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Sixth Semester B.E. Degree Examination, Dec.2013/Jan.2014

Digital Communication

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With a block diagram, explain the generation and reconstruction of quadrature sampling of band pass signal. **(08 Marks)**

b. The signal $g(t) = 4\cos(4\pi t)\cos(400\pi t)$ is sampled at the rate of 500 sample/sec.
   i) Determine the spectrum of the resulting sampled signal.
   ii) What is the Nyquist rate for g(t)?
   iii) What is the cut-off frequency of ideal reconstruction filter? **(08 Marks)**

c. List the advantages of digital communication over analog communication. **(04 Marks)**

2 a. Derive an expression for output SNR of the quantizer and show that $(SNR)_0 = 1.8 + 6n$ in decibels if a sinusoidal signal is quantized. **(08 Marks)**

b. For a binary PCM signal, determine 'L' if the compression parameter $\mu = 100$ and the minimum $[SNR]_{0,dB} = 45$ dB. Determine the $[SNR]_{0,dB}$ with this value of L. **(04 Marks)**

c. What is the necessity of non-uniform quantization? Explain two compounding methods used *in practice.* **(08 Marks)**

3 a. What is slope overload distortion and granular noise in delta modulation and how it can be reduced? **(08 Marks)**

b. A binary data sequence is 0110011.... Sketch the waveform for the following formats:
   i) NRZ unipolar
   ii) RZ polar
   iii) NRZ bipolar **(06 Marks)**

c. Obtain an expression for power spectral density of NRZ polar waveform. **(06 Marks)**

4 a. What is ISI? Derive an expression for Nyquist pulse shaping criterion for distortionless baseband binary transmission. **(08 Marks)**

b. Discuss the performance of the data transmission using eye pattern. **(06 Marks)**

c. What is the necessity of equalization in digital transmission? What is adaptive equalization? **(06 Marks)**

PART – B

5 a. Derive an expression for the average probability of symbol error of coherent binary FSK system. **(10 Marks)**

b. With a block diagram, explain noncoherent differential phase shift keying transmitter and receiver and give that the average probability of error for DPSK is $P_e = \frac{1}{2}\exp\left(-\frac{E_b}{N_o}\right)$. **(10 Marks)**

6 a. Write a short note on Gram-Schmidt orthogonalization. **(06 Marks)**

b. Three signals $s_1(t)$, $s_2(t)$ and $s_3(t)$ are as shown in Fig.Q6(b). Apply Gram-Schmidt orthogonalization to obtain orthonormal basis functions for signals. Express the signals $s_1(t)$, $s_2(t)$ and $s_3(t)$ in terms of orthonormal basis functions.

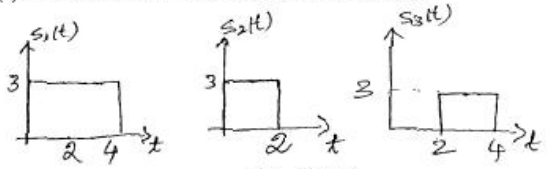

Fig.Q6(b) **(06 Marks)**

c. With necessary illustration, explain the geometric representation of signals for the case when N = 2 and M = 3. **(08 Marks)**

7 a. Show that the probability of bit error of a matched filter is given by $P_e = \frac{1}{2}\text{erfc}\sqrt{\frac{E_b}{N_o}}$. **(08 Marks)**

b. Write a note on correlation receivers. **(08 Marks)**

c. A binary data is transmitted using ASK. Over a AWGN channel at a rate of 2.4 Mbps. The carrier amplitude at the receiver is 1 mV. The noise spectral density $\frac{N_o}{r} = 10^{-15}$ Watt/Hz. Find average probability of error if the detection is coherent (where $\text{erfc}(5) = 3 \times 10^{-6}$). **(04 Marks)**

8 a. What is spread spectrum? Explain the principle of direct sequence spread spectrum system. **(08 Marks)**

b. The direct sequence spread spectrum communication system has following parameters:

Data sequence bit duration, $T_b = 4.095$ ms

Pin chip duration, $T_c = 1$ μs

$\frac{E_b}{N_o} = 10$ for average probability of error less than 10^{-5}.

Calculate processing gain and jamming margin. **(04 Marks)**

c. Explain the principle of slow frequency hopping, and list advantages and disadvantages of FH-SS system. **(08 Marks)**

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10EC/TE62

Sixth Semester B.E. Degree Examination, Dec.2013/Jan.2014
Microprocessors

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain with block diagram the personal computer model showing address, data and control bus structure. **(05 Marks)**

b. With a neat sketch, explain the execution unit and bus interface unit of the 8086 microprocessor. **(10 Marks)**

c. Explain segmentation in 8086 and advantages of using segment registers. **(05 Marks)**

2 a. Explain the different string instructions of the 8086. **(08 Marks)**

b. What are assembler directives? Explain the following :
(i) total db 00h (ii) inc word ptr [si] (iii) mov dx, offset msg (iv) assume **(08 Marks)**

c. Explain :
(i) MN / $\overline{MX}$ (ii) $AD_{15} - AD_0$ (iii) $\overline{RD}$ (iv) $\overline{WR}$ **(04 Marks)**

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

b. Write an assembly language program to arrange '10' bytes of data in descending order. **(10 Marks)**

c. Differentiate between macros and procedures. **(05 Marks)**

4 a. Draw the 8086 interrupt-pointer table and explain the dedicated interrupt pointers, reserved interrupt pointers and available interrupt pointers. **(10 Marks)**

b. Explain the priority of 8086 interrupts. **(05 Marks)**

c. Write a program to check if a given byte is bitwise palindrome. **(05 Marks)**

PART – B

5 a. Explain the different key switches used on keyboards. **(08 Marks)**

b. Explain the detection of matrix keyboard, key press, debouncing and encoding with a microcomputer using 4*4 keyboard. Also draw the flowchart for the same. **(12 Marks)**

6 a. Explain the 8087 architecture. Also explain the bit pattern of status register and control register. **(12 Marks)**

b. Explain :
(i) FLDZ (ii) FLD1 (iii) FLDPI (iv) FLDL2E **(08 Marks)**

7 a. Write a note on parallel printer interface (LPT). **(10 Marks)**

b. Explain the write cycle timing diagram for minimum mode. **(07 Marks)**

c. Explain the following :
(i) M / $\overline{IO}$ (ii) ALE (iii) $\overline{INTA}$ **(03 Marks)**

8 a. Draw the internal programming model of the 80486 and explain. **(10 Marks)**

b. Explain the memory system of 80386. **(05 Marks)**

c. Write a brief note on Pentium processors. **(05 Marks)**

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10EC63

Sixth Semester B.E. Degree Examination, Dec.2013/Jan.2014
Microelectronics Circuits

Time: 3 hrs. Max. Marks:100

Note: *1. Answer FIVE full questions, selecting at least TWO questions from each part.*
2. State all assumptions, including missing data.

PART – A

1 a. Derive an expression for drain-to-source current i_{DS} from i_D v/s V_{DS} relationship for triode and saturation regions of n-MOSFET. **(10 Marks)**

b. For an 0.8μm technology for which t_{OX} = 15nm, μ_n = 550 cm^2/V. Find k'_n and c_{OX} and the overdrive voltage $V_{ov} = V_{as} - V_t$ required to operate a transistor having W/L = 20 in saturation with I_D = 0.2 mA. What is the minimum V_{DS} needed? **(06 Marks)**

c. Design the circuit shown in Fig.Q.1(c) to obtain a drain voltage of 0.1V. What is the effective resistance between drain and source? At this operating point, let V_t = 0.8V and $K'_n\left(\frac{W}{L}\right) = 1mA/V^2$. **(04 Marks)**

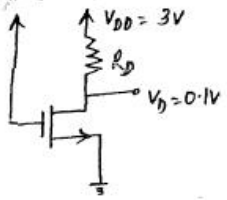

Fig.Q.1(c)

2 a. Briefly explain any two types of biasing methods in MOS amplifier circuits. **(06 Marks)**

b. For a common source amplifier with g_m = 2 mA/V, r_0 = 50KΩ and R_D = 10KΩ, R_G = 10MΩ, R_L = 20KΩ and R_{sig} = 0.5MΩ. Calculate R_{in}, G_v, A_{vs}, A_{vo}, R_{out}. **(10 Marks)**

c. Mention any 4 comparison of important characteristics of MOSFET and the BJT. **(04 Marks)**

3 a. Explain the CMOS implementation of IC common source amplifier and hence explain how to determine its small signal voltage gain. **(10 Marks)**

b. For the common gate amplifier with W/L = 4μm/0.2μm, μ_nC_{OX} = 350 $\mu A/V^2$, r_0 = 18 KΩ, I_D = 100μA, g_m = 1.2 mA/V, χ = 0.2, R_s = 10KΩ, R_L = 100 KΩ, C_{gs} = 20fF, C_{gd} = 5fF, C_L = 5fF. Find A_{vo}, R_{in}, R_{out}, G_v, G_{is}, G_i and f_H. **(10 Marks)**

4 a. Explain the circuit of MOS cascade amplifier and hence obtain an expression for short circuit transconductance G_M. **(10 Marks)**

b. Explain briefly with neat circuit diagrams:
i) Wilson MOS mirror
ii) Widlar current source. **(10 Marks)**

PART – B

5 a. Explain the basic operation of BJT differential pair. **(08 Marks)**

b. For the nMOS differential pair with a common-mode voltage V_{cm} applied as shown in Fig.Q.5(b). let $V_{DD} = V_{SS} = 2.5V$, $K_n' W/L = 3mA/V^2$, $V_{tn} = 0.7V$, $I = 0.2mA$, $R_D = 5K\Omega$. Neglect channel length modulation.

i) Find V_{OV} and V_{GS} for each transistor.

ii) For $V_{CM} = 0$ find V_s, i_{D1}, i_{D2}, V_{D1} and V_{D2}.

iii) Repeat (ii) for $V_{cm} = 1V$.

iv) What is the highest value of V_{cm} for which Q_1 and Q_2 remain in saturation, if current source I requires a minimum voltage of 0.3V to operate properly. What is the lowest value for V_s and hence for V_{cm}. **(12 Marks)**

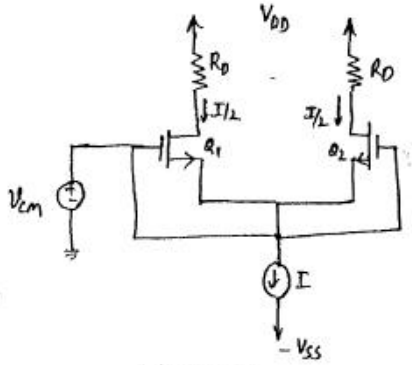

Fig.Q.5(b).

6 a. Explain briefly with expressions the properties of negative feedback. **(08 Marks)**

b. A series-shunt feedback amplifier employs a basic amplifier with input and output resistances each of 1KΩ and gain A = 2000 V/V. The feedback factor β = 0.1 V/V. Find the gain A_f the input resistance R_{i_f} and output resistance R_{o_f} of the closed loop amplifier. **(06 Marks)**

c. Explain briefly an alternative approach for finding loop gain Aβ. **(06 Marks)**

7 a. Explain instrumentation amplifier with neat circuit diagrams. **(08 Marks)**

b. With neat diagram, explain the sample and hold circuit using opamp. **(07 Marks)**

c. Derive an expression for an input resistance of the inverting amplifier taking into account *the finite open loop gain A of the opamp shown in Fig.Q.7(c).* **(05 Marks)**

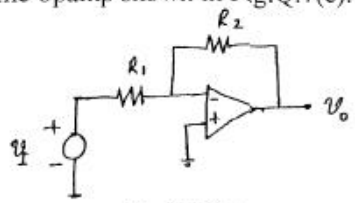

Fig.Q.7(c)

8 a. Briefly discuss the parameters used to characterize the operation and performance of logic circuit families. **(08 Marks)**

b. Write the expressions for propagation delay of an inverter. **(05 Marks)**

c. Sketch a CMOS logic circuit that realizes the function $Y = AB + \overline{AB}$ using equivalence or co-incidence function. **(07 Marks)**

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10EC64

Sixth Semester B.E. Degree Examination, Dec.2013/Jan.2014
Antennas and Propagation

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer FIVE full questions, selecting at least TWO questions from each part***
2. Draw diagrams wherever necessary.

PART – A

1 a. *What is directivity? Obtain the value of beam area in terms of radiation intensity.* **(05 Marks)**

b. What is effective length for an antenna? Obtain the value in the case of $\lambda/2$ dipole. **(06 Marks)**

c. Calculate the exact directivity for the following sources having following power patterns:

i) $U = U_m \cdot \sin^2\theta \cdot \sin^3\phi$.

ii) $U = U_m \cdot \sin\theta \cdot \sin^3\phi$.

iii) $U = U_m \cdot \sin^2\theta \cdot \sin^3\phi$.

U has value only for $0 \le \theta \le \pi$ and $0 \le \phi \le \pi$ and is zero else where. **(09 Marks)**

2 a. State and explain power theorems in terms of power density and radiation intensity. **(05 Marks)**

b. Explain the different radiation patterns for an antenna. **(07 Marks)**

c. Derive the expression for the field intensity in the case of 'n' number of isotropic sources with uniform spacing. **(08 Marks)**

3 a. Obtain the electric field intensity in the case of a thin linear antenna. **(10 Marks)**

b. Calculate the value of radiation resistance in the case of a short dipole. **(06 Marks)**

c. Obtain the value of directivity when two isotropic sources oppositely exited. **(04 Marks)**

4 a. Explain with neat diagrams different types of slot antenna and its working concept. **(08 Marks)**

b. Obtain the value of impedance of slot antenna in terms of its complimentary dipole antenna impedance Z_d. **(06 Marks)**

c. Explain Babinet's principle with illustrations. **(06 Marks)**

PART – B

5 a. Explain various types of horn antennas with neat diagrams. **(06 Marks)**

b. Explain the working of a log-periodic antenna with a neat diagram. **(08 Marks)**

c. Determine the cut-off frequencies and band pass of a log-periodic dipole array with a design factor of 0.7. Ten dipoles are used in the structure, the smallest having a dimension equal to $\frac{l_1}{2} = 0.3\,\text{mtrs}$. **(06 Marks)**

6 a. Explain a yagi-uda antenna structure with a neat diagram. **(07 Marks)**

b. Explain lens antenna and find the radius of curvature (R) in the case of a convex lens. **(07 Marks)**

c. A paraboloid reflector of 1.8mtr diameter is used at 6 GHz. Calculate beam width between the nulls and gain in dB. Area factor for dish is 0.65. **(06 Marks)**

7 a. Derive an expression for field intensity in the case of a space wave propagation. **(10 Marks)**

b. Explain duct propagation. **(05 Marks)**

c. A transmitter radiates 100 watts of power at a frequency of 50MHz in space wave propagation. The transmitting antenna has a gain of 5 and a height of 50mtrs. The receiving antenna height is 2mtrs. It is estimated that a field strength of 100μV/meter is required to give satisfactory signals at the receiver. Calculate the distance between the transmitting and receiving antennas assuming flat earth. **(05 Marks)**

8 a. Explain the mechanism of ionospheric wave propagation. Also derive an expression for the refractive index of ionosphere. **(10 Marks)**

b. Define the terms: *i) Critical frequency and ii) Skip distance for ionosphere with neat* diagrams. **(05 Marks)**

c. Calculate the value of frequency at which the electromagnetic wave should be propagated in the D-region. It is given that refractive index $\mu = 0.5$ and electron density $N = 10^{12}$ electrons/m^3. **(05 Marks)**

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10EC65

Sixth Semester B.E. Degree Examination, Dec.2013/Jan.2014
Operating Systems

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define an operating system. What are the different facets of user convenience? **(06 Marks)**

b. Explain partition based and pool based resource allocation strategies. **(06 Marks)**

c. Explain time sharing operating system with respect to, i) Scheduling and ii) Memory management. **(08 Marks)**

2 a. What are the functions of an operating system? Explain. **(06 Marks)**

b. Explain virtual machine operating system (VMOS). What are the advantages of using virtual machines? **(08 Marks)**

c. In a batch processing system, the results of 1000 students are to be printed. Reading a card or printing a result needs 100 msec whereas read/write operation in a disck needs only 20 msec. Processing a record needs only a 10 msec of CPu time. Compute the program elapsed time and CPu idle time with and without spooling. **(06 Marks)**

3 a. What is a process? What are the components of a process? Explain. **(04 Marks)**

b. Explain with neat diagrams, i) User threads ii) Kernel level threads. **(08 Marks)**

c. With a neat diagram, explain different states of a process and state transitions in the UNIX operating system. **(08 Marks)**

4 a. Explain the techniques used to perform memory allocation by using a free list. **(10 Marks)**

b. Explain internal and external fragmentation with examples. **(06 Marks)**

c. Compare contiguous and non-contiguous memory allocation methods. **(04 Marks)**

PART – B

5 a. What are the functions performed by the virtual memory manager? Explain. **(08 Marks)**

b. For the following page reference string, calculate the number of page faults with FIFO and LRU page replacement policies when i) Number of page frames are three ii) Number of page frames are four.

Page reference string : 5 4 3 2 1 4 3 5 4 3 2 1 5

Reference time string : $t_1, t_2, t_3, \ldots\ldots, t_{13}$ **(12 Marks)**

6 a. With a neat diagram, explain the facilities provided by the file system and IOCS layers. **(08 Marks)**

b. Explain the index sequential file organization with an example. **(08 Marks)**

c. What is a link? With an example, illustrate the use of a link in an acyclic graph structure directory. **(04 Marks)**

7 a. Compare : i) Preemptive and non-preemptive scheduling ii) Long term and short term schedulers. **(08 Marks)**

b. Describe the shortest request next (SRN) and highest response ratio next (HRN) scheduling policies and determine the average turn around time and weighted turn around time for the following set of processes shown in Table Q7 (b). **(12 Marks)**

Table Q7 (b)

Processes	P_1	P_2	P_3	P_4	P_5
Arrival time	0	2	3	4	8
Service time	3	3	5	2	3

8 a. Explain i) Direct and indirect naming.
ii) Blocking and non blocking sends. **(06 Marks)**

b. What is a mail box? With an example, explain the features of mailboxes and its advantages. **(08 Marks)**

c. Explain pipes and message queues in UNIX. **(06 Marks)**

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10EC661

Sixth Semester B.E. Degree Examination, Dec.2013/Jan.2014
Analog and Mixed Mode VLSI Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Determine the DNL and INL for a DAC that has a transfer curve as shown in Fig.Q.1(a). **(08 Marks)**

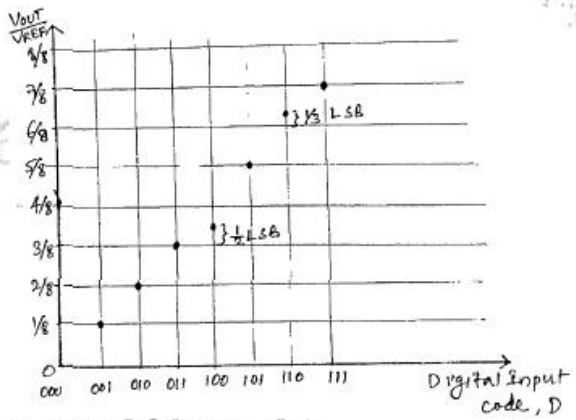

Fig.Q.1(a)

b. Explain the following ADC specifications:
   i) Quantization error
   ii) Missing codes
   iii) Offset and gain error
   iv) Aliasing. **(08 Marks)**

c. Explain in detail, the issues in mixed signal layouts with reference to
   i) Floor planning; ii) Shielding. **(04 Marks)**

2 a. Draw a general architecture of a resistor string DAC. Derive the expression for the INL and DNL of a resistor string DAC. **(08 Marks)**

b. Draw the architecture of a 6-bit charge scaling DAC using a split array. Determine the output for each of the following inputs by drawing the equivalent circuits.
   D = 000010 and 010000. Take V_{REF} = 16V. **(06 Marks)**

c. With the help of a neat diagram, explain the operation of a cyclic DAC. Show the value of the output voltage at the end of each cycle for a 4 bit DAC with an input value of $D_3D_2D_1D_0 = 0101$. Take V_{REF} = 5V. **(06 Marks)**

3 a. Design a 3 bit flash ADC with its quantization error centred about zero LSBs. Determine the worst case DNL and INL if the resistor matching is known to be 2%. Assume V_{REF} = 5V. **(07 Marks)**

b. With a neat diagram, explain the working of a pipeline ADC. What are its advantages and disadvantages? **(07 Marks)**

c. Perform the operation of a 4 bit successive approximation ADC with V_{REF} = 5V. Draw the block diagram and find the output for V_{IN} = 1V, 3V and full scale voltage. **(06 Marks)**

4 a. With relevant diagram using MOSFETs, explain the different stages in a voltage comparator. **(12 Marks)**

b. Show that multiplying quad acts as multiplier when all the MOSFETs in the multiplying quad have the same threshold voltage **(08 Marks)**

PART – B

5 a. Obtain the magnitude and phase response of a simple digital averaging filter using Z-domain approach. **(08 Marks)**

b. Give the concept of interpolation. With a neat block diagram, explain a dump-and-interpolate circuit and obtain its transfer function. **(07 Marks)**

c. Explain: i) ENOB; ii) SFDR; iii) Dynamic range and iv) Over sampling ratio. **(05 Marks)**

6 a. Explain with neat sketches, the submicron CMOS process flow. **(10 Marks)**

b. Write notes on: i) Native MOSFET capacitor; ii) Floating MOS capacitor. **(05 Marks)**

c. Describe NMOS and PMOS switches with necessary diagram. Estimate the delay time in the Fig.Q.6(c), if the effective digital resistance of the MOSFET is 1KΩ. **(05 Marks)**

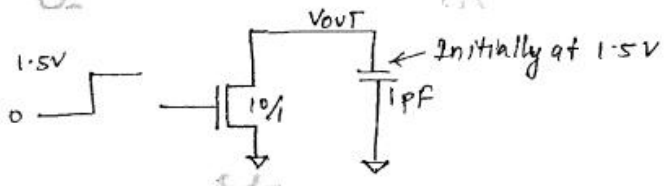

Fig.Q.6(c)

7 a. What are delay element? Explain the delay elements using i) CMOS inverters and pass transistors; ii) Clocked CMOS logic and iii) TSPC. **(10 Marks)**

b. With the help of diagram, explain the working of a 4 bit pipelined adder. Write the equations for the sum and carry of a 1-bit adder and implement it using dynamic logic. **(10 Marks)**

8 a. Consider the AC small signal amplification of floating current source as in Fig.Q.8(a). Assuming the NMOS cascade output resistance is labeled as R_{ncas}, what is the small signal resistance seen by the test voltage v_{test}? **(08 Marks)**

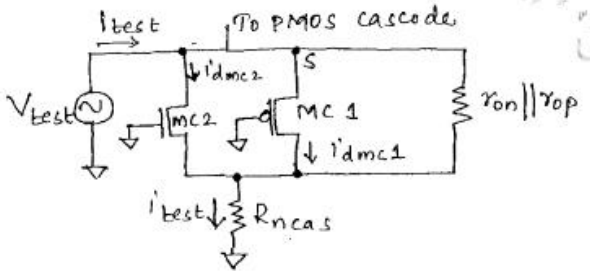

Fig.Q.8(a)

b. Explain in detail, the operation of a differential opamp. **(12 Marks)**

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10TE63

Sixth Semester B.E. Degree Examination, Dec. 2013/Jan. 2014
Antennas and Propagation

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Define :
   i) Radiation intensity
   ii) Stray – factor
   iii) Directivity. **(09 Marks)**

   b. Show that effective height and radiation resistance and the intrinsic impendence of the media (space). **(07 Marks)**

   c. An antenna has a field pattern $E(\theta) = \cos^2 \theta$ for $0 \le \theta \le 90°$. Find the HPBW. **(04 Marks)**

2 a. State and prove power theorem. **(05 Marks)**

   b. Find the directivity of the source with unidirectional cosine squared power pattern. **(05 Marks)**

   c. Obtain the relative field pattern for the array of two isotropic point sources of same amplitude and opposite phase, spaced $\lambda/2$ apart. **(10 Marks)**

3 a. What is retardation effect in short dipole? **(05 Marks)**

   b. Write the retarded value of current for thin linear antenna. **(05 Marks)**

   c. Derive the radiation resistance of short electric dipole. **(10 Marks)**

4 a. State and illustrate Babinets principle. **(05 Marks)**

   b. Write brief note on patch antenna. **(05 Marks)**

   c. Derive the instantaneous value of far fields of small area loop antenna. (square loop antenna). **(10 Marks)**

PART – B

5 a. Give a brief account of design considerations, working principle and applications of helical antenna. **(08 Marks)**

   b. What is Femats principle? **(04 Marks)**

   c. With the aid of neat diagram, explain the design and working principle of LPDA. **(08 Marks)**

6 Write brief notes on :

   a. Grand penetrating radar antennas. **(08 Marks)**

   b. Plasma antenna. **(07 Marks)**

   c. Embedded antenna. **(05 Marks)**

7 a. Discuss knife edge and rounded surface diffraction models. **(10 Marks)**

b. A free space LoS microwave link operating at 10GHz consists of a transmitter and receiver antenna, each having gain of 25 dB. The distance between two antennas is 30 km and the power radiated by the transmitter antenna is 10 W. Calculate the pathloss of the link and also the received power. **(10 Marks)**

8 a. With the aid of neat sketch for propagation path in the ionosphere, define virtual height. **(05 Marks)**

b. With the aid of neat sketch of ray paths for different angles of incidence, illustrate skip-distance. **(05 Marks)**

c. Derive the expression that relates critical frequency and the angle of incidence to the maximum usable frequency (MUF). **(05 Marks)**

d. A line – of – sight 10 GHz microwave link is to be established on the surface of the earth (mean radius 6370 km). The straight line distance between the two antennas is 60 km and the height of the transmitting antenna is 60 m. Calculate the minimum height of the receiving antenna, assuming that the propagation is taking place in the absence of atmosphere. **(05 Marks)**

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10TE65

Sixth Semester B.E. Degree Examination, Dec. 2013/Jan. 2014
Information Theory and Coding

Time: 3 hrs. Max. Marks:100

Note: *Answer FIVE full questions, selecting atleast TWO questions from each part.*

PART – A

1 a. A discrete source emits one of six symbols once every m-sec. The symbol probabilities are $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{32}, \frac{1}{32}$ respectively. Find the source entropy and information rate of it. **(06 Marks)**

b. Define : i) Self information ii) Information rate. **(04 Marks)**

c. The state diagram of Markaff source is as shown in the Fig. Q1(c). P(state i) = $\frac{1}{2}$ for i = 1, 2. Find : i) Entropy of each state Hi ii) Entropy of source H iii) G_1 and G_2 and ST $G_1 \geq G_2 \geq H$. **(10 Marks)**

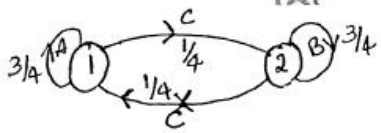

Fig. Q1(c)

2 a. Explain with a neat block diagram, the digital communication system indicating various types of the communication channels. Mention different probabilities with reference to coding channel. **(10 Marks)**

b. A source emits an independent sequence of symbols from a source of 5 symbols S = {S_1, S_2 S_3, S_4, S_5} and $P = \left\{\frac{1}{4}, \frac{1}{8}, \frac{1}{8}, \frac{3}{16}, \frac{5}{16}\right\}$ respectively. Find the Shannon code for each symbol and efficiency and redundancy of the coding scheme. **(10 Marks)**

3 a. A binary symmetric channel has the following of noise matrix with source probabilities of $P(x_1) = \frac{2}{3}$ and $P(x_2) = \frac{1}{3}$

$$P(y/x) = \begin{array}{c|cc} & y_1 & y_2 \\ x_1 & 3/4 & 1/4 \\ x_2 & 1/4 & 3/4 \end{array}$$

Find : i) H(X), H(Y) H(X, Y), H(Y/X), H(X/Y) and I(X, Y)
ii) Find channel capacity
iii) Find channel efficiency and redundancy. **(12 Marks)**

b. A source consists of six symbols with probabilities S = {S_1, S_2, S_3, S_4, S_5, S_6}. Find Huffman i) Binary and P = $\{\frac{1}{3}, \frac{1}{4}, \frac{1}{8}, \frac{1}{8}, \frac{1}{12}, \frac{1}{12}\}$ ii) Trinary coding. Also find efficiency in each case. **(08 Marks)**

4 a. State and explain Shannon – Hartley law and derive an expression for maximum capacity of a noisy channel. **(10 Marks)**

b. An analog signal has 4KHz bandwidth. The signal is sampled at 2.5 times the Nyquist rate and each sample quantized into 256 equally likely levels. Assume that the successive sample are independent.
i) Find the information rate of this source
ii) Can the output of this source be transmitted with out errors over a Gaussian channel of bandwidth of 50 KHz and (S/N) ratio of 20 dB
iii) If the output of this source is to be transmitted without errors over an analog channel having (S/N) of 10 dB. Compute the bandwidth requirement of the channel. **(10 Marks)**

PART – B

5 a. Explain the need of error control coding. **(05 Marks)**

b. Prove $CH^T = 0$. **(03 Marks)**

c. In a LBC the syndrome is given by $S_1 = r_1 + r_2 + r_3 + r_5$, $S_2 = r_1 + r_2 + r_3 + r_4 + r_7$. Find : i) Generator matrix [G] ii) Parity check matrix [H] iii) write encoder and decoder circuit iv) How any errors it can detect and correct v) find the code word vi) Find the syndrome for the received data 1011011. **(12 Marks)**

6 a. A (15, 5) linear cyclic code has a generator polynomial $g(x) = 1 + x + x^2 + x^4 + x^5 + x^8 + x^{10}$

i) Draw the block diagram of an encoder and syndrome calculator for this code

ii) Find the code polynomial for the message polynomial $D(x) = 1 + x^2 + x^4$ in systematic form.

iii) Is $v(x) = 1 + x^4 + x^6 + x^8 + x^{18}$ a code polynomial? **(12 Marks)**

b. Design an encoder for (7, 4) binary cyclic code generated by $g(x) = 1 + x + x^3$. Verify its operation using the message vector (1001) and (1011) with shift register table. **(08 Marks)**

7 a. Explain in brief :

i) RS codes ii) Golay codes iii) Shortened cyclic code. **(15 Marks)**

b. Consider (31, 15) RS code. i) How many bits are there ii) What is the block length in bits and minimum distance of the code iii) How many symbols in error can the code correct? **(05 Marks)**

8 a. For the convolution encoder in Fig. Q8(a), information sequence is d – 10011. Find the output sequence using : i) Time domain approach ii) Transfer domain approach. **(10 Marks)**

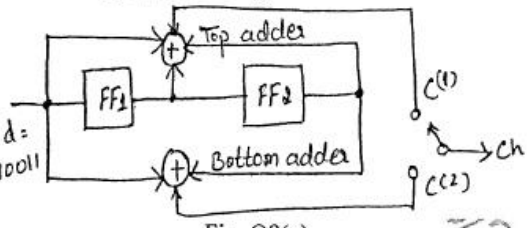

Fig. Q8(a)

b. Consider the convolutional encoder as in Fig. 8(b). The code is systematic of (2, 1, 1)

i) Draw the state diagram

ii) Draw the code tree

iii) Find the encodes output proceeded by message sequence 10111

iv) Verify the output using time domain approach. **(10 Marks)**

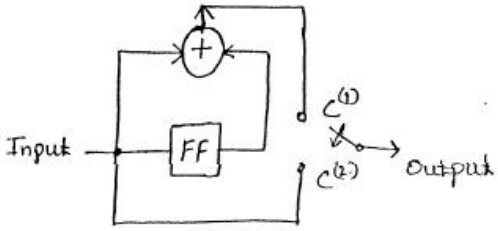

Fig. Q8(b)

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