XXXXX (Sub Code)	ANALOG ELECTRONICS AND LINEAR INTEGRATED CIRCUITS	L T P C 3 0 0 3

COURSE OBJECTIVES:

✓	To understand the operation of small and large signal amplifiers using BJT and FET.
✓	To gain knowledge in designing and analyzing circuits for various industrial and research applications.
✓	To learn the fundamentals of IC fabrication and different technologies used in the process.
✓	To study the linear and non-linear circuits using operational amplifiers.
✓	To understand the working principles, functions, and applications of special integrated circuits (ICs).
✓	To integrate business statistics in electronics engineering for data-driven design optimization and reliability assessment.

UNIT - 1	SMALL AND LARGE SIGNAL AMPLIFIERS USING BJT AND FET	8

Applications: *Audio Processing, Measurement & Instrumentation, Audio Power Amplification, Wireless & RF Transmission, Medical & Scientific Equipment.*

Overview of Semiconductor devices - Need for Biasing - Biasing Circuits - Classification of bias - CC - CE - CB Amplifiers - FET amplifier - Differential Amplifier using BJT - Power Amplifiers - Class A - Class B - Class C - Class D - Push pull Amplifier.

UNIT - 2	FEEDBACK AMPLIFIERS AND OSCILLATORS	8

Applications: *Audio amplifiers, operational amplifiers (Op-Amps), RF amplifiers, instrumentation amplifiers, Clock Generators, Signal Generators, Radio Transmitters, Tone Generators.*

Advantages of negative feedback – Feedback Amplifiers - Classifications - Voltage/Current - Series - Shunt - Positive feedback - Condition for oscillations - Phase shift - Wien bridge - Hartley - Colpitts - Crystal oscillators.

UNIT - 3	IC FABRICATION	7

Applications: *Automotive Electronics, Communication Systems, Smart Home Devices, Consumer Electronics.*

IC Classification - Monolithic IC technology - Basic planar processes - Fabrication of Monolithic transistors - FET - Monolithic diodes - Integrated resistors - Integrated capacitors - and PV cell.

UNIT - 4	**OPERATIONAL AMPLIFIER AND ITS APPLICATIONS**	8

Applications: *Industrial & Automation, Wireless Communication, ADAS & LiDAR Systems - Pedestrian Detection*

Basic operations of Op-Amp-AC and DC Characteristics – Inverting - Non-inverting Amplifiers - Summer - Differentiator - Integrator – Instrumentation Amplifiers – Log and Antilog Amplifiers - Schmitt trigger – A/D Converter using Op-Amps.

UNIT - 5	**SPECIAL ICs AND SIGNAL CONVERSION CIRCUITS**	8

Applications: *FPGA, MEMS (Micro-Electro-Mechanical Systems), Analog & Mixed-Signal ICs*

V/I and I/V conversion - V/F and F/V conversion - IC 555 Timer - IC566 Voltage controlled oscillator - IC565 Phase Locked Loop - LM317 - IC723 voltage regulators- Astable and monostable operation - AD 633 Analog multiplier ICs - SMPS - ICL 8038 Function generator ICs.

UNIT - 6	**CURRENT TRENDS IN LINEAR INTEGRATED CIRCUITS**	6

Industry Demand - Important aspects of ICs policies - Design and Performance standards - Safety Considerations – EMI/EMC compliance - Industry-based IC circuit design - System-on-Chip (SoC) and System-in-Package (SiP) integration - MEMS-based analog sensors - Shaping the IC Market using AI and ML technologies Integration.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students will be able to

1.	Describe the principles, characteristics, and frequency response of small and large signal amplifiers using BJT and FET.
2.	Design the feedback amplifiers and oscillators through a comprehensive understanding of their operational behaviors.

3.	Explain the fundamental concepts, materials, and processes involved in Integrated Circuit (IC) fabrication.
4.	Design op-amp-based simple circuits by understanding the operational characteristics of both linear and non-linear circuits.
5.	Demonstrate the working of special ICs for timing and pulse generation applications.
6.	Understand key IC policies, regulations, standards, and technology integrations to meet industry requirements.
TEXTBOOKS:	
1.	S. Salivahanan, N. Suresh Kumar, "Electronic Devices and Circuits", 4th edition, McGraw-Hill Education, 2016.
2.	Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits" 4th Edition, Pearson Publisher, 2020.
3.	B. P. Singh, Rekha Singh, "Electronic Devices and Circuits", 2nd Edition, Pearson Education, 2013.
REFERENCES:	
1.	Jacob Millman, Christos C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits", Tata McGraw Hill Publishing Limited, New Delhi, 2015.
2.	Albert Malvino & David J. Bates, "Electronic Principles" McGraw-Hill Education, 2015 (8th Edition)
3.	Haocheng Jin, "The History, Current Applications and Future of Integrated Circuit" USA, 2023.
4.	D. Roy Choudhary, Sheil B. Jani, "Linear Integrated Circuits", 4th Edition, New Age International, New Delhi, 2010.
5.	"Analog Design Journal" by Texas Instruments.

CO – PO MAPPING

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	2	1	1	-	-	-	-	-	-	-	1	1	-	1
2	3	3	2	-	-	-	-	-	-	-	1	1	2	1
3	2	1	1	-	-	-	-	-	-	-	1	1	-	1
4	3	3	2	-	-	-	-	-	-	-	1	1	2	1
5	2	1	1	-	-	-	-	-	-	-	1	1	-	1
6	2	2	2	-	-	-	-	-	-	-	1	1	-	1
AVG	2.33	1.83	1.5	-	-	-	-	-	-	-	1	1	0.67	1
LOW (1); MEDIUM(2) ; HIGH(3)														

	CONTROL SYSTEMS	L T P C 3 0 0 3

COURSE OBJECTIVES:

✓	To introduce the fundamental concepts of control systems and their practical applications.
✓	To analyze the time - domain and frequency - domain behavior of control systems.
✓	To understand stability analysis methods and design compensators/controllers for system improvement.
✓	To explore modern control techniques using state - space analysis.
✓	To introduce real - world applications in control systems.

UNIT - 1	SYSTEMS AND THEIR REPRESENTATIONS	7

Applications of control systems in robotics and industrial automation.

Introduction to Control System, Open - loop & closed - loop systems, transfer functions of mechanical & electrical systems, block diagram reduction, signal flow graphs and servo motor applications.

UNIT - 2	TIME DOMAIN ANALYSIS	8

Applications of cruise control and automobile suspension systems.

Time Response & Stability Analysis: Standard test signals, first & second - order system response, stability concepts, pole - zero analysis, Routh - Hurwitz criterion and root locus techniques.

UNIT - 3	FREQUENCY RESPONSE ANALYSIS	8

Applications of design of power system stabilizers (PSS) in electrical power networks.

Frequency Response & Stability Analysis: Bode plot, Polar plot, time - frequency domain correlation, Nyquist stability criterion.

UNIT - 4	COMPENSATOR AND CONTROLLER	8

Applications of temperature control in industrial processes.

Compensator Design & PID Control: Realization of basic compensators - lag, lead and lag - lead compensators using Bode plot. PID controller design using reaction curve and Ziegler - Nichols technique.

UNIT - 5	STATE SPACE ANALYSIS	7

Applications of flight control systems in aerospace engineering.

State - Space Analysis: State variable formulation, state transition matrix, eigen values, eigenvectors, controllability and observability.

UNIT - 6	CURRENT TRENDS	7

Control Systems Applications & Trends: Used in smart grids, autonomous vehicles and IoT automation. Transfer function to controllable, observable and Jordon canonical forms using scilab coding.	
TOTAL: 45 PERIODS	
OUTCOMES:	
At the end of the course the students will be able to	
1.	Utilize the concepts of control systems to model and derive transfer functions for electrical and mechanical systems.
2.	Implement the system response and stability using time-domain methods, Routh-Hurwitz and Root Locus.
3.	Apply frequency response techniques like Bode plots and Nyquist criterion to assess system stability.
4.	Implement compensation methods and PID controllers for enhancing system performance.
5.	Formulate state-space models, compute state transition matrices and analyze controllability and observability.
6.	Apply control systems in smart technologies and perform canonical forms using Scilab.
TEXT BOOKS:	
1.	"Data-Driven Science and Engineering: Machine Learning, Dynamical Systems and Control" by Steven L. Brunton and J. Nathan Kutz, published in 2022.
2.	"Control Systems: An Introduction" by Hassan Khalil, published in 2022.
3.	Norman S. Nise, “Control System Engineering”, John Wiley & Sons, 6th Edition, 2011.
REFERENCES:	
1.	"Modern Control Systems" by Richard C. Dorf and Robert H. Bishop, 14th Edition, 2020.
2.	"Automatic Control Systems" by Farid Golnaraghi and Benjamin C. Kuo, 10th Edition, 2017
3.	"Control Systems Engineering" by Norman S. Nise, 8th Edition, 2019.
4.	"Adaptive Control: Algorithms, Analysis and Applications" by Ioan Doré Landau, Rogelio Lozano, Mohammed M. Saad and Alireza Karimi, 2024
5.	C. Dorf & R.H. Bishop, “Modern Control Systems”, Pearson Education, 11th Edition, 2008.

CO – PO MAPPING

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	3	1	-	-	-	-	-	-	-	1	3	3	1
2	3	3	2	-	-	-	-	-	-	-	1	3	3	1
3	3	3	2	-	-	-	-	-	-	-	1	3	3	1
4	3	3	2	-	-	-	-	-	-	-	1	3	3	1
5	3	3	2	-	-	-	-	-	-	-	1	3	3	1
6	2	1	1	-	-	-	-	-	-	-	1	1	1	1
LOW (1) ; MEDIUM (2) ; HIGH (3)														

	ELECTRICAL MACHINES II	L T P C 3 0 0 3

COURSE OBJECTIVES:

✓	To understand the construction and performance of salient and non – salient type synchronous generators.
✓	To develop an concept of understanding theprinciple of operation and performance of synchronous motor.
✓	To comprehend the behavior ofpoly phase induction machinesunder the aspect of construction, principle of operation, and performance.
✓	To understand the starting and speed control of three-phase induction motors.
✓	To gain knowledge in the construction and working principles ofsingle phase induction motor and special electrical machines.
✓	To explore the recent trends in electrical machines, focusing on modern applications.

UNIT - 1	**SYNCHRONOUS GENERATOR**	8

Applications*:* *Industrial Applications - Transportation - Power Generation - Automotive and Marine*

Construction & types - Operating principle of synchronous generator - EMF equation - Equivalent circuit - Phasor diagrams - Synchronization&Parallel Operation - Voltage regulation - EMF, MMF, ZPF and A.S.A method - Two reaction theory - Slip test .

UNIT - 2	**SYNCHRONOUS MOTOR**	8

Applications:*Commercial and Infrastructure-Ship Propulsion Systems-Rolling Mills and Metal Processing-Elevators and Escalators*

Principle of operation - Torque equation - Operation on infinite bus bars - V and Inverted V curves - Power input and power developed equations - Starting methods - Current loci for constant power input, constant excitation and constant power Developed-Hunting - Natural frequency of oscillations - Damper windings

UNIT - 3	**THREE PHASE INDUCTION MOTOR**	8

Applications: *Conveyors and Material Handling-Office Equipment-Electric Vehicles - Hybrid Vehicles-Trains and Metro Systems*

Constructional details - Types of rotors - Principle of operation - Slip - Equivalent circuit - Torque-Slip characteristics - Condition for maximum torque - Losses and efficiency - Load test - No load and blocked rotor tests - Circle diagram - Separation of losses - Double cage induction motors - Induction generators .

UNIT - 4	**STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR**	8

Applications:*Pumps and Compressors-Water Treatment Plants -Large Air Compressors- Cranes and Lifts*

Need for starting - Types of starters - DOL, Rotor resistance, Autotransformer and Star delta starters - Speed control - Voltage control, Frequency control and pole changing - Cascaded Connection-V/f control - Braking of three phase induction motor - Plugging, dynamic braking and regenerative braking

UNIT - 5	**SINGLE PHASE INDUCTION MOTOR AND SPECIAL MACHINES**	8

Applications*-Aerospace and Aviation-CNC Machines-Camera Auto-Focus Mechanisms*

Constructional details - Double field revolving theory - Equivalent circuit - No load and blocked rotor test - Starting methods of single-phase induction motors - Linear induction motor - Repulsion motor - Hysteresis motor - AC series motor- Servo motors - Stepper motors.

UNIT - 6	**CURRENT TRENDS IN ELECTRICAL MACHINES**	5

Market Demand and Consumer Preferences - Factors affecting CAGR - Best firms– Recent Products - Upcoming Trends in Electrical machines - Smart Grid Integration -Automation and Control-IoT based solutions- Current Industry oriented applications - Simulation design of electrical machines using tools.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students would be able to

1.	Analyze the operation and characteristics of synchronous generators under different operating conditions..
2.	Compute the efficiency and performance of a synchronous motor using equivalent circuit parameters.
3.	Interpret the equivalent circuit of three phase induction motor, by identifying key components and their effects on performance.
4.	Analyzethe speed control and starting methodsof three phase induction motor.
5.	Illustrate the characteristics, advantages, and limitations ofsingle phase induction motor, stepper motors, universal motors, and other special machines.
6.	Examine the market trends, industry-oriented applications, and technological advancements in electrical machines.

TEXT BOOKS:

1.	A.E.Fitzgerald, Charles Kingsley,Stephen.D.Umans,‘ElectricMachinery’,McGrawHillpublishing Company Ltd, 6th Education 2017.
2.	Stephen J. Chapman, ‘Electric Machinery Fundamentals’4th edition, McGraw Hill Education Pvt. Ltd, 4th Edition 2017.
3.	D.P.KothariandI.J.Nagrath,‘ElectricMachines’,McGrawHillPublishingCompanyLtd,5th Edition 2017.

REFERENCES:

1.	Vincent Del Toro, ‘Basic Electric Machines’PearsonIndia Education,2016.
2.	B.R.Gupta,’FundamentalofElectricMachines’NewageInternationalPublishers,3rdEdition, Reprint 2015.

3.	Murugesh Kumar, 'Electric Machines',Vikas PublishingHousePvt.Ltd,Firstedition2010.
4.	IEEE Energy Conversion Congress and Exposition, ECCE
5.	P.S.Bhimbhra,'Electrical Machinery',Khanna Publishers, second edition,2021.

CO – PO MAPPING

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	1	-	-	-	-	-	-	-	-	2	3	-
2	3	2	1	-	-	-	-	-	-	-	-	2	3	-
3	3	2	1	-	-	-	-	-	-	-	-	2	3	-
4	3	2	1	-	-	-	-	-	-	-	-	2	3	-
5	3	2	1	-	-	-	-	-	-	-	-	2	3	-
6	2	2	1	-	-	-	-	-	-	-	-	2	3	-
LOW (1) ; MEDIUM (2) ; HIGH (3)														

(XXXXX) Subject Code	LIFE SKILL IV – PUBLIC SPEAKING PRACTICES	L T P C 2 0 0 1

COURSE OBJECTIVES:

- ✓ To develop proficiency in public speaking, including its history, significance, and benefits. **(C 18)**
- ✓ To explore the history and evolution of public speaking. **(C 19)**
- ✓ To engage with the audience, especially in high-pressure situations like press meets.
- ✓ To apply structured debate formats to evaluate arguments critically and develop reasoning skills.
- ✓ To synthesize and articulate ideas effectively by engaging in complex and abstract discussions
- ✓ To demonstrate public speaking skills in real-world contexts by presenting on topics related to education, history, entertainment, and current affairs.

UNIT - I BASICS OF PUBLIC SPEAKING 2

History of public speaking – benefits

Practice :Effective practices for public speaking- Public speaking topics

UNIT - II LISTENING TO FAMOUS SPEECHES 2

TED talks – presentations, Josh talks **(C 20)**

Practice: Key elements of TED talk presentations - prioritize simplicity in visuals and strong stage presence

UNIT - III RESPONDING AND TACKLING THE QUESTIONS 2

Facing the audience (Press meet)

Practice: Engaging with the audience in a press meet – Handling Challenging questions **(C21)**

UNIT - IV GROUP DEBATE 2

Dos and Don’ts of group debate – Practicing various types of debate format **(C 22)**

Practice : Structuring a debate session - Focusing on moral reasoning **(C 23)**

UNIT - V GROUP DISCUSSION LEVEL 2 2

Engaging in discussions on complex and contemporary topics **(C 24)**

Practice: Argument structure & logical flow

UNIT - VI PUBLIC SPEAKING PRACTICES 2

Topics in Education, History, Entertainment, Current affairs

Practice: Content, delivery, engagement, and overall effectiveness

TOTAL: 12 PERIODS

OUTCOMES:

At the end of the course the students would be able to

1. Initiate and manage professional conversations with correct greetings and courtesies.
2. Demonstrate proficiency in asking clear and appropriate questions in professional and technical conversations.
3. Adjust their tone and intonation based on the context of the conversation.
4. Demonstrate confidence in handling one-on-one interviews and personal conversations through effective communication strategies.
5. Students will be able to formulate and ask open-ended brainstorming questions.
6. Understand the importance and purpose of group discussions in professional and academic settings.

REFERENCES:

1. "Advanced Communication Skills" by Mathew Richardson, Charlie Creative Lab, 2020
2. Andy Gillett, Using English for Academic purposes for students in higher Education. https://www.uefap.org/reading/
3. Meenakshi Raman & Sangeeta Sharma (2017). Technical Communication: Principles and Practice (3rd Edition). Oxford University Press, India.
4. Rajendra Pal & J.S. Korlahalli (2011). Essentials of Business Communication. Sultan Chand & Sons, New Delhi.

CO – PO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
2	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
3	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
4	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
5	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
LOW (1) ; MEDIUM (2) ; HIGH (3)															

(XXXXX) Subject Code	INVENTIVE PRINCIPLES	L T P C 2 0 0 1

COURSE OBJECTIVES:

- ✓ Understand the fundamental concepts of invention, innovation, and creativity through historical case studies of engineering breakthroughs.
- ✓ Learn the 40 Inventive Principles of TRIZ and their application in systematic engineering problem-solving.
- ✓ Gain knowledge about patents, copyrights, trademarks, and the legal framework for protecting innovations
- ✓ Study various knowledge-sharing methods, reverse engineering, and product analysis techniques for innovation development
- ✓ Implement structured methodologies to approach problem-solving in engineering applications
- ✓ Foster creativity and critical thinking skills to develop innovative solutions for complex engineering challenges

UNIT – I INTRODUCTION TO INVENTIVE PRINCIPLES 2

Definition of invention and innovation - creativity – History - Case studies of successful engineering innovations

UNIT – II TRIZ AND SYSTEMATIC PROBLEM SOLVING 2

Inventive Principles of TRIZ - Engineering applications of TRIZ principles - Practical exercises and brainstorming

UNIT – III INTELLECTUAL PROPERTY AND PATENT LAWS 2

Introduction to patents – Types of patents (Utility Patents, Design Patents , Plant Patents , Provisional Patents , Non-Provisional Patents , Software Patents , Business Method Patents) – comparison - copyrights and trademarks - Patent filing process and IP rights

UNIT – IV OPEN-SOURCE INNOVATION AND KNOWLEDGE SHARING 2

Methods of problem identification, Reverse engineering and product analysis- Future Trends and Innovations

UNIT – V ETHICS IN ENGINEERING AND INNOVATION 2

Importance of ethics in engineering - Professional codes of ethics (IEEE, ASME, ASCE, etc.)

Case studies of ethical dilemmas in engineering.

UNIT – VI PRACTICAL IMPLEMENTATION & CASE STUDIES 2

Case studies of famous Patent and their impact analysis on industry, economy, and society

TOTAL: 12 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

1. Demonstrate an understanding of how engineering innovations emerge and their impact on society
2. Utilize systematic TRIZ-based approaches to address engineering challenges effectively
3. Understand the importance of intellectual property protection and the procedures involved in securing patents.
4. Apply open-source methodologies, reverse engineering, and product analysis for innovative problem-solving
5. Evaluate past engineering innovations to extract key lessons and best practices
6. Create and refine innovative ideas using structured methodologies like TRIZ and other inventive principles

TEXT BOOKS:

1. "And Suddenly the Inventor Appeared: TRIZ, the Theory of Inventive Problem" Solving, Genrich Altshuller, Technical Innovation Center, Inc., 2nd Edition, 1996.
2. "Engineering Design: A Project-Based Introduction", Clive L. Dym, Patrick Little Wiley Publisher, 4th Edition, 2013.
3. "Intellectual Property: Patents, Trademarks, and Copyright, Richard Stim Cengage Learning Publisher, 14th Edition, 2020.
4. "Open Innovation: The New Imperative for Creating and Profiting from Technology", Henry Chesbrough, Harvard Business Review Press, 1st Edition, 2003.

REFERENCE BOOKS:

1. "TRIZ for Engineers: Enabling Inventive Problem Solving", Karen Gadd, Wiley Publisher, 1st Edition, 2011.
2. "The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail", Clayton M. Christensen,Harvard Business Review Press, 1st Edition, 1997.
3. "Engineering Ethics: Concepts and Cases", Charles E. Harris Jr., Michael S. Pritchard, Michael J. Rabins, Cengage Learning Publisher, 6th Edition, 2018.
4. "Reverse Engineering: Mechanisms, Structures, Systems & Materials", Wego Wang CRC Press, 1st Edition, 2010.

XXXXX (Sub Code)	ELECTRONICS AND LINEAR INTEGRATED CIRCUITS LAB	L T P C 0 0 3 2

COURSE OBJECTIVES:

✓	To gain knowledge about rectifiers with a filter and design the linear circuit applications using an Op-amp.
✓	To analyze small and large signal amplifiers and oscillator circuits.
✓	To design analog circuits for various applications using simulation software tools and hardware by applying the knowledge of semiconductor devices.

LIST OF EXPERIMENTS:

1.	Characteristics of BJT-CE configurations.
2.	Characteristics of JFET.
3.	Voltage regulator using Zener diode.
4.	Design and Frequency Response Characteristics of a Common-Emitter Amplifier.
5.	Characteristics of Half-wave and Full-wave rectifiers with filter.
6.	Inverting & non-inverting amplifiers using op-amp.
7.	Integrator and differentiator circuits using op-amp.
8.	Wien bridge oscillator using op-amp.
9.	Astable operation using IC 555.
10.	Simulation of op-amp circuits using simulation software tools.

TOTAL: 30 PERIODS

OUTCOMES:

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

1.	Analyze the rectifier circuits with different filter configurations.

2.	Analyze the behavior of small-signal and large-signal amplifiers.
3.	Design and simulate analog circuits using industry-standard simulation software and hardware tools for real-world applications.

CO – PO MAPPING

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	3	2	1	-	-	-	-	-	-	-	-	1	1
2	3	3	2	2	-	-	-	-	-	-	-	-	1	1
3	3	3	2	2	-	-	-		-	-	-	-	1	1
LOW (1) ; MEDIUM (2) ; HIGH (3)														

EEXXX	ELECTRICAL MACHINES -II LABORATORY	L T P C 0 0 3 1.5
COURSE OBJECTIVES:		
✓	To Provide hands-on experience in understanding the construction, operation, and characteristics of various AC machines (generators and motors) .	
✓	To conduct various tests (no-load, blocked rotor, open circuit, short circuit, V and Inverted V) on AC machines to determine their performance parameters, efficiency, and regulation.	
✓	To Familiarize students with characteristics of single phase induction motor.	
LIST OF EXPERIMENTS:		
1.	Regulation of three phase alternator by EMF and MMF methods.	
2.	Regulation of three phase alternator by ZPF and ASA methods	
3.	Regulation of three phase salient pole alternator by slip test.	
4.	V and Inverted V curves of Three Phase Synchronous Motor	
5.	Load test on three-phase induction motor.	
6.	No load and blocked rotor tests on three-phase induction motor.	
7.	Load test on single-phase induction motor.	
8.	No load and blocked rotor test on single-phase induction motor	
	TOTAL: 45 PERIODS	
OUTCOMES:		
At the end of the course the students is expected to be able to		

CO1	Analyze the operation and characteristics of synchronous generators by conducting open circuit and short circuit test.
CO2	Compute the efficiency and performance of a synchronous motor using V and Inverted V method
CO3	Interpret the equivalent circuit of three phase induction motor, by identifying key components and their effects on performance.
CO4	Obtain the equivalent circuit of single phase induction motor, by conducting no load and blocked rotor test.
CO5	Examine the characteristics of single phase induction motor by conducting load test.

CO – PO MAPPING

CO	**PO**											**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	**3**	**3**	**1**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**1**	**-**
2	**3**	**3**	**1**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**1**	**-**
3	**3**	**3**	**1**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**1**	**-**
4	**2**	**2**	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**1**	**-**
5	**2**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**1**	**-**
LOW (1) ; MEDIUM (2) ; HIGH (3)														

CONTROL AND INSTRUMENTATION LABORATORY **L T P C**
0 0 3 1.5

COURSE OBJECTIVES:

- To explore simulation techniques for analyzing linear and nonlinear differential equations in control systems. make the students familiarize with various representations of systems.
- To understand system modeling, identification methods and stability analysis for various physical systems.
- To design and evaluate compensators, controllers and discrete-time models for improving system performance.

LIST OF EXPERIMENTS:

1. Analog (op amp based) simulation of linear differential equations.
2. Numerical Simulation of given nonlinear differential equations.
3. Real time simulation of differential equations.
4. Mathematical modeling and simulation of physical systems in at least two fields.
   - Mechanical
   - Electrical
   - Chemical process
5. Stability analysis using Pole zero maps and Routh Hurwitz Criterion in simulation platform.
6. Root Locus based analysis in simulation platform.
7. Determination of transfer function of a physical system using frequency response and Bode's asymptotes.
8. Design of Lag, lead compensators and evaluation of closed loop performance.
9. Design of PID controllers and evaluation of closed loop performance.
10. Discretization of continuous system and effect of sampling.
11. Test of controllability and observability in continuous and discrete domain in simulation platform.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1: Implement analog and numerical simulations for solving linear and nonlinear differential equations in control systems.

CO2: Utilize system modeling, identification techniques and stability analysis to evaluate physical system dynamics.

CO3: Utilize system modeling, identification techniques and stability analysis to evaluate physical system dynamics.