Jabalpur Engineering College, Jabalpur

(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) IV Semester (Electronics & Tele Communication Engineering)

w.e.f. July 2023

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical						
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work		L	T	P	
1	EC41	PCC	Electromagnetic Theory	70	20	10	-	-	100	3	1	-	4
2	EC42	PCC	Analog Integrated Circuits	70	20	10	30	20	150	3	-	2	4
3	EC43	PCC	Digital Circuits & Systems	70	20	10	30	20	150	3	-	2	4
4	EC44	PCC	Analog Communication	70	20	10	30	20	150	3	-	2	4
5	EC45	PCC	Communication N/W & Transmission Lines	70	20	10	-	-	100	3	1	-	4
6	EC46	ESC	Software Lab	-	-	-	30	20	50	-	-	4	2
			Total	**350**	**100**	**50**	**120**	**80**	**700**	**15**	2	**10**	**22**
7	EC47	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-	-	8
8	EC48	MC	NSS/NCC/Swatchhata Abhiyan/Rural Outreach	Qualifier									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum 8 credits against additional MOOC courses in subject code EC47 for the award of Honours (Minor Specialization).									

Note: MOOC/NPTEL subjects shall be taken with permission of HOD/Coordinator.

1 hour lecture (L) = 1 credit	1 hour Tutorial (T) = 1 credit	2 hour Practical (P) = 1 credit

PCC: Professional Core Course, ESC: Engineering Science Course, DLC: Distance Learning Course, MC: Mandatory Course

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/ Week			Total Credits
EC41	Electromagnetic Theory	Theory			Practical						
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work		L	T	P	4
		70	20	10	-	-	100	3	1	-	

Course Contents

Module I: Coordinate Systems and Transformation

Cartesian coordinates, circular cylindrical coordinates, spherical coordinates, Vector calculus, Differential length, area and volume, line surface and volume integrals, del operator, gradient of a Scalar, divergence of a vector and divergence theorem, curl of a vector, Green's and Stoke'stheorem, Laplacian of a scalar.

Module II: Electrostatics

Electrostatic fields, Coulombs law and field intensity, Electric fielddue to charge distribution, Electric flux density, Gausses" Law - Maxwell's equation, Electric dipole and flux lines, energy density in electrostatic fields. Electric fleld in material space: Properties of materials, convection and conduction currents, conductors, polarization indielectrics, dielectricconstants, continuity equation and relaxation time, boundary condition.Electrostatic boundary value problems: Poisson's and Laplace's equations, general procedures for solving Poisson's or Laplace's equations, resistance and capacitance, method of images.

Module III: Magnetostatics

Magneto-static fields, Biot-Savart's Law, Ampere's circuit law,Maxwell's equation, application of ampere's law, magnetic flux density- Maxwell's equation,Maxwell's equation for static fields, magnetic scalar and vector potential. Magnetic forces, materials and devices: Forces due to magnetic field, magnetic torque and moment, a magneticdipole, magnetization in materials, magnetic boundary conditions, inductors and inductances,magnetic energy,

Module IV: Waves and Applications

Maxwell's equation, Faraday's law, Transformer and motional electromotive forces, displacement current, Maxwell's equation in final form.

ModuleV: Electromagnetic Wave Propagation

Wave propagation in lossy dielectrics, plane waves in lossless dielectrics, plane wave in free space, plain waves in good conductors, power and the pointing vector, reflection of a plain wave in a normal incidence.

Text Book

1. Hayt, W.H. and Buck, J.A. 'Engineering Electromagnetics Tata McGraw Hill Pubiishing Co. Ltd., New Delhi Seventh edition.
2. Jordan E.C. and Balmain K.G. 'Electromagnetic' wave and radiating systems. PHI Second edition.
3. Krauss J. D. 'Electromagnetics ' Tata McGraw Hill Fifth edition.
4. Ramo S, Whinnery T.R. and Vanduzer T. 'Field and Waves in CommunicationElectronicsJohn Wiely and Sons Third edition.
5. Elements of Engineering Electromagnetics, N.N. Rao, 5th Edition, PHI.
6. Electromagnetic Waves and Antennas: Collins: TMH

Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Understand different coordinate systems.
CO2	Knowledge of relation between various Laws.
CO3	Understand various boundary conditions.
CO4	Analyze behavior of Electric Field.
CO5	Analyze behavior of Magnetic Field.

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/ Week			Total Credits
		Theory			Practical						
EC42	Analog Integrated Circuits	End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work		L	T	P	4
		70	20	10	30	20	150	3	-	2	

MODULE-I IC technology
Classification, IC Chip size and circuit complexity, fundamentals of Monolithic IC Technology, Basic Planar Processes, Fabrication of a Typical Circuit, Active and Passive components of ICs, Thin film and Thick film technology.
Basics of OP-AMP: Brief review of basic building blocks of Op-amp (differential amplifier, current mirror, active load, level shifter, output stage). Ideal Operational amplifier, Operational Amplifier Internal Circuit, Op-amp Configuration- Inverting and Non-Inverting
DC Characteristics: Input bias Current, Input offset Current, Input offset Voltage, Thermal Drift,
AC Characteristics: Frequency Response, Stability of an OP-AMP, Frequency Compensation (External & Internal), Slew Rate, CMRR
Applications: Instrumentation amplifier, AC amplifier, Voltage to current and current to Voltage Converter, Op-Amp as summer (Adder), Subtractor, Multiplier, Divider, Differentiator, Integrator

MODULE-II Waveform Generator
Square wave generators: 555Timer-Description of Functional Diagram and operation (Monostable,Astable, Bistable,Schmitt Trigger),
Ramp Generator: Triangle generator, Sawtooth generator
Sine wave generator: Requirement for sinusoidal oscillations, Wien-bridge and twin-T oscillators.
Function Generators: Multi op-amp function generators, IC function generators
Digitally controlled frequency synthesizer: PLL Fundamentals, Basic Principles, Phase Detector /Comparator, Voltage Controlled Oscillator (VCO), Low Pass Filter, Monolithic Phase- Locked Loop, PLL Applications

MODULE-III
Oscillators: Basic Principle of sine wave Oscillators (RC-Phase shift, Wien's bridge), & LC Oscillators (Hartley and Colpitt's), Crystal controlled Oscillator
Voltage Regulator: Series OP-AMP Regulator, IC Voltage Regulators, 723 General Purpose Regulators, Switching Regulator,
D-A & A-D Converters: Basic DAC Techniques, A-D Converters.

MODULE-IV Non-linear Circuits
Logarithmic Amplifiers, Log/Antilog Modules, Precision Rectifier, Peak Detector, Sample and Hold Circuits. OP-AMP as Comparator, Schmitt Trigger, Square and Triangular Wave Generator, Monostable Multivibrator. IC Analog Multiplier applications, Operational Amplifier (OTA).

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MODULE-V Active Filters:
Introduction to filtering: Frequency response, Characteristics and terminology, Active versus passive filters
Low pass filter: First order low pass active filter, second order active filter model, second order low pass filter characteristics
High pass active filter.
Band pass filter: single op-amp band pass filter, multistage band pass filter, State variable filter

Text Books:

1. Millman and Halkias: Integrated Electronics, TMH
2. Gayakwad: OP-AMP and Linear Integrated Circuits,Pearson Education
3. D. Roy Choudhury and Shail B. Jain: Linear Integrated Circuits, New Age
4. Boylestad and Nashelsky: Electronic Devices and Circuit Theory, PHI
5. Sedra and Smith: Microelectronics, Oxford Press
6. Graham Bell: Electronics Devices and Circuits, PHI
7. Donald A Neamen: Electronic Circuits Analysis and Design, TMH
8. S. Reddy: Electronic Devices and Circuits, Alpha Science International Limited

Reference Book:

1. B.P. singh and Rekha Singh, Electronic Devices an Integrated Circuits; Pearson Education, 1st Edition 2006.

Course Outcomes:
Upon successful completion of course students will be able to:

CO1	Understand the Integrated Circuit technology and fabrication and Apply and Interpret the AC and DC Characteristic of Operation Amplifier.
CO2	Design various waveform generators using Operation Amplifier.
CO3	Understand the concept of active filters and their designing.
CO4	Design various non linear circuits using Op-amp
CO5	Design Oscillators, Voltage regulators and DAC & A/D converters using Op-amp

List of experiments (Expandable):

1. Design of Adder, Subtractor, Integrator, Differentiator, Log/Antilog amplifier using Op- Amp
2. Design of RC Phase shift Oscillator using Op-Amp
3. Design of Colpitt's oscillator using Op-Amp
4. Design of Hartley Oscillator using Op-Amp
5. Design of Wien's Bridge Oscillator using Op-Amp
6. Design of Monostable Multivibrator using IC555 Timer
7. Design of Astable Multivibrator using IC555 Timer
8. Design of Schmitt trigger using IC555 Timer
9. Design of Weighted resistor DAC using Op-amp.
10. Design of Low pass Active filter

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/ Week			Total Credits
		Theory			Practical						
EC43	Digital Circuits & Systems	End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work		L	T	P	4
		70	20	10	30	20	150	3	-	2	

MODULE-I
Number Systems: Decimal, Binary, Octal and Hexadecimal systems, arithmetic operations of binary numbers, conversion from one base to another, Codes-BCD, Excess- 3, Gray codes, error correcting and error detecting codes- Hamming codes, ASCII, EBCDIC. Logic gates and binary operations- AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive– NOR.

MODULE-II
Implementations of Logic Functions using gates, NAND–NOR implementations – Multi level gate implementations- Multi output gate implementations. Boolean postulates and laws – De-Morgan's Theorem - Principle of Duality, Boolean function, Canonical and standard forms, Minimization of Boolean functions, Minterm, Maxterm, Sum of Products (SOP), Product of Sums (POS), Karnaugh map Minimization, Don't care conditions, Quine - McCluskey method of minimization.

MODULE-III
Design and analysis of combinational circuits: Design and analysis of code convertor, half- adders, half subtractor, full adders, full subtractor circuits, Series & parallel adders and BCD adders. look-ahead carry generator and adders. Decoders, Encoders, Binary Multiplier – Binary Divider, multiplexers & demultiplexers, parity checker, parity generators, code converters, Magnitude Comparator. Designing of combinational circuits with ROM and PLA.

MODULE-IV
Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation Unit-4 Registers and Counters: Asynchronous Ripple or serial counter. Asynchronous Up/Down counter - Synchronous counters – Synchronous Up/ Down counters – Programmable counters

MODULE-V
Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like FPGA. Logic implementation using Programmable Devices

Reference Books:

i) W. H. Gothman, "Digital Electronics" (PHI) "
ii) R.J. Tocci, "Digital Systern Principles & Application.
iii) Z. Kohair (TMH), "Switching & Automata Theory"
iv) M. Mano (PHI) "Digital Logic & Computer Design"
v) M. Mano (PHI) "Digital Design".

Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Understand Binary Number System, Logic Gates.
CO2	Understand Demorgans Theorem to simplify expression, K-Map,Q-M method.
CO3	Design and analysis of Combinational Circuits.
CO4	Design and Analysis of Sequential Circuits.
CO5	Describe semiconductor memories with PLA.

DIGITAL CIRCUIT & SYSTEMS LAB

LIST OF EXPERIMENTS

1. To study the operation & working of various types of logic gets with the help of electronic kit.
2. To study of Binary Adder.
3. To study of Encoder &Decoder.
4. To study of multiplexer and demultiplexer.
5. Experiment on multivibrators: Astable, Bistable, Monostable.
6. Study of Binary subtractor.
7. Study of Analog to Digital convertor.
8. Study of Digital to Analog convertor.

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/ Week			Total Credits
		Theory			Practical						
		End Sem	Mid-Sem Exam	Quiz/ Assignment	End Sem	Lab work		L	T	P	
EC44	Analog Communication	70	20	10	30	20	150	3	-	2	4

MODULE-I Amplitude Modulation System

Representation of bandpass signals, Frequency Translation, A Method of Frequency Translation, Recovery of Baseband Signal, Amplitude Modulation, Maximum Allowable Modulation, Spectrum of an Amplitude Modulated Signal, Generation and Detection of AM waves. Suppressed Carrier Systems (DSB-SC), Single Sideband Modulation, Vestigial Sideband Modulation, Comparison of various AM Systems, Frequency Division Multiplexing, AM Transmitter and AM Radio Broadcasting.

MODULE-II Angle Modulation System

Angle modulation, Phase & Frequency Modulation, Relation between Phase & Frequency Modulation, Phase & Frequency Deviation, Spectrum of an FM Signal, Features of Bessel Coefficient, Narrowband FM, Wideband FM, Bandwidth of FM Signal, Effect of Modulation Index on Bandwidth, Phasor Diagram of FM signal, FM Generation and Detection, FM Radio Broadcasting.

MODULE-III Random Variables

Random Variables, CDF, PDF, the relation between CDF & PDF, Average Value of RandomVariables, Variance of Random Variable, Tchebycheff's Inequality, Gaussian Probability Density, Error Function, Rayleigh Probability Density, Correlation between Random Variables, Central Limit Theorem, Autocorrelation,

MODULE-IV Random Processes

Description of Statistical Average, Stationary, Random Processes and Linear System, Spectrum of Stochastic Processes, Transmission over LTI System, Gaussian processes. White Power processes, Bandlimited Processes, and Sampling, Bandpass Processes.

Module V Effect of Noise on Analog Communication Systems

Effect of noise on a Baseband Signal, DSB-SC AM, SSB AM, and Conventional System, The PLL, Effect of Additive Noise on Phase Estimation, Threshold effect in Angle Modulation, Pre- Emphasis and De-Emphasis Filtering. Comparison of Analog Modulation System, Characterization of Thermal Noise Sources, Effective Noise Temperature and Noise Figure, Transmission Losses, Repeaters for Signal Transmission.

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Reference Books:

1. H.TaubDL.Schilling: Principles of Communication System; TMH
2 Simon Haykins- Communication System; John Wiley
3 B P Lathi- Modern Digital and Analog communication
4.J. Prokis and Salehi- Communication Engineering System, Prentice Hall.
5. Hawaii. P. Hsu- Schaum's Outline of Analog and Digital Communication

Course Outcomes:

Upon successful completion of the course students will be able to:

CO1	Basic concept of signal, Generation and Detection of Analog Modulated Signals.
CO2	Understanding of Angle and Phase Modulation, generation and detection of Frequency modulated signals
CO3	Basic Concepts of Random Variable, its statistical parameter and understanding of CDF and PDF of different distribution
CO4	Basic Concepts of Random Process, itscharacteristics and understanding of Gaussian process.
CO5	Understanding of effect of Gaussian noise for Analog Modulated System

ANALOG COMMUNICATION LAB

(Suggested Exercise)

List of Experiments:

1) Study of AM, DSB - SC & SSB.
2) Study of AM Transmitters.
3) Study of AM Receivers.
4) Study of FM Generation by Armstrong Method.
5) Study of FM Generation by Reactance Modulator.
6) Study of Superheterodyne Receivers.
7) Study of Sampling Theorem and Reconstruction of Bandlimited signal

Evaluation:

Evaluation will be continuous an integral part 0f the class followed by the examination as well as through external assessment.

Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Understand various types of amplitude modulators and demodulators
CO2	Understand various types of frequency modulators and demodulators
CO3	Study various types of transmitters and receiver circuits

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours / Week			Total Credits
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		End Sem.	Mid-Sem. Exam	Quiz/ Assignment	End Sem.	Lab work		L	T	P	
EC45	Communication Network & Transmission Line	70	20	10	-	-	100	3	1	-	4

MODULE I

Synthesis: Concept of stability of system (polynomial ratio) from pole-zero concept, Hurwitz polynomials, Properties of Hurwitz polynomials, Concept of Network synthesis, procedure of synthesis, LC Network synthesis, Foster's Canonic form, Cauer form, Cauer Canonic form of relative network, application of Foster & Cauer forms.

MODULE II

Characteristic Parameters of Symmetrical and Asymmetrical Two Port Networks and their Design: Image impedance, iterative impedance, characteristic impedance, propagation coefficient, image transfer coefficient , iterative transfer coefficient, Lattice and Bridged T networks, reactive matching networks, matching techniques, insertion loss, symmetrical and asymmetrical attenuators and their design.

MODULE III

Passive LC Filters: Analysis and design of Low pass, high pass, band pass and band elimination filters, m-derived filters, composite filters, Filter specifications, Butterworth approximation, Chebyshev approximation, elliptic function approximation, frequency transformation. **Positive Real Function:** LC, RL, RC, and RLC network synthesis, Foster and Cauer network, minimum positive real function, Brune's method, Bott-Duffin method, Synthesis-Coefficient.

MODULE IV

Transmission Line Fundamentals: Lumped parameter equivalent, voltage and current on a transmission line, infinite line, characteristic impedance and propagation constant, waveform distortion, attenuation and phase equalizers, distortion-less line, loading, linear reflection on a line, reflection coefficient, input and transfer impedances, open circuit and short circuit line, reflection factors, reflection loss, insertion loss, T and π equivalents of a line, location of line fault, construction and design of two wire line and coaxial cable.

MODULE V

Transmission Line at Radio Frequencies: Parameters of transmission line and coaxial cable at radio frequencies, distortion-less line, voltage and current on a distortion-less line, standing waves, standing wave ratio, input impedance of open and short circuit line, power and impedance measurement on lines, quarter-wave and half wave line, circle diagram, Smith chart, solution of problems using Smith chart, single and double stub matching. Introduction to microstrip lines and its analysis.

References Books:

1. Ryder: Networks and Transmission Lines, PHI Leaming.
2. Valkenberg: lntroduction to Modern Network synthesis, Wiley India.
3. Suresh: Electric Circuits and Networks, Pearson Education.
4. Raju: Electromagnetic field theory and Transmission Lines, Pearson Education'
5. Ganesan: Transmission Lines and Waveguides, TMH.
6. Rao: Electromagnetic Waves and Transmission Lines, PHI learning

Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Explain describe characteristic parameters of different types of two port networks.
CO2	Analysis and design passive LC filters
CO3	Define and Describe positive real function and network synthesis
CO4	Evaluate transmission line fundamentals.
CO5	Analyze and explain different aspects of line at radio frequencies

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