 1}{2s^3 + 2s}$$

- 14 In the circuit shown in figure below, determine the current equations for  $i_1$  and  $i_2$  when the switch is closed at  $t = 0$ . (10)



- 15 Write short notes on Waveform synthesis. (10)

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**FACULTY OF ENGINEERING**

B.E. 2/4 (Inst.) II - Semester (Old) Examination, November / December 2016

**Subject : Transducer Engineering****Time : 3 Hours****Max. Marks: 75****Note: Answer all questions from Part-A and answer any five questions from Part-B.****PART – A (25 Marks)**

- 1 Define ruggedness and repeatability. (2)
- 2 What are primary standards? (2)
- 3 What are passive transducers? Give two examples. (3)
- 4 Draw a wheatstone bridge and derive the condition for its balance. (3)
- 5 Mention the principle of a resistive transducer used for angular motion measurement. (2)
- 6 How is humidity measured using resistive principle? (2)
- 7 Give the expression for sensitivity of a thermal element. (3)
- 8 Mention the principle of a pyrometer. (2)
- 9 Compare flat and corrugated diaphragms. (3)
- 10 How is a Khudsen gauge used for measuring pressure? (3)

**PART – B (50 Marks)**

- 11 Explain any two dynamic features of instrumentation system. (10)
- 12 (a) Explain the construction and working of a bonded strain gauge. (5)  
(b) What are possible errors that may occur in bonded strain gauges and how can they be minimized? (5)
- 13 (a) Explain the functioning of an eddy current types of inductive transducer. (5)  
(b) How is the thickness of a sheet measured using variable capacitance principle? (5)
- 14 Explain the construction and working of a platinum resistance thermometer. (10)
- 15 (a) Discuss the working principle of a Piezoelectric pressure transducer. (5)  
(b) Compare its performance with other pressure measuring devices. (5)
- 16 (a) Explain the significance of the thermocouple laws. (5)  
(b) Discuss the parameters considered in the selection of a transducer. (5)
- 17 Write short notes on the following: (10)  
(a) Thermistor linearization.  
(b) First-order and second-order instruments characteristics

**FACULTY OF ENGINEERING****B.E. 2/4 (Inst.) II - Semester (New) (Suppl.) Examination, November / December 2016****Subject : Transducer Engineering****Time : 3 Hours****Max. Marks: 75****Note: Answer all questions from Part-A and answer any five questions from Part-B.****PART – A (25 Marks)**

- 1 Explain the basic difference between Static and Dynamic characteristics of Measurement systems. (2)
- 2 What is the significance of "ORDER" of systems? Define Zero order system. (3)
- 3 Write any 6 basic requirements of transducers. (3)
- 4 Write any three applications of Strain Gauges. (2)
- 5 What is RVDT? Briefly explain. (2)
- 6 Explain the principle of capacitive displacement transducer. (3)
- 7 What are the different types of standards for temperature of calibration? (3)
- 8 What are the different types of Non-Electrical type pressure sensors? (2)
- 9 Write the disadvantages of Capsules. (2)
- 10 Briefly explain the principle of McLeod gauge. (3)

**PART – B (50 Marks)**

- 11 (a) Explain different standard test signals with equations. (5)  
(b) Define : (i) Linearity (ii) Hysteresis (iii) Span (iv) Calibration. (5)
- 12 Derive the expression for gauge factor for metal wire gauges. Derive the expression for strain in Poisson's bridge. (5+5)
- 13 Explain the basic principle of variable capacitive transducer. With a neat diagram explain the variable capacitive proximity sensor. (4+6)
- 14 What is a Thermocouple? Explain the different laws of thermocouples. (3+7)
- 15 With neat diagram explain: (5+5)  
(a) Corrugated diaphragms  
(b) Thermal conductivity gauges
- 16 Write short notes on : (5+5)  
(a) LVDT  
(b) Types of filled in system thermometers
- 17 With a neat diagram explain the force balance type pressure transducers. Derive the transfer function and block diagram. (5+5)

**FACULTY OF ENGINEERING****B.E. 2/4 (ECE/M/P/AE/CSE) II - Semester (Old) Examination, Nov. / Dec. 2016****Subject : Mathematics – IV****Time : 3 hours****Max. Marks : 75****Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.****PART – A (25 Marks)**

- 1 State the necessary condition for  $f(z) = u(x, y) + i v(x, y)$  to be analytic. 2
- 2 Evaluate  $\oint_C (x^2 - iy^2) dz$  along the parabola  $y = 2x^2$  from  $(1, 1)$  to  $(2, 8)$ . 2
- 3 Expand  $f(z) = \sin z$  in powers of  $\left(z - \frac{f}{2}\right)$ . 2
- 4 Find the image of the line  $y = 1$  under the transformation  $w = \frac{1}{z}$ . 2
- 5 The probability density function  $f(x)$  of a continuous random variable is given by  $f(x) = \begin{cases} kx^3, & 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$ . Find the value of  $k$ . 2
- 6 State Baye's theorem. 3
- 7 If the variance of a Poisson variate is 3, then find  $P(1 \leq x < 4)$ . 3
- 8 Write the uses of t-test. 3
- 9 Define correlation and regression. 3
- 10 Prove that the coefficient of correlation lies in the interval  $[-1, 1]$ . 3

**PART – B (50 Marks)**

- 11 a) Prove that  $u = 2x(1-y)$  is harmonic and find a function  $v$  such that  $f(z) = u + iv$  is analytic. 5
- b) Evaluate  $\oint_C \frac{3z^2 + z}{z^2 - 1} dz$ , where  $C$  is  $|z-1| = 1$  using Cauchy's integral formula. 5
- 12 a) Determine the poles and the residues at the poles of  $f(z) = \frac{z^2 + 4}{z^3 + 2z^2 + 2z}$ . 5
- b) Evaluate  $\int_0^{\infty} \frac{1}{(x^2 + 1)^2} dx$ . 5

..2



- 13 a) A bag A contains 8 white and 4 black balls. A second bag B contains 5 white and 6 black balls. One ball is drawn at random from bag A and is placed in bag B. Now, a ball is drawn at random from bag B. It is found that this ball is white. Find the probability that a black ball has been transferred from bag A. 5
- b) A random variable X has the following probability distribution.

x :	0	1	2	3	4	5	6	7	8
P(x) :	0	3a	5a	7a	9a	11a	13a	15a	17a

Determine the value of a and  $P(x < 3)$ . 5

- 14 a) Find the variance of the normal distribution. 5
- b) Two random samples of sizes 9 and 6 gave the following values of a variable.

Sample 1 :	15	22	28	26	18	17	29	21	24
Sample 2 :	8	12	9	16	15	10	--	--	--

Test the difference of the estimates of the population variances at 5% level of significance. 5

$$(\text{Given } F_{0.05}(8, 5) = 4.82)$$

- 15 Find the correlation coefficient and the two regression lines for the following data: 10

x :	2	4	6	8	10
y :	5	7	9	8	11

- 16 a) State and prove Cauchy's integral theorem. 5

- b) Find the Laurent series expansion of  $f(z) = \frac{1}{z^2 - 3z + 2}$  valid in the region  $1 < |z| < 2$ . 5

- 17 a) If X is a continuous random variable and  $Y = aX + b$ , prove that  $E(Y) = aE(X) + b$  and  $V(Y) = a^2 V(X)$ . 5
- b) Fit a Poisson distribution to the following data. 5

x :	0	1	2	3	4
y :	419	352	154	56	19

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**FACULTY OF ENGINEERING**  
**B.E. 2/4 (M/P/A.E./CSE) II - Semester (New) (Suppl.) Examination,**  
**November / December 2016**

**Subject : Mathematics - IV**

**Time : 3 Hours**

**Max. Marks: 75**

**Note: Answer all questions from Part-A and answer any five questions from Part-B.**

**PART – A (25 Marks)**

- 1 Show that  $f(z) = z + 2\bar{z}$  is not analytic anywhere in the complex plane. (3)
- 2 Verify the function  $u(x, y) = e^x \cos y + x - y^2$  is harmonic or not. (2)
- 3 Expand  $f(z) = z^2 e^z$  in a Taylor's series about  $z = 1$ . (3)
- 4 Define removable and essential singularities with an example of each. (2)
- 5 Find the Z transform of  $\left\{ \sin \frac{nf}{2} \right\}$ . (3)
- 6 Obtain  $Z^{-1} \left\{ \frac{1}{(1-z^{-1})(1-2z^{-1})} \right\}$ . (2)
- 7 Express the function  $f(x) = \begin{cases} 1, & |x| \leq 1 \\ 0, & |x| > 1 \end{cases}$  as a Fourier integral. (3)
- 8 Find the Fourier sine transform of  $f(x) = \frac{e^{-2x}}{x}$ . (2)
- 9 Find the Newton-Raphson iterative formula to find  $N^{1/n}$ , where  $N > 0$  and  $n$  is an integer. (3)
- 10 Evaluate  $\Delta^3(e^x)$ , where  $h = 1$ . (2)

**PART – B (50 Marks)**

- 11 (a) Determine the analytic function  $f(z) = u + iv$ , where  $u + v = e^x (\sin y + \cos y)$ . (5)  
 (b) State Cauchy's integral theorem and verify it for  $\oint_C (2z^2 - iz + 3) dz$   
 where  $C : |z| = 4$ . (5)
- 12 (a) Classify the singular point  $z = 0$  of  $f(z) = z^2 \cos\left(\frac{1}{z}\right)$  and hence compute the residue. (5)  
 (b) Evaluate  $\int_0^{2\pi} \frac{\sin \theta}{3 + \cos \theta} d\theta$ . (5)
- 13 (a) If  $Z \{f_n\} = \frac{(z-1)^2(z+2)}{(z+3)(z+5)^2}$ , find  $f_1$  and  $f_2$ . (5)  
 (b) Verify convolution theorem when  $f_n = g_n = 2^n$ . (5)

..2..

14 (a) Find the Fourier transform of  $f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a \end{cases}$  and hence evaluate

$$\int_{-\infty}^{\infty} \frac{\sin ax}{x} dx. \quad (5)$$

(b) Define finite sine and cosine transforms. Find the finite cosine transform of  $f(x) = 2x$  in  $(0, 4)$ . (5)

15 (a) Obtain the Lagrange interpolating polynomial that fits the following data: (5)

x	-2	1	0	2
f(x)	3	-3	1	-1

(b) Find the approximate value of  $y(2, 2)$  for  $\frac{dy}{dx} = 2 + \sqrt{xy}$ ,  $y(2) = 1$  using fourth order Runge-Kutta method. (5)

16 (a) Evaluate  $\oint_C \frac{z^3 - \sin 3x}{(z - f/2)^3} dz$ ,  $C : |Z|=2$  using Cauchy's integral formula. (5)

(b) Show that the bilinear transformation  $w = \frac{iz + 2}{4z + i}$  transforms the real axis in the z-plane into a circle in the w-plane. (5)

17 (a) Solve  $y_{n+2} + 5y_{n+1} + 6y_n = 0$ ,  $y_0 = 1$ ,  $y_1 = 1$  using Z transform. (5)

(b) Find  $f^{(1)}(0)$  from the following data : (5)

x	0	5	10	15	20
f(x)	0	3	14	69	228

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**FACULTY OF ENGINEERING****B.E. 2/4 (ECE) II - Semester (New) (Main) Examination, November / December 2016****Subject : Probability Theory and Stochastic Processes****Time : 3 Hours****Max. Marks: 75****Note: Answer all questions from Part-A and answer any five questions from Part-B.****PART – A (25 Marks)**

- 1 State the Fundamental Axioms of Probability. (3)
- 2 State Baye's Theorem. (2)
- 3 Define Probability density function and state its properties. (3)
- 4 A pair of dice is rolled. Find the probability of an event A defined as  $A = \{\text{sum of two dice}=5\}$ . (3)
- 5 What is a Uniform Random Variable? (2)
- 6 If X is a continuous random variable, define the Expectation of the random variable and the Variance of the random variable. (3)
- 7 Define the characteristic function of a random Variable X. (2)
- 8 State the Central Limit Theorem. (2)
- 9 Define the concept of Wide sense Stationary Random process. (3)
- 10 Define White Noise. (2)

**PART – B (50 Marks)**

- 11 A standard deck of playing cards has 52 cards that can be divided in several manners. There are four suits (spades, hearts, diamonds, clubs) each of which has 13 cards (aces, 2,3,..., 10, jack, queen, king). There are two red suits (hearts and diamonds) and two black suits (spades and clubs). The jack, queen and king cards are referred as face cards while other cards are referred as number cards. Suppose one card is drawn at random from the deck and if the events are defined as  $A = \{\text{red card selected}\}$ ,  $B = \{\text{number card selected}\}$ ,  $C = \{\text{Heart selected}\}$ . Find the Probabilities  $P(A)$ ,  $P(B)$ ,  $P(C)$ ,  $P(A \cap B)$ ,  $(A \cap C)$ . (10)
- 12 (a) Define Cumulative Distribution function (CDF) and state its properties. (4)  
(b) Suppose a random variable has a CDF given by  $F_X(x) = (1 - e^{-x})u(x)$ . Find the probabilities  $P(x > 5)$ ,  $P(x < 5)$ ,  $P(3 < X < 7)$ . (6)
- 13 A certain random variable has the following density function of the form
 
$$f_X(x) = \begin{cases} a^{-bx}, & x \leq 0 \\ 0, & \text{otherwise} \end{cases}$$
 Where a, b are constants.
  - (i) Determine the relationship between 'a' and 'b'. (5)
  - (ii) Determine the corresponding Cumulative Distribution function (CDF). (5)
- 14 (a) Let X be a random variable with  $E[X]=1$  and  $\text{Var}(X)=4$ . Find  $E[2X - 4]$ ,  $E[X]^2$ ,  $E[2X-4]^2$ . (5)  
(b) Find the characteristic function of an Exponential random variable whose probability density function is given by  $f_X(x) = \exp(-x)u(x)$ . (5)

..2..

- 15 (a) Define joint Cumulative Density function  $f_{xy}(x, y)$  and state its properties. (5)
- (b) A pair of random variables has the joint CDF given by  $f_{xy}(x, y) = c \exp(-x - \frac{y}{z})$ .  
Find the constant  $c$  and the probability of the event  $[X > Y]$ . (5)
- 16 Show that if  $X$  and  $Y$  are statistically independent random variables, then the PDF of  $Z = X + Y$  is given by the convolution of the PDFs of  $X$  and  $Y$  i.e.  $f_z(Z) = f_x(Z) * f_y(Z)$ . (10)
- 17 Consider a random process  $X(t) = a \sin(\omega_0 t + \theta)$  where  $\theta$  is a uniform random variable in the interval  $(0, 2\pi)$ .
- (a) Check whether the random process is wide sense stationary. (5)
- (b) Check whether the random process is ergodic in mean and autocorrelation. (5)

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## FACULTY OF INFORMATICS

B.E. 2/4 (I.T.) II – Semester (Old) Examination, November / December 2016

Subject: Probability and Random Process

Time: 3 Hours

Max.Marks: 75

Note: Answer all questions from Part A. Answer any five questions from Part B.

### PART – A (25 Marks)

- 1 Define conditional probability 2
- 2 A box contains three white balls  $w_1, w_2$  and  $w_3$  and two red balls  $r_1$  and  $r_2$ . We remove at random two balls in succession. What is the probability that the first removed ball is white and the second is red? 2
- 3 Prove the inequalities  $P\left(\bigcup_k A_k\right) \leq \sum_k P(A_k)$ . 3
- 4 A fair coin is tossed twice, and let the random  $x$  represent the number of heads. 3
- 5 What is the memory less property of exponential distribution? 3
- 6 A fair die is rolled 10 times. We shall determine the probability that " $f_1$ " shows three times and "even" shows six times. 3
- 7 Suppose that  $x(t)$  is a WSS process with autocorrelation  $R(\tau) = Ae^{-|\tau|}$ , then determine the second order moment of the random variable  $x(8) - x(5)$ . 3
- 8 State the properties of autocorrelation. 2
- 9 State Weiner-Kinchine theorem. 2
- 10 Define Colour Noise. 2

### PART – B (5x10 = 50 Marks)

- 11 a) Two players A and B draw balls one at a time alternatively from a box containing  $m$  white balls and  $n$  black balls. Suppose the player who picks the first white ball wins the game, what is the probability that the player who starts the game will win. 5
  - b) A box contains white and black balls. When two balls are drawn without replacement. Supposed the probability that both are white is  $1/3$ . Find the smallest number of balls in the box. 5
- 12 a) A certain test for a particular cancer is known to be 95% accurate. A person submits to the test and the result is positive. Suppose that the person comes from a population of 100,000 where 2000 people suffer from that disease. What can we conclude about the probability that the person under test has that particular cancer? 6
  - b) State and prove Baye's Theorem. 4

- 13 a) A fair coin is tossed 1000 times. Find the probability  $P_a$  that heads will show 500 times and the probability  $P_b$  that heads will show 510 times. 4
- b) An insurance company has policies to 100,000 people for a premium of \$500 person. In the event of causality, the probability of which is assumed to be 0.001, the company pays \$200,000 causality. What is the probability that the company will suffer a loss. 6
- 14 a) Suppose that the resistance  $r$  is uniform between 900 and 1000  $\Omega$ . Determine the density of the corresponding conductance  
 $g = 1/r$  5
- b) Let  $f_{xy}(x,y) = \begin{cases} 1 & 0 < |y| < x < 1 \\ 0; & \text{otherwise} \end{cases}$   
 Determine  $E\{x|y\}$  and  $E\{y|x\}$  5
- 15 Let  $X \sim U(0, 1)$ ,  $Y \sim U(0, 1)$ . Suppose  $X$  and  $Y$  are independent. Define  $Z = X + Y$ ,  
 $W = X - Y$ . Show that  $Z$  and  $W$  are not independent, but uncorrelated random variables. 10
- 16 a) Find  $R(\tau)$  if  $S(S) = 1/(1+S^4)$ . 5
- b) Find  $S(S)$  if  $R(\tau) = e^{-\tau^2}$ . 5
- 17 a) If  $\{N(t)\}$  is a band limited white noise centered at a carrier frequency 5  

$$S_{NN}(S) = \frac{N_0}{2} \text{ for } |\check{S} - \check{S}_0| < \check{S}_B$$
 0, elsewhere  
 find the autocorrelation of  $\{N(t)\}$ .
- b) i) Define Gaussian Process. 5  
 ii) Write the probability density function of third order Gaussian Process.

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**FACULTY OF INFORMATICS****B.E. 2/4 (I.T.) II – Semester (New) (Main) Examination, November / December 2016****Subject: Probability and Random Processes****Time: 3 Hours****Max.Marks: 75****Note: Answer all questions from Part A. Answer any five questions from Part B.****PART – A (25 Marks)**

- 1 State Addition theorem for n events. (3)
- 2 A number is chosen at random from 200 numbers. Find the probability it is divisible by 4 or 6. (3)
- 3 Derive the characteristic function for  $f(x) = k \begin{cases} a < x < b \\ a < b \end{cases}$ . (3)
- 4 Show that the area under the exponential distribution curve is one. (3)
- 5 Find mean and variance of Poisson distribution. (2)
- 6 Define power spectral density function. (2)
- 7 Show that if X and Y are independent random variables  $\text{COV}(X, Y) = 0$ . (3)
- 8 State the properties of joint probability distribution function. (2)
- 9 Define independent random variable and prove that  $E(XY) = E(X) E(Y)$  if X and Y are independent Random Variables. (2)
- 10 State Wiener – Khinchin theorem. (2)

**PART – B (5 x 10 = 50 Marks)**

- 11 a) Suppose box 1 contains a white ball and b black balls and box 2 contain c white balls and d black balls. One ball of unknown color is transferred from the first box into the second one and then a ball is drawn from the latter. What is the probability that it will be a white ball? (5)
- b) Show that  $P(A_1 \cup A_2 \cup A_3 \cup \dots \cup A_n) = P(A_1) + P(A_2) + \dots + P(A_n) - P(A_1 \cap A_2 \cap A_3 \dots A_n)$ .
12. a) State and prove Baye's theorem. (5)
- b) A speaks truth 4 out of 5 times; a dice is rolled he reports that there is a six. What is the probability that there was a six? (5)
- 13 If  $U(t) = X \cos t + Y \sin t$  and  $V(t) = Y \cos t + X \sin t$  where X and Y are independent R.V.'s such that  $E(X) = 0 = E(Y)$ ;  $E(X^2) = E(Y^2) = 1$ ; Show that  $\{U(t)\}$  and  $\{V(t)\}$  are individually stationary in the wide sense (WSS) but they are not jointly W.S.S. (10)
- 14 a) The joint pdf of (X, Y) is given by  $f(x, y) = e^{-(x+y)}$ ,  $0 < x, y < \infty$ . Are X and Y Independent? Why? (5)



- b) To input to a binary communication system, denoted by a RV  $X$ , takes on one of two values 0 or 1 with probabilities  $3/4$  and  $1/4$  respectively. Because of errors caused by noise in the system, the output  $Y$  differs from the input occasionally. The behavior of the communication system is modeled by the conditional probabilities give as (5)  
 $P(Y = 1/X = 1) = 3/4$  and  $P(Y = 0/X = 0) = 7/8$   
 Find (i)  $P(Y = 1)$ : (ii)  $P(Y = 0)$  and (iii)  $P(X = 1/Y = 1)$
- 15 a) Let  $X(t) = A \cos wt + B \sin wt$ ,  $Y(t) = B \cos wt - A \sin wt$  where  $A$  and  $B$  are random variables,  $w$  is a constant, show that  $X(t)$  and  $Y(t)$  are wide sense stationary if  $A$  and  $B$  are uncorrelated, with zero mean and same variance. (5)
- b) Find the autocorrelation function of a random telegraph signal process. (5)
- 16 a) Show that the power spectrum of a real random process  $X(t)$  is real. (5)
- b) For a random process having  $R_{xx}(\tau) = ae^{-b|\tau|}$  | find the spectral density function, where  $a, b$  are constants. (5)
- 17 Explain about
- Gaussian process.
  - White noise.
  - Colored noise.

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