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06EC61

Sixth Semester B.E. Degree Examination, December 2011
Digital Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain the natural sampling, with relevant waveforms. Give all the time-domain and frequency domain equations. **(08 Marks)**

b. Show that the shifted Sinc functions $\text{sinc}(2f_m t - n)$, used in the reconstruction of sampled signal are mutually orthogonal. **(06 Marks)**

c. Consider the signal $x(t) = 5\cos(2000\pi t) + 10\cos(6000\pi t)$.
   i) What is the Nyquist rate and Nyquist interval?
   ii) Assume that, if we sample the signal using sampling frequency $f_s = 5000$ Hz, what is the resulting discrete-time signal?
   iii) Draw the spectrum of the sampled signal when $f_s = 5000$Hz. **(06 Marks)**

2 a. What are the advantages of digital representation of analog signals? **(04 Marks)**

b. What is the need for non-uniform quantization? Explain the μ-law compounding. **(09 Marks)**

c. Derive an expression for the SNR of a PCM system. **(07 Marks)**

3 a. With block diagrams, explain the adaptive delta modulation system. **(07 Marks)**

b. Determine the PSD of polar quaternary format of NRZ type based on natural code. Assume statistically independent and equally likely message bits. **(07 Marks)**

c. Consider a speech signal with maximum frequency of 3.4 kHz and maximum amplitude of 1V. This speech signal is applied to a delta modulator whose bit rate is 20 kbps. Discuss the choice of appropriate step size for the modulator. **(06 Marks)**

4 a. Explain the basic elements of a baseband binary PAM system. **(08 Marks)**

b. The binary data 001101001 are applied to the input of a duobinary system.
   i) Construct the duobinary coder output and corresponding receiver output, without a precoder.
   ii) Suppose that due to error during transmission, the level at the receiver input produced by the second digit is reduced to zero. Construct the new receiver output. **(08 Marks)**

c. Write a note on eye-pattern. **(04 Marks)**

PART – B

5 a. With block diagrams, explain the QPSK transmitter and receiver. **(08 Marks)**

b. Explain the coherent binary FSK system, with the help of a signal space diagram. Indicate the decision boundary. **(06 Marks)**

c. A binary sequence 101101 is transmitted over a communication channel, using the differential phase-shift keying (DPSK). The channel introduces a phase shift of 180°.
   i) Sketch the transmitted signal, using an initial bit of '0'.
   ii) Assume that the channel is noise free, show that the DPSK detector in the receiver produces the original binary sequence despite 180° phase reversal in the channel. **(06 Marks)**

6 a. i) Using the Gram-Schmidt orthogonalization procedure, find a set of orthonormal basis functions to represent the three signals $s_1(t)$, $s_2(t)$ and $s_3(t)$ as shown in Fig.Q6(a).

ii) Express each of these signals in terms of the set of basis functions found in part (i).

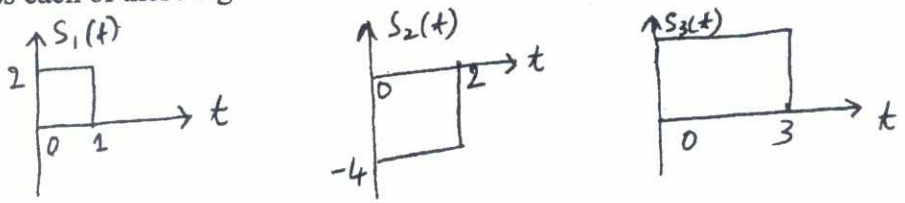

Fig.Q6(a) **(12 Marks)**

b. Show that for a noisy input, the mean value of the j^{th} correlator output x_j depends only on s_{ij} and all the correlators output x_j , j = 1, 2, ...N, have a various equal to the PSD No/2 of the additive noise process w(t). **(08 Marks)**

7 a. List the properties of a matched filter receiver. **(08 Marks)**

b. Explain the non-coherent quadrature receiver, using correlators. **(06 Marks)**

c. Explain the maximum likelihood detector. **(06 Marks)**

8 a. Explain the slow frequency hopping spread spectrum system. **(10 Marks)**

b. Define the processing gain and jamming margin. **(04 Marks)**

c. Consider the PN sequence 000100110101111. Demonstrate the properties of the PN sequence. **(06 Marks)**

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06EC62

Sixth Semester B.E. Degree Examination, December 2011
Microprocessors

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. With a neat sketch, explain the CPU architecture of 8086. **(10 Marks)**

b. Explain with example, the different addressing modes of the 8086 microprocessor. **(10 Marks)**

2 a. What is the segment override prefix? Explain with examples. **(05 Marks)**

b. What do the following instructions do?
i) ROR ii) RCR iii) SHR iv) STD v) JE **(05 Marks)**

c. Explain the following:
i) WAIT ii) HLT iii) NOP iv) LOCK v) ESC **(10 Marks)**

3 a. Write a display macro, using for statement that is used to display 'VTU' on the screen. **(05 Marks)**

b. Write the DOS function CALL numbers, to achieve the following:
i) Reading a key with an echo. ii) Reading a key without an echo.
iii) Reading an entire line with echo. iv) To display an ASCII character.
v) To display a string of characters. **(05 Marks)**

c. Write a 8086 program to enter a string and display the reversed string on the screen. **(10 Marks)**

4 a. Explain the software interrupt operation of 8086. **(05 Marks)**

b. Explain the functions of atleast five dedicated interrupts in 8086. **(10 Marks)**

c. Which are the two hardware interrupt inputs of the 8086 microprocessor? Write the interrupt priority of 8086. **(05 Marks)**

PART – B

5 a. Explain the interfacing of a 4×4 keyboard to the 8086 microprocessor. **(10 Marks)**

b. Explain the interfacing of a stepper motor to a microcomputer. **(10 Marks)**

6 a. Write a program to find the area of a circle, with the arithmetic co-processor. **(08 Marks)**

b. Differentiate between the following instructions :
i) Forward and reverse division ii) FADD and FADDP
iii) FINIT and FNINIT iv) FTST and FXAM **(12 Marks)**

7 a. Bring out the differences between minimum mode and maximum mode operation of 8086. **(04 Marks)**

b. Explain the read cycle timing diagram for minimum mode. **(08 Marks)**

c. Write a note on the peripheral component interconnect (PCI) bus. **(08 Marks)**

8 a. Write a short note on Pentium processor. **(08 Marks)**

b. Describe the features of i) 80386 and 80486 ii) Memory system of 80386. **(12 Marks)**

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06EC63

Sixth Semester B.E. Degree Examination, December 2011
Analog Mixed Mode VLSI Design

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define DNL, INL, offset error, gain error. **(04 Marks)**

b. Explain the issues involved in mixed signal layout. **(10 Marks)**

c. Explain the working of a simple sample and hold circuit with the help of a circuit diagram. Explain the typical errors associated with the S/H circuit. **(06 Marks)**

2 a. With a neat block diagram, explain the working of a 3 bit pipelined DAC. List the advantages of the pipelined DAC over cyclic DAC. **(07 Marks)**

b. For a 3 bit pipelined DAC, find the outputs for inputs 001, 110 and 101 V_{Ref} = 5V. List the intermediate values with respect to clock cycles. **(08 Marks)**

c. Design a 3 bit DAC, using a binary switch array with V_{Ref} = 5V, power dissipation 5mW. Find the output for D = 011. **(05 Marks)**

3 a. For a 4 bit and 8 bit pipelined ADC if V_{Ref} = 5V and V_{in} = 2V, find the digital output. Convert it back to the analog value. Comment on the result regarding the resolution of the converter. **(08 Marks)**

b. How would the design of the resistor string change for a 3 bit flash ADC, for the quantization error to be centered about '0' LSB? **(02 Marks)**

c. With a neat block diagram, explain the working of a dual slope integrating ADC. **(10 Marks)**

4 a. For a successive approximation ADC if V_{in} = 2.49V, what will be the output? If the comparator makes a mistake in the MSB, what will be the final output? V_{Ref}= 5V N = 4. **(06 Marks)**

b. For an 8 bit dual slope ADC with V_{Ref} =5V and clock frequency 1MHz, what is the minimum and maximum conversion time? If V_{in} = 2.5V, what will be total conversion time? **(04 Marks)**

c. Explain the working of a comparator, with a block diagram. **(10 Marks)**

PART – B

5 a. Explain SNR, spurious free dynamic range, ENOB, SNDR. **(08 Marks)**

b. Develop an expression for ENOB in terms of the SNR measured, if the input sinewave has a peak to peak amplitude of 40% of V_{Ref+}- V_{Ref-}. **(04 Marks)**

c. Bring out the principle of interpolation and decimation. **(08 Marks)**

6 a. With a neat block diagram, explain the accumulator and dump circuit. Plot the general frequency response of an averaging filter. **(10 Marks)**

b. Sketch the block level circuit diagram of a fs/4 digital resonator after deriving the transfer function. **(05 Marks)**

c. Discuss the advantages and disadvantages of cascading averaging circuits to increase filter attenuation. **(05 Marks)**

7 a. Describe the CMOS process flow with neat sketches. **(10 Marks)**

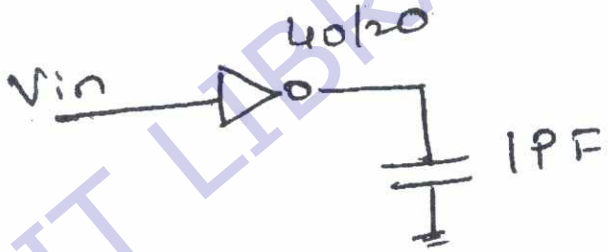
b. Explain how MOSFET behaves as a capacitor. Also explain the floating MOS capacitor. **(06 Marks)**

c. Explain the simple delay element, using the pass transistors and CMOS inverters. **(04 Marks)**

8 a. Draw the arrangement for a 4 bit pipelined adder and full adder bit implemented, using the dynamic logic. **(08 Marks)**

b. Explain the limitation of inverter at the output of op-amp with the help of its transfer curve. How is it overcome? **(06 Marks)**

c. Estimate the high to low and low to high delays in **(06 Marks)**



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06EC64

Sixth Semester B.E. Degree Examination, December 2011
Antenna and Propagation

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain the following terms with proper expressions: i) Directivity ii) Field pattern iii) Half power beam width. **(09 Marks)**

b. Show that maximum effective aperture of a $\frac{\lambda}{2}$ dipole is $0.13\ \lambda^2$. **(06 Marks)**

c. A radio link has a 15 W transmitter connected to an antenna of 2.5 m^2 effective aperture at 5 GHz. The receiving antenna has an effective aperture of 0.5 m^2 and is located at a 15 km line of sight distance from the transmitting antenna. Assume lossless antennas. Find the power delivered to the receiver. **(05 Marks)**

2 a. Derive the expression for total field, in case of two isotropic point sources with the same amplitude and equal phase. Plot the field pattern for two isotropic sources spaced $\frac{\lambda}{2}$ apart. **(10 Marks)**

b. For a square having radiation intensity $u = u_m \sin^2\phi \sin^3\phi$, given $0 \le \theta \le \pi$ and $0 \le \phi \le \pi$. Find the directivity by i) Exact method ii) Approximate method **(10 Marks)**

3 a. Explain the principle of pattern multiplication. **(05 Marks)**

b. A linear array consists of 4 isotropic point sources. The distance between the adjacent elements is $\frac{\lambda}{2}$. The power is applied with equal magnitudes and a phase difference –dr. Obtain the field pattern and find BWFN (Beam Width First Null) and HPBW. **(10 Marks)**

c. State and prove the power theorem. **(05 Marks)**

4 a. Show that the radiation resistance of $\frac{\lambda}{2}$ is 73 ohms. **(06 Marks)**

b. Derive the expressions for the field components of a short dipole, starting with the expression of electric potential and vector magnetic potential. Also determine the far-field component. **(14 Marks)**

PART – B

5 a. Explain Babinet's principle with illustrations. Discuss features of complementary antenna. **(10 Marks)**

b. Write short notes on: i) Horn antenna ii) Loop antenna. **(10 Marks)**

6 a. Explain the features of an helical antenna. Explain the practical design considerations of the helical antenna. **(10 Marks)**

b. Write short notes on a log periodic antenna. **(06 Marks)**

c. A 64 m diameter dish antenna, operating at a frequency of 1.43 GHz is fed by a non-directional antenna. Calculate its i) HPBW ii) BWFN. **(04 Marks)**

7 a. In tropospheric propagation, show that radius of curvature of path is a function of the rate of change of dielectric constant, with height and also explain the duct propagation of wave. **(10 Marks)**

b. Derive the expression for resultant field strength at a point due to space wave propagation. **(10 Marks)**

8 a. Define the following terms as related to ionospheric propagation: i) MUF ii) Critical frequency iii) Virtual height **(06 Marks)**

b. Derive the expression for conductivity, relative permittivity and refractive index as a function of electron density and angular frequency. **(08 Marks)**

c. Explain skip distance and derive the expression for skip distance for flat earth surface. **(06 Marks)**

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06EC65

Sixth Semester B.E. Degree Examination, December 2011
Information Theory and Coding

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. The international morse code uses a sequence of dots and dashes to transmit letters of English alphabets. The dash is represented by a current pulse that has a duration of 3 units and the dot has a duration of 1 unit. The probability of occurrence of dash is 1/3 of the probability of occurrence of a dot.

i) Calculate the information content of a dot and a dash.
ii) Calculate the average information in the dot dash code.
iii) Assume that the dot lasts 1 msec which is the same interval as the pause between symbols. Find the average rate of information transmission. **(08 Marks)**

b. For the source model shown in Fig.Q1(b), find the source entropy and the average information content per symbol in messages containing one, two and three symbols.

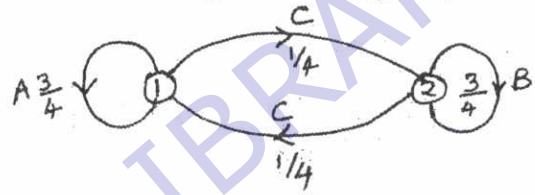

Fig.Q1(b) **(12 Marks)**

2 a. For the binary symmetric channel shown in Fig.Q2(a), find the rate of information transmission over the channel when p = 0.9, 0.8 and 0.6, given that the symbols rate is 1000/sec. **(06 Marks)**

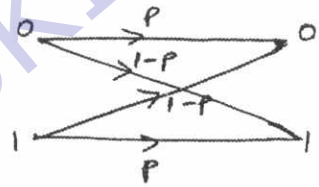

Fig.Q2(a)

P[x = 0] = 1/2

P[x = 1] = 1/2

b. A source emits an independent sequence of symbols A, B, C, D and E with the probabilities 1/4, 1/8, 1/8, 3/16 and 5/16 respectively. Find the Shannon code and efficiency. **(08 Marks)**

c. A binary source emits an independent sequence of 0's and 1's, with probabilities p and 1 – p. Prove that the entropy is maximum at p = ½. Plot the entropy. **(06 Marks)**

3 a. Explain the prefix coding and decision tree with examples. **(08 Marks)**

b. A discrete memoryless source has an alphabet of five symbols, with their probabilities as given below.

Symbol	S_0	S_1	S_2	S_3	S_4
Probability	0.55	0.15	0.15	0.10	0.05

Compute two different Huffman codes for this source. For each of the two codes, find
i) The average code word length ii) The variance of the average code word length over the ensemble of source symbols. **(12 Marks)**

4 a. Derive an equation for the capacity 'C' of a channel of Bandwidth B Hz effected by additive white Gaussian noise of power spectral density of $N_o/2$. **(10 Marks)**

b. An analog signal has a 4 kHz bandwidth and is sampled at 2.5 times the Nyquist rate and each sample is quantized into one of 256 equally likely levels.

i) What is the information rate of the source?

ii) Can the output of this source be transmitted without errors over a Gaussian channel with a Bandwidth of 50 kHz and S/N of 20 db?

iii) What will be the bandwidth requirements of an analog channel for transmitting the output of the source without errors, if the S/N ratio is 10 db? **(10 Marks)**

PART – B

5 a. Write a note on encoding and decoding of linear block code. **(06 Marks)**

b. The parity clock bits of a (8, 4) block code are generated by

$C_5 = d_1 + d_2 + d_4$ $C_6 = d_1 + d_2 + d_3$ $C_7 = d_1 + d_3 + d_4$ $C_8 = d_2 + d_3 + d_4$

where d_1, d_2, d_3 and d_4 are message bits.

i) Find the generator matrix ad parity check matrix.

ii) Find the minimum weight of this code.

iii) Show through an example that this code can detect and correct errors. **(08 Marks)**

c. Design a single error correcting code with a message block size of 8-bits. **(06 Marks)**

6 a. The generator polynomial of a (7, 4) cyclic code is $g(x) = 1 + x + x^3$.

i) Find the codewords for messages 1010, 1110, 1100, 1111.

ii) Find the codewords for i) using the systematic form. **(08 Marks)**

b. Discuss the features of encoder and decoder, used for cyclic codes, with examples. **(12 Marks)**

7 Write short notes on any four:

i) RS codes ii) BCH codes iii) Golay codes

iv) Shortened cyclic codes v) Burst error correcting codes. **(20 Marks)**

8 Consider a (3, 1, 2) convolutional code with

$g^{(1)} = 110$; $g^{(2)} = 101$; $g^{(3)} = 111$

i) Draw the encoder block diagram

ii) Find the generator matrix

iii) Find the codeward corresponding to the information sequence 11101, using the time domain and transform domain approach. **(20 Marks)**

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06EC661

Sixth Semester B.E. Degree Examination, December 2011
Programming in C++

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. List all the features of object oriented programming (OOP) technique. Briefly explain any two of them. **(07 Marks)**

b. Mention the application areas of OOP and give examples of OOP languages. **(04 Marks)**

c. Explain the following, with examples:
i) Enumerated datatype ii) Manipulators iii) Reference variables. **(09 Marks)**

2 a. Write a C++ program to find the volume of a sphere and display the result. In this context, explain i) cin ii) cout iii) #include iv) namespace **(08 Marks)**

b. Write the definition and give example for each:
i) Identifiers ii) Qualifiers iii) Modifiers iv) Constant. **(06 Marks)**

c. Discuss the precedence and associativity of the operators, with classification. With a programming example, show how to use the 'dot'(.) operator to access structure members. **(06 Marks)**

3 a. With flowchart and pseudocode, explain the following:
i) if ii) if – else iii) while **(09 Marks)**

b. Write a C++ program to generate the prime numbers between 50 and 500. Display the result using 'setw'. **(05 Marks)**

c. Write a C++ program to accept a string from the keyboard, count the different vowels and display each count separately. Use the 'switch' statement. **(06 Marks)**

4 a. With a programming example, explain the 'call-by-value' and 'call-by-reference' parameter passing methods to a function. **(08 Marks)**

b. What is 'inline' function? Explain with syntax and example. What are its limitations? **(06 Marks)**

c. State the requirements for 'function overloading' in C++. Write a C++ program to illustrate this concept, using a function addition( ). **(06 Marks)**

PART – B

5 a. What are the exceptions? Explain the THROW and TRY exception handling mechanisms, in C++. **(10 Marks)**

b. Create a class called EMPLOYEE. The data members are: employee name, employee id and salary per month. 10% bonus will be added at the end of the year. Write member functions to read the details, compute gross salary per annum and display the details. In the main( ) program, make this record for 3 employees. In this context, explain the concept of classes, objects, private and public. **(10 Marks)**

6 a. With a programming example, explain the concept of 'friend' function and 'friend' class. **(10 Marks)**

b. What are the constructors? With a programming example, explain the parameterized constructor and copy constructor. **(10 Marks)**

7 a. What is the operator overloading? Write the syntax and name the operators in C++ that cannot be overloaded. **(04 Marks)**

b. Write a C++ program to illustrate overloading the binary '+' operator to concatenate two strings S_1 = "VTU" and S_2 = "KARNATAKA". Display the concatenated string and two original strings. Use string class and necessary member functions. **(08 Marks)**

c. What is dynamic memory management? Discuss the use of 'new' and 'delete' operators with a programming example. **(08 Marks)**

8 a. What is the advantage of inheritance? Briefly describe the different classifications, with diagrams. **(06 Marks)**

b. Create a class called STUDENT, with data members student id, age and fees paid. Using inheritance, create the classes UGSTUDENT and PGSTUDENT with data members as semester and average marks. Write a main( ) program to create two objects of each derived class. Use member functions to read and display the details. **(08 Marks)**

c. Illustrate with a programming example, how to access base class members in derived class, using the single level inheritance, with public derivation of base class. **(06 Marks)**

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06EC662

Sixth Semester B.E. Degree Examination, December 2011

Satellite Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. What is satellite communication? List the applications and some of the service provided by satellites. **(06 Marks)**

b. Explain how a satellite continues to be in orbit and derive expressions for :
i) Satellite velocity ii) Orbital period. **(08 Marks)**

c. Define and explain elevation and Azimuth angles of a ground station antenna for communication with an orbiting satellite. **(06 Marks)**

2 a. State Kepler's three laws of planetary motion with the help of appropriate diagrams and give necessary equations. **(08 Marks)**

b. The orbit for an earth orbiting satellite has an electricity of 0.15 and semi major axis of 9000 kms. Determine : i) Periodic time, ii) Apogee height, iii) Perigee height. Given $h = 3.986 \times 10^5$ km^3/s^2. Assume a mean value of 6371 kms for earth's radious. **(06 Marks)**

c. With the help of a neat sketch, explain : **(06 Marks)**
i) Inclination ii) Right ascension of exceeding node iii) Argument of perigee.

3 a. List out the major subsystems required on satellite. **(04 Marks)**

b. Briefly describe the three axes method of satellite stabilization. Define the terms roll, pitch and yaw. **(10 Marks)**

c. State the types of satellite antenna normally used to produce radiation pattern. How spot beams are are produced? **(06 Marks)**

4 a. Derive the satellite link formula. Express the formula in decibels also. **(08 Marks)**

b. A satellite downlink at 12 GHz operates with a transmit power of 6 watts and an antenna gain of 48.2 dB. Calculate EIRP in dBW. **(04 Marks)**

c. Show that the rain attenuation in dB is given by $A_p = \alpha R_p^b L_s r_p$ with usual notations. **(08 Marks)**

PART – B

5 a. With the help of a block diagram, explain the arrangement for Master antenna TV system. **(03 Marks)**

b. Compare CATV and MATV system. **(07 Marks)**

c. With the aid of a block diagram, describe the functioning transmit-receive earth station. **(10 Marks)**

6 a. Explain the concepts of TDMA and FDMA using appropriate figures. Discuss the relative advantage and disadvantage of each. **(10 Marks)**

b. Describe briefly the modes of interference that can occur in a satellite communication system. Distinguish between satellite and terrestrial modes of interference. **(10 Marks)**

7 a. Explain : i) Bit rate for digital TV ii) Radar satellite **(10 Marks)**

b. Explain in detail GPS along with a block diagram of GPS receiver. **(10 Marks)**

8 Write short notes on : a) Pre assigned TDMA b) Home satellite TV
c) Geo stationary orbit d) Irridium **(20 Marks)**

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06EC663

Sixth Semester B.E. Degree Examination, December 2011
Random Processes

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***
2. ***Statistical tables may be provided.***

PART – A

1 a. Define i) Sample space ii) Events iii) Two axioms on probability. **(06 Marks)**

b. In a box, there are 100 resistors, having resistances and tolerances given in the table below. A resistor is to be selected from the box. Assume each resistor has the same likelihood of being chosen, A as draw a 47 – Ω resister, B as draw a resistor with 5% tolerance and C as draw a 100 – Ω. Find the probabilities, joint probabilities and conditional probabilities. **(09 Marks)**

Resistance	Tolerance		
	5%	10%	Total
22	10	14	24
47	28	16	44
100	24	8	32
Total	62	38	100

c. State and prove Baye's theorem on probability. **(05 Marks)**

2 a. Define i) Probability density function ii) Gaussian random variable . Explain any two properties of a distribution function. **(06 Marks)**

b. State any four properties of a probability density function. Suppose a random variable is known to have the triangular probability density function as

$$f_2x)\begin{cases} 0 & , \quad 3 > x \geq 13 \\ (x-3)/25 & , \quad 3 \leq x < 8 \\ 0.2 - \dfrac{(x-8)}{25} & , \quad 8 \leq x < 13 \end{cases}$$

Find the probability that x has values greater than 4.5 and not greater than 6.7. **(07 Marks)**

c. Define : i) Binomial density function ii) Rayleigh density function iii) Rayleigh distribution function iv) Chi square density function v) The characteristic function of Erlang random variable X. **(07 Marks)**

3 a. Define the expected value of a random variable. Find the mean value of the continuous exponentially distriable. (Use suitable assumption). **(06 Marks)**

b. Discuss the mean value of the random variable, with a reference to conditional expected value. **(07 Marks)**

c. State the expressions for central moments and find the variance of X, for which, X denotes the exponential density function. **(07 Marks)**

4 a. Show that the maximum magnitude of a characteristics function is unity. **(06 Marks)**

b. Give the expression for the moment generating function. Discuss the use of moment generating function on exponential density function. **(07 Marks)**

c. Compute the coefficient of skewness for the exponential density function. Draw the suitable figure to state the large coefficient of skewness. **(07 Marks)**

PART – B

5 a. State six properties of joint distribution. **(06 Marks)**

b. Define joint density function. Find the explicit expressions for $F_{X,Y}(x, y)$. The marginal distributions $F_X(x)$ and $F_Y(y)$ for the joint sample as S_j have possible elements (1, 1) , (2,1) and (3,3). The probabilities are P(1, 1) = 0.2, P(2, 1) = 0.3 and P(3, 3) = 0.5. **(07 Marks)**

c. Use $f_w(w) = \int_{-\infty}^{\infty} f_y(y)\ f_x(w-y)\ dy$ to find the density of $W \leq x + y$, where the densities are assumed to be $f_x(x) = \frac{1}{a}[u(x) - u(x-a)]$; $f_y(y) = \frac{1}{b}[u(y) - u(y-b)]$, $0 < a < b$. **(07 Marks)**

6 a. Give an expression for the expected value of the function of random variables $X_1, X_2, \ldots X_n$. Find the mean (expected) value of a sum of N weighted random variables. **(06 Marks)**

b. Find the mean, variance and covariance of y_1 and y_2, when x_1 and x_2 have zero means and $\sigma_{x_1}^2 = 4$, $\sigma_{x_2}^2 = 9$ and C_{x_1, x_2} is 3. Given

$y_1 = x_1 - 2x_2$; $y_2 = 3x_1 + 4x_2$. **(07 Marks)**

c. Discuss the use of complex random variable $z = x + jy$ with a reference to statistically independent. **(07 Marks)**

7 a. Discuss in brief : i) Deterministic random process ii) Non deterministic random process iii) Correlation function. **(06 Marks)**

b. Prove that $X(t)_s$ A $\cos(W_o t) + B \sin(w_o t)$ and $Y(t) = B \cos(w_o t) - A \sin(w_o t)$ are jointly wide – sense stationary. **(07 Marks)**

c. Define i) the time average of a quantity ii) the ergodicity of a function iii) autocorrelation function. **(07 Marks)**

8 a. Give the properties of the cross correlation function applicable to processes that are at least wide sense stationary. **(06 Marks)**

b. Prove that Gaussian process is known to be wide sense stationary with a mean of $\overline{X} = 4$ and auto correlation function $R_{xx}(\tau) = 25e^{-3|\tau|}$. **(07 Marks)**

c. Explain the Poisson random process, with suitable assumption. **(07 Marks)**

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06EC665

Sixth Semester B.E. Degree Examination, December 2011
Low Power VLSI Design

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain in detail working of MIS structure in unbiased and biased mode, with the respect to energy band diagrams. **(10 Marks)**

b. Derive an equation for the subthreshold drain–source current of an MOSFETs, starting from diffusion current equation. **(10 Marks)**

2 a. Derive an equation for short circuit power dissipation. **(10 Marks)**

b. Explain with mathematical equations for a system limits in low power VLSI design. **(10 Marks)**

3 a. Explain in detail, the algorithm using 1^{st} order differences for a behavioral level transforms. **(12 Marks)**

b. Explain briefly the architecture – driven voltage scaling. **(08 Marks)**

4 a. With an example, explain the optimization procedure. **(12 Marks)**

b. Explain briefly the different circuit levels. **(08 Marks)**

PART – B

5 a. Explain in detail, the differential current switch logic. **(08 Marks)**

b. With mathematical denotions, explain the leakage current estimation. **(08 Marks)**

c. Explain the key factors to minimize short channel effect. **(04 Marks)**

6 a. With a neat diagram, explain the multiple threshold voltage. **(12 Marks)**

b. Explain with a neat sketch, multiple supply voltages. **(08 Marks)**

7 a. Derive an equation for energy dissipation. **(14 Marks)**

b. Explain briefly, the supply clock generation. **(06 Marks)**

8 Write short notes on:

a. Instruction level power analysis

b. Algorithm Transformations to match computational resources

c. Instruction set design

d. Power management. **(20 Marks)**

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Sixth Semester B.E. Degree Examination, December 2011

Modern Control Theory

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain the disadvantages of the conventional control theory over the modern control theory with respect to the following :
i) Analysis ii) Time-varying system iii) Non-linear system
iv) Designment v) Computer application oriented **(10 Marks)**

b. Determine the state space model by the direct decomposition method for the given system whose transfer function is given below :

$$\frac{y(s)}{u(s)} = \frac{5s^2 + 6s + 8}{s^3 + 3s^2 + 7s + 9}$$ **(06 Marks)**

c. Find out the eigen values and the corresponding eigen vectors for the given matrix A :

$$A = \begin{bmatrix} -4 & 1 & 0 \\ 0 & -3 & 1 \\ 0 & 0 & -2 \end{bmatrix}$$ **(04 Marks)**

2 a. With neat diagrams, explain the state diagrams, for both continuous-time and discrete time state models. **(06 Marks)**

b. For the given matrix A, $A = \begin{bmatrix} 2 & -2 & 3 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$ obtain the following :
i) Characteristic equation ii) Model matrix. **(10 Marks)**

c. "Low-pass filter is a time-invariant system." Justify. **(04 Marks)**

3 a. What is a state transition matrix? List at least three important properties of the state transition matrix. **(05 Marks)**

b. For the given three solutions, three different initial conditions are available at the considered homogeneous equation, $\dot{X} = AX$, where, A is a 3 × 3 matrix,

$$\begin{bmatrix} e^{-t} \\ -e^{-t} \\ 2e^{-t} \end{bmatrix}, \quad \begin{bmatrix} e^{-2t} \\ -2e^{-2t} \\ 0 \end{bmatrix}, \quad \begin{bmatrix} 2e^{-3t} \\ -6e^{-3t} \\ 0 \end{bmatrix}$$

i) Identify the initial conditions
ii) Find the state transition matrix
iii) Find the system matrix. **(15 Marks)**

4 a. Prove and determine that the set of all solutions of a linear time-varying continuous time system, using homogeneous solution method, forms an n-dimensional vector space over the field of real numbers. **(10 Marks)**

4 b. Obtain the time response y(t) of the system given below by first transforming the state model into a canonical model :

$$\dot{X} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} X + \begin{bmatrix} 0 \\ 0 \\ 2 \end{bmatrix} u, \quad y = [1 \quad 0 \quad 0]x$$

U is a unit step function and $X^T(0) = [0\ 0\ 2]$. **(10 Marks)**

PART – B

5 a. Mention the conditions for complete controllability and complete observability of continuous time systems. What do you mean by the principle of duality between controllability and observability? **(06 Marks)**

b. In order to introduce an equivalence transformation, explain and design Jordan canonical form. **(08 Marks)**

c. Determine state transition matrix for the given state model of second order system given below :

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 \\ -4 & -5 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t) \quad \text{and} \quad y = [1 \ \ 0]x.$$ **(06 Marks)**

6 a. State and explain Laypunov theorems on :
i) Asymptotic stability ii) Global asymptotic stability iii) Instability **(06 Marks)**

b. Determine the stability of the following non-linear system using direct method of Laypunov:

$$\dot{x}_1 = x_2, \qquad \dot{x}_2 = -x_1 - x_1^2 x_2$$ **(06 Marks)**

c. List the sufficient conditions of autonomous system stability and explain in brief. **(08 Marks)**

7 a. Explain the prime requirements for designing multivariable controllers. **(06 Marks)**

b. For the given linear system having transfer function, $\frac{Y(s)}{U(s)} = \frac{10}{s(s+1)(s+2)}$, design the feedback controller with a state feedback, so that, closed loop poles are placed at (-2), (-1±j). **(08 Marks)**

c. What are singular points? Explain them with respect to stability of non-linearities in a system. **(06 Marks)**

8 a. Sketch the following non-linearities :
i) Ideal relay
ii) Relay with dead zone
iii) Relay with dead zone and hysteresis
iv) Relay with hysteresis
v) Dead zone. **(05 Marks)**

b. What is phase-plane plot? Describe the delta method for drawing phase plane tranjectories. **(10 Marks)**

c. Explain the full order observer. **(05 Marks)**

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06EC667

Sixth Semester B.E. Degree Examination, December 2011
Digital System Design Using VHDL

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Draw the block diagram and logic circuit of a 2:4 decoder. Write the VHDL code using the case statement. **(10 Marks)**

b. Write the VHDL code for full adder using logic equations. Draw the logic circuitry and T.T. **(10 Marks)**

2 a. Explain the operation of the basic ROM structure. **(10 Marks)**

b. An N – bit bidirectional shift register has N parallel data inputs, N outputs, a left serial input (LSI), a right serial input (RSI), a clock input and the following control signals :

Load : Load parallel data into reg(load overrides shift)
Rsh : Shift the register right (LSI goes into left end)
Lsh : Shift the register left (RSI goes into right end)

If the register is implemented using PAL 22V10 what is the maximum value of N? **(10 Marks)**

3 a. With the state graph of binary multiplier control, write the behavioral model for a 4 × 4 binary multiplier. **(10 Marks)**

b. Draw the block schematic of a signed divider (32 bits by 16 bits) with the associated control circuits. Supply the steps of procedure to carry out the division. Draw the state graph for the control circuit. **(10 Marks)**

4 a. Construct an SM chart equivalent to the following state table. Test only one variable in each decision box. Try to minimize the number of decision boxes.

Present state	Next state				o/p z_1 z_2			
$x_1 x_2$ =	00	01	10	11	00	01	10	11
S_0	S_3	S_2	S_1	S_0	00	10	11	01
S_1	S_0	S_1	S_2	S_3	10	10	11	11
S_2	S_3	S_0	S_1	S_1	00	10	11	01
S_3	S_2	S_2	S_1	S_0	00	00	01	01

(10 Marks)

b. Write VHDL description of the state machine, based on SM chart of Q.No.4(a). **(10 Marks)**

PART – B

5 a. With the help of block diagram, explain the CLB of xilinx 3000 series logic cells in FPGA. **(10 Marks)**

b. Draw the block diagram of AHera 7000 series CPLD and explain in brief. **(10 Marks)**

6 a. Trace the flow chart for floating point multiplication and explain its operation. **(10 Marks)**

b. How the bus structure helps in loading the registers? Explain with a neat sketch. **(10 Marks)**

7 a. Using sample waveforms, explain transport and inertial delays in VHDL. **(10 Marks)**

b. Develop VHDL code for synthesis of a case statement and explain optimization. **(10 Marks)**

8 a. Develop the VHDL model for the memory that does not take time limit into consideration. **(10 Marks)**

b. Draw the SM chart for simplified 486 bus interface. **(10 Marks)**

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