06 EC, EE, ML

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06EC61

Sixth Semester B.E. Degree Examination, December 2012
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. A low pass signal g(t) and its spectrum is given by

$$G(f) = \begin{cases} 1 - \dfrac{|f|}{200} & |f| < 200\,\text{Hz} \\ 0 & \text{Elsewhere} \end{cases}$$

i) Assume that g(t) is ideally sampled at f_s = 300 Hz. Sketch the spectrum of the sampled signal.

ii) Repeat part (i) for f_s = 400 Hz. **(06 Marks)**

b. State and prove sampling theorem for band pass signals. **(10 Marks)**

c. Highlight the advantages and disadvantages of digital communication over analog communication. **(04 Marks)**

2 a. Twenty-four voice signals are sampled uniformly and then time-division multiplexed. The sampling operation uses flat-top samples with 1 microseconds duration. The multiplexing operation includes provision for synchronization by adding an extra pulse of sufficient amplitude and also 1 microsecond duration. The highest frequency component of each voice signal is 3.4 kHz.

i) Assuming a sampling rate of 8 kHz, calculate the spacing between successive pulse of the multiplexed signal.

ii) Repeat your calculation assuming the use of Nyquist rate sampling. **(06 Marks)**

b. Determine the probability of symbols error for binary encoded PCM wave and is given by

$$P_e = \frac{1}{2}\text{erfc}\left(\frac{A}{2\sqrt{2}\,\sigma}\right)$$ **(10 Marks)**

c. Write a note on robust quantization. **(04 Marks)**

3 a. For the sinusoidal modulating signal $x(t) = A_0 \cos 2\pi f_0 t$. Show that the output signal-to-noise ratio in a delta modulated system under the assumption of no slope overload is given by

$$(SNR)_0 = \frac{3f_s^3}{8\pi^2 f_0^2 f_M}$$

where f_s = sampling frequency and f_M = cut-off frequency of the low pass filter in the receiver. **(08 Marks)**

b. Give the binary sequence 011010110, construct the polar octal format of the NRZ type using i) natural code ii) Gray code **(06 Marks)**

c. Explain the inter symbol interference with the help of spectral analysis. How it will be eliminated? **(06 Marks)**

4 a. Explain duobinary signalling scheme. **(10 Marks)**

b. A binary wave using polar signalling is generated by representing symbol 1 by a pulse of amplitude +1 volt and symbol 0 by a pulse of amplitude –1 volt; in both cases the pulse duration equals the bit duration. This signal is applied to a low-pass RC filter with transfer function

$$H(f) = \frac{1}{1 + j^{f/f_0}}$$

Construct the eye pattern for the filter output for the following sequences:
i) Alternating 1s and 0s.
ii) A long sequence of 1s followed by a long sequence of 0s. **(06 Marks)**

c. Highlight the significance of raised cosine technique. **(04 Marks)**

PART – B

5 a. Explain the generation and detection of binary phase shift keying. **(10 Marks)**

b. Find the average probability of symbol error for a coherent QPSK system. **(10 Marks)**

6 a. For the signals $s_1(t)$, $s_2(t)$, $s_3(t)$ and $s_4(t)$ shown in the Fig.Q6(a), find the orthonormal basis functions using Gram-Schmidt orthogonalisation procedure. **(10 Marks)**

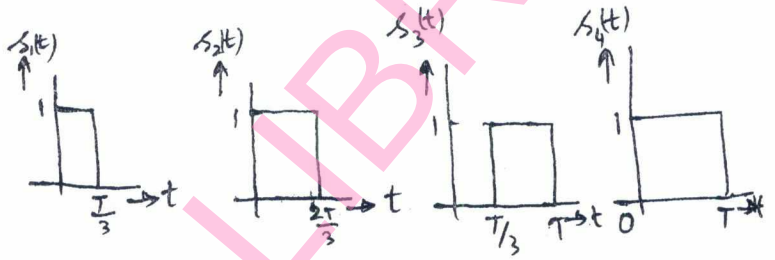

Fig.Q6(a)

b. In an FSK system the following data are observed;
Transmitted binary data rate = 2.5×10^6 bits/sec
PSd of zero mean AWGN = 10^{-20} Watts/Hz.
Amplitude of received signal in the absence of noise = 1 μVolt.
Find the probability of error assuming coherent detection. Given erfc($\sqrt{5}$) =1.7. **(05 Marks)**

c. Explain correlative receiver. **(05 Marks)**

7 a. State and prove properties of matched filter receiver. **(10 Marks)**

b. Explain adaptive equalizer with respect to a suitable block diagram. **(10 Marks)**

8 a. Explain the properties of maximum length sequence generated from 3 stage shift register with linear feedback. Verify these properties and determine the period of the given PN sequence 01011100101110. **(08 Marks)**

b. Explain with a block diagram the model of direct sequence spread binary PSK system. **(08 Marks)**

c. Highlight the applications of spread spectrum techniques. **(04 Marks)**

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06EC62

Sixth Semester B.E. Degree Examination, December 2012
Micro Processors

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With neat block diagram, explain how 8086 CPU supports pipelined architecture. **(10 Marks)**

b. Explain significance of special bit indicators available in 8086. **(05 Marks)**

c. If the opcode of MOV instruction is 100010 then find machine code for MOV[BX + 24h], AL. **(05 Marks)**

2 a. With respect to 8086 CPU explain the following:
i) LDS BX, [LOC]
ii) DAS
iii) LOOP
iv) DB
v) Length. **(10 Marks)**

b. Bring out the difference between
MOV AX, BX and MOV AX, [BX]. **(02 Marks)**

c. WALP to pack the two unpacked BCD numbers stored in the locations LOC and LOC + 1. **(05 Marks)**

d. Replace the following program segment by its single equivalent instruction:
NEG BL
ADD AL, BL
CMC. **(03 Marks)**

3 a. Using table translation method WALP to find equivalent seven segment code for given BCD digit. **(08 Marks)**

b. WALP to read a string from key board and check whether it is a palindrome or not. If palindrome display PAL else NPAL on monitor. **(12 Marks)**

4 a. What is an interrupt? Discuss the interrupt classification in 8086. **(07 Marks)**

b. What do you mean by an IVT? Explain IVT of 8086 microprocessor. **(07 Marks)**

c. Explain microprocessor's response for an INTR interrupt. **(06 Marks)**

PART – B

5 a. Differentiate between memory mapped I/O and I/O mapped I/O schemes. **(04 Marks)**

b. With neat diagram write an 8086 program for 4 × 4 matrix keyboard interface and display key value on monitor. **(10 Marks)**

c. WALP to rotate the stepper motor for 270^{o} in anticlock wise direction. **(06 Marks)**

6 a. Explain data types for 8087 NDP. **(10 Marks)**

b. Represent 20.59375_{10} into short real form. **(04 Marks)**

c. Explain the following with respect ot 8087 coprocessor:

i) FLD src

ii) FADD

iii) FLDPI. **(06 Marks)**

7 Write a note on:

a. Minimum mode configuration of 8086. **(10 Marks)**

b. PCI bus. **(05 Marks)**

c. Flow chart to generate USB data. **(05 Marks)**

8 a. With neat block diagram, explain memory organization in 80386 processor. **(08 Marks)**

b. Explain the following terms for 80486 process or

i) AHOLD

ii) BREQ

iii) $\overline{\text{FLUSH}}$. **(06 Marks)**

c. Explain branch prediction logic and cache structure of Pentium processor. **(06 Marks)**

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06EC63

Sixth Semester B.E. Degree Examination, December 2012
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. With a neat diagram, explain the mixed signal layout strategy. **(07 Marks)**

b. Explain the different specifications of DAC. **(07 Marks)**

c. With a neat sketch, explain the typical errors associated with sample and hold circuit. **(06 Marks)**

2 a. With a neat diagram, explain the working of 3 bit pipeline DAC. **(07 Marks)**

b. With a neat circuit diagram, explain the working of R-2R ladder type DAC architecture. **(07 Marks)**

c. Determine the effective number of bits for a resistor string DAC which is assumed to be limited by the INL. The resistors are passive poly resistors with a known relative matching of 1% and $V_{ref} = 5V$. **(06 Marks)**

3 a. With the help of block diagram, explain the flash type ADC. **(07 Marks)**

b. With a neat block diagram, explain the working of successive approximation ADC. **(07 Marks)**

c. For an 8 bit single slope ADC with $V_{ref} = 5V$ and clock frequency of 2 MHz, calculate the conversion time for an input of 2V. Also calculate the sampling frequency. **(06 Marks)**

4 a. With a neat block diagram, explain the working of voltage comparator. Also draw the schematic of pre-amplification stage of comparator. **(10 Marks)**

b. With a neat circuit diagram, explain the working of CMOS analog multiplier. Also explain the biasing of the multiplying quad. **(10 Marks)**

PART – B

5 a. With the help of block diagram explain the operation of an accumulate and dump circuit used for decimation and averaging. **(08 Marks)**

b. Explain the principle of interpolation and decimation. **(08 Marks)**

c. Determine the effective number of bits required for an ADC with a SNR of 50db. **(04 Marks)**

6 a. With neat sketches described the CMOS process. **(10 Marks)**

b. With neat CV curves explain natural MOSFET capacitor and floating MOS capacitor. **(10 Marks)**

7 a. With a neat circuit schematic, explain the working of a fulladder implemented using dynamic logic. **(07 Marks)**

b. Explain the simple delay element using clocked CMOS logic. **(07 Marks)**

c. Explain the design steps involved in analog circuit design. **(06 Marks)**

8 a. With a neat circuit schematic, explain the design of mixed signal op-amp. **(14 Marks)**

b. Explain fully differential op-amp. **(06 Marks)**

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06EC64

Sixth Semester B.E. Degree Examination, December 2012
Antennas and Propagation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the following terms with respect to antenna:
i) Antenna Beamwidth ii) Directivity iii) Beam Efficiency **(09 Marks)**

b. Explain the different types of aperture and their relationships. **(06 Marks)**

c. Distinguish the parameters of antenna field zones. **(05 Marks)**

2 a. The radiation intensity of an antenna is given by $u(\theta, \phi) = \cos^4\theta \sin^2\phi$, for $0 \le \theta \le \pi/2$ and $0 \le \phi \le 2\pi$. This zero in the lower half space. Find,
i) Exact directivity in dB ii) HPBW (Half power beam width) **(06 Marks)**

b. Derive an expression and draw the field pattern for an array of two isotropic point sources of same amplitude and opposite phase. Also determine its maxima, minima and HPBW. **(08 Marks)**

c. Calculate the maximum effective aperture of a short dipole. **(06 Marks)**

3 a. Calculate the diversity for the power pattern given as $U = U_m \sin^2\theta \sin^3\phi$, for $0 \le \theta \le \pi$ and $0 \le \phi \le \pi$ and zero elsewhere. **(06 Marks)**

b. Show that effective height of an antenna is given by, $h_e = \sqrt{\frac{A_{e_m} R_v}{30\pi}}$. **(05 Marks)**

c. Illustrate the principle of pattern multiplication with suitable example. **(05 Marks)**

d. State and explain power theorem to point sources. **(04 Marks)**

4 a. Derive the expression for radiation resistance of short dipole. **(07 Marks)**

b. Derive the far field components of short dipole. **(07 Marks)**

c. Four isotropic sources are placed $\frac{\lambda}{6}$ mt apart. They have a phase difference of $\pi/3$ between the adjacent elements. Find the beam width between first nulls. **(06 Marks)**

PART – B

5 a. Show that the radiation resistance of loop antenna is given by

$$31200 \left(\frac{nA}{\lambda^2}\right)^2$$ **(08 Marks)**

b. Explain the concept of Babinet's principle with neat figure. **(06 Marks)**

c. Write a note on pyramidal horn antenna with design equation. **(06 Marks)**

6 a. Explain the practical design operation for the monopilar axial mode helical antenna. **(06 Marks)**

b. With neat diagram, explain the operation of log-periodic antenna. **(06 Marks)**

c. Write short notes on : i) Embedded antennas and ii) Ultra-wide band antennas. **(08 Marks)**

7 a. Derive an expression for space wave field intensity. **(08 Marks)**

b. Show that radius of curvature of path is a function of the rate of change of dielectric constant with height in tropospheric propagation. **(08 Marks)**

c. Explain the three factors which affect the propagation of radio waves in an actual environment. **(04 Marks)**

8 a. Explain the structure of the ionosphere and derive an expression for refractive index of ionosphere assuming the value of $\in_r$. **(08 Marks)**

b. Define and derive the expression for the following:
i) Critical frequency ii) Virtual height iii) Skip distance. **(09 Marks)**

c. A radio link is established for a range of 300 km. If the reflection region of ionosphere is at a height of 200 km with critical frequency of 8 MHz, calculate MUF. **(03 Marks)**

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06EC65

Sixth Semester B.E. Degree Examination, December 2012
Information Theory and Coding

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. An analog signal is band limited to 500Hz and is sampled at "Nyquist rate". The samples are quantized into 4 levels and each level represent one message. The quantization levels are assumed to be independent. The probabilities of occurrence of 4 levels are $P_1 = P_4 = 1/8$ and $P_2 = P_3 = 3/8$. Find the information rate of the source. **(04 Marks)**

b. Design a system to report the heading of a collection of 400 cars. The heading is to be quantized into three levels: heading straight (s), turning left (L), and turning right ®. This information is to be transmitted every second. Based on the data given below, construct a model for the source and calculate: i) the entropy of each state; ii) entropy of the source; iii) the rate of transmission.

I. On the average, during a given reporting interval, 200 cars were heading straight, 100 were turning left and 100 cars were turning right.

II. Out of 200 cars that reported heading straight during a reporting period, 100 of them (on the average) going straight during the next reporting period, 50 of them reported turning left during the next period, and 50 of them reported turning right during the next period.

III. On the average, out of 100 cars that reported as turning during a signaling period, 50 of them continued their turn during the next period and the remaining headed straight during next reporting period.

IV. The dynamic of the cars did not allow them to change their heading from left to right or right to left during subsequent reporting periods. **(10 Marks)**

c. Define the following:

i) Entropy
ii) Self information
iii) Information rate. **(06 Marks)**

2 a. Using Shannon's encoding algorithm find the binary code for the symbol of length two (ie. N = 2) generated by the information source given in Fig.Q.2(a). Also compute the average number of bits/symbols and efficiency of the codes. **(12 Marks)**

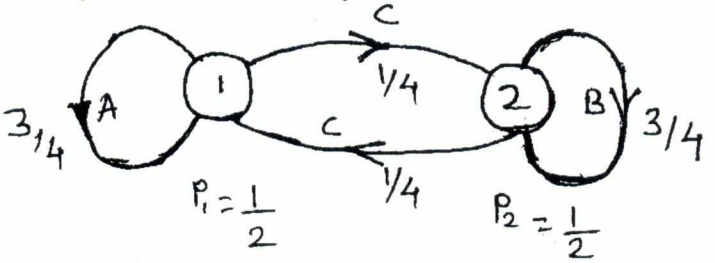

Fig.Q.2(a)

b. A Gaussian channel has a 10 MHz bandwidth and S/N = 100. Calculate the capacity of a channel and the maximum information rate. **(04 Marks)**

c. Determine the capacity of the channel shown in Fig.Q.2(c). **(04 Marks)**

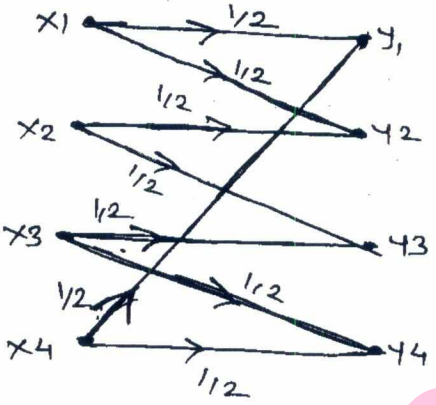

Fig.Q.2(c)

3 a. A source emits an independent sequence of symbols from an alphabet consisting of a 6 symbols A, B, C , D, E and F with probabilities $P = \left\{\frac{1}{3}, \frac{1}{4}, \frac{1}{8}, \frac{1}{8}, \frac{1}{12}, \frac{1}{12}\right\}$. Determine the Huffman code by shifting the combined symbols as high as possible. Also find the coding efficiency of the code. **(08 Marks)**

b. Explain the properties of mutual information and prove that the mutual information of the channel is symmetric. **(12 Marks)**

4 a. Prove that the maximum value of the differential entropy of white Gaussian noise with variance σ^2 is given by $h(x) = 1/2 \log_2 (2 \pi e \sigma^2)$. **(10 Marks)**

b. A channel has the following characteristics :

$$P\left(\frac{Y}{X}\right) = \begin{array}{c} \\ X_1 \\ X_2 \end{array} \begin{array}{c} \begin{array}{cccc} Y_1 & Y_2 & Y_3 & Y_4 \end{array} \\ \begin{bmatrix} 1/3 & 1/3 & 1/6 & 1/6 \\ 1/6 & 1/6 & 1/3 & 1/3 \end{bmatrix} \end{array}$$

Find H(X), H(Y), H(X, Y) and channel capacity if r = 1000 symbols/sec. Assume $P(X_1) = P(X_2) = 1/2$. **(10 Marks)**

PART – B

5 a. In a linear block code the syndrome is given by :

$S_1 = r_1 + r_2 + r_3 + r_5$

$S_2 = r_1 + r_2 + r_4 + r_6$

$S_3 = r_1 + r_3 + r_4 + r_7$

Find:

i) Generator matrix [G]

ii) Parity check matrix [H]

iii) Find the code word for all the messages

iv) A single error has occurred in the received vector 1011011. Detect and correct this error. **(10 Marks)**

b. Explain syndrome properties. **(10 Marks)**

6 a. The generator polynomial for (15, 5) cyclic code is $g(x) = 1 + x^4 + x^6 + x^7 + x^8$. Find the code-vector in systematic form for the message vector $D(x) = x^2 + x^3 + x^4$. **(06 Marks)**

b. The generator polynomial of a (15, 7) cyclic code is $g(x) = 1 + x + x^4$. Illustrate the encoding procedure by listing the state of the register with the message vector 10010110111. **(08 Marks)**

c. Explain the error correction procedure for cyclic codes. **(06 Marks)**

7 a. Explain the interlacing technique for the correction of burst and random errors. Consider a (15, 7) BCH code generated by $g(x) = x^8 + x^4 + x^2 x + 1$; construct a interleaved code with $\lambda = 5$, with a burst error correcting ability of 10. **(08 Marks)**

b. Write short notes on any three:
   i) RS codes
   ii) Shortened cyclic codes
   iii) BCH codes
   iv) Golay codes. **(12 Marks)**

8 a. Consider a (2, 1, 2) convolution code with the impulse response $g^{(1)} = (1, 1, 1)$ and $g^{(2)} = (1, 0, 1)$ and the incoming message sequence is 10011.
   i) Draw the encoder block diagram.
   ii) Find the generator matrix.
   iii) Find the code vector if the encoder generates.
   The two output sequences by convoluing the message sequence with the impulse response of the path using time domain approach. **(10 Marks)**

b. For the (3, 2, 1) convolution encoder shown in Fig.Q.8(b), find the codeword for the input sequence 110110 using i) Time domain approach (using generator matrix); ii) Transfer domain approach by constructing transfer function matrix. **(10 Marks)**

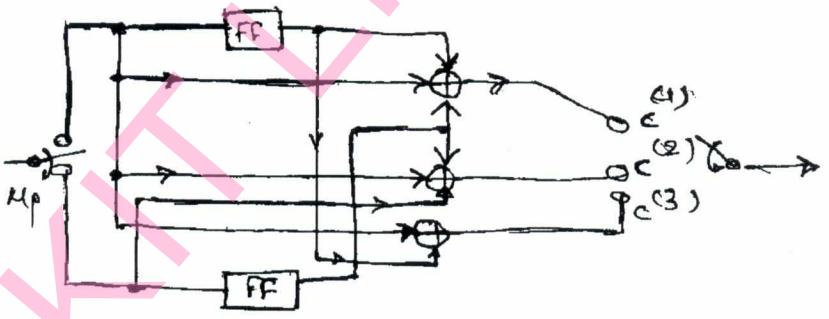

Fig.Q.8(b)

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06EC662

Sixth Semester B.E. Degree Examination, December 2012

Satellite Communications

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. State and explain Kepler's three laws of planetary motions. **(06 Marks)**

b. With the help of neat diagram, explain Keplerian orbital elements. **(08 Marks)**

c. Determine the rate of regression of the nodes and the rate of rotation of the line of apsides for LEO satellite of semimajor axis 7192.335 km, inclination is 98.6328°, eccentricity 0.0011501, mean motion is 14.23304826 day^{-1}, ω_o = 113.5534°, Ω_o = 251.5324° also find new value for ω and Ω one period after epoch. **(06 Marks)**

2 a. Give the conditions for geostationary orbit. Determine the angle of tilt required for polar mount antenna used with an earth station at latitude 49° N, assume earth mean radius 6371 km. **(08 Marks)**

b. Define saturation flux density. Derive the expression for saturation flux density. **(06 Marks)**

c. A multiple carrier satellite circuit operates in 14/12 GHz band with following characteristics:
Uplink: Saturation flux density -67.5 dB W/m^2
Input Backoff 11 dB, satellite G/T – 11.6 dBK^{-1}
Down link: Satellite saturation EIRP 26.6 dBW, output BO 6 dB, FSL 196.7 dB, earth station G/T 40.7 dBK^{-1}, calculate carrier to noise density ratio for both links and combined value. **(06 Marks)**

3 a. For the system given in Fig.Q3(a)(i) and (ii), the receiver noise figure is 12 dB, cable loss 5 dB, LNA gain 50 dB and it's noise temperature 150 K, antenna noise temperature 35 K, calculate noise temperature referred to the input. Conclude the result. **(07 Marks)**

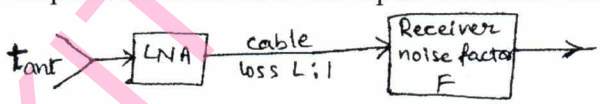

Fig.Q3(a)(i)

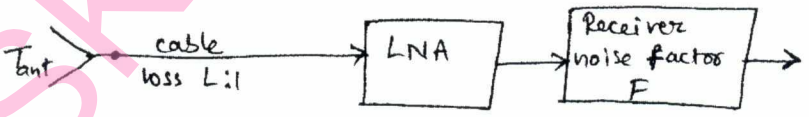

Fig.Q3(a)(ii)

b. Calculate rain attenuation for a frequency of 18 GHz for circular polarization. The rain height 2 km, a rain rate of 10 mm/h is exceeded for 0.001 percent of the year. The earth station altitude 600 m and antenna elevation angle is 35°. (a_n = 0.0751, q = 0.0691, b_h = 1.099, b_v = 1.065) **(08 Marks)**

c. Explain earth eclipse of satellite and sun transit outage. **(05 Marks)**

4 a. With the help of neat diagram, explain two forms of attitude control. **(12 Marks)**

b. Explain satellite wide band receiver and input demultiplexer. **(08 Marks)**

PART – B

5 a. Explain indoor and outdoor unit of direct broadcasting satellite TV reception with block diagram. **(10 Marks)**

b. An FM/TV carrier is specified as having a modulation index of 2.571 and a top modulating frequency of 4.2 MHz. Calculate the protection ratio required to give a quality impairment factor of (i) 4.2 and (ii) 4.5. **(04 Marks)**

c. Explain preassigned FDMA. **(06 Marks)**

6 a. Explain unique word detection. Obtain equation for miss probability and false detection probability. **(12 Marks)**

b. Explain on Board Signal processing for FDMA/TDM operation. **(08 Marks)**

7 a. Explain global positioning satellite system in detail. **(08 Marks)**

b. Describe the operation of typical VSAT system. **(06 Marks)**

c. Explain iridium satellite system. **(06 Marks)**

8 a. Explain the services provided by the satellites. **(08 Marks)**

b. Explain the following:

i) Spade system

ii) Transmit-Receive earth stations. **(12 Marks)**

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