

PRINCIPLES OF ELECTRONIC COMMUNICATIONS

Subject Code : EC511OE
Regulations : R16 - JNTUH
Class : III Year B.Tech EEE I Semester



Department of Electrical and Electronics and Engineering

BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY

Ibrahimpattam - 501 510, Hyderabad

PRINCIPLES OF ELECTRONIC COMMUNICATIONS (OPEN ELECTIVE - I)

I. COURSE OVERVIEW:

- Impart knowledge on analog and digital modulation techniques as well as make the students to understand about various wireless and cellular, mobile, satellite and telephone communication systems.

II. PREREQUISITE:



- Basic knowledge of Probability, Calculus
- Fourier Transform
- Basic Knowledge on Analog and Digital Communications.

III. COURSE OBJECTIVE:

1.	To Introduce the students to modulation and various analog and digital modulation schemes.
2.	Make students to have a broad understanding of satellite, optical, cellular, mobile, wireless and telecom concepts.

IV. COURSE OUTCOME:

SL. NO	DESCRIPTION	BLOOM'S TAXANOMY LEVEL
1.	Students are able to work on various types of modulations.	Knowledge, Understand (Level 1, Level 2)
2.	Students can be able to use these communication modules in implementation	Apply, Evaluate, Analyze, Create (Level 3, Level 4, Level 5, Level 6)
3.	They will have a basic understanding of various wireless and cellular, mobile and telephone communication systems.	Understand (Level 2), (Analyze (Level 4))

V. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (PO)		Level	Proficiency assessed by
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Assignment, Mock Test
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	3	Assignment, Mock Test
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations	3	Assignment, Mock Test
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	Assignment, Mock Test
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	3	Assignment, Mini project, Mock Test
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health,	1	Assignment,

	safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice		
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	1	Assignments
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	2	Seminar, mini projects
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	2	Mini projects
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	Seminar, participation in paper presentation
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	3	Seminar, Mini Projects
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	Paper presentation, participation in workshop and seminars. Conferences and Journal publication

VI. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED

	Program Specific Outcomes (PSO)	Level	Proficiency assessed by
PSO1	<i>Talented to analyze, design and implement electrical & electronics systems and deal with the rapid pace of innovations and developments.</i>	2	Test, Assignments, Seminars
PSO2	Skillful to use application and control techniques for research and advanced studies in Electrical & Electronics Engineering domain.	1	Test, Assignments, mini projects

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) - : None

VII. SYLLABUS:

UNIT – I

Introduction: Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.

UNIT – II

Simple description on Modulation: Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes.

UNIT - III



Telecommunication Systems: Telephones Telephone system, Paging systems, Internet Telephony. Networking and Local Area Networks: Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

UNIT – IV

Satellite Communication: Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems. Optical Communication: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing

UNIT - V

Cellular and Mobile Communications: Cellular telephone systems, AMPS, GSM, CDMA, and WCDMA. Wireless Technologies: Wireless LAN, PANs and Bluetooth, Zig Bee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

TEXT BOOKS:

1. Principles of Electronic Communication Systems, Louis E. Frenzel, 3e, McGraw Hill publications, 2008.
2. Electronic Communications systems, Kennedy, Davis 4e, MC GRAW HILL EDUCATION, 1999

REFERENCE BOOKS:

1. Theodore Rapp port, Wireless Communications - Principles and practice, Prentice Hall, 2002.
2. Roger L. Freeman, Fundamentals of Telecommunications, 2e, Wiley publications.
3. Introduction to data communications and networking, Wayne Tomasi, Pearson Education, 2005.

NPTEL Web Course:

<http://nptel.ac.in/courses/106105082/32>

NPTEL Video Course:

- https://onlinecourses.nptel.ac.in/noc18_ee03/preview
https://onlinecourses.nptel.ac.in/noc17_ec14/preview
https://onlinecourses.nptel.ac.in/noc17_cs37/preview

UGC-NET Syllabus

Introduction: Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels. Simple description on Modulation: Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes. Satellite Communication: Satellite Orbits, satellite communication systems , Optical Communication: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing

VIII. COURSE PLAN (WEEK-WISE):

Session	week	Unit	Topics	Course Learning Outcomes	Reference
1.	1,2	1	Introduction of Modulation	Knowledge	T1,T2
2.			Need for Modulation	Comprehension	T1,T2
3.			Frequency translation	Comprehension	T1
4.			Frequency translation	Comprehension	T1
5			Electromagnetic spectrum	Knowledge	T1
6.			Gain, Attenuation and decibels.	Evaluate	T1
7			Gain, Attenuation and decibels.	Evaluate	T1

8.	2,3	2	Simple description on Modulation: Analog Modulation-AM	Comprehension, Synthesis	T1,T2
9.			FM	Comprehension, Synthesis	T1,T2
10.			Pulse Modulation-PAM	Comprehension, Synthesis	T1,T2
11.			PWM	Comprehension, Synthesis	T1,T2
12.			PCM	Comprehension, Synthesis	T1,T2, R2
13.			Digital Modulation Techniques-ASK	Comprehension, Synthesis	T2
14.	3,4		FSK, PSK	Comprehension, Synthesis	T2
15.			QPSK modulation	Comprehension, Synthesis	T2
16.			QPSK modulation	Comprehension, Synthesis	T2,R1
17.			Demodulation schemes.	Comprehension, Synthesis	T2
18.			Demodulation schemes.	Comprehension, Synthesis	
19.	5,6	3	Telecommunication Systems: Telephones Telephone system	Knowledge, Comprehension	T1,R1
20.			Paging systems, Internet Telephony	Comprehension	R1
21.			Networking and Local Area Networks: Network fundamentals	Comprehension	R1,R2,T1
22.			Networking and Local Area Networks: Network fundamentals		
23.			LAN hardware	Comprehension, Application	T1,R1,R2
24.			Ethernet LANs		T1, R2
25.			Token Ring LAN.	Comprehension, Application	T1
26.	7,8,9,10	4	Satellite Communication: Satellite Orbits,	Comprehension, Application	T1,R2
27.			satellite subsystems ,Ground Stations Satellite Applications	Comprehension, Application	T1,R2
28.			Global Positioning systems	Comprehension, Application	T1,
29.			Global Positioning systems	Comprehension, Application	T1,
30.			Optical Communication: Optical Principles,	Comprehension, Application	T1,
31.			Optical Communication Systems	Knowledge, Application	T1,R2
32.			Fiber –Optic Cables	Knowledge,	T1



				Application	
33.			Optical Transmitters & Receivers	Comprehension, Synthesis	T1
34.			Wavelength Division Multiplexing	Comprehension, Synthesis	T1
35.			Wavelength Division Multiplexing	Comprehension, Synthesis	T1
36.	11,12,13,14,15	5	Cellular and Mobile Communications: Cellular telephone systems,	Comprehension, Application	T1,R1,R2
37.			Cellular telephone systems, AMPS,	Comprehension,	T1,R1
38.			GSM	Comprehension, Application	T1,R1
39.			CDMA, and WCDMA.	Comprehension, Application	T1,R1
40.			Wireless Technologies: Wireless LAN	Comprehension	T1,
41.			PANs and Bluetooth	Comprehension	T1
42.			Zig Bee and Mesh Wireless networks	Comprehension	T1
43.			Wimax and MANs	Comprehension, Application	T1
44.			Infrared wireless, RFID communication.	Comprehension	T1
45.			UWB.	Comprehension	T1

IX. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

	Program Outcomes												Program Specific Outcome	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	1	-	-	-	-	2	1	1	1
CO2	3	3	3	2	3	1	2		2	2	-	-	1	1
CO3	-	-	-	-	2	2	2	-	-	-	-	-	1	1
AVG.	1.3	1	1	0.6	1.6	1.3	1.3	-	0.6	0.6	0.6	0.33	1	1

X. QUESTION BANK (JNTUH)

UNIT I

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Explain the need for modulation.	Analyse	1
2	A superheterodyne receiver must cover the range from 220 to 224 MHz. The first IF is 10.7 MHz; the second is 1.5 MHz. Find (a) the local oscillator tuning range, (b) the frequency of the second local oscillator, and (c) the first IF image frequency	Evaluate	1

	range. (Assume a local oscillator frequency higher than the input by the IF.)		
3	An amplifier has a gain of 45,000, which is too much for the application. With an input voltage of $20 \mu\text{V}$, what attenuation factor is needed to keep the output voltage from exceeding 100 mV? Let A_1 = amplifier gain = 45,000; A_2 =attenuation factor; AT =total gain.	Evaluate	1
4	An amplifier has an input of 3 mV and an output of 5 V. What is the gain in decibels? A filter has a power input of 50 mW and an output of 2 mW. What is the gain or attenuation?	Evaluate	1
5	Describe the various frequency ranges in the electromagnetic spectrum with its applications.	Remember	1
6	Communication system has five stages, with gains and attenuations of 12, 245, 68, 231, and 9 dB. What is the overall gain?	Evaluate	1
7	A power amplifier has an input of 90 mV across 10 kV. The output is 7.8 V across an 8-V speaker. What is the power gain, in decibels? You must compute the input and output power levels first.	Evaluate	1
8	A piece of communication equipment has two stages of amplification with gains of 40 and 60 and two loss stages with attenuation factors of 0.03 and 0.075. The output voltage is 2.2 V. What are the overall gain (or attenuation) and the input voltage?	Evaluate	1
9	Explain the concept of frequency translation with suitable example?	Understand	1
10	Explain gain , attenuation and decibels with suitable example?	Understand	1

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Define Modulation.	Remember	1
2	Why is modulation required?	Analyse	1
3	Define frequency and wavelength	Remember	1
4	Why frequency translation is required?	Analyse	1
5	What is frequency translation?	Remember	1
6	Define gain and decibel	Remember	1
7	What is the voltage gain of an amplifier that produces an output of 750 mV for a $30\text{-}\mu\text{V}$ input?	Evaluate	1
8	The maximum peaks of an electromagnetic wave are separated by a distance of 8 in. What is the frequency in megahertz? In gigahertz?	Evaluate	1
9	Define attenuation	Remember	1
10	A signal with a wavelength of 1.5 m has a frequency of	Evaluate	1

UNIT II

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
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1	Write AM equation. Define modulation index, and percentage modulation	. Apply	2
2	Define under-modulation and over modulation. Explain why over modulation is undesirable	Analyse	2
3	Explain operation of square law detector with circuit diagram and waveforms	Apply	2
4	An Am transmitter has an un-modulated carrier power of 10KW. It can be modulated by sinusoidal modulating voltage to a maximum depth of 40% without overloading. If the maximum modulation index is reduced to 30%. What is the extent upto which the unmodulated carrier power can be increased to avoid overloading	Evaluate	2
5	Describe the time domain band-pass representation of SSB with necessary sketches.	Apply	2
6	Find the percentage of power saved in SSB when compared with AM system.	Evaluate	2
7	Draw the frequency modulated wave equation and explains each term with the help of frequency spectrum.	Understanding	2
8	Determine the bandwidth when modulating signals amplitude is doubled? The maximum frequency deviation allowed in an FM broadcast system is 75 kHz. If the modulating signal is a single-tone sinusoid of 10 kHz, find the bandwidth of the FM signal. What will be the change in the bandwidth, if modulating frequency is doubled.	Evaluate	2
9	The input to an FM receiver has an S/N of 2.8. The modulating frequency is 1.5 kHz. The maximum permitted deviation is 4 kHz. What are (a) the frequency deviation caused by the noise and (b) the improved output S/N ?	Evaluate	2
10	Draw the ASK, FSK and PSK waveforms for digital data 10100110.	Understanding	2
12	Discuss about the spectra of PWM and PPM signals.	Analyse	2
13	Explain the working of QPSK modulator and demodulator	Understanding	2

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Define AM and FM	Remember	2
2	Compare AM and FM	Analyse	2
3	Explain the phasor diagram of FM signals	Understanding	2
4	State Carson's Rule?	Remember	2
5	Derive the equations for AM & FM waves?	Apply	2
6	State sampling theorem?	Remember	2
7	Define Image frequency rejection ratio	Remember	2
8	Define ASK, FSK and PSK	Remember	2
9	Show the space representation of PSK and QPSK	Understand	2
10	Construct the constellation diagram for Quadrature phase shift keying	Understand	2
11	Compare PAM, PPM and PWM	Analyse	2
12	Define PCM.	Remember	2

UNIT III

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Describe the characteristics of the various signals used in telephone communication.	Analyze	3
2	Explain the working of Telecommunication System with neat diagram	Understand	3
3	State the general operation of a cordless telephone.	Understand	3
4	Describe the operation of an Internet Protocol telephone.	Understand	3
5	Describe the operation of a PBX.	Understand	3
6	Illustrates the diagrams of LANs arranged according to the three basic topologies: star, ring, and bus.	Analyse	3
7.	Describe how repeaters,transceivers, hubs, bridges, routers, and gateways are used in LANs.	Analyse	3
8.	Discuss and compare various types of networks.	Analyse	3
9.	Explain the working of Ethernet and Token ring with neat diagram.	Understand	3
10	Describe the types of possible links between telephone exchanges. Are they two-line or four-line?	Understand	3

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Define specifically what is meant by the <i>local loop</i> .	Understand	3
2	State the characteristics of the ringing signal supplied by the telephone company.	Understand	3
3	What two tone frequencies are generated when you press the pound key (#) on a TouchTone phone?	Remember	3
4	Define POTS and PSTN.	Remember	3
5	What is network? What are its goals and application?	Understanding	3
6	Define the terms LAN, MAN, and WAN.	Remember	3
7	An office with 20 PCs is to be wired so that any computer can communicate with any other. How many interconnecting wires (or links, <i>L</i>) are needed?	Apply	3
8	What is meant by topologies?Name some popular topologies	Understanding	3
9	Define MAC address.	Understanding	3
10	What is an Ethernet switch, and what benefit does it offer?	Analyse	3

UNIT IV

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
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1	Discuss the elements of satellite communication systems? Explain each with a suitable block diagram?	Understand	3
2	A satellite is orbiting in the equatorial plane with a period from perigee to perigee of 12 hours. Given that the eccentricity is 0.002, calculate the semi-major axis. The earth's equatorial radius is 6378.1414 Km.	Apply	3
3	Explain how light is propagated through a fiber-optic cable. Name the three basic types of fiber-optic cables, and state the two materials from which they are made.	Understand	3
4	Explain the block diagram of optical fiber communication system with transmitter and receiver.	Remember	3
5	Explain the operation of an optical detector and receiver.	Understand	3
6	Define dispersion. What are its different types? How these affect the working of optical fibre communication system.	Analyse	3
7	Explain in detail different type of losses in OFC	Understand	3
8	Explain the operation of LED. Also explain different types of LED's and its different structures	Understand	3
9	Explain the Working of GPS with neat diagram	Understand	3
10	Explain the Concepts of Wavelength Division Multiplexing	Understand	3

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Distinguish direct and retrograde orbits?	Understand	3
2	Explain how a satellite is located with respect to earth?	Understand	3
3	Discuss the advantages and disadvantages of satellite communications?	Understand	3
4	What is meant by apogee and perigee heights?	Understand	3
5	Write a short note on population inversion.	Understand	3
6	What is the role of photo diode in OFC?	Analyse	3
7	List any three applications with respect to satellite communications?	Remember	3
8	Explain the frequency allocation for satellite with respect to International Telecommunication Union (ITU)?	Understand	3
9	Show the importance of 6/4 GHz system?	Apply	3
10	What do you mean by Optical splicing.	Understand	3
11	Provide at least two reasons why satellite repeaters operate above the shortwave bands	Analyse	3

UNIT V

Long Answer Questions

S. No.	Question	Blooms Taxonomy Level	Course Outcome
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1	Describe the digital cellular land mobile systems and the limitations of AMPS standard.	Understand	3
2	Mention the two frequency reuse schemes and explain N-Cell reuse pattern in detail for four and seven cell reuse with illustrative diagrams. b) Discuss the performance criteria of the basic cellular system?	Analyse	3
3	Explain about the co-channel interference reduction factor and derive the general formula for C/I. b) Briefly explain the multiple knife edge diffraction	Understand	3
4	Compare and contrast Near end and Far end interferences. b) Briefly discuss different diversity techniques.	Analyse	3
5	Detail notes about GSM – system overview, physical and logical channels.	Understand	3
6	Explain about CDMA principle, power control	Understand	3
7	Explain forward & reverse channel parameters of IS-95 CDMA	Understand	3
8	Discuss about 3G standards – WCDMA/UMTS for wireless network.	Analyse	3
9	Identify the features, benefits, applications, and operation of the wireless technologies Bluetooth, ZigBee	Analyse	3
10	Identify the features, benefits, applications, and operation of the wireless technologies WiMAX, and ultrawideband (UWB).	Analyse	3

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Write advantages 2G over 1G.	Understand	3
2	What are services offered by GSM?	Understand	3
3	Define burst formatting in GSM.	Understand	3
4	Define personal-area network (PAN) and wireless local area network (WLAN).	Understand	3
5	Name two popular PAN technologies.	Remember	3
6	List the Advantages and Disadvantages of UWB	Remember	3
7	What is the IEEE standard on which ZigBee is based?	Remember	3
9	List the operating frequency ranges of ZigBee and the maximum data rates for each.	Remember	3
11	Name the two primary network topologies used with Zig Bee.	Knowledge	3
12	Describe the basic concept of UWB. Is a carrier used?	Understand	3

OBJECTIVE QUESTIONS:

UNIT I



1. Which is the process of encoding information from a message source in suitable manner for transmission?
 - a) Modulation
 - b) Demodulation
 - c) Encryption
 - d) Decryption
2. -----frequencies are exact multiples of the fundamental frequency.
 - a. Harmonic
 - b. Distortion
 - c. Radio
 - d. Modulation
3. The signal which is superimposed on a high-frequency sine wave is called _____.
 - a. Sideband
 - b. Square wave
 - c. Carrier
 - d. Information
4. What is the main purpose of a communications system?
 - a. To have a frequency assignment
 - b. For modulation
 - c. To provide an acceptable replica of the information at the designation
 - d. None of these
5. A carrier signal has _____.
 - a. Constant peak amplitude
 - b. Frequency range 20-20000 Hz
 - c. The information
 - d. A varying amplitude
6. He was the one who developed the mathematical solution to a complex repetitive waveform.
 - a. P.H Smith
 - b. J. Fourier
 - c. Carson
 - d. Y. Uda
7. The entire range of _____ of electromagnetic radiation is called the frequency spectrum.
 - a. Phases
 - b. Frequencies
 - c. Amplitudes
 - d. Energies
8. Which is not true about modulation
 - a. Transmission over longer distances
 - b. More practical antenna
 - c. Multiple transmission
 - d. Narrower bandwidth
9. Noise is added to a signal in a communication system
 - a. At the receiving end
 - b. At transmitting antenna
 - c. In the channel
 - d. During regeneration of the information
10. Calculate the minimum sampling rate to avoid aliasing when a continuous time signal is given by $x(t) = 5 \cos 400\pi t$
 - a. 100 Hz
 - b. 200 Hz

- c. 400 Hz
- d. 250 Hz

UNIT II

1. AM signal have all information in _____ of the carrier.
 - a) Amplitude
 - b) Magnitude
 - c) Frequency
 - d) Power
2. ASK modulated signal has the bandwidth
 - a. Same as the bandwidth of baseband signal
 - b. Half the bandwidth of baseband signal
 - c. Double the bandwidth of baseband signal
 - d. None of the above
3. In frequency modulation, the amplitude of modulated carrier signal is _____ and its frequency is _____ by the modulating message signal.
 - a) Constant, constant
 - b) Varied, constant
 - c) Constant, varied
 - d) Varied, varied
4. FM has _____ noise immunity when compared to amplitude modulation.
 - a) Same
 - b) Less
 - c) No
 - d) Better
5. BPSK system modulates at the rate of
 - a. 1 bit/ symbol
 - b. 2 bit/ symbol
 - c. 4 bit/ symbol
 - d. None of the above
6. QPSK system uses a phase shift of
 - a. Π
 - b. $\Pi/2$
 - c. $\Pi/4$
 - d. 2Π
7. The data rate of QPSK is _____ of BPSK.
 - a. Thrice
 - b. Four times
 - c. Twice
 - d. Same
8. The maximum bandwidth is occupied by
 - a. ASK
 - b. BPSK
 - c. FSK
 - d. None of the above
9. The binary waveform used to generate BPSK signal is encoded in
 - a. Bipolar NRZ format
 - b. Manchester coding
 - c. Differential coding
 - d. None of the above
10. The BPSK signal has +V volts and -V volts respectively to represent
 - a. 1 and 0 logic levels
 - b. 11 and 00 logic levels



- c. 10 and 01 logic levels
 - d. 00 and 11 logic levels
11. In different types of Pulse Width Modulation,
- a. Leading edge of the pulse is kept constant
 - b. Tail edge of the pulse is kept constant
 - c. Centre of the pulse is kept constant
 - d. All of the above
12. In pulse width modulation,
- a. Synchronization is not required between transmitter and receiver
 - b. Amplitude of the carrier pulse is varied
 - c. Instantaneous power at the transmitter is constant
 - d. None of the above

UNIT III

1. The number to be dialed or called to reach a subscriber in the same local area network or numbering area is
- a. Local code
 - b. Area code
 - c. Toll access cod
 - d. d. Subscriber No.
2. A link linking telephone central offices is called ----- line.
- a. Tie
 - b. Inter-office trunk
 - c. Routing
 - d. Connector
3. Which is of telephone traffic defined as one user making a call of one second duration.
- a. CCS
 - b. Call-second
 - c. Erlangs
 - d. Call-hour
4. The following are the transmission media used for telephone systems except
- a. Parallel wire
 - b. Coaxial cable
 - c. Fiber optics
 - d. NOTA
5. Header of datagram in IPv4 has _____
- a) 0 to 20 bytes
 - b) 20 to 40 bytes
 - c) 20 to 60 bytes
 - d) 20 to 80 bytes
6. Network layer at source is responsible for creating a packet from data coming from another _____
- a) Station
 - b) Link

- c) Node
- d) Protocol
- 7. Which is a link layer protocol?
 - a) ARP
 - b) TCP
 - c) UDP
 - d) HTTP
- 8. Which protocol is commonly used to retrieve email from a mail server?
 - a) FTP
 - b) IMAP
 - c) HTML
 - d) TELNET
- 9. An internet is a _____
 - a) Collection of WANS
 - b) Network of networks
 - c) Collection of LANS
 - d) Collection of identical LANS and WANS
- 10. MAC address is of
 - 1) 24 bits
 - b) 36 bits
 - c) 42 bits
 - d) 48 bits
- 11. The maximum size of payload field in ethernet frame is
 - a) 1000 bytes
 - b) 1200 bytes
 - c) 1300 bytes
 - d) 1500 bytes
- 12. Ethernet frame consists of
 - a) MAC address
 - b) IP address
 - c) both MAC address and IP address
 - d) none of the mentioned

UNIT IV

- 1. An Active satellite carriers
 - a. Antenna system
 - b. Transmitter
 - c. Receiver
 - d. All of the above
- 2. A passive satellite
 - a. Amplifier the signal
 - b. Reflects the signal
 - c. Absorbs the signal
 - d. None of the above
- 3. An active satellite has
 - a. Antenna system
 - b. Antenna system transmitter and receiver



- c. Antenna system, transmitter, receiver and power supply
 - d. Only metallic balloon
4. For global communication the number of satellite needed is
 - a. 1
 - b. 2
 - c. 3
 - d. 10
 5. Satellite operate in the frequency range
 - a. MF
 - b. HF
 - c. VHF
 - d. VHF and UHF
 6. The source of energy for a satellite is
 - a. Battery
 - b. Magneto hydrodynamic generator
 - c. Fuel cell
 - d. Solar cell
 7. In the structure of fiber optic cable, the refractive index of core is always _____ the refractive index of cladding.
 - a. Less than
 - b. Equal to
 - c. Greater than
 - d. None of the above
 8. If a noisy channel has a bandwidth of 4 MHz with signal to noise ratio of about 1, what would be the maximum capacity of the channel?
 - a. 2 Mb/sec
 - b. 4 Mb/sec
 - c. 6 Mb/sec
 - d. 8 Mb/sec
 9. Which among the following is/are responsible for generating attenuation of an optical power in fiber?
 - a. Absorption
 - b. Scattering
 - c. Waveguide effect
 - d. All of the above
 10. The small section of fiber which is coupled to the optical source is known as
 - a. Flylead
 - b. Pigtail
 - c. Both a and b
 - d. None of the above
 11. In an optical network, increase in the number of lasers _____ the bit rate.
 - a. Increases
 - b. Stabilizes
 - c. Decreases
 - d. None of the above

UNIT V

1. Which of the following is not a characteristic of cellular telephone system?
 - a) Accommodate large number of users
 - b) Large geographic area

- c) Limited frequency spectrum
- d) Large frequency spectrum
2. What is the responsibility of MSC in cellular telephone system?
 - a) Connection of mobile to base stations
 - b) Connection of mobile to PSTN
 - c) Connection of base station to PSTN
 - d) Connection of base station to MSC
3. Who has the responsibility of billing and system maintenance function in cellular system?
 - a) Base Station
 - b) PSTN
 - c) MSC
 - d) Mobile system
4. What is the shape of the cell present in the cellular system?
 - a) Circular
 - b) Square
 - c) Hexagonal
 - d) Triangular
5. Why the size of the cell is kept small in cellular network?
 - a) Increase capacity
 - b) Decrease capacity
 - c) Increased size of base station electronics
 - d) Slow process of handoffs
6. What is handoff?
 - a) Forward channel
 - b) Switching technique
 - c) Roamer
 - d) Guard channel
7. Which one is not an advantage of using frequency reuse?
 - a) Increased capacity
 - b) Limited spectrum is required
 - c) Same spectrum may be allocated to other network
 - d) Number of base stations is reduced
8. The process of transferring a mobile station from one base station to another is
 - a) MSC
 - b) Roamer
 - c) Handoff
 - d) Forward channel
9. Which of the following specifies a set of media access control (MAC) and physical layer specifications for implementing WLANs?
 - a) IEEE 802.16
 - b) IEEE 802.3
 - c) IEEE 802.11
 - d) IEEE 802.15
10. Which of the following is the 802.11 High Rate Standard?
 - a) IEEE 802.15



- b) IEEE 802.15.4
 - c) IEEE 802.11g
 - d) IEEE 802.11b
11. UMTS uses which multiple access technique?
- a) CDMA
 - b) TDMA
 - c) FDMA
 - d) SDMA
12. What is the chip rate of W-CDMA?
- a) 1.2288 Mcps
 - b) 3.84 Mcps
 - c) 270.833 Ksps
 - d) 100 Mcps
13. What is the term used by ITU for a set of global standards of 3G systems?
- a) IMT 2000
 - b) GSM
 - c) CDMA
 - d) EDGE

XI. GATE QUESTIONS / UGC - NET:

A modulated signal is $y(t) = m(t)\cos(40000 \pi t)$, where the baseband signal $m(t)$ has frequency components less than 5 kHz only. The minimum required rate (in kHz) at which $y(t)$ should be sampled to recover $m(t)$ is _____.

- A. 10KHz
- B. 20 KHz
- C. 30KHz
- D. 40KHz

The voltage of an electromagnetic wave propagating in a coaxial cable with uniform characteristic impedance is $V(l) = e^{-\gamma l + j\omega t}$ volts, where 'l' is the distance along the length of the cable in meters. $\gamma = -(0.1 + j 40) \text{ m}^{-1}$ is the complex propagation constant, and $\omega = 2\pi \times 10^9 \text{ rad/s}$ is the angular frequency. The absolute value of the attenuation in the cable in dB/meter is ____

- A. 0.85
- B. 0
- C. 2.12
- D. 1.20

In binary frequency shift keying (FSK), the given signal waveform is $U_0(t) = 5\cos(2000\pi t); 0 \leq t \leq T$, and $U_1(t) = 5\cos(2000\pi t); 0 \leq t \leq T$, Where T is the bit-duration interval and t is in seconds. Both $u_0(t)$ and $u_1(t)$ are zero outside the interval $0 \leq t \leq T$. With a matched filter (correlator) based receiver, the smallest positive value of T (in milliseconds) required to have $u_0(t)$ and $u_1(t)$ uncorrelated is

- A. 0.25ms
- B. 0.5 ms
- C. 0.75 ms
- D. 1.0 ms

An optical fiber is kept along the \hat{z} direction. The refractive indices for the electric fields along \hat{x} and \hat{y} directions in the fiber are $n_x = 1.5000$ and $n_y = 1.5001$, respectively ($n_x \neq n_y$ due to the imperfection in the fiber cross-section). The free space wavelength of a light wave propagating in the fiber is λ_0 . If the light wave is circularly polarized at the input of the fiber, the refractive index of the fiber is 1.5 at the input of

the fiber, the minimum propagation distance after which it becomes linearly polarized, in centimeter, is _____.

- A. 0.375 cm
- B. 0.5 cm
- C. 1.234 cm
- D. none of these

In a PCM system, the signal $V \sin 100\pi t \cos 100\pi t$ is sampled at the Nyquist rate. The samples are processed by a uniform quantizer with step size $0.75V$. The minimum data rate of the PCM system in bits per second is _____.

- A. 50
- B. 100
- C. 150
- D. 200

The transmitted signal in a GSM system is of 200 kHz bandwidth and 8 users share a common bandwidth using TDMA. If at a given time 12 users are talking in a cell, the total bandwidth of the signal received by the base station of the cell will be at least (in kHz)

- A. 300 kHz
- B. 400 kHz
- C. 450 kHz
- D. 500 kHz

In a code-division multiple access (CDMA) system with $N = 8$ chips, the maximum number of users who can be assigned mutually orthogonal signature sequences is _____

- A. 6.54-6.56
- B. 6.99- 7.01
- C. 7.54-7.56
- D. 7.99 -8.01

XII. WEBSITES:

<http://nptel.ac.in/courses/117105144/>

<http://www.wirelesscommunication.nl/reference/chaptr05/digimod/digimod.htm>

XIII. EXPERT DETAILS:

Prof. Aditya K. Jaganatham

Associate Professor

Department of Electrical Engineering

IIT Kanpur

XIV. JOURNALS:

INTERNATIONAL / NATIONAL

- IEEE Transactions On Wireless Communications
- EURASIP Journal on Wireless Communications and Networking
- IEEE Wireless communication
- IEEE Transactions on Communications Systems

XV. LIST OF TOPICS FOR STUDENT SEMINARS:

- Pulse Code Modulation
- Wavelength Division Multiplexing
- GSM
- PAN

XVI. CASE STUDIES / SMALL PROJECTS:



- Design AM modulator and Demodulator using MATLAB
- Design an FM modulator and Demodulaor using MATLAB
- Design an ASK/FSK modulator and Demodulator using MATLAB
- Design an QPSK modularor using MATLAB
- Do data transfer between the two laptop using zigbee module