Proposed Course Structure of Certificate/Diploma in ECE (Certificate + 1 Year)

Year I **Semester I**

S.N.	Course Code	Course Title	L	T	P	Credit
1.	HS11101	Remedial English – I	2	0	2	03
2.	PH11101	Physics – I	3	0	2	04
3.	CY11101	Chemistry – I	3	0	2	04
4.	MA11101	Mathematics – I	3	1	0	04
5.	ES11151	Engineering Drawing	0	0	6	03
6.	ES11152	Workshop Practice	0	0	4	02
		Total				**20**

Semester II

S.N.	Course Code	Course Title	L	T	P	Credit
1.	HS11201	Remedial English – II	2	0	2	03
2.	PH11201	Physics – II	3	0	2	04
3.	CY11201	Chemistry – II	2	0	2	03
4.	MA11201	Mathematics – II	3	1	0	04
5.	ES11200	Basic Electrical & Electronics Engineering	3	0	2	04
6.	EC11251	Electronics Workshop -I	1	0	4	03
		Total				**21**

Year II **Semester - III**

S.N.	Course Code	Course Title	L	T	P	Credit
1.	MA12101	Mathematics – III	3	1	0	04
2.	ES12100	Basics of Computer and Programming	2	0	2	03
3.	EC12101	Principles of Electronics Circuits and Devices	2	1	2	04
4.	EC12102	Fundamentals of Telecommunication Engg.	3	0	2	04
5.	EC12151	Electronics Workshop-II	0	0	6	03
6.	EC12152	Electronic Servicing & Maintenance I	0	0	6	03
		Total				**21**

Semester - IV

S.N.	Course Code	Course Title	L	T	P	Credit
1.	ES12201	Technical Mechanics	3	1	0	04
2.	ED12288	Extra-Curricular Activities	0	0	0	02
3.	HS12201	Entrepreneurship and start Ups	3	0	0	03
4.	EC12201	Radio Engineering	3	0	2	04
5.	EC12202	Consumer Electronics	3	0	0	03
6.	EC12251	Electronic Servicing & Maintenance II	0	0	4	02
7.	HS12202	**Essence of Indian Traditional Knowledge**	2	0	0	00
8.	EC12279	**(Winter Internship for 3 Weeks after III Sem.)**	0	0	0	03
		Total				**21**

EC 12101	**Principles of Electronics Circuits and Devices** **4 credits**	**(2-1-2)**
Unit I	Transistors: Basic principles of operation, I/V characteristics, Modes of operation Active, Saturation and cut off, alpha ,beta calculations	5 Lectures
Unit II	Amplifier configuration: CE, CB, CC, Biasing of Transistors, Load line and Q point. Introduction to Class A, B and C amplifier circuits. Simple calculation of Voltage/ current gain (using simplified pi model), Input/ output impedance power amplifier. Introduction to multistage amplifiers.	10 lectures
Unit III	Elementary ideas of feedback and oscillators. Operation principles of colpitt and Hartley Oscillator. Specifications of other types of oscillators.	7 Lectures
Unit IV	RC differentiator and Integrator. Introduction to Multivibrators: Astable, Monostable, Bistable. Basic ideas of JFET, MOSFET, SCR, DIAC, TRIAC, UJT and their uses.	8 Lectures
Unit V	Introduction to IC: Familiarization with popular ICs like LM 117,317,741,555,7400/7402/7406,7805,7809,7812, Audio & Video amplifiers.	10 lectures
Text Books/ Reference	1. Electronic Devices and Circuit theory, 8th ed. by Robert L boylestad and Louis Nashelshky (PHI) 2. Electronics Principles by A.P. Malvino (TMH)	

Material: 3. Microelectronics by J. Millman and Arvin Grabel.(TMH)
4. Integrated Electronics by J.Millman and C.C Halkias.(TMH)

EC 12102 Fundamentals of Telecommunication Engg.: 4 Credit (3-0-2)

Unit I	Principles of Radiation, Introduction to EM waves and their spectrum. Types of EM wave propagation –Ground wave, Sky wave, Space wave propagation. Structure of Ionosphere, Skip distance, Radio horizon, skip zone.	10 Lectures
Unit II	Introduction to Antennas –HF, VHF, UHF and microwave antennas. Introduction to RADAR, Satellite and Optical communication systems.	10 Lectures
Unit III	Introduction to Transmission lines –Twisted pair wires, coaxial cables and Wave guides, Introduction to communication systems: Telephony, Telegraphy, Radio and TV transmission.	10 Lectures
Unit IV	Principles of Amplitude, Frequency and phase Modulation Techniques.	10 Lectures

Text Books/ Reference Material:
1. Elements of Electromagnetics 4th Edition – M.N.O. Sadiku , Oxford.
2. J.D. Kraus, Antennas, McGraw Hill, 1988
3. Radio Engineering.by G.K.Mithal and Ravi Mittal.(Khanna Pub.).
4. Electronic Communication Systems.by George Kennedy. (TMH).
5. Electronics Communication Systems.by Dennis Roody and John Coolen. (PHI).
6. Audio Video System Principle, Maintenance and Troubleshooting by R.G.Gupta.(TMH).
7. Fundamentals of Audio and Video Systems. M.L. Anand.(Khanna Pub.)

EC 12151 Electronics workshop-II 3 credits (0-0-6)

Unit-I	Soldering Practice.
Unit II	Designing inductors of desired value.
Unit III	Testing of Diodes, Transistors and JFETS using ohmmeter method, Testing of Logic gates.
Unit IV	Transformer winding. Fixed and variable power supply design
Unit V	PCB Design: Desibn rules, Manual and CAD based .
Unit VI	Repairing of speakers, Baffle design.
Unit VII	Study of internal block diagram of pre amplifier and audio power amplifiers.
Unit VIII	Design and assembly of a small electronic gadget.

Books:
1. Electronics Sourcebook for engineers by George Loveday. (Wheeler publishing)
2. Printed Circuit Board: Design and Technology by W C Bosschart.

EC 12152 Electronic servicing & Maintenance-I 3 Credits (0-0-6)

Unit-I	Maintenance and servicing of transformer, dc power supply.
Unit II	Maintenance and servicing of SMPS, UPS and inverter.
Unit III	Maintenance and servicing of PMMC and Moving Iron Ammeter and voltmeter.

Unit IV	Maintenance and servicing of Analog Multimeter, DVM and Digital Multimeter.
Unit V	Maintenance and servicing of Personal Computer.
Text Books/ Reference Material:	1. Electronic Troubleshooting by Daniel R Tomal, Neal Widmer,T.Daniel. (TMH) 2. Troubleshooting Electronic Equipment by R S Khandpur (TMH) 3. Electronic Servicing and Repairs by Trevor Linsley, Newnes.

EC 12201 Radio Engineering: 4 Credits (3-0-2)

Unit-I	Aerials and Front stage: Ferrite rod MW band aerial, SW band Loop antenna, antenna coils and associated RF and mixer circuits. Transmitter antenna, quarter wave and half wave dipoles, horizontal and vertical dipoles mast and top loading. AM Transmitter: AM Modulation, Low level and high level modulation, Class C high level plate/collector modulators, Low level grid/base modulators, 1kW Transistor Class C collector modulator.	10 Lectures
Unit-II	Super heterodyne Radio Receiver: Tuned radio frequency (TRF) and super heterodyne AM receivers, selectivity and sensitivity of receivers, RF & local oscillator and IF frequencies, image frequency and image frequency rejection, Mixer stage, Single sweep capacitor tuning ratio, AGC need and types.	9 Lectures
Unit-III	Transistorized Radio Circuit: Over all transistorized 3 band radio receiver circuit assembly, tracking and alignment techniques, testing and repair and servicing methods of detector, volume control pot cum on/off switch, dc/ac fed power supply sections and audio stages.	9 Lectures
Unit-IV	Radio Bands: MW and SW_1, SW_2 radio wave bands, Band changer-Switches, Push button switch, construction assembly and repair. FM radio Receiver: Basics principles of FM reception, FM frequency bands, FM band intermediate frequency, FM detection methods.	12 Lectures

Text Books/ Reference Material:

1. Radio Engineering.by G.K.Mithal and Ravi Mittal.(Khanna Pub.).
2. Electronic Communication Systems.by George Kennedy. (TMH).
3. Electronics Communication Systems.by Dennis Roody and John Coolen. (PHI).
4. Basic Radio and Television. byS.P.Sharma . (TMH)
5. Audio Video System Principle, Maintenance and Troubleshooting by R.G.Gupta.(TMH).
6. Fundamentals of Audio and Video Systems. M.L. Anand.(Khanna Pub.)
7. Television and Radio Engineering. by Arvind M. Dhake.(TMH).

EC 12202 Consumer Electronics: 3 Credits (3-0-0)

Unit-I	Audio Fundamentals and Devices Basic characteristics of sound signal, Audio level metering, decibel level in acoustic measurement, Microphone & Types, speaker types & working principle, Sound recording principle & types.	9Lectures
Unit-II	Home theatre sound system, Digital console, FM tuner, ICs used in FM tuner TDA 7021T , PA address system.	6 Lectures
Unit-III	Television Systems- Monochrome TV standards, scanning process, aspect ratio, persistence of vision and flicker, interlace scanning, picture resolution, Composite video signal, Colour TV standards, colour theory, hue, brightness, saturation, luminance and chrominance, Different types of TV camera, Transmission standards.	8 Lectures

Unit-IV	Television Receivers and Video SystemsPAL-D colour TV receiver, Digital TVs:- LCD, LED , PLASMA, HDTV, 3-D TV, projection TV, DTH receiver, Video interface, Digital Video, SDI, HDMI Multimedia Interface , Digital Video Interface, CD and DVD player.	8 Lectures
Unit-V	Home / Office Appliances Diagrams, operating principles and controller for FAX and Photocopier, Microwave Oven, Washing Machine, Air conditioner and Refrigerators, Digital camera and cam coder.	9 Lectures

Text Books/ Reference Material:

1. Consumer Electronics by Bali S.P., Pearson Education India,2010 , latest edition
2. Television and Radio Engineering. by Arvind M. Dhake.(TMH).
3. Monochrome and Colour Television. byR.R.Gulati. (Wiley)
4. Monochrome and Colour Television. Practice by R.R.Gulati. (Wiley Eastern)
5. Basic Radio and Television. byS.P.Sharma . (TMH)
6. Sound System Engineering, Don Davis and Eugene Patronis (Focal Press)

EC 12251 Electronic Servicing & Maintenance –II 2 Credits (0-0-4)

Unit I	Servicing and maintenance of voltage stabilizer
Unit-II	Servicing and maintenance of AM signal generator, FM signal generator and CRO.
Unit III	Servicing and maintenance of TV, DTH/STB, CD &DVD players.
Unit IV	Servicing and maintenance of telephone receiver, mobile phone and cordless phone sets.

Text Books/ Reference Material:

1. Troubleshooting and Repairing Major Appliances by Kleinert, Eric , Tab Books
2. Major Appliances: Operation, Maintenance, Troubleshooting and Repair by Langley, Billy C, Prentice Hall.

Department: **Electronics and Communication Engineering**
Course Number: EC13101
Title of the Course: Electronic Instrumentation and Measurements
Designation: REQUIRED course
Pre-Requisite:

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	3	0	2	5	4

Course Assessment Methods:

Theory:	**Assignments & Quiz:**	**20% of 100**	**75% of Theory component**
	Mid-Semester Exam:	**30% of 100**	
	End-Semester Exam:	**50% of 100**	
Practical:	**Class Performance:**	**50% of 100**	**25% of Practical component**
	Practical Exam:	**50% of 100**	
Total Assessment	**Theory 75%**	**Practical 25%**	**100 Marks**

Course Outcomes:

CO1: Study of different measurement terminology and dynamic response of measuring instruments

CO2: Understand the concepts of popular instruments like analog, digital and cathode ray oscilloscope.

CO3: Acquire the concept and use of different types of bridges.
CO4: Study of different types of transducers and their application.

Topic Covered:		**Lectures**
UNIT-I	Generalized Measurement system: Accuracy, Precision, Fidelity, speed of response, static & dynamic performance characteristics, dynamic- step response, ramp response of first and second order instruments. Classifications of errors, error analysis of measurement.	8
UNIT-II	Analog and Digital instruments: PMMC Galvanometer, Analog multimeter, range extension of voltmeter and ammeter, Series and shunt ohmmeter. Digital multimeter, Signal generator and Function generator. Cathode Ray Oscilloscope, basic of CRO circuit and components. Uses of CRO for different measurement. Lissajous pattern.	14
UNIT-III	AC and DC Bridges: Introduction to DC and AC bridges for measurement of voltage / current / resistance /capacitance and inductance.	10
UNIT-IV	Definition of transducer, classification, resistive, capacitive, inductive, magnetic, optical, piezoelectric, pneumatic.	8

Text Books/ Reference Material:

1. Principles of Electronics instrumentation and measurements. Berlyn and Getz (McMillan Pub. Co.)
2. A Course in Electrical Electronics Measurements and instrumentation. A.K. Sawhney (Dhanpat Roy & Co.).
3. Modern Electronics Instrumentation and Measurement Techniques Albert D. Heltrick, W. D. Cooper. (PHI).
4. Murthy DVS – Transducers & Instrumentation, PHI, ND, 1995.
5. Elements of Electronic Instrumentation and Measurement. Joseph J. Carr. Pearson Education
6. PC-Based Instrumentation Concept and Practice N. Mathivanan PHI

Department: **Electronics and Communication Engineering**
Course Number: EC13102
Title of the Course: Digital Electronics
Designation: REQUIRED course
Pre-Requisite:

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	2	1	2	5	4

Course Assessment Methods:

Theory:	**Assignments & Quiz:**	**20% of 100**	**75% of Theory component**
	Mid-Semester Exam:	**30% of 100**	
	End-Semester Exam:	**50% of 100**	
Practical:	**Class Performance:**	**50% of 100**	**25% of Practical component**
	Practical Exam:	**50% of 100**	
Total Assessment	**Theory**	**Practical**	**100 Marks**
	75%	**25%**	

Course Outcomes:

CO1: Acquire knowledge about basics of digital electronics, number systems and Boolean algebra.
CO2: Analyze and design digital combinational circuits for SSI, LSI and MSI circuits
CO3: Understand the operation of different types of logic families and MSI chips.
CO4: Analyze and design of sequential digital circuits.

Topic Covered:		**Lectures**
UNIT-I	Number System and Boolean Algebra: Binary Numbers. Hexadecimal number, r's complement & (r-1)'s complement, binary addition, subtraction, binary multiplication and Division. Codes and their conversions: BCD, Octal, Hexadecimal, ASCII, Gray, Excess 3. Boolean Algebra: Boolean identities, De Morgan's theorems. SOP, POS. Concepts of min term and max terms. AND-OR networks. Algebraic Simplification. Karnaugh Map , MEV technique and Quine-McClusky method	10
UNIT-II	Combinational Circuit: Basic logic gates and universal Gate. Design of Combinational logic circuit. Half Adder, Full adder, Ripple Carry adder, the carry look-ahead adders. Half- Subtractor, Full Subtractor, code converter, decoder, multiplexer, de-multiplexer parity generator and checker.	10
UNIT-III	Logic Families: Different Logic families- TTL, ECL, MOS and CMOS, their operation Circuits for INVERTER, NAND, NOR. Transfer Characteristics, noise margin, propagation delay, fan in fan out, power dissipation consideration	6
UNIT-IV	Data Processing Circuits MSI CHIPS: Multiplexer, Decoder, Decoder driver, 7 segment display decoder driver, Encoders Octal to Binary, Decimal to BCD encoders, Priority encoders. Implementation of combinational circuit by MSI chip.	6
UNIT-V	Introduction to sequential circuits: Latch, R-S, J-K, D flip flops, Master Slave, arrangement, Edge triggered flip flops, shift registers, asynchronous and synchronous counters	8

Text Books/ Reference Material:

1. Digital Systems: Principles and Applications, Ronald J .Tocci, 10th Ed, PHI
2. Digital Principles and Applications, A.P.Malvino, D.P.Leach, 8th Ed ,TMH
3. Fundamentals of Logic Design, C.A.Roth, Jr., Jaico, 7th Ed, Publishing House.
4. Digital Design. Morris Mano. 5th Ed. PHI, 2008
5. Fundamentals of Digital Circuits, A. Anand Kumar, 4th Ed. PHI, 2016
6. Digital Integrated Electronics- H.Taub& D. Shilling, 1st Ed. MGraw Hill.
7. Modern Digital Electronics R.P Jain, 4th Ed. TMH, 2010
8. Digital Fundamentals, T. L. Floyd,(9th Edition), Prentice Hall.

Department: **Electronics and Communication Engineering**
Course Number: EC13103
Title of the Course: Signals and Systems.
Designation: REQUIRED course
Pre-Requisite:

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	2	1	0	3	3

Course Assessment Methods:

Theory:	**Assignments & Quiz:**	**20% of 100**
	Mid-Semester Exam:	**30% of 100**
	End-Semester Exam:	**50% of 100**

Course Outcomes:

CO1: Represent and characterize the signals and systems using linear algebra.

CO2: Classify systems based on their properties and determine the response of LTI system using convolution.

CO3: Analyse the spectral characteristics of continuous-time and discrete-time periodic aperiodic signals using Fourier analysis.

CO4: Apply the Laplace transform and Z- transform to analyse continuous-time and discrete-time signals and systems and understand the process of sampling and the effects of under Sampling.

Topic Covered:		**Lectures**
UNIT-I	**Continuous and discrete time signals:** Classification of Signals, Transformation of independent variable of signals, Basic continuous-time and discrete-time signals. Energy and power signals. Unit Impulse, Unit Step Functions and Ramp Function. Periodic and aperiodic signals, Orthogonal signal.	6
UNIT-II	**Basic system properties**: Analysis of Continuous-time and Discrete-time LTI Systems and their properties. Linear constant co-efficient differential equations and difference equations.	8
UNIT-III	Fourier-series and Fourier Transform representation of Continuous-time Signals and their properties. Discrete-Time Fourier-series and Discrete-Time Fourier Transform representation of discrete-time Signals and their properties.	8
UNIT-IV	Laplace Transform and its properties. Unilateral Laplace Transform. Analysis of LTI systems using Laplace-transform. Z-transform and its properties. Unilateral Z-Transform. Analysis of LTI systems using Z - transform	8
UNIT-V	State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems.	10

Text Books/ Reference Material:

1. Signals & Systems, Alan V. Oppenheim, Alan S. Willsky , S. Hamid Nawab, 2nd Ed., Pearson Education. 2013
2. Signals and Systems, S.Haykin and B. VanVeen , 2nd Ed. Wiley.2007
3. Signal Processing and Linear Systems, B.P.Lathi, PHI 2009
4. Principles of Linear Systems and Signals, B.P. Lathi, 3rd Ed. Oxford.2009
5. B. P. Lathi, "Signal Processing and Linear Systems", Oxford University Press

Department: **Electronics and Communication Engineering**
Course Number: EC13201
Title of the Course: Microprocessors and Applications
Designation: REQUIRED course
Pre-Requisite: **EC13102**

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	2	1	2	5	4

Course Assessment Methods:

Theory:	**Assignments & Quiz:**	**20% of 100**	**75% of Theory component**
	Mid-Semester Exam:	**30% of 100**	
	End-Semester Exam:	**50% of 100**	
Practical:	**Class Performance:**	**50% of 100**	**25% of Practical component**
	Practical Exam:	**50% of 100**	
Total Assessment	**Theory**	**Practical**	**100 Marks**
	75%	**25%**	

Course Outcomes:

CO1: Discuss the architecture of 8085 processor, instruction sets and timing diagram.
CO2: Have the concept of micro and macro programming.
CO3: Understand various interrupts and the concept of interfacing.
CO4: Understand the basics of 16-bit processor

Topic Covered:		**Lectures**
UNIT-I	Microprocessors: Evolution of microprocessor, Architecture of Intel 8085A microprocessor. Register organization, pin description. Instruction sets, operand addressing modes, instruction cycle, machine cycle, Timing diagram, Mapping of I/O to microprocessor	10
UNIT-II	Programming: Concept of Micro and Macro programming, arithmetic and logical computations, block of data moving looping, counting, time delaying operations. Stack and subroutines, Concept of stack memory.	10
UNIT-III	Interrupts and Peripherals: Vectored interrupts, maskable and unmaskable interrupts. Intel 8085 software and hardware interrupts and their working mechanism. Usage of RIM, and SIM instructions. Peripherals: Introduction to I/O addressing. Study of peripherals like Intel 8255, 8257, 8254 and 8251. Interfacing of I/O to microprocessor.	10
UNIT-IV	Evolution of 16-bit microprocessors from the 8 bit 8085: Introduction to Intel 8086/8088 microprocessor architecture, Architecture, Addressing Modes, Data Movement, Arithmetic and Logic operations, Concept of segmentation and computation of physical addresses. The maximum and minimum mode of operation of 8086 processor.	10

Text Books/ Reference Material:

1. Microprocessor Architecture Programming Application with the 8085/8080A, R.S. Gaonkar, 6th Ed. Prentice Hall of India, 2013
2. Intel Corp: The 8085/8085A. Microprocessor Book–Intel marketing communication, Wiley intersciencepublications, 1980.
3. Intel Corp. Micro Controller Handbook–Intel Publications,1994.
4. Microprocessors and Interfacing, Douglas V. Hall, McGraw Hill International Ed.
5. Assembly Language Programming the IBMPC, Alan R. Miller, SubexInc, 1987
6. Bary B. Brey, "The Intel Microprocessors:8086/8088,80186,80286,80386 & 80486" Prentice Hall, India 2018.
7. Introduction to Microprocessors, A.P. Mathur, 3rd Ed. Tata McGraw Hill,2001
8. Fundamental of Microprocessor and Microcomputers, B. Ram, 1st Ed. Dhanpat Rai

Department: **Electronics and Communication Engineering**
Course Number: EC13202
Title of the Course: Analog Communication Systems
Designation: REQUIRED course
Pre-Requisite:

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	3	0	0	3	3

Course Assessment Methods:

Theory:	**Assignments & Quiz:**	**20% of 100**
	Mid-Semester Exam:	**30% of 100**
	End-Semester Exam:	**50% of 100**

Course Outcomes:

CO1: Learn about the signals used in communication, basic signal analysis techniques.
CO2: Have the concept of AM, FM, PM modulation techniques.
CO3: Understand and analyse noise and random signal theory.
CO4: Interpret the concept of communication receiver and its basic theory.

Topic Covered:		**Lectures**
UNIT-I	Introduction to various types of signals used in communication engineering and their Mathematical representations. Review of Fourier series, Fourier Transform.	8
UNIT-II	Study and analysis of AM, FM and PM and their respective Demodulation Techniques, Advantages of FM over AM. AM Limiters. Pre-emphasis and De-emphasis. Transmitters for AM, FM, SSB, ISB systems.	10
UNIT-III	Introduction to Pulse Modulation techniques- PAM, PPM, PDM and PCM systems. TDM and FDM systems and their comparison.	6
UNIT-IV	Review of random signals and noise, signal to noise ratio in amplitude and angle modulated systems. Thermal and shot noise, White noise and filtered noise, AWGN Properties, Noise equivalent bandwidth concept. Discrete probability theory, Continuous random variables, Statistically independent random variables, Probability density functions of sums, Transformation of density functions, Ergodic functions, Auto correlation and Cross Correlation process, Spectral density.	10
UNIT-V	TRF and super heterodyne receiver, AGC, FM receiver, sensitivity, selectivity, image frequency rejection measurements, communication receiver and its special features, PLL, Power Line Carriers & Interfacing with power line.	6

Text Books/ Reference Material:

1. Introduction to Analog and Digital Communication, Simon Haykin, Wiley 2009
2. Electronic Communication Systems, G. Kenedy&Bermard, 5th Ed., TMH 1999
3. Electronics Communication, Roody&J.Coolen, 4th Ed. Prentice Hall1977
4. Principles of Communication System, HTaub and D. L. Schilling, "(2nd Edition), McGraw Hill.
5. Communication System, Carlson, (5th Edition) Tata McGrawHill, New Delhi,
6. Modern Digital and Analog Communication Systems, B P Lathi and Zhi Ding, Oxford University Press.
7. Digital and Analog Communication System, L. W. Couch Li, (6th Edition), Pearson Education, Pvt. Ltd, 2017
8. Signal Processing, Modulation and Noise, J A Betts, Hodder & Stoughton Ltd
9. Communication Systems,SimanHaykin,(4th Edition), John Wiley.
10. Fundamental of Communication Systems, John G. Proakis and M Salehi, Pearson Education

PROGRAM ELECTIVE-I

Department: **Electronics and Communication Engineering**
Course Number: EC13011
Title of the Course: Digital Signal Processing
Designation: Elective course
Pre-Requisite:

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	3	0	0	0	3

Course Assessment Methods:

Theory:	**Assignments & Quiz:**	**20% of 100**
	Mid-Semester Exam:	**30% of 100**
	End-Semester Exam:	**50% of 100**

Course Outcomes:

CO1: Understand signal processing systems using basic concepts.
CO2: Analyze signal using the discrete Fourier transform and its effective computation by FFT techniques.
CO3: Specify and design FIR and IIR type digital filters and identify the fundamentals of multi rate signal processing and its applications.
CO4: Understand advanced digital signal processing techniques.

Topic Covered:		**Lectures**
UNIT-I	Review of Discrete-time Fourier Transform, Frequency response of discrete time systems, All pass inverse and minimum phase systems.	5
UNIT-II	DFT, Relationship of DFT to other transforms, FFT, DIT and DIF algorithms, Linear filtering using DFT and FFT.	8
UNIT-III	Frequency response of FIR filter, Design of FIR Digital filters, Window method, Park-McClellan's method, Frequency Sampling Method, Design of IIR Digital Filters, Butterworth, Chebyshev and Elliptic Approximations, Lowpass, Bandpass, Bandstop and High pass filters, Mapping formulas, Frequency transformations.	11
UNIT-IV	Direct form realization of FIR and IIR systems, Lattice structure for FIR and IIR systems, Finite-word length effects. Limit cycle oscillations.	6
UNIT-V	Multirate signal processing – Sampling rate conversion – applications of multirate signal processing. Parametric and non-parametric spectral estimation. Application of DSP.	10

Text Books/ Reference Material:

1. Digital Signal Processing, Algorithms and Applications, Proakis and Manolakis, 3rd edition, Prentice Hall of India, New Delhi.
2. Discrete-time Signal processing, Alan V Oppenheim and Ronald W Schafer, 3rd edition, Pearson.
3. The Scientist & Engineer's Guide to Digital Signal Processing, Steven W Smith.
4. Understanding Digital Signal Processing, Richard G Lyons, Pearson.2017
5. Digital Signal Processing: A Practical approach, EmmanualC.Ifeachoret. Al., Pearson Education, 2nd edition.

Department: **Electronics and Communication Engineering**
Course Number: EC13012
Title of the Course: Filters and Transmission lines
Designation: ELECTIVE course
Pre-Requisite:

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	3	0	0	3	3

Course Assessment Methods:

Theory:	**Assignments & Quiz:**	**20% of 100**
	Mid-Semester Exam:	**30% of 100**
	End-Semester Exam:	**50% of 100**

Course Outcomes:

CO1: Understanding networks and concept of impedance matching and its significance.
CO2: Understanding the resonance in steady state AC circuits.
CO3: Ability to design attenuators, equalizers and filters for given applications.
CO4: Analyze and interpret the voltage and current distributions on the transmission lines and solve impedance matching issues.

Topic Covered:

		Lectures
UNIT-I	Network Theorems (DC and AC) Mesh analysis, Thevenin, Norton, Superposition and Maximum power transfer theorems. Networks – One port, Two port, Balanced, unbalanced, Active , Passive, T, PI, Lattice, Ladder networks, Concepts and significance of Characteristic impedance, propagation constant, attenuation constant, phase shift constant of T and PI network, Star- Delta transformation.	10
UNIT-II	Series Resonance: properties of series RLC resonance circuit, bandwidth, selectivity, frequency response, Parallel Resonance: properties of parallel RLC resonance circuit, bandwidth, selectivity, frequency response.	6
UNIT-III	Study of various types of Attenuators and Equalizers (Qualitative treatment only) and their applications	7
UNIT-IV	Various types of Passive Filters, LPF, HPF, BPF, BSF, m-Derived and their applications, basic concept of active filters and their comparison with passive filters.	8
UNIT-V	Transmission-line Equation and solutions, Reflection and Transmission coefficients, Standing wave and Standing wave ratio. Line Impedance and Admittance. Smith chart and Single stub matching	9

Text Books/ Reference Material:

1. Networks, Lines and Fields, John D. Ryder. (PHI) 1st Ed.1978
2. Circuit Theory (Analysis and Synthesis), A. Chakraborty (Dhanpat Rai & Co.)3rd Ed.2010
3. Network Analysis, M.E. VanValkenburg (PHI) 3rd Ed. 2006
4. Network and Systems, D. Roy Choudhury (New Age International).1st Ed. 1998
5. Networks, Filters and Transmission lines, P.K. Jain, Gurbir Kaur.(TMH).1st Ed. 1994

Department: **Electronics and Communication Engineering**
Course Number: EC13013
Title of the Course: Control system

Designation: ELECTIVE course
Pre-Requisite:

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	3	0	0	3	3

Course Assessment Methods:

Theory:	**Assignments & Quiz:**	**20% of 100**
	Mid-Semester Exam:	**30% of 100**
	End-Semester Exam:	**50% of 100**

Course Outcomes:

CO1: Realize block diagrams, mathematical model and transfer functions of open and closed loop control systems.

CO2: Have an in-depth knowledge on transient, steady state and stability of a control system.

CO3: Specify control system performance in the frequency-domain in terms of gain and phase margins, design compensators to achieve the desired performance.

CO4: Model and analyze control systems using state-space analysis and knowledge on digital control System.

Topic Covered:		**Lectures**
UNIT-I	Elementary control concepts: Open loop and close loop control system. Transfer function, impulse response, modeling of electrical and mechanical (translational and rotational) systems, DC motor block diagram simplification, and signal flow graphs.	8
UNIT-II	Transient response analysis of I and II order system: Type of systems and its effect on error function, stability, steady state error.	6
UNIT-III	Stability concept: Routh Hurwitz criterion of stability, Root locus techniques: Root-Loci and complementary root loci rules for root locus plots.	6
UNIT-IV	Frequency Response Analysis: Nyquist plot and Bode plot. Gain and phase margins, compensation typical examples. Compensators and controllers: lead, lag and lag-lead compensators, proportional, PI and PID controllers.	10
UNIT-V	State Space Analysis: State Variables and State Model, State Transition Matrix and its properties, Concept of Controllability and Observability. Digital Control System: Sampled Data Control System, Step Response (First & Second Order Systems), Introduction to Digital PID Controller, block schematic of PLC and addressing.	10

Text Books/ Reference Material:

1. Control Systems Engineering, Nagaratha and Gopal.
2. Discrete-Time Control Systems, K. Ogata, Pearson Education/PHI, 2 Edition
3. Modern Control Engg, K. Ogata, 2nd ed., PHI, 1995
4. Automatic Control Systems, B. C. Kuo, 9th ed., PHI, 1995.

PROGRAM ELECTIVE-II

Department: **Electronics and Communication Engineering**
Course Number: EC13014
Title of the Course: Optical Fiber Communications
Designation: ELECTIVE course
Pre-Requisite:

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	3	0	0	3	3

Course Assessment Methods:

Theory:	**Assignments & Quiz:**	**20% of 100**
	Mid-Semester Exam:	**30% of 100**
	End-Semester Exam:	**50% of 100**

Course Outcomes:

CO1: Quantitatively analyze individual components of Optical Fiber Communication link.
CO2: Compute analog and digital optical fiber link design parameters.
CO3: Analyze optical source, Fiber and Detector operational parameters.
CO4: Understand, model and analyze the components of optical networking technology

Topic Covered:		**Lectures**
UNIT-I	Introduction: Advantage over other communication system. Optical wave guides-Ray theory of transmission, Total internal reflection, acceptance angle, Numerical aperture, skews rays.	6
UNIT-II	EM theory of optical propagation. Setup and graded index fibers, Modes and their coupling, single mode fiber, mode field diameter, spot size. Transmission characteristics of optical fiber- Intrinsic and Extrinsic absorption, Linear scattering, Fiber band loss, Material and waveguide dispersion, Intermodal dispersion, Modified single mode fiber.	8
UNIT-III	Optical sources-LASERS: Absorption and emission of radiation, Einstein relation, Population inversion, Optical feedback and threshold condition for laser oscillation, Optical emission from semiconductors- PN Junction, Spontaneous and stimulated emission and lasing. Heterojunctions, semiconductor injection laser, efficiency, Laser modes, Single mode operations, Injection Laser characteristics. LED structure- surface and edge emitters. LED characteristics-Optical output power, output spectrum, Modulation BW.	10
UNIT-IV	Optical detectors-Principles, Direct and Indirect absorption, Group 3 to 5 alloy. Quantum efficiency, p-n-p-n, Avalanche and p-i-n photodiode. Receiver structure-Low and high impedance front end	8
UNIT-V	Optical amplification-Semiconductor Laser and fiber amplifier. Optical TDM, WDM. Transmission link analysis, Point to point links, System considerations, Link power budget, Rise time budget. Fiber attenuation measurements-Optical time domain reflecto-meter. Fiber fault location, Dispersion measurements.	8

Text Books/ Reference Material:

1. Optical Fiber Communication: Principles and Practice, 3rd Ed. John Senior, Prentice Hall of India, New Delhi., 1992
2. Optical Fiber Communication, 3rd Ed., G. Keiser, McGraw Hill International, New York, 2000

Department: **Electronics and Communication Engineering**
Course Number: EC13015
Title of the Course: Basics of VLSI design
Designation: ELECTIVE course
Pre-Requisite:

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	3	0	0	3	3

Course Assessment Methods:

Theory:	**Assignments & Quiz:**	**20% of 100**
	Mid-Semester Exam:	**30% of 100**
	End-Semester Exam:	**50% of 100**

Course Outcomes:

CO1: Understand CMOS technology and be able to do DC and transient analysis of digital CMOS circuits.

CO2: Describe the techniques used for VLSI fabrication and ability to estimate timing characteristics, noise margins, power consumption of a digital VLSI circuit. Design static

CO3: CMOS and dynamic clocked CMOS circuits.

CO4: Analyze working of SRAM cell and DRAM cell

Topic Covered:		**Lectures**
UNIT-I	VLSI design flow Design; MOS Transistor; DC Transfer Characteristics: Static CMOS Inverter DC Characteristics,	8
UNIT-II	CMOS Processing Technology: Layout design rules, CMOS Process enhancements; Stick Diagrams; Technology-Related CAD Issues, Manufacturing Issues.	8
UNIT-III	Delay: Delay Models; Logical Efforts of Paths, Timing Analysis of Delay Models Power: Dynamic Power and Static Power.	6
UNIT-IV	Combinational Circuit Design: CMOS Logic Gates, The Compound Gates, Pass Transistors and Transmission Gates, Tristate buffer, Multiplexers. Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass-Transistor Circuits. Subthreshold Circuit Design	10
UNIT-V	Sequential MOS logic circuitry: Behavioral of Bistable element, Flip-Flop. Sequencing Static Circuits; Circuit Design of Latches and Flip-Flops; Memory: SRAM; DRAM; Semiconductor memories: Introduction, Read-Only Memory circuits, SRAM circuits, DRAM circuits	8

Text Books/ Reference Material:

1. "CMOS VLSI Design", Pearson Education, Neil H.E. Weste, David Harris, Ayan Banerjee, 3rd Edition.
2. "CMOS digital Integrated Circuits, Analysis and Design", Sung-Mo Kang and Yusuf Leblebici, Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. "Basic VLSI Design", Douglas. A. Pucknell, Kamaran Eshraghian, PHI,3rd Edition
4. "Introduction to VLSI Circuits & Systems", John P. Uyemura Wiley India Edition

Department: **Electronics and Communication Engineering**
Course Number: EC13016
Title of the Course: Fundamentals of Electromagnetic Theory
Designation: ELECTIVE course
Pre-Requisite:

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	3	0	0	3	3

Course Assessment Methods:

Theory:		
	Assignments & Quiz:	**20% of 100**
	Mid-Semester Exam:	**30% of 100**
	End-Semester Exam:	**50% of 100**

Course Outcomes:

CO1: Understand the coordinates systems, vector calculus and apply it in electromagnetic problem
CO2: Understand the physics of electrostatics and apply it to solve electrostatic problems
CO3: Understand the physics of magnetostatics and apply it to solve magnetostatics problems
CO4: Understand the time varying field and waves in different media

Topic Covered:		**Lectures**
UNIT-I	Review of vector Algebra, Rectangular, Cylindrical, spherical Coordinate systems and transformation, Vector Calculus – Gradient, Divergence and curl, Green's and Stroke theorems.	6
UNIT-II	Electrostatics, Coulomb's law. Gauss's law and applications. Electric potential. Poisson's and Laplace equations. Method of images. Electrostatic fields in matter. Dielectrics and dielectric polarization. Capacitors with dielectric substrates	10
UNIT-III	Magnetostatics, Biot-Savart's Law, Ampere Circuits Law, Applications of Potentials, Magnetic Force- charge particle, current elements, Magnetic field in Potentials, Magnetic Force- charge particle, current elements, Magnetic field in Material space, Magnetization, Magnetic Boundary Conditions, Inductor, Inductances, Magnetic Energy.	10
UNIT-IV	Time-varying Fields, Faraday's Law, Transformer and Motional Electromotive Forces, Displacement current, Maxwell Equations, Time Varying Harmonic Fields.	7
UNIT-V	Electromagnetic waves, General wave Equations, waves in lossy dielectrics, Plane wave in lossless dielectrics, free space, good conductors, Wave polarization, Poynting vector and reflection of waves	7

Text Books/ Reference Material:

1. Elements of Electromagnetics 4th Edition – M.N.O. Sadiku , Oxford.
2. Electromagnetic waves and radiating systems, 2th edition, E. Jordan and K. Balmin, Prentice Hall of India, New Delhi, 2001
3. Advanced Engineering Electromagnetics, C.A. Balanis, John Willy and Sons, New York, 2001
4. Electromagnetics, 4th edition, J.D.Kraus, Tata McGrawhill, New Delhi, 1991.

PROGRAMME ELECTIVE-III

Department: **Electronics and Communication Engineering**
Course Number: EC13021
Title of the Course: Linear Integrated Circuits
Designation: ELECTIVE course

Pre-Requisite: **EC12101**

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	3	0	0	3	3

Course Assessment Methods:

Theory:	**Assignments & Quiz:**	**20% of 100**
	Mid-Semester Exam:	**30% of 100**
	End-Semester Exam:	**50% of 100**

Course Outcomes:

CO1: To understand the basic characteristics of a differential amplifier

CO2: To understand the basic characteristics of an OPAMP and its different linear and nonlinear application

CO3: To understand the principle of oscillation, types of oscillators and design.

CO4: To understand the different types of OPAMP filters, and data convertors.

Topic Covered:		**Lectures**
UNIT-I	Differential Amplifiers (DA): Single ended and fully differential output topology, voltage gain, CMRR, PSRR and ICMR and output swing of BJT-based DA., active loads, IC biasing, current source and sink, current mirrors, level translators' circuits.	10
UNIT-II	OPAMP: Block-level and internal circuit level working of op-amp, ideal characteristics, open loop gain, negative feedback configurations with closed loop gain, various linear applications adder, subtractor, averager, precision rectifiers, integrator, differentiator, log and antilog amplifiers, absolute value detectors, voltage limiters, instrumentation amplifier etc., non-linear applications such as comparators, zero crossing detector, analog multipliers, etc.	12
UNIT-III	OSCILLATORS: Classification, Barkhausen Criterion, frequency stability, inverting and non-inverting Schmitt triggers, integrator, square wave and triangular wave oscillators, Phase Shift Oscillator, Wein Bridge Oscillator, voltage-controlled oscillator (VCO) circuit design using OP-AMP, PLL	8
UNIT-IV	ACTIVE FILTERS and CONVERTERS: classification and characterization of filters, Various types of active RC-filters of first order and second order and their design. State variable Biquadratic filters. Converters: Various types of Analog to Digital and Digital to Analog Converter, working principle, characteristics.	10

Text Books/ Reference Material:

1. Op-Amps and Linear Integrated Circuits 4 Edition Author(s): Ramakant A. Gayakwad Publisher: PHI earning
2. Linear Integrator Circuits by D.R. Chaudhury and S.B. Jain, New age International Publishers, Fourth Edition
3. Operational Amplifiers with Linear Integrated Circuits 4th Edition, Author(s):William D. Stanley, Publisher: Pearson (2004).
4. Electronics Principles By: A. P. Malvino, Tata McGraw Hill
5. Integrated Electronic circuits By: J. Millman and C.C.Halkias, TMH.
6. Electronic Devices and Circuits, Fourth Edition by David A. Bell. (PHI).
7. Electronics Circuits By: D. Shilling, Tata McGraw.

Department: **Electronics and Communication Engineering**

Course Number: EC13022

Title of the Course: Medical Electronics

Designation: ELECTIVE course

Pre-Requisite:

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	3	0	0	3	3

Course Assessment Methods:

Theory:	**Assignments & Quiz:**	**20% of 100**
	Mid-Semester Exam:	**30% of 100**
	End-Semester Exam:	**50% of 100**

Course Outcomes:

CO1: Understanding biomedical signals and specifically cardiological signals like ECG
CO2: Analyzing biomedical signals in Frequency domain
CO3: Spectral Analyzing of biomedical signals
CO4: Understanding adaptive filtering of biomedical signals

Topic Covered:		**Lectures**
UNIT-I	Introduction: General measurements and diagnostic system, classification, biomedical signal acquisition, difficulties in signal acquisition. ECG: signal origin, parameters-QRS detection different techniques, ST segment analysis, Arrhythmia, Arrhythmia analysis, Arrhythmia monitoring system	8
UNIT-II	ECG Data Reduction, compression: Turning Point, AZTEC, Cortes, FAN, Transformation, Karhunen - Loeve Transform, DPCM, Huffman coding, Data compression. Signal averaging: Basics, Signal averaging as a digital filter, A typical averager, Software and limitations	8
UNIT-III	Frequency Domain Analysis, Spectral analysis, linear filtering, cepstral analysis and homomorphic filtering. Removal of high frequency noise, motion artefacts and power line interference in ECG, Time Series Analysis: AR models, Estimation of AR parameters, ARMA models. Spectral modelling and analysis of PCG signals	8
UNIT-IV	Spectral Estimation, Evaluation of prosthetic heart valves using PSD techniques. Comparison of the PSD estimation methods. Event Detection and waveform analysis: Identification of heart sounds, Morphological analysis of ECG waves and Activity	8
UNIT-V	Adaptive Filtering: Introduction, General structure, LMS, adaptive noise cancellation in ECG, cancellation of ECG from EMG signal, Cancellation of maternal ECG in fetal ECG. EEG: EEG signal characteristics, Sleep EEG classification and epilepsy	8

Text Books/ Reference Material:

1. "Biomedical Signal Analysis" A case study approach, Rangaraj M Rangayyan, John Wiley publications.
2. "Biomedical Signal Processing Time and Frequency Domains Analysis (Volume I)", Arnon Cohen, CRC press.
3. Biomedical Signal Processing Principles and Techniques" D.C.Reddy, Tata Mc Graw-Hill
4. "Biomedical Digital Signal Processing", Willis J. Tompkins, PHI.

Department: **Electronics and Communication Engineering**
Course Number: EC13023
Title of the Course: Network Analysis and Synthesis.
Designation: ELECTIVE course
Pre-Requisite:

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	3	0	0	3	3

Course Assessment Methods:

Theory:	**Assignments & Quiz:**	**20% of 100**
	Mid-Semester Exam:	**30% of 100**
	End-Semester Exam:	**50% of 100**

Course Outcomes:

CO1: Compute responses of first, second and higher order networks using time domain analysis and Laplace Transform to solve for circuit response.

CO2: Understanding LTI two port systems using the popular parameters and solving them.

CO3: Synthesizing networks using RL, RC and LC circuits.

CO4: Applying graph theory for network analysis.

Topic Covered:		**Lectures**
UNIT-I	Review of Network Theorems, Formulations of network equations: First – order systems, Natural response, Initial conditions, complete response of First-order systems, zero state and zero input responses. Second order system, Natural response, Overdamped, Underdamped and critically damped case. Geometry of plane, unit-step and unit impulse response, linear system with sinusoidal inputs, impedance and admittance, power, concept of Complex frequency.	10
UNIT-II	Transform Impedances Network functions of one port and two port networks, concept of poles and zeros, properties of driving point and transfer functions, time response and stability from pole zero plot, frequency response. Characterization of LTI two port networks ZY, ABCD and h-parameters, reciprocity and symmetry. Inter relationships between the parameters, interconnections of two port networks. Transient analysis of different electrical circuits with and without initial conditions.	10
UNIT-III	Positive real function; definition and properties; properties of LC, RC and RL driving point functions, synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms.	11
UNIT-IV	Graph of a Network, definitions, tree, co tree, link, basic loop and basic cut set, Incidence matrix, cut set matrix, Tie set matrix Duality, Loop and Node methods of analysis.	9

Text Books/ Reference Material:

1. " Network Analysis", M.E. Van Valkenburg, Prentice Hall of India
2. "An Introduction to Circuit analysis: A System Approach" Donald E. Scott McGraw Hill Book Company.
3. 'Circuit Theory" A.Chakrabarti, Dhanpat Rai and Co.
4. "Networks and Systems" D.RoyChoudhary, Wiley Eastern Ltd.

Department: **Electronics and Communication Engineering**
Course Number: EC13024
Title of the Course: Digital Communication
Designation: ELECTIVE course
Pre-Requisite:

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	3	0	0	3	3

Course Assessment Methods:

Theory:		
	Assignments & Quiz:	**20% of 100**
	Mid-Semester Exam:	**30% of 100**
	End-Semester Exam:	**50% of 100**

Course Outcomes:

CO1: Understand data conversion techniques.

CO2: Understand digital modulations.

CO3: Familiarize with digital data transmission techniques.

CO4: Familiarize with information theory and coding schemes.

Topic Covered: **Lectures**

UNIT-I	Review of Sampling theorem, Pulse-Amplitude Modulation, Channel bandwidth. Natural and Flat top sampling. Quantization of signals, Quantization error, Pulse-code modulation (PCM), Electrical representation of binary digits, PCM system, Companding, Multiplexing. Differential PCM, Delta modulation, Adaptive delta modulation, Vocoders, Channel Vocoder, Linear Predictive coder.	12
UNIT-II	Digital Modulation Techniques: Binary Phase-Shift Keying (BPSK), Differential Phase-Shift Keying, Differentially Encoded PSK (DEPSK), Quadrature Phase- Shift Keying (QPSK), Quadrature Amplitude Shift Keying (QASK), Binary Frequency-Shift Keying (BFSK), Similarity of BPSK and BFSK, M-ary FSK, Minimum Shift Keying (MSK).	12
UNIT-III	Data Transmission: Baseband signal receiver, Probability of error. Matched Filter, Probability of error in Matched filter, Coherent reception of PSK and FSK, Non-Coherent reception of FSK, PSK and QPSK. Error probability of BPSK, BFSK and QPSK. Bit-by-bit encoding versus Symbol-by-Symbol encoding, Relationship between Bit error rate and Symbol Error rate, comparison of modulation systems.	10
UNIT-IV	Information Theory and Coding: Discrete messages, information, Entropy, Information rate, coding to increase average information per bit. Shannon's theorem, Capacity of Gaussian channel, Bandwidth-S/N trade off, use of orthogonal signals to attain Shannon's limit, Efficiency of orthogonal signal transmission, Coding: Parity check bit coding, error detection and error correction coding, Block codes, Convolution codes, Comparison of error rates in coded and uncoded transmission.	6

Text Books/ Reference Material:

1. Electronic Communications Systems, Wayne Tomasi, Pearson Education
2. Principles of Communication Systems, Taub and Schilling TMH.
3. Digital Communication, S. Haykin, Wiley.
4. Analog and Digital Communication, S. Haykin, Wiley.

OPEN ELECTIVE:

Department: **Electronics and Communication Engineering**
Course Number: EC13041
Title of the Course: Electronic circuits and Devices
Designation: Open Elective
Pre-Requisite: ES11200

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	3	0	0	3	3

Course Assessment Methods:

Theory:	**Assignments & Quiz:**	**20% of 100**
	Mid-Semester Exam:	**30% of 100**
	End-Semester Exam:	**50% of 100**

Course Outcomes:

CO1: To understand the working principle and application of OPAMP.
CO2: To understand the working of different types of regulators.
CO3: Understanding the concept of tuned amplifier.
CO4: To study different types of power control switching circuits..

Topic Covered: **Lectures**

UNIT-I	Operational Amplifier: Introduction to op-amp, offset voltage/currents, CMRR, Feedback amplifier, Linear and Nonlinear application, active filters, performance comparison of typical op-amp (741C, LM411, LM118, LM108, QD611.)	10
UNIT-II	Regulated Power Supply: Regulated power supply design, capacitive(CRC) filter based power supply, Linear series regulators, single op-amp regulator, three terminal regulators, adjustable power supply, Linear ICs such as LM78XX, LM79XX, LM317, LM 337, Switched capacitor conversion (LM-7660). Switching power supply, Basic principles, Buck regulator, Boost regulator.	12
UNIT-III	Tuned Amplifiers: Single tuned circuit, FET & BJT amplifier, FET tuned amplifier, tuned transistor amplifier with tuned load, narrow band approximation and tuning (Synchronous & Stagger), cascade tuned IF amplifier, Design of tuned amplifier, oscillator possibility and sensitivity. Oscillators: Wein bridge, phase shift, twin T and crystal oscillators.	10
UNIT-IV	Power Switches and ICs: Introductory idea and use of SCR, Diac, Triac and UJT circuits. Integrated Circuits: Introduction to IC, familiarization with popular IC NE/SE-555, 7400 7402, 7406, Audio and Video amplifiers.	8

Text Books/ Reference Material:

1. Basic Electronics and Linear Circuits, 6th Ed., N.N. Bhargav, D.C. Kulshreshta, S.C.
2. Gupta,Tata McGraw Hill, New Delhi, 2001
3. Electronics Principles, 6th Ed., A.P. Malvino, Tata McGraw Hill, New Delhi, 1999.
4. Micro Electronics, 2nd Ed., J. Millman, Arvin Grabel, Tata McGraw Hill, New Delhi,1999.
5. Integrated Electronics, J. Millman, & C.C. Halkias, Tata McGraw Hill, New Delhi, 1999

Department: **Electronics and Communication Engineering**
Course Number: EC13042
Title of the Course: Instrumentation and Measurements
Designation: Open elective
Pre-Requisite:

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	3	0	0	3	3

Course Assessment Methods:

Theory:	**Assignments & Quiz:**	**20% of 100**
	Mid-Semester Exam:	**30% of 100**
	End-Semester Exam:	**50% of 100**

Course Outcomes:

CO1: Concepts of generalized measurement system,
CO2: To study the working of AC and DC bridges for measurement of different type of measurands.
CO3: Recognize the kind of instrument suitable for typical measurements and understand the concepts popular instruments like cathode ray oscilloscope and its usages.
CO4: Acquire the details of various transducers which are used to measure strain, temperature etc.

Topic Covered:		**Lectures**
UNIT-I	Generalized Measurement system: Accuracy, Precision, Fidelity, speed of response, static & dynamic performance characteristics, dynamic- step response, ramp response of first order instrument. Classifications of errors, error analysis of measurement.	10

UNIT-II	Introduction to DC and AC bridges for measurement of voltage / current / resistance /capacitance and inductance.	8
UNIT-III	Principle and Working of voltmeter, ammeter and ohmmeter, Introduction to DVM, Electronic multimeter. Cathode Ray Oscilloscope- Introduction, cathode ray tube, electron gun, and deflection plates, basic CRO circuit, Lissajous pattern. Digital multimeter, Signal generator and Function generator using multi op-amp and crystal.	12
UNIT-IV	Definition of transducer, classification, resistive, capacitive, inductive, magnetic, optical, piezoelectric, pneumatic.	10

Text Books/ Reference Material:

1. Principles of Electronics instrumentation and measurements. Berlyn and Getz (McMillan Pub. Co.)
2. A Course in Electrical Electronics Measurements and instrumentation. A.K. Sawhney (Dhanpat Roy & Co.).
3. Modern Electronics Instrumentation and Measurement Techniques Albert D. Heltrick, W. D. Cooper. (PHI).
4. Murthy DVS – Transducers & Instrumentation, PHI, ND, 1995.
5. Elements of Electronic Instrumentation and Measurement. Joseph J. Carr. Pearson Education
6.PC-Based Instrumentation Concept and Practice N. Mathivanan PHI

Department: **Electronics and Communication Engineering**
Course Number: EC13043
Title of the Course: Electronic Engineering Materials.
Designation: Open ELECTIVE course
Pre-Requisite:

Course Details:	**Lectures**	**Tutorial**	**Practical**	**Contact Hours**	**Credits**
	3	0	0	3	3

Course Assessment Methods:

Theory:	**Assignments & Quiz:**	**20% of 100**
	Mid-Semester Exam:	**30% of 100**
	End-Semester Exam:	**50% of 100**

Course Outcomes:

CO1: Understanding of the properties of conducting materials, their alloys and knowledge of semiconducting materials, their types, carrier concentration and fermi distribution function.
CO2: Define magnetic materials and describe their properties.
CO3: Understand the optical properties of materials and their applications.
CO4: Discuss the various properties of Insulating, piezo-electric and dielectric materials.

Topic Covered:		**Lectures**
UNIT-I	Conducting materials - Effect of temperature on resistivity of different conducting materials, Metal and alloys for fuses, Properties and specifications of wire, cable and antenna material. Semiconducting materials - Element and compound semiconductors and their properties, Carrier concentration in semiconductors, Variation of fermi level and carrier concentration with temperature, Hall effect.	10
UNIT-II	Magnetic materials – Different types of magnetic materials and their properties, Diamagnetism, Paramagnetism, ferromagnetism, anti ferromagnetism and ferrimagnetism. Hard and Soft magnetic materials, Magnetic materials used at high frequencies. Frequency dependence of dielectric constant; Ferroelectricity and Piezoelectricity in materials.	10
UNIT-III	Optical properties of materials: metals, insulators and semiconductors, Phosphorescence and fluorescence, Different phosphors used in CRO screens, Liquid crystal as display, materials for LEDs, Photoconductivity and photo conducting materials. Light interaction with solids; Absorption, Transmission and Reflection; Luminescence; Photoconductivity; Lasers.	10
UNIT-IV	Insulating materials- Atomic interpretation of dielectric material of mono atomic gases and poly atomic molecules, general feature of static dielectric constant of solids, piezo electricity and piezoelectric materials, Dielectric properties in alternating fields: Frequency dependence of electronic and ionic polarizability, complex dielectric constant, dielectric relaxation and losses, temperature dependence, superconductors.	10

Text Books/ Reference Material:

1. Electronics Engineering Materials and Devices, John Allyson, 1st Ed.,Tata McGraw Hills 1973
2. Introduction to Materials Science for Engineers, James Shakelfolk, 6th Ed. Macmillan Publishing Co. 2007
3. Materials Science and Engineering, V. Raghavan, 2nd Ed. Prentice Hall of India. 2015
4. Electrical Engineering Materials, A.J.Dekker, 3rd Ed. Prentice Hall of India, New Delhi 2007