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14ELD11

First Semester M.Tech. Degree Examination, June/July 2016
Advanced Mathematics

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions.*

1 a. Apply shifted QR algorithm to A and hence find eigen values of $A = \begin{pmatrix} 3 & 1 \\ 1 & 5 \end{pmatrix}$. **(10 Marks)**

b. Find the generalized inverse of,

$$A = \begin{bmatrix} 2 & 2 & -2 \\ 2 & 2 & -2 \\ -2 & -2 & 6 \end{bmatrix}.$$ **(10 Marks)**

2 a. Find the extremals of $\int_1^2 \frac{\sqrt{1+y'^2}}{x} dx$ given that $y(1) = 0$, $y(2) = 1$. **(10 Marks)**

b. Find the path on which a particle in the absence of friction will slide from one point to another in shortest time under the action of gravity. **(10 Marks)**

3 a. Find a function $y(x)$ for which $\int_0^1 x^2 + y'^2 dx$ is a stationary function given that,

$\int_0^1 y^2 dx = 2$, $y(0) = 0$, $y(1) = 0$. **(10 Marks)**

b. Find the distance between a parabola $y = x^2$ and a straight line $x - y = 5$. **(10 Marks)**

4 a. A string is stretched between two points $x = 0$ and $x = l$. The motion is started by displacing the string in the form $u = \sin\left(\frac{\pi x}{l}\right)$, $0 < x < l$ and released from rest at $t = 0$. Find the displacement at any point of string at any time t. **(10 Marks)**

b. Solve the heat conduction equation, $K\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$, $-\infty < x < \infty$, $t > 0$ given that

$u(x,t) \to 0$ as $x \to \pm\infty$

$u_x(x,t) \to 0$ as $x \to \pm\infty$

and $u(x,0) = f(x)$, $-\infty < x < \infty$. **(10 Marks)**

5 a. Using Laplace transform method solve $u_{xx} = \frac{1}{C^2}u_{tt} - \cos\omega t$, $0 < x < \infty$ given that $u(0,t) = 0$, u is bounded as $x \to \infty$, $u(x,0) = 0$, $u_t(x,0) = 0$, $t > 0$, $0 < x < \infty$. **(10 Marks)**

b. Find the temperature u(x, t) in a semi-infinite rod $0 < x < \infty$, $t > 0$ subject to

$u(x, 0) = 0$ $0 < x < \infty$,

$u_x(0,t) = -u_0$ (a constant) $u(x,t)$ is bounded as $x \to \infty$. **(10 Marks)**

6 a. Solve $u_{xx} + u_{yy} = 0$, $x \geq 0$, $y \geq 0$ given that $u(0,y) = 0$, u & $\frac{\partial u}{\partial x} \to 0$ as x, $y \to \infty$ and $u_y(x,0) = f(x)$. **(10 Marks)**

b. Define harmonic function. If ϕ is a harmonic function in R and $\frac{\partial \phi}{\partial x} = 0$ on ∂R then show that ϕ is constant in $\overline{R}$. **(10 Marks)**

7 a. Use two phase simplex method to minimize $z = 7.5x_1 - 3x_2$, subject to $3x_1 - x_2 - x_3 \geq 3$, $x_1 - x_2 + x_3 \geq 2$, $x_1, x_2, x_3 \geq 0$. **(10 Marks)**

b. Use Lagrange's multipliers method to minimize $z = x_1^2 + x_2^2 + x_3^2$ subject to $x_1 + x_2 + 3x_3 = 2$, $5x_1 + 2x_2 + x_3 = 5$, $x_1, x_2, x_3 \geq 0$. **(10 Marks)**

8 a. Use dual simplex method to solve LPP,

Minimize $z = 2x_1 + 2x_2 + 4x_3$

Subject to $2x_1 + 3x_2 + 5x_3 \geq 2$

$3x_1 + x_2 + 7x_3 \leq 3$

$x_1 + 4x_2 + 6x_3 \leq 5$

$x_1, x_2, x_3 \geq 0$ **(10 Marks)**

b. Use Kuhn-Tucker method to

Maximize $z = 10x_1 + 4x_2 - 2x_1^2 - x_2^2$

Subject to $2x_1 + x_2 \leq 5$, $x_1, x_2 \geq 0$ **(10 Marks)**

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14ECS12

First Semester M.Tech. Degree Examination, June/July 2016
Antenna Theory and Design

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Show that $\psi = ce^{-J\beta r}/r$ satisfies $\nabla^2\psi + \beta^2\psi = 0$ at all points except the origin. **(10 Marks)**

b. Derive the magnetic field intensity expression of an ideal dipole antenna with necessary equations. **(10 Marks)**

2 a. Explain the following antenna parameters:
i) Side lobe level (SLL)
ii) Half-power beam width
iii) Directivity and gain **(08 Marks)**

b. Derive the radiation efficiency (e) of ideal dipole and short dipole. **(12 Marks)**

3 a. Explain with neat diagram of a typical linear array and explain how to determine array factor. **(12 Marks)**

b. Write note on pattern multiplication with necessary equations. **(08 Marks)**

4 a. Explain with neat diagram, different types of feeding structures for arrays. **(08 Marks)**

b. With neat sketch, explain micro-strip antennas and write important advantages and disadvantages of microstrip antennas. **(12 Marks)**

5 a. With neat figure, explain Sleeve monopole antenna configurations. **(08 Marks)**

b. Derive characteristic impedance at any point of infinite Biconical antenna. **(12 Marks)**

6 a. Explain Fourier series method for linear array with necessary equations. **(10 Marks)**

b. Explain Dolph-Chebyshev linear array method for narrow main beam, lowside lobe methods. **(10 Marks)**

7 a. Derive Pocklington's integral equations. **(10 Marks)**

b. Write a note on source modeling. **(10 Marks)**

8 Write short notes on:
a. Yagi-Uda antennas
b. Mutual coupling effect in array antennas
c. Wedge diffraction theory
d. Cylindrical parabolic antennas. **(20 Marks)**

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14ECS13

First Semester M.Tech. Degree Examination, June/July 2016
Probabilities & Random Process

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions.*

1 a. Define the terms: i) Event ii) Disjoint events iii) Equally likely event iv) Probability v) Sample space **(07 Marks)**

b. Prove that if $P_r\left(\frac{B}{A}\right) = P_r(B)$, then it follows that $P_r(A,B) = P_r(A)\,P_r(B)$ **(03 Marks)**

c. What is MAP rule? With the equations explain how you will decide logic '1' is sent in optical communication system. **(10 Marks)**

2 a. Define and list the properties of PDF $f_x(x)$ and CDF $f_x(x)$. **(06 Marks)**

b. A random variable has a PDF given by,

$$f_x(x) = \frac{1}{\sqrt{8\pi}} \exp\left(-\frac{(x+3)^2}{8}\right)$$

Find each of the following probabilities and express the answers in terms of Q-functions:
i) $P_r(x \le 0)$ ii) $P_r(x > 4)$ iii) $P_r(|x+3| < 2)$ iv) $P_r(|x-2| > 1)$ **(06 Marks)**

c. Write the expressions for PDF, CDF and mention the applications of,
i) Uniformly distributed random variable.
ii) Exponential random variable.
iii) Rayleigh random variable. **(08 Marks)**

3 a. Consider a random variable with a uniform probability density function given as,

$$f_x(x) = \begin{cases} \frac{1}{a} & 0 \le x \le a \\ 0 & \text{Otherwise} \end{cases}$$

Find its mean and n^{th} moment. **(04 Marks)**

b. What is conditional expected value? Obtain conditional expected value of a random variable x which is N(0, 1) given that $x > 0$. **(06 Marks)**

c. An exponential random variable has a PDF given by,
$f_x(x) = b \cdot \exp(-bx)u(x)$
Find the central moments for n = 1, 2, 3, 4. Also find the skewness and Kurtosis **(10 Marks)**

4 a. What is a characteristics function? Derive the characteristic function for a normal random variable. **(06 Marks)**

b. Find the probability generating function for a geometric random variable, with $P_x(K) = (1-P)P^K$. Also obtain the expression for factorial moment h_K and hence find variance of the random variable. **(10 Marks)**

c. Define SQNR and average information entropy. **(04 Marks)**

5 a. Define the expected value of g(x, y), correlation, covariance and the correlation coefficient of two random variables x and y. Explain their significance. **(10 Marks)**

b. Define joint CDF of a pair of random variables x and y. List the properties of joint CDF. **(06 Marks)**

c. Write a note on independent random variables. **(04 Marks)**

6 a. For a linear transformation of vector of random variables of the form, $Y = AX + b$, prove that,

i) The means of random variables x and y are related by $\mu_y = A\mu_x + b$.

ii) Correlation matrices of x and y are related by,

$R_{YY} = AR_{XX}A^T + A\mu_x b^T + b\mu_x^T A^T + bb^T$. **(10 Marks)**

b. Explain the linear prediction of speech. **(10 Marks)**

7 a. Explain random process and define its mean. **(05 Marks)**

b. What is an autocorrelation function? List its properties. **(06 Marks)**

c. Define widesense stationary process. Given $x(t) = At + B$, where A and B are independent random variables, both uniformly distributed over the interval (-1, 1), show that x(t) is not a wide sense stationary process. **(09 Marks)**

8 a. Define the Gaussian random process. **(06 Marks)**

b. Write short notes on Markov process. **(06 Marks)**

c. Write short notes on Poisson process. **(06 Marks)**

d. A communication system sends data packets of fixed length. If it is received incorrectly it is retransmitted. Let probability of incorrect reception be q, determine average number of transmissions. **(02 Marks)**

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14ECS14

First Semester M.Tech. Degree Examination, June/July 2016
Advanced Digital Communication

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions.***
2. ***Use erfc table.***

1 a. Explain in brief with a neat diagram. $\frac{\pi}{4}$QPSK transmitter and Receiver along with constellation diagram. **(10 Marks)**

b. Derive the probability of errors for M-ary QAM signals. **(10 Marks)**

2 a. Explain DPASK transmitter and receiver, with block diagram. The binary sequence 10010011 is applied to the DPSK transmitter. Illustrate the generation of DPSK signal. **(10 Marks)**

b. With neat diagram explain carrier and symbol synchronization. **(10 Marks)**

3 a. For the rate $\frac{1}{3}$ systematic encoder with generator vector $g_1 = [100]$, $g_2 = [101]$, $g_3 = [111]$.

i) Draw state diagram and trellis

ii) If message sequence u = 00110100 find encoded vector V. **(10 Marks)**

b. Explain in brief sequential decoding algorithm. **(10 Marks)**

4 a. Explain linear equalization with a neat block diagram of a linear transversal fitter. Discuss the coefficient optimization using peak dictation criterion. **(12 Marks)**

b. Explain in brief Turbo equalization. **(08 Marks)**

5 a. Explain the adaptive zero forcing equalizer. **(10 Marks)**

b. What is self recovering (blind) equalization? **(10 Marks)**

6 a. With neat block diagram explain the direct sequence spread spectrum. **(10 Marks)**

b. Explain the acquisition phase in the time synchronization of the receiver of a spread spectrum signal. **(10 Marks)**

7 a. Write short notes on statistical models for fading channels. **(10 Marks)**

b. With a simple block diagram, explain the RAKE demodulator. **(10 Marks)**

8 Write shot notes on any two.

a. Diversity techniques for fading multipath channels.

b. Multiple antenna systems.

c. Frequence hop spread spectrum system. **(20 Marks)**

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14ECS154

First Semester M.Tech. Degree Examination, June/July 2016
CMOS VLSI Design

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. With the help of physical structure and characteristics, explain the working of NMOS enhancement transistor. **(08 Marks)**

b. Calculate the threshold voltage for an NMOSFET at 300°K for a process with a Si substrate with $N_A = 1.8*10^{16}$, a Sio_2 gate oxide with thickness 200A°, Assume ϕ_{ms} = -0.9V and $Q_{fe} = 0$. **(08 Marks)**

c. Draw the small signal model of MOSFET and determine the channel resistance, trans-conductance in linear and saturation region. **(04 Marks)**

2 a. With schematic diagram, characteristics and equivalent circuit explain the operation of an inverter in different regions. **(10 Marks)**

b. Define Noise margin and its significance in the design of an inverter based circuit. **(05 Marks)**

c. Constant a transmission gate and explain the working. Draw the layout diagram. **(05 Marks)**

3 a. What do you mean by λ - based design rules? List the λ-based design rules of metal layer, polysilicon layer and transistor. **(08 Marks)**

b. Draw the CMOS schematic and layout diagram for 3 input NOR gate. **(06 Marks)**

c. Design the CMOS schematic and Euler's graph for $Z = \overline{A(D+E)+BC}$ **(06 Marks)**

4 a. Describe with neat sketch p-well process for CMOS fabrication. **(08 Marks)**

b. Estimate the rise time and fall time of CMOS inverter. **(08 Marks)**

c. Explain the sheet resistance and area capacitances of layers. **(04 Marks)**

5 a. Give the principle of pass transistor in particular the logic 1 and logic 0 transfer. **(10 Marks)**

b. What is voltage boot strapping technique? Derive an expression for the required capacitance ratio. **(10 Marks)**

6 a. Derive an expression for switching threshold voltage for SMOS NOR 2 gate. **(10 Marks)**

b. Construct gate level as well as CMOS SR latch using NOR2 gates and explain its working. **(10 Marks)**

7 a. Explain the working and analysis of CS amplifier with resistive load. Derive an expression for the gain without and with channel length modulation. **(12 Marks)**

b. Discuss the general principle of band gap reference. **(08 Marks)**

8 a. With the help of general structure construct Domino logic circuit for Y = AB + CD. **(08 Marks)**

b. Explain charge sharing problem in pass transistor. **(08 Marks)**

c. Determine the charge on each capacitor of Fig Q8(c). Show below before and after P turns ON if $C_1 = 20fF$, $C_2 = 20fF$, $V_1=1V$ and $V_2 = 5V$. **(04 Marks)**

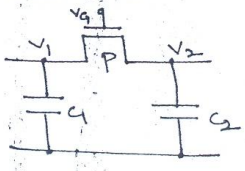

Fig. Q8(c)

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