Integral University, Lucknow

ELECTRICAL ENGINEERING I Year/ Semester I/II

				Effective from Session		2022-2023	
Course Code	**EE103**	Title of The Course	BASIC ELECTRICAL ENGINEERING	L	T	P	C
Pre-Requisite	NONE	Co-Requisite	NONE	3	1	0	4

Objective	□ Knowledge and concept of D.C Circuit Analysis and Network Theorems Circuit. □ Use of Steady State Analysis of Single Phase AC Circuits AC fundamentals. □ Knowledge and concept of Three Phase AC Circuits Three phasesystem and measuring devices. □ Basic concepts of Power System and Transformer □ Study of Electromechanical energy conversion devices: AC/ DC Machines.

	Course Outcomes
CO1	Know about the concept of D.C Circuit Analysis and Network Theorems Circuit.
CO2	Steady State Analysis of Single Phase AC Circuits AC fundamentals.
CO3	Know about concept of Three Phase AC Circuits Three phase system and measuring devices
CO4	Layout of Power System and transformer
CO5	Know about Electromechanical energy conversion devices: AC/ DC Machines

No.	Content	Contact Hrs.	Mapped CO
1	**D.C Circuit Analysis and Network Theorems** **Circuit concepts:** Concept of network, Active and passive elements, linear network and non linear network, unilateral and bilateral elements, lumped and distributed network, sources, open circuit and short circuit, source transformation, Kirchhoff's Law. Loop analysis and nodal analysis, star delta transformation. **Network theorems:** Needs of theorem**,** Superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem.	8	CO1
2	**Steady State Analysis of Single Phase AC Circuits** **AC fundamentals:** Basic terminology, Average and effective value of Sinusoidal waveform, form factor and peak factor, concept of phasor, addition and subtraction of alternating quantities, Apparent, active and reactive powers, power factor, causes and problems of low power factor, power factor improvement methods, analysis of series RLC circuits. resonance, bandwidth and quality factor in series circuit.	8	CO2
3	**Three Phase AC Circuits and Measuring Instruments** **Three phase system:** Its necessity and advantages, meaning of phase sequence, balanced and unbalanced supply, balanced load and unbalanced load, star and delta connections, line and phase voltage/current relationship, power measurement. **Measuring Instruments:** Types of instruments: construction and working principle of	8	CO3

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	PMMC, MI type instruments and induction type energy meter.		
4	**Power System and Magnetic Circuit** **Introduction of Power System:** General layout of electrical power system, standard generation, transmission and distribution voltage levels, concept of grid. **Magnetic circuit:** Concepts, analogy between electric and magnetic circuit. **Single Phase Transformer**: Principle of operation, construction, emf equation, types, losses, efficiency, condition for maximum efficiency, voltage regulation, Introduction to auto transformer.	8	CO4
5	**Electromechanical energy conversion devices** **DC Machines:** Principle of operation, emf equation and torque equation of motor, applications. **Three Phase Induction Motor**: principle of operation and applications. **Single Phase Induction Motor**: Principle of operation and applications. **Three Phase Synchronous Machines**: Principle of operation and applications.	8	CO5

References Books:

1. V.Deltoro, "Principle of Electrical Engg." PHI, 2009..
2. M.A Mallick, Dr. I. Ashraf, "Fundamental of Electrical Engg," CBS Publishers, 2010.
3. A. Hussain, "Basic Electrical Engg" Dhanpat Rai & sons, 2007
4. I J Nagrath,"Basic Electrical Engg" ,TMH, 2010.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3	PSO4
CO1	3	3	2	1	1	3						3	3	3	2	3
CO2	3	3	3	2	1	1						2	3	2	2	3
CO3	3	2	1	1	2	2	3					3	2	2	2	3
CO4	3	2	2	2	3	3						2	3	2	2	3
CO5	3	1	1	1	1	2	1					2	3	2	2	3

3: Strong contribution, 2: average contribution, 1: Low contribution

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ELECTRICAL ENGINEERING II Year/ III Semester

				Effective from Session		2022-23	
Course Code	EE201	Title of The Course	**LINEAR NETWORK AND SYSTEMS**	L	T	P	C
Pre-Requisite	NONE	Co-Requisite	NONE	3	1	0	4

Objectives	• To acknowledge the students about basic laws and theorems • To analyze the theoretical and practical values of given circuit • To know about transient state and steady state • To acknowledge the students about stability, two port network and graph theory

	Course Outcomes
CO1	For a given network, would be able to apply the knowledge of mathematics, science, and engineering to theanalysis and design of electrical circuits, Identify, formulate, and solve engineering problems in the area electrical circuits & systems.
CO2	For a given system with dc and ac circuits, describe the different network theorems, would be able to apply,solve and verify the solutions using modern tools for lifelong learning like MATLAB.
CO3	For given a system with two port networks described in standard form, would be able to characterize,modeling, analyze, and verify the network in terms of all network parameters.
CO4	For given a system with RL, RC, and RLC circuits, would be able to understand, perform, formulate, andsolve the differential equations for RL, RC, and RLC circuits and analyze the characteristics of the system.
CO5	For given a system description, would be able to explore and apply to alternate system description, andimplement using basic blocks for network transfer function in s-domain and Two port networks.

No.	Content	Contact Hrs.	Mapped CO
1	**Concept and AC Network theorems** Kirchoff's law, Source transformation, loops analysis, node analysis, super mesh and super node. AC Network theorems: Superposition, Thevenin's, Norton's, Maximum power transfer theorem, Reciprocity, Substitution, Compensation, Millman's and Tellegen's theorem.	8	CO1
2	**Transient and steady state analysis** Transient and steady state analysis for R-L, R-C and RLC circuits, Initial value and final	8	CO2

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	theorem Use of Laplace transform in circuit analysis, Solution of differential equations. Lap lace transform of complex waveform.		
3	**Network Synthesis** Concept of poles and zeros, transfer function, Stability , Hurwitz Polynomial, Positive real function: Definitions and properties, Synthesis of RC, LC and RL Networks using Cauer and Foster I and II forms	8	CO3
4	**Two port networks** Two port parameters, Inter-Conversion of two port Parameters, Interconnections of Two port networks, Reciprocity and Symmetry, T-pie transformation.	8	CO4
5	**Introduction to graph theory** Definitions: Branch, Graphs, Tree, Co- tree, Path and Loop, Concept of Planner and non planner network, Incidence, Cut-set, Tie-set matrices for planer network. loop and nodal analysis.	8	CO5

References Books:

1. M.E.Van Valkenburg, Network Analysis, PHI
2. J.A.Edminister, Electric Circuits, Schaum Series, PHI
3. W.H. Hayt and Jack.E.Kammerly, Engineering Circuit Analysis, Tata Mc Graw Hill
4. A.Hussain, Network and Systems, Khanna publications

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	2	1		1	1	1		2	3	3	2	2
CO2	3	2	3	3	2	2	1	2		1		1	3	3	3	2
CO3	3	3	2	3	2	1							3	2	2	3
CO4	3	2	2	3	1			1		1		1	3	3	2	3
CO5	3	3	3	3	2	1		1		1			3	2	2	3

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ELECTRICAL ENGINEERING II Year/III Semester

				Effective from Session		2022-2023	
Course Code	EE 203	Title of The Course	Electro Mechanical Energy Conversion-I	L	T	P	C
Pre-Requisite	NONE	Co-Requisite	NONE	3	1	0	4

Objective	Knowledge and concept of D.C Circuit Analysis and Network Theorems Circuit. • Use of Steady State Analysis of Single Phase AC Circuits AC fundamentals. • Knowledge and concept of Three Phase AC Circuits Three phase system and measuring devices. • Basic concepts of Power System and Transformer • Study of Electromechanical energy conversion devices: AC/ DC Machines.

	Course Outcomes
CO1	Know about the concept of D.C Circuit Analysis and Network Theorems Circuit
CO2	Steady State Analysis of Single Phase AC Circuits AC fundamentals.
CO3	Know about concept of Three Phase AC Circuits Three phase system and measuring devices
CO4	Layout of Power System and transformer
CO5	Know about Electromechanical energy conversion devices: AC/ DC Machines

No.	Content	Contact Hrs.	Mapped CO
1	**Principle of Electromechanical Energy Conversion**: Introduction, Energy in electromagnetic system, Flow of energy in electromechanical devices, Energy in magnetic field and co-energy, Dynamics of electromechanical systems, singly excited systems, Doubly Excited. System.	8	CO1
2	**DC MACHINES** Construction, function of commutator, simplex lap and wave windings, emf and torque equations, armature reaction and commutation,Remedial measures used for reducing commutation,D. C. generator characteristics	8	CO2
3	**DC MACHINES AND SPECIAL MACHINES** Characteristics of dc motors, testing of dc machines, Hopkinson's test and Swinburne test, dc motor starters, speed control and braking of dc motors **Special motors**: universal motor, permanent magnet dc machines, hysteresis motor,	8	CO3

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	reluctance motor, and stepper motor		
4	**ELECTRICAL TRANSFORMER- I** Principle of transformer action. Construction of two winding transformer, Equivalent circuits and phasor diagrams of Ideal and real transformers, Losses in transformers, Testing: open circuit, short circuit tests and Sumpner's test, per unit system, Efficiency and voltage regulation	8	CO4
5	**ELECTRICAL TRANSFORMER II** Autotransformers: Introduction, Comparison with two winding transformers, Three phase transformer: Construction,phase groupings; Parallel operation, Phase transformation: Three phase to two-phase, single-phase, and six-phase, Application of different types of transformer	8	CO5

References Books:

1. Electric Machines, M.A.Mallick, IK International Pvt. Ltd New Delhi,2009
2. Electrical Machinery, Fitzgerald, Kingsley (McGraw Hill),6th Edition,2020
3. Electrical Machines and their Applications, J Hind Marsh,4th Edition,1984
4. Fundamental of Electrical Machines, B.R. Gupta & V. Singhal ,New Age International Pub.,2005
5. Electric Machinery and Transformers, I.L.Kosow, PHI,2007
6. Electrical Machine, I J Nagrath and D P Kothari ,TMH,2004

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1	1	3						3	3	2	1	3
CO2	3	3	3	2	1	1						2	3	2	2	2
CO3	3	2	1	1	2	2	3					3	2	2	1	3
CO4	3	2	2	2	3	3						2	3	3	1	2
CO5	3	1	1	1	1	2	1					2	3	1	2	2

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ELECTRICAL ENGINEERING II Year/III Semester

				Effective from Session		2022-2023	
Course Code	EE-205	Title of The Course	Solid State Devices & Circuit	L	T	P	C
Pre-Requisite	NONE	Co-Requisite	NONE	3	1	0	4

Objective	• To analyze and designing concept of special purpose diodes and their industrial application. Understand the advancement in conductivity of semiconductors material. • To facilitate and understand the advancement in transistors like JFET, MOSFET, PMOS, NMOS, CMOS etc. and their various types' applications in Industries. Analyze the frequency response. • To develop and analyze the performance of small signal amplifiers and large signal amplifiers (Power amplifiers). • How to develop concept of feedback amplifiers, their different topologies and Implement it for various applications. To analyze their stability and their responses for different applications. • To analyze the design considerations of the active and passive filters. How to develop the various orders of filters and their industrial applications. To understand the constructional difference and working of various types of oscillators

	Course Outcomes
CO1	Analyze and designing concept of special purpose diodes for different types of operation for industrial application purpose. Understand the advancement in conductivity of semiconductors material. Analysis the different regions in which BJT operates and their applications as a switches, amplifiers etc.
CO2	Understand the advancement in transistors like JFET, MOSFET, PMOS, NMOS, CMOS etc. and their various types' applications in Industries. Analyze the frequency response of these devices as different amplifier applications. To Understand how the gain of amplifier effected with frequency changes and their applications.
CO3	To develop and analyze the performance of small signal amplifiers and large signal amplifiers (Power amplifiers) . To understand and implement the various power amplifier in applications as transmitter and receiver in communication purpose.
CO4	Developing the concept of feedback amplifiers, their different topologies and Implement it for various applications. To analyze their stability and their responses for different applications.
CO5	To analyze the design considerations of the active and passive filters. How to develop the various

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	orders of filters and their industrial applications. To understand the constructional difference and working of various types of oscillators. How the oscillators can be developed and their use in industries.

No.	Content	Contact Hrs.	Mapped CO
1	**Diode and BJT** Special Diodes, LED, Zener, Varactor, Schotkey barrier, photo diode, and tunnel diode: their constructions and characteristics. Bipolar Junction Transistors, biasing of BJT, equivalent circuit, Transistor as a switch, cut off and saturation region, complete static characteristics of BJT, Darlington pair.	8	CO1
2	**FET and MOS:** Field Effect transistor: Structure and physical operation. Enhancement and depletion types MOSFET, Classification of MOS: NMOS, PMOS and CMOS I/V characteristics, Biasing of FET, Low and high frequency response of common source and common emitter configuration, Common base and Common gate cascade configurations, CC-CE cascade	8	CO2
3	**Amplifiers** Small signal amplifiers: BJT and MOSFET, Frequency response improvement, Classification of amplifiers: Class A, Class B, Class C amplifiers, Power amplifiers, push pull amplifiers, DC amplifier, coupling methods.	8	CO3
4	**Feedback amplifiers** Basic concept, General feedback structure, properties of negative feedback, four basic feedback topologies: series-series, series-shunt, shunt-series and shunt-shunt, determination of Loop gain, stability analysis, wave shaping circuits.	8	CO4
5	**Filters & Oscillators:** Active filters, Oscillators, condition for oscillation, Basic principles of sinusoidal oscillator, RC oscillators, Phase Shift oscillator, weinbridge oscillator, Hartley and Colpitt"s oscillator, Crystal Oscillator, Operational amplifier: Characteristics and application	8	CO5

Text books:

1. A.S. Sedra and K.C. Smith, "Microelectronic circuits", Oxford University Press (India). 2. B.P. Singh & R. Singh, Electronics Devices & Integrated Circuits, Pearson

2. Millman, J. and Grabel, A./"Microelectronics"/McGraw Hill

References Books:

1. Bell, David A,'Electronic Devices &Circuits',Prentice Hall (India) 4th Edition.

2. Nair, B. Somanathan, 'Electronics Devices &Applications',Prentice-Hall (India)

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3. Neamen, Donald A., 'Electronic Circuit Analysis &Design',Tata McGraw Hill.

4. Sedra, 'Micro Electronics Circuits', Oxford University Press.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	3	3	1	1	1		2	2	2	2	2	2
CO2	3	3	2	3	2	3	2						2	2	1	2
CO3	3	2	3	2	2	2	1	1			1	1	2	3	2	2
CO4	3	1	1	1	2	2	2						2	2	1	2
CO5	3	1	1	1	2	2	2						2	3	1	3

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ELECTRICAL ENGINEERING II Year/ III Semester

				Effective from Session		2022-23	
Course Code	EE 211	Title of The Course	Electro Mechanical Energy Conversion II	L	T	P	C
Pre-Requisite	NONE	Co-Requisite	NONE	3	1	0	4

Objective	Knowledge of principle of operation of three phase ac motors □ Identify different ac motors on the basis of characteristics □ Analyzedifferent ac machines □ To evaluate the performance of ac machines □ Knowledge of parallel operation of ac generators

	Course Outcomes
CO1	Knowledge of different types of three phase induction machines
CO2	Analyze the induction machines performance under loading condition
CO3	Evaluate the performance of single phase ac machines
CO4	Knowledge of three phase synchronous machines
CO5	Evaluate the performance of synchronous machines

No.	Content	Contact Hrs.	Mapped CO
1	**INDUCTION MACHINE I** Electro-mechanical energy conversion principles: Force and EMF production in a rotating machine Classification of rotating machine; 3-phase Induction Machines: Types, construction,Introduction to windings and winding factor	9	CO1
2	**INDUCTION MACHINE II** Production of revolving magnetic field, working principle on 3-phase induction machine, equivalent circuit, phasor diagram, Losses and power flow diagram, slip-torque curves, no load and blocked rotor tests, starting methods, speed control	7	CO2
3	**SELECTED TOPICS IN ELECTRICAL MACHINES** Space harmonics, effects of space harmonics; cogging, crawling, and noise.	8	CO3

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	Single-phase induction motors: Principle of operation; double revolving field and cross field theories; equivalent circuit and torque-speed characteristics; Starting methods of single-phase induction motors: split-phase and shaded pole motors. Induction generator and its applications		
4	**SYNCHRONOUS MACHINES- I** Construction, armature reaction and two reaction theory, synchronous reactance and phasor diagram, expression for power developed and power angle curve for salient and non-salient pole machines, maximum power. Open circuit, short circuit and zero power factor tests, Alternator load characteristics. Voltage regulation and its determination by synchronous impedance and Potier triangle method.	8	CO4
5	**SYNCHRONOUS MACHINES- II** Synchronization of three phase alternators, effect of governor characteristics on load sharing of alternators, operation on infinite bus bars, active and reactive power control. Synchronous motors: methods of starting, synchronizing power, hunting, V-curves, synchronous condenser	8	CO5

References Books:

1. D.P. Kothari & I.J. Nagrath ,'Electric Machines', Tata Mc Graw Hill,2004.
2. Ashfaq Hussain ,'Electric Machines',Dhanpat Rai & Company,2010.
3. Fitzerald ,A.E., Kingsley and S.D.Umans, 'Electric Machinery', MC Graw Hill,2014.
4. P.S.Bimbhra, 'Electrical Machinery', Khanna Publishers,2003
5. P.S. Bimbhra, 'Generalized Theory of Electrical Machines', Khanna Publishers ,1995
6. M.G.Say, 'Alternating Current Machines', Pitman & Sons,3rd Edition, 1995.

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO4
CO1	3	2		1									2		2	3
CO2	3	2		1									2	3	2	2
CO3	3	1										2	2	3	2	3
CO4	3	2										1	2	3	2	3
CO5	3	2					1						2	3	3	2

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ELECTRICAL ENGINEERING II Year/ IV Semester

				Effective from Session		2022-23	
Course Code	**EE 213**	Title of The Course	**Numerical Analysis and Applications**	L	T	P	C
Pre-Requisite	NONE	Co-Requisite	NONE	3	1	0	4

Objective	• To provide suitable and effective methods called Numerical Methods, for obtaining approximate representative numerical results of the problems. • To solve problems in the field of applied mathematics, theoretical physics and engineering which requires computing of numerical results using certain raw data. • To solve complex mathematical problems using only simple arithmetic operations. The approach involves formulation of mathematical models of physical situations that can be solved with arithmetic operations. • To deal with various topics like finding roots of equations, solving systems of linear algebraic equations, interpolation and regression analysis, numerical integration & differentiation, solution of differential equation, boundary value problems, and solution of matrix problems. • To facilitate numerical computing.

	Course Outcomes
CO1	Apply Numerical analysis which has enormous application in the field of Science and some fields of Engineering.
CO2	Describing and understanding of the several errors and approximation in numerical methods.
CO3	The explaining and understanding of the several available methods to solve the simultaneous equations by modern IT tools.
CO4	To solve problems in the field of applied mathematics, theoretical physics and engineering which requires computing of numerical results using certain raw data by using modern tools and follow the ethical rules.
CO5	To deal, communicate and environment sustainability with various topics like finding roots of equations, solving systems of linear algebraic equations, interpolation and regression analysis, numerical integration & differentiation, solution of differential equation, boundary value problems, and solution of matrix problems in the field of Engineering and modern life.

No.	Content	Contact Hrs.	Mapped CO
1	**Errors and approximations** Error definitions, accuracy and precision, round off and truncation errors **Roots of equations**- Solution of Algebraic and Transcendental equations, Newton- Raphson method, Secant method, Bisection method, Fixed Iteration method, Regula-Falsi method. **Finite differences**- Forward differences, Back ward differences, Central differences.	8	CO1
2	**Solutions of simultaneous linear algebraic equations** Gauss elimination method, Gauss-Jordan method, Matrix inversion method, LU decomposition methods, iterative method: Gauss-Seidel, Jacobi's method	8	CO2

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3	**Curve fitting** Introduction, method of least square, fitting of a straight line by method of least square, change of origin and scale, normal equations for different form of curve. Interpolation with equal and unequal intervals: Newton's Gregory forward interpolation, Newton's Gregory backward interpolation, Newton's divided difference interpolation, Lagrange's interpolation	8	CO3
4	Numerical differentiation: Newton's Gregory forward interpolation formula to get derivatives, Newton's Gregory backward interpolation formula to get derivatives, Newton's divided difference interpolation formula to get derivatives, Lagrange's interpolation formula to get derivatives Numerical integration: Newton-cotes quadrature formula, Trapezoidal rule, Simpson's rule, Boole's rule, Weddle's rule	8	CO4
5	**Numerical solutions for ordinary differential equations** Initial and Boundary value problems, Picard method of successes approximation, Taylor's series method, Euler's method, Modified Euler method, Runge-Kutta Method (First, second, third and fourth order)	8	CO5

References Books:

1. Josef Stoer and R. Bulirsch, "Introduction to Numerical Analysis" *Springer Science & Business Media*, ISBN 978-1-47575-592-3, Third Edition, 2013.
2. Lloyd N. Trefethen and David Bau III, "Numerical Linear Algebra", *Society of Industrial and Applied Mathematics*, ISBN: 978-0-898713-61-9, Illustrated edition, 1997.
3. C. T. Kelley, "Iterative Methods for Linear and Nonlinear Equations" , Frontiers in Applied Mathematics, Society for Industrial and Applied Mathematics, Philadelphia, ISBN:978-0-89871-352-7, 1995.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1									1		1	2
CO2	3	2					1							2		2
CO3	3	1										2		2		3
CO4	3	2										1	2		2	2
CO5	3	2					1							3		2

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ELECTRICAL ENGINEERING III Year/ V Semester

				Effective from Session		2022-23	
Course Code	**EE 301**	Title of The Course	CONTROL SYSTEMS	L	T	P	C
Pre-Requisite	NONE	Co-Requisite	NONE	3	1	0	4

Objective	• To learn the concept of transfer function and mathematical modeling of systems. • To get the knowledge of first order and second order system. • To gain information of the system. • To evaluate the stability of the system using Nyquist stability criterion • To design the compensator and also study of state space analysis

	Course Outcomes
CO1	To learn the concept of transfer function and mathematical modeling of systems.
CO2	To get the knowledge of first order and second order system.
CO3	To gain information of the system.
CO4	To evaluate the stability of the system using Nyquist stability criterion
CO5	To design the compensator and also study of state space analysis.

No.	Content	Contact Hrs.	Mapped CO
1	**Input/ Output Relationship** Introduction to control system, Open and closed loop control system, Mathematical modeling of physical systems, Transfer function of electrical and mechanical system, Analogous systems, Block Diagram Reduction Algebra and signal flow graph, Mason's gain formula.	8	CO1
2	**Time Domain Analysis** Time domain criteria; Test Signals; Transient and steady state response of first and second order feedback systems; Performance indices; Error analysis and error constants; Relative stability, Controllers, Response analysis with proportional, Proportional- Derivative (PD) controller, Proportional-Integral (PI) controller and Proportional- Integral Derivative (PID) controller.	8	CO2
3	**Stability, Algebraic Criteria and Frequency response Analysis** Asymptotic and conditional stability, Routh Hurwitz criterion, Frequency response analysis, Correlation between time and frequency domain specifications, Resonant peak, Resonant frequency, Bandwidth, Cutoff frequency, Polar plots, Bode plots, Gain margin, Phase margin.	8	CO3
4	**Root Locus Technique and Stability in Frequency Domain** The root locus concepts, Construction of root loci, Nyquist stability criterion, Constant M and N circles	8	CO4
	Introduction to Design and State variable technique	8	CO5

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5	Design through compensation Techniques; Realization of Lag, Lead, And Lag-Lead compensation; Design of closed loop control system using root locus and bode plot compensation. Introduction to State variable analysis, State space representation, State equations, State transfer matrices, Controllability and observability.		

References Books:

1. B. C. Kuo, Automatic Control System, Wiley, 9th Edition, 2014.
2. I. J. Nagrath & M. Gopal, Control System Engineering, New Age International, 4th Edition, 2015.
3. K. Ogata, Modern Control Engineering, PHI, 4th Edition, 2002.
4. S. K. Bhattacharya, Control System Engineering, Pearson Education, 2nd Edition, 2008.
5. S. Hasan Saeed, Automatic Control System, Kataria and sons, New Delhi, 8th Edition, 2016
6. Nise, Norman S., Control systems engineering, John Wiley & Sons, 2020.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1									2	1	2	3
CO2	3	2		1									3	2	3	3
CO3	3	2										1	3	1	2	3
CO4	1	3		2								1		2		3
CO5	2	2	3									1	1		2	3

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ELECTRICAL ENGINEERING III Year/ V Semester

				Effective from Session		2022-23	
Course Code	**EE305**	Title of The Course	**COURSE: DIGITAL CIRCUITS AND SYSTEMS**	L	T	P	C
Pre-Requisite	NONE	Co-Requisite	NONE	3	1	0	4

Objective	□ To understand number representation and conversion between different representation in digital electronic circuits. □ Became familiar with the digital signal, positive and negative logic, Boolean algebra, logic gates, logical variables, the truth table, number systems, codes, and their conversion from one to others. □ To analyze logic processes and implement logical operations using combinational logic circuits. □ To understand competence in Combinational Logic Problem formulation. □ To understand concepts of sequential circuits and to analyze sequential systems in terms of state machines. □ To understand competence in analysis of synchronous and asynchronous sequential circuits. □ To understand characteristics of memory and their classification. □ To understand concept of Programmable Devices, PLA, PAL, PLD and FPGA and implement digital system. □ To impart how to design Digital Circuits.

	Course Outcomes
CO1	Convert different type of codes and number systems which are used in digital communication and computer systems. Develop a digital logic and apply it to solve real life problems.
CO2	Employ the codes and number systems converting circuits and Compare different types of logic families which are the basic unit of different types of logic gates in the domain of economy, performance and efficiency.
CO3	Analyze, design and implement combinational and sequential logic circuits.
CO4	Analyze different types of digital electronic circuit using various mapping and logical tools and know the techniques to prepare the most simplified circuit using various mapping and mathematical methods.

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CO5	Design different types of with and without memory element digital electronic circuits for particular operation, within the realm of economic, performance, efficiency, user friendly and environmental constraints. Classify different semiconductor memories. Assess the nomenclature and technology in the area of memory devices and apply the memory devices in different types of digital circuits for real world application.

No.	Content	Contact Hrs.	Mapped CO
1	**Number system, codes and Minimization Techniques:** Decimal, Binary, Hexadecimal, Octal Number systems and their Conversions, Arithmetic operations, subtraction using 1's and 2's compliment, Binary coded decimal, Excess-3 Codes, Gray Codes. Different types of Logic Gates and their implementation, Standard representation of logic functions- SOP and POS forms, simplification of switching functions- K Map..	8	CO1, CO2
2	**Logic Families** Introduction to different logic families. RTL, DTL,TTL, MOS. TTL inverter – circuit description and operation, CMOS inverter – circuit description and operation, design of gates using TTL and CMOS circuits, Electrical characteristics of logic gates	8	CO1, CO2
3	**Combinational logic systems, Modules and their applications** Basic logic operation and logic gates, Decoder, Encoder, Multiplexer, De-multiplexer, Parity circuits and comparators, Arithmetic modules- Half Adder, Full Adder, Half Subtractor, Full Subtractor, Carry Look Ahead Adder, Serial Adder, BCD adder	8	CO3, CO4
4	**Sequential logic systems, Modules and their applications** Sequential Circuits- Latches and Flip-flops, Transition, Excitation table, Excitation maps and equations, Counters, Shift registers, 555 timers, Multivibrator.	8	CO3, CO4
5	**Memory and Programmable logic devices** Read only memory, read/write memory- SRAM and DRAM. PLAs, PALs and their application, Sequential PLDs and their application, Introduction to Field Programming Gate Array.	8	CO5

References Books:

1. R.P. Jain, "Modern Digital Electronics", TMH, 4th Edition, 2010.
2. Morris Mano, "Digital Design", PHI, 3rd Edition, 2014.
3. R. J. Tocci, "Digital Systems", PHI, 4th Edition, 2016.
4. Malvino and Leach, "Digital principles and applications", TMH, 8th Edition, 2014.
5. J. M. Yarbrough, "Digital Logic-Application and Design", PWS Publishing, 5th Edition, 2006
6. B. S. Nai, " Digital Electronics and Logic Design", PHI, 7th Edition, 2012

Name &Sign of Program Coordinator	Sign & Seal of HoD

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2		1	2	1		1		1	2	2		2
CO2	2	3		2	2	1	3			1	1	1	2	3	2	2
CO3	3	3	3	2	2						1	1	3	3	3	3
CO4	2	3	3	2		2	2			2	3		2	2	3	3
CO5	1	2	2	2	2	2		3			1		2	2	2	3

3: Strong contribution, 2: average contribution, 1: Low contribution

Name &Sign of Program Coordinator	Sign & Seal of HoD

Integral University, Lucknow

ELECTRICAL ENGINEERING III Yeer/VI Semester

				Effective from Session		2022-23	
Course Code	**EE-313**	Title of The Course	**Microprocessor and Peripheral Devices**	L	T	P	C
Pre-Requisite	NONE	Co-Requisite	NONE	3	1	0	4

Objectives	• Knowledge of I/O devices and memories • To get knowledge of architecture of 8085 and 8086 • To attain knowledge of different instruction set of 8085 and 8086 • To study about different types of Programmable Peripheral Interface • To have the knowledge of analog to digital and digital to analog converter chips

	Course Outcomes
CO1	Understand the basics of microprocessor
CO2	Understand the architecture of 8085 and 8086
CO3	Knowledge of instruction set of 8085 and 8086
CO4	Knowledge of programmable peripheral interface
CO5	Knowledge of analog to digital and digital to analog converter

No.	**Content**	**Contact Hrs.**	**Mapped CO**
1	**Introduction of Microcomputer System:**General definition of minicomputer, microprocessors,CPU, I/O devices, clock, memory, bus architecture, tri-state logic, address bus, data bus and control bus. **Semiconductor Memories:** Development of semiconductor memory, internal structure and decoding,memory read and writes timing diagrams, ROM, RAM.	8	CO1
2	**Architecture of Microprocessors:** Introduction of Intel 8085 and 8086 microprocessor, Pindescription and their internal architecture. Introduction of Intel 80386. **Operation and Control of Microprocessor:** Timing and control unit, memory read/write machinecycles, I/O read/write machine cycles, interrupt acknowledge machine cycle.	8	CO2
3	**Instruction Set**: Addressing modes- Data transfer, arithmetic, logical, branch, stack andmachine control groups of instruction set, unspecified flags and instructions. Assembly Language Programming, Assembler directives, Subroutines..	8	CO3
4	**Interfacing:** Interfacing of memory chips, Interfacing of I/O devices, I/O addressing-I/Omapped and memory mapped I/O schemes, 8257(DMA Controller), 8259(Interrupt priority Control), 8253/8254 Programmable timer/counter with modes of operation. **Interrupts:** Interrupt structure of 8085 microprocessor.	8	CO4
5	**Programmable Peripheral Interface**: Intel 8255, pin configuration, internal structure of a	8	CO5

Name &Sign of Program Coordinator	Sign & Seal of HoD

	portbit, modes of operation, bit SET/RESET feature, ADC and DAC chips and their interfacing. **Programmable Interval Timer:** Intel 8253, pin configuration, internal block diagram of counter andmodes of operation, counter read methods.		

References Books:

1.B.Ram, "Fundamentals of Microprocessor and Microcomputer", Dhanpat Rai Publication, 4th Edition.2008

2. M.Rafiquzzaman, "Microprocessors and Applications", John Wiley & Sons ,2008

3. Hall D.V.,"Microprocessor and Interfacing-Programming and Hardware", 2nd Ed., Tata McGraw-Hill Publishing Company Limited, reprinted 2008

4. GaonkarR.S.,"MicroprocessorArchitecture,Programming and Applications", 6th Ed., Penram International, 2013.

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3			1	1	1	1					3	3	3	2	3
CO2	3	2	2	2	2	1						3	3	3	2	3
CO3	3	2	2	2	2	1						3	3	2	2	2
CO4	3	2	2	2	2	1	1					3	2	2	2	2
CO5	3	1	1	1	1	1	1					3	3	2	2	3

3: Strong contribution, 2: average contribution, 1: Low contribution

Name &Sign of Program Coordinator	Sign & Seal of HoD

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