Programme Name/s	**: Digital Electronics/ Electronics & Tele-communication Engg./ Electronics & Communication Engg./ Electronics Engineering/ Industrial Electronics**
Programme Code	**: DE/ EJ/ ET/ EX/ IE**
Semester	**: Third**
Course Title	**: PRINCIPLES OF ELECTRONIC COMMUNICATION**
Course Code	**: 313326**

I. RATIONALE

In the fastest growing telecommunication era, diploma engineers deal with electronic communication systems. The use of basic principles of electronic communication will help the students in handling communication systems in the industry and consumer market .This course is developed to empower the students to apply their knowledge and skill to maintain the communication systems.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attend the following industry/employer expected outcome through various teaching learning experiences .
Maintain basic electronic communication system.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Select relevant frequency range/band for different communication mode.
- CO2 - Maintain AM based communication system.
- CO3 - Maintain FM based communication system.
- CO4 - Identify propagation mode for specified radio frequency band.
- CO5 - Identify relevant type of antenna for given frequency range/application.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313326	PRINCIPLES OF ELECTRONIC COMMUNICATION	PEC	DSC	3	-	2	1	6	3	3	30	70	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Sem. : 1 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Identify the relevant frequency band of electromagnetic spectrum for the specified signal. TLO 1.2 Differentiate analog and digital signal. TLO 1.3 Compare features of the given types of transmission modes. TLO 1.4 Distinguish between external and internal noise sources.	**Unit - I Basics of Electronic Communication** 1.1 Electromagnetic (EM) wave spectrum, frequency bands and their applications 1.2 Signals and its representation: analog and digital signal (In time and frequency domain) 1.3 Block diagram of Analog communication system and operation of each block 1.4 Transmission modes: Simplex , half duplex and full duplex, quadraplex ,Synchronous, Asynchronous and iso-synchoronus 1.5 Noise, Sources of Noise, signal to noise ratio(S/N) and noise figure unit for noise (only concept) 1.6 Ancient communication method in India :-In the history of communication humans relied on non-verbal forms of communication such as drum sounds, pigeons, messengers , symbols and smoke signals. (IKS-1 hour, No question in theory paper)	Chalk-Board Presentations Video Demonstrations

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Define modulation and give its need. TLO 2.2 Describe with sketches the given parameters of AM signal. TLO 2.3 Calculate modulation index and modulated signal power of the given AM signal. TLO 2.4 Describe working of the given type of AM detection method . TLO 2.5 Describe working of each block of super heterodyne receiver.	**Unit - II Amplitude Modulation (AM) Communication** 2.1 Modulation ,Need for modulation 2.2 Types of modulation techniques ,Amplitude Modulation: Modulating signal , Carrier signal , modulation Index , mathematical representation of AM Signal (no derivation, only numericals) ,representation in time and frequency domain , Frequency Spectrum ,Types of AM band spectrum (DSB, SSB and VSB)and their applications , Power relations in AM wave (no derivation, only numerical) 2.3 Generation of AM: Block Diagram and working Low level and High Level AM transmitter 2.4 Demodulation of AM signal: Diode detector and practical diode detector, Automatic gain control and Delayed AGC 2.5 Block diagram and working of each block of super heterodyne receiver with waveforms Characteristics Selectivity , Sensitivity and Fidelity	Chalk and Board Videos demostration Visit to Telecommunication Industry
3	TLO 3.1 Differentiate between AM and FM. TLO 3.2 Generate FM signal using given type of method. TLO 3.3 Explain working of the each block of FM receiver . TLO 3.4 Explainworking of the given FM detector circuit. TLO 3.5 Differentiate between FM and PM waveforms.	**Unit - III Frequency Modulation (FM) Communication** 3.1 Frequency modulation: Mathematical representation of FM signal Use of Bessel's function (no derivation),representation of FM signal in time domain and frequency domain, frequency deviation ratio, modulation index (numerical), types of frequency modulation (Narrow Band and Wide Band FM), Concept of Pre-emphasis and De-emphasis and working 3.2 Generation of FM using direct method (varactor diode and reactance modulator) and indirect method (Armstrong method) 3.3 FM detector circuits: Ratio detector and PLL as FM demodulator 3.4 FM Receiver : Block diagram and working with waveforms 3.5 Phase Modulation : definition, waveforms and applications	Chalk and Board Video Demonstrations, Visit to Telecommunication Industry

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Describe with sketches propagation mode of the given type of radio wave /band. TLO 4.2 Describe properties of the given type of wave propagation. TLO 4.3 Define critical frequency, skip distance, skip zone, fading, multiple hop with respect to sky wave propagation. TLO 4.4 Describe the concept of Duct propagation and troposphere scatter propagation of waves.	**Unit - IV Wave Propagation** 4.1 Concept of propagation of radio waves 4.2 Ground Wave propagation 4.3 Sky wave: Ionospheric layers, concept of actual height and virtual height, critical frequency, skip distance, skip zone. concept of fading, maximum usable frequency, multiple hop sky wave propagation 4.4 Space Wave propagation : line of sight, multipath space wave propagation , radio horizon, shadow zone 4.5 Duct propagation (microwave space-wave propagation) Troposphere scatter propagation	Chalk-Board Collaborative learning
5	TLO 5.1 Describe with sketches the working principle of the given type of antenna. TLO 5.2 Sketch the radiation pattern of resonant and non-resonant antenna. TLO 5.3 Compare given type of antenna on the basis of parameters. TLO 5.4 Select type of antenna for transmission and reception of given frequency band.	**Unit - V Antenna** 5.1 Antenna fundamentals :Resonant antenna and Non-resonant antennas, ideal antenna, principle of transmitting and receiving antenna Concept of Electromagnetism interference (EMI) and Electromagnetic Compatibility (EMC) 5.2 Antenna parameters : Radiation pattern , polarization, bandwidth, beam width, antenna resistance, directivity and power gain, antenna gain 5.3 Dipole antenna: Half dipole antenna (Resonant Antenna) and its radiation pattern, folded dipole antenna and its radiation pattern, radiation pattern of Dipole antenna for different length Major lobe , minor lobe , Radiation Pattern for Unidirectional , bidirectional and Omni directional antenna 5.4 Antenna (working principle, constuction, radiation pattern and applications) : Loop antenna, Telescopic antenna, Yagi-Uda antenna, Micro wave antenna - Dish antenna, Horn antenna and Micro-strip patch antenna , Printed antenna, Smart antenna flexible antenna	Chalk-Board Site/Industry Visit Demonstration

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Test the output of simplex and duplex mode of communication . LLO 1.2 Determine the number of channels for simplex, half duplex and full duplex Communication .	1	* Demonstrate the simplex ,half duplex and full duplex communication link using switches, wires and LEDs.	2	CO1

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 2.1 Test analog and digital signals on CRO and spectrum analyzer. LLO 2.2 Observe the difference between time domain and frequency domain representation of a signal .	2	Observe the different analog and digital signals on CRO and spectrum analyzer in time domain and frequency domain.	2	CO1
LLO 3.1 Interpret the effect of change in modulating frequency on AM signal.	3	Observe the AM modulated waveforms generated for different modulating frequencies.	2	CO2
LLO 4.1 Calculate modulation index 'm' from the observed AM waveform . LLO 4.2 Interprete the effect of 'm' on AM signal.	4	*Generate AM wave and measure its modulation index for different values of modulating signal amplitude.	2	CO2
LLO 5.1 Observe the AM demodulated signal on DSO/CRO. LLO 5.2 Observe the output waveform of AM demodulator and measure its frequency.	5	Build and test the AM demodulator circuit .	2	CO2
LLO 6.1 Observe the AM signal using simulation software. LLO 6.2 Interpret the demodulated AM signal using simulator software.	6	* Display the AM modulator and demodulator signal using MATLAB Simulink/SCILAB /relevant software for different modulating frequencies.	2	CO2
LLO 7.1 Observe the waveforms and measure the voltages at various test points of AM receiver. LLO 7.2 Troubleshoot various faults of AM receiver such as low volume, hum sound.	7	Test the output of various stages/blocks of the AM receiver.	2	CO2
LLO 8.1 Calculate modulation index 'm' from the observed FM wave . LLO 8.2 Interpret the frequency deviation and modulation index of the FM signal.	8	* Build and test FM signal using voltage controlled oscillator / IC 566 to measure frequency deviation and modulation index.	2	CO3
LLO 9.1 Interpret the FM signal using simulation software. LLO 9.2 Calculate the modulation index and frequency deviation of FM signal.	9	Display FM signal using suitable simulation software such as MATLAB/SCILAB/ relevant software.	2	CO3
LLO 10.1 Build a FM detector circuit using IC 564/565. LLO 10.2 Observe the FM demodulated signal and draw the input and output waveforms.	10	* Demodulate the given FM signal using IC 564/565 and test the output from the given input waveforms.	2	CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 11.1 Observe the waveforms and measure the voltages at various test points of FM receiver. LLO 11.2 Troubleshoot various faults in AM receiver such as popping, hissing etc.	11	Test the output of various stages/blocks of the FM receiver.	2	CO3
LLO 12.1 Interpret the MUF for the given critical frequency.	12	Use simulation software to measure MUF for the given critical frequency and incident angle.	2	CO4
LLO 13.1 Use RF source and field meter to measure the field strength of given antenna. LLO 13.2 Plot the radiation pattern of given antenna .	13	*Test the performance of given dipole antenna ,measure the field strength and plot the radiation pattern for different length of antenna.	2	CO5
LLO 14.1 Use RF source and field meter to measure the field strength of given yagi-uda antenna. LLO 14.2 Plot the radiation pattern of Yagi- Uda antenna and interpret the beamwidth .	14	Test the performance of given Yagi-Uda antenna .	2	CO5
LLO 15.1 Interpret the directivity and beamwidth from the radiation pattern of the given antenna.	15	* Use suitable simulation software to plot the radiation pattern of given antenna.	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Visit

- BSNL/Radio station and prepare report on technique used for modulation demodulation.

Micro project

- 1.Develop a intercom circuit.

2.Build a Walkie Talkie Circuit.
3.Build a circuit of AM receiver.
4.Build a circuit of FM receiver.

Assignment

- 1.Prepare report on AM FM transmission of nearby your city.

2.Draw neat sketches of AM and FM receivers.
3.Draw neat sketches of different AM and FM generation circuits.
4.Prepare Internet based report on the role of electronic communication used for Defense/ISRO.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Digital multimeter : 3 1/2 digit display ,9999 counts digital multimeter measures :Vac,Vdc (1000 V max) ,Adc,Aac (10 A max) , Resistance (0 to 100 Mohm).	1,7,11
2	Antenna trainer kit : for dipole and Yagi- Uda antenna, mobile antenna, omnidirectional antenna, horn antenna, other common types of antenna.	13,14
3	Function generator : Frequency range 0.1 Hz to 30 Mhz.	2,3,4,5,8,10
4	AM Trainer kit for Modulation and Demodulation.	3,4,5,7
5	RF signal generator with wide frequency range 100 Khz to 150 Mhz fine frequency adjustment by calibrated dial built in audio frequency generator.	3,4,5,7,8,10,11
6	DSO with Bandwidth : 50-100 MHz TFT colour LCD Dual channel real time sampling 1GSa/s equivalent sampling 25 GSa/s Memory 1Mbpts 10 waveforms and 10 Set ups can be stored.	3,4,5,8,10
7	Simulation software suitable for communication experiments : MATLAB,SCILAB,TINA PRO or any other relevant open source software.	6,9,12,15
8	FM Trainer kit for Modulation (using voltage controlled Oscillator / IC 566) and Demodulation (using IC 564/565) .	8,10,11
9	Cathode ray oscilloscope Dual Trace 20/30/100 Mhz,1 Mega ohm input impedance .	All
10	Regulated power supply : DC supply voltages Dual DC 0-30V ; 0-2A Automatic overload(current protection) constant voltage and constant current operation.	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Basics of Electronic Communication	CO1	6	4	4	4	12
2	II	Amplitude Modulation (AM) Communication	CO2	13	4	6	8	18
3	III	Frequency Modulation (FM) Communication	CO3	10	2	6	6	14
4	IV	Wave Propagation	CO4	7	2	4	6	12
5	V	Antenna	CO5	9	4	4	6	14
Grand Total				**45**	**16**	**24**	**30**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two offline unit tests of 30 marks and average of two-unit test marks will be consider for out of 30 marks.

For formative assessment of laboratory learning 25 marks.
Each practical will be assessed consider 60% weightage to process, 40% weightage to product.

Summative Assessment (Assessment of Learning)

- End semester assessment of 70 marks.

End semester summative assessment of 25 marks for laboratory learning.

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	-	1	1	2	1	1			
CO2	2	3	3	2	2	1	2			
CO3	2	3	3	2	2	1	2			
CO4	2	-	1	2	2	-	1			
CO5	2	-	1	2	2	1	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Dennis Roddy John Coolen	Electronic Communication	Pearson Education India, New Delhi , ISBN: 978-817758-558-2
2	GEORGE KENNEDY BERNARD DEVIS	ELECTRONICS COMMUNICATION SYSTEM	TATA Mc- Graw Hill, New Delhi, ISBN: 9780071077828
3	Ravi Kumar Jatoth , T. Kishore Kumar , V .V. Mani	Electronics and Communications Engineering	Apple Academic Press ISBN: ISBN-13 978-1774633892
4	Tomasi W.	ELECTRONIC COMMUNICATION SYSTEM	Pearson Education India, New Delhi, ISBN: 9780130221254
5	Constantine A. Balanis	Antenna Theory: Analysis and Design	Wiley-Student edition India, New Delhi, ISBN: 9788126524228
6	Frenzel George:Dravid Bernard:Prasanna SRM	Electronic Communication Systems	Mc-Graw Hill , New Delhi ,ISBN: 9780071077828
7	R. L. Yadava	Antenna and Wave Propagation	EEE, PHI,ISBN : 9788120342910

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description

Sr.No	Link / Portal	Description
1	https://www.electronicsforu.com/electronics-projects/fm-radio-receiver-using-ic-ta-7640ap	FM radio receiver
2	https://www.etti.unibw.de/labalive/index/amplitude-modulation/	Amlitude Modulation
3	https://www.etti.unibw.de/labalive/experiment/amtransmitterrecordaudiodemo/	AM transmitter 1 - record audio transmit signal via file
4	https://www.etti.unibw.de/labalive/experiment/amtransmitrecordedsignal/	AM transmitter 2 - transmit recorded signal via USRP
5	https://www.etti.unibw.de/labalive/experiment/fmtransmitterrecordaudiodemo/	FM transmitter
6	https://www.etti.unibw.de/labalive/experiment/fmdemod/	FM receiver
7	https://www.tutorsglobe.com/homework-help/electrical-engineering/fault-in-fm-radio-receiver-71490.aspx	Fault finding in FM radio receiver.
8	https://www.radioandtvhelp.co.uk/help-guides/radio/troubleshooting-interference-to-am-radio#:~:text=Problems%20on%20AM%20radio%20can,and%20could%20indicate%20reception%20problems.	Fault finding in AM radio receiver.
9	https://ijarsct.co.in/Paper10949.pdf	Simulation software to measure MUF for the given critical frequency and incident angle.
10	https://www.ahsystems.com/articles/Understanding-antenna-gain-beamwidth-directivity.php	Antenna parameters .
11	https://kcgcollege.ac.in/Virtual-Lab/Electronics-and-Communication-Engineering/Exp-2/	Frequency Modulation and Demodulation
12	https://vlab.amrita.edu/?sub=3&brch=163&sim=260&cnt=2644	Amplitude Modulation (Simulation experiment)

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students