

Answer question 1 and any six from rest.

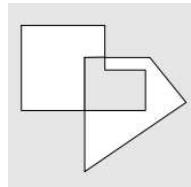
- i) Answers to the same question should be in contiguous pages.
- ii) Missing data, if any, may be assumed with justification.

1. Answer the following questions (Any 10) $10 \times 2 = 20$

- a. Define 4-neighbors and diagonal neighbours of a pixel.
- b. What is histogram of an image? Define D8-distance.
- c. _____ and _____ transformations are used to compress the dynamic range of values within an image.
- d. _____ image is a logical array of 0s and 1s. Find the number of bits required to store a 256×256 image with 32 gray levels.
- e. What is the effect of notch filter on image?
- f. Prove the validity of the equation: $F[f(x,y)e^{j\pi(x+y)}] = F(u - M/2, v - N/2)$
- g. Write Sobel horizontal and vertical edge detection masks.
- h. What are the principal sources of noise in digital images?
- i. What is data redundancy? What are the three basic data redundancies in digital image compression?
- j. What will be the output of input image shown below after median filtering?

1	2	3
6	5	4
7	3	1

- k. What are max and min filters?
- l. What do you mean by translation of a set? Which morphological operation is suitable for conversion of given images from left to right?
- m. How many different shades of gray are there in a safe color RGB system? Let the intensity value of Red is 50 in an RGB image. For a color to be gray find the values of Green and Blue.
- n. The following figure shows two closed sets A and B. Give an expression using \cap , \cup and $\overline{\cdot}$ for the shadowed part.



2. a) Given a grayscale image in tif with the following information:

FileSize: 297030; Width: 600; Height: 494; BitDepth: 8; XResolution: 105.5118; YResolution: 105.5118;
 ResolutionUnit: 'Centimeter'. Find: (i) Physical width of image (ii) Physical height of image (iii) Compression ratio. 3

b) Define Histogram equalization? Draw the original histogram, Equalized histogram from the given table having 3 bit image of size 64×64 . 7

Gray Level	0	1	2	3	4	5	6	7
No. of Pixel	700	990	650	480	460	300	150	75

3. a) Discuss the spatial domain methods for image enhancement. 4
 b) Explain first order and second order derivative for following data. Discuss property and applications of both. 4+2

5	5	4	3	2	1	0	0	0	6	0	0	0	0	1	3	1	0	0	0	0	7	7	7	7
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

4. a) Describe how homomorphic filtering technique is used to separate illumination and reflectance component of a digital image? 5
 b) Explain sampling and quantization with reference to digital image processing. 3
 c) Given digital picture moon.tif has following attributes:
 File size: 252238, Width: 466, Height: 540, Bit Depth: 8
 (i) Find the compression ratio.
 (ii) Find the physical size of moon.tif
 (A) if it is displayed on a monitor of size 12x9 on resolution 800x600.
 (B) if it is printed on a laser printer of dpi 300.

5. a) Find an image f by restoring the given image g with median filter of size 3×3 with zero padding: 4

4	6	1
6	2	0
2	5	4

g

- b) Given a sample of poor resolution of text (broken characters) on left hand side and suggest a suitable method by using FFT for its correction as shown on right hand side. (a) Write in detail all steps of whole process of FFT, (b) suggest suitable filter 5+1



6. a) With neat diagram, explain the image degradation model. An input image $g(x, y)$ is blurred by convolution by a blurring function $h(x, y)$ and then has random noise $n(x, y)$ added. Give a mathematical expression for the resulting image $f(x, y)$. Describe how to restore the image using the Inverse Fourier filter, i.e. how to estimate $g(x, y)$ given $f(x, y)$ and knowing $h(x, y)$. Give an expression for the noise distribution $n'(x, y)$ in the restored image. 4+1
 b) Complete the following table with the most suitable restoration filters: 5

Noise ->	Gaussian	Salt	Pepper	Salt-and-pepper	Gaussian & Salt-and-pepper
Filter					

7. What is the goal of image Compression? Draw a functional block diagram of a general image compression system. Discuss compression process and de-compression process with this block diagram. 1+2+7

8. a) What are the different mean filters used for restoration? Explain with suitable example of application. 4
 b) With help mathematical expression explain the effect of the following noises on image and suggest filters to remove them
 (i) Salt & Pepper Noise (ii) Raleigh Noise (iii) Uniform Noise 6
9. a) Define Erosion and Dilation processes with reference to digital image processing. 2+2
 b) Apply morphological erosion on image *A* by using structuring element *SE* and show your result. 3

0	1	0
1	1	1
0	1	0

SE

	1	1	1	1	
	1	1	1	1	
	1	1	1	1	
			1	1	
	1	1	1	1	

Given Image *A*

- c) Apply morphological dilation on image *B* by using structuring element *SE* and show your result. 3

0	1	0
1	1	1
0	1	0

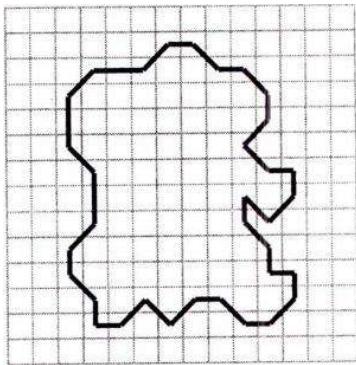
SE

		1	1		
			1		

Given Image *B*

10. a) What are the basic qualities that are used to describe the quality of a chromatic light source? Define all. 3
 b) Explain RGB color model of an image. 4
 c) Elucidate the step by step process to convert RGB to HSI model. 3
11. a) Discuss in detail Opening operation which is important Morphological operations. 3
 b) Explain briefly Region based segmentation. 4
 c) Prove that the Laplacian operator is independent of rotation. 3
12. a) Describe the HSI color image model. Explain the colors conversion from HSI to RGB. 3+4
 b) Explain CMY model used in color image processing. 3
13. a) What is image segmentation? Write the applications of segmentation. What are the basic approaches for segmenting an image? 2+1+1

- b) Discuss about thresholding based image segmentation techniques. 6
14. a) For an Object with the following boundary, obtain a rotation invariant chain code description. 5



- b) Discuss in brief Hit or Miss Transformation for object shape detection
15. a) Discuss in detail Thinning and Thickening which are important Morphological operations. 5
- b) Encircle the most suitable frequency domain filter: 5
- | | | |
|--|--------------------|---------------------|
| A. Notch | B. Gausian Lowpass | C. Gausian Highpass |
| a. to sharp edges of an image | A B C | |
| b. to change the average intensity value of an image to zero | A B C | |
| c. to blur an image | A B C | |
| d. to reduce contrast in the image | A B C | |
| e. to change uniform background | A B C | |

-End-

Odd Semester Examination, 2021

**Paper Code: HU401; Paper name: Professional Values and Ethics
Electronics and Communication Engineering Department**

Full Marks: 80

Time: 3 Hours

*(The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as possible)*

GROUP: A (Answer *any five* questions) (7 x 5 = 35)

$$(7 \times 5 = 35)$$

1. Krish is a junior engineer in a big oil company. She has been working under Andy's supervision for the past three years. Krish knows that Andy is a good manager, but she has noticed that he frequently has liquor on his breath at work and that sometimes his speech is slurred. One day Krish learns that Andy is about to be offered a better paying position. She is happy for Andy until she learns that his new job will be the Chief Safety Inspector for all the oil rigs that the company owns in the region. Krish worries that Andy's drinking habit will interfere with his future job. Andy agrees that he will have to cut back on his drinking, but he tries to assure Krish that he has things under control. He says that he is going to take the job, and he asks Krish not to tell anyone about his drinking. Should Krish take her concerns to higher management? Give reason for your answer.
 2. Define values. What are the various types of values?
 3. What is Multinational Corporation? What are the various International Human Rights?
 4. What is computer ethics? Describe different types of problems found in computer ethics.
 5. Define safety and risk. Describe different methods to determine the risk (testing for safety).
 6. What is Occupational crime? What are the various types of occupational crime?
 7. Define courage. What are the various types of courage? What characteristic does courageous people own and have?

GROUP: B (Answer *any three* questions) (3 x 15 = 45)

1. You find a novel solution to an important problem posed by your advisor; however, your advisor sees this as an opportunity for him to get published, downplays the significance of the results, collates a paper and submits it before you are any the wiser (the paper acknowledges a discussion with you, but does not include you as an author). You are absolutely clear that this idea was yours, and feel suitably put out. You approach your advisor and make a complaint, but he empathizes with you and tells you to be a bit quicker with the write-up next time. He tells you, “That’s just the way of the world.”

You decide not to leave it there, and approach the head of the department (going up one link in the management chain). You make your complaint to him, and he asks you for evidence, but you can't provide any because you didn't keep a dated notebook: all of your notes are in several ring binders, some at home and some in your desk at work. You start feeling a bit silly, and the head advises you to drop the matter.

- i. Should you drop the issue?
 - ii. Are there long-term consequences for anyone to not dropping the issue?

- iii. Is there a “fair” way to make a claim to the results?
 - iv. In the last question, what does the word “fair” mean?
 - v. The section on Educational Concerns has a case study about whistle blowing. Are there any whistleblower aspects to this case study?
2. What are the moral and ethical lessons learnt from the space shuttle challenger study.
 3. What is a conflict of interest? Explain the different types of conflicts of interest with suitable examples. You are in a subfield of physics that is financially strapped. You are asked to do a technical review of an experiment, which is not directly the same as one you have proposed but if it is not funded, yours is likely to be (or vice-versa).
 - i. Should you refuse to participate in the review?
 - ii. Why or why not?
 4. Explain three levels of moral development with respect to Kohlberg theory. How did Gilligan view the three levels of moral development initiated by Kohlberg?

Full marks: 80

Time : Writing 3.00 Hrs, Uploading 30 minutes.

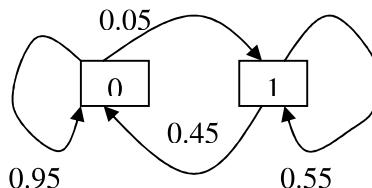
Answer any five questions. Only the 1st five answers will be evaluated.

A question, bearing 5 marks or less, has to be answered within one page.

Symbols have their usual meaning.

The file name of the uploaded answer script should be **OddSem2020_21_ECE401_RollNo.pdf**

- | | | |
|---|---|----|
| 1 | Prove that information capacity of a continuous channel bandwidth W Hz, disturbed by AWGN of power density $N_0/2$ and limited in bandwidth to W Hz and with average transmitted power P watt is given by $C = W \log_2 \left(1 + \frac{P}{N_0 W}\right)$. | 16 |
| 2 | a Describe the method for calculation of source entropy $H(X)$ from a 1 st order Markov source where outputs symbols belong to GF(2).
b For the given 1 st Order Markov Source calculate the source entropy $H(X)$. | 8 |



- | | | |
|---|---|-------------------------|
| 3 | a Explain the Lloyd-Max quantizer optimization procedure.
b Consider a continuous input signal (X) having uniform probability density function between $[-1,1]$, and zero outside. This input has to be quantized into two discrete quantizer levels using Lloyd-Max optimization procedure. Find the quantizer threshold and quantizer levels. | 8 |
| 4 | a Write the LSBF and MSBF algorithms using pseudo language for modular polynomial multiplication over $GF(2^m)$, generated by $G(x)$.
b Let $A(x)=x^2+x+1$ and $B(x)=x^2+x$ are two elements of $GF(2^3)$, where $G(x)=x^3+x+1$. Compute $C(x)=A(x)B(x) \bmod G(x)$ using only the LSBF algorithm of (a). | 4+4 |
| 5 | a What is systematic linear block code?
b What is code rate?
c What is coding gain of a code?
d For a systematic linear block code, explain mathematically the construction of the generation and the parity check matrices.
e What is syndrome of a code word. | 3
1
1
4+4
3 |
| 6 | a What is a cyclic code?
b Describe a circuit for systematic encoding of a (n, k) cyclic code.
c Let $g(x)=1+x+x^3$ be the generator polynomial of a binary $(7, 4)$ cyclic code. Encode in systematic form the message vector $\mathbf{u}=(1011)$ using the circuit in (b). | 2
6
8 |
| 7 | a Describe the Meggit Decoder of a cyclic code with proper mathematical explanation and diagram.
b Let $g(x)=1+x+x^3$ be the generator polynomial of a binary $(7, 4)$ cyclic code. Suppose the code polynomial $u(x) = 1+x^3+x^5+x^6$ is transmitted over a noisy channel, and the | 8
8 |

corresponding received polynomial is $r(x)=1+x^2+x^3+x^5+x^6$. Using a Meggit Decoder of the code, find the error polynomial $e(x)$.

- | | | |
|----|---|-------|
| 8 | a Define the binary and the q-ary BCH code. Define the Reed-Solomon code. | 1+1+1 |
| | b Describe the Peterson-Gorenstein-Zierler (PGZ) decoding algorithm using a flow chart. | 5 |
| | c Consider a 3-error correcting (15, 5) binary BCH code with generator polynomial $g(x)=1+x+x^2+x^4+x^5+x^8+x^{10}$. Assume that the received polynomial is $r(x)=x^2+x^7$. Using the PGZ algorithm, find the error locator polynomial and the error locations. | 8 |
| 9 | a What is convolutional code? | 4 |
| | b What is the fundamental difference between a convolutional code and a block code? | 4 |
| | c Explain, with help of a (2,1,2)-convolutional code with your chosen output equations, various methods of representations of this code. Compute the minimum distance of this example code. | 8 |
| 10 | a What is the advantage of a concatenated code? | 2 |
| | b Suppose the format of a product-code is | 14 |

d_1	d_2	p_{12}
d_3	d_4	p_{24}
p_{13}	p_{24}	

, where $p_{mn}=d_m \text{ XOR } d_n$, $m \in [1,2,3,4]$, $n \in [1,2,3,4]$, for all parity bits in the format. Such a codeword was transmitted over an AWGN channel with zero mean and unity variance. At the receiver, the following word was received in soft form as

0.8	0.05	1.25
0.1	0.15	1.05
3.5	0.5	

Find the transmitted code word using Turbo decoder.

Regular and Supplementary Exam (B Tech, 7th Semester) 2021

Subject: RF and Microwave engineering

Subject code: ECE 403

Time: 3 Hours

Full marks: 80

Answer any eight questions.

1. Define the following terms: (a) Gain of an antenna, (b) Mode coupling, (c) Impedance BW, (d) Efficiency of an antenna, (e) Cut off frequency of waveguide.

[2*5=10]

2. Calculate the field expressions ($E_X, E_Y, E_Z, H_X, H_Y, H_Z$) for TE to Z mode in rectangular wave guide? [10]

3. Calculate the power dissipation in rectangular wave guide walls for TE_{01} Modes [10]

4. Calculate the quality factor of rectangular resonator for TE_{011} Mode. [10]

5. Calculate the phase and group velocities and the wave impedance of the TE_{10} mode in rectangular waveguide filled by air with the internal dimensions $a = 22$ mm, $b = 10$ mm. The operating frequency 10 GHz. [3+3+4]

6. An air-filled 5- by 2-cm waveguide has $E_z = 20 \sin 40\pi x \sin 50\pi y e^{-j\beta z}$ V/m at 15 GHz. (a) What mode is being propagated? (b) Find β . [5+5]

7. (a) Write Maxwell equations for source free and with source region. (b) Write boundary conditions for dielectric interface. (c) Write boundary conditions for perfect electric conductor. (e) Write boundary conditions for magnetic wall. [4+2+2+2]

8. (a) What are the properties and characteristics of Waveguides? (b) Define TE and TM mode in rectangular waveguide? (c) Why TEM mode does not supported by waveguide. (d) Write the frequency range for the following bands: L, Ca, Ku, X, UHF, VHF. [2+2+2+4]

9. (a) What is waveguide junction? (b) What types of waveguide junctions are available? Explain each type with construction, field line. (c) Explain waveguide E bend and H bend. [1+6+3]

10. (a) What are the differences between attenuator and directional coupler (b) What is two holes directional coupler. Explain with diagram. Also write the S matrix of two ports, two holes directional coupler. [3+2+4+1]

- 11.** What is reflex klystron? Explain the working principle of reflex klystron with diagram.
Application of reflex Klystron [2+6+2]
- 12.** What is TWT ? Explain the working principle of TWT with diagram. Also write the application of TWT [2+6+2]
- 13.** What are Transferred electron devices? What is the need of negative resistance in microwave generation? Mathematically explain the working principle of GUNN diode. [2+2+6]
- 14.** (a) The interior of a $\frac{20}{3} \text{ cm} \times \frac{20}{4} \text{ cm}$ rectangular waveguide is completely filled with a dielectric of $\epsilon_r = 4$. Waves of free space wave – length shorter than.....can be propagated in the TE₁₁ mode.
- (b) Refractive index of glass is 1.5 Find the wavelength of a beam of light with a frequency of 10^{14} Hz in glass. Assume velocity of light $3 \times 10^8 \text{ m/s}$ is vacuum. [5+5]
- 15.** (a). A rectangular metal wave guide filled with a dielectric material of relative permittivity $\epsilon_r = 4$ has the inside dimensions $3.0 \text{ cm} \times 1.2 \text{ cm}$. The cut off frequency for the dominant mode is
(b) A rectangular waveguide having TE₁₀ mode as dominant mode is having a cut off frequency of 18 GHz for the TE₃₀ mode. The inner broad – wall dimension of the rectangular waveguide is [5+5]
- 16.** How will you measure the impedance in microwave test bench [10]
- 17.** Draw a microwave test bench and explain each section [10]

Instructions: Answer all parts of a question in the same place in continuous manner. Brief and to the point answers are encouraged to restrict number of pages as minimum as possible

Answer any 5 from Question No. 1 and any 5 from the rest.

1. (a) What are different types of satellite launch vehicles? 5x2
 (b) Write down two differences between LEO and MEO satellites?
 (c) Write down two applications of satellite communication.
 (d) What do you understand by Molniya & HAP orbits?
 (e) What is geosynchronous satellite?
 (f) What is isotropic antenna?
 (g) What are satellite resources?

2. Define the following parameters with reference to satellite orbits: (a) Apogee & Perigee, (b) Eccentricity, (c) Ascending & Descending nodes, (d) Look angles and (e) Sub-satellite point 4+2+3+3+2

3. (a) Describe three principle sections and their functions in the structure of an active satellite.
 (b) Calculate the slant range of a geostationary satellite orbiting at 42000 km from an earth station making an elevation angle of 20° . Also find the viewing angle of the satellite. 8+6

3. (a) Describe briefly the different types of spacecraft antennas?
 (b) Write down the expressions for gain and 3 dB beam width of aperture antenna.
 (c) The earth subtends an angle of 17° when viewed from geostationary orbit. What are the dimensions and gain of horn antenna that will provide global coverage at 4 GHz? 6+3+5

4. (a) Why signal attenuation takes place in satellite communication? Derive an expression of path loss.
 (b) An earth station transmits at 5.62 GHz from an antenna of 6 m diameter. The transmitter generates an output of 8 kW. The satellite is 39920 km away from the earth station. The efficiency of transmitting antenna is 0.7. Calculate (i) path loss, (ii) EIRP, (iv) received power at the satellite. 8+6

5. (a) Deduce the expression of rain attenuation using Simple Attenuation Model (SAM).
 (b) Calculate the rain attenuation if an earth station is at a latitude of 35° and the transmission takes place on a carrier of 6.21 GHz. The elevation angle of earth station antenna and rain rate are 35° and 15 mm/hr respectively. 8+6

6. (a) Compare among different multiple access techniques?
 (b) Calculate the frame efficiency and number of voice channels in QPSK and BPSK in case of INTELSAT frame wth following information: total frame length of 120832 symbols, traffic burst per frame of 14, reference burst per frame of 2, guard interval of 103 symbols, preamble of 280 symbols, voice channel bit rate of 64 kbps, post ample of 8 symbols and frame period of 2 ms. Assume 2 bits/symbol. 6+8

7. (a) Describe noise model of satellite receiver and deduce the expression of equivalent system noise temperature?
 (b) Calculate the nose temperature of a 6 GHz receiver system having gains and noise temperatures are as follows: $T_{in} = 75K$, $T_{rf} = 75K$, $T_m = 400K$, $T_{if} = 1000K$, $G_{rf} = 23dB$, $G_m = 10 dB$ and $G_{if} = 35dB$. 8+6

8. Write short notes on any two of the following: 7x2
 (a) Attitude and Orbit Control System
 (b) Ionospheric Losses
 (c) CDMA
 (d) BPSK Demodulation Technique

ALIAH UNIVERSITY
Department of Electronics and Communication Engineering

Even Semester (Reg.+Supple.) Examination 2020

Subject Name: Photonic Devices & Optical Communication; Subject Code: ECE304

Time: 2 hrs.

Total Marks: 40

Answer any 8 Questions. (8x5)

1. Draw and show different blocks of a general communication system and an optical communication system. Indicate any two differences. 2+2+1
2. What wavelength of light has the lowest loss in silica fiber? An optical fiber has numerical aperture of 0.20 and cladding refractive index of 1.49, calculate acceptance angle of the fiber in water which has refractive index of 1.33 and critical angle at the core-cladding interface. 1+2+2
3. What is the criterion of a single mode fiber? Define cut off wavelength of such fiber. A single mode SI fiber is operating in guided mode. The core refractive index and radius are 1.49 and 5 μm respectively. The refractive index difference between core and cladding is 0.25%. Calculate the cutoff wavelength of the fiber. 2+3
4. What do you understand by fiber modes? What is cut-off wavelength of a single mode fiber? A multimode step index fiber with a core diameter of 50 μm and a refractive index difference of 5% is operating at a wavelength of 1300 nm. If the core refractive index is 1.49, calculate normalized frequency and number of guided modes of the fiber. 1+1+3
5. What is pulse dispersion? Why graded index fiber has negligible inter modal dispersion compared to step index fiber? A single mode fiber operating at 1.3 μm is found to have a total material dispersion of 2 ns and total waveguide dispersion of 0.4 ns. Calculate the received pulse width and approximate bit rate of the fiber, if the transmitted pulse has a width of 0.5 ns. 1+1+3
6. Describe the role of material absorption losses and linear scattering losses in relevance to optical fiber loss mechanism. If input power to a multimode fiber is 200 μW and the output power after traversing 15 km in the fiber is 4 μW , find the fiber loss in dB. 4+1
7. With the help of a schematic diagram, explain the operation of a double heterojunction LED and point out some advantages compared to homo-junction structures. 4+1
8. How laser is different from LED? Draw V-I characteristics curves of these two light sources. Calculate the emission wavelength from a direct band gap semiconductor of band-gap energy 0.67 eV. 2+1+2
9. Derive the expression of SNR for an optical receiver using p-n/p-i-n type photodetectors. 5
10. A silicon p-i-n photodiode used in an optical receiver has quantum efficiency of 70% at an operating wavelength of 1.3 μm . The receiver uses an amplifier whose noise figure is 3 dB. The dark current is 1 nA and the load resistance is 8 k Ω . If the incident optical power is 100 nW and post detection bandwidth is 6 MHz, calculate the SNR at the output of the receiver. 5
11. The parameters for a long-haul single mode optical fiber system operating at 1.3 μm are: transmitter power: 3 dBm, 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. 5

Aliah University

End-Semester Examination (Spring Semester) - 2020 (*B.tech 3rd Year 6th Semester*)

Subject Name: Computer Network

Full Marks: 40

Subject Code: CSE302

Answer any 8 questions

$8 \times 5 = 40$

1. (a) How does a switch differ from a hub?
(b) What are the advantages and disadvantages of ring topology? (2+3)
2. (a) Define switching and multiplexing.
(b) Differentiate between Time division and Frequency division multiplexing with diagrams. (2.5+2.5)
3. (a) Suppose the following sequence of bits arrive over a link: 01101011111010100111111101100111110. Show the resulting frame after any stuffed bits have been removed. Indicate any errors that might have been introduced into the frame.
(b) Suppose that the sender wants to send 4 frames each of 8 bits, where the frames are 11001100, 10101010, 11110000 and 11010011. Calculate the checksum for this message. (2.5+2.5)
4. Suppose we want to transmit the message 1011 0010 0100 1011 and protect it from errors using the CRC polynomial $x^8 + x^2 + x^1 + 1$.
(a) Use polynomial long division to determine the message that should be transmitted.
(b) Suppose the leftmost bit of the message is inverted due to noise on the transmission link. What is the result of the receiver's CRC calculation? How does the receiver know that an error has occurred? (2.5+2.5)
5. What do you understand by switching along with various types of switching mechanisms? (5)
6. (a) What is the sender and receiver window size in Go Back N protocol?
(b) Explain why the sender and receiver window size in Selective Repeat protocol can be at most 2^{m-1} . What happens if it becomes greater than 2^{m-1} ? (1+4)
7. Explain class A and class B addresses. What is the purpose of subnetting? (5)
8. (a) Explain with diagram the 3-way handshaking mechanism for connection establishment in transport protocol.
(b) What are the differences between TCP and UDP services? (3+2)
9. Write short notes on
(a) LAN
(b) Slotted ALOHA (2.5+2.5)

Aliah University
Department of Electrical Engineering
B. Tech. VI Sem Examination December -2020

Sub: Power Electronics

Full Marks: 40

Code- EE306

Duration: 2 hrs

Group-A
(Answer any Four: 4X5 = 20)

1. Draw and explain reverse recovery characteristics of PN junction power diode.
2. A bipolar transistor has $\beta = 50$, has load resistance $R_C = 10\Omega$, dc supply voltage $V_{CC} = 120V$ and input voltage to base circuit, $V_B = 10$ volt. For $V_{CES} = 1.2V$ and $V_{BES} = 1.6$ volt, calculate
 - A. the value of R_B for operation in the saturated state
 - B. the value of R_B for an Overdrive factor 6
 - C. forced current gain and
 - D. power loss in the transistor for both part A and B.
3. With proper diagram explain the working principle of n channel depletion type MOSFET
4. With proper circuit diagram explain the working principle of single-phase half wave rectifier with RL load. Draw the input and output voltage and current characteristics for the circuit. Derive the average output voltage for the rectifier circuit.
5. For three phase diode bridge rectifier –
 - (A) How much is the value of periodicity?
 - (B) How this value of periodicity can be varied?
 - (C) Derive the average value of the load voltage.
 - (D) Determine the ripple voltage

Group-B
(Answer any Four: 4 X 5 = 20 Marks)

6. Explain the working of step-Up chopper with the help of relevant circuits, waveforms and equations.
7. A battery powered electric vehicle uses a dc motor drive, controlled by a Step-Down chopper working at 10 kHz. The battery voltage is 200 V. The minimum turn-on & turn-off time of the chopper switch are $5 \mu s$ & $20 \mu s$, respectively. Determine the minimum & maximum dc voltage that the chopper can deliver to the motor.
8. Explain the working of Single-Phase Full Bridge Inverter with RL-load with the help of circuit diagram and waveforms. Show the active circuit in each of the four modes of operation for a complete cycle operation.
9. Discuss briefly the voltage control of an inverter. Describe Sine-PWM technique in detail.
10. Draw and explain the operation table (table indicating the conducting switches, phase voltages & line voltages in each of the six modes) for a three-phase inverter in 120 degree mode.

End Semester Examination (December-2020)
Academic Session-2019-20
Digital Signal Processing (ECE302)
ECE & EEN 3rd Year 6th SEM,Credit: 4

Full Marks-40**Time-2.00Hrs****Answer any four questions**

1. a. Find the odd and even components of the following sequence

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

- b. Find the linear convolution of the following signals by using graphical method

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

$$5+5=10$$

2. Show that output of system $y(n)$ is the convolution of input signal $x(n)$ with impulse response $h(n)$.

What is LTI system?

$$5+5=10$$

3. Determine the (a) Impulse Response and (b) Step Response of the following system and also asses the stability.

$$y[n] + y[n-1] - 2y[n-2] = x[n-1] + 2x[n-2]$$

$$4+4+2=10$$

4. Define Z-Transform of a discrete sequence and prove the convolution property of Z-Transform. Define ROC and write down its properties.

$$1+4+1+4=10$$

- a. Determine the Z-transform of the following sequence and find ROC

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

- b. Find inverse Z-transform of the following

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

$$5+5=10$$