College code: 6F

PALLAVI ENGINEERING COLLEGE

(UGC AUTONOMOUS)

Accredited by NBA and NAAC with 'A' grade. Approved by AICTE, New Delhi & Affiliated to JNTUH-Hyderabad
Certified by ISO 9001 : 2015 | ISO 14001 : 2015 | ISO 50001 : 2018
Kuntloor(V), Adibullapurmet(M), Near Hayathnagar, R.R. Dist. Hyd - 501505, (T.S.) India

B.Tech. in ELECTRICAL AND ELECTRONICS ENGINEERING COURSE STRUCTURE & SYLLABUS (PR25 Regulations)
Applicable from AY 2025-26 Batch

I Year I Semester

S. No.	Course Code	Course Title	L	T	P	Credits
1.	PMA101BS	Matrices and Calculus	3	1	0	4
2.	PPH102BS	Advanced Engineering Physics	3	0	0	3
3.	PME103ES	Computer Aided Engineering Graphics	2	0	2	3
4.	PEN103BS	English for Skill Enhancement	3	0	0	3
5.	PEE109ES	Electrical Circuits-I	2	0	0	2
6.	PCS105ES	Programming for Problem Solving	3	0	0	3
7.	PPH106ES	Advanced Engineering Physics Lab	0	0	2	1
8.	PCS107ES	Programming for Problem Solving Lab	0	0	2	1
9.	PCS108BS	English Language and Communication Skills Lab	0	0	2	1
		Induction Program				
		Total Credits	**16**	**1**	**8**	**21**

I Year II Semester

S. No.	Course Code	Course Title	L	T	P	Credits
1.	PMA201BS	Ordinary Differential Equations and Vector Calculus	3	0	0	3
2.	PCH202BS	Engineering Chemistry	3	0	0	3
3.	PEE203ES	Electrical Circuits-II	3	0	0	3
4.	PCS204ES	Python Programming	3	0	0	3
5.	PCS205ES	Data Structures	3	0	0	3
6.	PCH206BS	Engineering Chemistry Lab	0	0	2	1
7.	PCS207ES	Data Structures Lab	0	0	2	1
8.	PCS208ES	Python Programming Lab	0	0	2	1
9.	PEE209ES	Electrical Circuits Lab	0	0	2	1
10.	PME210ES	Engineering Workshop	0	0	2	1
		Total Credits	**15**	**0**	**10**	**20**

(Dr. Kiran Kumar) (Dr. M.B. Raju, Principal) (N. Mahesh)

(B. Raju) (Dr. T. Anil Kumar) (M. Venkateshwara Rao)

HEAD OF THE DEPART... Electrical & Electronics Engi...

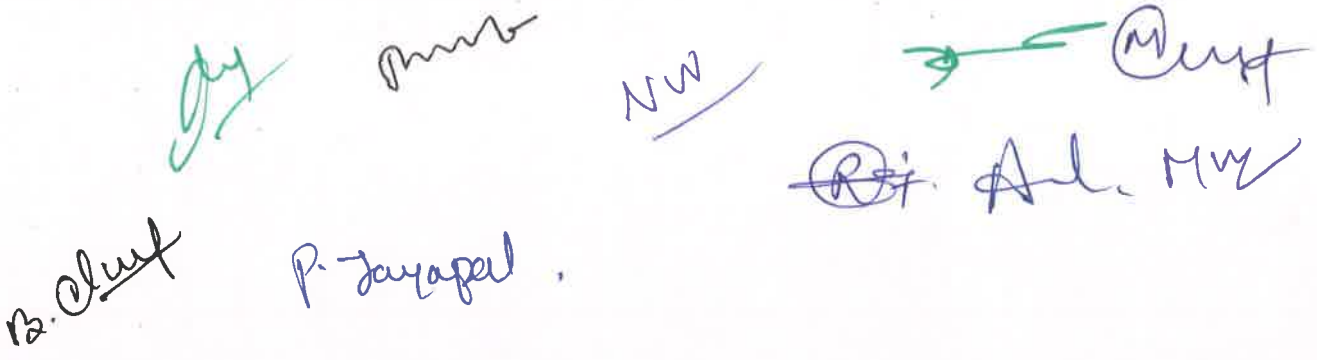
II YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1.	PEE301PC	Electromagnetic fields	3	0	0	3
2.	PEE302PC	Electrical Machines-I	3	0	0	3
3.	PEC303PC	Electronic Devices and Circuits	3	0	0	3
4.	PEE304PC	Power Systems-I	3	0	0	3
5.	PEE305PC	Electrical Measurements and Sensors	2	0	0	2
6.	PSM306MS	Innovation and Entrepreneurship	2	0	0	2
7.	PEE307PC	Electrical Machines-I Lab	0	0	2	1
8.	PEE308PC	Electrical Measurements and Sensors Lab	0	0	2	1
9.	PEE309PC	Electronic Devices and Circuits Lab	0	0	2	1
10.	PEE310SD	Design of Electrical Systems using Auto CAD	0	0	2	1
11.	PCH311	Environmental Science	1	0	0	1
		Total Credits	**17**	**0**	**8**	**21**

II YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1.	PMA401BS	Numerical Methods and Complex Variables	3	0	0	3
2.	PEE402PC	Electrical Machines-II	3	0	0	3
3.	PEE403PC	Power Systems-II	3	0	0	3
4.	PEE404PC	Digital Electronics	3	0	0	3
5.	PEE405PC	Control Systems	3	0	0	3
6.	PMA406BS	Computational Mathematics Lab	0	0	2	1
7.	PEE407PC	Electrical Machines-II Lab	0	0	2	1
8.	PEE408PC	Control Systems Lab	0	0	2	1
9.	PEE409PC	Digital Electronics Lab	0	0	2	1
10.	PEE410SD	PCB Design	0	0	2	1
		Total Credits	**15**	**0**	**10**	**20**

***Note:** Students who wish to exit after II Year II Semester has to register or this optional course and acquire the credits allotted by doing 6 weeks Work-based Vocational Course/ Internship or Apprenticeship. Please refer PR25 Academic Regulations for more information.



PEE109ES: ELECTRICALCIRCUITS– I

B.Tech. I Year I Sem.

L	T	P	C
2	0	0	2

Prerequisites: Mathematics

Course Objectives:

- To gain knowledge in circuits and to understand the fundamentals of derived circuit laws.
- To learn steady state analysis of single-phase and three-phase circuits.
- To understand Theorems and concepts of magnetic coupled circuits.

Course Outcomes: After successful completion of the course, the student will be able to:

- Apply knowledge of mathematics, science, and engineering to the analysis and design of electrical circuits.
- Solve the complex AC & DC electric circuits by applying suitable principles and theorems.
- Analyze electric circuits using network theorems and concepts of magnetic coupled circuits.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To gain knowledge in circuits and to understand the fundamentals of derived Circuit laws.	3	2	2	1	1	-	-	1	-	-	-	1
To learn steady state analysis of single-phase and three-phase circuits.	3	2	1	1	1	-	-	1	-	-	-	1
To understand Theorems and concepts of magnetic coupled circuits.	3	1	1	1	1	-	-	1	-	-	-	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Apply knowledge of mathematics, science, and engineering to the analysis and design of electrical circuits.	3	2	2	1	1	-	-	1	-	-	-	1
Solve the complex AC& DC electric circuits by applying suitable principles and theorems.	3	2	1	1	1	-	-	1	-	-	-	1
Analyze electric circuits using network	3	1	1	1	1	-	-	1	-	-	-	1

Theorems and concepts of magnetic coupled circuits.												

UNIT-I:

Network Elements & Laws: Active elements- Independent and dependent sources, Passive elements- R, L and C, Energy stored in Inductance and Capacitance, Kirchhoff's laws, Source transformation, Star-Delta transformation, Node voltage method, and Mesh current method.

UNIT-II:

Single-Phase Circuits: RMS and average values of periodic sinusoidal and non-sinusoidal waveforms, Phasor representation, j-Notation, Steady-state analysis of series, parallel circuits. Impedance, Admittance, Active and Reactive Powers, Complex Power.

Resonance: Series and parallel circuits, Bandwidth and Q-factor.

UNIT-III:

Three-phase Circuits: Analysis of balanced and unbalanced three-phase circuits, Star and delta connections, Measurement of three-phase power for balanced and unbalanced loads.

UNIT-IV:

Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorems, Maximum power transfer theorem, Tellegen's theorem, Compensation theorem, Millman's theorem and Reciprocity theorem. (AC & DC).

UNIT-V:

Magnetic Coupled circuits: Concept of self and mutual inductance, Dot convention, Coefficient of coupling, Analysis of circuits with mutual inductance.

TEXT BOOKS:

1. Van Valken burg M.E, "Network Analysis", Prentice Hall of India, 3rd Edition, 2000.
2. Ravish R Singh, "Network Analysis and Synthesis", McGraw Hill, 2nd Edition, 2019.

REFERENCE BOOKS:

1. B. Subramanyam, "Electric Circuit Analysis", Dream tech Press & Wiley, 2021.
2. James W.Nilsson, Susan A.Riedel, "Electric Circuits", Pearson, 11th Edition, 2020.
3. A Sudhakar, Shyammohan S Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill, 5th Edition, 2017.
4. Jagan N.C, Lakshrni narayana C., "Network Analysis", B. S. Publications, 3rd Edition, 2014.
5. William Hayt H, Kimmerly Jack E. and Steven Durbin M, "Engineering Circuit Analysis", McGraw Hill, 6th Edition, 2002.
6. Chakravarthy A., "Circuit Theory", Dhanpat Rai & Co., First Edition,1999.

Online Recourses:

1. https://nptel.ac.in/courses/108/104/108104139/
2. https://nptel.ac.in/courses/108/106/108106172/

PEE203ES: ELECTRICAL CIRCUITS – II

B.Tech. I Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: Matrices and Calculus and Electrical Circuits-I

Course Objectives:

- To study the transient and steady state analysis of RL, RC and RLC circuits (Series and Parallel)
- To understand the applications of Laplace transform.
- To learn about two-port networks and concept of filters.

Course Outcomes: After successful completion of the course, the student will be able to:

- Observe the response of transient and steady state analysis of RL, RC and RLC circuits (Series and Parallel).
- Examine the behavior of circuits using Laplace transforms
- Obtain two port network parameters and design of various passive filters.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To study the transient and steady state analysis of RL, RC and RLC circuits (Series and Parallel)	3	2	2	3	2	-	-	1	-	-	-	1
To understand the applications of Laplace transform.	3	2	2	2	2	-	-	1	-	-	-	1
To learn about two-port networks and concept of filters.	3	2	2	3	2	-	-	1	-	-	-	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Observe the response of transient and steady state analysis of RL, RC and RLC circuits (Series and Parallel).	3	2	2	3	2	-	-	1	-	-	-	1
Examine the behavior of circuits using Laplace transforms	3	2	2	2	2	-	-	1	-	-	-	1
Obtain two port network parameters and applications and design of various filters.	3	2	2	3	2	-	-	1	-	-	-	1

UNIT-I:

Transient analysis:

Significance of Initial conditions of R, L and C elements

Transient response of series RL, RC and RLC circuits using integro-differential approach for DC and Sinusoidal excitations.

Transient response of parallel RL, RC and RLC circuits using integro-differential approach for DC and Sinusoidal excitations.

UNIT-II:

Electrical circuit Analysis using Laplace Transforms:

Laplace Transforms of step, ramp, exponential, impulse functions (inputs)

Transient response of series RL, RC and RLC circuits using Laplace Transforms approach for DC and Sinusoidal excitations.

Transient response of parallel RL, RC and RLC circuits using Laplace Transforms approach for DC and Sinusoidal excitations.

UNIT-III: Network Topology

Graph, tree, chord, Tie-set, cut-set, incident matrices, Problems on Tie-set and cut-set matrices.

UNIT-IV:

Two port network parameters: Open circuit impedance, short-circuit admittance, Transmission, Hybrid parameters & inter-relationships, Series, parallel and cascade connection of two port networks.

UNIT-V:

Filters: Classification of filters–Low pass, High pass, Band pass and Band Elimination, Elementary treatment of Constant-k and M-derived filters-Low pass and High pass Filters, Band pass and Band elimination filters

TEXT BOOKS:

1. Van Valken burg M.E, "Network Analysis", Prentice Hall of India, 3rd Edition, 2000.
2. Ravish R Singh, "Network Analysis and Synthesis", McGraw Hill, 2nd Edition, 2019.

REFERENCE BOOKS:

1. B. Subramanyam, "Electric Circuit Analysis", Dream tech Press & Wiley, 2021.
2. James W.Nilsson, Susan A. Riedel, "Electric Circuits", Pearson, 11th Edition, 2020.
3. A Sudhakar, Shyammohan S Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill, 5th Edition, 2017.
4. Jagan N.C,Lakshrninarayana C., "Network Analysis", B.S. Publications, 3rd Edition,2014.
5. William Hayt H,Kimmerly Jack E. and Steven Durbin M, "Engineering Circuit Analysis", McGraw Hill, 6th Edition, 2002.
6. Chakravarthy A.,"Circuit Theory", Dhanpat Rai &Co., First Edition, 1999.

Online Recourses:

1. https://nptel.ac.in/courses/108/104/108104139/
2. https://nptel.ac.in/courses/108/106/108106172/
3. https://www.digimat.in/nptel/courses/video/108105159/L01.html
4. https://www.digimat.in/nptel/courses/video/108102042/L01.htm

P. Jayapal.

PEE209ES: ELECTRICAL CIRCUITS LAB

B.Tech. I Year II Sem.

L	T	P	C
0	0	2	1

Prerequisites: Electrical Circuits-I

Course Objectives:

- TodesignelectricalsystemsandanalyzethembyapplyingvariousNetworkTheorems
- To measure three phase Active and Reactive power.
- To understand the concept of resonance.

Course Outcomes: After successful completion of the course, the student will be able to:

- Analyze complex DC and AC linear circuits
- Apply concepts of electrical circuits across engineering
- Evaluate response of a give network by using theorems.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To design electrical systems and analyze them by applying various Network Theorems	3	2	2	3	3	-	-	1	2	2	2	1
To measure three phase Active and Reactive power	3	2	2	2	3	-	-	1	2	2	2	1
To understand The concept of resonance.	3	2	2	3	3	-	-	1	2	2	2	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Analyze complex DC and AC linear circuits.	3	2	2	3	3	-	-	1	2	2	2	1
Apply concepts of electrical circuits across engineering	3	2	2	2	3	-	-	1	2	2	2	1
Evaluate response of a given network by using theorems.	3	2	2	3	3	-	-	1	2	2	2	1

The following experiments are required to be conducted compulsorily:

1. Verification of Series and Parallel Resonance using any circuit simulation software (LT Spice etc...).
2. Determination of Time response of first order RL and RC circuit or periodic non -sinusoidal inputs – Time Constant and Steady-state error using any circuit simulation software(LT Spice etc...).
3. Determination of Two port network parameters-Z, Y, Transmission and Hybrid parameters.

4. Measurement of 3-phase power in Balanced Star connected load using Two-Wattmeter method.
5. Determination of Co-efficient of coupling, self and mutual inductance in magnetic Coupled Circuits.
6. Frequency domain analysis of Low-pass filter and High-pass filters using circuit simulation software (LT Spice etc...).
7. Verification of Superposition and Maximum Power Transfer theorems using any circuit simulation software (LT Spice etc...).
8. Verification of Thevenin's and Norton's theorems using any circuit simulation software (LT Spice etc...).

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

1. Measurement of Active Power for Delta connected balanced loads.
2. Measurement of Reactive Power for Star and Delta connected balanced loads.
3. Frequency domain analysis of Band-pass filters.
4. Frequency domain analysis of Band-stop filters
5. Determination of Time response of first order RL, RC circuit for periodic non-sinusoidal inputs – Time Constant and Steady state error.
6. Verification of Compensation theorem.

TEXT BOOKS:

1. Van Valken burg M.E, "Network Analysis", Prentice Hall of India, 3rd Edition, 2000.
2. RavishRSingh,"NetworkAnalysisandSynthesis",McGrawHill,2nd Edition,2019.

REFERENC EBOOKS:

1. B. Subramanyam, "Electric Circuit Analysis", Dream tech Press & Wiley, 2021.
2. James W.Nilsson, Susan A.Riedel, "Electric Circuits", Pearson,11th Edition, 2020.
3. A Sudhakar, Shyammohan S Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill, 5th Edition, 2017.
4. Jagan N.C,Lakshrninarayana C.,"Network Analysis", B.S.Publications,3rd Edition, 2014.
5. William Hayt H,Kimmerly Jack E. and Steven Durbin M, "Engineering Circuit Analysis", McGraw Hill, 6thEdition, 2002.
6. ChakravarthyA., "CircuitTheory",DhanpatRai&Co.,FirstEdition,1999.

Online Recourses:

1. https://nptel.ac.in/courses/108/104/108104139/
2. https://nptel.ac.in/courses/108/106/108106172/
3. https://ocw.mit.edu/search/ocwsearch.htm?q=laboratory

PEE108ES: BASIC ELECTRICAL ENGINEERING LAB

B.Tech. I Year I Sem.

L	T	P	C
0	0	2	1

Prerequisites: Introduction to Basic Electrical Engineering.

Course Objectives:

- To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach.
- To study the transient response of various R, L and C circuits using different excitations.
- To determine the performance of different types of DC,AC machines and Transformers.

Course Outcomes: After learning the contents of this paper the student must be able to

- Verify the basic Electrical circuits through different experiments.
- Evaluate the performance calculations of Electrical Machines and Transformers through various testing methods.
- Analyze the transient responses of R, L and C circuits for different input conditions.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach	3	2	1		2	0	0	1	2	0	1	2
To study the transient response of various R, L and C circuits using different excitations	3	2	1	1	3	0	0	0	2	0	1	1
To determine the performance of different types of DC ,AC machines and Transformers	3	2	0		3	0	0	0	1	2	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Verify the basic Electrical circuits Through different experiments	3	2	1	0	1	0	0	0	2	0	2	2
Evaluate the performance calculations of Electrical Machines and Transformers through various Testing methods	3	2	1	0	3	1	0	1	1	2	1	2
Analyze the transient responses of R, L and C circuits for different input	3	2	1	1	3	2	0	0	1	0	2	2

conditions												

List of experiments/demonstrations:

PART-A(compulsory)

1. Verification of KVL and KCL
2. Verification of Thevenin's and Norton's theorem
3. Transient Response of Series RL and RC circuits for DC excitation
4. Resonance in series RLC circuit
5. Calculations and Verification of Impedance and Current of RLC series and Parallel AC circuits
6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
7. Performance Characteristics of a DC Shunt Motor
8. Torque-Speed Characteristics of a Three-phase Induction Motor.

PART-B(any two experiments from the given list)

1. Verification of Superposition theorem.
2. Load Test on Single Phase Transformer(Calculate Efficiency and Regulation)
3. Measurement of Active and Reactive Power in a balanced Three-phase circuit
4. No-Load Characteristics of a Three-phase Alternator

TEXTBOOKS:

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4thEdition,2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2ndEdition, 2008.

REFERENCEBOOKS:

1. P.Ramana,M.Suryakalavathi,G.T.Chandrasheker,"BasicElectricalEngineering",S.Chand, 2ndEdition, 2019.
2. D.C.Kulshreshtha,"BasicElectricalEngineering",McGrawHill,2009
3. M.S.Sukhija,T.K.Nagsarkar,"BasicElectricalandElectronicsEngineering",Oxford,1stEdition, 2012.
4. AbhijitChakrabarthi,SudiptaDebnath,ChandanKumarChanda,"BasicElectrical Engineering", 2ndEdition, McGraw Hill, 2021.
5. L.S.Bobrow,"FundamentalsofElectricalEngineering",OxfordUniversityPress,2011.
6. E.Hughes,"ElectricalandElectronicsTechnology",Pearson,2010.
7. V.D.Toro,"ElectricalEngineeringFundamentals",PrenticeHallIndia,1989.

HEAD OF THE DEPARTMENT
Electrical & Electronics Engineering
AVN ENGINEERING COLLEGE
Kandlakoya (V), Hyderabad

PEE208ES: BASIC ELECTRICAL ENGINEERING LAB

B.Tech. I Year II Sem.

L	T	P	C
0	0	2	1

Prerequisites: Introduction to Basic Electrical Engineering.

Course Objectives:

- To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach.
- To study the transient response of various R, L and C circuits using different excitations.
- To determine the performance of different types of DC,AC machines and Transformers.

Course Outcomes: After learning the contents of this paper the student must be able to

- Verify the basic Electrical circuits through different experiments.
- Evaluate the performance calculations of Electrical Machines and Transformers through various testing methods.
- Analyze the transient responses of R, L and C circuits for different input conditions.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach	3	2	1		2	0	0	1	2	0	1	2
To study the transient response of various R, L and C circuits using different excitations	3	2	1	1	3	0	0	0	2	0	1	1
To determine the performance of different types of DC ,AC machines and Transformers	3	2	0		3	0	0	0	1	2	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Verify the basic Electrical circuits Through different experiments	3	2	1	0	1	0	0	0	2	0	2	2
Evaluate the performance calculations of Electrical Machines and Transformers through various Testing methods	3	2	1	0	3	1	0	1	1	2	1	2
Analyze the transient responses of R, L and C circuits for different input	3	2	1	1	3	2	0	0	1	0	2	2

conditions												

List of experiments/demonstrations:

PART-A (compulsory)

1. Verification of KVL and KCL
2. Verification of Thevenin's and Norton's theorem
3. Transient Response of Series RL and RC circuits for DC excitation
4. Resonance in series RLC circuit
5. Calculations and Verification of Impedance and Current of RLC series and Parallel AC circuits
6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
7. Performance Characteristics of a DC Shunt Motor
8. Torque-Speed Characteristics of a Three-phase Induction Motor.

PART-B (any two experiments from the given list)

1. Verification of Superposition theorem.
2. Load Test on Single Phase Transformer(Calculate Efficiency and Regulation)
3. Measurement of Active and Reactive Power in a balanced Three-phase circuit
4. No-Load Characteristics of a Three-phase Alternator

TEXTBOOKS:

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4thEdition,2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2ndEdition, 2008.

REFERENCEBOOKS:

1. P.Ramana,M.Suryakalavathi,G.T.Chandrasheker,"BasicElectricalEngineering",S.Chand, 2ndEdition, 2019.
2. D.C.Kulshreshtha,"BasicElectricalEngineering",McGrawHill,2009
3. M.S.Sukhija,T.K.Nagsarkar,"BasicElectricalandElectronicsEngineering",Oxford,1stEdition, 2012.
4. AbhijitChakrabarthi,SudiptaDebnath,ChandanKumarChanda,"BasicElectrical Engineering", 2ndEdition, McGraw Hill, 2021.
5. L.S.Bobrow,"FundamentalsofElectricalEngineering",OxfordUniversityPress,2011.
6. E.Hughes,"ElectricalandElectronicsTechnology",Pearson,2010.
7. V.D.Toro,"ElectricalEngineeringFundamentals",PrenticeHallIndia,1989.

PEE114ES: INTRODUCTION TO ELECTRICAL ENGINEERING

B.Tech. I Year I Sem.

L	T	P	C
2	0	0	2

Prerequisites: Mathematics

Course Objectives:

- To understand DC and Single & Three phase AC circuits
- To study and understand the different types of DC,AC machines and Transformers.
- To import the knowledge of various electrical installations and the concept of power, power factor and its improvement.

Course Outcomes: After learning the contents of this paper the student must be able to

- Understand and analyze basic Electrical circuits
- Study the working principles of Electrical Machines and Transformers
- Introduce components of Low Voltage Electrical Installations.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To understand DC and Single & Three phase AC circuits.	3	2	1		2	0	0	1	2	0	1	2
To study and understand the different types of DC, AC machines and Transformers.	3	2	1	1	3	0	0	0	2	0	1	1
To import the knowledge of various electrical installations and the concept of power, power factor and its improvement.	3	2	0		3	0	0	0	1	2	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand and analyze basic Electrical circuits	3	2	1	0	1	0	0	0	2	0	2	2
Study the working principles of Electrical Machines and Transformers	3	2	1	0	3	1	0	1	1	2	1	2
Introduce components of Low Voltage Electrical Installations.	3	2	1	1	3	2	0	0	1	0	2	2

UNIT-I:

D.C. Circuits: Introduction to R, L and C elements, Independent voltage and current sources, KVL & KCL, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT-II:

A.C. Circuits: Introduction to sinusoidal waveforms, phasor representation, the concept of power and power factor, Analysis of 1-phase RLC series and parallel circuits, resonance in series R-L-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III:

Transformers: Principle of operation, equivalent circuit, losses, regulation and efficiency. Introduction to Auto-transformer.

HEAD OF THE DEPARTMENT
Electrical & Electronics Engineering

UNIT-IV:

Electrical Machines: Principle of operation of DC machine, performance characteristics of dc shunt machine. Principle of operation of a 3-phase induction motor, torque-slip characteristics. Principle of operation of synchronous generator.

UNIT-V:

Electrical Installations: Components of LT Switchgear: SFU, MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, and Characteristics. Elementary calculations for energy consumption, power factor improvement and battery backup.

TEXTBOOKS:

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4thEdition,2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2nd Edition, 2008.

REFERENCEBOOKS:

1. P.Ramana,M.Suryakalavathi,G.T.Chandrasheker,"BasicElectricalEngineering",S.Chand, 2ndEdition, 2019.
2. D.C.Kulshreshtha,"BasicElectricalEngineering",McGrawHill,2009
3. M.S.Sukhija,T.K.Nagsarkar,"BasicElectricalandElectronicsEngineering",Oxford,1stEdition, 2012.
4. AbhijitChakrabarthi,SudiptaDebnath,ChandanKumarChanda,"BasicElectricalEngineering", 2ndEdition, McGraw Hill, 2021.
5. L.S.Bobrow,"FundamentalsofElectricalEngineering",OxfordUniversityPress,2011.
6. E.Hughes,"ElectricalandElectronicsTechnology",Pearson,2010.
7. V.D.Toro,"ElectricalEngineeringFundamentals",PrenticeHallIndia,1989.

HEAD OF THE DEPARTMENT
Electrical & Electronics Engineering
PRAGATI ENGINEERING COLLEGE

PEE104ES: BASIC ELECTRICAL ENGINEERING

B.Tech.I Year ISem.

L	T	P	C
3	0	0	3

Prerequisites: Mathematics

Course Objectives:

- To understand DC and Single & Three phase AC circuits
- To study and understand the different types of DC,AC machines and Transformers.
- To import the knowledge of various electrical installations and the concept of power, power factor and its improvement.

Course Outcomes: After learning the contents of this paper the student must be able to

- Understand and analyze basic Electrical circuits
- Study the working principles of Electrical Machines and Transformers
- Introduce components of Low Voltage Electrical Installations.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To understand DC and Single & Three phase AC circuits.	3	2	1		2	0	0	1	2	0	1	2
To study and understand the different types of DC, AC machines and Transformers.	3	2	1	1	3	0	0	0	2	0	1	1
To import the knowledge of various electrical installations and the concept of power, power factor and its improvement.	3	2	0		3	0	0	0	1	2	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand and analyze basic Electrical circuits	3	2	1	0	1	0	0	0	2	0	2	2
Study the working principles of Electrical Machines and Transformers	3	2	1	0	3	1	0	1	1	2	1	2
Introduce components of Low Voltage Electrical Installations.	3	2	1	1	3	2	0	0	1	0	2	2

UNIT-I:

D.C. Circuits: Introduction to R, L and C elements, Independent voltage and current sources, KVL & KCL, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT-II:

A.C. Circuits: Introduction to sinusoidal waveforms, phasor representation, the concept of power and power factor, Analysis of 1-phase RLC series and parallel circuits, resonance in series R-L-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III:

Transformers: Principle of operation, equivalent circuit, losses, regulation and efficiency. Introduction to Auto-transformer.

UNIT-IV:

Electrical Machines: Principle of operation of DC machine, performance characteristics of dc shunt machine. Principle of operation of a 3-phase induction motor, torque-slip characteristics. Principle of operation of synchronous generator.

UNIT-V:

Electrical Installations: Components of LT Switchgear: SFU, MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, and Characteristics. Elementary calculations for energy consumption, power factor improvement and battery backup.

TEXTBOOKS:

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4thEdition,2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2nd Edition, 2008.

REFERENCEBOOKS:

1. P.Ramana,M.Suryakalavathi,G.T.Chandrasheker,"BasicElectricalEngineering",S.Chand, 2ndEdition, 2019.
2. D.C.Kulshreshtha,"BasicElectricalEngineering",McGrawHill,2009
3. M.S.Sukhija,T.K.Nagsarkar,"BasicElectricalandElectronicsEngineering",Oxford,1stEdition, 2012.
4. AbhijitChakrabarthi,SudiptaDebnath,ChandanKumarChanda,"BasicElectricalEngineering", 2ndEdition, McGraw Hill, 2021.
5. L.S.Bobrow,"FundamentalsofElectricalEngineering",OxfordUniversityPress,2011.
6. E.Hughes,"ElectricalandElectronicsTechnology",Pearson,2010.
7. V.D.Toro,"ElectricalEngineeringFundamentals",PrenticeHallIndia,1989.

PEE214ES: NETWORK ANALYSIS AND SYNTHESIS

B.Tech. I Year II Sem **L T P C**
3 0 0 3

Course Objectives:

1. To understand the basic concepts on RLC circuits.
2. To know the behavior of the steady state and transient states in RLC circuits.
3. To understand the two port network parameters.
4. Learn the design concepts of various filters and attenuators

Course Outcomes: Up on successful completion of the course, students will be able to:

1. Gain the knowledge on basic RLC circuits behavior.
2. Analyze the Steady state and transient analysis of RLC Circuits.
3. Characterization of two port network parameters.
4. Analyze the Design aspect of various filters and attenuators

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	1	-	-	-	-	1
CO2	2	3	2	-	-	-	1	-	-	-	-	1
CO3	3	2	1	-	-	-	-	-	-	-	-	1
CO4	2	3	3	-	-	-	1	-	-	-	-	1

UNIT-I

Network Topology: Basic cutset and tie set matrices for planar networks, Magnetic Circuits, Self and Mutual inductances, dot convention, impedance, reactance concept, Impedance transformation and coupled circuits, co-efficient of coupling, equivalent T for Magnetically coupled circuits, Ideal Transformer.

UNIT-II

Transient and Steady state analysis: RC, RL and RLC Circuits, Sinusoidal, Step and Square responses. RC Circuits as integrator and differentiators. 2ndorder series and parallel RLC Circuits, Quality factor and bandwidth for series and parallel resonance, resonance curves.

UNIT-III

Two port network parameters: Z, Y, ABCD, h parameters, Characteristic impedance, Image transfer constant, image and iterative impedance, network function, driving point and transfer functions – using transformed (S) variables, Poles and Zeros. Standard T, π, L Sections, Characteristic impedance, image transfer constants.

UNIT-IV

Filters: Classification of Filters, Filter Networks, Constant-K Filters-Low pass, high pass, Band pass, band-stop filters, M-derived Filters- T and π filters- Low pass, high pass

Attenuators: Types – T, π , L, Bridge T and lattice ,Asymmetrical Attenuators T, π , L Equalizers-Types- Series, Shunt, Constant resistance, bridge T attenuation, bridge T phase, Lattice attenuation, lattice Phase equalizers

UNIT–V

Network Synthesis: Driving point impedance and admittance, transfer impedance and admittance, network functions of Ladder and non ladder networks, Poles, Zeros analysis of network functions,

HEAD OF THE DEPARTM
Electrical & Electronics Engine

Hurwitz polynomials, Positive Real Functions, synthesis of LC, RC and RL Functions by foster and causer methods.

TEXT BOOKS:

1. Van Valkenburg-Network Analysis, 3rdEd.,Pearson,216.
2. JDRyder-Networks,LinesandFields,2ndEd.,PHI, 1999.

REFERENC EBOOKS:

1. J. Edminister and M. Nahvi - Electric Circuits, Schaum's Outlines, Mc Graw Hills Education,1999.
2. A. Sudhakar and Shyam mohan S Palli-Networks & Circuits,4thEd., Tata McGraw-Hill Publications
3. William Haytand Jack E.Kimmerley-EngineeringCircuitAnalysis,6thEd., William Haytand Jack E. Kimmerley, McGraw Hill Company

PEE211ES: BASIC ELECTRICAL ENGINEERING LAB
Common to CSE, CSE-DS & CSE-CS

B.Tech. I Year II Sem.

L	T	P	C
0	0	2	1

Prerequisites: Introduction to Basic Electrical Engineering.

Course Objectives:

- To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach.
- To study the transient response of various R, L and C circuits using different excitations.
- To determine the performance of different types of DC,AC machines and Transformers.

Course Outcomes: After learning the contents of this paper the student must be able to

- Verify the basic Electrical circuits through different experiments.
- Evaluate the performance calculations of Electrical Machines and Transformers through various testing methods.
- Analyze the transient responses of R, L and C circuits for different input conditions.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach	3	2	1		2	0	0	1	2	0	1	2
To study the transient response of various R, L and C circuits using different excitations	3	2	1	1	3	0	0	0	2	0	1	1
To determine the performance of different types of DC ,AC machines and Transformers	3	2	0		3	0	0	0	1	2	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Verify the basic Electrical circuits Through different experiments	3	2	1	0	1	0	0	0	2	0	2	2
Evaluate the performance calculations of Electrical Machines and Transformers through various Testing methods	3	2	1	0	3	1	0	1	1	2	1	2
Analyze the transient responses of R, L and C circuits for different input	3	2	1	1	3	2	0	0	1	0	2	2

conditions													

List of experiments/demonstrations:

PART-A(compulsory)

1. Verification of KVL and KCL
2. Verification of Thevenin's and Norton's theorem
3. Transient Response of Series RL and RC circuits for DC excitation
4. Resonance in series RLC circuit
5. Calculations and Verification of Impedance and Current of RLC series and Parallel AC circuits
6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
7. Performance Characteristics of a DC Shunt Motor
8. Torque-Speed Characteristics of a Three-phase Induction Motor.

PART-B(any two experiments from the given list)

1. Verification of Superposition theorem.
2. Load Test on Single Phase Transformer(Calculate Efficiency and Regulation)
3. Measurement of Active and Reactive Power in a balanced Three-phase circuit
4. No-Load Characteristics of a Three-phase Alternator

TEXTBOOKS:

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4thEdition,2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2ndEdition, 2008.

REFERENCEBOOKS:

1. P.Ramana,M.Suryakalavathi,G.T.Chandrasheker,"BasicElectricalEngineering",S.Chand, 2ndEdition, 2019.
2. D.C.Kulshreshtha,"BasicElectricalEngineering",McGrawHill,2009
3. M.S.Sukhija,T.K.Nagsarkar,"BasicElectricalandElectronicsEngineering",Oxford,1stEdition, 2012.
4. AbhijitChakrabarthi,SudiptaDebnath,ChandanKumarChanda,"BasicElectrical Engineering", 2ndEdition, McGraw Hill, 2021.
5. L.S.Bobrow,"FundamentalsofElectricalEngineering",OxfordUniversityPress,2011.
6. E.Hughes,"ElectricalandElectronicsTechnology",Pearson,2010.
7. V.D.Toro,"ElectricalEngineeringFundamentals",PrenticeHallIndia,1989.

HEAD OF THE DEPARTMENT
Electrical & Electronics Engineering

PEE204ES: BASIC ELECTRICAL ENGINEERING
Common to CSE, CSE-DS & CSE-CS

B.Tech. I Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: Mathematics

Course Objectives:

- To understand DC and Single & Three phase AC circuits
- To study and understand the different types of DC,AC machines and Transformers.
- To import the knowledge of various electrical installations and the concept of power, power factor and its improvement.

Course Outcomes: After learning the contents of this paper the student must be able to

- Understand and analyze basic Electrical circuits
- Study the working principles of Electrical Machines and Transformers
- Introduce components of Low Voltage Electrical Installations.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To understand DC and Single & Three phase AC circuits.	3	2	1		2	0	0	1	2	0	1	2
To study and understand the different types of DC, AC machines and Transformers.	3	2	1	1	3	0	0	0	2	0	1	1
To import the knowledge of various electrical installations and the concept of power, power factor and its improvement.	3	2	0		3	0	0	0	1	2	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand and analyze basic Electrical circuits	3	2	1	0	1	0	0	0	2	0	2	2
Study the working principles of Electrical Machines and Transformers	3	2	1	0	3	1	0	1	1	2	1	2
Introduce components of Low Voltage Electrical Installations.	3	2	1	1	3	2	0	0	1	0	2	2

UNIT-I:

D.C. Circuits: Introduction to R, L and C elements, Independent voltage and current sources, KVL & KCL, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT-II:

A.C. Circuits: Introduction to sinusoidal waveforms, phasor representation, the concept of power and power factor, Analysis of 1-phase RLC series and parallel circuits, resonance in series R-L-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III:

Transformers: Principle of operation, equivalent circuit, losses, regulation and efficiency. Introduction to Auto-transformer.

UNIT-IV:

Electrical Machines: Principle of operation of DC machine, performance characteristics of dc shunt machine. Principle of operation of a 3-phase induction motor, torque-slip characteristics. Principle of operation of synchronous generator.

UNIT-V:

Electrical Installations: Components of LT Switchgear: SFU, MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, and Characteristics. Elementary calculations for energy consumption, power factor improvement and battery backup.

TEXTBOOKS:

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4thEdition,2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2nd Edition, 2008.

REFERENCEBOOKS:

1. P.Ramana,M.Suryakalavathi,G.T.Chandrasheker,"BasicElectricalEngineering",S.Chand, 2ndEdition, 2019.
2. D.C.Kulshreshtha,"BasicElectricalEngineering",McGrawHill,2009
3. M.S.Sukhija,T.K.Nagsarkar,"BasicElectricalandElectronicsEngineering",Oxford,1stEdition, 2012.
4. AbhijitChakrabarthi,SudiptaDebnath,ChandanKumarChanda,"BasicElectricalEngineering", 2ndEdition, McGraw Hill, 2021.
5. L.S.Bobrow,"FundamentalsofElectricalEngineering",OxfordUniversityPress,2011.
6. E.Hughes,"ElectricalandElectronicsTechnology",Pearson,2010.
7. V.D.Toro,"ElectricalEngineeringFundamentals",PrenticeHallIndia,1989.

HEAD OF THE DEPARTM
& Electronics Engg

PEE111ES: ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING

B.Tech. I Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. To introduce the concepts of electrical circuits and its components
2. To understand magnetic circuits, DC circuits and AC single phase and three phase circuits
3. To study and understand the different types of DC, AC machines and Transformers.
4. To import the knowledge of various electrical installations.
5. To introduce the concept of power, power factor and its improvement.
6. To introduce the concepts of diodes and transistors, and
7. To impart the knowledge of various configurations, characteristics and applications.

Course Outcomes:

1. To analyze and solve electrical circuits using network laws and theorems.
2. To understand and analyze basic Electric and Magnetic circuits
3. To study the working principles of Electrical Machines
4. To introduce components of Low Voltage Electrical Installations
5. To identify and characterize diodes and various types of transistors.

UNIT-I:

D.C. Circuits: Electrical circuit elements (R, L and C), voltage and current sources, KVL and KCL, analysis of simple circuits with dc excitation.

UNIT-II:

A.C. Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits, Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III:

Electrical Machines: Working principle of Single-phase transformer, equivalent circuit, losses in transformers, efficiency, working principle of DC motors, Torque equations, Construction and working principle of Three phase Induction motor, Torques equations. Construction and working principle of synchronous generators.

UNIT-IV:

Electrical Installations: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

UNIT-V:

P-N Junction and Rectifiers and Filters: Principle Operation of Diode, Volt, Ampere characteristics, Zener diode characteristics. P-N junction as a rectifier, Half Wave Rectifier, Ripple Factor, Full Wave Rectifier, Bridge Rectifier, Filters – Inductor Filters, Capacitor Filters, L-section Filters, π- section Filters.

Bipolar Junction Transistor (BJT) and Field Effect Transistor (FET): Construction and Principle of Operation of BJT and FET, Common Emitter, Common Base and Common Collector configurations, Comparison of CE, CB and CC configurations. Comparison of BJT and FET.

TEXT BOOKS:

1. Basic Electrical and electronics Engineering, M S Sukija and TK Nagasarkar, Oxford University, 1st Edition, 2012
2. Basic Electrical and electronics Engineering, DP Kothari and IJ Nagarath, Mc Graw Hill Education, 2nd Edition, 2020

REFERENCE BOOKS:

1. Electronic Devices and Circuits, R.L.Boylestad and Louis Nashelsky, PElandPHI, 9th Edition, 2006.
2. Millman's Electronic Devices and Circuits,J. Millman, C. C. Halkias and Satyabrata Jit, TMH, 2nd Edition, 1998.
3. Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, McGraw Hill, 6th Edition, 1971.
4. Linear circuit analysis, Raymond A. DeCarlo andPen,Min, Lin, Oxford University Press, 2nd edition, 2004.
5. Network Theory, N.C. Jaganand C.Lakshmi narayana, McGrawHill,2nd Edition,2005.
6. Network Theory, Sudhakar and Shyam Mohan Palli, Tata McGrawHill,2nd Edition,2011.
7. Fundamentals of Electrical Engineering, L. S. Bobrow, Oxford University Press, 12th edition, 2003.
8. Electrical and Electronic Technology, E.Hughes,PearsonEducation,10thEdition,2010.
9. Electrical Engineering Fundamentals, V.D.Toro, Prentice HallIndia,2nd Edition,1989.

PEE112ES: ELEMENTS OF ELECTRICAL AND ELECTRONIC ENGINEERING LAB

B.Tech. I Year I Sem.

L	T	P	C
0	0	2	1

Pre requisites: Basic Electrical and Electronics Engineering

Course Objectives:

1. To introduce the concepts of electrical circuits and its components.
2. To understand magnetic circuits, DC circuits and AC single phase and three phase circuits.
3. To study and understand the different types of DC, AC machines and Transformers.
4. To import the knowledge of various electrical installations.
5. To introduce the concept of power ,power factor and its improvement.
6. To introduce the concepts of diodes and transistors.
7. To impart the knowledge of various configurations, characteristics and applications.

Course Outcomes:

1. To analyze and so level electrical circuits using network laws and theorems.
2. To understand and analyze basic Electric and Magnetic circuits.
3. To study the working principles of Electrical Machines.
4. To introduce components of Low Voltage Electrical Installations.
5. To identify and characterize diodes and various types of transistors.

List of Experiments:

PARTA: ELECTRICAL

1. Verification of KVL and KCL
2. (i)Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single Phase Transformer
   (ii)Verification of Relationship between Voltages and Currents (Star Delta, Delta Delta, Delta Star, Star Star) in a Three Phase Transformer
3. Measurement of Active and Reactive Power in a balanced Three phase circuit
4. Performance Characteristics of a Separately Excited DC Shunt Motor
5. Performance Characteristics of a Three phase Induction Motor
6. No Load Characteristics of a Three phase Alternator

PARTB: ELECTRONICS

1. Study and operation of
   (i) Multimeters (ii) Function Generator (iii) Regulated Power Supplies (iv) CRO.
2. P-N Junction diode characteristics
3. Zener diode characteristics and Zener as voltage Regulator
4. Input and Output characteristics of Transistor in CB, CE configuration
5. Full Wave Rectifier with and without filters
6. Input and Output characteristics of FET in CS configuration

TEXT BOOKS:

1. BasicElectricalandelectronicsEngineering,M.S.SukijaandT.K.Nagasarkar,Oxford University press, 1st Edition, 2012.
2. BasicElectricalandelectronicsEngineering,D.P.KothariandI.J.Nagarath,McGrawHill Education, 2nd Edition,2020.

HEAD OF THE DEPAR

REFERENCEBOOKS:

1. Electronic Devices and Circuits, R.L.Boylestad and Louis Nashelsky, PEIandPHI, 9thEdition, 2006.
2. Millman's Electronic Devices and Circuits, J. Millman,C. C. Halkias and Satyabrata Jit, TMH, 2ndEdition, 1998.
3. Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, McGraw Hill, 6th Edition, 1971.
4. Linear circuit analysis, Raymond A. De Carlo and Pen, Min, Lin, Oxford University Press 2nd Edition, 2004.
5. Network Theory, N.C.Jagan and C.Lakshminarayana, Mc GrawHill,2nd Edition,2005.
6. Network Theory, Sudhakar and ShyamMohanPalli, Tata McGrawHill,2nd Edition,2011.
7. Fundamentals of Electrical Engineering, L. S. Bobrow, Oxford University Press, 12th Edition 2003.
8. Electrical and Electronic Technology, E.Hughes,PearsonEducation,10thEdition,2010.
9. Electrical Engineering Fundamentals, V.D.Toro, Prentice Hall India,2ndEdition,1989.

PEC305PC: CONTROLSYSTEMS

B.Tech. II Year I Sem. **L T P C**
2 0 0 2

Pre-Requisites: Linear Algebra and Calculus, Ordinary Differential Equations and Multivariable Calculus Laplace Transforms, Numerical Methods and Complex variables

Course Objectives:

1. To introduce the fundamental concepts, classifications, and mathematical modeling of control systems for mechanical and electrical domains.
2. To analyze control system behavior in time and frequency domains and stability criteria using root locus, Bode plot, Nyquist plot, etc.
3. Design and evaluate compensators and controllers to improve system performance.
4. Explain state-space representation, solution of state equations, and assess system controllability and observability.

Course Outcomes: Up on completion of this Course, the students will be able to:

1. Describe open-and closed-loop systems, and develop mathematical models using block diagrams and signal flow graphs.
2. Analyze time response of second-order systems using time-domain specifications, and assess stability using Routh-Hurwitz criterion and root locus techniques.
3. Analyse frequency response plots including Bode, Polar, and Nyquist plots, and investigate system stability.
4. Design compensators and controllers to meet specific performance criteria in control systems.
5. Apply the state-variable approach and analyze controllability and observability.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	-	-	-	-	-	-	-	-
CO2	3	3	2	1	1	-	-	-	-	-	-
CO3	3	3	2	1	1	-	-	-	-	-	-
CO4	3	3	3	2	1	-	-	-	-	-	-
CO5	3	3	2	1	1	-	-	-	-	-	-

UNIT-I

Control System fundamentals: Classification of control systems, Open and Closed loop systems. Mathematical modelling of mechanical systems and their conversion into electrical systems. Block diagram reduction and Signal flow graphs.

UNIT-II

Time response Analysis: Transfer function and Impulse response, types of input. Transient response of second order system for step input. Time domain specifications. Types of systems, static error coefficients, Routh - Hurwitz criterion for stability.

Root locus techniques: Analysis of typical systems using root locus techniques. Effect of location of roots on system response.

UNIT-III

Frequency response Analysis: Frequency domain specifications, bode plots, Gain margin and Phase Margin. Polar plot, Nyquist plot, and Nyquist criterion for stability.

UNIT-IV

Compensators and controllers: Introduction to compensators, Lag compensator, Lead compensator, Lag-Lead compensator, Design of compensators using bode plot. Introduction to controllers, P, I, D, PI, PD, PID controllers.

UNIT-V

State space representation: Concept of state and state variables. State models of linear time invariant systems, State transition matrix, Solution of state equations. Controllability and observability.

TEXT BOOKS:

1. I.J. Nagrath and M.Gopal,Control System Engineering, 5ed., New Age Publishers, 2009.
2. Benjamin C.Kuo, Automatic Control Systems,7ed.,PHI,2010.

REFERENCE BOOKS:

1. K.Ogata, Modern Control Engineering, 2ed.,Prentice Hall, 2010.
2. M.Gopal, Control Systems: Principles and Design, Tata Mc Graw-Hill, 1997.
3. Norman S.Nise, Control Systems Engineering, 5ed.,John Wiley & Sons, 2007.
4. A.K. Jairath, Solutions and Problems of Control Systems, CBSPublishers, 2013.
5. A. Nagoor Kani, Control Systems, 2ed.,RBA Publications, 2007

II YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1.	PEE301PC	Electromagnetic fields	3	0	0	3
2.	PEE302PC	Electrical Machines-I	3	0	0	3
3.	PEC303PC	Electronic Devices and Circuits	3	0	0	3
4.	PEE304PC	Power Systems-I	3	0	0	3
5.	PEE305PC	Electrical Measurements and Sensors	2	0	0	2
6.	PSM306MS	Innovation and Entrepreneurship	2	0	0	2
7.	PEE307PC	Electrical Machines-I Lab	0	0	2	1
8.	PEE308PC	Electrical Measurements and Sensors Lab	0	0	2	1
9.	PEE309PC	Electronic Devices and Circuits Lab	0	0	2	1
10.	PEE310SD	Design of Electrical Systems using Auto CAD	0	0	2	1
11.	PCH311	Environmental Science	1	0	0	1
		Total Credits	**17**	**0**	**8**	**21**

II YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1.	PMA401BS	Numerical Methods and Complex Variables	3	0	0	3
2.	PEE402PC	Electrical Machines-II	3	0	0	3
3.	PEE403PC	Power Systems-II	3	0	0	3
4.	PEE404PC	Digital Electronics	3	0	0	3
5.	PEE405PC	Control Systems	3	0	0	3
6.	PMA406BS	Computational Mathematics Lab	0	0	2	1
7.	PEE407PC	Electrical Machines-II Lab	0	0	2	1
8.	PEE408PC	Control Systems Lab	0	0	2	1
9.	PEE409PC	Digital Electronics Lab	0	0	2	1
10.	PEE410SD	PCB Design	0	0	2	1
		Total Credits	**15**	**0**	**10**	**20**

***Note:** Students who wish to exit after II Year II Semester has to register or this optional course and acquire the credits allotted by doing 6 weeks Work-based Vocational Course/ Internship or Apprenticeship. Please referR25 Academic Regulations for more information.

PEE302PC: ELECTRICAL MACHINES - I

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites: Electrical Circuits- I & II

Course Objectives:

- To study and understand different types of DC machines and their performance evaluation through various testing methods.
- To understand the operation of single-phase and Three-phase Transformers
- Toanalyzetheperformanceoftransformersthroughvaroustestingmethods.

Course Outcomes: After successful completion of the course, the student will be able to:

- Identify different parts of a DC machines & understand their operation.
- Carry out different excitation, starting, speed control methods and testing of DC machines.
- Analyze single & three phase transformers and their performance through various testing methods.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To study and understand different types of DC Machines and their performance evaluation through various testing methods.	3	3	3	2	-	2	1	-	2	-	1	1
To understand the operation of single-phase and three-phase Transformers	3	3	3	2	-	2	1	-	2	-	1	1
To analyze the performance of transformers through various Testing methods	3	3	3	2	-	2	1	-	2	-	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Identify different parts of a DC machines & understand their operation	3	3	3	2	-	2	1	-	2	-	1	1
Carry out different excitation, starting, speed control methods and testing of DC machines	3	3	3	2	-	2	1	-	2	-	1	1
Analyze single & three phase transformers	3	3	3	2	-	2	1	-	2	-	1	1

and their performance through testing												

UNIT-I:

D.C. Generators: Principle of operation - Action of commutator - constructional features - armature windings- lap and wave windings - simplex and multiplex windings (elementary treatment only) - EMF Equation. Concept of Armature reaction and commutation - Cross magnetizing and de-magnetizing AT/pole. Methods of Excitation - separately excited and self-excited generators - build-up of EMF - critical field resistance and critical speed. Performance Characteristics of shunt, series and compound generators and applications.

UNIT-II:

DC Motors: Principle of operation-Back EMF.-Torque equation-characteristics and application of shunt, series and compound motors.

3-pointstarter, Speed control of DC shunt and series motors-Armature voltage and field flux control methods. Losses– Constant & Variable losses-calculation of efficiency–condition for maximum efficiency.

Testing of DC Machines: Methods of Testing-Direct, Indirect, and Regenerative Testing-Brake Test-Swinburne's Test- Hopkinson's Test.

UNIT-III:

Single Phase Transformers: Types-constructional details-minimization of hysteresis and eddy current losses- EMF equation - operation on no-load and on load - phasor diagrams and Applications.

UNIT-IV:

Equivalent circuit-lossesandefficiency–regulation-Alldayefficiency-effectofvariationsoffrequency & supply voltage on iron losses.

Testing of Transformers: Open Circuit and Short Circuit tests- Sumpner's Test- predetermination of efficiency and regulation-separation of losses test.

UNIT-V:

Parallel operation with equal and unequal voltage ratios - auto transformers- equivalent circuit - comparison with two winding transformers.

Poly-phase transformers- Poly-phase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ, Scott connection and Applications.

TEXT BOOKS:

1. P.S.Bimbhra, "Electrical Machinery", Khanna Publishers, Revised Edition, 2021.
2. I.J.Nagrath and D.P.Kothari, "Electric Machines", McGraw Hill Education, 2010.

REFERENCE BOOKS:

1. Prithwi raj Purkait, Indrayudh Bandy opadhyay, "Electrical Machines", Oxford, 2017.
2. M.G.Say, "Performance and design of AC machines", C B S Publishers, 2002.
3. A.E.Fitzgerald and C.Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
4. A.E.Clayton and N.N.Hancock, "Performance and design of DC machines", C B SPublishers, 2004.

Online Recourses:

1. https://nptel.ac.in/courses/108/105/108105155/
2. https://nptel.ac.in/courses/108/105/108105017/
3. https://nptel.ac.in/courses/108/106/108106071/

PEE304PC: POWERSYSTEM – I

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Electrical Circuits-I & II

Course Objectives:

- To understand the power generation through conventional and non-conventional sources
- To illustrate the economic aspects of power generation and tariff methods
- To know about substations and distribution systems

Course Outcomes: After successful completion of the course, the student will be able to:

- Understand the operation of conventional and renewable electrical power generating stations
- Evaluate the power tariff methods and Economics associated with power generation
- Analyze the operations of AIS &GIS and Distribution systems

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To understand the power generation through conventional and non-conventional sources	3	3	3	2	-	2	1	-	2	-	1	1
To illustrate the economic aspects of power generation and Tariff methods	3	3	3	2	-	2	1	-	2	-	1	1
To know about substations and distribution systems	3	3	3	2	-	2	1	-	2	-	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand the operation of conventional and renewable electrical power generating stations	3	3	3	2	-	2	1	-	2	-	1	1
Evaluate the power tariff methods and Economics associated with power generation	3	3	3	2	-	2	1	-	2	-	1	1
Analyze the operations of AIS & GIS, and Distribution systems	3	3	3	2	-	2	1	-	2	-	1	1

UNIT-I

Generation of Electric Power: Operation of Hydel, Thermal, Nuclear and Gas Power plant with layouts - Description of components-Choice of site-advantages and disadvantages, Introduction and description of components- renewable energy sources and plants (solar and wind).

UNIT-II:

Economics of Power Generation: Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, Load curve, Load duration curve, number and size of generator units. Base load and peak load plants.

Cost of electrical energy-fixed cost, running cost, Tariffs.

UNIT-III:

Air Insulated Substations (AIS): Indoor & Outdoor substations: Substations layout showing the location of all the substation equipment. Bus bar arrangements in the Sub-Stations: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams.

UNIT-IV

Gas Insulated Substations (GIS): Advantages of Gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, busbar, construction aspects of GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

UNIT-V:

AC Distribution: Introduction, AC distribution, Single phase, 3-phase3 wire, 3-phase4 wire system, busbar arrangement, Selection of site for substation. Voltage Drop Calculations (Numerical Problems) in AC Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

TEXT BOOKS:

1. C. L. Wadhwa, "Generation, Distribution and Utilization of Electrical Energy", 2nd Edition, New Age International, 2009.
2. A.Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar, "A Text book on Power System Engineering", Dhanpat Rai Publishing Company (P) Ltd, 2008.
3. J.B.Gupta, A Course in Power Systems" Katson Books,11th Edition, 2016.

REFERENCE BOOKS:

1. C.L.Wadhwa, "Electrical Power Systems", 5th Edition, New Age International, 2009.
2. M.V.Deshpande, "Elements of Electrical Power Station Design", 3rdEdition,Wheeler Pub.1998.
3. H.Cotton & H.Barber, "The Transmission and Distribution of Electrical Energy", 3rdEdition,1970.
4. W.D.Stevenson ,"Elements of Power System Analysis", 4th Edition, McGraw Hill,1984.
5. V. K. Mehta and Rohit Mehta, "Principles of Power Systems", S. Chand & Company Ltd, New Delhi, 2004.

Online Recourses:

1. https://nptel.ac.in/courses/108/102/108102047/
2. https://nptel.ac.in/content/storage2/courses/108105053/pdf/L-2(TB)(ET)((EE)NPTEL).pdf
3. https://onlinecourses.nptel.ac.in/noc20_ee67/preview

P. Jayapal

PEE305PC: ELECTRICAL MEASUREMENTS AND SENSORS

B.Tech. II Year I Sem.

L	T	P	C
2	0	0	2

Prerequisites: Electrical Circuits-I & II, Analog Electronics and Electromagnetic Fields.

Course Objectives:

- To introduce the basic principles of all measuring instruments.
- To deal with the measurement of voltage, current, Power factor, power, energy and magnetic measurements.
- To understand the basic concepts of smart and digital metering.

Course Outcomes: After successful completion of the course, the student will be able to:

- Understand different types of measuring instruments, their construction, operation and characteristics and identify the instruments suitable for typical measurements.
- Apply the knowledge about transducers and instrument transformers to use them effectively.
- Apply the knowledge of smart and digital metering for industrial applications.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To introduce the basic principles of all measuring instruments	3	3	2	2	2	-	-	-	1	-	-	1
To deal with the measurement of voltage, current, Power factor, power, energy and magnetic measurements.	3	3	2	2	2	-	-	-	1	-	-	1
To understand the basic concepts of smart and digital metering	3	3	2	2	2	-	-	-	1	-	-	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand different types of measuring instruments, their construction, operation and characteristics and identify the instruments suitable for typical measurements	3	3	2	2	2	-	-	-	1	-	-	1
Apply the knowledge about transducers and instrument transformers to use them effectively	3	3	2	2	2	-	-	-	1	-	-	1

Apply the Knowledge of smart and digital metering for industrial applications	3	3	2	2	2	-	-	-	1	-	-	1

UNIT-I:

Introduction to Measuring Instruments: Classification– deflecting, control and damping torques– Ammeters and Voltmeters - PMMC, moving iron type instruments - expression for the deflecting torque and control torque- Errors and compensations, extension of range using shunts and series resistance. Electrostatic Voltmeters-electrometer type and attracted disc type - extension of range of Electrostatic Voltmeters.

UNIT-II:

Potentiometers & Instrument Transformers: Principle and operation of DC Crompton's potentiometer - standardization - Measurement of unknown resistance, current, voltage. AC Potentiometers: polar and coordinate type's standardization - applications. CT and PT - Ratio and phase angle errors (Qualitative approach).

UNIT-III:

Measurement of Power & Energy: Single phase dynamometer wattmeter, LPF and UPF, Double element and three element dynamo meter wattmeter, expression for deflecting and control torques- Extension of range of watt meter using instrument transformers–Measurement of active and reactive powers in balanced and unbalanced systems.

Single phase induction type energy meter - driving and braking torques - errors and compensations - testing by phantom loading using RSS meter. Three phase energy meter - tri vector meter, maximum demand meters (Qualitative approach).

UNIT-IV:

DC & AC Bridges: Method of measuring low, medium and high resistance– sensitivity of Wheat-stone's bridge-Kelvin's double bridge for measuring low resistance, measurement of high resistance-loss of charge method.

Measurement of inductance- Maxwell's bridge, Hay'sbridge, Anderson's bridge. Measurement of capacitance and loss angle -De Sauty's Bridge - Wien's bridge - Schering Bridge. (Qualitative approach)

UNIT-V:

Sensors-Classification of transducers- Temperature sensors- Proximity sensor- Pressure sensor- IR sensors- Motion detection sensors- Ultrasonic sensors- Rotor Position Sensors, Operation of Strain Gauge-Thermo couples, construction and working of LVDT, Piezo electric transducers, photovoltaic, photo conductive cells, and photo diodes-Applications.

Smart instruments: Intelligent transducer, self-diagnosis and remote calibration features, HART communication, MEMS, non-linearity compensation; smart energy meter components, working principle; Automatic Meter Reading (AMR), Advanced Metering Infrastructure (AMI) environments.

TEXT BOOKS:

1. A.K. Sawhney, "Electrical & Electronic Measurement & Instruments", Dhanpat Rai &Co. Publications,2005.
2. Dr.Rajendra Prasad, "Electrical Measurements & Measuring Instruments", Khanna Publishers1989.

REFERENCE BOOKS:

1. G.K.Banerjee, "Electrical and Electronic Measurements", PHI Learning Pvt.Ltd., 2nd Edition,2016.
2. R.K. Rajput, "Electrical & Electronic Measurement & Instrumentation", S.Chandand Company Ltd., 2007.
3. S.C. Bhargava, "Electrical Measuring Instruments and Measurements", BS Publications, 2012.
4. Buckingham and Price, "Electrical Measurements", Prentice- Hall,1988.
5. Reissl and, M.U, "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Limited Publishers, 1st Edition 2010.
6. E.W.Golding and F.C.Widdis, "Electrical Measurements and measuring Instruments", fifth Edition,

Wheeler Publishing, 2011.

Online Recourses:

1. https://nptel.ac.in/courses/108/105/108105153/
2. https://www.cdac.in/index.aspx?id=pe_pe_PEG_SMARTENERGY

PEE307PC: ELECTRICAL MACHINES-I LAB

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

Prerequisites: Electrical machines-I

Course Objectives:

- To uncover he students to the operation of DC Generators.
- To know the operation of various types of DC Motors.
- To examine the performance of Single and Three Phase Transformers.

Course Outcomes: After successful completion of the course, the student will be able to:

- Start and control the Different DC Machines.
- Assess the performance of different machines using different testing methods
- Evaluate the performance of different Transformers using different testing methods

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To uncover the students to the operation of DC Generators	3	3	3	2	-	2	1	-	2	-	1	1
To know the operation of various types of DC Motors.	3	3	3	2	-	2	1	-	2	-	1	1
To examine the performance of Single and Three Phase Transformers	3	3	3	2	-	2	1	-	2	-	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Start and control the Different DC Machines	3	3	3	2	-	2	1	-	2	-	1	1
Assess the performance of different machines using different testing methods	3	3	3	2	-	2	1	-	2	-	1	1
Evaluate the performance of different Transformers using different testing methods	3	3	3	2	-	2	1	-	2	-	1	1

The following experiments are required to be conducted compulsory experiments:

1. Magnetization characteristics of DC shunt generator (Determination of critical field resistance and critical speed)
2. Load test on DC shunt generator (Determination of characteristics)
3. Load test on DC series generator (Determination of characteristics)
4. Hopkinson's test on DC shunt machines (Predetermination of efficiency)
5. Swinburne's test (Predetermination of efficiency)
6. Brake test on DC compound motor (Determination of performance curves)

7. OC and SC Test on Single Phase Transformer
8. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star)

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:

1. Brake Test on DC shunt motor (Determination of performance curves)
2. Load Test on DC compound generator (Determination of characteristics).
3. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
4. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
5. Speed control of DC shunt motor
6. Modeling of DC Machine using simulation tools.
7. Equivalent circuit of Transformer using simulation tools.

TEXT BOOKS:

1. P.S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I.J. Nagrath and D.P.Kothari, "Electric Machines", McGraw Hill Education, 2010.

REFERENCE BOOKS:

1. Prithwi raj Purkait, Indrayudh Bandyopadhyay, "Electrical Machines", Oxford, 2017.
2. M.G.Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. A.E. Fitzgerald and C.Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
4. A.E.Clayton and N.N.Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

PEE308PC: ELECTRICAL MEASUREMENTS AND SENSORS LAB

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

Prerequisites: Electrical Circuits-I & II

Course Objectives:

- To calibrate Watt, Energy and PF Meter and determination of three phase active & reactive powers.
- To determine unknown inductance, resistance, capacitance by performing experiments on DC Bridges & AC Bridges.
- To determine the ratio and phase angle errors of Instrument transformers.

Course Outcomes: After successful completion of the course, the student will be able to:

- Choose and test any measuring instruments.
- Find the accuracy of any instrument by performing experiments.
- Calculate the various parameters using different types of measuring instruments.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To calibrate Watt, Energy and PF Meter and determination of three phase active & reactive powers.	3	3	2	2	2	-	-	-	1	-	-	1
To determine unknown inductance, resistance, capacitance by performing experiments on DC Bridges & AC Bridges.	3	3	2	2	2	-	-	-	1	-	-	1
To determine the ratio and phase angle errors of Instrument transformers	3	3	2	2	2	-	-	-	1	-	-	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Choose and test any measuring instruments	3	3	2	2	2	-	-	-	1	-	-	1
Find the Accuracy of any instrument by performing experiments	3	3	2	2	2	-	-	-	1	-	-	1

Calculate the various parameters using different types of measuring instruments	3	3	2	2	2	-	-	-	1	-	-	1

The following experiments are required to be conducted as compulsory experiments:

1. Calibration and testing of single-phase energy Meter.
2. Calibration of dynamometer power factor meter.
3. Crompton DC Potentiometer-Calibration of PMMC ammeter and PMMC voltmeter.
4. Kelvin's double Bridge- Measurement of resistance- Determination of Tolerance.
5. Dielectric testing of oil using HT Testing Kit.
6. Schering Bridge & Anderson Bridge.
7. Measurement of 3-Phase reactive power with single-phase wattmeter.
8. Measurement of displacement with the help of LVDT.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:

1. Calibration LPF wattmeter-by Phantom testing.
2. Measurement of 3-phase power with single wattmeter and two CTs.
3. C.T. testing using mutual Inductor–Measurement of % ratio error and phase angle of given CT by Null method.
4. PT testing by comparison–V. G. as Null detector - Measurement of % ratio error and phase angle of the given PT
5. Resistance strain gauge-strain measurements and Calibration.
6. Transformer turns ratio measurement using AC bridges.
7. Measurement of % ratio error and phase angle of given CT by comparison.
8. Demonstration of different sensors using trainer kit

TEX TBOOKS:

1. A.K. Sawhney, "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Co. Publications, 2005.
2. Dr. Rajendra Prasad, "Electrical Measurements & Measuring Instruments", Khanna Publishers1989.

REFERENCE BOOKS:

1. G.K. Banerjee, "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2nd Edition, 2016.
2. R.K. Rajput, "Electrical & Electronic Measurement & Instrumentation", S.Chand and Company Ltd.,2007.
3. S.C. Bhargava, "Electrical Measuring Instruments and Measurements", BS Publications, 2012.
4. Buckingham and Price, "Electrical Measurements", Prentice- Hall,1988.
5. Reissl and, M.U, "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Limited Publishers, 1" Edition 2010.
6. E.W. Golding and F.C.Widdis, "Electrical Measurements and measuring Instruments", fifth Edition, Wheeler Publishing, 2011.

PEE310SD: DESIGN OF ELECTRICAL SYSTEMS USING AUTO CAD

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

Prerequisite:

Course Objectives:

1. To provide hands-on training in using Auto CAD for electrical design and drafting.
2. To understand the principles of preparing electrical wiring diagrams and panel layouts.
3. To enable students to design residential, commercial, and industrial electrical systems.
4. To introduce students to symbols, standards, and practices in electrical CAD.

Course Outcomes: After successful completion of the course, the student will be able to:

1. Apply Auto CAD tools to create electrical schematics and layouts.
2. Design residential and commercial wiring systems as per standards.
3. Develop and document substation and panel wiring drawings.
4. Inter prêt electrical diagrams and create professional CAD documentation.
5. Work on real-time electrical design problems using CAD tools.

Module I: Introduction to Auto CAD for Electrical Design Overview of Auto CAD interface and tools

- Layers, blocks, and an notation in Auto CAD
- Electrical symbols :IEC/ANSI/IS standards
- Drawing and modifying basic electrical elements

Lab Experiments:

- Creating simple electrical circuit diagrams using Auto CAD
- Use of layers and blocks for electrical layouts

Module II: House Wiring and Lighting System Design

- Design of single-line diagrams (SLDs)
- Layout of internal wiring for residential buildings
- Load calculation and cable selection
- Earthing and protection system basics

Lab Experiments:

- Preparation of residential wiring layout
- Switchboardandlightingplanfor1BHK/2BHKhouse

Module III: Commercial and Industrial Electrical Layouts

- Design of power circuits and lighting for commercial buildings
- Distribution board design and component placement
- Panel board and bus barn layout

Lab Experiments:

- Design and drafting of distribution system for a small commercial building
- Electrical room layout with control panels

Module IV: Substation and Control Circuit Design

- Single-line diagram of sub stations
- Control circuit schematics
- Relay control and contactor wiring diagrams
- Cable routing and tray layout

Lab Experiments:

- Drawing of 11kV/440V substation SLD
- Panel wiring diagram for DOL/Star-Delta motor starter

Module V: Mini Project and Professional Practice

- Project planning, drawing standards, title block, and BOM
- Design and documentation of a small-scale electrical system
- Printing, plotting, and exporting drawings

Lab Activity:

- Mini-project: Design and documentation of electrical system for a small apartment, lab, or factory setup

Software Requirements:

- Auto CAD Electrical (Student or Institutional License)
- Optional: E-Plan, Draft Sight, or similar tools for advanced users

TEXT BOOKS:

1. K.B. Raina andS.K. Bhattacharya "Electrical Design Estimating and Costing" New Age International.
2. Prof.Sham Tickoo "Auto CAD Electrical 2023 for Electrical Control Designers" CAD CIM Technologies.
3. Surjit Singh "Basic Electrical Engineering Drawing" Dhanpat Rai & Co.

REFERENC EBOOKS:

1. Frederic P.Hart well and Herbert P.Richter "Practical Electrical Wiring" Park Publishing.
2. James A. Leach and Shawna Lockhart "Auto CAD 2023 Instructor" SDC Publications.
3. Ray C. Mullin and Phil Simmons "Electrical Wiring Residential" C engage Learning.
4. IS732: Code of Practice for Electrical Wiring Installations.
5. National Electrical Code(NEC)-India.

Online Resources:

1. **Auto desk Knowledge Network**: https://knowledge.autodesk.com.
2. **NPTEL**: Basic Electrical Drawing and CAD-related modules (search under "Electrical Engineering").

PEE402PC: ELECTRICAL MACHINES - II

B.Tech. II Year II Sem.

L T P C
3 0 0 3

Prerequisites: Electrical Circuits-I & II and Electrical Machines-I

Course Objectives:

- To deal with the detailed analysis of three phase induction motors & Alternators.
- To understand operation, construction and types of single-phase motors and their applications.
- To introduce the concept of parallel operation of alternators.

Course Outcomes: After successful completion of the course, the student will be able to:

- Understand the concepts of rotating magnetic fields.
- Examine the operation of AC machines.
- Analyze performance characteristics of AC machines.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To deal with the detailed analysis of three phase induction motors & Alternators	3	3	3	2	-	2	1	-	2	-	1	1
To understand operation, construction and types of single-phase motors and their applications.	3	3	3	2	-	2	1	-	2	-	1	1
To introduce the concept of parallel operation of alternators	3	3	3	2	-	2	1	-	2	-	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand the concepts of rotating magnetic fields	3	3	3	2	-	2	1	-	2	-	1	1
Examine the operation of AC machines	3	3	3	2	-	2	1	-	2	-	1	1
Analyze performance characteristics of AC machines	3	3	3	2	-	2	1	-	2	-	1	1

UNIT-I:

Three Phase Induction Machines: Constructional details of cage and wound rotor machines- production of a rotating magnetic field - principle of operation - rotor EMF and rotor frequency - rotor reactance, rotor current and Power factor at stand still and using operation. Rotor power input, rotor copper loss and mechanical power developed and their interrelation. Torque equation-expressions for maximum torque and starting torque– torque-slip characteristics.

UNIT-II:

Characteristics of Induction Machines: Equivalent circuit- phasor diagram- crawling and cogging, No-load Test and Blocked rotor test -Predetermination of performance-Methods of starting and starting current and Torque calculations, Applications.

Speed Control Methods: Change of voltage, change of frequency, voltage/frequency, injection of an EMF in to rotor circuit (qualitative treatment only)-induction generator-principle of operation.

UNIT-III:

Synchronous Generator (Alternator): Constructional Features of round rotor and salient pole machines - Armature windings- Integral slot and fractional slot windings; Distributed and concentrated windings-distribution, pitch and winding factors–EMF Equation. Harmonics in generated EMF–suppression of harmonics-armature reaction-leakage reactance- synchronous reactance and impedance- phasor diagram- load characteristics.

UNIT-IV:

Regulation of Synchronous Generator: Synchronous impedance method, MMF method, ZPF method and ASA methods- two reaction theory- Determination of X_d and X_q (Slip test) Phasor diagrams–Regulation of salient pole alternators.

Parallel Operation of Synchronous Generator: Synchronizing Alternators with infinite bus bars–synchronizing power torque–parallel operation and load sharing -Effect of change of excitation and mechanical power input.

UNIT-V:

Synchronous Motors: Theory of operation - phasor diagram - Variation of current and power factor with excitation–synchronous condenser–Mathematical analysis for power developed. Hunting and its suppression- Methods of starting.

Single Phase Machines: Single phase induction motor - Constructional Features-Double revolving field theory - split-phase motors - AC series motor- Universal Motor- Shaded pole motor and Applications.

TEXT BOOKS:

1. P.S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I.J. Nagrath and D.P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

REFERENCE BOOKS:

1. Prithwi raj Purkait, Indrayudh B and yopadhyay, "Electrical Machines", Oxford, 2017.
2. M.G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. A.E. Fitzgerald and C. Kingsley, "Electric Machinery", NewYork, McGraw Hill Education, 2013.
4. A.E. Clayton and N.N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

Online Recourses:

1. https://nptel.ac.in/courses/108/105/108105131/
2. https://nptel.ac.in/courses/108/106/108106072/

PEE403PC: POWER SYSTEM – II

B.Tech. II Year II Sem.

L T P C
3 0 0 3

Prerequisite: Electrical Circuits- I & II and Power Systems–I

Course Objectives:

- To study the performance of transmission lines and travelling waves.
- To understand the concept of voltage control, compensation methods and per unit representation of power systems.
- To know the, Symmetrical components and fault calculation analysis

Course Outcomes: After successful completion of the course, the student will be able to:

- Analyze transmission line performance and apply load compensation techniques to control reactive power.
- Understand the application of per unit quantities in power systems.
- Determine the fault currents for symmetrical and unbalanced faults.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To study the performance of transmission lines and travelling waves.	3	3	3	2	-	2	1	-	2	-	1	1
To understand the concept of voltage control, compensation methods and per unit representation of power systems.	3	3	3	2	-	2	1	-	2	-	1	1
To know the, Symmetrical components and fault calculation analysis	3	3	3	2	-	2	1	-	2	-	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Analyze transmission line performance and apply load compensation techniques to control reactive power.	3	3	3	2	-	2	1	-	2	-	1	1
Understand the application of per unit quantities in power systems.	3	3	3	2	-	2	1	-	2	-	1	1

Determine the fault currents for symmetrical and unbalanced faults.	3	3	3	2	-	2	1	-	2	-	1	1

UNIT-I

Overhead Transmission Lines: Line conductors, Composite conductors transposition, bundled conductors, Inductance and capacitance of single phase and three phase lines with symmetrical spacing, and effect of earth on capacitance, skin and proximity effects.

Overhead Line Insulators: Introduction, types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, testing of insulators, Sag and Tension calculations.

UNIT-II:

Performance of Lines: Representation of lines, short transmission lines, medium length lines, nominal T and PI- representations, long transmission lines. The equivalent circuit representation of a long Line, A, B, C, and D constants, Ferranti Effect.

Corona: Introduction, disruptive critical voltage, corona loss, Factors affecting corona loss and methods of reducing corona loss, Advantages and Disadvantages of corona, interference between power and Communication lines.

UNIT-III:

Voltage Control & Power Factor Improvement: Introduction - methods of voltage control, shunt and series capacitors / Inductors, tap changing transformers, synchronous phase modifiers, power factor improvement methods.

Compensation in Power Systems: Introduction - Concepts of Load compensation–Load ability characteristics of overhead lines - Uncompensated transmission line - Symmetrical line.

UNIT-IV

Per Unit Representation of Power Systems: The one-line diagram, impedance and reactance diagrams, per unit quantities, changing the base of per unit quantities, advantages of per unit system.

Travelling Waves on Transmission Lines: Production of travelling waves, open circuited line, short-circuited line, line terminated through a resistance, line connected to a cable, Reflection and Refraction coefficients.

UNIT-V:

Symmetrical Components and Fault Calculations: Significance of positive, negative and zero sequence components, Average 3-phase power in terms of symmetrical components, sequence impedances and sequence networks, fault calculations, sequence network equations, single line to ground fault, line to line fault, double line to ground fault, three phase fault, faults on power systems, faults with fault impedance, reactors and their location, short circuit capacity of a bus.

TEXT BOOKS:

1. C.L. Wadhwa, "Generation, Distribution and Utilization of Electrical Energy", 3rd Edition, New Age International, 2009.
2. D.P. Kothari and I.J.Nagrath, "Modern Power System Analysis", Tata McGraw Hill Pub. Co., New Delhi, Fourth edition, 2011.

REFERENCE BOOKS:

1. A. Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar, "A Textbook on Power System Engineering", Dhanpat Rai Publishing Company (P) Ltd, 2008.
2. W.D. Stevenson, "Elements of Power System Analysis", 4th Edition, McGraw Hill, 1984.
3. John J. Grainger & W.D. Stevenson, "Power System Analysis", McGraw Hill International,1994.
4. Hadi Sadat, "Power System Analysis", Tata McGraw Hill Pub.Co. 2002.

Online Recourses:

1. https://nptel.ac.in/courses/108/102/108102047/

PEE405PC: CONTROL SYSTEMS

B.Tech. II Year II Sem. **L T P C**
3 0 0 3

Prerequisite: Electrical Circuits-I &II and Electrical Machines-I

Course objectives:

- Understand the mathematical modeling of physical systems.
- Comprehend there presentation of dynamical systems through input-output models, including transfer functions and state-space models.
- Understand the design of controllers and compensators to enhance the performance and stability of dynamical systems

Course Outcomes: After successful completion of the course, the student will be able to:

- Findthetransferfunctionandstate-spacerepresentationoflineartime-invariantdynamicalsystems.
- Analyzetheperformanceandstabilityoflineartime-invariantsystemsinboththimeandfrequency domains.
- Studyclassicalcontrollers/compensatorstoimprovetheperformanceandstabilityoflineartime- invariant systems.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand the mathematical modelling of physical systems.	3	3	3	3	3	-	-	1	-	-	2	2
Comprehend the representation of dynamical systems through input-output models, including transfer functions and state-space models.	3	3	3	3	3	-	-	1	-	-	2	2
Understand the design of controllers and compensators to enhance the performance and stability of dynamical systems	3	3	3	3	3	-	-	1	-	-	2	2

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Find the transfer function and st ate-space representation of linear time-invariant dynamical systems	3	3	3	3	3	-	-	1	-	-	2	2

Analyze the performance And stability of linear time-invariant systems in	3	3	3	3	3	-	-	1	-	-	2	2
Both time and frequency domains												
Study the classical controllers/compensators to improve the performance and stability of linear time-invariant systems.	3	3	3	3	3	-	-	1	-	-	2	2

UNIT-I:

Mathematical modeling of physical systems: Open–loop and Closed loop Systems, Concept of Feedback Control, Benefits of Feedback and Effects of feedback, Linear, Non-Linear, Time Variant and Time Invariant systems, Mechanical and Electrical Systems. Transfer function, Block-Diagram Techniques, Signal flow graph, Controller Components: DC Servo motors, AC Servomotors, Synchro's.

UNIT-II:

Time-Domain Analysis with Input-Output Models: Time response of first and second order systems for standard test inputs. Analysis of standard Second order systems with step input, Types of System, Error Analysis for Linear time Invariant Systems, Design specifications for second-order systems based on the time- response.

Concept of Stability: Routh-Hurwitz Criteria. Relative Stability analysis, Root-Locus technique: Construction of Root-loci.

UNIT-III:

Frequency Domain Analysis: Introduction to frequency response, Relationship between time and frequency response, Concept of Bode plots and construction. Polar plots, Nyquist stability criterion. Relative stability using Nyquist criterion –gain and phase margin

UNT -IV:

Classical Controllers and Compensators: Proportional, Integral and Derivative Controllers-PI, PD and PID controllers, Lead, Lag and Lead-Lag compensators (elementary treatment only).

UNT -V:

State Variable Analysis: Concept of State, State variables and State model. State Representation, Transformation of State variables, Solution of state equations and Complete response of the Systems. Concept of controllability and observability.

TEXT BOOKS:

1. I.J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.
2. B.C. Kuo, "Automatic Control System", Prentice Hall, 1995.
3. Norman S Nise, "Control Systems Engineering", Wiley, 2019 8th Edition.

REFERENC EBOOKS:

1. K.O gata, "Modern Control Engineering", Prentice Hall,1991.
2. K.R. Varmah, "Control Systems", McGraw Hill Education, 2010.

Online Recourses:

1. https://www.controleng.com
2. https://www.mathworks.com
3. https://nptel.ac.in/courses/108/102/108102043

PEE407PC: ELECTRICAL MACHINES - II LAB

B.Tech. II Year II Sem.

L T P C
0 0 2 1

Prerequisites: Electrical Machines–I

Course Objectives:

- To understand the operation of Induction, Synchronous Machines and Transformers.
- To study the performance analysis of Induction and Synchronous Machines through various Testing methods.
- To analyze the performance of single and three-phase transformers.

Course Outcomes: After successful completion of the course, the student will be able to:

- Assess the performance of different types of AC machines using different testing methods.
- Analyze the suitability of AC machines and Transformers for real word applications
- Determine the performance of single and three-phase transformers.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To understand the operation of Induction, Synchronous machines and Transformers	3	3	3	3	3	-	-	1	-	-	2	2
To study the performance analysis of Induction and Synchronous Machines through various Testing methods	3	3	3	3	3	-	-	1	-	-	2	2
To analyze the performance of single and three-phase phase transformer	3	3	3	3	3	-	-	1	-	-	2	2

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Assess the performance of different types of AC machines using different Testing methods	3	3	3	3	3	-	-	1	-	-	2	2
Analyze the suitability of AC machines and Transformers for real word applications	3	3	3	3	3	-	-	1	-	-	2	2
Determine the performance of single and three-phase transformers	3	3	3	3	3	-	-	1	-	-	2	2

The following experiments are required to be conducted as compulsory experiments:

1. Sumpner's test on a pair of single-phase transformers
2. No-load & Blocked rotor tests on three phase Induction motor
3. Regulationofathree-phasealternatorbysynchronousimpedance&MMFmethods
4. 'V' and 'Inverted V' curves of a three–phase synchronous motor.
5. Equivalent Circuit of a single-phase induction motor
6. Determination of Xd and Xq of a salient pole synchronous machine
7. Brake Test on three phase Induction Motor
8. Regulation of three-phase alternator by ZPF and ASA methods

In addition to the above experiments, at least any two of the following experiments are required to be conducted from the following list:

1. Separation of core losses of a single-phase transformer
2. Efficiency of a three-phase alternator
3. Parallel operation of Single-phase Transformers
4. Measurement of sequence impedance of a three-phase alternator.
5. Scott Connection of transformer

TEXT BOOKS:

1. P.S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I.J. Nagrath and D.P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

REFERENCE BOOKS:

1. Prithwiraj Purkait, Indrayudh B and yopadhyay, "Electrical Machines", Oxford, 2017.
2. M.G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. A.E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
4. A.E. Clayton and N.N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

PEE408PC: CONTROL SYSTEMS LAB

B.Tech. II Year II Sem. **L T P C**
0 0 2 1

Course Objectives:

- Understand system representations like transfer function and states pace, and assess system dynamic response.
- Evaluate system performance using both time and frequency domain analyses, identifying methods to enhance performance.
- Study controllers and compensators to improve system performance based on the assessments from time and frequency domain analyses.

Course Outcomes: After successful completion of the course, the student will be able to:

- Improve system performance by skillfully selecting appropriate controllers and compensators tailored to specific applications.
- Applydiversetimedomainandfrequencydomaintechniquestoeffectivelyassessandenhance system performance.
- Demonstrate the application of various control strategies to different systems such as power systems and electrical drives, showcasing adaptability and versatility in control applications.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand system representations like transfer function and states pace, and assess system dynamic response.	3	3	3	3	3	-	-	1	-	-	2	2
Evaluate system performance using both time and frequency domain analyses, identifying methods to enhance performance.	3	3	3	3	3	-	-	1	-	-	2	2
Study controllers and compensators to improve system performance based on the assessments from time and frequency domain analyses	3	3	3	3	3	-	-	1	-	-	2	2

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Improve system performance by	3	3	3	3	3	-	-	1	-	-	2	2

Skillfully selecting appropriate controllers and compensators tailored to specific applications.												
Apply diverse time domain and frequency domain techniques to effectively assess and enhance system performance.	3	3	3	3	3	-	-	1	-	-	2	2
Demonstrate the application of various control strategies to different systems such as power systems and electrical drives, showcasing adaptability and versatility in control applications.	3	3	3	3	3	-	-	1	-	-	2	2

The following experiments are required to be conducted compulsory experiments:

1. Time response of Second order system
2. Characteristics of Synchro's
3. Effect of feedback on DC servomotor
4. Transfer function of DC motor
5. Transfer function of DC generator
6. Lag and lead compensation-Magnitude and phase plot
7. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using simulation tools.
8. State space model for classical transfer function using simulation tools.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

1. Characteristics of AC servo motor
2. Temperature controller using PID
3. Effect of P, PD, PI, PID Controller on a second order systems
4. (a) Simulation of P, PI, PID Controller.
   (b) Linear system analysis (Time domain analysis, Error analysis) using suitable software
5. Programmable logic controller- Study and verification of truth tables of logic gates, simple Boolean expressions, and application of speed control of motor.
6. Design of Lead-Lag compensator for the given system and with specification using suitable software

TEXT BOOKS:

1. M.Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
2. B.C.Kuo, "Automatic Control System", Prentice Hall, 1995.

REFERENCE BOOKS:

1. K.Ogata, "Modern Control Engineering", Prentice Hall, 1991.
2. I.J. Nagrath and M.Gopal, "Control Systems Engineering", New Age International, 2009.

PEE410SD: PCB DESIGN

B.Tech. II Year II Sem. **L T P C**
0 0 2 1

Course Objectives:

- To understand the basics of PCB types, materials, and design standards.
- To gain hands-on experience with PCB layout software tools.
- To develop skills in schematic capture, component placement, routing, and Gerber generation.
- To fabricate and test a simple single-layer PCB.

Course Outcomes: After successful completion of the course, the student will be able to:

- Understand the design and fabrication process of PCBs.
- Design schematic diagrams and convert them to PCB layouts.
- Apply routing and layout techniques using EDA tools.
- Generate Gerber files and perform DRC/ERC effectively.
- Fabricate, assemble, and test basics ingle-layer PCBs.

Module I: Fundamentals of PCB Design

- Types of PCBs: Single-layer, Double-layer, Multilayer
- PCB materials and manufacturing process
- PCB design rules and standards (IP Cstandards)
- Introduction to EDA tools (e.g., Ki Cad, Eagle, Altium, Easy EDA)

Lab Activity:

- Exploring the user interface of PCB design software
- Setting up design rules

Module II: Schematic Design

- Creating circuits schematics using PCB CAD tools
- Component library management
- Electrical rule checking (ERC)
- Net list generation

Lab Activity:

- Designing a basic power supply or LED flasher circuit
- Performing ERC and generating net list

Module III: PCB Layout and Routing

- Importing net list to layout editor
- Foot print assignment and component placement
- Manuals auto-routing
- Design Rule Check (DRC)

Lab Activity:

- Placing components and routing for the schematic designed earlier
- Performing DRC and correcting errors

Module IV: PCB Output Files and Fabrication

- Generating Gerber files, drill files, and BOM
- Understanding layers (Top, Bottom, Solder mask, Silkscreen)
- PCB printing, photo resist method, and etching
- Introduction to SMD and through-hole assembly

Lab Activity:

- Generate Gerber files and preview using Gerber viewer

Module V: Mini Project and Testing

- Assembling components on fabricated PCB
- Soldering and de soldering techniques
- Continuity testing and trouble shooting
- Mini-project: Design a simple power supply, logic gate trainer, or timer circuit

Lab Activity:

- Complete mini project: From schematic to testing of PCB

TEXT BOOKS:

1. Walter C. Boss hart "Printed Circuit Board Design and Technology" Tata McGraw Hill
2. Clyde F. Coombs "Printed Circuit Boards: Design and Technology": McGraw-Hill
3. Peter Dalmaris "PCB Design Using Ki Cad6"

REFERENCE BOOKS:

1. *Kraig Mitzner* **"Complete PCB Design Using Or CAD Capture and PCB Editor"**
2. *James Angus* **"Electronic Product Design"**

IPC Standards:

1. IPC-2221: Generic Standard on Printed Board Design
2. IPC-7351: Generic Requirements for Surface Mount Design

Software Tools (Free/Open Source Recommended):

1. **Ki Cad** (Open-source)
2. **Easy EDA** (Online tool)
3. **Eagle CAD** (Free for education)
4. **LT Spice/Tinker cad** for circuit simulation (optional)