Roll No								

National Institute of Technology Goa

Programme Name: B.Tech.

End-Semester Examination, May 2023

B. Tech
ECE
3rd year
6th Sem

Course Name: **Wireless Communication**

Date: 12/05/2023

Duration: 3 Hours

Course Code:EC351

Time:02:00 AM-05:00 PM

Max. Marks: 100

1. Consider a cellphone user in a car which is moving at 60 miles per hour at an angle of $\theta = 45\,^{\circ}$ with the line joining the base station.
   (a) Compute the Doppler shift of the received signal at a carrier frequency of $f_c = 1850$ MHz. [5]
   (b) Compute the coherence time T_c at the carrier frequency $f_c = 1.85$ GHz. [5]

2. (a) Give the classification of MIMO receivers. [5]
   (b) Describe any one of the linear MIMO receivers. [10]

3. (a) For the thermal noise at the receiver, compute the noise power at $T = 293$ K and noise figure $F =$ 5 dB. The bandwidth $B = 30$ kHz. [5]
   (b)Consider the 1×2 wireless system given as follows: [10]

$$y = \begin{bmatrix} 1+j, & 1-j \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + n$$

   Obtain the effective Alamouti channel matrix, the effective received vector and the beamformers.

4. Consider the MIMO channel matrix given below and σ_n^2= 3 dB for the system.

$$\mathrm{H} = \begin{bmatrix} 1 & -1 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 2 \end{bmatrix}$$

   (a) Compute the SVD of the above MIMO channel matrix. [5]
   (b) What is the capacity optimal transmit scheme for a transmit power of 3 dB? [10]

5. (a) Describe the Log-normal shadowing. [5]
   (b) Consider a cellular system with $N = 48$ channels per cell, and blocking probability $PB = 0.02$ = 2% for supported traffic of 38.4 E. The traffic per user is $A_0 = 0.04$ E. The hexagonal cell's inner circle radius is 1 km. What is the number of users that can be supported in a city of 603 square km area? [10]

6. (a) Using figure, describe the method for locating co-channel cells in a cellular system with $N = 19$ (i.e., $i = 3$, $j = 2$). [5]

(b)Prove that for a hexagonal geometry, the co-channel reuse ratio is given by $Q=\sqrt{3N}$, where $N = i^2 + ij + i^2$. [10]

7. (a) Write short notes on Walsh codes for CDMA application. [5]

(b) Give one simple example of CDMA coding (encoding and decoding) using orthogonal Walsh codes of length 4. [5]

(c) Describe improvement in jammer margin, graceful degradation and, effective frequency reuse in CDMA based 3G communication. [5]

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NATIONAL INSTITUTE OF TECHNOLOGY GOA

Farmagudi, Ponda, Goa-403401

Programme Name: B.Tech.

End Semester Examinations, May-2023

B.Tech 3rd year 6th Sem

Course Name: **Communication Network** Course Code: **EC354** ECE

Date: **10.05.2023** Time: **2.00-5.00 PM**

Duration: **3 Hour 00 Minutes** Max. Marks: **100**

ANSWER ALL QUESTIONS

Q1	**(a)**	Draw event timing diagrams for circuit switching, virtual circuit packet switching?	**5**
	(b)	List at least ten names of the protocol of application layer with port number?	**5**
	(c)	Define each seven layers in one sentence?	**5**
	(d)	Elaborate about the following's application architectures; 1. Client-server 2. Peer to peer (P2P) 3. Hybrid of client-server and P2P	**10**
Q2	**(a)**	Elaborate the concept of window advertisement?	**5**
	(b)	How will the server differentiate whether the CONNECTION REQ.-1is a new connection request or duplicate of the CONNECTION REQ.-2?	**5**
	(c)	Elaborate about the sliding window protocol in noisy channel?	**10**
Q3	**(a)**	Demonstrate with suitable examples about the DHCP?	**5**
	(b)	Elaborate how network address translation (NAT) is cost effective?	**5**
	(c)	Elaborate about the types of the CSMA?	**5**
	(d)	Plots the figures between λ_{in} versus λ_{out} for the following? 1. Throughput can never exceed capacity. 2. Retransmission deceases effective throughput. 3. Un-needed duplicates further deceases effective throughput. 4. Up-stream transmission capacity/buffering wasted for packets lost downstream.	**10**
Q4	**(a)**	How slotted ALOHA is better than the pure ALOHA, explain?	**5**
	(b)	Demonstrate how many bits of redundant information should be added for a 42-bit message in two-dimensional parity?	**5**
	(c)	With suitable example, elaborate about the cyclic redundancy check with and without the errors?	**10**
Q5	**(a)**	Elaborate about the data link sublayers?	**5**
	(b)	Write short note on packet multiplexing over wireless networks?	**5**

**********All the Best**********

Roll No										

National Institute of Technology Goa

Programme Name: **B.Tech**

End Semester Examinations, May 2023

B.Tech
ECE/EEE
3rd year
6th Sem

Course Name: **Linear Integrated Circuits**

Date: **09/05/2023**

Duration : **3 Hours**

Course Code: **EC352**

Time: **02.00 PM - 05.00 PM**

Max. Marks: **100**

ANSWER ALL QUESTIONS

Note: Assume suitable values if data is insufficient

1. Design RC-Phase Shift oscillation of 10kHz frequency. Also calculate what is the feedback factor β at 5kHz. What happens to the output if $A\beta > 1$. [10M]

2. Design Narrow Band pass filter with the given parameters
   Quality factor Q=12.
   Center frequency 3kHz.
   Gain=-2. [10M]

3. Explain the functionality of successive approximation ADC. Details the conversion process for an analog input voltage of 3V. Consider 8-Bit, full scale voltage (Reference voltage) of 8V. [10M]

4. In a 3-Bit inverted R-2R DAC, what is the output voltage for an input bits of 101. Calculate current in each resistor. Consider $R = 1K\Omega$ and V_R=10 V. [10M]

5. Design astable multivibrator using 555 timer. $t_{High} = 0.6$ ms, $t_{Low} = 0.4$ ms. What happens if control input[Pin. 5] is given $0.1V_{cc}$ V additionally. [10M]

6. In a schmitt Trigger circuit, hysteresis of 0.1 V is required, calculate V_{ref}, V_{sat}, and R_1. Whereas $A_{OL} = 100000$, loop gain 1000, R_2=$1k\Omega$, $V_{UT} = V_{ref}$. [10M]

7. In an op-amp, open loop gain $A_{OL} = 10^5$ and corner frequencies are $f_1 = 200kHz$ Hz, $f_2 = 2MHz$ and $f_3 = 20MHz$. Design Dominant-pole compensation. [5M]

8. (a) Design an Instrumentation amplifier for the gain of 20. (b) Convert 1 V DC voltage source to current source of 1 mA when load is connected to Ground. [10M]

9. Design practical Integrator circuit for an input signal having minimum frequency 1kHz. Draw the output waveform for the square wave form peak-to-peak voltage 2 V having time period of 0.5ms. [10M]

10. What is the slew rate? What is the maximum input frequency you can apply (without any distortion in the output) if the slew rate is $0.5V/\mu s$, and amplitude of 1 V signal. [5M]

11. In the relaxation oscillator shown in Fig. 1 , the forward voltage of zener diodes is 0.7 V. Estimate output waveform. [10M]

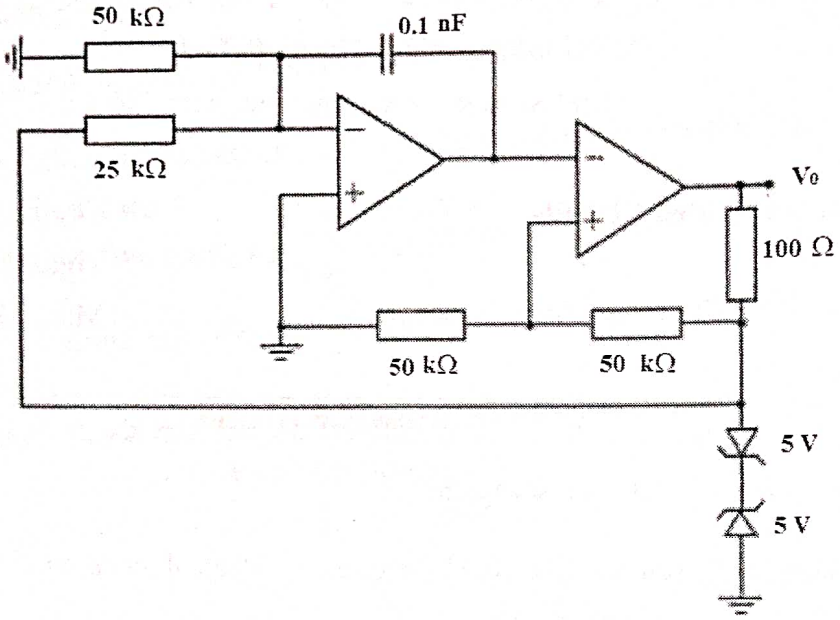

Figure 1:

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B.Tech ECE
3rd year
6th Sem

National Institute of Technology Goa

Programme Name: **B.Tech.**

MID Semester Examinations, March-2023

Course Name: Communication Network
Date: **17.03.2023**
Duration: **1 Hours 30 Min**

Course Code: **EC354**
Time: 9.30 AM to 11 AM
Max. Marks: **50**

ANSWER ALL QUESTIONS

Q1	(a)	How application data passes through different layers?	4
	(b)	In connection establishment, list out the three ways of handling delayed duplicates?	4
	(c)	What are the five services of transport layer?	4
	(d)	Elaborate about the stop and wait flow control algorithm for noise channel?	4
	(e)	Elaborate about the sliding window protocol and point out what problem it resolved which belongs to stop and wait protocol?	5
	(f)	Difference between Go back N ARQ and selective repeat ARQ?	5
Q2	(a)	Draw the router architecture then describe the three switching fabrics?	6
	(b)	Elaborate about the original and fragmented datagram with suitable examples?	6
Q3	(a)	Define the following term; Network edge, Network core, host (end system), Connection oriented and connectionless services	6
	(b)	Difference between TCP/IP layer and OSI layer?	6

**********All the best**********

Roll No										

National Institute of Technology Goa

Programme Name: **B.Tech.**

Mid Semester Examinations, March 2023

B.Tech ECE
3rd year
6th Sem

Course Name: **Digital Communication**

Date: **16/03/2023**

Duration : **1.5 Hours**

Course Code: **EC353**

Time: **09.30 AM - 11.00 AM**

Max. Marks: **50**

ANSWER ALL QUESTIONS

1. [2X5=10]

   (a) Define power spectral density and autocorrelation function of a random process.

   (b) State sampling theorem for bandpass signal. Determine the adequate sampling frequency to recover the original signal from the sampled of a band pass signal with frequency range of 100 MHz to 104 MHz.

   (c) Consider a linear DM system designed to accommodate analog message signals limited to bandwidth of 4kHz. A sinusoidal test signal of amplitude Am=1V and frequency $f_m = 800$Hz is applied to the system. The sampling rate of the system is two times Nyquist rate. Find the minimum value of step size to avoid slope overload error.

   (d) What is the theoretical minimum system bandwidth needed for a 80 Mbps signal using 32-level PAM without ISI?

   (e) State the condition when MAP criterion equals ML criterion and express average provability of error.

2. Show that the power spectral density (PSD) $\Phi(e^{jw})$ of discrete signal $x(n)$ is real for real valued signal. [6]

3. Ten telemetry signals, each of bandwidth 2 kHz, are to be transmitted simultaneously by binary PCM. The maximum tolerable error in sample amplitudes is 0.2% of the peak signal amplitude. The signals must be sampled at least 20% above the Nyquist rate. Framing and synchronizing requires additional 1% extra bits. What is the minimum possible data rate and minimum transmission bandwidth? [8]

4. How the ISI can be completely eliminated by using Nyquist Criterion? [4]

5. A rectangular pulse having amplitude 5 V and duration 1 ms transmitted through a baseband channel. Consider the received signal is added with noise of power spectral density is 0.0005 W/Hz. An integrator and dump circuit is used to receive the pulse. Derive the distribution of the random variable obtained at the output of the integrator and dump circuit. [6]

6. Consider the signal s(t) shown in the figure [3+3+2=8]

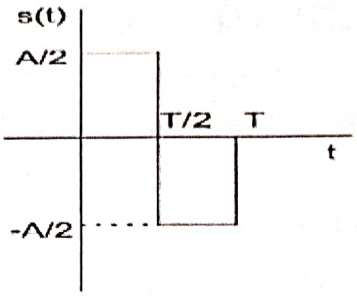

Figure 1: Signal in Q5

(a) Determine the impulse response of a filter matched to this signal and sketch it as a function of time.

(b) Plot the matched filter output as a function of time.

(c) What is the peak value of the output?

7. 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 $s_3(t)$ shown in figure. Express each of these signals in terms of the set of basis functions. [8]

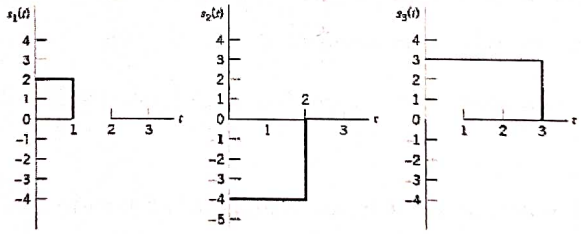

Figure 2: Signal in Q7

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National Institute of Technology Goa

Programme Name: **B.Tech**

Mid Semester Examinations, March 2023

B.Tech ECE
3rd year
6th Sem

Course Name: **Linear Integrated Circuits**
Date: **15/03/2023**
Duration : **1.5 Hours**

Course Code: **EC352**
Time: **09.30 AM - 11.00 PM**
Max. Marks: **50**

ANSWER ALL QUESTIONS

Note: Assume suitable values if data is insufficient

1. In the figure 1, if the input voltage $V_{in} = 0.1V$, the output voltage $V_{out} = 1V$. Also if $V_{in} = 1V$, $V_{out} = 6V$. Calculate the ratio R_f/R_1. [6M]

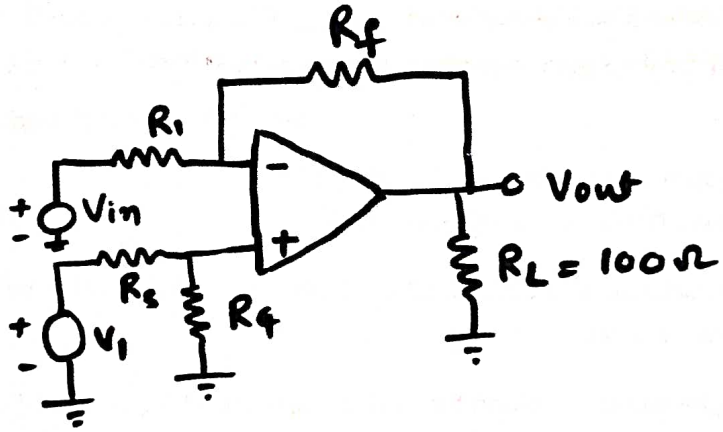

Figure 1:

2. In the given figure 2, find the output waveforms, for the given input waveforms (a) and (b). [6M]

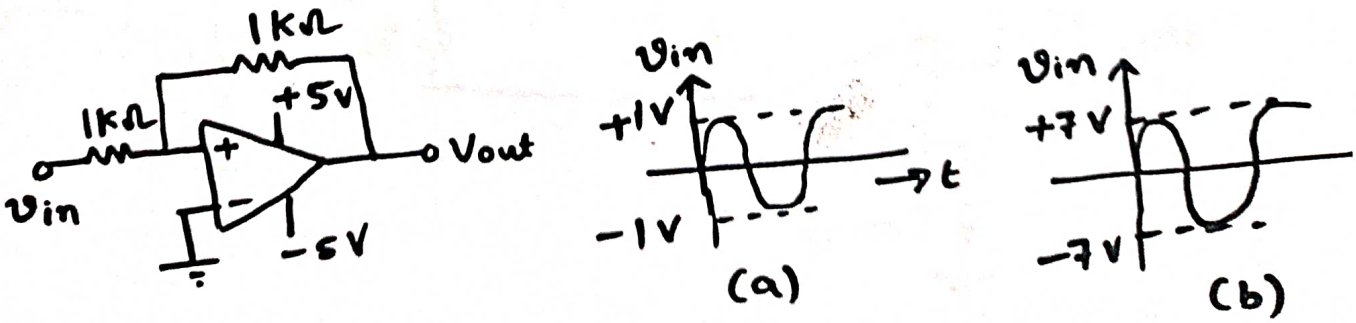

Figure 2:

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3. In an op-amp, open loop gain $A_{OL} = 10^5$ and corner frequencies are $f_1 = 200kHz$ Hz, $f_2 = 2MHz$ and $f_3 = 20MHz$. Design Dominant-pole and Pole-zero compensations. Calculate bandwidth in both cases and comment on it. [6M]

4. Design Op-amp circuits for the given input and output waveform shown in Fig. 3. Describe the operation. [6M]

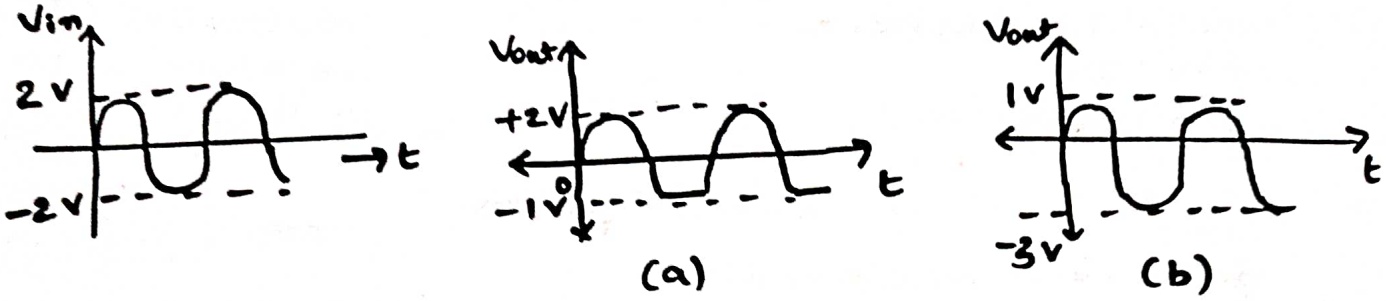

Figure 3:

5. Design practical differentiator circuit for an input signal having maximum frequency 1kHz. Draw the output waveform for the square wave form peak-to-peak voltage 2 V having time period of 10mS. [6M]

6. Explain DC compensation techniques for (a) input bias current, (b) input offset current, (c) input offset voltage, and (4) total output offset voltage. [6M]

7. Plot transfer characteristics of differential amplifier. Find CMRR value for $R_E = 3.6k\Omega$ and the voltage drop across is 2 V. [7M]

8. In the figure 4, plot output waveform for an given input signal $V_{in} = \sin(2000\pi t)V$. Also find output values for (a) $V_{in} = \sin(\pi/3)V$ (b) $V_{in} = \sin(3\pi/2)V$. [7M]

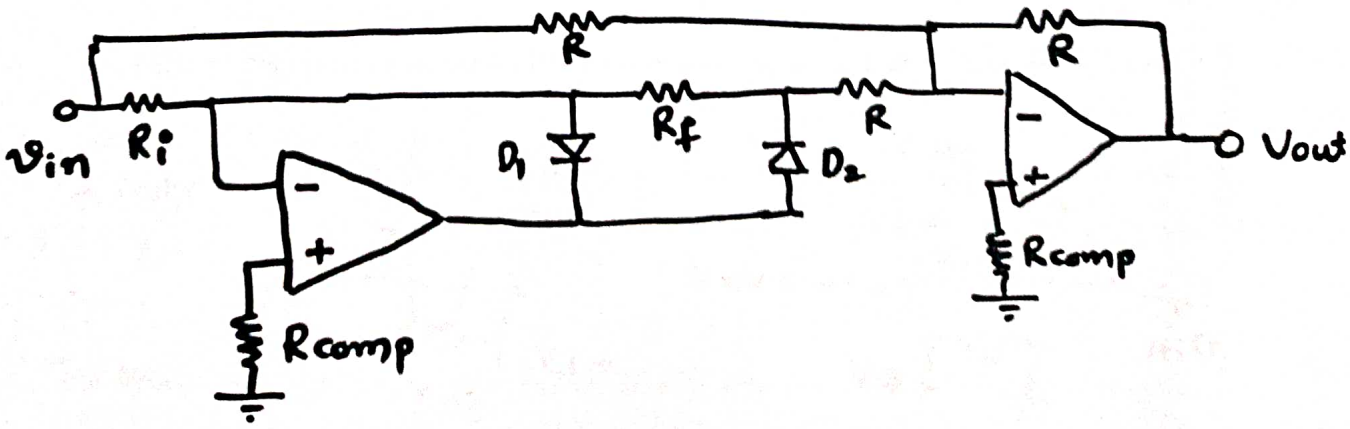

Figure 4:

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National Institute of Technology Goa

Programme Name: B.Tech.

Mid Semester Examinations, March 2023

B.Tech ECE
3rd year
6th Sem

Course Name: **Wireless Communication**

Date: 14/03/2023

Duration:1 Hour 30 Minutes

Course Code: **EC351**

Time: 09.30AM - 11.00AM

Max. Marks: 50

ANSWER ALL QUESTIONS

1. Derive the BER expression for BPSK in AWGN channel. Compute the linear SNR and SNR in dB required to maintain the BER of one PPM in said wireline framework. [10]

2. Describe the Rayleigh fading in wireless cellular networks with related equations. Estimate the fading channel coefficient of the Rayleigh fading wireless channel with AWGN for the following pair of the input $x^{(p)}$ and the output $y^{(p)}$ symbol vectors: [10]

   $x^{(p)} = \frac{1}{\sqrt{P}}[-1+j, 1+j, 1-j, 1+j]^T$

   $y^{(p)} = [-0.7850 + j0.3631, 0.4072 + j0.7757, 0.8004 - j0.4359, 0.4464 + j0.8222]^T$

3. Describe Maximum Ratio Combining (MRC) technique for SIMO wireless systems. For two receiver antenna wireless channel with following complex fading coefficients: [10]

$$h_1 = \frac{1}{\sqrt{2}}(1+j)$$
$$h_2 = \frac{1}{\sqrt{2}}(1-j)$$

   (i) Describe the system model and compute optimal beam former vector. (ii) Obtain SNR with MRC.

4. Compare the MIMO based Zero-Forcing (ZF) receiver with MMSE receiver. For the MIMO system model,

$$\begin{bmatrix} y1 \\ y2 \\ y3 \end{bmatrix} = \begin{bmatrix} 2 & 3 \\ 1 & 3 \\ 4 & 2 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \end{bmatrix} + \begin{bmatrix} n1 \\ n2 \\ n3 \end{bmatrix}$$

   Compute the zero-forcing receiver. [10]

5. Consider the average power profile of a wireless system:

$$\phi(\tau) = \kappa e^{-\tau/\tau_0}$$

   Compute the RMS delay spread for this profile. Assume $\kappa = 2$ and $\tau = 1\mu s$. [10]

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System with a Pr/Blocking/ = 20% ...

B. Tech EEE
3rd year
6th Sem

Roll no									

NATIONAL INSTITUTE OF TECHNOLOGY GOA
Farmagudi, Ponda, Goa - 403 401

Programme Name: B.Tech.	Mid Semester Examination	March - 2023
Course Name: Switchgear & Protection	Course Code: EE 350	Class : VI Semester
Date : 13th March, 2023	Time : 09.30 AM to 11:00 AM	Max. Marks : 50

Answer All Questions

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1. Define the following terms: (i) Cut-off current (ii) Melting time (iii) rapturing capacity. Also, write the applications of HRC Fuses. .... **(5 M)**
2. What are the drawbacks of isolated neutral system? Explain the same with neat phasor diagram and mathematical expressions. .... **(5 M)**
3. A 132 kV, 3-Φ, 50 Hz overhead line 50 km long has a capacitance to earth for each line of 0.0157μF per km. Determine the inductance and kVA rating of the arc suppression coil suitable for this system. .... **(5 M)**
4. Distinguish clearly between the recovery voltage and restriking voltage and explain the significance of RRRV in the operation of a circuit breaker by deriving necessary expression. .... **(6 M)**
5. In a 220 kV system, the reactance and capacitance up to the location of circuit breaker are 8 Ω and 0.025 μF respectively. A resistance of 600 Ω is connected across the contacts of the circuit breaker. Determine the following:
   (i) Natural frequency of oscillation
   (ii) Damped frequency of oscillation
   (iii) Critical value of resistance which will give no transient oscillation
   (iv) The value of resistance which will give damped frequency of oscillation, one fourth of the natural frequency of oscillation .... **(6 M)**
6. How to reduce the severity of voltage oscillations caused during the interruption of capacitive currents. Also, derive the expression for the value of resistance to be inserted to reduce effect of RRRV. ... **(6 M)**
7. Briefly explain how the arc is struck between the circuit breaker contacts. Also explain different arc interruption principles. .... **(6 M)**
8. Describe the construction and arc quenching mechanism of minimum oil circuit breaker with neat sketch. Also, mention its advantages and disadvantages. .... **(6 M)**
9. A 3-ph, 11 kV, 400 MVA circuit breaker suddenly closes on to a fault. Determine
   (i) Symmetrical breaking current,
   (ii) Asymmetrical breaking current assuming 50% dc component,
   (iii) Peak making current .... **(5 M)**

All the Best

Roll No								

National Institute of Technology Goa

B. Tech 3rd year 6th Sem ECE

Programme Name: **B.Tech.**

End Semester Examinations, December 2021

Course Name: **Digital Communication**

Date: **20/05/2022**

Duration : **3 Hours**

Course Code: **EC353**

Time: **02.00 PM - 05.00 PM**

Max. Marks: **100**

ANSWER ALL QUESTIONS

[$2 \times 10 = 20$]

1.

(a) The auto-correlation function of a stochastic process $x(t)$ is $\phi_{xx}(\tau) = 10^{-6}\delta(\tau)$. Suppose $x(t)$ is the input to an ideal bandpass filter having bandwidth 10 MHz. Determine the noise power at the output of the filter.

(b) A 8-bit PCM system carries 24 voice channel over separate pairs of wires with regeneration repeaters spread at approximately 2 Km intervals. The time division multiplexing system uses one extra bit for synchronization after transmitting all 24 voice channel each sampled at 8000 samples per second. Determine the data rate in the channel and also calculate the required bandwidth when a pulse shaping filter is used with roll off factor of 0.25.

(c) Define Hamming distance (d_H). What is the minimum Hamming distance for (31,26) Hamming code?

(d) Determine the Shannon capacity of a 5 MHz wide-band channel at 30 dB SNR.

(e) What is multiple access technique? How is it different from multiplexing?

(f) How the eye diagram is useful for the design of digital data receiver?

(g) Define bandwidth efficiency of a digital modulation scheme. What is the bandwidth efficiency for 16-ary FSK modulation technique.

(h) Compare the power spectral density of $M = 2, 4, 8$-ary PSK modulation techniques.

(i) Draw the constellation diagram for DPSK receiver signal.

(j) Derive the relation between bit error rate with symbol error rate for M-ary communication when bits are mapped to symbol using Gray code.

2. The signal $x(t) = 4\cos(400\pi t) + 12\cos(360\pi t)$ is ideally sampled at a frequency of 300 samples per second. The sampled signal is passed through a unit gain LPF with a cut off frequency of 150 Hz. Plot the spectrum of signal $x(t)$ and sampled signal $x(n)$ and then list the frequency components present at the output of the LPF? [8]

3. Describe how the errors are corrected using Hamming code with an example. Let the code vector [1110010] is sent, the received vector is [1100010]. Calculate the syndrome and correct the error. Can (7,4) Hamming code correct 2 errors at a time? Justify your answer. [10]

4. With the help of the signal constellation diagrams explain the minimum shift keying (MSK) modulation schemes. [8]

5. What is orthogonal frequency division multiplexing (OFDM). Explain the design of OFDM transceiver. [8]

6. Figure 1 shows the waveform produced by a baseband modulator for the binary data sequence displayed on top of the figure. It is known that bits 0 and 1 are equally likely. The modulators output is transmitted over an AWGN channel with two-sided power spectral density $N_0/2$.

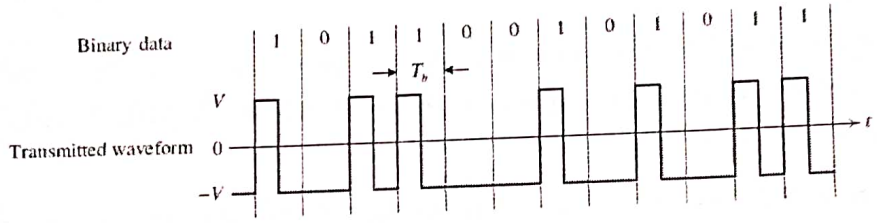

Figure 1: Examples of binary data and transmitted waveform.

(a) Identify and clearly plot the waveforms of signal set $\{s_1(t), s_2(t)\}$ used by the modulator. As usual, the transmitter sends $s_1(t)$ for bit 0 and $s_2(t)$ for bit 1. Also find the energies E_1 and E_2 of the two signals in terms of voltage level V and bit duration T_b. [4]

(b) Write exact expressions to represent $s_1(t)$ and $s_2(t)$ as linear combinations of the two basis functions shown below. Then clearly show the locations of the two signals $s_1(t)$ and $s_2(t)$ on the signal space spanned by $\phi_1(t)$ and $\phi_2(t)$. Draw the optimum decision boundary and identify the two decision regions. Write an expression for the optimum decision rule and simplify it as much as you can. [6]

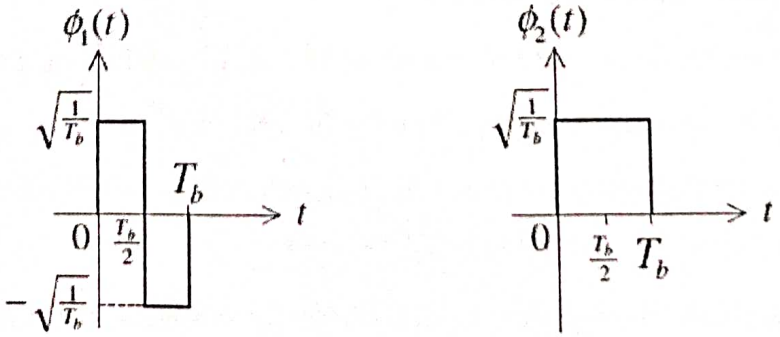

Figure 2: Orthonormal basis functions considered in Part (b).

(c) Draw the block diagram of such an optimum receiver that uses only one matched filter. Determine and plot the impulse response of the matched filter. [3]

(d) Assume that $N_0 = 10^{-6}$ watts/Hz. What is the minimum voltage level V you can set in order to transmit at the rate of 1 Mbps (megabits per second) and with a probability of error $P[error] \leq 10^{-5}$. Hint: $Q^{-1}(10^{-5}) \approx 4.25$. [2]

7. **8-QAM Constellation**: Consider an 8-QAM constellation in Figure below, which is used in the upstream channel, i.e., from a cable modem (CM) to a cable modem termination system (CMTS).

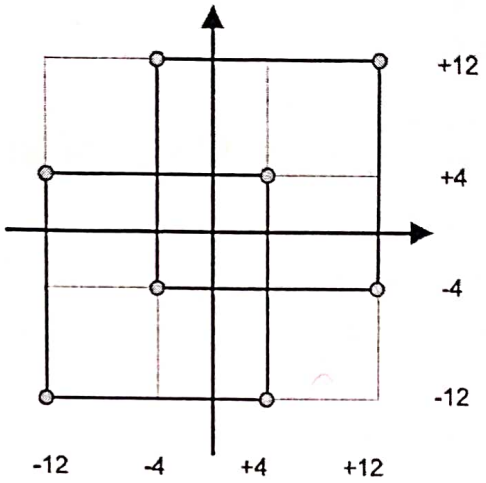

Figure 3: Constellation for 8-QAM

(a) Compute the average energy for the constellation. [3]

(b) Comparison of above 8-QAM constellation with the 8-PSK constellation. What is the minimum distance of the 8-PSK constellation if it has the same average energy as that of the 8-QAM constellation in Fig. 3? Based on this result and the minimum distance of the 8-QAM constellation, what is a better constellation in terms of power efficiency and why? [5]

(c) Neatly draw the minimum-distance decision boundary for the 8-QAM constellation. Which signals in this constellation are most susceptible to error and why? [5]

(d) It is not possible to specify a Gray mapping for the 8-QAM constellation of Fig. 2. However, it is possible to specify a mapping with only two Gray-code violations. To this end, start by mapping the signals at (-12,-12), (-4,-4), (+4, +4) and (+12, +12) with 100, 010, 011 and 101, respectively. Complete mappings for the remaining 4 signals. [3]

8. Consider a random variable $X = \{x_1, x_2, ..., x_7\}$ with probabilities $\{0.49, 0.26, 0.12, 0.04, 0.04, 0.03, 0.02\}$ Find a binary Huffman code for X. Determine the expected code length for this encoding and then compare with the entropy of X. [4+3 = 7]

9. Binary data are transmitted over a microwave link at the rate of one Mbps, and the power spectral density of the noise at the receiver input is 10^{-10} W/Hz. Find the average power needed to maintain an average probability of error $P_e \leq 10^{-6}$ for (a) BPSK (b) DPSK. Use $Q(x) \approx \frac{1}{\sqrt{2\pi}x} e^{-\frac{x^2}{2}}$ [8]

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Roll No									

National Institute of Technology Goa

Programme Name: B.Tech.

End Semester Examinations, May 2022

B. Tech 3rd year 6th Sem ECE/EEE

Course Name: **Linear Integrated Circuits&Integrated Circuits**

Course Code: **EC352&EE353**

Date: 19/05/2022

Time:2pm

Duration:3 Hour

Max. Marks: 100

ANSWER ALL QUESTIONS

Note: Assume suitable values if data is insufficient

1. What are magnitute and phase conditions for sustainable oscillations in oscillarors. Design a Wein-Bridge oscillator for 1kHz. [10M]

2. A dual slope ADC uses 16-bit counter and a 5-MHz clock rate. The maximum input voltage is 10V. The maximum integrator output voltage should be -12 V when the counter has cycled through 2^n counts. The capacitor used in the integrator is 0.1 μF. (a) Find the value of the resistor R. (b) Find the equivalent digital output if input voltage is 7 V. [10M]

3. In Schmitt trigger circuit, R_1=10kΩ, R_2=25kΩ, $V_{ref} = 5V$, Supply voltage (Vcc, Vsat) = 14 V. Calculate V_{UT}(Upper threshold) and V_{LT} (Lower threshold). If a input is 7sin (1000πt), calculate Hysteresis loop width? [8M]

4. A symmetric trangular wave-form of Peak to Peak voltage $2V$ with 1ms time period is applied to differentiator. Plot output waveform. Consider all resistor values 1kΩ, capacitor of 0.01μF. [8M]

5. Design a 3-bit inverted R-2R digital to analog converter for the resolution of 1.428 V. [8M]

6. Consider the voltage-shunt feedback network of op-amp having an open loop Gain 10^5, Feedback factor $\beta = 0.5$. Input and output impedances are 10kΩ and 100 Ω, respectively. Unity gain Bandwidth of 1 MHz. Calculate the effect of feedback on input impedance, Gain, output impedance and Bandwidth. [8M]

7. Explain the operation of successive approximation ADC. Consider the correct code 01101011 for input analog signal and what are the intermediate digital outputs will it have to give final output code.? [8M]

8. An Asymmetric square wave-form of Peak voltages 2V and -1V with 1ms time period is applied to Integrator. Plot output waveform. consider all resistor values 1kΩ, capacitor of 0.01μF. [8M]

9. Design an astable multivibrator using 555 timer with Duty cycle of 30%. The capacitor value is 0.01μF. Calculate time-period and frequency of output waveform ? [8M]

capacity loss due to trunking for 57 channels when going from

10. In an monostable multivibrator, all the resistors values are equal to 1kΩ. The capacitor value is $0.01\mu F$. Calculate time-period for output pulse.? [8M]

11. Design a North-filter with central frequency 1kHz with a bandwidth of 2kHz. [8M]

12. Design a Butterworth filter of third order with cut-off frequency of 2GHz. [8M]

***ALL THE BEST ***

...pacity loss due to trunking f...

Roll No									

B.Tech 3rd year 6th Sem ECE

National Institute of Technology Goa

Farmagudi, Ponda, Goa 403401

Programme Name: B.Tech.

End Semester Examinations, May 2022

Course Name: **Wireless Communication**

Course Code: EC351

Date: 18/05/2022

Time: 02:00PM-05:00PM

Duration: 3 Hours

Max. Marks: 100

!!ANSWER ALL QUESTIONS & ASSUME APPROPRIATE DATA WHEREVER REQUIRED!!

Q.1: Derive the expression for probability of error P_e for a M-ary PSK system using the angle between the nearest neighbours in its constellation diagram. **[10]**

Q.2: List the various digital modulation schemes and compute the transmit SNR in linear and dB values for 8-ary PSK to achieve probability of error P_e of 5×10^{-4}. **[10]**

Q.3: Consider binary signal vector detection problem with $\mathbf{u}_A = \sqrt{P}[1, 1, 1, 1]^T$ and $\mathbf{u}_B = \sqrt{P}[1, -1, 1, -1]^T$ as two possible transmit vectors with P=15dB. If received vector is represented as $\mathbf{y}=\mathbf{u}+\mathbf{w}$ and $\mathbf{w} \sim \mathcal{N}(0, 2I)$. Derive the average probability of error for this communication system **[10]**

Q.4: Consider a channel with the average power profile $\phi(\tau)=\alpha e^{-\frac{\tau}{\beta}}$, where α=2 and β=1 μ s. Compute the RMS delay spread for this exponentially decaying profile. **[10]**

Q.5: Consider a multi-path channel with the power delay profile $P(\tau)=\sum_{i=0}^{N-1}\alpha_i e^{-\frac{\tau}{\beta_i}}$, where α_i, and β_i are parameters varying with i for $0 \leq i \leq N$-1.Compute the RMS delay spread for this channel. **[10]**

Q.6: Derive the expression for signal to interference plus noise power ratio SINR_u at the u^{th} user for the CDMA downlink scenerio with multiple users. **[10]**

Q.7: Discuss the advantages of CDMA based cellular systems over that of 1G FDMA and 2G TDMA. **[10]**

Q.8: For the below given channel matrix H, find the zero-forcing MIMO receiver.

$$H=\begin{bmatrix} 2 & 3 \\ 1 & 3 \\ 4 & 2 \end{bmatrix}$$ **[10]**

Q.9: Compare zero-forcing receiver and MMSE receiver for MIMO systems. **[10]**

Q.10: Discuss the implications of coherence time in design of wireless communication systems. **[10]**

Roll no									

National Institute of Technology Goa

B.Tech-IV Semester - End Semester Examination

B.Tech 3rd year 6th Sem ECE

Course Name: Object Oriented Programming
Course Code: CS252
Date: May 17, 2022.
Time: 9 30 A M
Duration: 3 Hours
Max. Marks: 100

Instructions:

1. *Write legibly. Unnecessary details attracts penalty.*
2. *You must complement your explanation with the short fragments of code where appropriate.*
3. *Your programs should compile on any standard C++/Java compiler and be executed.*
4. *You should assume that appropriate headers and namespace std are included in each program.*

Question 1: You have to provide justification for your answer.

A. What is the output of the following program? **(3)**

```
#include <iostream>
using namespace std;
struct a
{
    int count;
};

/*the rest of the code is on right side*/
struct  b
{
    int* value;
};
```

```
/*Continuation of A. */

struct c : public a, public b
{

};
int main()
{

    c* p = new c;
    p->value = 0;
    cout << "Inherited";
    return 0;
}
```

B. What is the output of the program? **(3)**

```
void func( int a, double b) {
 cout << "First func function \n";
}

 void func ( char a, double b ) {
 cout << "Second func function \n";
}
 /*rest of the code is on right side*/
```

```
/* Continuation of B.*/
int main() {
        char X = 'b';
        int Y = 6;
        func( X, Y );
        return 0;
}
```

C. What is the result of compiling and running this program? **(3)**

```
#include <iostream>
using namespace std;
int A = 10;
float functionB( int A, char B, float C=5 ) {
        return ::A + B + C;
}
int main() {
        int A = 2;
        float X = 11.1;
        cout << functionB( A, X );
        return 0;
}
```

D. Give the output of the following program. **(2)**

```
class some
{
        public:
       ~some()
        {
          cout<<"some's destructor"<<endl;
        }
};
int main()
{
    some s;
    s.~some();
    return 0;
}
```

E. What is the output of the program? **(3)**
Note: sizeof(int)=4;

```
class base {
   int arr[10];
};
class b1: public base { };
class b2: public base { };
class derived: public b1, public b2 { };

int main(void)
{
 cout << sizeof(derived);
 return 0;
}
```

F. What is the output of the following program? **(2)**

```
class base
{
   public :void  out() {  cout<<"base ";    }
};
class deri
{
       public : void out() { cout<<"deri ";  }
};
 int main() {
            deri dp[3];
             base *bp = (base*)dp;
             for (int i=0; i<5;i++)
            (bp++)->out();
             return 0;
}
```

G. Which of the following declares a pointer to a function g, which takes two ints and returns nothing? **(2)**

a) (*g)(int,int);
b) void (*g)(int,int);
c) (*g)(int,int) = void;
d) *(void g(int,int));

H. In C++, which system-provided function is called when no handler is provided to deal with an exception? **(1)**

a) terminate()
b) unexpected()
c) abort()
d) kill()

I. What is the output of the program? **(4)**

```
#include <iostream>
using namespace std;
class Top {
        public:
        Top() { cout << "Start Top\n";}
        ~Top() { cout << "End Top\n";}
};
class Bottom : public Top {
      public:
          Bottom() { cout << "Start Bottom\n";}
          ~Bottom() { cout << "End Bottom\n";}
};
 /*rest of the code is at the right hand side*/
```

```
/*Continuation of H*/
class Test {
      public: Bottom deal;
          Test() { cout << "Start Test\n";}
};
int main()
{
      Test me;
      Bottom b;
      return 0;
   }
```

2.

a. In C++, list out the impact on public, protected and private data members of the base class, when the base class is derived by public, protected and private access specifiers. You can explain with a simple example program. In particular, explain what is the use of protected access specifier? **(5)**

b. How to achieve run-time polymorphism in C++? With an example program explain run-time polymorphism. **(5)**

c. What are the advantages of overloading operators through friend functions? Write a program to overload post increment and pre-increment operators. **(5)**

3.

a. Explain the concept of exception handling supported by C++ with the help of a program. Under which circumstances the terminate () and unexpected () functions will be invoked and what are their default actions? How to setup different handlers for these functions? **(8)**

b. With an example program, explain how derived class exceptions are handled in C++? **(4)**

c. How to catch all exceptions in C++? How to check whether an exception thrown is caught or uncaught? **(2)**

d. How to prevent a function from throwing few types of exceptions? Explain with an example program. How to prevent a function from throwing any exceptions? **(5)**

4.

a. How Java achieves platform-neutrality? Explain the process of creating and executing a "Hello World" Java Program. **(5)**

b. Discuss the visibility of a member of a class to other classes with respect to different access modifiers such as public protected, friendly (default), private, private protected. Also consider the classes and subclasses within the same package and also the classes and subclasses in the other packages. You can use the table. **(8)**

c. What are the uses of Vector? What are its advantages over arrays? Why wrapper classes are required? **(5)**

5.

a. In how many ways you can create threads in Java? Explain with an example program. **(5)**

b. Explain in detail the life cycle of a thread. Explain in detail each state. **(10)**

c. How multiple inheritance is supported in Java? How to pass arguments to the base class constructor from derived class? **(5)**

d. How to create a package in Java? Explain the process with an example. Also explain how to add a class to an existing package? **(5)**

**********All the Best**********

Roll No									

National Institute of Technology Goa

Programme Name: **B.Tech.** B.Tech

End Semester Examinations, May-2019 ECE 6th Sem

Course Name: Communication Network
Date: 04.05.2019
Duration: **3 Hours**

Course Code: EC 354
Time: 9.30 am – 12.30 pm
Max. Marks: **100**

ANSWER ALL QUESTIONS

Necessary assumptions can be made with proper justification.

Q1. A computer network uses polynomial over GF(2) for error detection with 8 message bits 01011011 as information bits and uses $x^3 + x + 1$ as the generator polynomial to generate the check bits. How the message is transmitted after appending check bits? **[5 M]**

Q2. Consider a 128×10^3 bits per second satellite communication link with one way propagation delay of 150 ms. Selective repeat protocol is used on this link to send data with a frame size of 1 kB. Neglect the transmission time of acknowledgement. Find the minimum number of bits required for the sequence number field to achieve 100% utilization. Hint: consider integer value for number of frames. **[5 M]**

Q3. Consider an IP packet with a length of 4500 bytes that includes 20 byte IPv4 header. The packet is forwarded to an IPv4 router that supports a Maximum Transmission Unit (MTU) of 600 bytes. Assume that the length of the IP header in all the ongoing fragments of this packet is 20 bytes. Find the fragmentation offset value stored in the third and seventh fragment. **[5 M]**

Q4. A single parity check is an error detection code which appends a single parity bit to an information bit string. The parity bit is set to 1 if the number of ones in the information bit string is odd and is set to 0 otherwise. Let the information bit string be 0000. If a single parity check bit is added to it and the resulting bit string is sent over a noisy channel, list all possible received bit strings which are declared error free at the destination. **[5 M]**

Q5. Classify the following MAC addresses as unicast, broadcast and multicast addresses: **[5 M]**

(a) AA BB CC AA BB CC
(b) 11 11 11 11 11 11
(c) FF FF FF FF FF FF
(d) 44 44 44 44 44 44
(e) EE EE EE EE EE EE

Q6. Consider different activities related to email.
m1: Send an email from a mail client to a mail server
m2: Download an email from mailbox server to a mail client
m3: Checking email in a web browser

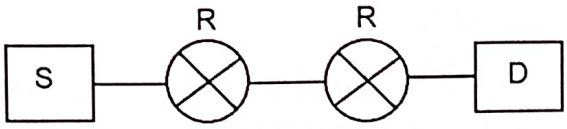
Which is the application level protocol used in each activity? **[5 M]**

Q7. A sender uses the stop-and-wait ARQ protocol for reliable transmission of frames. Frames are of size 1000 bytes and the transmission rate at the sender is 80 kbps. Size of an acknowledgment is 100 bytes and the transmission rate at the receiver is 8 kbps. The one way propagation delay is 100 ms. Assume no frame is lost, find the sender throughput. **[5 M]**

E. Mahesh

Q8. Consider a system generating 20 bit frames and connected through a shared 20 kbps channel. Find throughput in percent if slotted ALOHA is used and frame rate is 1000 frames per second. **[5 M]**

Q9. Assume that source S and destination D are connected through two intermediate routers labeled R. Determine how many times each packet has to visit the network layer and the data link layer during a transmission from S to D. **[5 M]**



Q10. Data transmitted on a link uses the following 2D parity scheme for the error detection: Each sequence of 28 bits is arranged in a 4×7 matrix (rows r_0 through r_3, columns d_7 through d_1) and is padded with a column d_0 and row r_4 of parity bits computed using even parity scheme. Each bit of column d_0 (respectively, row r_4) gives the parity of the corresponding row (respectively, column). These 40 bits are transmitted over the data link.

	d_7	d_6	d_5	d_4	d_3	d_2	d_1	d_0
r_0	0	1	0	1	0	0	1	1
r_1	1	1	0	0	1	1	1	0
r_2	0	0	0	1	0	1	0	0
r_3	0	1	1	0	1	0	1	0
r_4	1	1	0	0	0	1	1	0

The table shows data received by a receiver and has n corrupted bits. What is the minimum possible value of n? **[5 M]**

Q11.

(a) Consider three machines PC1, PC2, and PC3 with the IP address 100.10.5.2, 100.10.5.5, and 100.10.5.6 respectively. The subnet mask is set to 255.255.255.252 for all the three machines. Which of the statement is true: PC1, PC2, and PC3 all belong to same subnet; Only PC1 and PC2 belong to same subnet; PC1, PC2, and PC3 all belong to three different subnets; Only PC2 and PC3 belong to same subnet. Justify your answer.

(b) If a class B network on the Internet has a subnet mask of 255.255.248.0, what is the maximum number of hosts per subnet? **[10 M]**

Q12.

(a) Computer A has 19.5MB to send on a network and transmits the data in a burst at the rate of 6 Mbps. The maximum transmission rate across routers in the network is 4 Mbps. If Computer A's transmission is shaped using a leaky bucket, how much capacity must the queue in the bucket hold not to discard any data?

(b) For a host machine that uses the token bucket algorithm for congestion control, the token bucket has a capacity of 1 MB and the maximum output rate is 20 megabytes per second. Token arrive at a rate of 10 megabytes per second. The token bucket is currently full and the machine needs to send 12 MB of data. Find the minimum time required to transmit the data. **[10 M]**

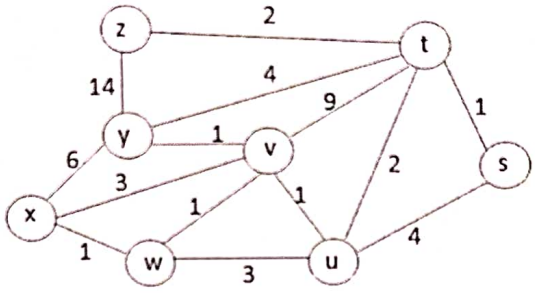
Q13.

(a) Which one of the following fileds: Checksum; Source address; TTL; Length, of an IP header is not modified by a typical router? Give justification for your answer.

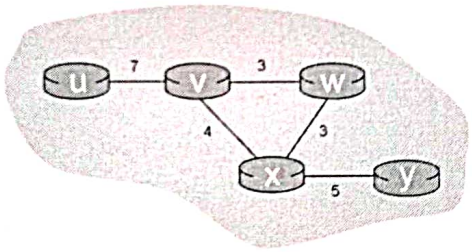
(b) Which of the following statement is true; both Ethernet frame and IP packet include checksum fields, ethernet frame includes a CRC field and IP packet includes a checksum field? Also, mention ethernet frame format and IP header format. **[10 M]**

Q14.

(a) Use Dijkstra's algorithm to find the shortest route from source node x to all the destinations for the given 8 node network:



(b) Find the least cost route using Bellman Ford algorithm for the given 5 node network:



[10 M]

Q15.

(a) A network has a data transmission bandwidth of 20×10^6 bits per second. It uses CSMA/CD in the MAC layer. The maximum signal propagation time from one node to another node is 40 μs. Find the minimum size of the frame in the network in bytes.

(b) Assume CSMA/CD protocol. Find the least frame length in bytes for a 2 Mbps bit rate and 1.5 km long network where propagation delay is 4.25 nano seconds per meter. **[10 M]**

*******All the best*******

E. Mohammed

Roll No									

National Institute of Technology Goa

Programme Name: B.Tech.

End Semester Examinations, April-May 2019

B. Tech
6th Sem
ECE

Course Name: **Digital Communication**

Date: 03/05/2019

Duration:3 Hours

Course Code: **EC353**

Time: 9.30 AM - 12.30 PM

Max. Marks: 100

ANSWER ALL QUESTIONS

1. [2*10=20]

(a) What is the need for non-uniform quantization?

(b) Draw the signal space diagram for QAM signal for M=32.

(c) Fifty voice signals each having maximum frequency 3.4 kHz are sampled following Nyquist sampling rule and then time division multiplexed. What will be the minimum channel bandwidth required to transmit the whole data?

(d) What is the theoretical minimum system bandwidth needed for a 10 Mbps signal using 16-level PAM without ISI?

(e) Why is E_b/N_0 a natural figure of merit in digital communication system?

(f) Calculate the minimum required bandwidth for a noncoherently detected orthogonal binary FSK system. The higher-frequency signaling tone is 1 MHz and the symbol duration is 1 ms.

(g) Write the difference between QPSK and MSK modulation techniques.

(h) What is the need of channel coding in digital communication system?.

(i) Define code rate. What is the code rate for repetition code?

(j) How antipodal signaling improves the performance of a MAP receiver in AWGN channel?

2. The signal $x(t) = 4\cos(400\pi t) + 12\cos(360\pi t)$ is ideally sampled at a frequency of 300 samples per second. The sampled signal is passed through a unit gain LPF with a cut off frequency of 220 Hz. List the frequency components present at the output of the LPF? [6]

3. A delta modulator with a fixed step size of 0.75 V, is given a sinusoidal message signal. If the sampling frequency is 25 times the Nyquist rate, determine the maximum permissible amplitude of the message signal if slope overload is to be avoided. [6]

4. A real-valued base-band pulse $g(t)$ with support $[0, T]$ is given by

$$g(t) = A\cos\left(\frac{\pi t}{T} - \pi\alpha\right)\text{rect}\left(\frac{t-(T/2)}{T}\right), A > 0, 0 < \alpha < 0.5$$

Let $h(t)$ be the impulse response of a filter matched to $g(t)$, satisfying the condition $h((1-\alpha)T) = A/2$, Let $y(t) = h(t) * g(t)$

(a) Find $h(t)$ and sketch its plot, labeling the relevant portions. [8]

(b) Find the matched filter output $y(t)$ in the range $0 < t < T$. Find the value of α for which $y(T/2) = 0$. [8]

5. Equicorrelated signals $y_1(t), y_2(t), y_3(t)$ over a signaling interval $[0, T]$, each having energy E, and satisfying

$$\int_o^T y_i(t)y_j(t)dt = \frac{E}{2}, \quad \text{for} i \neq j,$$

are converted to another set of signals $\{s_1(t), s_2(t). s_3(t)\}$ by the transformation

$$s_i(t) = y_i(t) - \frac{1}{3}\sum_{k=1}^{3} y_k(t), \quad i = 1, 2, 3$$

What is the dimension N of the signal space $\{s_1(t), s_2(t), s_3(t)\}$? Starting with $s_1(t)$, obtain orthonormal basis $\{\phi_1(t), ..., \phi_N(t)\}$ for the signal using Gram-Schmidt orthogonalization. [10]

6. The signal component of a coherent PSK system is defined by

$$s(t) = A_c k \sin(2\pi f_c t) \pm A_c\sqrt{1-k^2}\cos(2\pi f_c t), \qquad 0 \leq t \leq T_b$$

where the plus sign corresponds to symbol 1 and the minus sign corresponds to symbol 0. The first term represents a carrier component included for the purpose of synchronizing the receiver to the transmitter.

(a) Draw the signal space diagram for the scheme described here; what observation can you make about this diagram? [4]

(b) Show that, in the presence of additive white Gaussian noise of zero mean and power spectral density $N_0/2$, the average probability of error is [4]

$$P_e = Q\left(\sqrt{\frac{2E_b}{N_0}(1-k^2)}\right)$$

where $E_b = 0.5A_c^2T_b$

(c) Suppose that 10% of the transmitted signal power is allocated to the carrier component. Determine the Eb/N_0 required to realize a probability of error equal to 10^{-4} [4]

(d) Compare this value of $E_b/N_0$with that required for a conventional PSK system with the same probability of error. [2]

7. Illustrate the transmitter, receiver and the generation of the noncoherent version of PSK with neat sketch. [10]

8. Determine the transmission bandwidth reduction and average signal energy of 256-QAM, compared to 64-QAM. Also determine the increase in average signal energy. [8]

9. Describe how the errors are corrected using Hamming code with an example. Let the code vector [1110010] is sent, the received vector is [1100010]. Calculate the syndrome and correct the error. Can (7,4) Hamming code correct 2 errors at a time? [10]

ALL THE BEST

Roll No									

National Institute of Technology Goa

Programme Name: B.Tech.

End Semester Examinations, May 2019

B. Tech
ECE
6th Sem

Course Name: Linear Integrated circuits | Course Code: EC 352

Date: 02/05/2019 | Time: 9.30 AM

Duration: 3 Hours | Max. Marks 100

ANSWER ALL QUESTIONS

Note: Assume suitable values if data is insufficient

1. Design the practical differentiator so that the peak gain is 20 dB at frequency 10 kHz. Use capacitor values 0.01μF. [10M].

2. Design Twin-T notch filter of central frequency 10 kHz and Q-factor of 12. [8M].

3. What are the merits of Instrumentation amplifier. Derive the expression for the gain. [8M]

4. Design an astable multi-vibrator of frequency 1 kHz using 555 timer with duty cycle of 30%. [8M]

5. A dual slope ADC uses 12-bit counter and a 5-MHz clock rate. The integrator attains maximum output voltage of -15 V for a given input maximum voltage of 10 V when the counter has cycled through 2^n counts. Find the value of capacitor for the resistor value of 20 kΩ (a) Find the value of the resistor R. (b) Find the equivalent digital output if input voltage is 6 V. [8M]

6. In the relaxation oscillator shown in Fig.1 , the forward voltage of zener diodes is 0.7 V. Estimate output waveform. [8M]

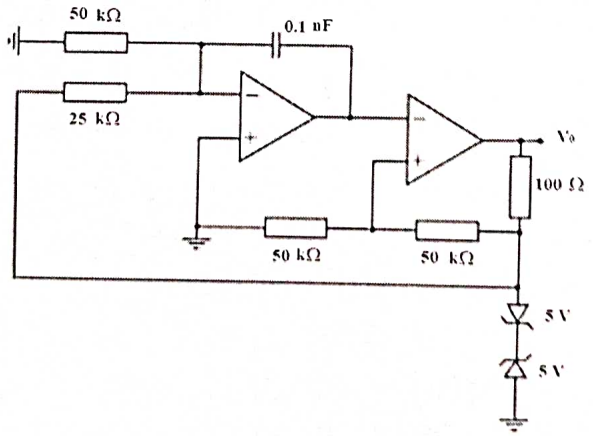


Figure 1:

7. Design third order Butterworth filter of upper cut-off frequency 2 kHz. Draw frequency characteristics. [8M]

8. Design a 3-bit inverted R-2R digital to analog converter for the resolution of 1.428 V. [8M]

9. Design a precision full-wave rectifier for input signal of $v_{in} = 5sin(200\pi t)$. Explain the operation. [8M]

10. For an input voltage $v_m = 2sin(\omega t)$, design a suitable electronic circuit and explain such that output voltage is [8M]

$$V_{out} = \left\{ \begin{array}{l} 2\sin(\omega t), V_{in} > -1.5 \\ -1.5, \text{Otherwise} \end{array} \right\}$$

11. Design an all-pass filter so that output voltage $v_{out} = 2sin(10^3 t - 60°)$ for an input voltage of $v_{in} = 2sin(10^3 t + 60°)$. [8M]

12. Explain about grounded load V to I converter. [8M]

13. Design trangular wave generator (lesser components). Estimate frequency of output waveform. [10M]

* * *END OF QUESTION PAPER * **

Roll No									

National Institute of Technology Goa

Farmagudi, Ponda, Goa 403401

Programme Name: B.Tech.

End Semester Examination, May 2019

B. Tech
ECE
6th Sem

Course Name: **Wireless Communication**
Date: 01/05/2019
Duration: 3 Hrs

Course Code: EC351
Time: 09:30AM-12:30 PM
Max. Marks: 100

!!ANSWER ALL QUESTIONS!!

Q1: Consider a cellular system in which total available voice channels to handle the traffic are 960. The area of each cell is 6 square km and the total coverage area of the system is 2000 square km. Calculate (a) the system capacity if the cluster size N =4 and (b) N=7. How many times would a cluster of size 4 have to be replicated to cover the entire cellular area? Does decreasing the reuse factor N, increase the system capacity? Explain. **[10]**

Q2: A receiver in an urban cellular radio system detects a 1mW signal at $d = do = 1$ meter from the transmitter. In order to mitigate co-channel interference effects, it is required that the signal received at any base station receiver from another base station transmitter which operates with the same channel must be below -100 dBm. A measurement team has determined that the average path loss exponent in the system is $n = 4$. Determine the major radius of each cell if a seven-cell reuse pattern is used. What is the major radius if a four-cell reuse pattern is used? **[10]**

Q3: Exercise in trunking theory **[2+3+5= 10]**

1. What is the maximum system capacity (total and per channel) in Erlangs when providing a 2% blocking probability with 20 channels, and with 40 channels?
2. How many users can be supported with 20 channels and with 40 channels at 2% blocking ? Assume H=105 s, λ =1 call/hr.
3. For a N = 7 system with a Pr[Blocking] = 2% and average call length of two minutes, find the traffic capacity loss due to trunking for 57 channels when going from the omnidirectional antennas to 60° sectored antennas. (Assume that blocked calls are cleared and the average per user call rate is $\lambda = 1$ call/hr per hour.)

Q4: (a) What is MAHO? How it is different from first generation hand off process? Explain how umbrella cell minimizes the number of hand off in urban area. **[5]**

(b) What do you understand by "Multiple Access" (MA) technique? Name the MA techniques being used by 1G, 2G and 3G technologies? **[5]**

Q5: Define the terms (i) Doppler spread and (ii) coherence bandwidth. Consider a mobile station working at carrier frequency of 1800 MHz and it is moving at a speed of 100 Kmph directly towards the base station. Calculate (i) Doppler spread, (ii) received frequency, and (iii) coherence time. **[10]**

Q6: Derive the SINR for CDMA uplink and downlink scenarios in frequency selective environment. Consider that the system is using RAKE receiver. **[10]**

Q7: If the BER of a particular communications system is given by $Q(\sqrt{SNR})$ then calculate the BER of a CDMA downlink system having 2 users with spreading length sequence 256. Further, power transmitted by desired user and interfering user is same and given by $P_0^{dB} = P_1^{dB} = -10$ dB and assume that the noise variance is unity. **[10]**

Q8: Consider a MIMO system with $r = 3$ receive antenna and $t = 3$ transmit antenna. The total available power is $P_{\text{dB}} = -2\text{dB}$ and the noise power is $\sigma_{n}^{2}{}_{\text{dB}} = 3\text{dB}$. For the MIMO channel given below, compute the maximum capacity using optimal power allocation:**[10]**

$$H = \begin{bmatrix} 0 & -0.32 & -0.6 \\ 1.6 & -1.44 & 0.48 \\ 1.2 & 1.92 & -0.64 \end{bmatrix}$$

Q9: Derive the expression of ZF receiver for MIMO and discuss the problem of noise amplification. **[10]**

Q10: Consider a 1x2 MIMO system with $h_1 = \sqrt{2} - \sqrt{2}j$ and $h_2 = -\sqrt{3} + 1j$. Let the MIMO system under consideration employs OSTBC to achieve the diversity. What should be the OSTBC for this system if the symbols to be transmitted are s_1 and s_2? Show that the OSTBC for this system is a full-rate code and system is equivalent to a 2x2 MIMO. Further, calculate the beam former vectors $\underline{w}_1$ and $\underline{w}_2$ to detect symbols s_1 and s_2. **[10]**

* * *ALL THE BEST * **

Roll No									

NATIONAL INSTITUTE OF TECHNOLOGY GOA

Farmagudi, Ponda, Goa, 403401

Programme Name: B.Tech./M.Tech./Ph.D.

End Semester Examinations, April/May-2019

B.Tech ECE 6th Sem

Course Name: Digital Electronics
Date: 01.05.2019
Duration: 3 hours

Course code: EC251
Time: 2.00 PM -5.00 PM
Max. Marks: 100

ANSWER ALL QUESTIONS

NOTE: Question No. 1 - 10: 10 marks (Each)

Qu.1 (i) Explain the complete process steps for Analog to Digital signal conversion.
(ii) We know clock is an integral part of sequential circuits. Collect your knowledge from basic electronics and design a circuit to generate a clock of frequency 1 MHz?
(iii) Explain why is a two-input NAND gate called universal gate? Can you have more than two inputs for a NAND gate and will you still call it a universal gate? **(3+3+4 marks)**

Qu.2) Apply suitable Boolean laws and theorems to modify the expression for a two input EX-OR gate in such a way as to implement a two input EX-OR gate by using minimum number of two input NAND gates only.
Additionally, Explain any one more Boolean theorems with its proof.

Qu.3) For a particular application you need D and T flip flops but in your inventory you only have J-K flip flops and all basic gates. Implement D and T flip flops using J-K flip flop and basic gates, with its truth tables.
What is race around condition in flip flops? Explain the condition for the same. How can it be avoided?

Qu.4). Explain the various parameters on which the different Logic Families are classified. How a BJT is different from MOS devices? Discuss the working of a CMOS inverter. **(4+3+3 marks)**

Qu.5) Simplify the following expression using a Karnaugh map to yield a solution in product-of-sums form and implement it using only NOR gates & NAND gates assuming complemented input variables available:

$$Y = (B+\overline{C}+\overline{D})(\overline{A}+B+\overline{C})(A+B+\overline{D})(A+\overline{B}+\overline{C})$$

Qu. 6) An autonomous robot, capable of turning in 4 directions is to be designed to survey a location. The robot consists of 3 sensors (**S0**, **S1**, and **S2**), a digital system and an actuator system. **S0** is mounted on right, **S1** on front and **S2** on left. If any obstacle is detected by a sensor it produces logic **1** else **0**. Based on the data collected from these sensors, the digital system generates 4 outputs. Based on these outputs, the actuator system changes the moving direction of the robot either on left, right, front or back. The robot should (a) turn left if there is obstacle on front and no obstacle on left (b) turn right if there is obstacle on left and front (c) move forward if there is no obstacle in front and (d) backward if obstacles on all sides.

(i) Write the truth table for this digital system and the Boolean expressions for all outputs in canonical **SOP** and canonical **POS** form.
(ii) Minimize the canonical **SOP** Boolean expressions using K-map.
(iii) Implement the minimized expression with only **AND**, **OR** and **NOT** gates.
(iv) Implement the same digital system with all NAND gates.
(v) Implement the same digital system using four 4x1 **MUX** with **S1**, and **S0** as select lines.

Qu.7) While designing CPU for a 4-bit computer, it has been observed that adder is a major subsystem which affects the processing speed. What could be the problem if using 4 **Full adders** in cascade to perform 4-bit number addition? How can you improve the design of the adder at the cost of extra circuit to improve the **speed** (decrease the propagation delay) of the adder? Explain and implement the improved adder.

Qu.8) 4-bit output of a digital system ranges from 0000 to 1001. The designer of the digital system wants to attach a seven segment **LED** display to visualize the output. Help him to design the decoder for seven segment **LED** display and explain the procedure with the help of:

(i) Truth table and writing the Boolean expression for each segment.
(ii) Minimize each Boolean expression using K-Map.
(iii) Realize each minimized expression using basic gates.

Qu. 9) Design a combinational logic circuit that takes an unsigned 2-bit digital data as input and computes its square. Explain the complete design steps for the same.

Qu.10) What is the difference between a saturated and unsaturated Logic? Explain with related details. How can you design a NOT gate using a BJT transistor. **(5+5 marks)**

Roll No								

National Institute of Technology Goa

Programme Name: B.Tech.

End Semester Examination, April-2019

B.Tech ECE 6th sem

Course Name: Object Oriented Programming | Course Code: CS252

Date: 29. 04. 2019 | Time: 2:00 PM - 5:00 PM

Duration: 3 Hours | Max. Marks: 100

ANSWER ALL QUESTIONS

1. (a) Write a C++ program to create a class called *Account* with private attributes such as account number and balance. The attributes should be initialized through constructors. The class should contain a public method named as *show*() to display the initialized attributes. Provide a mechanism to create an array of *Account* objects. The array size should be given by the user at run time. [5M]

   (b) A palindrome is a string that is the same backward as it is forward. For example,"noon" and "refer" are rather short palindromes. Write a C++ program that lets a user enter a string and that passes to a bool function a reference to the string. The function should return true if the string is a palindrome and false otherwise. [5M]

2. Write a C++ program that uses the following functions:
   Fill_array takes as arguments the name of an array of double values and an array size. It prompts the user to enter double values to be entered in the array. It ceases taking input when the array is full or when the user enters non-numeric input, and it returns the actual number of entries.
   Show_array takes as arguments the name of an array of double values and an array size and displays the contents of the array.
   Reverse_array takes as arguments the name of an array of double values and an array size and reverses the order of the values stored in the array.
   The program should use these functions to fill an array, show the array, reverse the array, show the array, reverse all but the first and last elements of the array, and then show the array. [10M]

3. Write a C++ function named *digit_name* that takes an integer argument in the range from 1 to 9, inclusive, and prints the English name for that integer on the computer screen. No newline character should be sent to the screen following the digit name. The function should not return a value. The cursor should remain on the same line as the name that has been printed. If the argument is not in the required range, then the function should print *digit error* followed by the newline character. Thus, for

example, the statement *digit_name*(7) should print seven on the screen; the statement *digit_name*(0) should print digit error on the screen and place the cursor at the beginning of the next line. [10M]

4. (a) Can we use the same function name for a member function of a C++ class and a non-member function in the same program file? If yes, how are they distinguished? If no, give reasons. Support your answer with an example. [5M]

   (b) Write a C++ program which initializes a string variable to the content, "*If you want a thing done well, do it yourself*" and outputs the string to the disk file OUT.TXT. You have to include all the header files required. [5M]

5. (a) Consider the following C++ program:

```
class A {
public:
A() { a = 1; }
int a;
};
class B : public A {
public:
B() { a += 1; }
};
class C : public A {
public:
C() { a *= 2; }
};
class D : public B, public C {};
int main() {
D* d = new D();
std::cout << d->a;
return 0;
}
```

   Assume that all the required header files are included. The code is rejected by the compiler. Briefly explain why. [5M]

   (b) What class methods does the compiler generate automatically if you do not provide them explicitly? Describe how these implicitly generated functions behave. [5M]

6. (a) What are the differences between overloading and overriding? Provide suitable C++ programs to illustrate the differences. [5M]

(b) The compiler performs a matching process to determine which function-template specialization to call when a function is invoked. Under what circumstances does an attempt to make a match result in a compile error? [5M]

7. (a) If no exceptions are thrown in a try block, where does control proceed to after the try block completes execution? [3M]

(b) What happens if an exception is thrown outside a try block? [3M]

(c) What happens when a catch handler throws an exception? [4M]

8. A supermarket chain has asked you to develop an automatic checkout system. All products are identifiable by means of a barcode and the product name. Groceries are either sold in packages or by weight. Packed goods have fixed prices. The price of groceries sold by weight is calculated by multiplying the weight by the current price per kilo.

Develop the C++ classes needed to represent the products first and organize them hierarchically. The *Product* class, which contains generic information on all products (barcode, name, etc.), can be used as a base class.

The *Product* class contains two data members of type long used for storing barcodes and the product name. Define a constructor with parameters for both data members. Add default values for the parameters to provide a default constructor for the class. In addition to the access methods *setCode*() and *getCode*(), also define the methods *scanner*() and *printer*(). For test purposes, these methods will simply output product data on screen or read the data of a product from the keyboard.

The next step involves developing special cases of the *Product* class. Define two classes derived from *Product*, *PrepackedFood* and *FreshFood*. In addition to the product data, the *PrepackedFood* class should contain the unit price and the *FreshFood* class should contain a weight and a price per kilo as data members. In both classes define constructor with parameters providing default-values for all data members. Use both the base and member initializer. Define the access methods needed for the new data members. Also redefine the methods *scanner*() and *printer*() to take the new data members into consideration.

Test the various classes in a main function that creates two objects each of the types *Product*, *PrepackedFood* and *FreshFood*. One object of each type is fully initialized in the object definition. Write a C++ program to test all the methods.

[10M]

9. (a) Given the Java program below, what will be the values of *asum* and *bsum*?

```
public class MyArray
{
```

```
private int [ ] X={3, 4, 5};
public MyArray( )
{
}
public int value( )
{ return(X[0]); }
public int value(int k)
{ return(X[k]); }
public static void main (String[ ] args)
{
MyArray [ ] Y = new MyArray[10];
int asum = 0, bsum = 0;
for(int i=0; i<10; i++)
{
Y[i]=new MyArray( );
asum = asum + Y[i].value( );
for(int j=0; j<3; j++)
bsum = bsum + Y[i].value(j);
}
System.out.println("asum: "+ asum + " bsum: " + bsum);
}
}
```

[3M]

(b) What will be the output of the following Java snippet?

```
try {
int num = Integer.parseInt("four thousand two hundred and ninety-five");
System.out.println("Your number is: " + num + ".");
} catch (NumberFormatException n) {
System.out.println("You don t have a number.");
} catch (Exception e) {
System.out.println("Something went terribly terribly wrong.");
} finally {
System.out.println("Number parsed successfully!");
}
```

[3M]

(c) Write a Java program that asks the user to enter 300 integers between 0 and 2000 inclusive. After the user enters these numbers, the statistical mode should be displayed. The statistical

mode is the most frequently occurring number. If there is a tie for the mode, "*no mode*" should be displayed. You need not perform error checking.

[4M]

10. (a) Consider the following Java classes:

```
class A {
public void func (Object o) { System.out.println("A"); }
}
class B {
public void func (String o) { System.out.println("B"); }
}
class C extends A {
public void func (String s) { System.out.println("C"); }
}
class D extends B {
public void func (Object o) { System.out.println("D"); }
}
class Main {
public static void main(String[] args) {
A a = new C(); a.func("Java");
C c = new C(); c.func("Java");
B b = new D(); b.func("Java");
D d = new D(); d.func("Java");
}
}
```

What will be the output of the execution of the method main in class Main?

[2M]

(b) Assume: $a = -1, b = -2, c = -4, d = 2, e = -1$. What will be the output of the following code fragment?

```
if ( a < 0 )
if ( b < 0 )
if ( c < 0 )
if ( !( d < 0 && e < 0 ) )
System.out.println( "One" );
else
System.out.println( "Two" );
if ( a == e )
```

```
System.out.println( "Three" );
else
System.out.println( "Four" );
```

[2M]

(c) Which pattern will be produced when the following code snippet is executed?

```
for(int i = -2; i <= 2; i++){
for(int j = -2; j <= 2; j++){
if(i < j)
System.out.print("*");
else
System.out.print(".");
}
System.out.println();
}
```

[2M]

(d) What will be the output of a call to the *printNums*() method? Assume *inFile* has been properly linked to the file whose content is shown below and *outFile* has been properly linked to some output file.

15
23
21

```
public static void printNums()
{
int n; String line;
line = inFile.readLine();
if (line != null) {
n = Integer.valueOf(line).intValue();
outFile.print(n + " "); printNums();
outFile.print(n + " ");
}
}
```

[4M]

* * *ALL THE BEST * **

Roll No									

राष्ट्रीय प्रौद्योगिकी संस्थान गोवा

NATIONAL INSTITUTE OF TECHNOLOGY GOA

Farmagudi, Ponda, Goa, 403401 B. Tech

Programme Name: B.Tech. ECE

Mid Semester Examinations, February-2020 6th Sem

Course Name: Communication Network
Date:17.02.2020
Duration: 1 Hour 30 Minutes

Course Code: EC354
Time: 2.00 pm – 3.30 pm
Max. Marks: 50

ANSWER ALL QUESTIONS

Q.1 Find out the check sum field value in the below pseudo-header with datagram: **[5 M]**

153.18.8.105			
171.2.14.10			
All 0s	17	15	
1087		13	
15		Check Sum	
T	E	S	T

Q.2 Answer the following based on your understanding of TCP: **[2 M + 3 M]**

a. Which of the control fields in TCP header is/are used to specify whether the sender has no more data to transmit? Also, mention the control fields in TCP header is/are used during connection establishment.

b. The values of parameters for the Stop-and –Wait protocol are as given below:

Bit rate of the transmission channel = 1 Mbps
Propagation delay from sender to receiver = 0.75 ms
Time to process a frame = 0.25ms
Number of bytes in the information frame = 1980
Number of bytes in the acknowledge frame = 20
Number of overhead bytes in the information frame = 20

Assume that there are no transmission errors. Then find out the transmission efficiency of the Stop-and –Wait protocol for the above transmission.

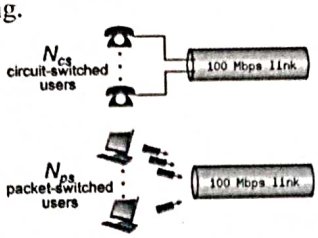
Q.3 Consider a long-lived TCP session with an end-to-end bandwidth of 1 Gbps. The session starts with a sequence number of 1234. Find the minimum time in seconds before this sequence number can be used again. **[5 M]**

Q.4 15 machines need to be connected in a LAN using 8-port Ethernet switches. Assume these switches do not have separate up link ports. Find the minimum number of switches needed. Draw switches and hosts suitably. Hint: up link ports are used for connecting switches. **[5 M]**

Q.5 Consider the two scenarios below:

- A circuit-switching scenario in which N_{cs} users, each requiring a bandwidth of 25 Mbps, must share a link of capacity 100 Mbps.

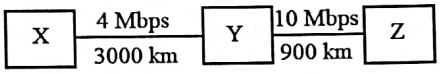
➢ A packet-switching scenario with N_{ps} users sharing a 100 Mbps link, where each user again requires 25 Mbps when transmitting.



Answer the following:

a. When circuit switching is used, what is the maximum number of circuit-switched users that can be supported? Explain your answer.
b. When packet switching is used. Suppose there are 7 packet-switching users (i.e., $N_{ps} = 7$). Can this many users be supported under circuit-switching? Explain. **[5 M]**

Q.6 Consider the figure below, with two links, each with the specified data rate and link length. Assume data travels through the links at the speed of light.



a. X wants to send a 500 byte packet to Z through Y. Y is supposed to follow the store-and-forward model, that is, Y will receive the whole packet from X and then start transmitting the packet to Z. What is the end-to-end delay seen by the packet?

b. Now, X wants to send a 5 MB file to Z in chunks of 500 byte packets. To prevent any packet loss, when X sends a 500 byte packet to Z (same way as explained in (a)), Z responds with a 50 byte packet to X (through Y) acknowledging that it has successfully received the packet. Only after receiving the acknowledgement does X send the next 500 byte packet. Assuming no losses, how long will it take for X to send the file to Z?

c. X has finished transmitting everything to Z. If Z starts sending 500 byte packets back-to-back to Y, then how many packets will Z have transmitted before Y starts receiving the first packet sent by Z? What does this value have to do with the term "bandwidth-delay product"? **[3 M + 5 M + 2 M]**

Q.7 Answer the following:

a. What is the significance of ARP, SMTP, HTTP and DNS protocol? They belong to which layers in the TCP/IP model.
b. Name the transport layer protocols used for real time multimedia, file transfer, DNS and email. **[6 M + 2 M]**

Q.8 Total 10 packets (i.e. P1 - P10) are being transmitted from the sender to the receiver and among them every 4th packet is lost. Total how many packets need to be transmitted and name the packets which are re-transmitted? In next scenario, if total n packets needs to be transmitted between sender and receiver with channel having probability of error, p. Find total transmissions required to send all the n packets? **[4 M + 3 M]**

Roll No								

National Institute of Technology Goa

Programme Name: B.Tech

Mid Semester Examinations, February 2019

B. Tech
ECE
6th Sem

Course Name: **Digital Communication**

Course Code: **EC353**

Date: 18/02/2020

Time: 9.30 AM - 11.00 AM

Duration: 1 Hour 30 Minutes

Max. Marks: 50

ANSWER ALL QUESTIONS

1. [2X5=10]

   (a) Plot probability density and distribution function for uniformly distributed random process.

   (b) State sampling theorem for band pass signal.

   (c) Consider a binary data transmission at rate of 64 kbps using base-band eight level pulse amplitude modulation (PAM) which is designed to have raised cosine spectrum. Find out the transmission bandwidth in kHz required for a rolloff factor of 0.25.

   (d) What should be the minimum duty cycle of the clock used for switching in flat-top sampling to avoid amplitude distortion and why?.

   (e) What are the difficulties in Nyquist criterion for eliminating ISI completely?

2. Show that the PSD $\Phi(e^{jw})$ of discrete signal $x(n)$ is real for real valued signal. [6]

3. Consider a white Gaussian noise process $\eta(t)$ with two sided power spectral density $S_\eta(f) = 0.5$ W/Hz as input to a filter with impulse response $0.5e^{-\frac{t^2}{2}}$ (where t is in second) resulting in output $y(t)$. Find the power of $y(t)$ in watts. [5]

4. Show that the matched filtering and then sampling the output at time T_b for rectangular pulse baseband signal is equivalent to the integration and dump operation. [5]

5. In a PCM system the signal $m(t) = sin(100\pi t) + cos(100\pi t))$V is sampled at the Nyquist rate. The samples are processed by a uniform quantiser with step size 0.75V. Find out the required minimum data rate of PCM system in bits per second. [5]

6. Show that when $h(t) = k[s_1(t) - s_0(t)]$, where $k > 0$ is arbitrary constant in a correlator receiver, supported in $[0, T_b]$, the minimum probability of error is P_e is $Q(\sqrt{\frac{\int_0^{T_b}[s_1(t)-s_0(t)]^2dt}{2N_0}})$ in AWGN noise with power spectra density of $N_0/2$, where the threshold $\lambda = \frac{1}{2}\int_0^{T_b}[s_0(t) + s_1(t)]h(t)dt$, $\int_0^{T_b}[s_0(t) - s_1(t)]h(t)dt > 0$. The pulses $s_0(t)$ and $s_1(t)$ are the pulses used for binary 0 and 1 and T_b is the bit duration. [10]

7. How the ISI can be completely eliminated by using raised cosine pulse in baseband communication? [4]

8. Write the problems in delta modulation (DM)? How can avoid these issues in DM? Derive the maximum power a DM can handle to avoid slope overloading problem for sinusoidal input signal $x(t) = A_m \sin(2\pi f_m t)$. [5]

* * *ALL THE BEST * **

Roll No								

National Institute of Technology Goa

Programme Name: B.Tech.

Mid Semester Examinations, February 2020

B. Tech
ECE
6th Sem

Course Name: **Linear Integrated Circuits**

Date: 19/02/2020

Duration:1 Hour 30 Minutes

Course Code: **EC352**

Time: 2.00 PM

Max. Marks: 50

ANSWER ALL QUESTIONS

Note: Assume suitable values if data is insufficient

1. Consider the basic differential amplifier of Fig. 1. Given: $R_C = 2$ kΩ, $R_E = 4.3$ kΩ, $V_{CC} = |V_{EE}| = 5V, \beta = 200, V_{BE} = 0.7V$, $V_1 = V_2 = 0$. After biasing, input signals are $v_1 = 15sin(2\pi 60t) + 5sin(2\pi 1000t)$ mV, $v_2 = 15sin(2\pi 60t) - 5sin(2\pi 1000t)$ mV. Calculate v_{01} and v_{02}. [8M]

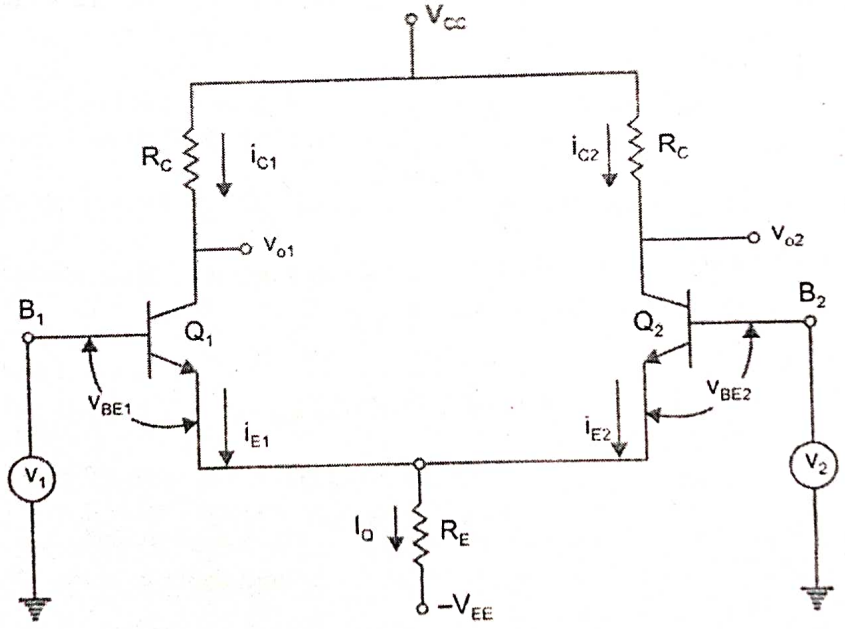


Figure 1: Differential amplifier

2. What are the internal circuits of operational amplifier. Explain individual circuit operations. [10M]

3. Consider the op-amp open loop gain of 10^5 and cut-off frequency of 300 Hz. If input signal is $v_{in} = 2sin(2\pi ft)$, calculate output voltages at f_1=100 Hz and f_2=2000 Hz in an inverting configuration. Consider $R_1 = 1$ kΩ, $R_2 = 2$ kΩ and remaining parameters are at ideal condition. [6M]

4. What are the transfer characteristics of differential amplifier. Specify ranges of each regions [6M]

5. (a) Design a DC compensation technique for input biasing current of 200 nA.
   (b) If total output offset voltage is 0.1 mV, design compensation circuit. [6M]

6. Operational amplifier is connected in non-inverting mode. $R_1 = 1k\Omega$, $R_2 = 2k\Omega$. Calculate gain A_{CL} for an openloop gain of $A_{OL} = 10^4$. [4M]

7. (a) Find v_n, v_p, and v_o in the below circuit. (b) Repeat with 10-kΩ resistance connected between A and B terminal. [6M]

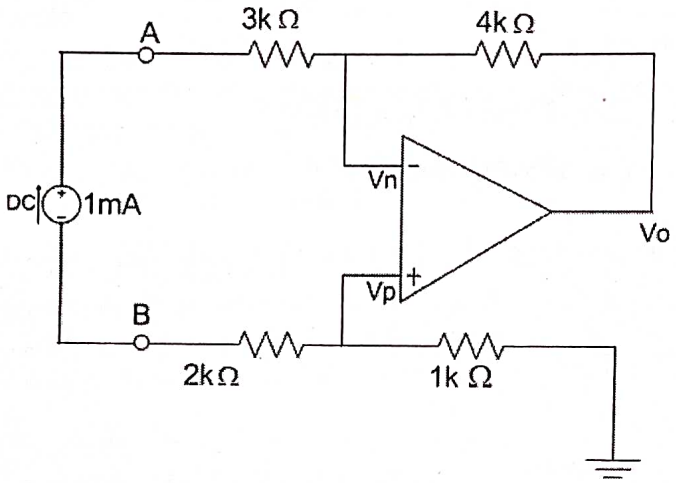


Figure 2:

8. In an differential amplifier, If $v_1 = 0.1$ mV and $v_2 = 0.3$ mV then $v_0 = 3$ V. If $v_1 = 0.2$ mV and $v_2 = 0.2$ mV then $v_0 = 0.1$ V. Calculate CMRR? [4M]

* * *ALL THE BEST * **

Roll No									

National Institute of Technology Goa

Programme Name: **B.Tech.**

End Semester Examinations, May-2019

B.Tech ECE 3rd yr 6th Sem

Course Name: Communication Network
Date: 04.05.2019
Duration: **3 Hours**

Course Code: EC 354
Time: 9.30 am – 12.30 pm
Max. Marks: **100**

ANSWER ALL QUESTIONS

Necessary assumptions can be made with proper justification.

Q1. A computer network uses polynomial over GF(2) for error detection with 8 message bits 01011011 as information bits and uses $x^3 + x + 1$ as the generator polynomial to generate the check bits. How the message is transmitted after appending check bits? **[5 M]**

Q2. Consider a 128×10^3 bits per second satellite communication link with one way propagation delay of 150 ms. Selective repeat protocol is used on this link to send data with a frame size of 1 kB. Neglect the transmission time of acknowledgement. Find the minimum number of bits required for the sequence number field to achieve 100% utilization. Hint: consider integer value for number of frames. **[5 M]**

Q3. Consider an IP packet with a length of 4500 bytes that includes 20 byte IPv4 header. The packet is forwarded to an IPv4 router that supports a Maximum Transmission Unit (MTU) of 600 bytes. Assume that the length of the IP header in all the ongoing fragments of this packet is 20 bytes. Find the fragmentation offset value stored in the third and seventh fragment. **[5 M]**

Q4. A single parity check is an error detection code which appends a single parity bit to an information bit string. The parity bit is set to 1 if the number of ones in the information bit string is odd and is set to 0 otherwise. Let the information bit string be 0000. If a single parity check bit is added to it and the resulting bit string is sent over a noisy channel, list all possible received bit strings which are declared error free at the destination. **[5 M]**

Q5. Classify the following MAC addresses as unicast, broadcast and multicast addresses: **[5 M]**

(a) AA BB CC AA BB CC
(b) 11 11 11 11 11 11
(c) FF FF FF FF FF FF
(d) 44 44 44 44 44 44
(e) EE EE EE EE EE EE

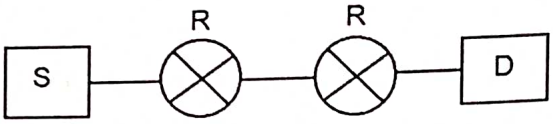
Q6. Consider different activities related to email.
m1: Send an email from a mail client to a mail server
m2: Download an email from mailbox server to a mail client
m3: Checking email in a web browser

Which is the application level protocol used in each activity? **[5 M]**

Q7. A sender uses the stop-and-wait ARQ protocol for reliable transmission of frames. Frames are of size 1000 bytes and the transmission rate at the sender is 80 kbps. Size of an acknowledgment is 100 bytes and the transmission rate at the receiver is 8 kbps. The one way propagation delay is 100 ms. Assume no frame is lost, find the sender throughput. **[5 M]**

Q8. Consider a system generating 20 bit frames and connected through a shared 20 kbps channel. Find throughput in percent if slotted ALOHA is used and frame rate is 1000 frames per second. **[5 M]**

Q9. Assume that source S and destination D are connected through two intermediate routers labeled R. Determine how many times each packet has to visit the network layer and the data link layer during a transmission from S to D. **[5 M]**



Q10. Data transmitted on a link uses the following 2D parity scheme for the error detection: Each sequence of 28 bits is arranged in a 4×7 matrix (rows r_0 through r_3, columns d_7 through d_1) and is padded with a column d_0 and row r_4 of parity bits computed using even parity scheme. Each bit of column d_0 (respectively, row r_4) gives the parity of the corresponding row (respectively, column). These 40 bits are transmitted over the data link.

	d_7	d_6	d_5	d_4	d_3	d_2	d_1	d_0
r_0	0	1	0	1	0	0	1	1
r_1	1	1	0	0	1	1	1	0
r_2	0	0	0	1	0	1	0	0
r_3	0	1	1	0	1	0	1	0
r_4	1	1	0	0	0	1	1	0

The table shows data received by a receiver and has n corrupted bits. What is the minimum possible value of n? **[5 M]**

Q11.

(a) Consider three machines PC1, PC2, and PC3 with the IP address 100.10.5.2, 100.10.5.5, and 100.10.5.6 respectively. The subnet mask is set to 255.255.255.252 for all the three machines. Which of the statement is true: PC1, PC2, and PC3 all belong to same subnet; Only PC1 and PC2 belong to same subnet; PC1, PC2, and PC3 all belong to three different subnets; Only PC2 and PC3 belong to same subnet. Justify your answer.

(b) If a class B network on the Internet has a subnet mask of 255.255.248.0, what is the maximum number of hosts per subnet? **[10 M]**

Q12.

(a) Computer A has 19.5MB to send on a network and transmits the data in a burst at the rate of 6 Mbps. The maximum transmission rate across routers in the network is 4 Mbps. If Computer A's transmission is shaped using a leaky bucket, how much capacity must the queue in the bucket hold not to discard any data?

(b) For a host machine that uses the token bucket algorithm for congestion control, the token bucket has a capacity of 1 MB and the maximum output rate is 20 megabytes per second. Token arrive at a rate of 10 megabytes per second. The token bucket is currently full and the machine needs to send 12 MB of data. Find the minimum time required to transmit the data. **[10 M]**

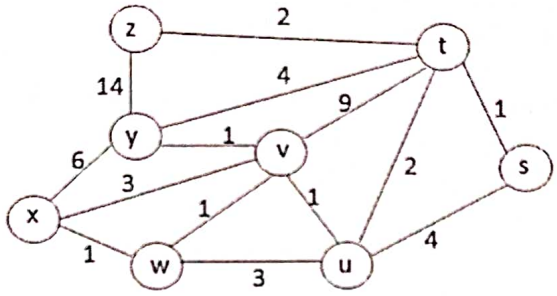
Q13.

(a) Which one of the following fileds: Checksum; Source address; TTL; Length, of an IP header is not modified by a typical router? Give justification for your answer.

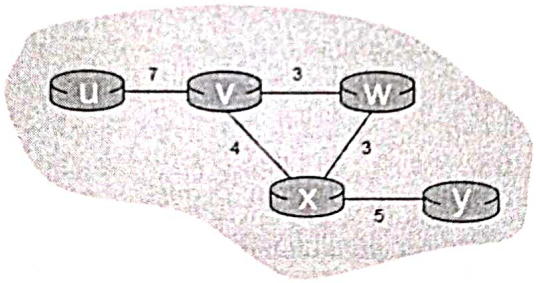
(b) Which of the following statement is true; both Ethernet frame and IP packet include checksum fields, ethernet frame includes a CRC field and IP packet includes a checksum field? Also, mention ethernet frame format and IP header format. **[10 M]**

Q14.

(a) Use Dijkstra's algorithm to find the shortest route from source node x to all the destinations for the given 8 node network:



(b) Find the least cost route using Bellman Ford algorithm for the given 5 node network:



[10 M]

Q15.

(a) A network has a data transmission bandwidth of 20×10^6 bits per second. It uses CSMA/CD in the MAC layer. The maximum signal propagation time from one node to another node is 40 μs. Find the minimum size of the frame in the network in bytes.

(b) Assume CSMA/CD protocol. Find the least frame length in bytes for a 2 Mbps bit rate and 1.5 km long network where propagation delay is 4.25 nano seconds per meter. **[10 M]**

*******All the best*******

Roll No								

National Institute of Technology Goa

Programme Name: B.Tech.

End Semester Examinations, April-May 2019

B. Tech ECE
3rd yr
6th Sem

Course Name: **Digital Communication**

Date: 03/05/2019

Duration:3 Hours

Course Code: **EC353**

Time: 9.30 AM - 12.30 PM

Max. Marks: 100

ANSWER ALL QUESTIONS

1. [2*10=20]

(a) What is the need for non-uniform quantization?

(b) Draw the signal space diagram for QAM signal for M=32.

(c) Fifty voice signals each having maximum frequency 3.4 kHz are sampled following Nyquist sampling rule and then time division multiplexed. What will be the minimum channel bandwidth required to transmit the whole data?

(d) What is the theoretical minimum system bandwidth needed for a 10 Mbps signal using 16-level PAM without ISI?

(e) Why is E_b/N_0 a natural figure of merit in digital communication system?

(f) Calculate the minimum required bandwidth for a noncoherently detected orthogonal binary FSK system. The higher-frequency signaling tone is 1 MHz and the symbol duration is 1 ms.

(g) Write the difference between QPSK and MSK modulation techniques.

(h) What is the need of channel coding in digital communication system?.

(i) Define code rate. What is the code rate for repetition code?

(j) How antipodal signaling improves the performance of a MAP receiver in AWGN channel?

2. The signal $x(t) = 4\cos(400\pi t) + 12\cos(360\pi t)$ is ideally sampled at a frequency of 300 samples per second. The sampled signal is passed through a unit gain LPF with a cut off frequency of 220 Hz. List the frequency components present at the output of the LPF? [6]

3. A delta modulator with a fixed step size of 0.75 V, is given a sinusoidal message signal. If the sampling frequency is 25 times the Nyquist rate, determine the maximum permissible amplitude of the message signal if slope overload is to be avoided. [6]

4. A real-valued base-band pulse $g(t)$ with support $[0, T]$ is given by

$$g(t) = A\cos\left(\frac{\pi t}{T} - \pi\alpha\right)\text{rect}\left(\frac{t-(T/2)}{T}\right), A > 0, 0 < \alpha < 0.5$$

Let $h(t)$ be the impulse response of a filter matched to $g(t)$, satisfying the condition $h((1-\alpha)T) = A/2$, Let $y(t) = h(t) * g(t)$

(a) Find $h(t)$ and sketch its plot, labeling the relevant portions. [8]

(b) Find the matched filter output $y(t)$ in the range $0 < t < T$. Find the value of α for which $y(T/2) = 0$. [8]

5. Equicorrelated signals $y_1(t), y_2(t), y_3(t)$ over a signaling interval $[0, T]$, each having energy E, and satisfying

$$\int_o^T y_i(t)y_j(t)dt = \frac{E}{2}, \quad \text{for} i \neq j,$$

are converted to another set of signals $\{s_1(t), s_2(t). s_3(t)\}$ by the transformation

$$s_i(t) = y_i(t) - \frac{1}{3}\sum_{k=1}^{3} y_k(t), \quad i = 1, 2, 3$$

What is the dimension N of the signal space $\{s_1(t), s_2(t), s_3(t)\}$? Starting with $s_1(t)$, obtain orthonormal basis $\{\phi_1(t), ..., \phi_N(t)\}$ for the signal using Gram-Schmidt orthogonalization. [10]

6. The signal component of a coherent PSK system is defined by

$$s(t) = A_c k \sin(2\pi f_c t) \pm A_c\sqrt{1-k^2}\cos(2\pi f_c t), \qquad 0 \leq t \leq T_b$$

where the plus sign corresponds to symbol 1 and the minus sign corresponds to symbol 0. The first term represents a carrier component included for the purpose of synchronizing the receiver to the transmitter.

(a) Draw the signal space diagram for the scheme described here; what observation can you make about this diagram? [4]

(b) Show that, in the presence of additive white Gaussian noise of zero mean and power spectral density $N_0/2$, the average probability of error is [4]

$$P_e = Q\left(\sqrt{\frac{2E_b}{N_0}(1-k^2)}\right)$$

where $E_b = 0.5A_c^2T_b$

(c) Suppose that 10% of the transmitted signal power is allocated to the carrier component. Determine the Eb/N_0 required to realize a probability of error equal to 10^{-4} [4]

(d) Compare this value of $E_b/N_0$with that required for a conventional PSK system with the same probability of error. [2]

7. Illustrate the transmitter, receiver and the generation of the noncoherent version of PSK with neat sketch. [10]

8. Determine the transmission bandwidth reduction and average signal energy of 256-QAM, compared to 64-QAM. Also determine the increase in average signal energy. [8]

9. Describe how the errors are corrected using Hamming code with an example. Let the code vector [1110010] is sent, the received vector is [1100010]. Calculate the syndrome and correct the error. Can (7,4) Hamming code correct 2 errors at a time? [10]

* * *ALL THE BEST * **

Roll No								

National Institute of Technology Goa

Farmagudi, Ponda, Goa 403401

Programme Name: B.Tech.

End Semester Examination, May 2019

B. Tech ECE
3rd yr
6th Sem

Course Name: **Wireless Communication**

Date: 01/05/2019

Duration: 3 Hrs

Course Code: EC351

Time: 09:30AM-12:30 PM

Max. Marks: 100

!!ANSWER ALL QUESTIONS!!

Q1: Consider a cellular system in which total available voice channels to handle the traffic are 960. The area of each cell is 6 square km and the total coverage area of the system is 2000 square km. Calculate (a) the system capacity if the cluster size N =4 and (b) N=7. How many times would a cluster of size 4 have to be replicated to cover the entire cellular area? Does decreasing the reuse factor N, increase the system capacity? Explain. **[10]**

Q2: A receiver in an urban cellular radio system detects a 1mW signal at $d = do = 1$ meter from the transmitter. In order to mitigate co-channel interference effects, it is required that the signal received at any base station receiver from another base station transmitter which operates with the same channel must be below -100 dBm. A measurement team has determined that the average path loss exponent in the system is $n = 4$. Determine the major radius of each cell if a seven-cell reuse pattern is used. What is the major radius if a four-cell reuse pattern is used? **[10]**

Q3: Exercise in trunking theory [2+3+5= **10**]

1. What is the maximum system capacity (total and per channel) in Erlangs when providing a 2% blocking probability with 20 channels, and with 40 channels?
2. How many users can be supported with 20 channels and with 40 channels at 2% blocking ? Assume H=105 s, λ =1 call/hr.
3. For a N = 7 system with a Pr[Blocking] = 2% and average call length of two minutes, find the traffic capacity loss due to trunking for 57 channels when going from the omnidirectional antennas to 60° sectored antennas. (Assume that blocked calls are cleared and the average per user call rate is $\lambda = 1$ call/hr per hour.)

Q4: (a) What is MAHO? How it is different from first generation hand off process? Explain how umbrella cell minimizes the number of hand off in urban area. **[5]**

(b) What do you understand by "Multiple Access" (MA) technique? Name the MA techniques being used by 1G, 2G and 3G technologies? **[5]**

Q5: Define the terms (i) Doppler spread and (ii) coherence bandwidth. Consider a mobile station working at carrier frequency of 1800 MHz and it is moving at a speed of 100 Kmph directly towards the base station. Calculate (i) Doppler spread, (ii) received frequency, and (iii) coherence time. **[10]**

Q6: Derive the SINR for CDMA uplink and downlink scenarios in frequency selective environment. Consider that the system is using RAKE receiver. **[10]**

Q7: If the BER of a particular communications system is given by $Q(\sqrt{SNR})$ then calculate the BER of a CDMA downlink system having 2 users with spreading length sequence 256. Further, power transmitted by desired user and interfering user is same and given by $P_0^{dB} = P_1^{dB} = -10$ dB and assume that the noise variance is unity. **[10]**

Q8: Consider a MIMO system with $r = 3$ receive antenna and $t = 3$ transmit antenna. The total available power is $P_{\text{dB}} = -2\text{dB}$ and the noise power is $\sigma_{n_{\text{dB}}}^2 = 3\text{dB}$. For the MIMO channel given below, compute the maximum capacity using optimal power allocation:**[10]**

$$H = \begin{bmatrix} 0 & -0.32 & -0.6 \\ 1.6 & -1.44 & 0.48 \\ 1.2 & 1.92 & -0.64 \end{bmatrix}$$

Q9: Derive the expression of ZF receiver for MIMO and discuss the problem of noise amplification. **[10]**

Q10: Consider a 1x2 MIMO system with $h_1 = \sqrt{2} - \sqrt{2}j$ and $h_2 = -\sqrt{3} + 1j$. Let the MIMO system under consideration employs OSTBC to achieve the diversity. What should be the OSTBC for this system if the symbols to be transmitted are s_1 and s_2? Show that the OSTBC for this system is a full-rate code and system is equivalent to a 2x2 MIMO. Further, calculate the beam former vectors $\underline{w}_1$ and $\underline{w}_2$ to detect symbols s_1 and s_2. **[10]**

* * *ALL THE BEST * **

Roll No								

National Institute of Technology Goa

Programme Name: B.Tech.

End Semester Examination, April-2019

B. Tech ECE
3rd yr
6th Sem

Course Name: Object Oriented Programming — Course Code: CS252

Date: 29. 04. 2019 — Time: 2:00 PM - 5:00 PM

Duration: 3 Hours — Max. Marks: 100

ANSWER ALL QUESTIONS

1. (a) Write a C++ program to create a class called *Account* with private attributes such as account number and balance. The attributes should be initialized through constructors. The class should contain a public method named as *show*() to display the initialized attributes. Provide a mechanism to create an array of *Account* objects. The array size should be given by the user at run time. [5M]

   (b) A palindrome is a string that is the same backward as it is forward. For example,"noon" and "refer" are rather short palindromes. Write a C++ program that lets a user enter a string and that passes to a bool function a reference to the string. The function should return true if the string is a palindrome and false otherwise. [5M]

2. Write a C++ program that uses the following functions:
   Fill_array takes as arguments the name of an array of double values and an array size. It prompts the user to enter double values to be entered in the array. It ceases taking input when the array is full or when the user enters non-numeric input, and it returns the actual number of entries.
   Show_array takes as arguments the name of an array of double values and an array size and displays the contents of the array.
   Reverse_array takes as arguments the name of an array of double values and an array size and reverses the order of the values stored in the array.
   The program should use these functions to fill an array, show the array, reverse the array, show the array, reverse all but the first and last elements of the array, and then show the array. [10M]

3. Write a C++ function named *digit_name* that takes an integer argument in the range from 1 to 9, inclusive, and prints the English name for that integer on the computer screen. No newline character should be sent to the screen following the digit name. The function should not return a value. The cursor should remain on the same line as the name that has been printed. If the argument is not in the required range, then the function should print *digit error* followed by the newline character. Thus, for

example, the statement *digit_name*(7) should print seven on the screen; the statement *digit_name*(0) should print digit error on the screen and place the cursor at the beginning of the next line. [10M]

4. (a) Can we use the same function name for a member function of a C++ class and a non-member function in the same program file? If yes, how are they distinguished? If no, give reasons. Support your answer with an example. [5M]

   (b) Write a C++ program which initializes a string variable to the content, "*If you want a thing done well, do it yourself*" and outputs the string to the disk file OUT.TXT. You have to include all the header files required. [5M]

5. (a) Consider the following C++ program:

```
class A {
public:
A() { a = 1; }
int a;
};
class B : public A {
public:
B() { a += 1; }
};
class C : public A {
public:
C() { a *= 2; }
};
class D : public B, public C {};
int main() {
D* d = new D();
std::cout << d->a;
return 0;
}
```

   Assume that all the required header files are included. The code is rejected by the compiler. Briefly explain why. [5M]

   (b) What class methods does the compiler generate automatically if you do not provide them explicitly? Describe how these implicitly generated functions behave. [5M]

6. (a) What are the differences between overloading and overriding? Provide suitable C++ programs to illustrate the differences. [5M]

(b) The compiler performs a matching process to determine which function-template specialization to call when a function is invoked. Under what circumstances does an attempt to make a match result in a compile error? [5M]

7. (a) If no exceptions are thrown in a try block, where does control proceed to after the try block completes execution? [3M]

(b) What happens if an exception is thrown outside a try block? [3M]

(c) What happens when a catch handler throws an exception? [4M]

8. A supermarket chain has asked you to develop an automatic checkout system. All products are identifiable by means of a barcode and the product name. Groceries are either sold in packages or by weight. Packed goods have fixed prices. The price of groceries sold by weight is calculated by multiplying the weight by the current price per kilo.

Develop the C++ classes needed to represent the products first and organize them hierarchically. The *Product* class, which contains generic information on all products (barcode, name, etc.), can be used as a base class.

The *Product* class contains two data members of type long used for storing barcodes and the product name. Define a constructor with parameters for both data members. Add default values for the parameters to provide a default constructor for the class. In addition to the access methods *setCode*() and *getCode*(), also define the methods *scanner*() and *printer*(). For test purposes, these methods will simply output product data on screen or read the data of a product from the keyboard.

The next step involves developing special cases of the *Product* class. Define two classes derived from *Product*, *PrepackedFood* and *FreshFood*. In addition to the product data, the *PrepackedFood* class should contain the unit price and the *FreshFood* class should contain a weight and a price per kilo as data members. In both classes define constructor with parameters providing default-values for all data members. Use both the base and member initializer. Define the access methods needed for the new data members. Also redefine the methods *scanner*() and *printer*() to take the new data members into consideration.

Test the various classes in a main function that creates two objects each of the types *Product*, *PrepackedFood* and *FreshFood*. One object of each type is fully initialized in the object definition. Write a C++ program to test all the methods.

[10M]

9. (a) Given the Java program below, what will be the values of *asum* and *bsum*?

```
public class MyArray
{
```

```
private int [ ] X={3, 4, 5};
public MyArray( )
{
}
public int value( )
{ return(X[0]); }
public int value(int k)
{ return(X[k]); }
public static void main (String[ ] args)
{
MyArray [ ] Y = new MyArray[10];
int asum = 0, bsum = 0;
for(int i=0; i<10; i++)
{
Y[i]=new MyArray( );
asum = asum + Y[i].value( );
for(int j=0; j<3; j++)
bsum = bsum + Y[i].value(j);
}
System.out.println("asum: "+ asum + " bsum: " + bsum);
}
}
```

[3M]

(b) What will be the output of the following Java snippet?

```
try {
int num = Integer.parseInt("four thousand two hundred and ninety-five");
System.out.println("Your number is: " + num + ".");
} catch (NumberFormatException n) {
System.out.println("You don t have a number.");
} catch (Exception e) {
System.out.println("Something went terribly terribly wrong.");
} finally {
System.out.println("Number parsed successfully!");
}
```

[3M]

(c) Write a Java program that asks the user to enter 300 integers between 0 and 2000 inclusive. After the user enters these numbers, the statistical mode should be displayed. The statistical

mode is the most frequently occurring number. If there is a tie for the mode, "*no mode*" should be displayed. You need not perform error checking.

[4M]

10. (a) Consider the following Java classes:

```
class A {
public void func (Object o) { System.out.println("A"); }
}
class B {
public void func (String o) { System.out.println("B"); }
}
class C extends A {
public void func (String s) { System.out.println("C"); }
}
class D extends B {
public void func (Object o) { System.out.println("D"); }
}
class Main {
public static void main(String[] args) {
A a = new C(); a.func("Java");
C c = new C(); c.func("Java");
B b = new D(); b.func("Java");
D d = new D(); d.func("Java");
}
}
```

What will be the output of the execution of the method main in class Main?

[2M]

(b) Assume: $a = -1, b = -2, c = -4, d = 2, e = -1$. What will be the output of the following code fragment?

```
if ( a < 0 )
if ( b < 0 )
if ( c < 0 )
if ( !( d < 0 && e < 0 ) )
System.out.println( "One" );
else
System.out.println( "Two" );
if ( a == e )
```

```
System.out.println( "Three" );
else
System.out.println( "Four" );
```

[2M]

(c) Which pattern will be produced when the following code snippet is executed?

```
for(int i = -2; i <= 2; i++){
for(int j = -2; j <= 2; j++){
if(i < j)
System.out.print("*");
else
System.out.print(".");
}
System.out.println();
}
```

[2M]

(d) What will be the output of a call to the *printNums*() method? Assume *inFile* has been properly linked to the file whose content is shown below and *outFile* has been properly linked to some output file.

15
23
21

```
public static void printNums()
{
int n; String line;
line = inFile.readLine();
if (line != null) {
n = Integer.valueOf(line).intValue();
outFile.print(n + " "); printNums();
outFile.print(n + " ");
}
}
```

[4M]

* * *ALL THE BEST * **

Roll No								

National Institute of Technology Goa

Programme Name: B.Tech.

Mid Semester Examinations, February 2019

B. Tech ECE
3rd yr
6th Sem

Course Name: **Linear Integrated Circuits**

Course Code: **EC352**

Date: 01/03/2019

Time: 9.30 AM - 11.00 AM

Duration:1 Hour 30 Minutes

Max. Marks: 50

ANSWER ALL QUESTIONS

Note: Assume suitable values if data is insufficient

1. Consider the basic differential amplifier of Fig. 1. Given: $R_C = 2$ kΩ, $R_E = 4.3$ kΩ, $V_{CC} = |V_{EE}| = 5V, \beta = 200, V_{BE} = 0.7V$. Determine:
   (i) Calculate Quiescent voltages and currents, $I_{BQ}, I_{CQ}, V_{CEQ}, V_{o1}$ and V_{o2}.
   (ii) A_{DM}, A_{CM}. and CMRR. [7M]

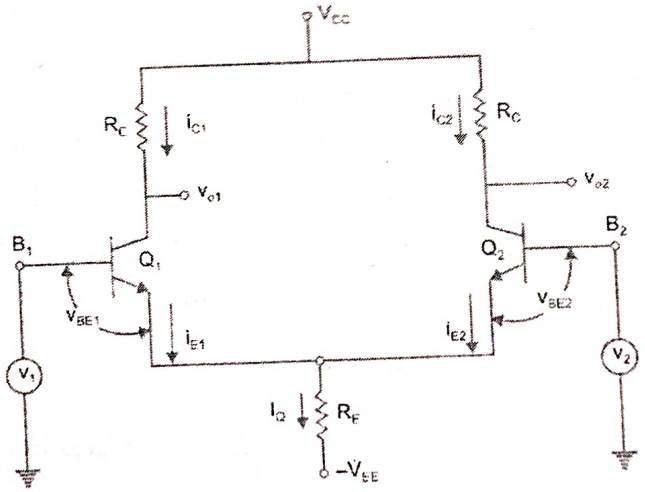


Figure 1: Differential amplifier

2. Discuss about internal circuit of operational amplifier. [5M]

3. Design pole-zero compensation network for an operational amplifier having corner frequencies of f_1=1 kHz, f_2=50 kHz, and f_3=100 kHz. [6M]

4. Consider the op-amp open loop gain of 10^5 and cut-off frequency of 300 Hz. If input signal is $v_{in} = 2sin(2\pi ft)$, calculate output voltages at f_1=100 Hz and f_2=2000 Hz in the non-inverting configuration. Consider R_1 = 1 kΩ, R_f = 2 kΩ and remaining parameters are at ideal condition. [7M]

5. If resistors with values 100 Ω, 1 kΩ, 2.3 kΩ, 4.7 kΩ, and 10 kΩ of unlimited number are given to you, design Instrumentation amplifier with minimum and maximum gains. [6M]

6. Design full-wave rectifier with operational amplifier. If the directions of diodes are reversed, what will be the output for any given sinusoidal signal. [7M]

7. Derive the voltage gain and the input impedance for inverting and non-inverting amplifiers. Consider ideal conditions. [6M]

8. Design practical integrator circuit for an input unit square wave signal of time period $T = 1$ ms. [6M]

* * *ALL THE BEST * **

Roll No	1	5	E	E				

National Institute of Technology Goa

Programme Name: B. Tech

Mid-Semester Examination, February-2019

B. Tech EEE
3rd yr
6th Sem

Course Name: **Switchgear and Protection**

Date: 28/02/2019

Duration: 1 Hour 30 Min

Course Code: EE350

Time: 9.30 AM-11.00 AM

Max. Marks: 50

ANSWER ALL QUESTIONS

(Assume suitable data if necessary)

1. A 132 kV, 3 $phase$, 50 Hz transmission line, 200 km long consists of three conductors of effective diameter 20 mm. The conductors are arranged at the corners of equilateral triangle of area $\sqrt{3}\ m^2$. Assume perfect transposition.Find the inductance and kVA rating of the ground fault neutralizer. [7 marks]

2. Briefly explain construction and operation of HRC Fuse. [5 marks]

3. Derive the expression for Rate of Rise of Restriking Voltage. [6 marks]

4. In a short circuit test on a 3 $pole$, 110kV circuit breaker, power factor was 0.4, the recovery voltage was 0.95 times full-line value. The fault was symmetrical, the frequency of oscillation of restriking voltage was 15,000 $cycles\ per\ second$. Estimate the average RRRV upto first peak. The neutral is grounded and the fault involves earth. [5 marks]

5. An IDMT type over-current relay is used to protect a feeder through 500/1 C.T, the relay has plug setting of 125 % and TMS is 0.3, find the time of operation of the said relay if a fault current of 5000 A flows through the feeder. Make use of the following characteristics. [5 marks]

PSM	2	3	5	8	10	15
Time for unity TMS	10	6	4	3.2	3	2.5

6. With the help of phasor, explain the importance of neutral grounding. [6 marks]

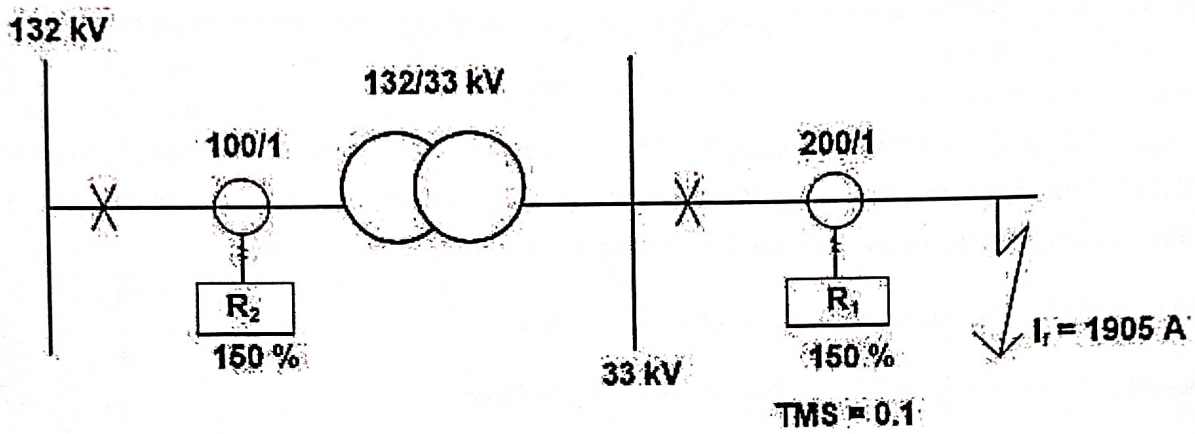
7. Explain the principle of operation of SF_6 circuit breaker. [4 marks]

8. List the characteristics which a material must possess to qualify as a fuse element. Also explain the term discrimination with an example. [4 marks]

9. Refer given figure. The fault current is 1905 A. If both the relays are set for plug setting of 150%, Determine the time of operation of both relays when the time grading margin of 0.5 *seconds* is given and TMS for Relay 1 is 0.1, Also find TMS for Relay 2. [8 marks]

The characteristics $(y = f(x))$ for the relay are defined by following set of conditions :

1. $\frac{dy}{dx} = \frac{-10}{x^2}$
2. Root of equation $y = f(x)$ is at $x = -10$



* * *ALL THE BEST * **

Roll no										

NATIONAL INSTITUTE OF TECHNOLOGY GOA

Farmagudi, Ponda, Goa 403 401

B. Tech. EEE 3rd yr 6th Sem

Programme Name: B.Tech. **Mid Semester Examination, February - 2019**

Course Name : Power System Analysis **Course Code: EE - 351** **Time : 02.00 – 03.30 PM**

Date : 28th February 2019 **Class : B.Tech. (VI Sem)** **Max. Marks : 50**

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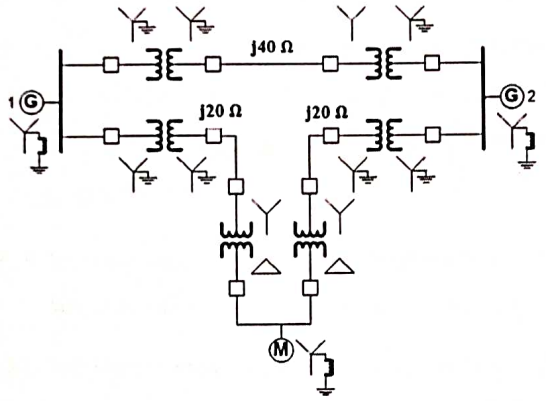
1. **Describe single line diagram representing synchronous machines, transformers and feeders from generating end to distributing end.**
2. **Discuss the advantages of using Y_{BUS} model of power system network for load flow studies.**
3. **What are the four ways of adding impedance to an existing system so as to modify Z_{bus} matrix?**
4. **Discuss the purpose of load flow studies of a power system. Also classify the buses for the same.**
5. **What is the importance of acceleration factor in load flow studies? Give the formula.** ***..... 5 x 3 = 15 M***
6. **Draw the p.u. impedance diagram of the system shown in Fig. below** ***..... 10 M***



The ratings are as follows:

G1: 20 MVA, 18 kV; X" = 20%

G2: 20 MVA, 18 kV; X" = 15%

M: 30 MVA, 13.8 kV; X" = 22%

3 ph Y-Y T/F: 20 MVA, 138/20 kV, X = 10%

3 ph Y-Δ T/F: 15 MVA, 138/13.8 kV, X = 10%

Choose a base of 50 MVA, 138 kV in the 40Ω line

7. **Obtain the load flow solution at the end of the first iteration of the power system using Gauss-Siedel Load Flow Method. The data is given in table below. The solution is to be obtained for following cases:**

Bus Data

Bus No.	P_{inj} (pu)	Q_{inj} (pu)	V_i
1	-	-	1.04 + j0
2	0.5	-0.2	-
3	-1.0	0.5	-
4	0.3	-0.1	-

i. **All buses except bus 1 are PQ buses.**

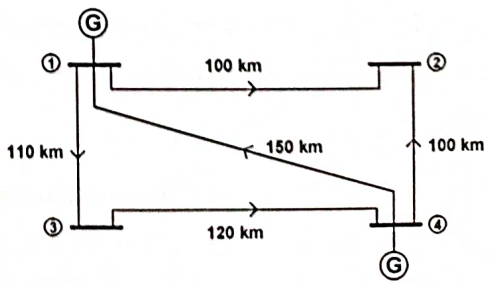
ii. **Bus 2 is a PV bus whose voltage magnitude is specified as 1.04.**

iii. **Case (*ii*) if $0.25 \leq Q_2 \leq 1.0$ pu** ***... 15 M***

Line Data

Bus Code	R (pu)	X (pu)
1-2	0.05	0.15
1-3	0.10	0.30
2-3	0.15	0.45
2-4	0.10	0.30
3-4	0.05	0.15

8. **Find Y_{Bus} for a 4-bus system shown in Fig. It is given that all the lines are characterized by a series impedance of 0.1+j0.7 ohm/km and shunt admittance of $j0.35*10^{-5}$ mhos/km. Consider base values as 200kV and 100MVA. Express all the values in p.u.** ***..... 10 M***



Roll No								

National Institute of Technology Goa

Programme Name: B.Tech

Mid Semester Examinations, February 2019

B. Tech ECE
3rd yr
6th Sem

Course Name: **Digital Communication**

Course Code: **EC353**

Date: 27/02/2019

Time: 9.30 AM - 11.00 AM

Duration: 1 Hour 30 Minutes

Max. Marks: 50

ANSWER ALL QUESTIONS

1. [2X5=10]

   (a) What is the difference between flat-top and natural sampling.

   (b) Determine the adequate sampling frequency to recover the original signal from the sampled of a band pass signal with frequency range of 104 MHz to 104.2 MHz.

   (c) Define auto-correlation function for a white process.

   (d) Define prediction gain produced by the differential quantization scheme in DPCM.

   (e) How large can be the filter roll-off factor be if the allowable system bandwidth is 1.375 MHz for 2.5 Mbps signal.

2. The autocorelation sequence of a discrete time stochastic process is $\phi(k) = (1/2)^{|k|}$. Determine its power spectral density function. [5]

3. The term matched-filter is often used synonymously with correlator. How is that possible when their mathematical operations are different? [5]

4. The information in an analog waveform, with maximum frequency $f_m = 3$ kHz, is to be transmitted over an M-ary PAM system, whre the number of pulse levels $M = 16$. The quantization distortion is specified not to exceed $\pm 1\%$ of the peak-to-peak analog signal. [8]

   (a) What is the minimum number of bits/sample should be used in digitizing the analog wave form?

   (b) What is the minimum required sampling rate, and what is the resulting bit transmission rate?

   (c) What is the PAM pulse or symbol transmission rate?

   (d) If the transmission bandwidth (including filtering) equals 12 kHz, determine the bandwidth efficiency for this system.

5. Prove that when $h(t) = k[s_1(t) - s_0(t)]$, where k is arbitrary constant in a correlator receiver, supported in $[0, T_b]$, the minimum probability of error P_e is $Q(\sqrt{\frac{\int_0^{T_b}[s_1(t)-s_0(t)]^2dt}{2N_0}})$ in AWGN noise with power spectra density of $N_0/2$, where the threshold $\lambda = \frac{1}{2}\int_0^{T_b}[s_0(t) + s_1(t)]h(t)dt$, $\int_0^{T_b}[s_0(t) - s_1(t)]h(t)dt > 0$. The pulses $s_0(t)$ and $s_1(t)$ are the pulses used for binary 0 and 1 and T_b is the bit duration. [10]

6. What is inter symbol interference (ISI) in base-band digital transmission? What is the ideal solution to overcome ISI? [6]

7. A binary PCM system using polar NRZ signalling operates just above the error threshold with an average probability of error equal to 10^{-6}. Suppose that the signaling rate is doubled. Find the new value of the average probability of error.
   Note: the function is approximated as $Q(x) < \frac{1}{\sqrt{2\pi}x}\exp(-x^2/2)$ [6]

* * *ALL THE BEST * **

Roll No								

National Institute of Technology Goa

Farmagudi, Ponda, Goa 403401

Programme Name: B.Tech.

Mid Semester Examination, February 2019

B. Tech
3rd yr.
ECE
6th Sem

*

Course Name: **Wireless Communication** Course Code: EC351

Date: 26/02/2019 Time: 09:30-11:00 AM

Duration: 1 Hrs. 30 Min. Max. Marks: 50

!!ANSWER ALL QUESTIONS!! **ATTEMPT PART WISE!!**

Part-A

QA1: Give the analytical models and expressions of average BER for wireless and wireline communication systems?**[2]**

QA2: Describe narrow band signal assumption? How this assumption leads to the simplification of received complex base-band signal expression?**[2]**

QA3: Calculate and compare the SNR (in dB) required to achieve a BER of 10^{-6} for wireline and wireless channels with and without receive diversity. Use appropriate approximation for Gaussian Q-function. And assume two receive antennas for receive diversity case.**[2]**

QA4: For GSM, 2G and 3G, and 5G technologies with multiple antenna systems, calculate the minimum spacing required among antennas.**[2]**

QA5: In a cellular system, there are two categories of mobile users: (i) slow moving and (ii) fast moving. How would you solve the problem of hand-off in this scenario? **[2]**

Part-B

QB1: Let, in a wireless communication system, complex gain of the channel is represented as $h = re^{j\phi}$. It is given that the magnitude r follows an exponential distribution with mean $1/\lambda$ whereas, the phase ϕ follows a uniform distribution from $0 \leq \phi \leq 2\pi$. Calculate probability that (i) the attenuation is worse than -20 dB and (ii) the phase lies between 0 to $\pi/6$. **[5]**+[5]

QB2: A wireless communication system employs MRC at the receiver having 3 receive antenna. The complex channel coefficients are given as $h_1 = \frac{2}{\sqrt{3}} + j\frac{7}{\sqrt{6}}, h_2 = \frac{1}{\sqrt{5}} - j\frac{1}{\sqrt{5}}, h_3 = -\frac{5}{\sqrt{3}} - j\frac{2}{\sqrt{3}}$. calculate the optimal MRC beamformer and received power at the output of the MRC combiner. **[5]** + [5]

QB3: Let, a wireless communication system has exponential average power profile given as

$$\bar{\phi}(\tau) = \alpha e^{-\tau/\beta} \qquad \tau \geq 0$$

Calculate (i) Fractional power profile, (ii) Average delay, and (iii) RMS delay spread. **[5]** +[5]

QB4: Calculate the probability of deep fade event for

(i) Rayleigh fading channel with pdf $f_R(r) = 2r\exp(-r^2), \quad r \geq 0$. **[5]**

(ii) Log-normal channel with pdf $f_R(r) = \frac{1/r}{\sqrt{2\pi\sigma_r^2}} \exp\left(-\frac{1}{2}\left(\frac{\ln(r)-\mu_r}{\sigma_r}\right)^2\right), \quad r \geq 0$. **[5]**

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Roll No										

NATIONAL INSTITUTE OF TECHNOLOGY GOA

Farmagudi, Ponda, Goa 403 401

3rd yr B.Tech ECE 6th Sem

Programme Name: B.Tech: III-ECE

End Semester Examination, April-May, 2018

Course Name: Linear Integrated Circuits | **Course Code: EC352**

Date: 04-05-2018 | **Time: 2.00PM – 5.00PM**

Duration: 3 hrs | **Max. Marks: 100**

ANSWER ALL QUESTIONS

1. (i) Design a non-inverting amplifier with a gain of 10 and an input resistance of 1kΩ. Also draw the circuit diagram. **(3M)**

   (ii) An OPAMP has a slew rate of 2V/μs. Find the rise time for an output voltage of 10V amplitude resulting from a rectangular pulse input if the OPAMP is slew rate limited. **(4M)**

   (iii) An amplifier has a closed loop voltage gain of 20dB and a CMRR of 90dB. If a common-mode signal is applied to the input at -60dBV, what is the output? **(3M)**

2. (i) Draw a circuit diagram of sample and hold circuit and explain its operation and indicate its uses. **(5M)**

   (ii) What is precision diode? Draw circuit of full wave rectifier using precision diode and explain how it gives the average value. **(7M)**

3. For the non-inverting Schmitt comparator circuit shown below, calculate the threshold levels V_{UT} and V_{LT} and the hysteresis V_H. **(6M)**

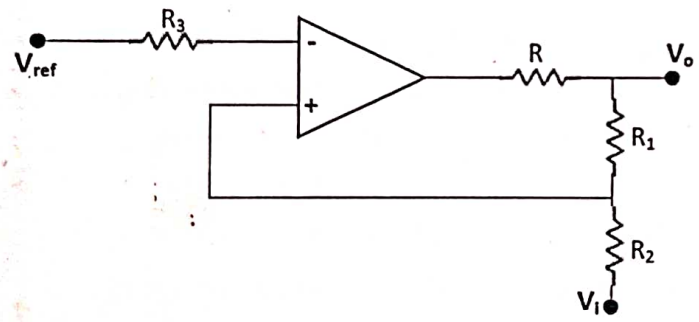

Figure 1. Non-inverting Schmitt trigger

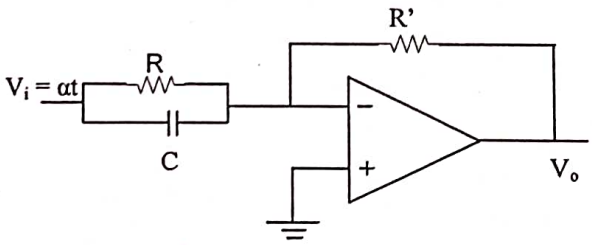

Figure 2. Limiter circuit for Prob. 4

4. In the circuit shown in Figure 2 input is a sweep voltage $V_i = \alpha t$. Find the output expression V_o. **(3M)**

5. (i) Design an active highpass filter with a gain of 4, a corner frequency of 1 kHz, and a gain roll-off rate of −60 dB/decade. **(6M)**

   (ii) Determine the order of a low pass Butterworth filter that is to provide 40 dB attenuation at $\omega/\omega_h = 2$. **(3M)**

   (iii) Design a band pass filter so that f_o = 2kHz, Q=20 and A_o = 10. Choose C = 1μF. **(7M)**

   (iv) Design a notch filter for f_o=8kHz and Q = 10. Choose C = 500pF. Also draw its circuit diagram. **(5M)**

6. (i) In the astable multivibrator using 555 timer circuit, R_A = 2.2 kΩ, R_B = 6.8 kΩ and C = 0.01μF. Calculate t_{high}, t_{low}, free running frequency and duty cycle. **(8M)**

(ii) Draw the circuit of a Schmitt trigger using 555 timer and explain its operation. (5M)

7. (i) Calculate output frequency f_o, lock range Δf_L and capture range Δf_C of a 565 PLL if $R_T = 10k\Omega$, $C_T = 0.01\mu F$ and $C=10\mu F$. (6M)

(ii) Determine the dc control voltage v_c at lock if signal frequency f_s = 10kHz, VCO free running frequency is 10.66 kHz and the voltage to frequency transfer coefficient of VCO is 6600 Hz/V. (5M)

8. (i) A counting ADC uses a 7 bit DAC. The MSB of DAC output voltage is +5V. (i) If the analog input voltage is +6.85V, what will be R-2R ladder output voltage when the clock stops? (ii) What is the number of clock pulses that occur between the release of reset and stopping of the clock? (7M)

(ii) What is conversion time of a 10bit successive approximation ADC if its input clock is 5MHz? (3M)

(iii) Assume that comparator/logic delays, amplifier settling times, and other factors require 0.4 μs total in a particular IC fabrication technique. If this technology is used to create AD converters, determine the maximum conversion time for the following 8-bit converters: (i) Flash type (ii) Successive approximation (iii) Counter type. (6M)

9. (i) Explain in detail about dual slope ADC with neat diagram. (5M)

(ii) A dual slope ADC uses an 18 bit counter with a 5MHz clock. The maximum input voltage is +12V. The maximum integrator output voltage at 2^N count is -10V. If the analog input is +5.237V, determine the digital number in binary which represents the count in the register. (3M)

-------All the Best------

Roll No.								

National Institute of Technology Goa

3rd yr B.Tech
ECE
6th Sem

Programme Name: B.Tech.

End Semester Examinations, April/May 2018

Course Name: **Digital Communication**
Date: 03/05/2018
Duration: 3 Hours

Course Code:EC353
Time:2:00-5:00 PM
Max. Marks: 100

ANSWER ALL QUESTIONS

[2*10=20]

1.

(a) Determine minimum sampling rate necessary to sample and perfectly reconstruct the signal $x(t) = \frac{\sin(6280t)}{6280t}$

(b) What is a matched filter?

(c) Draw the signal space diagram for QAM signal for M=8.

(d) Draw the NRZ and RZ code for the digital data 10110001.

(e) How does pulse shaping reduce inter symbol interference?

(f) A binary PAM wave is to be transmitted over a baseband channel with an absolute maximum bandwidth of 100 kHz. The bit duration is $10\mu s$. find a rasied-cosine spectrum that satisfies these requirements.

(g) What is the code rate of the parity check code?

(h) Find Hamming distance between the codes 10001101 and 10011001.

(i) What is the theoretical minimum system bandwidth needed for a 10 Mbps signal using 16-level PAM without ISI?

(j) Assume that in a binary digital communication system, the signal component out of the correlator receiver is $a_r(T) = \pm 1$ V with equal probability. If the Gaussian noise at the correlator output has unit variance, find the probability of a bit error.

2. In the compact disc (CD) digital audio system, an analog signal is digitized so that the ratio of the peak-signal power to the peak-quantization noise power is at least 96 dB. The sampling rate is 44.1 killosamples/s. [5]

(a) How many quantization levels of the analog signal are needed?

(b) How many bits per sample are needed for the number of levels found in part (a)?

(c) What is the data rate in bits/s?

3. The autocorrelation function of a stochastic process $X(t)$ is $\Phi_{xx}(\tau) = 1/2N_0\delta(\tau)$. Suppose $x(t)$ is the input to an ideal band-pass filter having bandwidth B Hz. Determine the noise power at the output of the filter. [5]

4. Consider the case of binary signaling over an AWGN channel in a bit interval $[0, T]$ with waveforms $s_1(t) = A\left(\frac{t^2}{\alpha^2 T^2} - 1\right) rect\left(\frac{t-(T/2)}{T}\right)$ (for symbol '1') and $s_0(t) = B\left(1 - \frac{4}{T^2}\left(t - \frac{T^2}{2}\right)\right) rect\left(\frac{t-(T/2)}{T}\right)$ (for symbol '0'), where the received signal is given by $x(t) = s_1(t) + w(t)$ if symbol '1' is transmitted and $x(t) = s_0(t) + w(t)$ if symbol '0' is transmitted. $0 \leq t \leq T$, $A > 0$, $B > 0$, $0 < \alpha < 1$. The aqdditive noise $w(t)$ is a real valued zero-mean white Gaussian random process with p.s.d. $N_0/2$. The MAP receiver makes the decision i.e. $\int_0^T x(t)h(t)dt$ is compared with λ_{MAP}. The apriori probability of occurrence of symbol '0' is p_0. The waveforms $s_1(t)$ and $s_0(t)$ are *orthogonal*, and $s_1(t)$ and $s_0(t)$ have the same energy. h(t) is chosen so as to minimize P_e and satisfies $h(0) = -A/2$.

(a) Find the value of α and Find B in terms of A [6]

(b) Sketch the plots of $s_1(t)$ and $s_0(t)$, labeling the relevant portions in terms of A, T, and t. Find $h(t)$ in terms of A, T, and t. [4]

(c) if $\lambda_{MAP} = \frac{N_0}{2} \ln\left(\frac{2}{3}\right)$, then calculate p_0. [4]

(d) For the values of the parameters obtained in (a), (b), and (c), find P_e in terms of A, T, and N_o. Calculate P_e when $A^2T = 9N_o$. [6]

5. Explain Binary PSK and QPSK with corresponding equations and constellation diagrams. [10]

6. [8]

(a) A pair of signals $s_i(t)$ and $s_k(t)$ have a common duration T. Show that the inner product of this pair of signals is given by

$$\int_0^T s_i(t)s_k(t)dt = \mathbf{s_i}^T\mathbf{s_k}$$

where $\mathbf{s_i}$ and $\mathbf{s_k}$ are the vector representation of $s_i(t)$ and $s_k(t)$, respectively.

(b) As followup to part (a), show that

$$\int_0^T (s_i(t) - s_k(t))^2 dt = ||\mathbf{s_i} - \mathbf{s_k}||^2$$

7. Consider a DMS source with source probabilities $\{0.35, 0.26, 0.19, 0.074, 0.04, 0.04, 0.03, 0.02\}$. [8]

(a) Find a binary Huffman code for X.

(b) Find the expected code length for this encoding and compare with the entropy of the random variable.

(c) What is the minimum length of any fixed length code for this random variable.

8. Consider the optimum detection of the sinusoidal signal

$$s(t) = \sin\left(\frac{8\pi t}{T}\right), \quad 0 \leq t \leq T$$

in additive white Gaussian noise.

(a) Determine the correlator output assuming a noiseless input. [4]

(b) Determine the corresponding matched filter output, assuming that the filter includes a delay T to make it causal. [6]

(c) Hence show that these two outputs are the same only at time instant $t = T$. [2]

9. Let P_{eI} and P_{eQ} denotes the probabilities of symbol error for the in-phase and quadrature channels of a narrowband digital communication system. Show that the average probability of symbol error for the overall system is given by [4]

$$P_e = P_{eI} + P_{eQ} - P_{eI}P_{eQ}$$

10. An FSK system transmits binary data at the rate of 2.5 Mbps. During the course of transmission, white Gaussian noise of zero mean and power spectral density 10^{-20} W/Hz is added to the signal. In the absence of noise, the amplitude of the received sinusoidal wave for digit 1 or 0 is 1 mV. Determine the average probability of symbol error for the following system configuration: [8]

(a) Coherent binary FSK

(b) Coherent MSK

(c) Noncoherent binary FSK

ALL THE BEST

Roll No								

National Institute of Technology Goa

Farmagudi, Ponda, Goa 403401

Programme Name: B. Tech.

End Semester Examination, April 2018

3rd yr B. Tech
ECE
6th Sem

Course Name: **Wireless Communication**

Date: 02/05/2018

Duration: 3 Hours

Course Code: **EC351**

Time: 02:00 PM-05:00 PM

Max. Marks: 100

!!ANSWER ALL QUESTIONS!! **ATTEMPT PART WISE!!**

Part-A

QA1: Even though a mobile station (MS) is stationary, the received signal from the base station (BS) fluctuates with time. Why? What will be the distribution of envelop of channel gain if there is a strong line-of-sight (LOS) between MS and BS. **[5]**

QA2: Consider a 5G communication system that is operating in an urban shadowed area (pathloss exponent $n = 5$) with carrier frequency 6 GHz, transmit power $P_t = 0.01$ W, unity antenna gains and unity system loss. Using log-distance path loss model, calculate the mean received signal strengths in dBm at distances $d_0 = 10$ m and $d = 500$ m. Further, if there is a log-normal shadowing with standard deviation $\sigma = 4$ dB, calculate the probability that the received signal power at d is 3 dBm more than the mean received signal power. **[5]**

QA3: If there are t transmit and r receive antennas, show that a total of t parallel independent streams of information can be created in an $r \times t$ MIMO system. **[5]**

QA4: Let for a wireless environment, the observed power profile in dB is given as

$$P_{dB}(0) = -20\text{dB}, P_{dB}(3) = -3\text{dB}, P_{dB}(4) = 0\text{dB}, P_{dB}(5) = 0\text{dB}, P_{dB}(7) = -3\text{dB}, P_{dB}(8) = -40\text{dB},$$

where time is in μs (time instants which are not mentioned have gain $-\infty$ dB). Calculate the coherence bandwidth of the channel. **[5]**

Part-B: Wireless Propagation

QB1: For given path loss exponent (a) $n = 4$ and (b) $n = 3$, find the frequency reuse factor and the cluster size that should be used for maximum capacity. The signal-to-interference ratio of 15 dB is minimum required for satisfactory forward channel performance of a cellular system. There are six co-channel cells in the first tier, and all of them are at the same distance from the mobile node. Use appropriate approximations. **[10]**

QB2: Draw the GSM architecture and explain each of the subsystems in detail. **[10]**

QB3: Consider a wireless system with binary signaling scheme that transmit a square pulse of duration T_b with amplitude $+\sqrt{E_b}$ and $-\sqrt{E_b}$, for symbols 1 and 0, respectively. Fading gain h of the channel is expressed as $h = X + jY$, where X and Y are both i.i.d. random variables with a Gaussian distribution having zero mean and variance $1/2$. Additive noise follows a Gaussian distribution with zero mean and variance σ_n^2. Show that the average BER of the system is given by $P_e = 0.5\left(1 - \sqrt{\frac{\Gamma}{1+\Gamma}}\right)$ for equi-probable symbols where Γ is signal to noise ratio and is given by E_b/σ_n^2. **[10]**

QB4: Show that the received power at a distance of d from the transmitter for the two-ray ground bounce model can be expressed as: $P_r = P_t G_t G_r \frac{h_t^2 h_r^2}{d^4}$ **[10]**

QB5: Show that in a 1×2 system it is possible to achieve diversity of order 2 without any pre-coding at the transmitter side. What is this technique called? For the channel coefficients $h_{11} = 1 - \sqrt{3}j$ and $h_{12} = -1 + \sqrt{2}j$, show that using this technique, the instantaneous SNR can be improved by 4 times without increasing average transmit power. **[10]**

Part-C:

QC1: Minimum mean-squared error (MMSE) receiver

QC1.1 What is the main disadvantage of the zero-forcing (ZF) receiver? Derive an expression for the linear combiner matrix of MMSE receiver and show that it can overcome the disadvantage pose by the ZF receiver. Why MMSE is called matched filter receiver in high SNR? **[10]**

QC1.2 Can successive interference cancellation (SIC) technique improve the performance of ZF and MMSE receiver further? Explain the best way to implement SIC in MIMO receiver. **[5]**

QC2: CDMA system

QC2.1: Consider an **uplink** scenario in a CDMA system with $U + 1$ users having $x_0, x_1, \ldots, x_U$ as information symbols and $\alpha_0, \alpha_1, \ldots, \alpha_U$ as their corresponding codes. Chip length is K and symbol power transmitted by any user, i, is P_i. Let the dispersive channel has D taps with channel vector between any user i and BS denoted by $\mathbf{c}_i=[c_i(0), c_0(1), \ldots c_0(D-1)]^T$. Further, the additive noise in this system follows a Gaussian distribution with zero mean and variance σ_n^2. Assuming that the CDMA system has RAKE receiver followed by the MRC combiner, calculate the SINR at the output of the receiver. **[10]**

QC2.2: What will happen to SINR if the clock at the receiver is not synchronized to the transmitter in CDMA? Assuming that the clock delay is a uniform random variable within $0 < t < T_c$, provide an analytical proof for your answer. **[5]**

* * *ALL THE BEST * **

Roll No									

National Institute of Technology Goa

Programme Name: B.Tech.

End Semester Examination, May-2018

Department of Electronics & Communication Engineering

3rd yr B. Tech ECE 6th Sem.

Course Name: **Object Oriented Programming** Course Code: CS252

Date: 01.05.2018 Time: 2:00-5:00PM

Duration: 3 Hours Max. Marks: 100

ANSWER ALL QUESTIONS

1. (a) Write a C++ program to convert a 2×2 matrix into 3×3 matrix, where a new row element is obtained by adding all elements in that row, a new column element is obtained by adding all elements in that column and the diagonal element is obtained by summing all diagonal elements of given 2×2 matrix. [5M]

   (b) Private attributes cannot be inherited. State a remedy for this problem so that attributes of a class behave like private attributes but can be inherited. Explain with an example. [5M]

2. (a) Create a C++ class called *Volume* which contains a method called *find_vol*(). Write down appropriate code to create two objects *sphere* and *cylinder* of the above class and implement function overloading to calculate volume of a sphere and cylinder based upon user input. [5M]

   (b) Create a C++ class *complex* with real and imaginary parts as member variables, member function *get*() and *disp*() to input and display a complex number respectively. Write a program using the above class to overload + and - operators to perform addition and subtraction of two complex numbers. [5M]

3. Consider the following code snippet:

```
class Test
{
    char paper[20];
    int marks;
public:
    Test ()     // Function 1
    {
        strcpy (paper, "Computer");
        marks = 0;
```

```
    }

    Test (char p[])     // Function 2
    {
        strcpy(paper, p);
        marks = 0;
    }

    Test (int m)     // Function 3
    {
        strcpy(paper,"Computer");
        marks = m;
    }

    Test (char p[], int m)     // Function 4
    {
        strcpy (paper, p);
        marks = m;
    }
};
```

i. Write statements in C++ that would execute Function 1, Function 2, Function 3 and Function 4 of class Test. [5M]

ii. Which feature of Object Oriented Programming is demonstrated using Function 1, Function 2, Function 3 and Function 4 together in the above class Test? [5M]

4. Define a C++ class to represent a book in a library. Include the following data members: *BookNumber*, *BookName*, *Author*, *Publisher*, *Price*, *No.ofcopiesissued*, *No.ofcopies*. Write member functions to

   (a) Assign initial values

   (b) Issue a book after checking for its availability

   (c) Return a book

   (d) Display book information.

   [10M]

5. Assuming that a text file named FIRST.TXT contains some text written into it, write a function named vowelwords(), that reads the file FIRST.TXT and creates a new file named SECOND.TXT, to contain

only those words from the file FIRST.TXT which start with a lowercase vowel (i.e., with 'a', 'e', 'i', 'o', 'u'). For example, if the file FIRST.TXT contains "Carry umbrella and overcoat when it rains", then the file SECOND.TXT shall contain "umbrella and overcoat it". [10M]

6. (a) What are the advantages of exception handling over traditional error handling? [4M]

   (b) Implement exception handling(C++) for the *Fraction* class, which is used to represent fractions. Dividing by 0 throws an exception that affects the constructor for the *Fraction* class. If the value of the denominator is 0, a DivisionByZero type exception should be thrown. Create several fractions, including some with a numerator value of 0 and one with 0 as its denominator. The exception handler should issue a message indicating the exception. [6M]

7. Predict the output of the following programs. Justify your answer.

(a)
```
#include<iostream>
using namespace std;

class Base
{
public:
    int fun()  { cout << "Base::fun() called"; }
    int fun(int i)  { cout << "Base::fun(int i) called"; }
};

class Derived: public Base
{
public:
    int fun() {  cout << "Derived::fun() called"; }
};

int main()
{
    Derived d;
    d.fun(5);
    return 0;
}
```

[2M]

(b)
```
#include<iostream>
using namespace std;
```

```
class Base
{
protected:
    int a;
public:
    Base() {a = 0;}
};

class Derived1:  public Base
{
public:
    int c;
};


class Derived2:  public Base
{
public:
    int c;
};

class DerivedDerived: public Derived1, public Derived2
{
public:
    void show()  {   cout << a;  }
};

int main(void)
{
    DerivedDerived d;
    d.show();
    return 0;
}
```

[2M]

(c)
```
#include<iostream.h>
int count=0;
class obj
```

```
{
public :
obj(){count++;}
~obj(){count--;}
};
int main()
{
obj A,B,C,D,E;
obj F;
{
obj G;
}
cout<<count;
return 0;
}
```

[3M]

(d)
```
#include <iostream>
using namespace std;

class Test {
public:
   Test() { cout << "Constructing an object of Test " << endl; }
  ~Test() { cout << "Destructing an object of Test "  << endl; }
};

int main() {
  try {
    Test t1;
    throw 10;
  } catch(int i) {
    cout << "Caught " << i << endl;
  }
}
```

[3M]

8. (a) Inheritance is a feature of object oriented programming system, by which a class can inherit the commonly used properties/features of another classes. Compare and contrast inheritance in C++ and JAVA.

[5M]

(b) What is wrong with the following code?

```
#include<iostream.h>
class Base
{
public :
Base(){};
virtual ~Base(){};
};
class Derived : protected Base
{
public:
virtual ~Derived(){};
};
int main()
{
Base *pb = new Derived();
return 0;
}
```

[5M]

9. (a) Write a Java program to input any number in a text box and print the sum of its odd factors only. Example:- If number is 36 then its factors are $1, 2, 3, 4, 6, 9, 12, 18$ and sum of its odd factors is $1 + 3 + 9 = 13$. [5M]

   (b) Write a Java program to identify common elements or numbers between two given arrays. You should not use any inbuilt methods to find common values. [5M]

10. (a) Write a C++ class T which contains a const integer field n. T should also have constructor(s) which initialise n to an integer argument passed as a parameter or to zero if no argument is given; T should also have a destructor. The constructor(s) and destructor should print the value of the n field of the object being constructed or destructed. Indicate why, or why not, any of your fields or methods are qualified with virtual. [5M]

    (b) Explain how objects of class T are allocated and deallocated, for each of the three areas: heap, stack and static store, noting one case where appropriate use of virtual is essential. What, if any, overlap in programmer convenience is there between stack-allocated objects with destructors and try-finally in Java? [5M]

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NATIONAL INSTITUTE OF TECHNOLOGY GOA

Farmagudi, Ponda, Goa, 403401

Programme Name: B.Tech.

End Semester Examinations, April-May 2018

3rd yr B.Tech ECE 6th Sem

Course Name: Communication Network
Date: 28-04-2018
Duration: 3 Hours

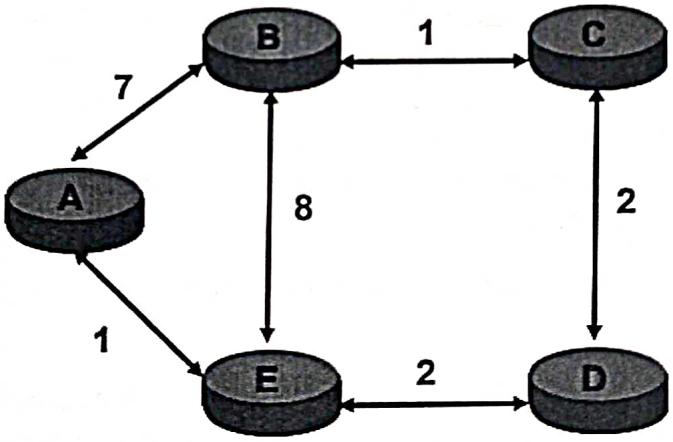
Course Code: EC354
Time: 2 PM
Max. Marks: 100

ANSWER ALL QUESTIONS

Q1. In MAC protocols, we have come across three generations of Carrier Sense Multiple Access protocols - the original CSMA, CSMA/CD, and CSMA/CA. Based on your knowledge to these variants of CSMA MAC protocols, answer the following questions. **[10 M]**

(a) How does CSMA/CD work in principle?
(b) Can frames collide in CSMA and how? What is the problem in CSMA that CSMA/CD is trying to resolve?
(c) How does CSMA/CA work in principle?
(d) How can collisions be detected? What is the problem in CSMA/CD that CSMA/CA is trying to resolve?
(e) What is the limit on the minimum frame size in CSMA/CD? Explain with example.

Q2. Find the least cost route for the below network using distance vector routing algorithm. **[10 M]**



Q4. How many devices can communicate simultaneously in the bluetooth technology? If additional device needs to be connected with the network, how it can be achieved? **[5 M]**

Q5. Find the minimum frame length in bytes for a 2 Mbps bit rate and 1.5 km long network where maximum propagation delay is 4.25 nano seconds per meter. **[5 M]**

Q6. Based on your understanding of TCP/IP architecture model, answer the following:

(a) What is the network-layer mechanism that allows a host to dynamically obtain an IP address, i.e., creating a host-IP mapping, when it joins a network?
(b) Which is the link-layer mechanism that allows a host to look up the ethernet address for a particular IP address? **[5 M]**

Q7. The transport layer uses TCP to provide reliable communication. For the TCP header in hexadecimal form: 05320017000000010000000500207FF00000000. What is
(a) Sequence no.,
(b) Acknowledgement no.,
(c) Length of the header,
(d) Window size,
(e) Checksum **[10 M]**

Q8. Match the following:

Field	Length (bits)
A. UDP header's port number	I. 48
B. Ethernet MAC address	II. 8
C. IPv6 Next Header	III. 32
D. TCP Header's sequence number	IV. 16

[5 M]

Q9. The error detection technique, CRC is used to provide reliable communication. Find CRC bits for the following message M = 1010001101 using the divisor polynomial $x^5 + x^4 + x^2 + 1$. **[5 M]**

Q10. NIT Goa is granted a block of addresses with the beginning address 14.24.74.0/24. Institute needs to have three sub blocks of addresses to use in its three subnets: one sub block of 10 addresses, one sub block of 60 addresses, and one sub block of 120 addresses. Design the sub blocks by starting with the largest block of address. **[5 M]**

Q11. Consider an IP packet with a length of 4500 bytes that includes 20 byte IPv4 header. The packet is forwarded to an IPv4 router that supports a Maximum Transmission Unit (MTU) of 600 bytes. Assume that the length of the IP header in all the ongoing fragments of this packet is 20 bytes. Find the value of relevant fields such as flag register, datagram length, offset value, identifier for each fragment because router has to do fragmentation before forwarding the packet on the link? **[10 M]**
[Hint: Offset value must be integer.]

Q12. For 11-bit data word 00100101010, generate the corresponding Hamming code word using even parity and odd parity. **[10 M]**

Q13. Consider a system generating 20 bit frames and connected through a shared 20kbps channel. Find throughput in percent if slotted ALOHA is used and frame rate is 1000 frames per second. **[5 M]**

Q14. Calculate the checksum (take block of 16 word bits) of the following data word given in hexadecimal format: FFABBCD00010EE99AAAA00000000CCDD. **[5 M]**

Q15. The value of HLEN is 5, in an IPv4 packet, and value of the total length field is $(0028)_{16}$. How many bytes of data are being carried by this packet? **[5 M]**

Q16. If a class B network on the Internet has a subnet mask of 255.255.248.0, what is the maximum number of hosts per subnet? **[5 M]**

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NATIONAL INSTITUTE OF TECHNOLOGY GOA

Farmagudi, Ponda, Goa, 403401 3rd yr.

Programme Name: B.Tech.-ECE 6th Sem

Mid Semester Examinations, February-2018 B. Tech. ECE

Course Name: Linear Integrated Circuits
Date: 01-03-2018
Duration: 1 hour 30 Minutes

Course code: EC352
Time: 9.30AM - 11.00 AM
Max. Marks: 50

ANSWER ALL QUESTIONS

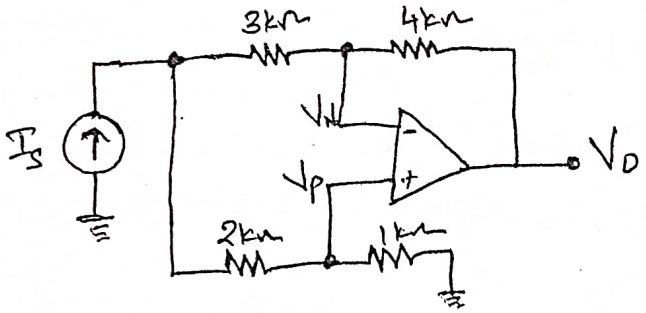
1. (i) A 741C opamp is used as an inverting amplifier with a gain of 25. The voltage gain vs frequency curve of 741C is flat upto 10kHz. What maximum peak to peak input signal can be applied without distorting the output? (3M)

   (ii) The LM312 opamp is used as an inverting amplifier with the following specifications: $\frac{\Delta V_{ios}}{\Delta T} = 30\mu V/^{\circ}C; \frac{\Delta I_{os}}{\Delta T} = 10nA/^{\circ}C$, $R_1 = 1k\Omega; R_f = 4.7k\Omega$. Assume that amplifier is nulled at 25°C. A sine wave of 10mV peak amplitude at 100Hz is applied. Draw the output voltage waveform at 25°C and 45°C. (5M)

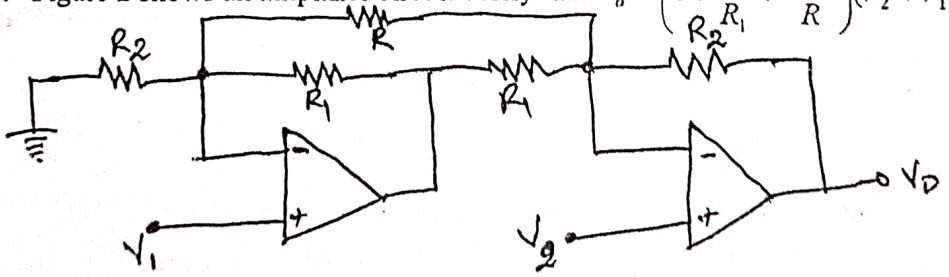
   (iii) Sketch the transconductance and transresistance amplifiers circuit also derive expressions for their source to load. (8M)

2. (i) Find V_N, V_P and V_o in the circuit of Figure 1 if I_S = 1 mA.(3M)

   (ii) Find a resistance R that when connected in parallel with the 1 mA source will cause V_o to drop to half the value found in (i). (3M)



3. Figure 2 shows an amplifier circuit verify that $V_o = \left(1 + \frac{R_2}{R_1} + \frac{2R_2}{R}\right)(V_2 - V_1)$. (5M)



4. In the Schmitt trigger circuit, V_o = 8V, V_{UT} = 4V and V_{LT} = 3V. Calculate R_1/R_2 and V_{ref}. Also calculate the value of V_{ref} so that V_{LT} is negative and calculate V_{ref} for $V_{UT} = -V_{LT}$. (6M)

5. For the circuit shown in Figure 3, what is the condition of each of the LEDs for (i) V_i = 1V (ii) V_i = 2V. (5M)

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NATIONAL INSTITUTE OF TECHNOLOGY GOA

Farmagudi, Ponda, Goa, 403401 3rd yr.
Programme Name: B.Tech.-ECE 6th Sem
Mid Semester Examinations, February-2018 B. Tech. ECE

Course Name: Linear Integrated Circuits
Date: 01-03-2018
Duration: 1 hour 30 Minutes

Course code: EC352
Time: 9.30AM - 11.00 AM
Max. Marks: 50

ANSWER ALL QUESTIONS

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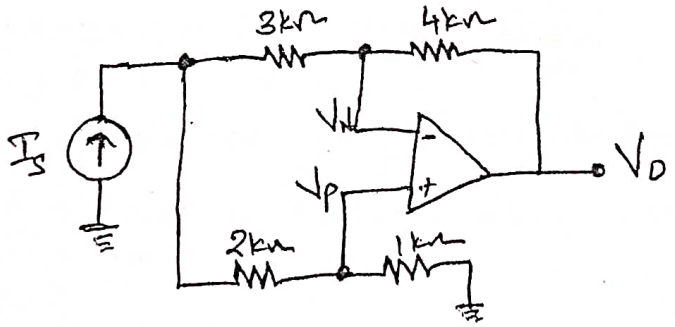
   (ii) Find a resistance R that when connected in parallel with the 1 mA source will cause V_o to drop to half the value found in (i). (3M)



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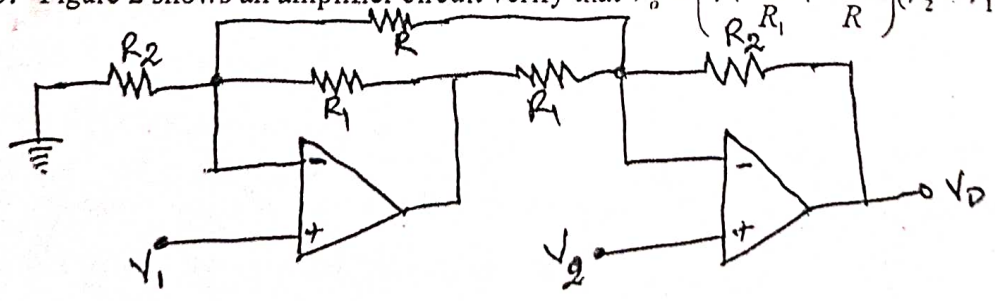

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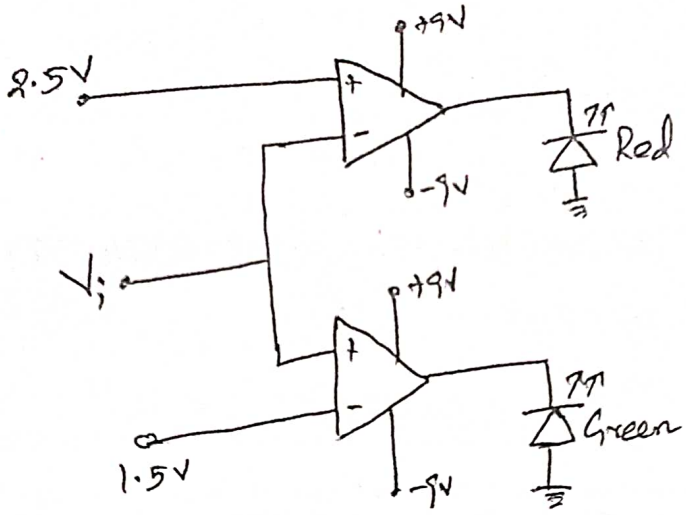

6. Draw the circuit of a clipper which will clip the input signal below the reference voltage. (5M)
7. An amplifier circuit of Figure 4 is used to amplify the output of a balanced microphone. The output of the microphone is 6 mV peak (12mV differential), and a common-mode hum signal is induced into the lines at 10 mV peak (0 mV differential). If the system has a CMRR of 100 dB, what is the output signal? (7M)

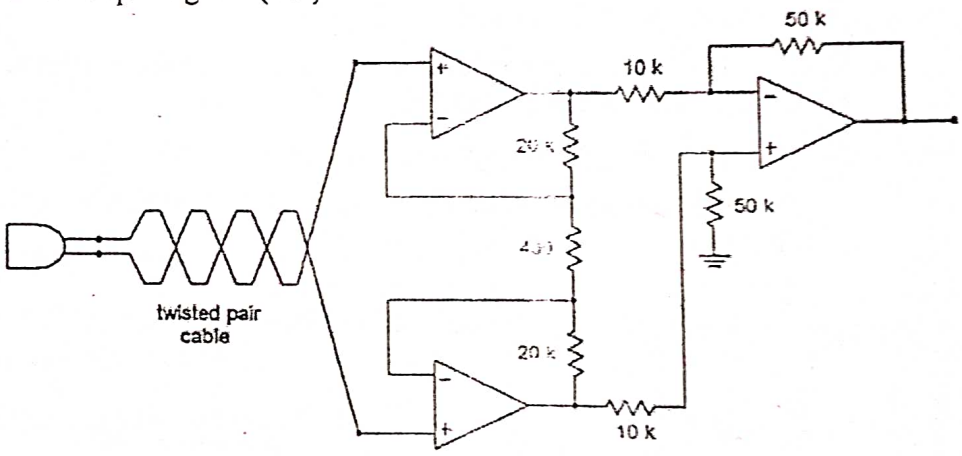

Figure 4. Amplifier circuit for Prob 7.

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NATIONAL INSTITUTE OF TECHNOLOGY GOA

Farmagudi, Ponda, Goa, 403401

Programme Name: B.Tech.

Mid Semester Examinations, February- 2018

3rd yr. 6th Sem B. Tech ECE

Course Name: **Digital Communication** Course Code:EC353

Date: 28/02/2018 Time:09:30-11:00 AM

Duration: 1 Hour 30 minutes Max. Marks: 50

ANSWER ALL QUESTIONS

1. [2X5=10]

(a) Define aperture effect in flat-top sampling.

(b) Determine the adequate sampling frequency to recover the original signal from the sampled of a band pass signal with frequency range of 10 MHz to 10.5 MHz.

(c) A speech signal has a total duration of 25s. It is sampled at the rate of 8 kHz and then encoded using PCM. The signal-to-quantization (SQNR) is required to be 45 dB. Calculate the minimum storage capacity needed to accommodate this digitized speech signal.

(d) State the condition when both ML and MAP criterion are same and define the average probability of error under that condition.

(e) How antipodal signaling improves the performance of a MAP receiver in AWGN channel?

2. Let X_r and X_i be statistically independent zero-mean Gaussian random variables with identical variance. Show that a (rotational) transformation of the form

$$Y_r + Y_i = (X_r + X_i)\exp(j\phi)$$

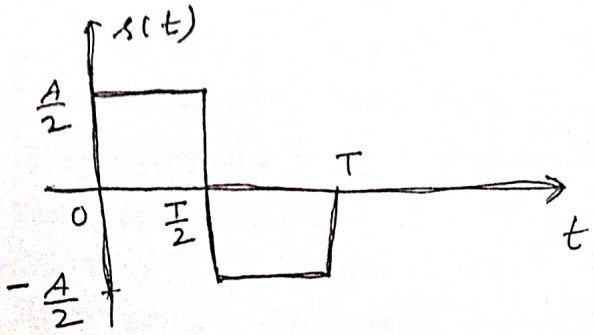
results in another pair (Y_r, Y_i) of Gaussian random variables have the same joint pdf as the pair (X_r, X_i). [6]

3. Consider the signal $s(t)$ shown in Fig. below. [2+2+1=5]

(a) Determine the impulse response of a filter to this signal and sketch it as a function of time.

(b) plot the matched filter output as a function of time.

(c) What is the peak value of the output?



4. Twenty four voice signals are sampled uniformly and then time-division multiplexed. The sampling operations uses flat-top samples with 1 μs duration. The multiplexed operation includes provision for synchronization by an extra pulse of sufficient amplitude and also 1 μs duration. the highest frequency component of each voice signal is 3.4 kHz. [2+2=4]

   (a) Assuming a sampling rate of 8 kHz, calculate the spacing between succesive pulses of the multiplexed signal.

   (b) Repeat your calculation assuming the use of Nyquist rate sampling.

5. Consider a sine wave of frequency f_m and amplitude A_m, which is applied to a delta modulator of step size Δ. Show that slope overload distortion will occur if

$$A_m > \frac{\Delta}{2\pi f_m T_s}$$

   whee T_s is the sampling period. What is the maximum power that may be transmitted without slope-overload distortion? [5]

6. Find $h(t)$ in a correlator receiver, supported in $[0, T_b]$, such that the probability of error P_e is minimum in AWGN noise with power spectra density of $N_0/2$, where the threshol $\lambda = \frac{1}{2}\int_0^{T_b}[s_0(t) + s_1(t)]h(t)dt$, $\int_0^{T_b}[s_0(t) - s_1(t)]h(t)dt > 0$. The pulses $s_0(t)$ and $s_1(t)$ are the pulses used for binary 0 and 1 and T_b is the bit duration. [10]

7. A continuous-time signal is sampled and then transmitted as a PCM signal. The random variable at the input of the decision device in the receiver has a variance of 0.01 volts^2. [5+5=10]

   (a) Assuming the use of polar NRZ signaling, determine the pulse amplitude that must be transmitted for the average error rate not to exceed 1 bit in 10^8 bits.

   (b) If the added presence of interference causes the error rate to increase to 1 bit in 10^6 bits, what is the variance of the interference.

   Note: use loose bound of Q-function as $Q(x) \leq \frac{1}{2}\exp(-x^2/2), x > 0$. For small value of x, the function is approximated as $Q(x) < \frac{1}{\sqrt{2\pi}x}\exp(-x^2/2)$

* * *ALL THE BEST * **

Roll No								

National Institute of Technology Goa

Farmagudi, Ponda, Goa 403401

Programme Name: B.Tech.

Mid Semester Examinations, February 2018

3rd yr
6th Sem
B. Tech ECE

Course Name: Wireless Communication
Date: 27/02/2018
Duration: 1 Hr 30 Min

Course Code: EC351
Time: 9:30-11:00 AM
Max. Marks: 50

!!ANSWER ALL QUESTIONS!! ATTEMPT PART WISE!!

Part-A

QA1: In wireless communication systems, it is observed that the instantaneous received signal strength fluctuates. What is the term for such behavior in communication theory? Also, explain the reason behind the fluctuations. [4]

QA2: Under what conditions a communication system is said to follow Rayleigh fading? Explain mathematically that in such fading environment, envelop and phase of the channel are having independent distributions. [4]

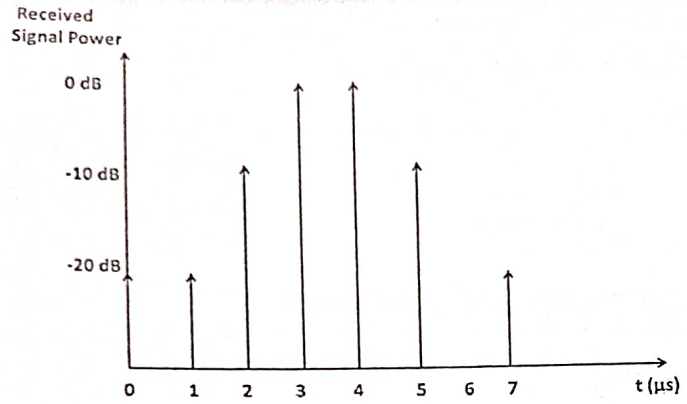
QA3: What is a "DEEP FADE" event? For a log-normal channel with envelop distribution $f_R(r) = \frac{1/r}{\sqrt{2\pi\sigma_r^2}} \exp\left(-\frac{1}{2}\left(\frac{\ln(r)-\mu_r}{\sigma_r}\right)^2\right)$, calculate the probability of deep fade event if the average noise power is σ_n^2. [4]

QA4: Define the terms (i) Doppler spread and (ii) coherence bandwidth. Consider a mobile station communicating with a carrier frequency of 1800 MHz and it is moving at a speed of 80 km/h at an angle of $\theta = 5$ degrees towards the base station. Calculate (i) Doppler spread, (ii) received frequency, and (iii) coherence time. [4]

QA5: Consider a WCDMA communication system that is operating in an urban shadowed area (pathloss exponent $n = 5$) with carrier frequency 2100 MHz, transmit power $P_t = 0.01$ W, unity antenna gains and unity system loss. Using log-distance path loss model, calculate the mean received signal strengths in dBm at distances $d_0 = 100$ m and $d = 1000$ m. Further, if there is a log-normal shadowing with standard deviation $\sigma = 6$ dB, calculate the probability that the received signal power at d is 5dBm more than the mean received signal power. [4]

Part-B

QB1: Power profile of a multipath wireless channel is shown in figure below. Calculate (i) maximum delay spread, (ii) average delay spread, (iii) RMS delay spread, and (iv) coherence bandwidth. [5]



QB2: Cellular Technology

QB2.1: Define the dwell time and explain how the first and second generation mobile systems have different hand-off strategies? [4]

QB2.1 The coverage area of a cellular system is 200 sq km with each cell having radii of 5 sq km, and there are total of 1000 radio channels available for handling the traffic. (a) Calculate the system capacity for 7 cell reuse. (b) If $N = 4$, how many times the cluster has to be replicated in order to approximately cover the entire cellular area? Calculate the system capacity for the given case. (c) Does decreasing the cluster size increase the system capacity? Explain your answer? [1+3+2=6]

QB3: Diversity systems:

QB3.1: For a receive diversity system employing MRC at the receiver, starting from received signal vector ($\underline{y} = \underline{h}x + \underline{n}$), show that the beam-former vector $\underline{w}$ is given by

$$\underline{w} = \frac{\underline{h}}{||\underline{h}||},$$

where $||\underline{h}||$ denote the norm of channel vector $\underline{h}$, $\underline{y}$ denote the received signal vector, and $\underline{n}$ denote the noise vector having zero mean vector and covariance matrix $\sigma_n^2 \mathrm{I}$. Also, calculate the maximum SNR at the output of MRC. [10]

QB3.2: You have been assigned a job to develop a transmit diversity system with 2 transmit and 1 receive antennas. How would you model the system? Is it possible to achieve diversity for such system at all? Justify your answer with proper algebra. [5]

ALL THE BEST

Roll No									

National Institute of Technology Goa

Farmagudi, Ponda, Goa 403401

Programme Name: B.Tech. (ECE)

Mid Semester Examinations, February 2018

3rd yr
6th Sem
B.Tech ECE

Course Name: **Object Oriented Programming** | Course Code: CS252

Date: 26/02/2018 | Time: 3:30-5:00PM

Duration: 1 hour 30 min | Max. Marks: 50

ANSWER ALL QUESTIONS

1. (a) What is the purpose of the scope resolution operator? [3M]

   (b) Compare and contrast the notions of struct and class in C++. [3M]

   (c) Compare and contrast dynamic memory allocation using the C++ operators new and delete, with dynamic memory allocation using the C Standard Library functions malloc and free. [4M]

2. Define a class to represent a bank account. Data members should include the depositors name, the account number (use a string), and the balance. Member functions should allow the following:

   (a) Initializing the object.

   (b) Displaying the depositors name, account number, and balance.

   (c) Depositing an amount of money given by an argument.

   (d) Withdrawing an amount of money given by an argument.

   Write a C++ program that illustrates all the features. [10M]

3. Predict the output of the following programs. Justify your answer.

   (a)
```
#include <iostream>
using namespace std;
void fun(int x, int y)
{
        x = 20;
        y = 10;
}
int main()
{
        int x = 10;
        fun(x, x);
```

```
        cout << x;
        return 0;
}
```

[2M]

(b)
```
class Test {
    int x;
};
int main()
{
  Test t;
  cout << t.x;
  return 0;
}
```

[2M]

(c)
```
#include<iostream>
using namespace std;
class test {
float x, y;
public:
test(float a = 1.0, float b = 2.0)
{
        x = a;
        y = b;
}
test operator + (test & obj) {
        return test(this->x + obj.x, y + obj.y);
}
operator float () {
        return (x + y) ;
}
};
int main () {
test obj1(1.23, 4.56), obj2;
obj2 = obj1 + obj2;
cout << obj2;
return 0;
}
```

[2M]

4. Define a class Tour in C++ with the description given below.

Private Members:

TCode	of type string
No. of Adults	of type integer
No. of Kids	of type integer
Kilometers	of type integer
TotalFare	of type float

Public Members:

A constructor to assign initial values as follows:

TCode with the word NULL
No. of Adults as 0
No. of Kids as 0
Kilometers as 0
TotalFare as 0

A function AssignFare() which calculates and assigns the value of the data member Totalfare for each adult as:

Fare(Rs)	For Kilometers
500	>=1000
300	<1000 & >=500
200	<500

For each kid, the above fare will be 50% of the fare mentioned in the list. For example, if kilometers is 850, $No.\ of\ adults = 2$ and $No.\ of\ kids = 3$ then TotalFare should be calculated as $2 \times 300 + 3 \times 150 = 1050$

A function EnterTour() to input the values of the data members TCode, No. of Adults, No. of Kids and Kilometers ; and invoke the AssignFare() function.

A function ShowTour() which displays the content of all the data members for a Tour.

[10M]

5. (a) Write a C++ program to swap two numbers using

   i. call by value [2M]

   ii. call by reference. [3M]

   (b) Write a C++ program to overload function $area()$ to calculate area of circle and area of a rectangle. [3M]

P.T.O.

6. What will be the output of the following programs? Rectify the errors (if any).

(a)
```
#include<iostream>
using namespace std;
class Test
{
private:
  int x;
public:
  Test(int x = 0) { this->x = x; }
  void change(Test *t) { this = t; }
  void print() { cout << "x = " << x << endl; }
};
int main()
{
  Test obj(5);
  Test *ptr = new Test (10);
  obj.change(ptr);
  obj.print();
  return 0;
}
```

[3M]

(b)
```
#include<iostream>
using namespace std;
class P {
public:
   void print()  { cout <<" Inside P"; }
};
class Q : public P {
public:
   void print() { cout <<" Inside Q"; }
};
class R: public Q { };
int main(void)
{
  R r;
  r.print();
  return 0;
}
```

[3M]

Roll No | | | | | | | | | | |

राष्ट्रीय प्रौधोगिकी संस्थान गोवा
NATIONAL INSTITUTE OF TECHNOLOGY GOA

Farmagudi, Ponda, Goa, 403401

Programme Name: B.Tech

Mid Semester Examinations, February-2018

3rd yr
6th Sem
B.Tech ECE

Course Name: Communication Network
Date: 26.02.2018
Duration: 1 Hour 30 Minutes

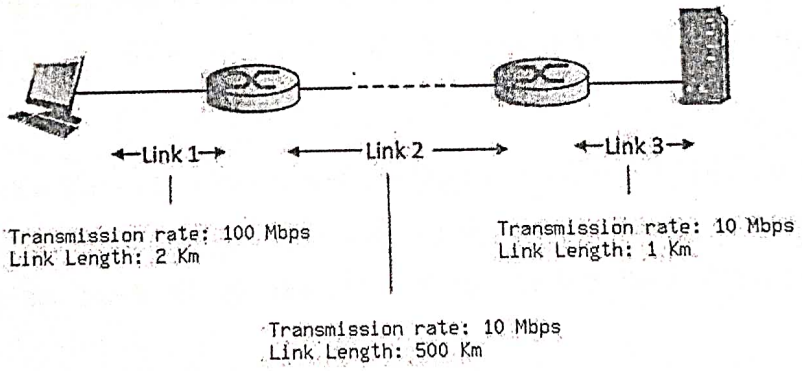
Course Code: EC 354
Time: 9.30 – 11.00 am
Max. Marks: 50

Attempt all questions. Necessary assumptions can be made with proper justification.

Q1. For the TCP header (in hex): 05320017 00000001 00000000 500207FF 00000000. Find sequence no., acknowledgement no., length of the header, window size, checksum. **[5 M]**

Q2. A link has a transmission speed of 10^6 bits/sec. It uses data packets of size 1000 bytes each. Assume that the acknowledgment has negligible transmission delay, and that its propagation delay is the same as the data propagation delay. Also assume that the processing delays and queuing delays at nodes are negligible. The efficiency of the stop-and-wait protocol is 25%. Find one-way propagation delay in milliseconds. **[5 M]**

Q3. Consider the figure below, with three links, each with the specified transmission rate and link length.



Find the end-to-end delay (including the transmission delays and propagation delays on each of the three links, but ignoring queuing delays and processing delays) from when the left host begins transmitting the first bit of a packet to the time when the last bit of that packet is received at the server at the right. The speed of propagation on each link is 3×10^8 m/sec. Assume a packet length of 4000 bits. **[5 M]**

Q4. In Go-Back-4, if every sixth packet that is being transmitted is lost and if we have to send 10 packets, then how many transmissions are required? **[5 M]**

Q5. To deliver a message to the correct application program running on a host, which address is used? Explain with an example. **[5 M]**

Q6. Suppose two hosts, A and B, are separated by 20000 km and are connected by a direct link of R=2 Mbps. Suppose the propagation speed over the link is 2.5×10^8 m/s.

(a) Calculate the bandwidth delay product.

(b) Consider sending a file of 800,000 bits from Host A to Host B. Suppose the file is sent continuously as one large message. What is the maximum number of bits that will be in the link at any given time? [10 M]

Q7. NIT Goa is granted IP address as 20.30.40.0/25. Now institute needs to assign four subnets of same sizes. Give the range of addresses for each subnet and also mention broadcast address in each subnet designed. [10 M]

Q8. Consider different activities related to email.

m1: Send an email from a mail client to a mail server
m2: Download an email from mailbox server to a mail client
m3: Checking email in a web browser

Which is the application level protocol used in each activity? [5 M]

Roll no										

National Institute of Technology Goa

Programme Name: B.Tech

End Semester Examinations, April-2016

3rd yr
6th Sem
B.Tech ECE

Course Name: Communication Network **Course Code:EC354**

Date: 29.04.2016 **Time: 2 - 5 pm**

Duration: 3 Hours **Max. Marks: 100**

ANSWER ALL QUESTIONS

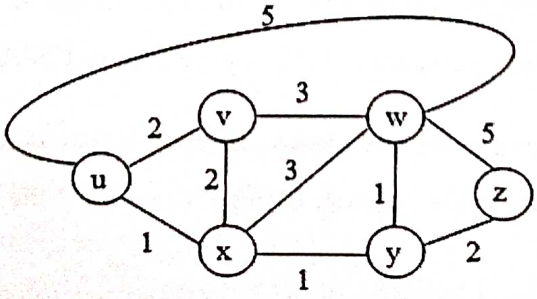
Q1. A hypothetical CSMA/CD system has three copper twisted-pair segments connected together by two repeaters. Each segment is 200 meter long. The one-way processing delay at a repeater is one microsecond. We wish to operate this system at 10 Mbps. If the speed of the signal in copper is 2×10^8 metres per second, what is the minimum size of the frame in such a system which will ensure that a collision never goes undetected? **(5 M)**

Q2. The length of a 10Base5 cable is 2500 m. If the speed of propagation in a thick coaxial cable is 2×10^8 m/s, how long does it take for a bit to travel from the beginning to the end of the network? Assume there is a 10 μs delay in the equipment. **(5 M)**

Q3. In the Standard Ethernet with the transmission rate of 10 Mbps, we assume that the length of the medium is 2500 m and the size of the frame is 512 bits. The propagation speed of a signal in a cable is 2×10^8 m/s. **(5 M)**

Q4. NIT Goa is granted a block of addresses with the beginning address 14.24.74.0/24. Institute needs to have 3 sub blocks of addresses to use in its three subnets: one sub block of 10 addresses, one sub block of 60 addresses, and one sub block of 120 addresses. Design the sub blocks by starting with the largest address. **(10 M)**

Q5: Find the shortest route for the given network: **(a)** using Dijkstra's algorithm by considering *u* as a source node, **(b)** based on distance vector routing algorithm, construct table which contains least costs by considering one node as source node at a time and remaining nodes as destination. **(2 × 5 M)**



Q.6 The value of HLEN is 5, in an IPv4 packet, and value of the total length field is $(0028)_{16}$. How many bytes of data are being carried by this packet? **(5 M)**

Q7: A packet in IPv4 has arrived with the first 8 bits as $(01000010)_2$. The receiver discards the packet. Explain why? **(5 M)**

Q8: Some CSMA/CD system has four copper twisted-pair segments connected together by three repeaters. Each segment is 400 metres long. The one-way processing delay at a repeater is 10 microseconds. We wish to operate this system at 10 Mbps. If the speed of the signal in copper is 2×10^8 metres per second, what is the minimum size of the frame in such a system which will ensure that a collision never goes undetected? **(5 M)**

Q9: Suppose a 1520 byte IPv4 datagram which has 1500 bytes of data and 20 bytes of header arrives at a router. It needs to be forwarded along a link which has an MTU of 500 bytes. So the router decides to do fragmentation. Write down the number fragments sent, the number of bytes in each fragment, the specific bytes contained in each fragment (assuming the original data bytes are numbered 1 to 1500), the value of the IPv4 offset field in each fragment's header, and the value of the IPv4 flag bits in each fragment's header. **(10 M)**

Q10: The following is the UDP header in hexadecimal format: 0045DF0000580000. Calculate the following: **(1.25 × 4 M)**

a. Source port number?

b. Destination port number?

c. Length of the data?

d. Total length of the user datagram?

Q11: Match the following random access MAC protocols to the descriptions below: ALOHA, Slotted ALOHA, 1-persistent CSMA, non persistent CSMA, p-persistent CSMA. **(2 × 5 M)**

a. Network has ten nodes. When a node has a frame to send, it listens to the channel. If the channel is idle it sends the frame immediately and if the channel is busy it waits till the end of the ongoing transmission and sends the frame.

b. Given network has total five nodes. Now a frame is generated at a node, it waits till the end of the current slot and then transmits the frame.

c. A particular node has a frame to send, it listens to the channel. If the channel is idle, it sends the frame immediately and if the channel is busy it waits for a random amount of time and listens to the channel again. This network has eight nodes.

d. Network with six nodes. Whenever a node has a frame to transmit it just sends the frame.

e. When a frame is generated at a node, it waits till the end of the current slot and then listens to the channel. If the slot is busy, it waits till the slot ends and listens to the channel again. If the slot is idle, it is equally likely to transmit its frame or defer until the next frame. Given network has total seven nodes.

Q.12: Suppose that the 4-bit generator (G) is 1001, and the data payload (D) is 10011101. What are the CRC bits associated with the data payload and transmitted frame? **(5 M)**

Q.13: For the given two 16-bit words:11111101 11101100, 00101110 11100101; compute the checksum. **(5 M)**

Q14: Answer the following based upon your understanding of different addresses assigned in the five layered TCP/IP architectural suite: **(5 × 3 M)**

a. One system is assigned this address 200.23.56.8 69, which address it represents? Explain briefly about different address parts?

b. The given address 200.23.56.8 falls under which category? Convert this into dotted binary address.

c. FF:FF:FF:FF:FF:FF is a MAC address, IP address, or Socket address? Does this address has any special significance, explain briefly?

All The Best

Roll no										

3rd yr
6th Sem
B. Tech ECE

ional Institute of Technology Goa

Programme Name: B.Tech/M.Tech/Ph.D
End Semester Examinations, April 2016

Course Name: Linear Integrated Circuits | **Course Code: EC352**
Date: 27-04-2016 | **Time: 2.00 PM-5.00 PM**
Duration: 3 Hours | **Max. Marks: 100**

ANSWER ALL QUESTIONS

Note: Assume suitable values if data is insufficient

Q1. The heart rate of an healthy human being is 72 beats/min. Due to some abnormality, one person has one missing beat that occurs after every 20th beat. Design a suitable electronic circuit to detect that missing beat. **(10)**

Q2. A PLL VCO has a free running frequency of 3 kHz. **(a)** An input signal $v_{in} = \sin(8000\pi t)$ is applied. Design a low pass filter in the PLL such a way that the input signal is captured. **(b)** An FM signal has frequency range 2.5 kHz to 3.5 kHz. Design a phase detector such that PLL is in lock with the input signal (Assume any amplitude levels of phase detector). **(10)**

Q3. A Fire-Engine alarm requires input frequency of 5kHz and power of 15 watts. Design an input electronic circuit for the alarm using Wien Bridge oscillator. Assume input impedance of the alarm device is 50 Ohms **(10)**

Q4. A dual slope ADC uses 16-bit counter and a 4-MHz clock rate. The maximum input voltage is 10V. The maximum integrator output voltage should be -8 V when the counter has cycled through 2^n counts. The capacitor used in the integrator is 0.1 μF. (a) Find the value of the resistor R. (b) Find the equivalent digital output if input voltage is 7V. **(8)**

Q5. Design a 3-bit inverted R-2R digital to analog converter for the resolution of 1.428 V. **(10)**

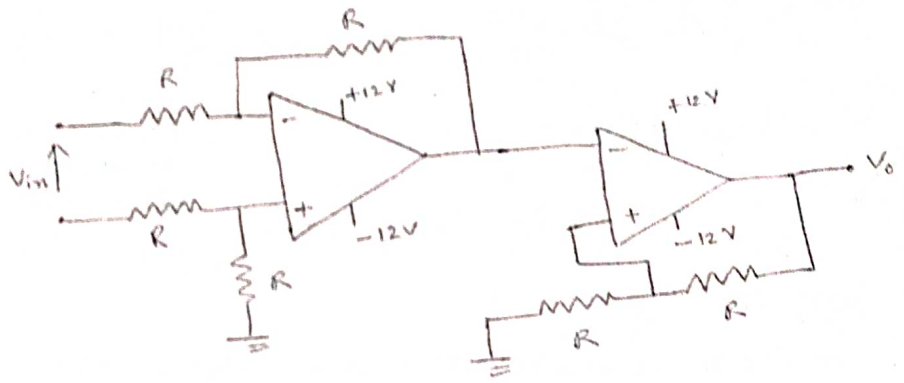
Q6. Explain the operation of successive approximation ADC. Consider the correct code 01100010 for input analog signal and what are the intermediate digital outputs will it have to give final output code.? **(8)**

Q7. Design an astable multi-vibrator of frequency 1 kHz using 555 timer with duty cycle of 40%. **(10)**

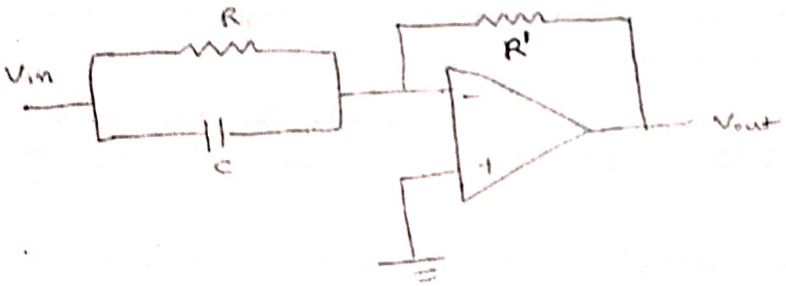
Q8. Design a Schmitt Trigger for input signal $v_{in} = 5\sin(2000\pi t)$. What are the required threshold levels such that the effect of noise is eliminated. Consider the noise margins are -1V and 1V . Assume $\pm V_{sat} = \pm 12V$. **(8)**

Q9. Design a precision full-wave rectifier for input signal of $v_{in} = 5\sin(2000\pi t)$. Explain the operation. **(6)**

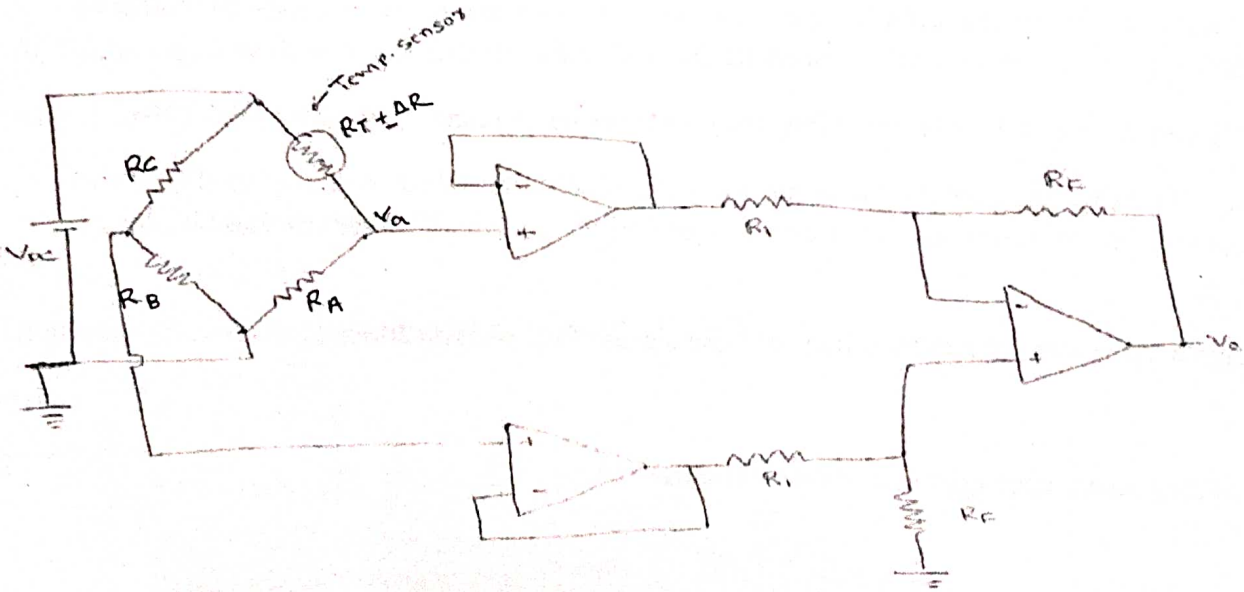
Q10. Plot the transfer characteristics of below circuit **(6)**



Q11. In the below circuit, if the input is a sweep voltage $v_{in} = \alpha t$. What could be the output voltage? **(6)**



Q12. In the circuit, $R_1 = 1k\Omega$, $R_F = 4.7k\Omega$, $R_A = R_B = R_C = 100k\Omega$, $V_{DC} = 5V$. The transducer is a thermistor with following specifications: , $R_T = 100k\Omega$ at a reference temperature of 25^0C. Temperature coefficient of resistance = $-1k\Omega/^0C$. Determine the output voltage at 0^0C and 100^0C. **(8)**



Roll no

NATIONAL INSTITUTE OF TECHNOLOGY GOA

Farmagudi, Ponda, Goa 403 401

3rd Yr
6th Sem
B. Tech ECE

Programme Name: B.Tech-ECE

End Semester Examination, April-2016

Course Name: Digital Communication **Course Code: EC353**

Date: 26/ 04/2016 **Time: 2.00 P. M. – 5.00 P.M.**

Duration: 3 Hr. **Max. Marks: 100**

ANSWER ALL QUESTIONS

(15)

Problem 1:

Let us assume a discrete memoryless source X which generate five possible symbols: x_1, x_2, x_3, x_4 *and* x_5. The probability of occurrence of each symbols can be described as $P(x_i)=\{P(x_{i-1})\}^2$. Based on the above information, calculate the entropy content of the source X.

a) Construct a Shanon-Fano Code for X, and also calculate the efficiency of the code.

b) Construct the Huffman Code and compute the efficiency.

Based on the above two codes find out which code is more efficient and with what amount?

(8)

Problem 2

The differential entropy defined over a random variable X is defined as; $H(x) = -\int_{-\infty}^{\infty} f_X(x)\log_2 f_X(x)dx$. Then, find the probability density function $f_X(x)$.

(6)

Problem 3

Show that the channel capacity of an ideal AWGN channel with infinite bandwidth can be given as $C_\infty = \frac{1}{\ln 2}\frac{S}{2\eta} \cong 1.44\frac{S}{\eta} b/\text{sec}$, where S is the average signal power and $\eta/2$, is the power spectral density of the white Gaussian noise.

(10)

Problem 4

Describe the DPSK modulation scheme with the transmitter and the receiver block diagram with its constellation diagram. Let us assume that GOOD NIGHT is binary coded as 0010010011. A similar encoding result in GOOD EVENING as 0010011011. A person wants to transmit an SMS of GOOD NIGHT to some number during EVENING time. Check by DPSK transmission if the SMS will be transmitted then the receiving number will receive either GOOD NIGHT or GOOD EVENING.

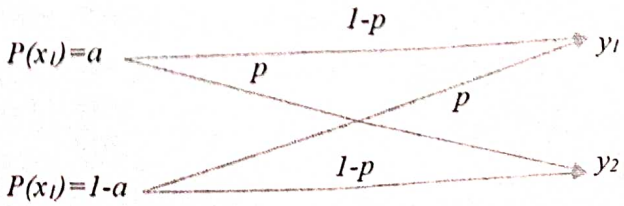
(15)

Problem 5

Explain in detail about binary symmetric channel. Consider a binary symmetric channel with $P(x_1)=a$, and for this do the following:

a) Show that the mutual information $I(X;Y)$ is given by

$$I(X;Y) = H(Y) + p\log_2 p + (1-p)\log_2(1-p)$$



b) Calculate $I(X;Y)$ for $a=0.5$ and $p=0.1$.

c) Consider a case when $a=0.5$ and $p=0.5$, and check the information content and hence comment on it.

Problem 6 (10)

Binary data has to be transmitted over a mobile link that has a usable bandwidth of 9000Hz and a maximum achievable signal-to-noise power ratio of 6 dB at its output.

a) Determine the maximum signaling rate and probability of error if a coherent ASK scheme is used for transmitting binary data through this channel.

b) If the data is maintained at 900 bits/sec, calculate the error probability.

Problem 7 (8)

Consider a telegraph source having two symbols, "." and "-". The "." duration is 0.2 sec. The "-" duration 3 times the "." duration. The probability of the "."'s occurring is twice that of the "-", and the time between symbols is 0.2 sec. Calculate the information rate of the telegraph source.

Problem 8 (8)

Consider a mobile communication provider which uses a seven bit ASCII encoder to perform source encoding. The source encoder encode the transmitted letter in the format $A=31$, $B=32$ and so on. Assume that a user wants to transmit symbol "NITGOAINDIA" to another user by the same service provider. However during the transmission through the channel due to some error the front end user receives symbol "NITGOAIODIA". However the service provider uses a longitudinal redundancy check for error correction (LRC) for channel encoding. Check LRC coding scheme to detect and correction of the error.

Problem 9 (6)

Prove that for a noiseless channel with m input symbols and n output symbols $H(X)=H(Y)$ and $H(Y|X)=0$.

Problem 10 (8)

Show that the mutual information $I(X;Y)$ of the channel described by information rate with the input probabilities $P(x_i)$, $i=1,2,...n$, can be expressed as $I(X;Y)=\sum_{i=1}^{m}\sum_{j=1}^{n}P(x_i,x_j)\log_2\frac{P(x_i\,|\,x_j)}{P(x_i)}$.

Problem 11 (6)

Consider a binary memoryless source X with two symbols x_1 and x_2. Prove that $H(x)$ is maximum when both x_1 and x_2 are equi-probable.

----------Best of Luck----------

Roll No.								

National Institute of Technology Goa

End Semester Examinations, April 2016

Programme Name: B.Tech

3rd yr
6th Sem
B. Tech ECE

Course Name: Wireless Communication
Date: 25/04/2016
Duration: 3 hours

Course Code:EC351
Time:2:00 P.M.-5:00 P.M.
Max. Marks: 100

ANSWER ALL QUESTIONS

1. For given path loss exponent (a) $n = 3$ and (b) $n = 4$, find the frequency reuse factor and the cluster size that should be used for maximum capacity. The S/I of 15 dB is minimum required for satisfactory performance. There are six co-channel cells are in the first-tier and all of them are at the same distance from the mobile. [6]

2. Given that the transmitter and receiver heights are 50 m and 25 m respectively. The obstacle of height 100 m lies 10 km away from the transmitter and 2 km from the receiver. Draw the geometry. Determine (a) the diffraction parameter γ and the height of the obstacle required to include 6 dB diffraction loss. Assume $f = 900$ MHz. [6]

3. [10]

   (a) What is the maximum system capacity (total and per channel) in Erlangs when providing a 2% blocking probability with 20 channels, and with 40 channels?

   (b) How many user can be supported with 40 channels at 2% blocking? Assume H=105 s, $\lambda = 1$ call/hour.

   (c) Using the traffic intensity calculated in part (a), find the GoS in a lost call delayed system for the case of delay being greater than 20 seconds. Assume that H=105 s, and determine the GoS for 20 channels and 40 channels.

   (d) Comparing part (a) and part (c), does a lost call delayed system with 20 s queue perform better than a system that cleared blocked calls

4. Power profile of a multipath wireless channel is given in table below. Calculate the mean excess delay, rms delay spread, and the maximum excess delay (10 dB) for the profile. Estimate the 50% and 90% coherence bandwidth of the channel. Would this channel be suitable for AMPS or GSM service without the use of an equalizer. [6]

Delay in microseconds	Power level (dB)
0.0	-20
1.0	-10
2.0	-10
5.0	0

5. Derive the expression of BER as a function of SNR for BPSK signalling for Rayleigh fading wireless communication channels. Extend the results for single user CDMA system without diversity. [12]

6. Find the percentage of time that a signal is 10 dB or more below the rms value for Rayleigh fading signal. [5]

7. For a spatial diversity system employing MRC at the receiver, starting from received signal vector ($\mathbf{y} = \mathbf{h}x + \mathbf{n}$), show that the optimum beam-former vector $\mathbf{w}_{opt}$ is given by

$$\mathbf{w}_{opt} = \frac{\mathbf{h}}{\|\mathbf{h}\|}$$

where $\|\mathbf{h}\|$ denote the norm of channel vector $\mathbf{h}$, $\mathbf{y}$ denote received signal vector, and $\mathbf{n}$ denote the noise vector having zero mean vector and covariance matrix $\sigma^2 I$. Also, calculate the maximum SNR at the output of MRC. [10]

8. Generate a PN sequence of length 15 using linear feedback shift register and verify the balance and cyclic shift property of the generated pseudo sequence. [8]

9. Consider a CDMA downlink scenario with $K+1$ number of users. Assume user 0 is the desired one. Let $h_0(0), ..., h_0(L-1)$ are the L tap multipath channel components between base station and user 0. Let c_i and P_i are the PN sequence and power of symbol s_i at ith user. Find the statistics of (i) desired user signal, (ii) multipath interference, (iii) multiuser interference, and (iv) SINR at the output of Rake receiver. [15]

10. Analytically show that the SINR performance of CDMA multi-user uplink system improves, when the received pseudo codes are not aligned. [8]

11. In QPSK scheme the symbols are represented as $s_0 = \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}j$, $s_1 = -\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}j$, $s_2 = -\frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}}j$, and $s_3 = \frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}}j$. A 2×3 MIMO system is employed for the transmission of bit sequence $\{011011001001\}$ having channel matrix

$$H = \begin{bmatrix} 0.2 + 0.2j & 0.6 - 0.3j \\ 0.1 + 0.5j & -0.3 + 0.5j \\ 0.5 - 0.1j & 0.2 - 0.4j \end{bmatrix}$$

using QPSK signaling. Determine the received bit sequence using Zero-Forcing algorithm. Assume noiseless channel. [14]

* * *ALL THE BEST * **

Roll No										

National Institute of Technology Goa

3rd yr 6th Sem B.Tech ECE

Programme Name: B.Tech, 3rd Year

Mid Semester Examinations, February-2016

Course Name: Digital Communication
Date: 22/2/2016
Duration: 2 Hours

Course Code: EC353
Time: 2.30-4.30PM
Max. Marks: 50

ANSWER ALL QUESTIONS

Problem: 1 **(07)**

The bandwidth of an input signal to the Pulse Code Modulation (PCM) is restricted to 4 kHz. The input signal varies in amplitude from -3.8 V to +3.8 V and has the average power of 30 mW. The required signal to noise ratio is given as 20dB. The PCM modulator produces binary output. Assuming uniform quantization,

a) Find the signal to noise ratio for the PCM modulator.
b) Find the number of bits required per sample.
c) Output of 30 such PCM coders are time multiplexed, what would be the minimum required transmission bandwidth for this multiplexed signal?

Problem: 2 **(07)**

A speech signal is sampled at a rate of 8 kHz logarithmically compressed and encoded into a PCM format using 8 bits per sample. The PCM data is transmitted through AWGN channel via M-level PAM signal. Determine the transmission bandwidth when M=4, M=8 and M=16. What is the maximum cut off frequency of LPF (for each) used for transmitting each of these signals that will preserve the amplitude information on the output pulse. What would be the minimum bandwidth if two signals (with M=8 and M=16) were frequency multiplexed using AM and SSB techniques.

Problem: 3 **(08)**

Give your comments about the noises found in Delta modulation. Is it possible to prove that to avoid slope overload distortion it is required that $\frac{\Delta}{T_s} \geq \left|\frac{dx(t)}{dt}\right|_{\max}$?

Consider a sinusoidal signal $m(t) = A\cos\omega_m t$ applied to a delta modulator with step size Δ. Show that the slope overload distortion will occur if $A > \frac{\Delta}{\omega_m T_s} = \frac{\Delta}{2\pi}\left(\frac{f_s}{f_m}\right)$.

Find the maximum amplitude of a 1 KHz sinusoidal signal input to a delta modulator that will prevent slope overload, when the sampling rate is 10,000 samples/sec and the step size is $\Delta = 0.1$.

Problem: 4 **(12)**

Let us assume a QPSK modulated signal can be written as

$$S_i(t) = \sqrt{\frac{2E}{T}}\cos(2\pi f_c t + \theta_i) \quad (k-1)T < t < kT, \text{ where } \theta_i = (i-1)\pi/2,\ i=1, 2, 3, 4.$$

a) Express $S_i(t)$ in terms of the two basis functions $\varphi_1(t)$ and $\varphi_2(t)$.
b) Design the transmitter and the receiver for the above signal.
b) Represent the signals $S_i(t)$, $i = 1, 2, 3, 4$, as vectors in the $\varphi_1\varphi_2$-plane.
c) Sketch the decision regions Z_i, $i = 1, 2, 3, 4$, in the $\varphi_1\varphi_2$-plane.

Problem: 5 **(10)**

Set up a block diagram for the generation and detection of a binary FSK signal $s(t)$ with continuous phase by using the representation $s(t) = \sqrt{\frac{2E_b}{T_b}}\cos\left(\frac{\pi t}{T_b}\right)\cos 2\pi f_c t \mp \sqrt{\frac{2E_b}{T_b}}\cos\left(\frac{\pi t}{T_b}\right)\sin 2\pi f_c t$.

Problem: 6 **(06)**

What is the need of companding in PCM? Describe different laws of companding.

Roll No.								

National Institute of Technology Goa

Programme Name: B.Tech. (3rd Year ECE)

Mid Semester Examinations, February 2016

3rd yr
6th Sem
B.Tech ECE

Course Name: **Wireless Communication**

Date: 22/02/2016

Duration: 2 Hours

Course Code:EC351

Time:9:30-11:30AM

Max. Marks: 50

ANSWER ALL QUESTIONS

1. With the help of timing diagram, illustrate how a call to a mobile user initiated by a landline subscriber is established. [5M]

2. A receiver in an urban cellular radio system detects a 1 mW signal at $d = do = 1$ meter from the transmitter. In order to mitigate co-channel interference effects, it is required that the signal received at any base station receiver from another base station transmitter which operates with the same channel must be below -100 dBm. A measurement team has determined that the average path loss exponent in the system is $n = 3$. Determine the major radius of each cell if a seven-cell reuse pattern is used. What is the major radius if a four-cell reuse pattern is used? [5M]

3. A hexagonal cell within a four-cell system has a radius of 1.387 km. A total of 60 channels are used within the entire system. If the load per user is 0.029 Erlangs, and $\lambda = 1$ call/hour, compute the following for an Erlang C system that has a 5% probability of a delayed call: [6M]

   (a) How many users per square kilometre will this system support?

   (b) What is the probability that a delayed call will have to wait for more than 10 s?

   (c) What is the probability that a call will be delayed for more than 10 s?

4. For a N = 7 system with a $Pr[Blocking] = 1\%$ and average call length of two minutes, find the traffic capacity loss due to trunking for 57 channels when going from the omnidirectional antennas to 60° sectored antennas. (Assume that blocked calls are cleared and the average per user call rate is = 1 per hour.) [5M]

5. Assuming a receiver is located 10 km from a 50 W transmitter. The carrier frequency is 1900 MHz, free space propagation is asumed, $G_t = 1$, $G_r = 2$, find (a) the power at the receiver in dBW and dBm; (b) the magnitude of the E-field at the receiver antenna; (c) the open circuit rms voltage applied to the receiver input assuming that the receiver antenna has a purely real impedance of 50 ohm and is matched to the receiver; (d) find the received power at the mobile using the two-ray ground reflection model assuming that the height of the transmitting antenna is 50 m, and receiving antenna is 1.5 m above the ground,and the ground reflection is -1. [10M]

6. Link budget analysis

(a) Employing the Okumura model, compute the median path loss at a distance of 8 km when the carrier frequency 1.8 GHz, the height of the transmitting antenna is 40 m, and receiving antenna is 2 m above the ground in a suburbun area. The correction factors $A_{mu}(2.1GHz, 8km) = 28$ dB and G_{AREA}=13 dB. [5M]

(b) Consider previous scenario (Question 6a) where the standard deviation σ of the log-normal shadowing is 6 dB. Compute the threshold γ, such that observed path loss P_L is greater than γ only 5% of the time or location. The value of Q(0.05)=1.65. [4M]

(c) Compute total noise power at 300 Kand noise figure 5 dB. The bandwidth is 200 kHZ. Assume that the interference noise is equal to thermal noise. [2M]

(d) Employing the above information (Questions 6a to 6c), compute the transmission power for 10 dB SNR requirements. [3M]

7. Write answer of the following questions [5M]

(a) How would you solve the problem of hand-off when the mobile user is moving fast?

(b) What is fading in wireless communication?

(c) Define Grade of Service (GOS) in trunking theory.

(d) Show that the signal used in GSM is narrowband.

(e) Write the expression of Fresnel-Kirchhoff diffraction parameter.

* * *ALL THE BEST * **

Roll No									

National Institute of Technology Goa

Programme Name: B.Tech./M.Tech./Ph.D.

Mid Semester Examinations, February 2016

3rd yr
6th Sem
B. Tech ECE

Course Name: **Linear Integrated Circuits**

Date: 23/02/2016

Duration: 2 Hours

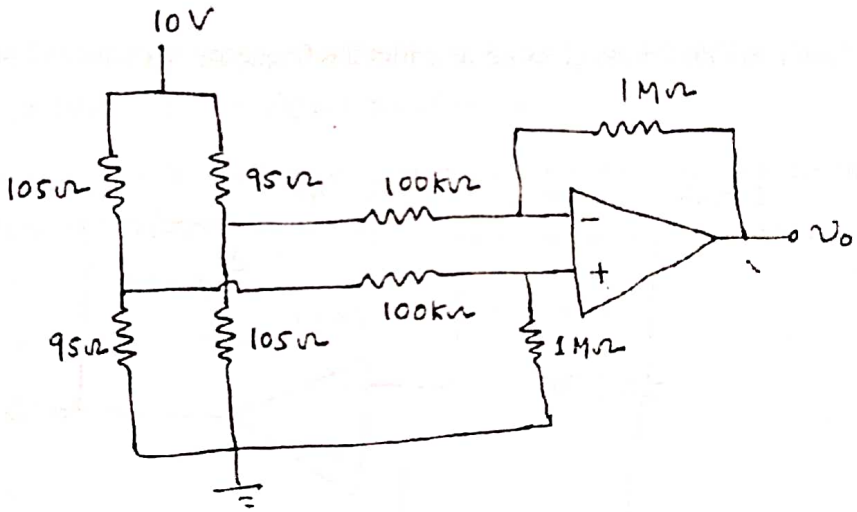
Course Code: EC352

Time: 09.30-11.30 A.M.

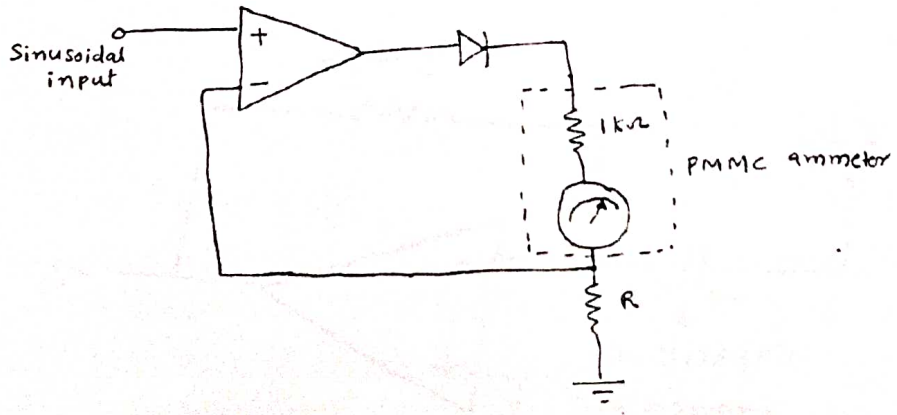
Max. Marks: 50

ANSWER ALL QUESTIONS

1. For the given op-amp circuit, calculate the output voltage v_0 [5M]

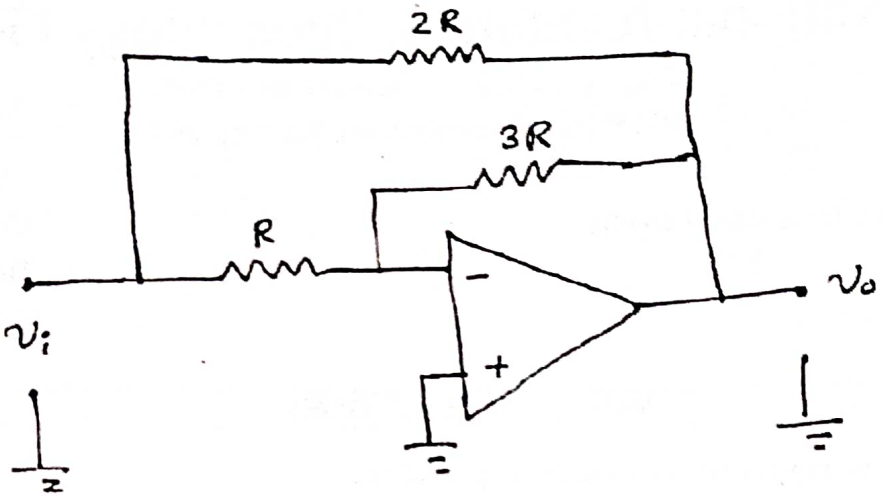


2. The op-amp based circuit of electronic voltmeter shown below uses a PMMC ammeter with a full scale deflection (FSD) current of 1 mA and a coil resistance of 1 kΩ. What is the value of R that gives FSD for a sinusoidal input voltage of 100 mV (RMS)? Note: PMMC meter measures average value. [6M]

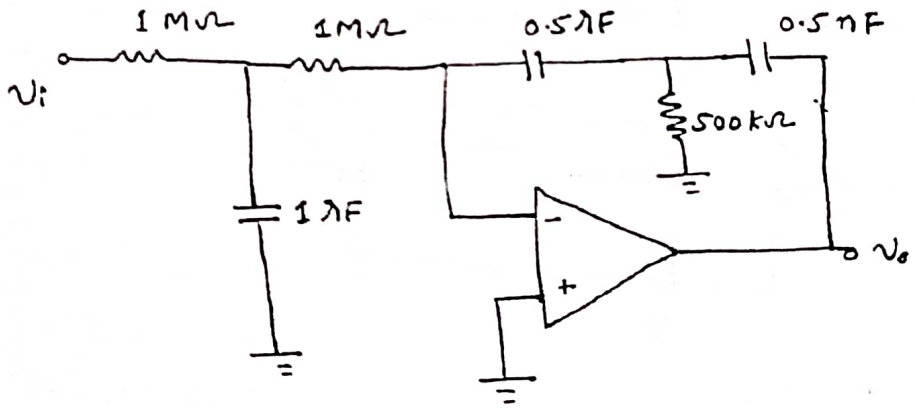


3. Design a high pass Butterworth filter of second order having cut-off frequency of 1 kHz. [5M]

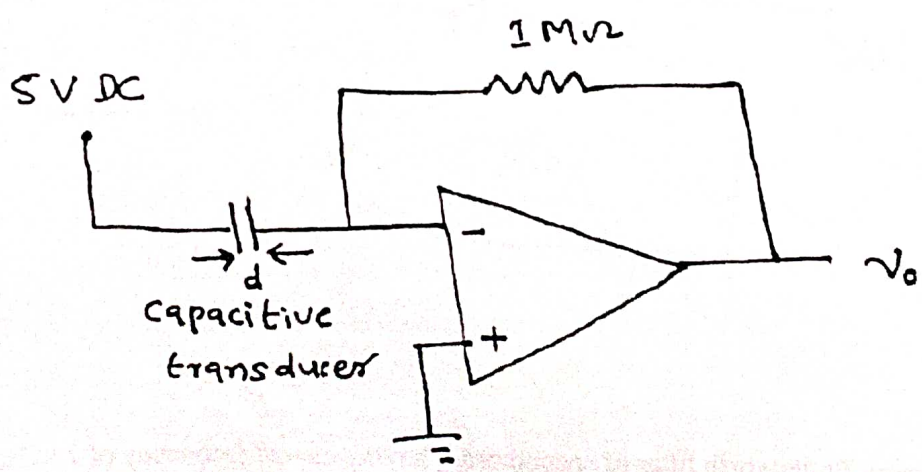
4. What is the input resistance of a given circuit? Assume idle op-amp.



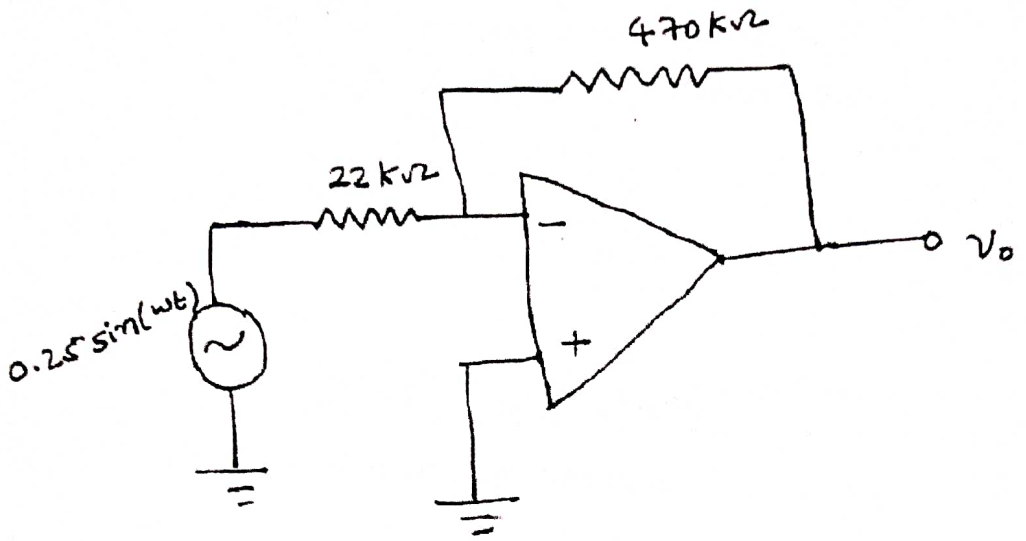
5. Derive the transfer function for the given circuit. Plot the frequency response and justify the type of filter. [6M]



6. A capacitive motion transducer circuit shown below. The gap d between the parallel plates of capacitor is varied as $d(t) = 10^{-3}[1 + 0.1sin(1000\pi t)]$ m. if the value of the capacitor is 2 pF at $t = 0$ ms, calculate the output voltage v_0 at $t = 2$ ms. [6M]



. The op-amp shown in the figure has a slew rate of 0.8 Volts/μs. The input signal is $0.25sin(\omega t)$. What is the the maximum frequency of the signal so that there is no distortion in the output. [5M]



8. Find R_1 and R_F in the lossy integrator so that the peak gain is 20 dB and the gain is 3 dB down from its peak when ω=10000 rad/s. Use capacitance of 0.01μF. [5M]

9. Design narrow band pass filter with band width of 300 Hz with centre frequency of 3 kHz. Assume suitable resistors and capacitors values. [7M]

* * *ALL THE BEST * **

Roll no										

National Institute of Technology Goa

3rd yr
6th Sem
B. Tech ECE

Programme Name: B.Tech

Mid Semester Examinations, February-2016

Course Name: Communication Network **Course Code:EC354**

Date: 24.02.2016 **Time: 9.30 - 11.30**

Duration: 2 Hours **Max. Marks:** 50

ANSWER ALL QUESTIONS

Q1. Convert following IP addresses from dotted decimal notation to dotted binary notation: **(2 M)**

a. 112.118.10.23

b. 10.192.19.1

Q2. Consider two hosts, A and B, connected by a single link of rate R bps. Suppose that the two hosts are separated by m meters, and the propagation speed along the link is s meters/sec. Host A is to send a packet of size L bits to Host B. **(4 M)**

a. Ignoring processing and queuing delays, obtain an expression for the end-to-end delay.

b. Suppose Host A begins to transmit the packet at time $t = 0$. At time $t = d_{trans}$, where is the last bit of the packet?

c. Suppose $d_{prop} > d_{trans}$. At time $t = d_{trans}$, where is the first bit of the packet?

d. Suppose $d_{prop} < d_{trans}$. At time $t = d_{trans}$, where is the first bit of the packet?

Q3. Suppose two hosts, A and B, are separated by 20000 km and are connected by a direct link of R=2 Mbps. Suppose the propagation speed over the link is 2.5×10^8 m/s. **(8 M)**

(a) Calculate the bandwidth delay product, R. d_{prop}.

(b) Consider sending a file of 800,000 bits from Host A to Host B. Suppose the file is sent continuously as one large message. What is the maximum number of bits that will be in the link at any given time?

(c) What is the width (in meters) of a bit in the link?

(d) Derive a general expression for the width of a bit in terms of the propagation speed s, the transmission rate R, and the length of the link m.

Q4. Suppose there is a 10 Mbps microwave link between a geostationary satellite and its base station on Earth. Every minute the satellite takes a digital photo and sends it to the base station. Assume a propagation speed of 3×10^8 m/sec. **(6 M)**

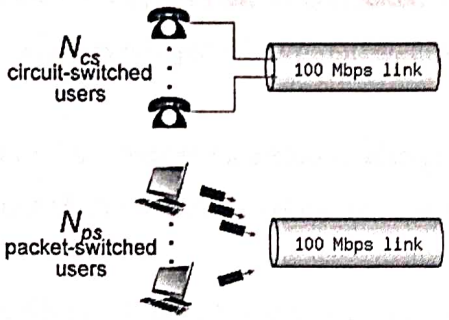
(a) What is the propagation delay of the link?

(b) What is the bandwidth delay product of the link?

(c) Let x denote the size of the photo. What is the minimum value of x for the microwave link to be continuously transmitting?

Q.5 Consider the two scenarios below: **(12 M)**

- A circuit-switching scenario in which N_{cs} users, each requiring a bandwidth of 25 Mbps, must share a link of capacity 100 Mbps.
- A packet-switching scenario with N_{ps} users sharing a 100 Mbps link, where each user again requires 25 Mbps when transmitting, but only needs to transmit 20 percent of the time.



Answer the following questions:

a. When circuit switching is used, what is the maximum number of circuit-switched users that can be supported? Explain your answer.

b. For the remainder of this problem, suppose packet switching is used. Suppose there are 7 packet-switching users (i.e., $N_{ps} = 7$). Can this many users be supported under circuit-switching? Explain.

c. What is the probability that a given (*specific*) user is transmitting, and the remaining users are not transmitting?

d. What is the probability that one user (*any* one among the 7 users) is transmitting, and the remaining users are not transmitting? When one user is transmitting, what fraction of the link capacity will be used by this user?

e. What is the probability that any 4 users (of the total 7 users) are transmitting and the remaining users are not transmitting?

f. What is the probability that *more* than 4 users are transmitting? Comment on what this implies about the number of users supportable under circuit switching and packet switching.

Q6: In the context of transport layer which resides at fourth place in the OSI/ISO or TCP/IP layered architecture model. This layer is heart of the TCP/IP protocol suite. Answer following questions based on your understanding: **(18 M)**

a. Which version of internet protocol i.e. IP is most commonly used version 4 or version 6? The IPv4 (Internet Protocol version 4) address is a 32 bit or 128 bit address?

b. Internet protocol works at the network layer or transport layer of layered architecture model? Does it provide reliable services or unreliable services?

c. The two important protocols of transport layer are TCP and UDP. At the time of defining socket address depending upon type of services i.e. connectionless or connection oriented, these protocols are selected. Can you explain which provide reliable and connection oriented services; and which provides unreliable and connectionless services?

d. What is socket address in transport layer addressing? How many bits in total it contains? Give an example of socket address with the port number 80, IP address can be of your choice.

e. The technique of multiplexing and demultiplexing is popular for providing communication between client and server. In the context of transport layer how such communication takes place between a client and two servers?

f. The flow control at the transport layer is based on four entities. Mention what are those entities? How flow control takes place between sender and receiver side? Can flow control be implemented with the two buffers?