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10EC/TE61

Sixth Semester B.E. Degree Examination, Dec.2014/Jan.2015

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. Explain the quadrature sampling of band pass signal with related block diagram, spectra and equations. **(06 Marks)**

b. A low pass signal has the spectrum given by,

$$G(f) = \begin{cases} 1-|f|, & |f|<1 \\ 0, & |f|>1 \end{cases}$$

Assume that g(t) is sampled at 1.5 Hz and then applied to a low pass reconstruction filter with cut off frequency at 1 Hz. Plot the spectrum of the resulting signal. **(06 Marks)**

c. What is flat top sampling? Derive an expression for the flat top sampled signal. **(08 Marks)**

2 a. A PCM system uses a uniform quantizer followed by n-bit encoder. Show that rms signal to quantization noise ratio is approximately given by SNR = 1.8 + 6n dB. Assume that input to PCM system is a sinusoidal signal. **(06 Marks)**

b. The output signal to noise ratio of a 10 bit PCM was found to be 30 dB, the desired SNR is 42 dB. To increase the SNR to desired value by increasing the number of quantization levels. Find the fractional increase in transmission band width required for this increase in SNR. **(06 Marks)**

c. What is the necessity of non uniform quantization and explain companding? **(08 Marks)**

3 a. Explain differential pulse code modulation transmitter and receiver with relevant equations and show that the quantized version of the signal is sum of original sample value and quantization error. **(06 Marks)**

b. With reference to delta modulation system shown in Fig. Q3 (b) show that the optimum step size $Kopt = \frac{2\pi A}{(f_s / f_m)}$

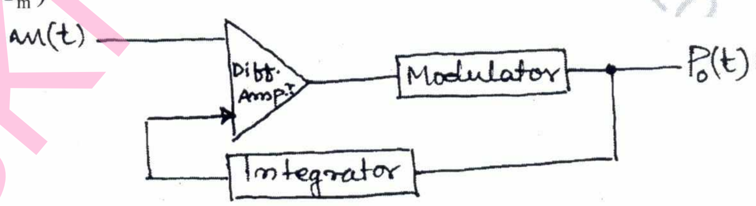

Fig. Q3 (b)

where A is amplitude of sine wave m(t), f_s is sampling frequency and f_m is the frequency of sine wave.

For K = 4 mV and K = 60 mV, does the slope overload occurs? If so in which case? Given $m(t) = 0.1\sin(2\pi\times10^3 t)$ **(08 Marks)**

c. For a given binary sequence 0 1 0 1 1 1 0 0 1 0 1 1, draw the digital format waveform corresponding to ,

i) Split phase manchester coding waveform.

ii) Bipolar NRZ waveform and

iii) 8- ary signalling waveform. **(06 Marks)**

4 a. What is ISI? Derive an expression for Nyquist pulse shaping criterion for distortionless base band binary transmission. **(06 Marks)**

b. What is correlative coding? Explain duobinary coding with and without precoding. **(06 Marks)**

c. The binary data 0 1 1 1 0 0 1 0 1 are applied to the input of a modified duo binary system.
i) Construct the modified duo binary coder output without precoder.
ii) Suppose that due to error in transmission, the level produced by the third digit is reduced to zero. Construct a new receiver output. **(08 Marks)**

PART – B

5 a. With neat block diagram, explain the DPSK transmitter and receiver. **(10 Marks)**

b. For the binary sequence 0 1 1 0 1 0 0 0 explain the signal space diagram for coherent QPSK system. **(04 Marks)**

c. Derive an expression for probability of error for coherent binary PSK system. **(06 Marks)**

6 a. With block diagram, explain the principle of detection and estimation. **(06 Marks)**

b. Suppose $S_1(t)$, $S_2(t)$ and $S_3(t)$ are represented with reference to two basis functions $\phi_1(t)$ and $\phi_2(t)$. The co-ordinates of these signals are,

$S_1 = (S_{11}, S_{12}) = (3, 0)$

$S_2 = (S_{21}, S_{22}) = (-2, 3)$

$S_3 = (S_{31}, S_{32}) = (-3, -3)$

Draw the constellation diagram and express $S_1(t)$, $S_2(t)$ and $S_3(t)$ as linear combination of the basis functions. **(06 Marks)**

c. Consider the signal $S_1(t)$, $S_2(t)$, $S_3(t)$ and $S_4(t)$ as given below:

Fig. Q6 (c)

Find an orthonormal basis function for these set of signal using Gram-Schmidt orthogonalization procedure. **(08 Marks)**

7 a. Explain the function of correlation receiver. **(06 Marks)**

b. Show that the probability of bit error of a matched filter receiver is given by $Pe = \frac{1}{2}\text{erfc}\sqrt{\frac{E_b}{N_o}}$. **(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 1mV. The noise power spectral density, $\frac{N_0}{2} = 10^{-15}$ watt/Hz. Find the average probability of error if the detection is coherent. Take $\text{erfc}(5) = 3 \times 10^{-6}$. **(06 Marks)**

8 a. Explain the working of direct sequence spread spectrum transmitter and receiver. **(08 Marks)**

b. Explain properties of PN sequence. **(06 Marks)**

c. Distinguish between slow frequency hopping and fast frequency hopping. **(06 Marks)**

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Sixth Semester B.E. Degree Examination, Dec.2014/Jan.2015
Microprocessors

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 sketch explain execution unit of 8086. **(06 Marks)**
b. Define addressing modes for specifying branch address and identify addressing modes of following instructions:
i) MOV [BP + SI + 5], AH ii) MOV AL, [5036] **(06 Marks)**
c. Explain various machine language instruction formats used in 8086 with suitable examples. **(08 Marks)**

2 a. Explain the functions of following instructions with examples:
i) LEA ii) IDIV iii) DAA iv) JNGE **(08 Marks)**
b. Write an assembly level language program to add two 16-digit packed BCD numbers. **(06 Marks)**
c. Explain the following directives and operators with suitable examples:
i) SEGMENT ii) ASSUME iii) DUP iv) SIZE **(06 Marks)**

3 a. Explain the following string instructions with examples:
i) MOVS B ii) CMPS B iii) SCAS B iv) Repeat prefix (REP) **(08 Marks)**
b. Write an Assembly level language program to convert four digit ASCII coded hexadecimal number to binary equivalent using string instructions. **(06 Marks)**
c. Write a recursive procedure to calculate the factorial of N. **(06 Marks)**

4 a. Give the classifications of interrupts in 8086. Explain the 8086 interrupt response mechanism. **(04 Marks)**
b. Explain INT N interrupt instruction? Write a program that outputs characters to printer using INT 17H interrupt. **(08 Marks)**
c. Explain interrupt data input using suitable circuit diagram. Write interrupt service procedure for reading characters from ASCII keyboard. **(08 Marks)**

PART – B

5 a. Write a keyboard procedure that scans the keyboard and returns with numeric code of the key in AL. **(10 Marks)**
b. Interface eight seven segment display, using 8255 with 8086. **(10 Marks)**

6 a. Explain data types of numeric data processor 8087. **(10 Marks)**
b. Represent 11.375_{10} in short real form. **(04 Marks)**
c. Explain functions of following instructions:
i) FLD iI) FADD iii) F2XM1 iv) FLDL2E **(06 Marks)**

7 a. Explain minimum mode configuration of 8086. **(08 Marks)**

b. Explain following with respect to PCI bus
   i) PCI bus timing diagram ii) PCI bus commands. **(08 Marks)**

c. Explain types of packets and contents found on USB. **(04 Marks)**

8 a. Give the features of 80386 microprocessor. Explain its memory system and I/O system with suitable diagrams. **(08 Marks)**

b. Explain programming model of 80486 microprocessor with suitable diagrams. **(08 Marks)**

c. Explain basic features of Pentium processor. **(04 Marks)**

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Sixth Semester B.E. Degree Examination, Dec.2014/Jan.2015

Microelectronics Circuits

Time: 3 hrs. Max. Marks:100

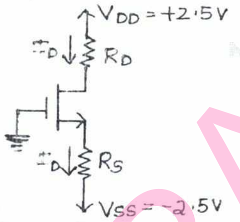
Note: ***Answer any FIVE full questions, selecting atleast THREE questions from Part-A and TWO from Part-B.***

PART – A

1 a. Derive an expression for drain current of a MOSFET in different regions of operation. **(06 Marks)**

b. Design a circuit of Fig.Q.1(b), so that the transistor operates at $I_D = 0.4$mA and $V_D = +0.5$V. The NMOS transistor has $V_t = 0.7$V, $\mu_n C_{ox} = 100\mu A/V^2$, L = 1μm, and W = 32μm. Neglect channel length modulation effect ($\lambda = 0$). **(04 Marks)**

Fig.Q.1(b)



c. Draw the small signal circuit model of MOSFET when $|VSB| \neq 0$ and explain briefly. (ie including the body effect). **(04 Marks)**

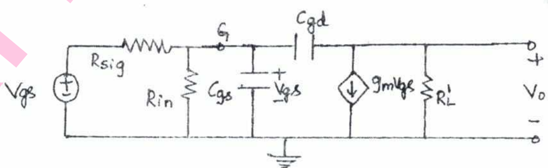
d. For the common drain amplifier stage, draw the small signal equivalent circuit and drive expressions for A_v, A_{vo}, G_v, R_{in} and R_{out}. **(06 Marks)**

2 a. Compare and explain the important characteristics of NMOS and NPN transistors. **(05 Marks)**

b. With a neat circuit diagram and equations explain the basic BJT current steering circuits. **(05 Marks)**

c. For the high frequency equivalent circuit of common source amplifier in Fig.Q.2(c), find the midband voltage gain $A_m = V_o/V_{sig}$ and upper 3dB frequency f_H using open circuit time constants. **(08 Marks)**

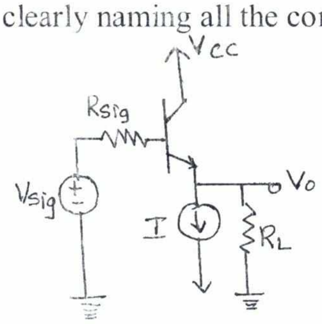
Fig.Q.2(c)



Where $R_L^{'} = 3.3K\Omega$; $R_{sig} = 100K\Omega$; $R_{in} = 420K\Omega$; $C_{gs} = C_{gd} = 1P_f$, $g_m = 4$m A/V.

d. For the emitter follower biased by a constant current source I, shown in Fig.Q.2(d), draw the high frequency equivalent circuit clearly naming all the components: **(02 Marks)**

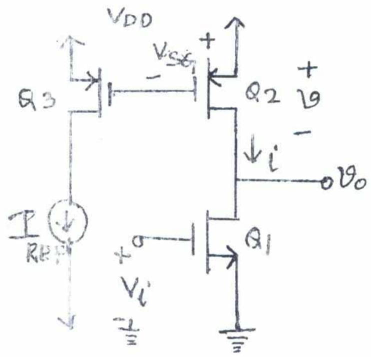
Fig.Q.2(d)



Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

3 a. A CMOS common source amplifier shown in Fig.Q.3(a) is fabricated with W/L = 100 μm/1.6 μm for all transistors. With Kn′ = 90 μA/V^2, Kp1′ = 30 μA/V^2, IREF = 100μA, V_{An} = 8 V/μm and V_{AP} = 12 V/μm, determine the following quantities g_{m1}, r_{o1}, r_{o2}, A_{vo}. **(06 Marks)**

Fig.Q.3(a)



b. Draw the MOS cascade amplifier circuit with current source biasing. With the help of small signal equivalent circuit. Show that the cascading increases magnitude of open circuit voltage gain from A_o to A_o^2. **(06 Marks)**

c. Write short notes on cascade MOS current mirror circuit. **(04 Marks)**

d. Find A_o for an NMOS transistor fabricated in a 0.4μm CMOS process for which Kn′ = 200μA/V^2, and VA′ = 20V/μm. The transistor has a 0.4μm channel length and is operated with an overdrive voltage of 0.25V. What must be W for NMOS transistor to operate at I_D = 100μA? Also find r_o and g_m. **(04 Marks)**

4 a. Explain the operation of MOS differential pair with a differential input voltage and derive the range of differential input for differential mode of operation. **(08 Marks)**

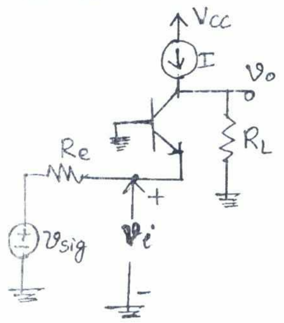
b. Prove that $A_{CM} = \frac{-r_{o4}}{2R_{SS}} \times \frac{1}{1+g_{m3} r_{03}}$ for the active loaded MOS differential amplifier. **(08 Marks)**

c. For the BJT differential amplifier having β = 100, matched to 10% or better, and areas that are matched to 10% or better, along with collector resistors that are matched to 2% or better, find V_{OS}, I_B and I_{OS}. The dc bias current is 100μA. **(04 Marks)**

5 a. Explain the operation of MOSFET as a linear amplifier. **(05 Marks)**

b. For the common base amplifier shown in Fig.Q.5(b) draw the small signal equivalent circuit and hence derive an expression for R_{in}, R_{out} and A_{vo}. **(06 Marks)**

Fig.Q.5(b)



c. A MOS differential amplifier is operated at a total current of 0.8mA, using transistors with W/L ratios of 100, $K_n' = \mu_n C_{ox}$ = 0.2 mA/V^2, V_A = 20V and R_D = 5KΩ. Find $V_{OV} = (V_{GS} - V_t)$, g_m, r_o, A_d. **(05 Marks)**

d. Explain channel length modulation effect of MOSFET. **(04 Marks)**

PART – B

6 a. What are the four properties of negative feed back? Briefly explain about each property. **(08 Marks)**

b. For the series-shunt feedback ideal amplifier find A_f, R_{if} and R_{of}. **(06 Marks)**

c. Discuss the method of frequency compensation for modifying open loop gain A(s) so that the closed loop amplifier is stable, by introducing a new pole in transfer function at sufficiently low frequency. **(06 Marks)**

7 a. Draw the circuit diagram of basic difference amplifier and derive an expression for the output voltage V_{out} and differential input resistance R_{id}. **(05 Marks)**

b. Show that the gain bandwidth product of an inverting amplifier is smaller than that of a non inverting amplifier. **(05 Marks)**

c. Find the output voltage of the circuit, assuming Op. Amp M1 has DC open loop gain of 1×10^5 and a bandwidth of 10 rad/sec., op amp M_2 is an ideal op. amp (Ref.Fig.Q.7(c)). **(06 Marks)**

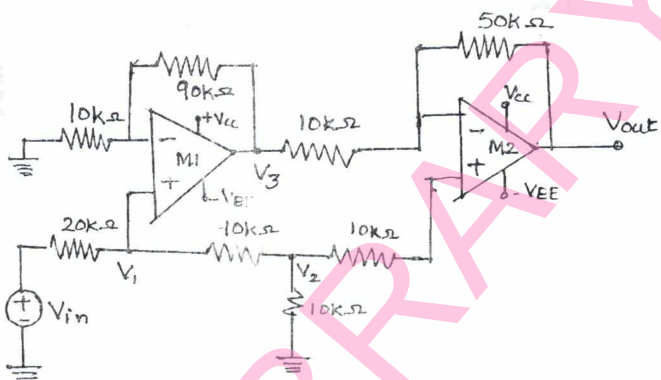


Fig.Q.7(c)

d. Write a note on use of op-amp in sample and hold circuit. **(04 Marks)**

8 a. Draw the basic structure of CMOS inverter and explain the voltage transfer characteristic of CMOS inverter **(08 Marks)**

b. Consider a CMOS inverter fabricated in a 0.25μm process for which C_{ox} = 6fF/μm^2, $\mu_n C_{ox}$ = 115μA/V^2, $\pi_p C_{ox}$ = 30μA/V^2, V_{tn} = -V_{tp} = 0.4V and V_{DD} = 2.5V. The W/L ratio of Q_N is 0.375 μm/0.25μm and for Q_p is 1.125μm/0.25μm. The equivalent capacitance value is 6.25fF. Find t_{PHL}, t_{PLH} and t_p. **(06 Marks)**

c. Explain with neat circuit diagrams about pull-up and pull-down networks used in CMOS logic circuits. **(06 Marks)**

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Sixth Semester B.E. Degree Examination, Dec.2014/Jan.2015
Antennas and Propagation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With the help of Maxwell's equation, explain how radiation and reception of EM takes place? **(06 Marks)**

b. Explain the following terms as related to antenna system:
i) Directivity; ii) HPBW; iii) Effective length; iv) Beam efficiency. **(08 Marks)**

c. Show that the directivity for unidirectional operation is 2(n + 1) for an intensity variation of $u = u_m \cos^n\theta$. **(06 Marks)**

2 a. With a neat diagram, obtain an expression for maximum effective aperture of a $\lambda/2$ dipole. **(07 Marks)**

b. Derive relationship between maximum effective aperture and directivity of an antenna. **(08 Marks)**

c. Find the maximum power received at a distance of 0.75km over free space 110 Mhz circuit consisting of a transmitting antenna of 30dB gain and a receiving antenna of 25dB gain, if the power i/p to the transmitting antenna is 120 watts. **(05 Marks)**

3 a. Starting from fundamentals derive the equation for radiation resistance of Hertzian dipole. **(08 Marks)**

b. A dipole antenna of length 5cm is operated at a frequency of 100MHz with terminal current, I_0 = 120mA. At time, t = 1 sec, $\theta = 45°$ and r = 3m. Find: i) E_r; ii) E_θ and iii) H_ϕ. **(08 Marks)**

c. Calculate the radiation resistance of a dipole of length = $\lambda/5$. (Assume triangular current distribution). **(04 Marks)**

4 a. Derive the far field expressions for small loop antenna. **(08 Marks)**

b. Derive an expression and draw the field pattern for an array of two isotropic point sources with equal amplitude and opposite phase. Take $d = \lambda/2$. **(08 Marks)**

c. Find half power beam width and directivity of a linear broadside array of four isotropic point sources of equal strength with $d = \lambda/2$? **(04 Marks)**

PART – B

5 a. Write explanatory note on: i) Folded – dipole antenna; ii) Yagi-uda antenna. **(10 Marks)**

b. Find the length, L, H-plane aperture and flare angles θ_E and θ_H of a pyramidal horn for which E-plane aperture is 10λ. Horn is fed by a rectangular waveguide with TE_{10} mode. Assume $\delta = 0.2\lambda$ in E-plane and 0.375λ in H-plane. Also find E-plane, H-plane beam widths and directivity. **(06 Marks)**

c. A dish antenna operating at a frequency of 1.43 GHz has a diameter of 64mts and is fed by a directional antenna. Calculate HPBW, BWFN and gain with respect to $\lambda/2$ dipole with even illumination. **(04 Marks)**

6 a. Write short notes on: i) Parabolic reflectors; ii) Log – periodic antenna. **(12 Marks)**

b. Determine the cut-off frequencies and bandpass 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 L/2 equal to 0.3m. **(08 Marks)**

7 a. Define a wave tilt of a surface wave propagation. Also, prove that

$$\text{Wave tilt, } \alpha = \tan^{-1}\frac{E_n}{E_v} = \tan^{-1}\left[\frac{1}{\sqrt{\epsilon_r}}\cdot\frac{1}{\left[1+x^2\right]^{1/4}}\right].$$ **(10 Marks)**

b. Derive the expression for resultant field strength at a point due to space wave propagation. **(05 Marks)**

c. For a VHF communication link, a 35 watt transmitter is operating at 90MHz. Determine the distance upto which LOS would be possible given that height of the transmitting and receiving antenna are 40m and 25m respectively. Evaluate the field strength at the receiving point. **(05 Marks)**

8 a. Define the following: i) MUF; ii) Critical frequency; iii) Virtual height; iv) Skip distance. **(08 Marks)**

b. Calculate the value of the operating frequency of the ionosphere layer specified by refractive index of 0.85 and an electron density 5×10^5 electrons/m^3. Calculate the critical frequency and MUF of the system with $\theta_i = 30°$. **(06 Marks)**

c. Calculate the critical frequencies for f_1, f_2 and E layers, for which, the maximum ionic densities are 2.3×10^6, 3.5×10^6 and 1.7×10^6 elections/cm^3 respectively. **(06 Marks)**

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Sixth Semester B.E. Degree Examination, Dec.2014/Jan.2015
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. What is O.S.? What are the common tasks performed by O.S. and when they are performed? **(07 Marks)**

b. Explain turn around time in batch processing system. **(06 Marks)**

c. Define distributed system. Give the key concepts and techniques used in distributed O.S. **(07 Marks)**

2 a. Explain with basic structure used for system generation in configuring and installing supervisor. **(07 Marks)**

b. Explain with a figure the working of a two layered O.S. structure. **(06 Marks)**

c. With a neat diagram, explain the working of a microkernel based O.S. **(07 Marks)**

3 a. Define a process. List the different fields of a process control block. **(06 Marks)**

b. Explain the four fundamental states of a process with state transition diagram. **(07 Marks)**

c. What are the advantages of threads over process? Explain kernel level threads. **(07 Marks)**

4 a. Explain the working of a buddy system allocator. **(06 Marks)**

b. Give the comparison of contiguous and non-contiguous memory allocation. **(06 Marks)**

c. Explain first fit and best fit technique used to perform a fresh allocation from a free list. **(08 Marks)**

PART – B

5 a. Explain what are the functions performed by paging hardware. **(06 Marks)**

b. What are the functions performed by VM handler? Give the data structures of VM handler. **(06 Marks)**

c. Consider the page reference string 5, 4, 3, 2, 1, 4, 3, 5, 4, 3, 2, 1, 5. How many page faults would occur for the following page replacement policies assuming 3 frames?
i) FIFO ii) LRU **(08 Marks)**

6 a. What are the facilities provided by the file system and the input-output control system? **(06 Marks)**

b. With a figure explain the working of a linked allocation of disk space. **(07 Marks)**

c. Explain the interface between file system and IOCS. **(07 Marks)**

7 a. With diagram explain the working of a long, medium and short term scheduling in a time sharing system. **(10 Marks)**

b. For the following given process for scheduling.

Process	P_1	P_2	P_3	P_4	P_5
Admission time	0	2	3	4	8
Service time	3	3	5	2	3

Calculate mean turn around time and mean weighted turn around for the (i) FCFS scheduling (ii) Round-Robin scheduling with time slicing (δ) for 1 second. **(10 Marks)**

8 a. Explain the primary issues in implementing message passing. **(06 Marks)**

b. Explain the working of a blocking and non-blocking delivery protocols. **(07 Marks)**

c. Explain mailboxes. Give the advantages of mailboxes. **(07 Marks)**

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10EC662

Sixth Semester B.E. Degree Examination, Dec.2014/Jan. 2015
Satellite Communication

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Describe the various services provided by the satellite with the frequency band designations. **(06 Marks)**

b. Define the terms : i) Ascending node ii) Prograde orbit iii) mean anomaly iv) true anomaly. **(04 Marks)**

c. Determine the rate of regression of the nodes and the rate of rotation of the line of apsides for the satellite parameters, mean motion 14.23/day inclination 98.63, recentricty 00.00115, argument of perigee 113.55°, right ascension of the ascenting node 251.53° and constant $k_1 = 66063.1704\ km^2$. Find the new values of argument of perigee and right ascension of the ascending node one period after epoch. Constant $\mu = 3.986005 \times 10^{14}\ m^3/s^2$. **(10 Marks)**

2 a. What is sidereal time and mean solar time? Give the relation between them. **(05 Marks)**

b. What is sun synchronous orbit? How it is achieved. **(07 Marks)**

c. A geostationary satellite is located at 90°W. The average radius of the earth is 6371 km and radius of the circular orbit is 42164. The earth station antenna is at latitude 35°N and longitude 100°W. Determine the azimuth, elevation and range of the satellite. **(08 Marks)**

3 a. Derive the noise temperature for an absorptive network. Show that at room temperature the noise factor of a lossy network is equal to the power loss. **(06 Marks)**

b. A multiple carrier satellite circuit operates in the 6/4 GHz band with the following characteristics ; uplink : saturation flux density –67.5 dBW/m^2 ; input Bo 11 dB; free space loss 196.7 dB, earth station G/T is 40.7 dBk^{-1}. Constant $k = 1.38 \times 10^{-23}$ J/k. The other losses may be ignored. Calculate the combined uplink and down link C/N ratio. **(08 Marks)**

c. Find the rain attenuation for a frequency 12 GHz signal transmission from the earth station attitude 600 m and the antenna elevation is 50°. The rain height is 1.5 km and horizontal polarization is used. The rain rate $R_{0.01}$ = 15 mm/h and attenuation coefficients $a_h = 0.0188$, $b_h = 1.217$. **(06 Marks)**

4 a. What are the functions of TT and C subsystem? Explain with a neat block diagram, of satellite control system. **(07 Marks)**

b. With a neat sketch, explain the operation of traveling wave tube amplifier. **(08 Marks)**

c. Describe briefly how the beam shaping of a satellite antenna radiation pattern is achieved. **(05 Marks)**

PART – B

5 a. Describe the master antenna TV system and the community antenna TV system. **(08 Marks)**

b. Explain the transit –receive earth station with a detected block diagram. **(07 Marks)**

c. A geostationary satellite employs a 3.5 m parabolic antenna at a frequency of 12 GHz. Find the –3 dB beam width and the spot diameter on the equator. **(05 Marks)**

6 a. Explain the operation of a spade system along with the channeling scheme. **(06 Marks)**

b. Describe the operating principle of a TDMA network. How the transmission bit rate is related to the input bit rate. **(07 Marks)**

c. A 14 GHz uplink operates with transmission losses 212 dB and a satellite [G/R] = 10 dB/k. The required uplink $[E_b/N_0]$ is 12 dB.

i) Assuming FDMA operation and on earth station uplink antenna gain of 46 dB, find the earth station transmitter power needed for T, baseband signal rate 1.544 Mb/s. Boltzmann's constant $k = 1.38 \times 10^{-23}$ J/k

ii) If the downlink transmission rate is 74 dBb/s find the uplink power innease required for TDMA **(07 Marks)**

7 a. Explain the satellite switched TDMA with the different modes of connectivity for three beams. How many switching modes are required for full inter connectivity? **(08 Marks)**

b. Explain the DBS frequency plan for region 2. **(06 Marks)**

c. How the bit rates for digital television are determined? Compute the uncompressed bit rate for SDTV format having resolution 640 × 480 pixels at 30 frames per second out 16 bit per pixel. **(06 Marks)**

8 a. Describe the operation of a typical VSAT system along with its application. **(08 Marks)**

b. Explain the GPS system for position determination. **(05 Marks)**

c. What is down to dusk orbit? Why the Ratarsat follows such an orbit? What are the application or Radarsat. **(07 Marks)**

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