Aliah University

End-Semester Examination (Spring Semester) – 2021-22

B.Tech 3rd year 6th Semester Electronics & Communication Engineering

Subject Name: Data Communication & Computer Networks **F.M: 80**

Subject Code: CSEUGOE04 **Time: 3hours**

Group-A

(Multiple Choice Type Questions)

Answer the following questions. **1X10=10**

1.
i. What is Routing?
ii. What do you mean by "Port Number"?
iii. In which layer of OSI model "Token passing" technique is applied?
iv. State the advantages of IPv6 over IPv4?
v. Which protocol maps, physical (MAC) Address to corresponding Logical Address?
vi. Write down the difference between FDM and WDM.
vii. Write the disadvantages of Full Duplex mode of transmission.
viii. What does "jitter" mean in data communication?
ix. "10001100.00110010.00111010.00010100" this IP address belongs to which class?
x. What is the function of a Modem?

Group-B **5X6=30**

(Short Answer Type Questions)

Answer any **six** questions.

2. Explain the terms "Bandwidth" and "Frequency" with examples.
3. Write down the differences between LAN, MAN & WAN.
4. What are the different layers of OSI? Write the Function of any two layers of them? (1+4)
5. What do you mean by classful and classless addressing? Which one is better and why? What do you mean by Net ID and Host ID? (2+2+1)
6. What do you mean by subnet mask? If IP address =17.14.12.28/29 then find the subnet address where mask=/29. Write the Default Mask for class C. (1+3+1)
7. Name one flow control protocol which one is used in the Noisy channel; describe it with suitable diagram. "Flow control" mechanism is used in which layer of the OSI Model? (4+1)
8. Explain Bit stuffing and Byte stuffing technique with examples. If Data= 10011001 then what is the value of a *Parity bit* in case of *Odd* parity. (4+1)

Group-C **10x4=40**

(Long Answer Type Questions)

Answer any **four** questions.

9. Describe TCP/IP model. Why switches and bridges are used in the network? Compare different types of switching technique. (4+2+4)

10. VRC can detect which type of error? Write the steps for Checksum method in both sender (creation of checksum) and receiver (validation of checksum) end. If *Sender* sends the bit stream **100110 111000 001001 100001** and *Receiver* receives the bit stream **100101 100110 111000 001001 100001**, then find out that receiver accepts the message or not. (1+4+5)

11. Write the advantages of fiber-optic cable. If IP address **196.26.32.40**, then find the *network ID*, *broadcasting address* and the *last host ID* under the network. Why topology is needed in data communication; If there are '**100**' devices in a network, then what is the number of cable links required for a mesh, ring, bus and star topology. (2+3+5)

12. If the Data block is **10110** and divisors is **1101**, then find the *CRC code* and the transmitted *Code Word*. Explain the term "Standard" with its different types. Write the function of SMTP. (5+3+2)

13. Write short notes in any *two* of the following: **5+5**
    i. TDM
    ii. CSMA
    iii. HDLC

B.Tech. Examination-2022
Electronics and Communication Engineering
(Even Semester Regular and Supplementary)
Digital Signal Processing (ECEUGPC15)

Full Marks: 80 Time: 3.00 Hrs

- *Answer all parts of a question in same place.*
- *Figures on the right hand side margin indicate full marks.*
- *Symbols have their usual meaning*

Answer Question No.1 and any five from the rest

1. Answer any <u>five</u> questions (2×5=10) Marks

(a) What do you mean by ROC in Z-transform? What is the ROC of the signal x(n)=δ(n-k)? 2

(b) How many complex additions that we need to perform in the linear filtering of any sequence using the FFT algorithm is? 2

(c) What is Gibbs phenomenon? How can this be removed ? 2

(d) Mention the differences between DTFT and DFT. 2

(e) Distinguish between FIR and IIR system 2

(f) What do you mean by linear phase system ? 2

2. (a) Find the odd and even components of the following sequence 7

$$x[n] = \{-2,1,3,\underset{\uparrow}{4}, -1,4\}$$

(b) Find the linear convolution of the following signals by using graphical method 7

$$x_1[n] = \{-1,\underset{\uparrow}{2},3,2\} \quad x_2[n] = \{-1,\ 0,\underset{\uparrow}{-2}, -2\}$$

3. (a) Determine the Z-transform of the following sequence and find ROC 7

$$x[n] = n\left(\frac{1}{2}\right)^n u[n]$$

(b) Find inverse Z-transform of the following 7

$$X(Z) = \frac{(z)^2}{z^2-3z+2}; ROC: |Z| > 2$$

4. (a) Determine and sketch energy density spectrum of the following the signal 8

$x(n)=a^n u(n)$ for a=-1

(b) Find the relationship between Fourier transform and Z-transform. 6

5. (a) Prove that uniform sampling of Discrete-Time Fourier Transform (DFT) of a sequence x(n) yields Discrete Fourier Transform (DFT) . 6

(b) Write down the condition for Aliasing error to get back original sequence. 2

(c) Find the DFT of the of the sequence x(n)=1 for $0 \leq n \leq 2$ for N=4 and hence plot magnitude and phase plot of DFT output. 6

6. (a) What do you mean by circular symmetry of a sequence? 3

(b) Show that multiplication between two sequence provides circular convolution. 5

(c) Determine the circular convolution of the two sequences as follows: 6

x1(n) ={1,2,3,1} and x2(n)={4,3,2,2} using time-domain formula.

7. (a) What is twiddle factor? 2

(b) Write down the (i) symmetry (ii) Periodicity property of twiddle factor. 4

(c) Describe the DIT-FFT algorithm for 8-point DFT computation. 8

8. Write shot notes on any two of the following. 2×7=14

(a) Window method for designing of FIR filters.

(b) Bilinear transformation for Designing of IIR filter

(c) Digital Filter

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B.Tech.Examination-2022
Electronics and Communication Engineering
(Even Semester Regular and Supplementary)
Photonics Devices and Optical Communication (ECEUGPC16)

Full Marks: 80

Time: 3.00 Hrs

- *Answer all parts of a question in same place.*
- *Figures on the right hand side margin indicate full marks.*
- *Symbols have their usual meaning*

		Answer <u>any Eight</u> questions	**Marks**
1.	**(a)**	Describe briefly evolution of optical fiber communication by mentioning the key features of its different generations.	6
	(b)	Draw and compare the block diagrams of general and an optical fiber communication system.	4
2.	**(a)**	What are the factors that describe a light source? What are the characteristic features of 'ray model' and 'wave model' of light?	2+2
	(b)	Explain briefly the advantages of optical glass fiber.	4
	(c)	What is the frequency of the light wave at a wavelength of 1550 nm?	2
3.	**(a)**	Compare step index and graded index fiber with respect to refractive index profiles and light propagation mechanisms.	4
	(b)	Derive NA and Acceptance angle for step index fiber.	4
	(c)	An optical fiber has core refractive index of 1.49 and relative refractive index difference is 25%, calculate numerical aperture and acceptance angle of the fiber.	2
4.	**(a)**	Starting from Maxwell's equations derive wave equation in cylindrical coordinates.	4
	(b)	With the help of separation of variable techniques estimate the solution in core and clad for step index fiber.	6
5.	**(a)**	Briefly describe the different loss mechanisms in glass optical fiber.	6
	(b)	Draw the loss curve of glass optical fiber.	2
	(c)	When a mean optical power launched into an 10 km length of fiber is 100 µW and the mean optical power at the fiber output is 5 µW, calculate overall fiber attenuation in decibels and fiber attenuation per kilometre.	2
6.	**(a)**	What is zero dispersion wavelength? Compare intermodal pulse dispersion in step index and graded index optical fiber.	1+3
	(b)	A 6 km optical link consists of multimode step index fiber with core refractive index of 1.5 and relative refractive difference of 1%. Calculate intermodal dispersion, rms pulse broadening and maximum bit rate that can be obtained assuming absence of other dispersions.	2+2+2
7.	**(a)**	Point out few requirements of an optical source for optical fiber communication.	2

	(b)	Describe the principle operation of double heterojunction LED.	4
	(c)	The minority carrier recombination lifetime for an LED is 5 ns. When a constant d.c. drive current is applied to the device optical output power is 300 µW. Determine the optical output power when the device is modulated with an rms drive current corresponding to the a.c. drive current at frequency of 100 MHz. Also determine the 3 dB optical bandwidth.	2+2
8.	**(a)**	Derive Einstein's relation in two level atomic system. What is population inversion?	5+1
	(b)	With neat energy band diagram explain how threshold condition of lasing is achieved in a semiconductor p-n junction laser.	4
9.	**(a)**	Compare LED and LASER in terms of output power, linearity, thermal behaviour, device response and spectral width.	5
	(b)	Give some advantages of injection laser.	2
	(c)	An injection laser has an active cavity with losses of 30 cm^{-1} and reflectivity of each cleaved facet is 30%. Determine the laser gain coefficient for the cavity when it has a length of 600 µm.	3
10	**(a)**	What is quantum efficiency and responsivity of an optical detector?	2
	(b)	Derive an expression of SNR for a p-n/p-i-n type receiver.	4
	(c)	A silicon p-i-n photodiode used in an optical receiver has quantum efficiency of 60% at an operating wavelength of 0.9 µm. The receiver uses an amplifier whose noise figure is 3 dB. The dark current is 3 nA and the load resistance is 4 $k\Omega$. If the incident optical power is 200 nW and post detection bandwidth is 5 MHz, calculate the SNR at the output of the receiver.	4
11	**(a)**	What is power and rise time budgeting in case of fiber optic point to point link?	2
	(b)	Describe the principle of operation of EDFA.	4
	(c)	The parameters for a long-haul single mode optical fiber system operating at 1.3 µm are-transmitter power: 3dBm, cable loss: 0.4 dB/km, splice loss: 0.1 dB/km, connector losses at transmitter & receiver end: 1 dB each and sensitivity or minimum power required for APD receiver is -55 dBm when operating at 35 Mbps (BER 10^{-9}). Estimate the maximum link distance assuming a system margin of 5 dB	4
12.	**Write shot notes on any two of the following.**		
	(a)	Quantum Well Laser (QWL)	5
	(b)	Fiber Bragg Grating (FBG)	5
	(c)	2x2 optical coupler	5
	(d)	Avalanche Photodiode (APD)	5

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B.Tech. Examination-2022
Electronics and Communication Engineering
(Even Semester Regular and Supplementary)
VLSI Circuit Design (ECEUGPC17)

Full Marks: 80 Time: 3.00 Hrs

- ***Answer any five questions.***
- *Figures on the right hand side margin indicate full marks.*
- *Symbols have their usual meanings*
- *Assume all necessary parameters*

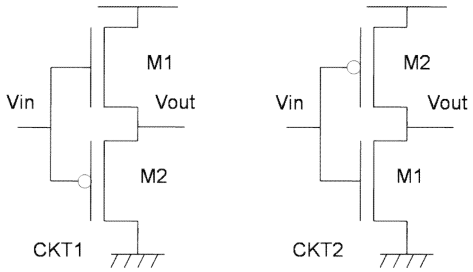
			Marks
1.	(a)	Show all the overlap capcitances associated with a MOS transistor in bulk Silicon process.	8
	(b)	Show the dependency of the overlap capacitances in 1(a) on the operating conditions/V_{GS} of the MOSFET with proper plots.	4
	(c)	Design a circuit, using a single MOSFET, and no other component, that emulates constant capacitance for the terminal voltage above V_T.	4
2		Derive an expression of the change in the transistor threshold voltage due to shortening of MOSFET channel length.	16
3.		Write short notes on the followings:	
	(a)	Drain Induced Barrier Lowering in MOSFET.	5
	(b)	Channel length modulation effect in MOSFET.	4
	(c)	Few device optimizations techniques in MOSFET to reduce short channel effects.	7
4	(a)	Explain the technological motivations for scaling of MOSFET.	8
	(b)	What is Moore's law?	3
	(c)	Suppose, there are 150 transistors in a one square micron area of a Si wafer for a digital circuit having supply voltage of 1.5 Volt and clock frequency of 250 MHz. During a design optimization step it is required to increase the number of transistors in that region by 50% and frequency by 1.2 times but keeping the power dissipation the same. What should be the new value of the supply voltage to that region of the wafer?	5
5	(a)	Draw the device cross-sections of NMOS and PMOS transistors in bulk single well CMOS as well as SOI processes.	4x2
	(b)	Draw the isometric device diagram of NMOS FinFET.	2
	(c)	State the advantages and disadvantages of SOI technology over bulk Silicon technology?	6
6	(a)	For the resistive load NMOS and PMOS inverters, draw and explain their VTCs.	6
	(b)	Derive expressions of V_{IL}, V_{IH}, V_{OH}, V_{OL} and V_{th} of one of inverters in 6(a).	5x2
7		For a CMOS inverter, driving another one, derive an expression of high-to-low delay assuming long channel regime. State all the necessary assumptions.	16
8	(a)	For N transistors connected as describe below, each having a distinct value of aspect ratio, find the approximate the aspect ratio of the equivalent transistor. The connections are (i) all in parallel, and (ii) all in series. State the simplifying assumptions.	2x4
	(b)	Show that the switching threshold voltage of the carry generation circuit of a Full Adder is dependent on the input condition.	8

9 (a) State the distinguishing properties of a digital circuit. 4

(b) Why on a VTC of a digital circuit, V_{IL} and V_{IH} are computed at the point of slope of -1? 4

(c) Explain why in a digital circuit the small signal voltage gain at the switching threshold voltage should be optimized? 4

(d) Explain with reasons, among the circuits given below, which one is a digital circuit? 4



10 (a) From the truth table of the full adder, derive the equations of carry generate (G) and propagate (P) signals. 4

(b) Prove that G and P signals of smaller consecutive subgroups can be associated to produce G and P signals of the combined larger group. 4

(c) Draw the transistor level diagram of the Manchester carry chain (MCC). Optimize the block size of a MCC cell with systematic approach. 4+4

11 (a) What is Miller's theorem? What is Miller's capacitance? 5+1

(b) For a simple resistive-load NMOS transistor-input amplifier, derive the expressions of the unity gain frequency, considering the source and the drain diffusion resistances. 5

(c) Explain, how the effect of Miller's capacitance is suppressed in cascode connection of transistors. 5

12 (a) What information is stored in the standard cell and the IO cell libraries? 4

(b) What is standardized in a standard cell? What are the spare cell and the filler cell? 4

(c) What do you understand by routing grids? 4

(d) Explain the basic optimization done on the directions of the routing grids of alternate metallization layers? 4

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