Vidya Pratishthan's Kamalnayan Bajaj Institute of Institute of Engineering and Technology, Baramati

Faculty of Science & Technology

Board of Studies

Electrical Engineering

SY B.Tech. Electrical Engineering

(Pattern: 2024)

(w.e.f. AY: 2025-26)

Syllabus: Second Year (SY B. Tech.) Electrical Engineering (2024 Pattern)
w.e.f. AY:2025-2026

SEMESTER-I

Course Code	NEP Category	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
BS24206	BSC	Application of Mathematics in Electrical Engineering	3			10	30	60				100	3			3
EL24201	PCC	Electrical Measurement and Instrumentation	3	2	-	10	30	60		30		130	3	1	-	4
EL24202	PCC	Electrical Circuit Analysis	3	2	-	10	30	60			30	130	3	1	-	4
EL24203	PCC	Analog and Digital Electronics	3	2	-	10	30	60		30		130	3	1	-	4
EL24204	VSEC	Energy Audit (Vocational and Skill Enhancement course)		2	1	10			30		30	70		1	1	2
XX240XX	MDM	Multi-disciplinary minor	2	2	-	10		60	30			100	2	1	-	3
EL24205	CORE	Community Engagement Project		4		10			30		30	70		2		2
Total			**14**	**14**	**1**	**70**	**120**	**300**	**90**	**60**	**90**	**730**	**14**	**7**	**1**	**22**

SEMESTER-II

Course Code	NEP Category	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
EL24211	PCC	Electrical Machines - I	3	2	-	10	30	60		30		130	3	1	-	4
EL24212	PCC	Power Electronics	3	2	-	10	30	60			30	130	3	1	-	4
EL24213	PCC	Power System Engineering	3		-	10	30	60				100	3		-	3
XX240XX	MDM	Multi-disciplinary minor	3	2	-	10	30	60	30			130	3	1	-	4
OE240XX	OE	(Open Electives)	2	-	-	10		60				70	2	-	-	2
HS24201	AEC	Public Speaking and Aptitude	1	2		10			30		30	70	1	1		2
HS24211	VEC	Environment Studies	2			10		60				70	2			2
Total			**17**	**8**	**0**	**70**	**120**	**360**	**60**	**30**	**60**	**700**	**17**	**4**	**0**	**21**

Mrs. J.S. Kulkarni
Dept. Autonomy Coordinator
Electrical Engg Dept.

Mrs. S. D. Rokade
Dept. Academic Coordinator
Electrical Engg Dept.

Mrs. P.N. Jaiswal
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Dr. C. B. Nayak
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VPKBIET BARAMATI
Affiliated to S.P.P.U. Pune Id No. PU/PN/Engg./152/2000
PUNE (MS.)

BS24206: Application of Mathematics in Electrical Engineering		
Teaching Scheme	**Credits: 03**	**Examination Scheme**
Theory: 3 Hrs./week		**In-Semester: 30Marks**
		End-Semester: 60 Marks
		Activity:10 Marks

Prerequisite Courses:
Differential & Integral calculus, Taylor series, Differential equations of the first order and first degree, Fourier series, Vector algebra and Complex numbers.

Course Objectives:
1. To familiarize the students with concepts and techniques in Ordinary differential equations, Fourier Transform & Z-Transform, Numerical methods, and Vector Calculus.
2. The aim is to equip them with the techniques to understand advanced-level mathematics and its applications that would enhance analytical thinking power, useful in their discipline.

Course Outcomes (COs): On successful completion of the course, the learner will be able to:
CO1: Solve higher-order linear differential equations using appropriate techniques for modeling and analyzing electrical circuits.
CO2: Apply Laplace transform to solve differential equations and problems related to signal processing and control systems.
CO3: Learn the concept of fourier transform and apply it to engineering problems.
CO4: Understand the concept of Z-transform and apply them to solve difference equations.
CO5: Perform vector differentiation & integration, to analyze the vector fields, and apply them to electromagnetic fields.
CO6: Analyze Complex functions, and conformal mappings, and perform contour integration in their study.

Course Content

Unit I: Linear Differential Equations (LDE) and Applications (7 Hrs)
Introduction, Solution of LDE, General method, short-cut method, Method of variation of parameters, Cauchy's, and Legendre's DE, Modeling of Electrical circuits.

Unit II: Laplace Transform (LT) (7 Hrs)
Properties and theorems of Laplace and Inverse Laplace transform. Laplace transform of standard functions and some special functions. Applications of LT for solving linear differential equations in Electrical systems.

Unit III: Fourier Transform (7 Hrs)
Fourier integral theorem, Fourier Sine & Cosine integrals, Fourier transform, Fourier Sine and Cosine transforms, and inverse transforms.

Unit IV: Z Transform (7 Hrs)
Introduction, Theorems and Properties of Z-transform, and Inverse Z-transform. Applications of Z-transforms to solve differential equations.

Unit V: Vector Calculus (7 Hrs)
Vector differentiation: Gradient, Divergence and Curl, Directional derivative, Solenoidal, Conservative fields, Scalar potential, and vector identities.
Vector Integration: Line, Surface, and Volume integrals, Work-done, Green's Lemma, Stoke's theorem, Gauss's Divergence theorem. Applications to problems in Electromagnetic fields.

Unit VI: Complex Variables (7 Hrs)
Functions of a Complex variable, Analytic functions, Cauchy-Riemann equations. Conformal mapping, Bilinear transformation. Cauchy's integral theorem, Cauchy's integral formula, Residue theorem, and applications.

Books and other Resources:
Textbooks:
1. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill).
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).

Reference Books:
1. Advanced Engineering Mathematics, 10e, by Erwin Kreyszig (Wiley India).
2. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).
3. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Cengage Learning).
4. Differential Equations, 3e by S. L. Ross (Wiley India).
5. Introduction to Probability and Statistics for Engineers and Scientists, 5e, by Sheldon M. Ross (Elsevier Academic Press).
6. Complex Variables and Applications, 8e, by J. W. Brown and R. V. Churchill (McGraw-Hill)

MOOC/NPTEL Courses:
1. Course on "Integral & Vector Calculus" https://nptel.ac.in/courses/111/105/111105122/
2. Course on "Complex Analysis" https://nptel.ac.in/courses/111/103/111103070/
3. Course on "Transform Calculus and its applications in differential equations." https://nptel.ac.in/courses/111/105/111105123/

PAC-1
Amol S. Jadhav

PAC-2
Sonawane D. S.

PAC-3
Bhoite G. G.

VPKBIET BARAMATI PUNE (MS.)

EL24201: Electrical Measurement and Instrumentation		
Teaching Scheme: **TH: 03 Hrs/Week** **PR: 02 Hrs/Week**	**Credits:04**	**Examination Scheme:** **Course Activity: 10 Marks** **In-Semester Exam: 30 Marks** **End-Semester Exam: 60 Marks** **Practical Exam: 30 Marks**

Prerequisite Courses:

Basic Electrical Engineering

Course Objectives:

1. To study the principle of operation and working of different types of instruments.
2. To understand the principle of operation and working of various types of bridges for measurement of parameters –resistance, inductance, capacitance.
3. To explain the construction, working principle of various types of instruments for measurement of electrical power.
4. To demonstrate construction, working principle of various types of instruments for measurement of energy.
5. To explain the principles of oscilloscope, transducer and sensor for measurement of various electrical quantities.
6. To study various types of measurement techniques like level, displacement and flow measurement.

Course Outcomes

On completion of the course, learner will be able to:

CO-1: Explain various characteristics and classification of measuring instruments along with techniques of range extension.

CO-2: Apply measurement techniques for measurement of resistance, inductance, and capacitance.

CO-3: Describe construction, working principle of various types of instruments for measurement of power.

CO-4: Describe construction, working principle of various types of instruments for measurement of energy

CO-5: Apply knowledge of oscilloscope, transducer and sensor for measurement of various electrical quantities.

CO-6: Explain the level measurement, displacement measurement and flow measurement.

Course Contents

Unit I: Measuring Instruments (7 Hrs)

A. Classification of Measuring Instruments:

Characteristics of measuring instruments: static and dynamic, accuracy, linearity, speed of response, dead zone, repeatability, resolution, span, reproducibility, drifts. Necessity of calibration, standards and their classification, absolute and secondary instruments, types of secondary instruments: indicating, integrating, and recording, analog and digital. Laser distance meter, Laser tachometer, Ammeter, and Voltmeter Theory: Essentials of indicating instruments deflecting, controlling, and damping systems. Construction, working principle, torque equation, advantages, and disadvantages of Moving Iron (MI) instruments (attraction and repulsion). Block diagram and operation of digital ammeter & voltmeter.

B. Range Extension:

Instrument Transformers: Construction, connection of CT & PT in the circuit, advantages of CT / PT for range extension of MI Instruments, transformation ratio, turns ratio, nominal ratio, and burden, ratio, and phase angle error.

Unit II: Measurement of Resistance, Inductance and Capacitance (7 Hrs)

A. **Measurement of Resistance:** Measurement of low, medium, and high resistance. Wheatstone bridge, Kelvin's double bridge, ammeter-voltmeter method, Megger. Earth tester for earth resistance measurement.

B. **Measurement of Inductance:** Introduction, sources, and detectors for A.C. Bridge. General equation for bridge balances, Maxwell's inductance - Capacitance Bridge, Anderson's bridge.

C. **Measurement of Capacitance:** Introduction, types of capacitances, measurement of capacitance by Schering Bridge.

Unit III: Measurement of Power (7 Hrs)

Construction, working principle, torque equation, errors and their compensation, advantages and disadvantages of dynamometer type wattmeter, low power factor wattmeter, poly-phase wattmeter. Active & reactive power measurement in three phase system for balanced and unbalanced load using three wattmeter method, two wattmeter method & one wattmeter method.

Unit IV: Measurement of Energy **(6 Hrs)**

Construction, working principle, torque equation of single phase conventional (induction type) energy meter. Block diagram and operation of single phase and three phase static energy meter. Calibration of static energy meter, TOD meter, Digital energy meter, Bidirectional net meter.

Unit V: Oscilloscope, Transducers & Sensors **(6 Hrs)**

A. **Oscilloscope:** Introduction, various parts, front panel controls, use of CRO for measurement of voltage, current, period, frequency. Phase angle & frequency by Lissajous pattern. Introduction to DSO.

B. **Transducers:** Introduction, classification, types: resistive, inductive, capacitive, basic requirements for transducers.

C. **Sensors:** Position sensors, Pressure sensors, Temperature sensors, Force sensors, Vibration sensors, Piezo sensors, Humidity sensors, Fluid property sensors.

Unit VI: Level, Displacement and Flow Measurement **(6 Hrs)**

A. **Level Measurement:** Introduction and importance of level measurement, level measurement methods: mechanical, hydraulic, pneumatic, electrical, nucleonic, and ultrasonic.

B. **Displacement Measurement:** LVDT & RVDT construction, working, applications, specifications, advantages & disadvantages, effect of frequency on performance.

C. **Flow Measurement:** Introduction, characteristics, construction & working of solenoid valve and its applications.

Books & other Resources:

Text Books:

1. A. K. Sawhney, "A Course in Electrical and Electronic Measurements & Instrumentation", Dhanpat Rai & Co.
2. J. B. Gupta, "A Course in Electronics and Electrical Measurements and Instrumentation", S. K. Kataria & Sons.
3. R. K. Jain, "Mechanical and Industrial Measurements", Khanna Publishers.
4. B. C. Nakra & K. K. Chaudhari, "Instrumentation Measurement and Analysis", Tata McGraw Hill.

Reference Books:

1. E. W. Golding & F. C. Widdies, "Electrical Measurements & Measuring Instruments", Reem Publications.
2. Dr. Rajendra Prasad, "Electronic Measurements & Instrumentation", Khanna Publishers.
3. Arun K. Ghosh, "Introduction to Measurements and Instrumentation", PHI Publication.
4. M. M. S. Anand, "Electronics Instruments and Instrumentation Technology", PHI Publication.

Guidelines for Laboratory Conduction:

1. DO's and DON'TS, along with precautions, are needed to be displayed at prominent locations in the laboratory.
2. Students should be informed about DO'S and DON'T and precautions before performing.

Guidelines for Students Lab Journal:

The Student's Lab Journal should contain following related to every experiment –

1. Theory related to the experiment.
2. Apparatus with their detailed specifications.
3. Connection diagram /circuit diagram.
4. Observation table/ simulation waveforms.
5. Sample calculations for one/two readings.
6. Result table.
7. Graph and Conclusions.
8. There should be continuous assessment for the TW.
9. Assessment must be based on understanding of theory, attentiveness during practical, understanding Session, how efficiently the student is able to make connections and get the results, and timely submission of journals.

List of Practicals (Any 08 experiments to be performed by the student)

1. To perform measurement of medium resistance by Ammeter - Voltmeter method.
2. To perform measurement of low resistance using Kelvin's double bridge.
3. To perform demonstration of Power analyser and multifunction meter for measurement of various electrical quantities.
4. To perform extension of ammeter range using CT, voltmeter range using PT and watt meter range using CT / PT.

5. To perform calibration of single-phase wattmeter at different power factors.
6. To perform measurement of active & reactive power in three phase balanced circuit using one wattmeter method with a two-way switch.
7. To perform measurement of three phase active & reactive power by two wattmeter method for balanced as well as unbalanced load.
8. To perform measurement of reactive power by one wattmeter with all possible connections of current coil and pressure coil.
9. To perform measurement of active power in three phases, four wire system using three CTs & two wattmeter.
10. To perform calibration of single-phase energy meter at different power factors.
11. To perform measurement of the displacement by using LVDT and plotting its characteristics.
12. To perform measurement of Inductance, Capacitance and Resistance using LCR meter.

Note : The list of experiments is not limited to the above, but a course coordinator may design few new experiments based on recent technologies/trends in the relevant Engineering Domain. However the course coordinator needs to get approval by the Program Assessment Committee and Chairman BOS/HOD well in time.

Industrial Visit: Minimum one visit should be arranged to electrical instrument manufacturing company or where electrical instruments are calibrated or where various measuring instruments (Electrical/Mechanical) can be seen or observed.

Course Activity (Any ONE of the following):

For the assessment of Course Activity, a student must complete at least ONE activity out of the following:

1. Chart preparation
2. Power point presentation

Mr. A. B. Akhade
PAC Member 1

Mrs. P. N. Jaiswal
PAC Member 2

Mrs. V. V. Deokate
PAC Member 3

VES BIET BAIRAMATI PUNE (MS.)

EL24202: Electrical Circuit Analysis		
Teaching Scheme: **TH: 03 Hrs/Week** **PR: 02 Hrs/Week**	**Credits:04**	**Examination Scheme:** **Course Activity: 10 Marks** **In-Semester Exam: 30 Marks** **End-Semester Exam: 60 Marks** **Oral Exam: 30 Marks**

Prerequisite Courses:

Engineering Physics, Engineering Mathematics I & II, Basic Electrical Engineering

Companion Course, if any: Laboratory Practical

Course Objectives:

1. To understand types of sources and to develop the ability to solve and analyse problems on electric circuits by application of the knowledge of Mesh Analysis, Nodal Analysis, Duality and Graph Theory.
2. To develop the ability to apply knowledge of various network theorems to electrical circuits to simplify, solve and analyse the electric circuit problems.
3. To understand and analyse transient and steady-state response of RLC circuits with time domain approach.
4. To be able to obtain Laplace Transformed networks and analyse transient and steady-state response of RLC circuits with Laplace Transform approach.
5. To understand and evaluate two port network parameters and their interrelationships and to design other circuit like passive filters.
6. To be able to determine network functions and to obtain time domain behaviour from the Pole-Zero plot to perform stability analysis.

Course Outcomes:

On completion of the course, learner will be able to:

CO-1: Solve and analyse problems on electric circuits by applying the knowledge of Mesh Analysis, Nodal Analysis, Duality and Graph Theory.

CO-2: Simplify, solve and analyse the electric circuit problems by applying knowledge of various network theorems.

CO-3: Analyse transient and steady-state response of RLC circuits in time domain.

CO-4: Apply Laplace transform to analyse transient and steady-state behaviour of RLC circuits.

CO-5: Evaluate two port network parameters and develop their interrelationships and design other circuit like passive filters.

CO-6: Determine network functions and obtain time domain behaviour from the Pole-Zero plot to perform stability analysis.

Course Contents

Unit I: Source Transformation, Mesh & Nodal Analysis, Duality, Graph Theory (7 Hrs)

Types of Sources: AC Sources, DC Independent (Ideal & Practical) and DC Dependent (controlled) voltage and current sources, Source Transformation, KVL & KCL, Mesh and Nodal Analysis of circuits with all types of sources, Concept of super node and super mesh, Concept of duality and dual networks, Dot convention for coupled circuits.

Graph Theory: Tree, Co-tree, Incidence matrix, F-cutest Matrix, Tie set B Matrix.

Unit II: Network Theorems **(7 Hrs)**

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Compensation theorem applied to electrical networks with all types of sources (AC & DC, DC independent and dependent).

Unit III: Transient Analysis in RLC Circuits – Time Domain Approach (7 Hrs)

Solution of first and second order differential equations for series and parallel R-L, R-C, RLC circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

Unit IV: Transient Analysis in RLC Circuits – Laplace Transform Approach (7 Hrs)

Introduction to Laplace transform, Properties of Laplace transforms, step, pulse, impulse & ramp functions, Laplace Transform of Basic R, L and C components, Laplace transformed networks with initial conditions, Solutions of differential equations and network equations using Laplace transform method for R-L, R-C and R-L-C circuits (series and parallel), Application of initial and final value theorem, Inverse Laplace transforms.

Unit V: Two Port Networks and Passive Filters **(7 Hrs)**

One Port and Two port networks, Open Circuit Impedance (Z) Parameters, Short circuit Admittance (Y) Parameters, Transmission (ABCD) Parameters, Inverse Transmission (A'B'C'D') Parameters, Hybrid (h) Parameters, Inverse Hybrid (g) Parameters, inter-relationships between all two port network parameters, Introduction to passive filters, low pass filters, high pass filters and m-derived LPF and HPF filters and design.

Unit VI: Network Functions **(7 Hrs)**

Driving Point functions for One and Two Port Networks, Transfer functions for two port network, Calculation of network functions, Poles and Zeros of network functions, Pole-Zero Plot, time domain behaviour from the Pole-Zero plot, Restrictions on poles and zeros locations for transfer functions and driving point functions, Parallel Resonance, Quality Factor.

Books & Other Resources:

Text Books:

1. Network Analysis, M. E. Van Valkenburg, Prentice Hall of India Private Limited.
2. Network Analysis & Synthesis, G. K. Mittal, Khanna Publication.
3. Network Analysis and Synthesis, Ravish R Singh, McGraw Hill.
4. Introduction to Electric Circuits, S. Charkraborty, Dhanpat Rai & Co.
5. Fundamentals of Electrical Networks, B. R. Gupta & Vandana Singhal, S. Chand Publications

Reference Books:

1. Introduction to Electric Circuits, Alexander & Sadiku, McGraw Hill.
2. Network Analysis, Cramer, McGraw Hill Publication.
3. Engineering Circuit Analysis, William H. Hayt, Jr. Jack E. Kemmerly, McGraw Hill Publication.

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Guidelines for Students Lab Journal:

The Student's Lab Journal should contain following related to every experiment –

1. Theory related to the experiment.
2. Apparatus with their detailed specifications.
3. Connection diagram /circuit diagram.
4. Observation table/ simulation waveforms.
5. Sample calculations for one/two readings.
6. Result table.
7. Graph and Conclusions.
8. There should be continuous assessment.

9. Assessment must be based on understanding of theory, attentiveness during practical, understanding Session, how efficiently the student is able to make connections and get the results, and timely submission of journals.

LIST OF PRACTICALS (Any 08 to be performed by the student)

1. Verification of Superposition theorem in A.C. circuits.
2. Verification of Thevenin's theorem in A.C. circuits.
3. Verification of Norton's theorem in A.C. circuits.
4. Verification of Reciprocity theorem in A.C. circuits.
5. Verification of Maximum Power Transfer theorem in A.C. circuits.
6. Verification of Millman's theorem.
7. Determination of time response of R-C circuit to a step D.C. voltage input. (Charging and discharging of a capacitor through a resistor)
8. Determination of time response of R-L circuit to a step D.C. voltage input. (Rise and decay of current in an inductive circuit)
9. Determination of time response of R-L-C series circuit to a step D.C. voltage input.
10. Determination of Z-parameters and Y-parameters of a Two Port Network.
11. Determination of h-parameters and ABCD parameters of a Two Port Network.
12. Determination of current under parallel Resonance condition.

Note: The list of experiments is not limited to the above, but a course coordinator may design few new experiments based on recent technologies/trends in the relevant Engineering Domain. However, the course coordinator needs to get approval by the Program Assessment Committee and Chairman BOS/HOD well in time.

Course Activity (Any ONE of the following):

For the assessment of Course Activity, a student must complete at least ONE activity out of the followings:

1. Concept Test
2. Simulation of Electrical Circuits

Mr. P. D. Upadhye	Mrs. J. S. Kulkarni	Mr. S. K. Raskar
PAC Member 1 Electrical Engg Dept.	PAC Member 2 Electrical Engg Dept.	PAC Member 3 Electrical Engg Dept.

VPKBIET BARAMATI
PUNE (MS.)

EL24203 : Analog and Digital Electronics		
Teaching Scheme: **TH: 03 Hrs/Week** **PR: 02 Hrs/Week**	**Credits:04**	**Examination Scheme:** **Course Activity: 10 Marks** **In-Semester Exam: 30 Marks** **End-Semester Exam: 60 Marks** **Practical Exam: 30 Marks**

Prerequisite Courses:

Basic Electronics Engineering

Course Objectives:

1. To design combinational circuits using fundamental logic gates, Boolean algebra & K-map to solve complex digital logic problems.
2. To construct sequential circuits including shift registers and counters using fundamental logic gates and Boolean algebra
3. To apply fundamental knowledge of diode rectifiers in power conversion of AC to DC.
4. To understand the fundamentals of operational amplifier.
5. To use basic principles of operational amplifiers to illustrate their various applications.
6. To understand the principles and types of multivibrators, filters and voltage regulators in electronic circuits.

Course Outcomes

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

CO1: Design combinational circuits using fundamental logic gates, Boolean algebra & K-map

CO2: Construct sequential circuits including shift registers and counters using fundamental logic gates and Boolean algebra

CO3: Apply fundamental knowledge of diode rectifiers in power conversion of AC to DC.

CO4: Explain the fundamentals of operational amplifier

CO5: Apply basic principles of operational amplifiers to illustrate their various applications

CO6: Explain the principles and types of multivibrators, filters and voltage regulators in electronic circuits.

Course Contents

Unit I: Combinational circuits **(7 Hrs)**

Karnaugh map: Structure for two, three and four Variables, SOP and POS form reduction of boolean expressions by K-map, Reduction of boolean expressions not specified in standard SOP form and don't care conditions, Introduction to combinational circuits, Study of encoders : Priority encoder, 4:2 encoder, Decoders : 2:4, 3:8 decoder, Subtractor : Half subtractor and full subtractor, Multiplexer and Demultiplexer.

Unit II: Sequential circuits **(7 Hrs)**

Introduction to sequential circuit, Basic SR Latch, Review of RS flip flop, D FF, JK FF and T FF, Study of synchronous and asynchronous up and down counters (2-bit, 3-bit and 4-bit), Asynchronous up-down counter, Design of asynchronous MOD-N counter, Shift registers : SISO,SIPO,PISO,PIPO and universal shift register, Ring and twisted ring counters.

Unit III: Diode rectifier **(7 Hrs)**

Single phase half wave rectifier with RL load. Single phase full wave centre tapped and bridge rectifier supplying RL load, Performance parameters of single phase half wave and full wave rectifiers. Three phase half wave rectifier with R and RL load, Three phase full wave bridge rectifier with R load.

Unit IV: Basics of operational amplifier **(6 Hrs)**

Introduction, Block Diagram and symbol of op-amp, Types of op-amp : Ideal op-amp and practical op-amp, Important characteristics of ideal and practical op-amp, Input modes of op-amp: single ended mode, Differential mode and common mode, Concept of virtual short and virtual ground, Open loop and closed loop configuration of op-amp : inverting, non inverting and differential amplifier.

Unit V: Applications of operational amplifier **(6 Hrs)**

Applications of op- amp : zero crossing detector, Schmitt trigger, V-I converter with grounded load and floating load, I-V converter, Peak Detector, Instrumentation amplifier,

Waveform generation using op-amp : Sinewave, Squarewave and Triangular waveform generator.

Unit VI: Filters, Multivibrators and voltage regulators **(7 Hrs)**

Active filters : Its configuration with frequency response, Analysis of first order low pass and high pass filters using OPAMP, IC 555 –construction, working and modes of operation-Astable, Monostable and multivibrators, Voltage regulators using IC78xx, 79xx, LM 317.

Books & Other Resources:

Text Books:

1) Floyd and Jain, "Digital Fundamentals", Pearson Education.
2) R. P. Jain, "Digital Electronics", Tata McGraw Hill, New Delhi.
3) Malvino, "Digital Computer Electronics- An Introduction to Microcomputers," Tata McGraw Hill.
4) Gaikwad R., "Operational Amplifier", PHI New Delhi.
5) Floyd, "Electronics Devices", Pearson Education.
6) Muhammad H. Rashid, "Power Electronics: Circuits, Devices and Applications", 3rd edition, Pearsons Education.
7) Fundamental of digital circuits, 4th Edition, by A Anand Kumar, PHI learning private limited publication

Reference Books:

1) Tokheim, "Digital Electronics-Principles and Application", 6th edition, Tata McGraw Hill, New Delhi.
2) A Jaico and Charles H. Roth, "Fundamentals of Logic Design" Jr. Forth Edition.
3) K. R. Botkar, "Integrated Circuits", Khanna Publication, New Delhi.
4) James, "Operational Amplifier and Linear Integrated Circuits Theory and Application."
5) P John Paul, "Electronics Devices and circuits", New Age international Publications.
6) P. S. Bimbhra, "Power Electronics", Khanna Publications.

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5. Sample calculations for one/two readings.
6. Result table.
7. Graph and Conclusions.
8. There should be continuous assessment for the TW.
9. Assessment must be based on understanding of theory, attentiveness during practical, understanding Session, how efficiently the student is able to make connections and get the results, and timely submission of journals.

LIST OF PRACTICALS (Any 08 to be performed by the student)

1. To develop a logic circuit for 3:8 decoder and realize it using logic gates.
2. To develop a logic circuit for priority encoder and realize it using logic gates.
3. To design three bit full adder to add two three digit numbers by using any open source software.
4. To develop a logical circuit to convert binary to EXCESS 3/Gray number system and implement it using logic gates.
5. To construct a toggle flip-flop using JK flip-flops and demonstrate its operation by connecting LEDs to the outputs.
6. To observe the output waveform of comparator.
7. To observe the output waveform of Schmitt Trigger.
8. To observe the output waveform of Monostable Multivibrator using IC 555.
9. To observe the output waveform of Astable Multivibrator using IC 555.
10. To observe the output waveform of single phase bridge rectifier using RL load.

Note :

The list of experiments is not limited to the above, but a course coordinator may design few new experiments based on recent technologies/trends in the relevant Engineering Domain. However the course coordinator needs to get approval by the Program Assessment Committee and Chairman BOS/HOD well in time.

Course Activity (Any one of the following)

For the assessment of course activity, a student must complete at least one activity out of the following

1.Unitwise objective test

2.Circuit simulation

Mr. A. V. Golande	Miss. S. D. Rokade	Miss. S. R. Sabale
PAC Member 1	PAC Member 2	PAC Member 3

EL24204: Energy Audit		
Teaching Scheme: **PR: 02 Hrs/Week** **Tut: 01 Hr/Week**	**Credits: 02**	**Examination Scheme:** **Course Activity: 10 Marks** **Oral Exam: 30 Marks** **Term-Work: 30 Marks**

Prerequisite Courses: Basic Electrical Engineering

Companion Course, if any: Laboratory Practical

Course Objectives:

1. To introduce fundamental concepts of energy auditing, energy management principles, and energy conservation techniques in electrical systems.
2. To develop the ability to interpret and analyze electrical energy parameters using appropriate measuring instruments for power quality and efficiency assessment.
3. To equip students with knowledge of energy-saving strategies and preliminary energy audit procedures for various sectors, ensuring awareness of sustainable energy practices.

Course Outcomes:

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

CO1: Identify and explain fundamental concepts of electricity billing, energy auditing, energy management principles, and the role of energy conservation in various electrical systems.

CO2: Interpret and analyze electrical energy parameters using appropriate measuring instruments for assessing power quality, efficiency, and performance in different applications.

CO3: Identify and describe energy-saving strategies and preliminary audit procedures for various sectors, including educational institutions, industries, and commercial establishments, ensuring compliance with sustainable energy practices.

Guidelines for Laboratory - Term work Assessment:

1. The distribution of weightage of term work marks should be informed to students before the start of the semester.
2. Term work assessment should be on a continuous basis. At frequent intervals, students are expected to share their progress/lagging.

Guidelines for Laboratory Conduction:

1. DO's and DON'TS, along with precautions, are needed to be displayed at prominent locations in the laboratory.
2. Students should be informed about DO'S and DON'T and precautions before performing.

List of Tutorials (Any 4 tutorial should be conducted)

1. Calculation of Electricity bill for residential and commercial consumer. (2 Numericals)
2. Study of Clean Development mechanism.
3. Study of building codes (green building).
4. Study of energy management tools.
5. Study of force field analysis from energy management point of views.
6. Study of Ethical Practices in Energy audit.

List of Practicals (Any 8 experiments to be performed by the student)

1. To analyse and interpret Electricity Bills for
   a) Residential consumer
   b) Commercial Consumer (e.g. College campus).
2. To perform assessment and calculations of energy generated by Solar PV or Diesel Generator available on the college campus.
3. To measure power and power factor in a single phase ac series inductive circuit and study of improvement of power factor using capacitor.
4. To study use of Power Analyser for measurement of electrical parameters useful for energy audit or power quality audit.
5. To perform adequacy assessment of Illumination systems by using Lux Meter
6. To study use of temperature measuring devices for analysis of heating systems.
7. To study use of other transducers (any one)
   a) Assessment of performance of fans and blowers by using Anemometer.

b) Use of Flow Meters for Pumping system analysis.

c) Use of pressure measuring equipment useful in audit study.

d) Smart meters and advanced energy meters

8. To execute Preliminary Energy Audit for (Any One) (Preferably this activity should be carried out with student group not exceeding 5)
   a. Laboratory
   b. Educational Institute
   c. Commercial Establishment
9. To execute Preliminary Energy Audit for (Any One) (Preferably this activity should be carried out with student group not exceeding 5)
   a. Small scale industry
   b. Residential Building
   c. Municipal Corporations
10. To perform Calculation of energy savings for following (Minimum one)
    a. Illumination
    b. Air conditioning System
    c. Irrigation/Agriculture Pumping Systems
11. To perform Calculation of energy savings for following (Minimum one)
    a. DG Sets
    b. UPS and Inverter Systems
    c. Lifts and elevators
12. Study of energy audit success stories (any one)
    a. Paper and Pulp Industry
    b. Sugar Industry
    c. Steel Industry
    d. Commercial Establishment
    e. Electrical Generation Plant

NOTE: The list of experiments is not limited to the above, but a course coordinator may design a few new experiments based on recent technologies/trends in the relevant Engineering Domain. However, the course coordinator needs to get approval by the Program Assessment Committee and Chairman BOS/HOD well in time.

Books & Other Resources:

Text Books:

1. Guide books for National Certification Examination for Energy Managers/Energy Auditors Book , 1-General Aspects (available on line)
2. Guide books for National Certification Examination for Energy Managers/Energy Auditors Book 2 – Thermal Utilities (available on line)
3. Guide books for National Certification Examination for Energy Managers/Energy Auditors Book 3- Electrical Utilities (available on line)
4. Guide books for National Certification Examination for Energy Managers/Energy Auditors Book 4 (available on line)

Reference Books:

1. Success stories of Energy Conservation by BEE (www. Bee-india.org)
2. "Utilization of Electrical Energy", S. C. Tripathi, Tata McGraw Hill.
3. "Energy Management" W. R. Murphy and Mackay, B. S. Publication.
4. "Generation and Utilization of Electrical Energy" B. R. Gupta, S. Chand Publication.
5. "Energy Auditing Made Simple" Balasubramanian, Bala Consultancy Services.

Course Activity (Any ONE of the following):

For the assessment of Course Activity, a student must complete at least ONE activity out of the following:

1. **Poster Presentation**
2. **Chart Preparation**

Mr. P. D. Upadhye	Mr. R. S. Tarade	Mr. S. K. Raskar	Mr. A. B. Akhade
Course Coordinator, Electrical Engg Dept.	PAC Member 1 Electrical Engg Dept.	PAC Member 2 Electrical Engg Dept.	PAC Member 3 Electrical Engg Dept.

VPKBIET BARAMATI PUNE (MS)

EL24205: Community Engagement Project		
Teaching Scheme	**Credits**	**Examination Scheme**
PR: 04 Hrs/Week	Practical: 02	Course Activity: 10 Marks TW: 30 Marks OR: 30 Marks

Prerequisites: Basic knowledge of Electrical Systems, along with problem-solving and project management skills relevant to community-based engineering solutions

Objectives:

1. Utilize electrical engineering principles to solve real-world community problems through field projects.
2. Gain practical exposure to electrical systems, power distribution, renewable energy, and automation in a real-world setting.
3. Develop engineering solutions that contribute to sustainable community development, such as rural electrification, energy conservation, or smart grid implementation.
4. Enhance problem-solving skills by analyzing electrical infrastructure, conducting energy audits, and proposing improvements.
5. Work effectively in multidisciplinary teams to design, develop, and implement electrical engineering solutions.
6. Understand industry standards, electrical safety regulations, and ethical considerations in engineering projects.
7. Encourage students to propose innovative solutions using modern electrical technologies.
8. Improve technical report writing, presentation skills, and project documentation for professional and academic purposes.

Course Outcomes:

1. Analyze community-based electrical engineering challenges and propose feasible technical solutions.
2. Apply electrical engineering concepts to design and implement practical field-based projects.
3. Evaluate the sustainability and impact of electrical engineering solutions on society and the environment.
4. Demonstrate teamwork, leadership, and project management skills in the execution of field projects.
5. Adhere to professional ethics, electrical safety standards, and regulatory compliance in engineering projects.
6. Develop effective communication skills through technical presentations, reports, and community engagement activities.

Procedure: A group of 4-5 students will be assigned to a faculty member called a mentor. Based on the engineering knowledge of a group and societal and industry problems, the mentor has to guide a group to identify project problems and plan the work schedule. Here, the expected outcomes of the project must be noted. The complete work-plan should be

divided in the form of the individual tasks to be accomplished with targets. Weekly review of the completed task should be taken and further guidelines are to be given to a group. The final activity will be presenting the work completed and submitting the report. A group should be promoted to participate in a competition or write a paper.

Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content, and the structure of the activity. It may have

- A few hands-on activities that may or may not be multidisciplinary.
- Use of technology in meaningful ways to help them investigate, collaborate, analyze, synthesize, and present their learning.
- Activities on solving real-life problems, investigation /study, and writing reports of in-depth study, fieldwork.

Course Activity (10 Marks): "Identifying a Problem Statement for Community/Field Project through Survey & Literature Review"

Objective:

Students will conduct a survey and literature review to identify a relevant problem for a community or field project. This exercise emphasizes practical research skills and helps in formulating a problem statement for engineering solutions in real-world community settings.

1. **Community Survey – (4 Marks)**

- Design and conduct a short survey (3-5 questions) to identify a specific engineering problem faced by the local community (e.g., water access, energy efficiency, waste management, etc.).
- Interview at least 5-10 community members (either physically or via an online platform) to gather their feedback.
- Summarize the results to highlight the most pressing issue.

2. **Literature Review – (4 Marks)**

- Conduct a literature review to explore existing research, solutions, and technologies related to the identified issue.
- Find at least 2-3 studies, articles, or reports on similar problems and solutions implemented in other communities.
- Compare the results of the survey with findings from the literature to understand how the community's issue has been addressed elsewhere.

3. **Formulate a Problem Statement – (2 Marks)**

- Based on the survey and literature review, write a concise problem statement.

- The problem statement should clearly define the issue, its relevance to the community, and the need for a mechanical engineering solution.

Evaluation Criteria: (10 Marks)

- Effectiveness and relevance of the survey in identifying a community problem – 4 Marks
- Depth and quality of the literature review – 4 Marks
- Clarity and impact of the problem statement – 2 Marks

Guidelines for implementing Community Engineering Project/ Field Project:

Assessment Criteria for Term Work (TW) – 30 Marks

1. Problem Identification and Research (6 Marks)

3 Marks: Well-defined problem statement supported by survey data and literature review.
3 Marks: Effective research including community insights and background analysis.

2. Design and Concept Development (7 Marks)

3 Marks: Innovative and technically feasible solution addressing community needs.
2 Marks: Use of electrical design tools (MATLAB, PSCAD, ETAP, AUTOCAD, etc.) for concept visualization.
2 Marks: Practicality in terms of cost, material selection, and energy efficiency.

3. Prototyping and Testing (8 Marks)

4 Marks: Development of a functional, safe, and user-friendly prototype.
3 Marks: Testing methodology, performance evaluation, and necessary modifications.
1 Mark: Documentation of the prototyping process (diagrams, simulation results, and photos).

4. Implementation and Community Engagement (5 Marks)

3 Marks: Successful deployment of the project with community interaction, training, and feedback.
2 Marks: Solution modifications based on community input and real-world testing.

5. Documentation and Report Writing (4 Marks)

3 Marks: Comprehensive, well-structured project report.
1 Mark: Proper referencing and citation of sources.

6. Presentation and Communication (5 Marks)

3 Marks: Clear, engaging presentation demonstrating the project's impact.
2 Marks: Effective visual aids (circuit diagrams, graphs, or multimedia) and ability to address queries confidently.

Assessment Criteria for Oral Examination (OR) – 30 Marks

1. Presentation Structure (10 Marks)

5 Marks: Logical flow from problem identification to solution deployment.
5 Marks: Well-organized content, smooth transition through key technical aspects.

2. Technical Understanding (8 Marks)

4 Marks: Demonstrates strong knowledge of electrical engineering concepts used in the project.
4 Marks: Effective problem-solving approach with engineering justifications.

3. Design & Prototyping (6 Marks)

3 Marks: Clear explanation of the design process, materials, and engineering tools used.
3 Marks: Functional explanation of the prototype with testing results.

4. Community Engagement (4 Marks)

2 Marks: Discussion on how community feedback was integrated into the solution.
2 Marks: Explanation of the social, economic, or environmental impact.

5. Response to Questions (2 Marks)

2 Marks: Confidence, accuracy, and clarity in answering queries.

Mr. D. S. Yeole	Dr. H. M. Shaikh	Mr. P. D. Upadhye
PAC Member 1	PAC Member 2	PAC Member 3

VSKBIET BARAMATI

EL24211: Electrical Machine I		
Teaching Scheme: **TH: 03 Hrs/Week** **PR: 02 Hrs/Week**	**Credits:04**	**Examination Scheme:** **Course Activity: 10 Marks** **In-Semester Exam: 30 Marks** **End-Semester Exam: 60 Marks** **Practical Exam: 30 Marks**

Prerequisite Courses:

Basic Electrical Engineering

Course Objectives:

1. To understand the fundamental principles of single-phase transformers, including their construction, operation, and applications.
2. To understand the principle and applications of three-phase transformer and autotransformer.
3. To demonstrate the principles of DC machines, including their construction, types, and operational characteristics.
4. To apply the knowledge of DC machines to demonstrate the characteristics and applications of DC motors.
5. To explain the construction, working principles, and characteristics of three-phase induction motor.
6. To evaluate various performance parameters of 3 phase Induction Motor.

Course Outcomes

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

CO1: Explain the fundamental principles of single phase transformers, including their construction, operation, and applications.

CO2: Explain the principle and applications of three-phase transformer and autotransformer.

CO3: Demonstrate the principles of DC machines, including their construction, types, and operational characteristics.

CO4: Apply the knowledge of DC machines to demonstrate the characteristics and applications of DC motors.

CO5: Explain the construction, working principles, and characteristics of three-phase induction motor.

CO6: Evaluate various performance parameters of three phase Induction Motor.

Course Contents

Unit I: Single Phase Transformer **(7 Hrs)**

Single phase Transformer: Concept of ideal transformer. Construction of Corrugated core transformer. Toroidal core Transformer, various parts of transformer, Useful and leakage flux, its effects. Resistance, leakage reactance and leakage impedance of transformer windings & their effects on voltage regulation and efficiency. Exact and approximate equivalent circuits referred to L.V. and H. V. side of the transformer. Phasor diagrams for no-load and on load conditions. Transformer ratings. Losses in a transformer, their variation with load, voltage & frequency. Efficiency and condition for maximum efficiency. All day efficiency, Parallel operation of single-phase transformers, conditions to be satisfied, load sharing under various conditions.

Unit II: Three Phase Transformer and Autotransformer **(7 Hrs)**

Standard connections of three phase transformers(star-star, star-delta, delta-star, delta-delta), zigzag connection and their suitability for various applications, voltage phasor diagrams and vector groups. Descriptive treatment of Parallel operation of three phase transformers, Scott connection and V connections. Three winding (tertiary windings) transformers, welding transformer.comparison of power transformer and distribution transformer.

Auto transformers, their ratings and applications. Comparison with two winding transformers with respect to saving of copper and size.

Unit III: DC Machines **(7 Hrs)**

Construction, main parts, magnetic circuits, poles, yoke, field winding, armature core, Armature windings: Simple lap and wave winding, commutator and brush assembly. Generating action, E.M.F equation, types of DC Generator, magnetization curves, Flashing of Generator. Motoring action. Types of DC motors, significance of back E.M.F, torque equation, working at no-load and on-load. Losses, power flow diagram and efficiency. Descriptive treatment of armature reaction.

Unit IV: Starters and speed control of DC Motor **(6 Hrs)**

Starting of DC motors, Need of starter, study of starters for series and shunt motor : 2 point starter, 3 point starter and 4 point starter, solid state starters.

Speed control of various types of DC motors : Flux control method and armature voltage control method. Characteristics and applications of D.C. Shunt and Series Motors.
Brushless DC Motor : construction, working and applications.

Unit V: Three Phase Induction Motor **(7 Hrs)**

Construction: Stator, Squirrel cage & wound rotors. Production of rotating mmf. Principle of working, simplified theory with constant air gap flux; slip, frequency of rotor emf and rotor currents, mmf produced by rotor currents, its speed w.r.t. rotor and stator mmf. Production of torque, torque-slip relation, condition for maximum torque, torque-slip Characteristics, effect of rotor resistance on torque-slip characteristics. Relation between starting torque, full load torque and maximum torque. Losses in three phase induction motor, power-flow diagram, Relation between rotor input power, rotor copper loss & gross mechanical power developed, efficiency. Exact & approximate equivalent circuit.Computation of performance characteristics from the equivalent circuit and circle diagram.

Unit VI: Starters and speed control of Three Phase Induction Motor **(6 Hrs)**

Necessity of starter for three phase induction motors. Starters for slip-ring and cage rotor induction motors : DOL, stator resistance, star-delta, rotor resistance, autotransformer. Comparison of various types of starters. Speed control methods : Stator side and rotor side. Testing of three phase induction motor as per IS 325 & IS 4029.

Books & Other Resources:

Text Books:

1) Edward Hughes "Electrical Technology", ELBS, Pearson Education.
2) Ashfaq Husain, "Electrical Machines", Dhanpat Rai& Sons.
3) S. K. Bhattacharya, "Electrical Machine", Tata McGraw Hill publishing Co. Ltd, 2nd Edition.
4) Nagrath & Kothari, "Electrical Machines", Tata McGraw Hill.
5) Bhag S Guru, Husein R. Hiziroglu, "Electrical Machines", Oxford University Press.
6) K Krishna Reddy, "Electrical Machines- I and II", SCITECH Publications (India) Pvt. Ltd. Chennai.

Reference Books:

1) A.E. Clayton and N. N. Hancock, "Performance and Design of Direct Current Machines", CBS Publishers, Third Edition.
2) A.E. Fitzgerald, Charles Kingsley, Stephen D. Umans, "Electrical Machines", TataMcGraw Hill Publication Ltd., Fifth Edition.
3) A.S. Langsdorf, "Theory and performance of DC machines", Tata McGraw Hill.
4) M.G. Say, "Performance and Design of AC. Machines", CBS Publishers and Distributors.
5) Smarajit Ghosh, "Electrical Machines", Pearson Education, New Delhi.
6) Charles I Hubert, "Electrical Machines Theory, Application, & Control", Pearson Education, New Delhi, Second Edition.

Guidelines for Laboratory Conduction:

1. DO's and DON'TS, along with precautions, are needed to be displayed at prominent locations in the laboratory.
2. Students should be informed about DO'S and DON'T and precautions before performing.

Guidelines for Students Lab Journal:

The Student's Lab Journal should contain following related to every experiment –

1. Theory related to the experiment.
2. Apparatus with their detailed specifications.
3. Connection diagram /circuit diagram.
4. Observation table/ simulation waveforms.
5. Sample calculations for one/two readings.
6. Result table.
7. Graph and Conclusions.
8. There should be continuous assessment for the TW.
9. Assessment must be based on understanding of theory, attentiveness during practical, understanding Session, how efficiently the student is able to make connections and get the results, and timely submission of journals.

LIST OF PRACTICALS (Any 08 to be performed by the student)

1. To perform O.C. and S.C. test on single phase Transformer

a) To determine equivalent circuit parameters from the test data
b) To determine voltage regulation and efficiency

2. To perform polarity test on single phase and three phase transformer.
3. To perform Parallel operation of two single phase transformers and study of their load sharing under various conditions of voltage ratios and leakage impedance.
4. To perform Sumpner's test.
5. To perform Brake test on D.C. Shunt motor.
6. To perform Load characteristics of D.C. series motor.
7. To perform speed control of D.C. Series motor by flux control method
8. To perform speed control of DC shunt motor by armature voltage control method.
9. To study of different types of starters of DC motor
10. To perform load test on three phase induction motor.
11. To perform No load & blocked-rotor test on 3-phase induction motor and determination of parameters of equivalent circuit.
12. To perform no load & blocked rotor test on 3-phase induction motor and plotting of circle diagram from the test data.

Note :

The list of experiments is not limited to the above, but a course coordinator may design few new experiments based on recent technologies/trends in the relevant Engineering Domain. However the course coordinator needs to get approval by the Program Assessment Committee and Chairman BOS/HOD well in time.

Industrial Visit: Minimum one compulsory visit to either transformer or DC Machine Manufacturing Industry.

Course Activity (Any one of the following)

For the assessment of course activity, a student must complete at least one activity out of the following

1.Chart preparation

2.V-Lab

Mr. A. V. Golande	Mrs. P. N. Jaiswal	Mrs. V. V. Deokate
PAC Member 1	PAC Member 2	PAC Member 3

EL24212: Power Electronics		
Teaching Scheme: **TH : 03 Hrs/Week** **PR: 02 Hrs/Week**	**Credits:04**	**Examination Scheme:** **Course Activity: 10 Marks** **In-Semester Exam: 30 Marks** **End-Semester Exam: 60 Marks** **Oral Exam: 30 Marks**

Prerequisite Courses:

Knowledge of semiconductor material, basic electronics, diode, BJT and its characteristics, diode, rectifier, concept of rms and average value

Companion Course, if any: Laboratory Practical

Course Objectives:

1. To demonstrate circuits using Thyristor Power Devices and understand their operational characteristics and protection requirements.
2. To design AC to DC Converters including single-phase and three-phase configurations with various load types.
3. To apply DIAC and TRIAC in practical AC voltage control circuits and implement protection strategies for power circuits.
4. To evaluate Transistor Power Devices (MOSFET, IGBT, MCT) and determine suitable applications based on their characteristics and specifications.
5. To analyze DC to DC Converters using different control techniques and understand their operational principles and filtering requirements.
6. To analyze single-phase and three-phase inverter principles, VSI, and CSI configurations.

Course Outcomes:

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

CO1: Demonstrate circuits using Thyristor Power Devices and understand their operational characteristics and protection requirements.

CO2: Design AC to DC Converters, including single-phase and three-phase configurations with various load types.

CO3: Apply DIAC and TRIAC in practical AC voltage control circuits and implement protection strategies for power circuits.

CO4: Evaluate Transistor Power Devices (MOSFET, IGBT, MCT) and determine suitable applications based on their characteristics and specifications.

CO5: Analyze DC to DC Converters using different control techniques and understand their operational principles and filtering requirements.

CO6: Analyze single-phase and three-phase inverter principles, VSI and CSI configurations.

Unit I: Thyristor Power Devices: **(6 Hrs)**

SCR: Static and dynamic Characteristics, specifications (Latching current, Holding current, dv/dt, di/dt, I2 t rating), Two-Transistor Analogy, Gate Characteristics, Trigering Circuits (R, R-C, UJT), Commutation, GTO.

Unit II: AC to DC Converters (1 phase & 3 phase) **(7 Hrs)**

Single-phase Converter (Half wave, Semi-converter, Full wave), three-phase (semi-controlled and fully controlled) converter with R, R-L, and RLE loads, Rectification and Inversion mode of operation, Concept of overlap Angle, and associated Voltage drop calculation, Dual converter, Selection of transformers and semiconductor devices for Converters, Numerical for R and RL Load only, Areas of application.

Unit III: AC Voltage Controllers & Protection of Power Circuits **(6 Hrs)**

(a) DIAC, TRIAC- four mode operation, triggering of TRIAC using DIAC; AC Voltage regulator principle, Single phase & three phase, analysis with R & RL Load, applications of two-stage, three-stage & multi-stage Voltage Controllers.

(b) Protection of Power Circuit: Protection from over voltage, over current, thermal, design of snubber circuit.

Unit IV: Transistor Power Devices **(6 Hrs)**

Characteristics, Specifications, Safe Operating Areas (SOA) Protection and Switching action of Power MOSFET, IGBT, MCT and their control circuit requirement, Comparison and Area of application of these devices.

Unit V: DC to DC Converter **(7 Hrs)**

The chopper's operation principle is a classification based on operating quadrants. Buck, Boost, Buck-Boost converter, their working, output waveforms, performance analysis, continuous conduction mode, Control techniques: CLC, TRC, PWM, and FM Techniques. Analysis of Step-up Chopper, Numericals with RLE load. Areas of application.

Unit VI: DC to AC Converters (Inverter) **(7 Hrs)**

Single phase & three phase inverters, Principle of operation, VSI and CSI inverters, applications, their operating frequency range, PWM inverters: Single Pulse, Multiple Pulse and Sinusoidal Pulse modulation PWM Techniques for voltage control and harmonic elimination. Three phase VSI for 120^0 and 180^0 modes of operation and their comparison,

Books & Other Resources:

Text Books:

1. M.H.Rashid – "Power Electronics" 2nd Edition, Pearson publication
2. Ned Mohan, T.M. Undeland, W.P. Robbins – "Power Electronics",3rd Edition, John Wiley & Sons (International) student edition.
3. B.W. Williams: "Power Electronics" 2nd edition, Macmillan publication
4. Ashfaq Ahmed- "Power Electronics for Technology", LPE Pearson Edition.
5. Dr. P.S. Bimbhra, "Power Electronics", Third Edition, Khanna Publication.
6. K. Hari Babu, Power Electronics , Scitech Publication.

Reference Books:

1. Vedam Subramanyam –" Power Electronics" , New Age International , New Delhi
2. Dubey, Donalda, Joshi,Sinha, "Thyristorised Power controllers", Wiely Eastern New Delhi.
3. M. D. Singh and K. B. Khandchandani, "Power Electronics", Tata McGraw Hill
4. Jai P. Agrawal, "Power Electronics systems theory and design LPE", Pearson Education. Asia.
5. L. Umanand, "Power Electronics – Essentials & Applications" Wiley Publication.
6. Randall Shaffer – "Fundamentals of Power Electronics with Matlab".

Online Resources:

NPTEL course on Power Electronics by Prof. D.Prasad, Prof. N.K. De, Dr. D.Kastha, Prof. Sabyasachi Sengupta, IIT Kharagpur

List of Practical (Any 8 experiments, however, three (03) simulation experiments should be covered using any professional software)

1. To study V-I characteristics of SCR, DIAC, TRIAC. (any two)
2. To study V-I characteristics of power semiconductor devices: GTO, MOSFET, IGBT. (any two)
3. To analyze the performance of the controlled converter with R and RL load.

4. To analyze the Three-phase AC-DC fully controlled bridge converter R and RL load performance.
5. To perform Power Quality Analysis (Harmonic and PF measurement) at the AC side of a phase-controlled Converter.
6. To perform Power Quality Analysis (Harmonic and PF measurement) at the AC side of the Three-phase phase-controlled Converter.
7. To study DC step-down chopper (PWM technique).
8. To study Single-phase A.C. voltage regulators with R and RL loads.
9. To study PWM controls of a single-phase inverter.
10. To verify the performance of the Three-phase voltage source inverter using 120^0 and 180^0 modes.
11. To verify the performance of a three-phase cascaded H-Bridge Multilevel inverter.
12. To perform Forced commutation circuits of SCR.

(Note: The list of experiments is not limited to the above, but a course coordinator may design a few new experiments based on recent technologies/trends in the relevant Engineering Domain. However, the course coordinator needs to get approval from the Program Assessment Committee and Chairman BOS/HOD well in time.)

Course Activities (Any ONE of the following):
For the assessment of Course Activity, a student must complete at least ONE activity out of the following:

1) Poster Presentation
2) Circuit Simulation/ Modelling

Mrs. P. N. Jaiswal
PAC Member 1

Mr. S. K. Raskar
PAC Member 2

Mrs. J. S. Kulkarni
PAC Member 3

VPKBIET BARAMATI
PUNE (MS.)

EL24213: Power System Engineering		
Teaching Scheme: **TH: 03 Hrs/Week**	**Credits:03**	**Examination Scheme:** **Course Activity: 10 Marks** **In-Semester Exam: 30 Marks** **End-Semester Exam: 60 Marks**

Prerequisite Courses:

Electrical Engineering Materials, Basic Electrical Engineering, Electrical Measurement and Instrumentation

Companion Course, if any: Laboratory Practical

Course Objectives:

1. To introduce students to the fundamental principles of Thermal power plant.
2. To understand the technological aspects of nuclear and diesel plant.
3. To explain the technical qualities of hydro power plant
4. To understand the important aspects of wind and solar energy system.
5. To analyse the important aspects of economics of power generation.
6. To analyse the basic structure of the electrical transmission system.

Course Outcomes

On completion of the course, learner will be able to:

CO-1: Identify components and elaborate working principles of thermal power plants.

CO-2: Explain the key components of a diesel power plant and basic principles of nuclear physics, including fission and fusion processes.

CO-3: Describe the basic principles of hydropower generation, including the conversion of potential energy from water into mechanical and electrical energy.

CO-4: Analyze the fundamental principles of wind energy and recognize the importance and opportunities of solar energy.

CO-5: Evaluate the economics of power generation and different factors associated with it.

CO-6: Analyze the basic structure of electrical transmission systems and different electrical terms related to them.

Course Contents

Unit I: Thermal Power Plant **(7 Hrs)**

Thermal power plant site selection, Thermal power plant layout, Main parts and its working, Types of boilers (fire tube and water tube), Fuel handling, Ash disposal and collection, Basics of thermodynamic cycle.

Unit II: Nuclear and Diesel Power Plant **(7 Hrs)**

A. Nuclear Power Plant: Introduction, atomic physics, nuclear reaction, materials, site selection, nuclear reactors and working of each part, classification of nuclear reactor, nuclear waste disposal.

B. Diesel Power Plant: Main components and its working, Diesel plant efficiency and heat balance, Site selection of diesel power plant.

Unit III: Hydro Power Plant **(7 Hrs)**

Site selection, Hydrology, storage and pondage, general arrangements and operation of hydro power plant, Hydraulic turbines, turbine size, Pelton wheel turbine, Francis and Kaplan turbines, selection of turbines, Dams, Spillways, gates, intake and out take works, canals and layout of penstocks, water hammer and surge tank, Numerical based on total energy generated.

Unit IV: Wind and Solar Energy Systems **(7 Hrs)**

A. Wind Energy: Historical development of wind energy, types of wind turbine, Wind turbine generators, Environmental impacts of wind turbines. Change in wind turbine blades and its effect on generation. Control of wind turbine generator, Numerical based on wind energy.

B. Solar Energy: Photovoltaic effect. Solar thermal energy systems. Solar photovoltaic (PV) systems and PV current equation. Solar cell, solar module and solar array. Effect of series and parallel cells arrangement. Solar radiation and its measurement.

Unit V: Economics of Power Generation **(7 Hrs)**

Structure of Electrical Power System, Different factors associated with generating stations such as connected load, maximum demand, demand factor, average load, load factor, diversity factor, plant capacity factor, reserve capacity, plant use factor. Load curve, load

duration curve, concept of base load and peak load stations, Interconnected grid system, Introduction to tariff, Numerical based on load curve and finding different factors.

Unit VI: Mechanical Design of Transmission System **(7 Hrs)**

A. Overhead Line Insulators: Types of insulators, its construction and their applications such as Pin type, Suspension type, Strain type, Shackle type, Post insulators, Bushing. Potential distribution over suspension insulators, String efficiency, Methods of improving string efficiency

B. Sag Calculations: Main components of overhead lines, Various types of line supports, Conductor spacing, Length of span, Calculation of sag for equal and unequal supports and effect of ice and wind loading, Numerical based on sag calculation.

Books & Other Resources:

Text Books:

1. P. K. Nag, "Power Plant Engineering", Tata McGraw Hill Publications.
2. Dr. P. C. Sharma, "Power Plant Engineering", S.K. Kataria Publications.
3. Chetan Singh Solanki "Solar Photovotaics: Fundamentals, Technology and Application" PHI Publications.
4. J. B. Gupta, "Transmission and Distribution", S. K. Kataria & Sons, New Delhi.
5. V. K Mehta, Rohit Mehta, "Principles of Power System", S Chand.

Reference Books:

1. Arora and Domkundwar, "A Course in Power Plant Engineering", DhapatRai Publication.
2. Dr. S. P. Sukhatme, "Solar Energy", Tata McGraw Hill Publication.
3. Mukund Patel, "Wind and Solar Power Plants", CRC Press.
4. Nagrath & Kothari, "Power System Engineering", Tata McGraw Hill Publications.

Course Activities (Any ONE of the following):

For the assessment of Course Activity, a student must complete at least ONE activity out of the following:

1. Mini project/ working model/ prototype model of any power plant.
2. Case studies/ research paper reading of any power plant.

Mr. D. S. Yeole	Mr. R. S. Tarade	Mr. H. M. Shaikh
Course Coordinator	PAC Member 1	PAC Member 2

HS24201:Public Speaking And Aptitude		
Teaching Scheme: **TH: 01 Hrs/Week** **PR: 02 Hrs/Week**	**Credits:02**	**Examination Scheme:** **Course Activity: 10 Marks** **TermWork: 10 Marks** **Oral Exam: 10 Marks**

Course Objectives:

This course is intended to:

1. To develop fluency in spoken English by improving vocabulary, pronunciation, intonation, and conversational skills for effective communication.
2. To enhance presentation skills by focusing on body language, voice modulation, strategic pauses, and empathetic communication for impactful public speaking.
3. To strengthen quantitative aptitude through problem-solving techniques in data interpretation, numerical computation, and statistics.
4. To develop logical and spatial reasoning skills for better analytical thinking and problem-solving in competitive exams.

Course Outcomes:

At the end of this course, student will be able to

CO-1: Communicate effectively in various spoken interactions, including telephone conversations and discussions.

CO-2: Deliver structured and engaging presentations with appropriate body language, voice modulation, and confident speech techniques.

CO-3: Solve quantitative problems efficiently using data interpretation, numerical computation, and statistical analysis techniques.

CO-4: Apply logical reasoning and spatial aptitude skills to analyze complex problems.

Course Contents

Unit I: Spoken English **(4 Hrs)**

Pre-Assessment, Vocabulary made easy, the Power of Words, Introduction to Word Accent, Introduction to Rhythm: Intonation, Rising Intonation, Falling Intonation, Introduction & Specific scenarios: Telephone Skills: Taking & Making Calls, Voice, Intonation, and Language, Conversations: The Role of Questions.

Unit II: Impactful Presentations **(4 Hrs)**

Body Language: Introduction, Mechanics and Style Voice Modulation: Voice Projection, replacing Fillers, and Emphasis Power of Pause: Pause to engage audience in Conversation, Combine Pause & Repetition Techniques, Demonstrate Confidence & Control, establish Presence Empathy: Essential Human Quality, Practice Heartful Communication, Impact of Communication, How to deliver memorable speech.

Unit III: General Aptitude for all Competitive Exams **(6 Hrs)**

Quantitative Aptitude

Data interpretation: data graphs (bar graphs, pie charts, and other graphs representing data), 2- and 3-dimensional plots, maps, and tables Numerical computation and estimation: ratios, percentages, powers, exponents and logarithms, permutations and combinations, and series Mensuration and geometry Elementary statistics and probability.

Analytical Aptitude

Logic: deduction and induction, Analogy, Numerical relations and reasoning.

Spatial Aptitude

Transformation of shapes: translation, rotation, scaling, mirroring, assembling, and grouping paper folding, cutting, and patterns in 2 and 3 dimensions.

Books & Other Resources:

Text Book

1. A Foundation "A Course in Phonetics and Spoken English" – T. Balasubramanian.
2. "Effective Technical Communication" – M. Ashraf Rizvi.
3. "Quantitative Aptitude for Competitive Examinations" – R.S. Aggarwal.

Reference Books:

1. "High School English Grammar & Composition" – Wren & Martin
2. "How to Speak, How to Listen" – Mortimer J. Adler
3. "Logical and Analytical Reasoning" – A.K. Gupta

NPTEL Course:

1. Mastering Speaking and Presentations: A case Based Approach by Prof. Seema Singh, IIT Kharagpur https://onlinecourses.nptel.ac.in/noc25_hs96/preview.

Lab Session Plan

Session 1: Vocabulary & Word Accent Mastery

- Pre-Assessment: Conduct a quick spoken test to evaluate pronunciation and fluency.
- Vocabulary exercises using flashcards & interactive word-building games.

Session 2: Intonation & Rhythm in Speech

- Introduction to rising and falling intonation with examples.
- Role play exercises for practicing intonation in different scenarios (expressing surprise, asking questions, etc.).
- Rhythm practice: Reading passages with proper pauses and stress patterns.

Session 3: Telephone Skills & Professional Conversations

- Practicing making and taking calls with simulated dialogues.
- Focus on voice modulation, clarity, and polite expressions.

Session 4: Body Language & Stage Presence

- Mirror exercises to improve facial expressions and gestures.
- Practicing posture, movement, and eye contact while speaking.

Session 5: Voice Modulation & Power of Pause

- Exercises on voice projection and eliminating fillers.
- Practicing pauses strategically to enhance speech impact.
- Repetition and emphasis techniques using speech excerpts.

Session 6: Empathy & Heartfelt Communication

- Interactive storytelling to practice emotional connection.
- Exercises on active listening and empathetic responses.
- Speech practice: delivering a short talk with an emotional appeal.

Session 7: Quantitative Aptitude – Data Interpretation & Computation

- Solving numerical problems based on bar graphs, pie charts, and tables.
- Quick estimation exercises using ratios, percentages, and logarithms.
- Group challenges on permutations and combinations.

Session 8: Analytical Aptitude – Logical & Numerical Reasoning

- Deduction and induction puzzles.
- Solving analogy-based reasoning questions.
- Speed tests for numerical relations and reasoning.

Session 09: Spatial Aptitude – Shape & Pattern Recognition

- Hands-on paper folding and cutting exercises.
- Visualization tasks for rotation, scaling, and mirroring of shapes.
- Solving pattern-based problems in 2D and 3D space.

Session 10: Mock Test

- Mock test from online test series of companies like TCS, Infosys employability tests like CoCubes, AMCAT etc.

Dr. A. B. Patil	Dr. R.K. Shastri	Dr. C. B. Nayak	Dr. S. M. Bhosle	Dr. S. B. Lande
Course Coordinator	HSSM BoS Chairman	Dean Autonomy	Dean Academics	Principal
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VPKBIET BARAMATI
PUNE (MS)

HS24211: Environmental Studies		
Teaching Scheme: **TH: 02 Hrs/Week**	**Credits:02**	**Examination Scheme:** **Course Activity: 10 Marks** **End-Semester Exam: 60 Marks**

Prerequisites:

Fundamentals of the environment.

Course Objectives:

1. Understand the fundamental concepts of environmental science and its relevance to engineering.
2. Analyze the environmental impact of various engineering industries.
3. Learn about sustainable engineering practices, pollution control, and waste management.
4. Study environmental laws in India and global initiatives for environmental conservation.

Course Outcomes

On completion of the course, learner will be able to:

CO-1: Understand the components of the environment and types of energy resources.

CO-2: Analyze the impact of engineering industries on the environment.

CO-3: Learn sustainable engineering solutions for mitigating environmental damage.

CO-4: Aware of Indian and global initiatives for environmental protection.

Course Contents

Unit I: Introduction to Environmental Studies **(6 Hrs)**

Importance of Environmental Studies, Components of the Environment: Atmosphere, Hydrosphere, Lithosphere, and Biosphere, Ecosystems and Biodiversity: Types, Importance, and Conservation, Sustainable Development Goals (SDGs) and Role of Engineers in Sustainability, Renewable and Non-Renewable Resources, Water Resources: Overuse, Pollution, and Engineering Solutions, Energy Resources: Fossil Fuels, Nuclear Power, and Renewable Energy Alternatives, Land Resources: Soil Degradation, Deforestation, and Urbanization.

Unit II: Impact of Engineering Industries on Environment **(7 Hrs)**

Manufacturing & Automobile Industry: Air pollution, Carbon emissions, Waste disposal, Chemical & Pharmaceutical Industry: Water and soil contamination, Hazardous waste, Construction & Infrastructure: Land degradation, Dust pollution, Waste generation,

Electronics & IT Industry: E-waste, Energy consumption, Semiconductor waste, Power Generation (Thermal, Hydropower, Nuclear): Pollution, Waste heat, Radiation hazards, Causes and Effects of Climate Change, Global Warming and Greenhouse Effect.

Unit III: Engineering Solutions for Environmental Mitigation and Sustainable Practices (7 Hrs)

Carbon Capture and Storage (CCS), Eco-friendly Materials, Sustainable Design & Life Cycle Assessment (LCA), Energy-efficient Technologies & Smart Grids, Case Studies on Successful Pollution Reduction **Waste Management Strategies:** Solid Waste and Biomedical Waste Management, E-Waste: Sources, Impact, and Recycling, Hazardous Waste Handling and Treatment, Circular Economy and Zero-Waste Technologies **Sustainable Engineering Practices:** Renewable Energy Technologies (Solar, Wind, Biomass, Hydropower) Green Buildings and Sustainable Architecture, Electric Vehicles and Smart Transportation Systems, Sustainable Agriculture and Water Conservation Technologies.

Unit IV: Environmental Initiatives in India and Worldwide (6 Hrs)

National Initiatives: Swachh Bharat Abhiyan, Namami Gange, National Green Tribunal (NGT), Corporate Social Responsibility (CSR) & Environmental Compliance, Environmental Activism and the Role of NGOs, Environmental Laws and Policies in India, The Environmental Protection Act, 1986, Role of Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCB), International Environmental Agreements (Kyoto Protocol, Paris Agreement, COP Summits), Global Initiatives: UNEP, IPCC, World Bank Environmental Policies.

Books & Other Resources:

Text Books:

1. Benny Joseph, Environmental Studies, McGraw Hill Education, 3rd Edition, 2021. Anubha Kaushik & C.P. Kaushik, Environmental Studies, New Age International Publishers, 5th Edition, 2022.

Reference Books:

1. R. Rajagopalan, Environmental Studies: From Crisis to Cure, Oxford University Press, 3rd Edition, 2021.
2. Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses, University Press, 3rd Edition, 2021.
3. Suresh K. Dhameja, Environmental Science and Engineering, S.K. Kataria & Sons, 2nd Edition, 2020.

Additional Reports & Resources:

- Government of India - Ministry of Environment, Forest & Climate Change (MoEFCC) Reports (Website)
- United Nations Environment Programme (UNEP) Reports (Website)
- IPCC Climate Change Reports (Website)

- Central Pollution Control Board (CPCB) Reports (Website)

List of Activities for reference:

Perform any two activities of the following.

1. **Ecosystem Study Report** – Visit a local park, water body, or forested area and document its ecosystem components (flora, fauna, food chains).
2. **Sustainability Case Study** – Choose one of the Sustainable Development Goals (SDGs) and prepare a report on its implementation in India.
3. **Renewable vs. Non-Renewable Resources** – Prepare a comparative chart listing sources, usage, and sustainability factors.
4. **Water Conservation Survey** – Conduct a survey in your neighborhood or campus to assess water consumption and suggest conservation strategies.
5. **Industrial Impact Assessment** – Select an engineering industry (automobile, chemical, IT, etc.) and analyze its environmental impact.
6. **Carbon Footprint Calculation** – Calculate the carbon footprint of your daily activities (electricity, transportation, food, etc.) and suggest ways to reduce it.
7. **Climate Change Awareness Video** – Create a short video (2–3 min) explaining global warming and its impact.
8. **Case Study on Pollution Control Failures** – Research a real-world incident of industrial pollution (e.g., Bhopal Gas Tragedy, Minamata Disease) and analyze the causes and consequences.
9. **Waste Management Audit** – Conduct a waste audit in your college or home, classify the waste generated, and propose a waste management plan.
10. **E-Waste Collection Drive** – Organize a drive to collect and safely dispose of e-waste in your locality. Submit a report on the amount collected and its disposal method.
11. **Renewable Energy Model** – Create a working or conceptual model of a solar panel, wind turbine, or biomass plant.
12. **Green Building Analysis** – Identify a green building in your city (or college) and analyze its energy-efficient features.
13. **Report on National Environmental Policies** – Summarize key environmental laws in India and their effectiveness.
14. **International Climate Agreements Presentation** – Prepare a presentation on major agreements like the Paris Agreement, Kyoto Protocol, and their impact on India.
15. **NGO/CSR Initiative Study** – Research an NGO or corporate social responsibility (CSR) initiative focused on environmental protection and prepare a report.
16. **Swachh Bharat Implementation Review** – Visit a local area, document cleanliness conditions, and suggest improvements under Swachh Bharat Abhiyan.

Evaluation Criteria (10 Marks Total)

- Depth of Analysis (3 Marks)
- Presentation & Clarity (3 Marks)
- Creativity & Practical Application (2 Marks)
- Timely Submission (2 Mark)

Mr. Abhijeet Gaikwad	Dr. R.K. Shastri	Dr. C. B. Nayak	Dr. S. M. Bhosle	Dr. S. B. Lande
Course Coordinator	HSSM BoS Chairman	Dean Autonomy	Dean Academics	Principal
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