Kolhapur Institute of Technology's

College of Engineering Kolhapur (Empowered Autonomous)

KOLHAPUR INSTITUTE OF TECHNOLOGY'S COLLEGE OF ENGINEERING KOLHAPUR (EMPOWERED AUTONOMOUS)

Syllabus

For

Second Year B. Tech

Electrical Engineering

(Undergraduate Program)

With Effect From

Academic Year: 2024-25

Dr. M.K. Aalam
BOS Chairman

Department of Electrical Engineering

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Dean Academics
Kolhapur Institute of Technology's
College of Engineering (Autonomous),
Kolhapur

SEMESTER III

Sr. No.	Category	Course Code	Course Name	L	T	P	Hrs. / Week	Credits	Evaluation Scheme			
									Component			
1	PC	UELPC0301	DC Machines & Transformers	3	1	-	4	4	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
2	PC	UELPC0302	Electrical Circuit Analysis	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
3	PC	UELPC0303	Computational Mathematics	3	-	-	3	3	ISE1 MSE ISE2 ESE	10- 30 10 50	 20	40
4	PC	UELPC0304	Analog Electronics Engineering	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
5	VEC	UELVE0301	Environmental Studies	2	-	-	2	2	ISE	50	20	20
6	HSSM	UELHS0301	Project Management	2	-	-	2	2	ESE	50	20	20
7	PC	UELPC0331	DC Machines & Transformers Laboratory	-	-	2	2	1	ISE ESE (POE)	25 50	10 20	
8	PC	UELPC0332	Electrical Circuit Analysis Laboratory	-	-	2	2	1	ISE ESE (OE)	25 25	10 10	
9	PC	UELPC0333	Analog Electronics Engineering Laboratory	-	-	2	2	1	ISE	25	10	
10	OJT (PBL)	UELIL0371	Innovative Practices	-	-	2	2	1	ISE	50	20	
11	MM	U**MM0***	Multi Disciplinary Minor-I	2	-	-	2	2	ESE	100	40	
			Total:				**27**	**23**	**Total Marks: 800** **Total Credit: 23**			

Kolhapur Institute of Technology's
College of Engineering Kolhapur (Empowered Autonomous)

Title of the Course: DC Machines and Transformers Course Code: UELPC0301	L	T	P	Credit
	3	-	-	3

Course Pre-Requisite: Basic Physics, Fundamentals of Electrical Engineering

Course Description: This course discusses the concepts of DC machines and Transformers.

Course Objectives:

1. The course aims at giving the fundamentals of energy conversion in electromechanical systems.
2. It covers details of construction and operation of dc machines in motoring and generating modes.
3. The course also deals with the magnetizing characteristics and operation of single phase and three-phase transformers.

Course Outcomes:

CO	After the completion of the course the student should be able to	Blooms level	Descriptor
CO1	Acquire knowledge about the construction and working of conventional and special purpose dc machines.	II	Understanding
CO2	Acquire knowledge about the constructional details, principle of operation of transformers.	VI	Developing / creating / designing
CO3	Acquire knowledge about testing and applications of dc machines & transformers.	III	Implementing / Apply

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	2										2	
CO2		3	3	2	2			1			1	1	1
CO3		2	2	1	1								

Assessment Scheme:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment Component	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and **ISE 2** are based on Assignment/Declared test/Quiz/Seminar/Group discussions/presentation, etc.
MSE is based on 50% of course content (first three units).
ESE is based on 100% course content with 60-70% weightage for course content (last three units) covered after MSE.

Course Contents

Unit No.	Unit Title and Contents	Hours
1	**D.C Generators:** Constructional features, armature windings - simple lap and wave winding. Working principle, Classifications, EMF equation, losses in dc generator, power flow diagram, efficiency, armature reaction, commutation, inter-poles, compensating windings, dc generator characteristics, voltage build-up of a dc shunt generator, and parallel operation of dc generators.	08
2	**D.C motors:** Working principle, Classifications, characteristics of different types; Applications, Losses, efficiency and power flow diagram. Starters, speed control of dc motor and braking.	08
3	**Testing of D.C. Machines**: Necessity of testing, Break load test, Swinburne's test, Hopkinson's test, Retardation test, Field test on D.C series motor.	06
4	**Single Phase Transformers:** Construction, Ideal transformer and practical transformer, name plate rating, phasor diagrams of transformer at no load, phasor diagrams of transformer at load, equivalent circuit and determination of its parameters from O.C and S.C tests; Per unit representation of single-phase transformers, Regulation, efficiency and all day efficiency expressions and calculations, Parallel operation of single-phase transformer, Sumpner Test, polarity test, Single-phase Auto transformer – Comparison of weight, copper loss with 2-winding transformer, applications.	08
5	**3-phase Transformer**: Construction, working principle, types of connection and their comparative features, Parallel operation of three-phase transformers. Scott-connected transformer and open-delta connection, Vector groups for various connections, practical application **Performance Of Transformers**: Switching inrush current, Harmonics in exciting current causes and effects, Harmonics with different transformers connection	08
6	**Special purpose DC Machines:** Stepper motors, Brushless DC motors, DC Servo motors, Permanent Magnet DC Motors, universal motor	06

Textbooks:

Sr. No.	Title	Edition	Author/s	Publisher	Year
1	DC Machines	3rd	A.E.Clayton	Mc Graw Hill publication	2004
2	A textbook of Electrical Technology, Vol II	4th	B. L. Theraja, A. K. Theraja	S. Chand	2018
3	Electric Machines	3rd	Ashfaq Husain	Dhanapat Rai & Co	2016
4	Electric Machinery	6th	E. Fitzgerald, C. Kingsley, Jr., and S. D. Umans	McGraw-Hill	2017
5	Electrical Machinery and Power System Fundamentals	3rd	J. Chapman	McGraw-Hill	2001

Reference books:

Sr. No.	Title	Edition	Author/s	Publisher	Year
1	Electrical Machines	3rd	S.K.Bhattacharya	Mc Graw Hill publication	2015
2	Electrical Machines	3rd	J. B. Gupta	S.K.Kataria and Sons, New Delhi.	2012
3	Electric Machine	2nd	Fitzerald and Kingsley,	Tata McGraw Hill	

Unit wise Measurable Students Learning Outcomes:

1. The students will be understand construction, working and characteristics of DC generators.
2. The students will be understand construction, working and characteristics of DC motors.
3. The students will be understand testing of DC machines.
4. The students will be understand single phase transformer.
5. The students will be understand construction, working, performance of three phase transformer.
6. The students will be understand construction, working, characteristics and applications of special purpose DC machines.

Title of the Course: Electrical Circuit Analysis Course Code: UELPC0302	L	T	P	Credit
	03	-	-	03

Course Pre-Requisite: Basic Electrical Engineering, Solution of Integral Differential Equations, Laplace Transform.

Course Description: This Course aims to discuss the basic concepts of network analysis, which is the pre-requisite for all the Electrical Engineering courses. The course deals with different methods of network reduction and network representations useful for analysis of different complex R-L-C circuits. The course enables students to design resonant circuits, filters and attenuators. Transient Response of complex R-L-C passive circuits is discussed in detail. It is necessary to design stable systems.

Course Objectives:

1. To analyze different complex circuits using various network reduction techniques such as source transformation, Network theorems etc.
2. To discriminate between series and parallel resonance and design resonant circuits.
3. To evaluate two port network parameters.
4. To implement different types of passive filters.

Course Outcomes:

COs	After completion of the course the students will be to	Bloom's Level	Descriptor
CO1	**Simplify and Analyze** the basic AC and DC circuits using Nodal analysis, mesh analysis & network. theorems.	IV	Analyzing
CO2	**Evaluate** steady state and transient performance of DC circuit.	IV	Analyzing
CO3	**Analyze different filters and attenuators**.	IV	Analyzing
CO4	**Derive** two port network parameters and their Inter relationships.	IV	Analyzing

PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	2	1	3	1		3	1		3	2	1
CO2	3	2	1	2	3	1		3	2		2	1	1
CO3	3	3	2	1	3	1		3	2		3	2	1
CO4	3	2	1	1	2	1		3	1		3	1	1

Assessments:

Teachers' assessment-

Two components of In Semester Evaluation (ISE),One Mid Semester Examination(MSE) and one End Semester Examination (ESE) having 20%, 30% and50% weights respectively.

Assessment	Marks
ISE1	10
MSE	30
ISE2	10
ESE	50

ISE1 and ISE2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on50% of course content (Normally first three modules)
ESE: Assessment is basedon100%course content with 60-70% weight-age for course content.(Normally last three modules) covered after MSE.

Course Contents:

Unit1:---Network Fundamentals Representation of voltage& current sources (Independent& Dependent), source transformation, Star- Delta transformation, reduction of networks: Mesh analysis, Node analysis. Super mesh and super node analysis.	**7Hrs**
Unit2:---Network Theorems Solution of D.C and A.C. networks using Superposition Theorem, Millman's Theorem, Norton's Theorem, Thevenin's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem, Duality Theorem, Compensation and Tellegen's Theorem.	**7Hrs.**
Unit3:---AC Circuit Analysis Introduction to three phase supply, Star Delta connection , Relation between phase and line parameter, Three phase power , Balanced and Unbalanced circuit , Resonance: Types: Series& parallel resonance. Series resonance- resonant frequency, variation of impedance, admittance, current& voltage across L& C with respect to frequency, Effect of resistance on frequency response, Selectivity, B.W. and Quality factor. Parallel resonance, resonance frequency, variation of impedance & admittance with frequency, Selectivity & B.W.	**6Hrs.**
Unit4:---Transient Response with DC excitation Analysis of RC, RL, and RLC networks with DC excitation with and without initial conditions using Laplace transforms. Steady state & transient response (Voltage & Current)	**8Hrs.**
Unit5:---Filters & Attenuators Filters**:** Definitions, classification& characteristics of different filters, filter fundamental such as attenuation constant, phase shift constant, propagation constant, characteristic impedance, relationship between decibel and neper. Attenuators-Definition, classification-T type, Π type attenuator	**8Hrs.**

Unit6:---Two Port Network Two port network: Open circuit impedance (Z) parameters, Short circuit admittance (Y) parameters, Hybrid (H)parameter, Transmission parameters (ABCD), Interrelation of different parameters, Interconnections of two port network (Series, Parallel, Cascaded, Series- Parallel)Network functions: Network functions for one port& two port networks, Driving point impedance and admittance of one port network, Driving point impedance, Admittance & different transfer function of two port network (Z,Y,H&T).	**6hrs**

Textbooks:

1. A.Sudhakar, Shyammohan S.Palli, "Circuit& Network – Analysis & Synthesis", IIIrdEdition– Tata McGraw Hill Publication (Unit II, IV, VI).
2. William H Hayt, Jack E Kimmerly and Steven M. Durbin,"Engineering Circuit Analysis", Tata McGraw Hill.

References:

1. Charles K. Alexander Matthew N.O.Sadiku, Fundamentals of Electric Circuit
2. M.E.Van Valkenburg,"Network Analysis",IIIrdEdition,Pearson Education/PHI.
3. Boylestad, "Introductory Circuit Analysis 'Universal book stall, New Delhi.(UnitI, II).
4. A.Chakrabarti,"CircuitTheory(Analysis&Synthesis)",IIIrdEdition(UnitI,II)DhanpatRai& Co.

Unit wise Measurable Students Learning Outcomes:

1. The students will be able to analyze Circuit using the methods learntin this course.
2. The students will be able to apply Network Theorems to simplify DC and AC circuits with R,L,C components.
3. The students will able to design R-L-C series and parallel resonant circuit for given specifications and evaluate them.
4. The students will be able to analyze Stepor DC response and Sinusoidal or AC response of RC/RL/R- L-C series circuit.
5. The students will be able to design & analyze filters and attenuators studied in this course.
6. The students will able to determine Z,Y,Hand ABCD parameters of given two port network.

Title of the Course: Computational Mathematics Course Code: UELPC0303	L	T	P	Credits
	3	---	---	3

Course Pre-Requisite: Basic terminologies of differential equations, vector algebra, Basic results of derivative and integration.

Course Description: This Course contains linear differential equations, Fourier series, Laplace transforms, Fourier Transforms, Vector Calculus.

Course Objectives:

1. To develop abstract, logical and critical thinking and the problem solving ability to reflect critically upon their work.
2. To build the strong foundation in mathematical tools like differential equations, integral transforms, vector calculus needed for the field of Electrical Engineering.
3. The student must be able to formulate a mathematical model for a real life and engineering problem, solve and interpret the solution.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Understand the numerical methods for linear system solution and evaluation of integrals.	II	Understanding
CO2	Solve higher order linear differential equations, problems on Laplace transform.	III	Applying
CO3	Apply the knowledge of vector calculus for finding the directional derivative, curl, divergence and probability distribution for finding probabilities of uncertain events.	III	Applying
CO4	Develop the Fourier series for periodic functions and obtain Fourier transform of given functions.	IV	Evaluating

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2									2		
CO2	2	2									2		
CO3	2	2									2		
CO4	2	2									2		

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three units)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three units) covered after MSE.

Course Contents:

Unit 1: Linear Differential Equations with Constant Coefficients and Its Applications 1.1 Definition, general form, complete solution 1.2 Rules for finding complementary function 1.3 Short methods for finding particular integral 1.4 General rule for finding particular integral 1.5 Applications to electrical circuits	8 **Hrs.**
Unit 2: Laplace Transforms 2.1 Definition, transforms of elementary functions 2.2 Properties of Laplace transform 2.4 Transforms of derivative and integral 2.3 Inverse Laplace transforms 2.5 Inverse Laplace transforms by using partial fractions and Convolution theorem. 2.6 Solution of linear differential equations with constant coefficients by Laplace transform method	7 **Hrs.**
Unit 3: Vector Calculus 3.1 Differentiation of vectors 3.2 Velocity and acceleration 3.3 Gradient of scalar point function and Directional derivative 3.4 Divergence of vector point function 3.5 Curl of a vector point function 3.6 Solenoid and Irrotational vector fields	8 **Hrs.**
Unit 4: Probability Distributions 4.1 Random variable 4.2 Probability mass function and probability density function 4.3 Binomial distribution 4.4 Poisson distribution 4.5 Normal distribution	7 **Hrs.**

Unit 5: Numerical Methods 5.1 Solution of simultaneous linear system of equations 5.1.1 Jacobi's iteration method 5.1.2 Gauss-Seidel iteration method 5.2 Numerical integration using 5.2.1 Trapezoidal rule 5.2.2 Simpson's 1/ 3-rule 5.2.3 Simpson's 3/8-rule	8 **Hrs.**
Unit 6: Fourier Series and Fourier Transform 6.1 Fourier series: Definition, Euler's formulae, 6.2 Fourier series with period 2π. 6.3 Expansion of odd and even periodic functions 6.4 Half range series 6.5 Fourier transforms 6.6 Fourier sine and cosine transforms	7 **Hrs.**

Recommended Books:

1. Higher Engineering Mathematics by Dr. B. S. Grewal, Khanna Publishers, Delhi.
2. A Text Book of Applied Mathematics, Vol. I, Vol. II and vol. III by P. N. Wartikar & J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley India Pvt. Ltd.
2. Advanced Engineering Mathematics by H. K. Dass, S. Chand, New Delhi.
3. A text book of Engineering Mathematics by N. P. Bali, Iyengar, Laxmi Publications (P) Ltd., New Delhi.
4. Mathematics for Engineers Vol-I & Vol-II by Rakesh Dube, Narosa Publishing House.

Title of the Course: Analog Electronics Engineering Course Code: UELPC0304	L	T	P	Credit
	3	-	-	3

Course Pre-Requisite: Basic understanding of circuit theory, including Ohm's Law, Kirchhoff's Laws, and basic semiconductor physics.

Course Description: This course is designed to provide students with a comprehensive understanding of electronic circuits that process continuous signals. The course focuses on the analysis, design, and practical implementation of analog circuits used in various electronic systems. Topics covered include basic semiconductor devices (diodes, BJTs, and MOSFETs), amplifiers, operational amplifiers (Op-amps), filters, oscillators, and voltage regulators.

Course Objectives

1. **Understanding** of semiconductor devices such as diodes, bipolar junction transistors (BJTs), and metal-oxide-semiconductor field-effect transistors (MOSFETs), OP-AMPS, including their operating principles, characteristics, and applications in electronic circuits.
2. **Analyz**e and design basic amplifier circuits using semiconductor devices, including common-emitter and common-source amplifiers, to achieve desired voltage and power gain characteristics.
3. **Apply** the knowledge gained during the course to design and implement complex electronic circuits using various circuit building blocks.

Course Outcomes:

COs	After completion of the course the students will be to	Bloom's Level	Descriptor
CO1	**Understand** the fundamental concepts of semiconductor devices.	II	Understand
CO2	**Analyze** the design, working and characteristics of various semiconductor devices such as BJT, MOSFET, JFET etc.	IV	Analyze
CO3	**Analyze** the design, working and characteristics of OPAMPS.	IV	Analyze
CO4	**Design** complex electronic circuits such as amplifiers, oscillators etc using basic electronic building blocks.	III	Apply

PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2			1	2					2	2	1
CO2	2	2	2	1	1	2					2	2	1
CO3	2	2	1	1	1	2					2	2	1
CO4	3	2	1	1	1	2					2	2	1

Assessments:

Teachers' assessment

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weight-age for course content.(Normally last three modules) covered after MSE.

Course Content

Unit 1:--- Introduction to Analog Electronics Semiconductor physics, Introduction to P-N junction diodes, operation, characteristics and applications of P-N junction diode, concept of load line, Zener diode and its break down phenomena, application of zener diode as a voltage regulator, LED, photo diode, varactor diodes**,** Half wave, Full wave & bridge rectifiers, Capacitor filter, Inductor filter, L-C filter	**8 Hrs**
Unit 2:--- Bipolar Junction Transistors Bipolar Junction Transistors (BJTs), working of PNP and NPN transistors, characteristics of common base, common emitter and common collector configurations. Biasing circuit of BJTs, DC operating point, stability analysis of BJTs, h-parameter models of BJTs, application of BJT as an amplifier.	**9 Hrs.**
Unit 3:--- Field Effect Transistors Field Effect Transistors (FETs), construction, working and characteristics, FET as an amplifier. Metal-Oxide Field Effect Transistors (MOSFETs), construction, working and characteristics, MOSFET as an amplifier.	**8 Hrs**
Unit 4:--- Amplifiers Small-signal amplifiers, Single-stage and multi-stage amplifiers, cascading, need for cascading, working of single-stage BJT amplifier, N stage cascaded amplifiers, working principle, operating characteristics, frequency response, bandwidth of multistage amplifiers. Power amplifiers, need for power amplifiers, working principle, comparison with small-signal amplifiers, classification of power amplifiers: class A, B, C and D. Stages of a practical power amplifier, push-pull amplifier	**8 Hrs**
Unit 5:--- OPAMP Construction, working principle and operating characteristics of OPAMP, OPAMP as an inverting and non-inverting amplifier. Design of summing and difference amplifiers using OPAMP. Cascaded OPAMP circuits. Applications of OPAMPS in digital-to-analog converters and instrumentation amplifiers.	**6 Hrs**

Unit 6:--- Oscillators Introduction to oscillators, necessity of oscillators, general theory of feedback, importance of negative feedback, types of negative feedback in transistor circuits: voltage series, current series, voltage shunt, current shunt feedback amplifiers, Barkhausen's criteria, RC phase shift & Wien bridge oscillator, Clapp oscillator, Tuned collector oscillator, Crystal oscillators, Colpitts Oscillator, Hartley Oscillator.	**9 Hrs**

Textbooks:

1. Analog Electronics (Basic Analog Electronics) by J. B. Gupta.
2. Electronic Devices and Circuit Theory by Robert Boyelstead and Boylestad Louis Nashelsky.
3. Electronic Principles by Albert Malvino and David Bates.

References:

1. Fundamentals of Microelectronics - Behzad Razavi.
2. Microelectronics Circuit by - Sedra & Smith.

Unit wise Measurable Students Learning Outcomes:

1. Understand semiconductor physics and the basic principles of PN junction diode.
2. Analyze the operation principles of bipolar junction transistors (BJTs) and field-effect transistors (FETs).
3. Analyze single-stage and multi-stage transistor amplifiers using appropriate biasing techniques to meet specified gain, input/output impedance, and bandwidth requirements.
4. Understand the properties and applications of operational amplifiers.
5. Understand the principles of feedback in analog circuits, stability criteria (Barkhausen's criterion), and the effects of feedback on amplifier gain, bandwidth, and distortion.
6. Apply basic electronic devices to construct oscillator circuits and analyze the factors affecting frequency stability in oscillators, such as component tolerances, temperature variations, and supply voltage changes.

Title of the Course: Environmental Studies Course Code: UELVE0301	L	T	P	Credits
	2	-	-	2

Course Pre-Requisite: Students shall have knowledge of:

- Basic Science (Physics and Chemistry)

Course Description: The objective of the course is imparting fundamental knowledge and awareness of Environmental Studies among students and importance of conservation of environment.

Course Learning Objectives:

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

1. Study scope and importance of natural resources, ecosystems, biodiversity for creating awareness and their conservation in multiple disciplines.
2. Learn various types of pollution, their impacts and control measures for minimizing pollution and sustainable development.
3. Understand social issues related to environment, environmental ethics and human rights towards environment.
4. Study various laws and regulations related to environment and its applicability in society and industries

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive	
		Level	Descriptor
CO1	Summarize natural resources, importance of ecosystem and conservation of biodiversity with respect to multiple disciplines	2	Understanding
CO2	Explain causes, effects, solutions for various pollution problems and its minimization strategies.	2	Understanding
CO3	Interpret environmental ethics and their implementation for betterment of environment and human life.	2	Understanding
CO4	Summarize the requirements of laws and regulations for environmental conservation and applicability of legislations in society and industries.	2	Understanding

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						2							
CO2	3											1	1
CO3							2						1
CO4						2							1

Assessment Scheme:

ESE: Assessment is based on 100% course content

Assessment Component	Marks
ISE	50

Course Contents:	
Unit 1: Nature of Environmental Studies Definition, scope and importance, Multidisciplinary nature of environmental studies, Need for public awareness.	4 **Hrs.**
Unit 2: Natural Resources and Associated Problems a) Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems. c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources. d) Food resources: World food problem, changes caused by agriculture effect of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewable and nonrenewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy. f) Land resources: Solar energy, Biomass energy, Nuclear energy, Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of individuals in conservation of natural resources.	5 **Hrs.**
Unit 3: Ecosystems Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers. Energy flow in the ecosystem, Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following ecosystem:- a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).	4 **Hrs.**
Unit 4:Biodiversity and its conservation Introduction- Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega- diversity nation, Western Ghat as a biodiversity region. Hot-spot of biodiversity. Threats to biodiversity habitat loss, poaching of wildlife, man wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity	4 **Hrs.**
Unit 5: Environmental Pollution Definition: Causes, effects and control measures of: Air pollution, Water pollution, soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.	4 **Hrs.**
Unit 6: Social Issues and the Environment Disaster management: floods, earthquake, cyclone, tsunami and landslides. Urban problems related to energy Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issue and possible solutions. Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products.	4 **Hrs.**

Unit 7:Environmental Protection From Unsustainable to Sustainable development. Environmental Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Population Growth and Human Health, Human Rights.	5 **Hrs.**

Textbooks:

1. Environmental Studies by Dr. P.D.Raut (Shivaji University, Kolhapur)

Reference Books:

1. Miller T.G. Jr., Environmental Science. Wadsworth Publications Co.(TB).
2. Odum, E.P.1971, Fundamentals of Ecology, W.B.Saunders Co. USA,574p
3. Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines,Compliances and Standards, vol. I and II, Environmental Media (R)

Unit wise Learning Outcomes:

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

UO 1: Describe scope and importance of environmental studies.
UO 2: Describe types of natural resources, their use and conservation.
UO 3: Explain structure and functions of ecosystem, their types and importance.
UO 4: Discuss biodiversity, endangered species and methods of biodiversity conservation.
UO 5: Explain causes, effects and solutions to pollution problems.
UO 6: Discuss environmental ethics and various social issues related to environment.
UO 7: Discuss laws and regulations for conservation of environment.

Title of the Course: Project Management Course Code: UELHS0301	L	T	P	Credit
	2	-	-	2

Course Pre-Requisite: Fundamental knowledge of management and basics of Projects

Course Description:

Course comprises of introduction to project management, project identification, selection and project planning. I cover concepts of project activities, work breakdown structure, activity duration, resource requirements. It also introduces about project scheduling, project risk management, project costing and project execution, control and close out.

Course Objectives:

1. To define concepts of project and project management.
2. To explain various steps in project identification, selection and planning.
3. To decide about project schedules and operation.
4. To analyze project risks and role of computers in project management.
5. To analyze aspects of project costing, project execution, control and close-out.

Course Learning Outcomes:

COS	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Define concepts related to project and project management	I	Remembering
CO2	Explain steps in project identification, selection and project planning	II	Understanding
CO3	Identify aspects of work breakdown structure, activity duration, resource requirements	III	Applying
CO4	Analyze project risks, role of computers, aspects of project costing, project execution, control and close-out	IV	Analyzing

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2		2	3		1	3	3	3	2
CO2	3	3	3	2		2	3		1	3	3	3	2
CO3	3	3	-	2		2	3		1	3	3	3	2
CO4	3	3	-	2		2	3		1	3	3	3	2

Assessment Scheme:

Assessment Component	Marks
ESE	50

Course Contents:

Unit1:Introduction to Project Management Definition of a project, project management & its need, characteristics objectives &importance of projects, classification of projects, project management process, project management life cycle &its phases, roles and responsibilities of project managers, types of project managers, forms of project management.	06Hrs.
Unit2:Project Selection, Planning & Risk Management Project ideas and sources, steps in project identification process, feasibility studies and types, feasibility report and its contents, financial institutions, project breakeven point Project planning-scope, delivery, budget, forms of organization structures-functional. Risk management, steps in risk management, Use of computers in project management	06 Hrs.

Unit 3:Project Activities & Resource Requirements Work breakdown structure (WBS)-product oriented and functionally oriented WBS, responsibility chart and responsibility matrix, integrating WBS and organization structure Methods for estimating activity duration.	06 Hrs.
Unit 4:Project Scheduling Activity, events, work packages, Gantt chart, scheduling of projects using network analysis PERT & CPM: Introduction to project evaluation and review, introduction to critical path method, deciding project duration using network diagram, calculation of earliest start time, latest finish time, slack, total float, free float.	06 Hrs.
Unit 5:Project Costing & Execution Elements of cost estimates and budgets of projects, Introduction to methods for assessing economic viability of projects, Project execution & Control-conduct project execution and control kick-off, manage CSSQ (cost, scope, schedule, quality) monitor & control risk. manage project execution, gain project acceptance, Project close-out, steps for closing the project. Case study of Electrical Project implementation	06 Hrs.

Textbooks:

1. Engineering Project Management-Parameshwar PIyer-Vikas Publishing House Pvt Ltd
2. Project Management-S.Choudhury,-TMHPublishingCo.Ltd,NewDelhi
3. Prasanna Chandra,Projects – Planning, Analysis, Financing, ImplementationandReview,Tata McGraw Hill,4th Ed, 1997

References:

1. NYSProjectManagementGuidebook-Release2
2. John M Nicholas, —Project Management for business and technology, 2ndedition,Pearson Education Asia, 2001
3. Effective Project Management Robert K. Wysocki, RobertBeck.Jr.,and David B.Crane;-John Wiley & Sons.
4. Total Project Management-The Indian Context-P.K.Joy,-MacmillanIndiaLtd.,Delhi
5. Project Management in Manufacturing and High Technology Operations-Adedeji Bodunde Badiru, -John Wiley and Sons.
6. Fundamentals of PERT/CP Mand Project Management-S.K.Bhattacharjee; -Khanna Publishers, New Delhi

Unit wise Measurable students Learning Out comes:

1. Student should be able to define concept related to project and project management
2. Student should be able to explain process involved in identifying project along with selection and project planning
3. Student should be able to explain concepts like work break down structure, activity duration, resource requirements
4. Student should be able to make use of Gantt chart and network analysis for optimum project schedules and durations.
5. Student should be able to analyze aspects of project costing, project execution, control and close-out

Title of the Course: DC Machines and Transformers Lab	L	T	P	Credit
Course Code: UELPC0331	-	-	2	1

Course Pre-Requisite: Basic Physics, Fundamentals of Electrical Engineering, DC machines & Transformers

Course Description: This course contains experimentation to familiarize and operate and control electric machines studied in DC machines and transformers theory course

Course Objectives:

1.To develop skills to demonstrate performance/ operation of DC motors &transformers using different tests.
2. To develop skills to analyze operation and performance of DC machines & transformers.

Course Outcomes:

CO	After the completion of the course the student should be able to	Blooms level	Descriptor
CO1	Understand electrical characteristics and performance of DC machines.	II	Understanding
CO2	Find electrical characteristics and performance of transformers.	VI	Developing / creating / designing
CO3	Control a machine as per requirement.	III	Implementing / Apply

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	2										2	
CO2		3	3	2	2			1			1	1	1
CO3		2	2	1	1								

Assessment Scheme:

Assessment Component	Marks
ISE	25
ESE(POE)	50

ISE is based on at least two of the assessment tools like performance of student in laboratory, experimental write-up, presentation, oral, and test (surprise/declared/quiz).
ESE Assessment is based on performance in a practical examination and oral test thereafter, at the end of the semester.

Course Content:

Expt. No.	Name of experiment	No. of Hrs
1	Speed control of dc shunt motor (i) Armature control method (ii) Field control method.	02
2	Determination of efficiency of DC motor by Swinburne's test.	02
3	Determination of efficiency of DC motor by Hopkinson's test.	02
4	Brake test on shunt motor to determine effect on various parameters.	02
5	Field test on series motor to determine effect on various parameters.	02
6	Open circuit and short circuit test for determining equivalent circuit parameters of a single phase transformer.	02
7	Polarity test on single phase and three phase transformers.	02
8	Parallel operation of single phase transformer to demonstrate load sharing.	02

9	Scott connections for converting 3 phase to 2 phase supply.	**02**
10	Equivalent Delta test or Heat run Test for determination of temperature rise and efficiency of 3 phase transformer	**02**
11	Verification of vector groups experimentally.	**02**
12	Sumpner's test on transformer (single phase and three phase) to determine losses and efficiency.	**02**

Textbooks:

Sr. No.	Title	Edition	Author/s	Publisher	Year
1	DC Machines	3rd	A.E.Clayton	Mc Graw Hill publication	2004
2	A textbook of Electrical Technology, Vol II	4th	B. L. Theraja, A. K. Theraja	S. Chand	2018
3	Electric Machines	3rd	Ashfaq Husain	Dhanapat Rai & Co	2016
4	Electric Machinery	6th	E. Fitzgerald, C. Kingsley, Jr., and S. D. Umans	McGraw-Hill	2017
5	Electrical Machinery and Power System Fundamentals	3rd	J. Chapman	McGraw-Hill	2001

Reference Books

Sr. No.	Title	Edition	Author/s	Publisher	Year
1	Electrical Machines	3rd	S.K.Bhattacharya	Mc Graw Hill publication	2015
2	Electrical Machines	3rd	J. B. Gupta	S.K.Kataria and Sons, New Delhi.	2012
3	Electric Machine	2nd	Fitzerald and Kingsley,	Tata McGraw Hill	

Unit wise Measurable Students Learning Outcomes:

1. The students will be understand speed control of DC motors.
2. The students will be able to determine efficiency of DC motor by Swinburne's test.
3. The students will be able determine efficiency of DC motor by Hopkinson's test
4. The students will be plot different characteristics of DC motor by direct loading method.
5. The students will be test DC series motor
6. The students will be able to perform OC and SC test on transformer.
7. The students will be able to find polarity of transformers.
8. The students will be able to share common load by parallel operation of transformers.
9. The students will be able to convert balanced three phase supply in balanced two phase supply by scott connection.
10. The students will be able to know procedure of transformer testing.
11. The students will be able to verify different vector groups experimentally.
12. The students will be able to find efficiency & regulation of transformer by Sumpner test.

Title of the Course: Electrical Circuit Analysis LAB Course Code: UELPC0332	L	T	P	Credit
	-	-	02	01

Course Pre-Requisite: Basic Electrical Engineering Lab

Course Description: This course contains experimentation to find/ verify properties of different electrical networks.

Course Objectives:

1. To make students demonstrate electrical circuit theorems through various experiments.
2. To develop skills for experimenting with first and second order electrical circuit.
3. To develop skills to measure two port electrical networks.

Course Outcomes:

COs	After the completion of the course the students will be	Bloom's level	Descriptor
CO1	**Verify** A.C. and D.C. circuit theorems through experiments.	IV	Analyzing
CO2	**Analyze** first and second order circuits through simulation.	IV	Analyzing
CO3	**Analyze** first and second order circuits through experiments.	IV	Analyzing
CO4	**Measure** parameters of any two port network	V	Applying

PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	2	1	3	1		3	1		3	2	1
CO2	3	2	1	2	3	1		3	2		2	1	1
CO3	3	3	2	1	3	1		3	2		3	2	1
CO4	3	2	1	1	2	1		3	1		3	1	1

Assessments:

Teachers' assessment-

In Semester Evaluation (ISE), and End Semester Examination (ESE) having 50% weightage each

Assessment	Marks
ISE	25
ESE(OE)	25

ISE is based on at least two of the assessment tools like performance of student in laboratory, experimentalwrite-up, presentation, oral, and test (surprise/declared/quiz). ESE Assessment is based on performance in apractical oral examination thereafter, at the end of the semester

Course Contents: Use of suitable software Tools is recommended.	
Experiment No.1:--- Analysis of D.C circuits using Mesh analysis.	**2Hrs**
Experiment No.2:--- Analysis of D.C circuits using Nodal analysis.	**2Hrs**
Experiment No.3:--- Validation of Superposition theorem.	**2Hrs**
Experiment No.4:--- Validation of Thevenin's theorem.	**2Hrs**
Experiment No 5:---Validation of Norton's theorem	**2Hrs**
Experiment No.6:---Verification of Maximum Power Transfer theorem.	**2Hrs**
Experiment No.7:--- Analysis of transient and steady state behavior of a first order circuit (R-C circuit).	**2Hrs**
Experiment No.8:--- Analysis of transient and steady state behavior of a second order circuit (R-L-C circuit).	**2Hrs**
Experiment No.9:--- Measurement of Z, Y, ABCD and Hybrid parameters of two port network.	**2Hrs**
Experiment No.10:--- Analysis of A.C. circuits using Mesh and Node analysis.	**2Hrs**

Textbooks:

1. C.K. Alexandar and M.O. Sadiku "Electric Circuits Analysis", Tata McGraw Hill, 5th Edition, 2013.

References:

1. L.P. Huelsman, "Basic Circuit Theory", PHI Publication, 3rd Edition, 2009.
2. M.E. Van Valkenburg, "Network Analysis", PHI publication, 3rd Edition, 1983.
3. Sudhakar Shyammohan "Circuit and Networks", Tata McGraw Hill, 2nd Edition, 2002.

Experiment wise Measurable students Learning Outcomes:

Experiment No.1 -The students will be able to find unknown circuit parameters using Kirchhoff's law.
Experiment No.2-The students will be able to analyze D.C circuits using Mesh and Node analysis.
Experiment No.3-The students will be able to use Superposition Theorem to analyze a circuit.
Experiment No.4-The students will be able to apply Thevenin's to analyze a circuit.
Experiment No.5--The students will be able to apply Norton's to analyze a circuit.
Experiment No.6-The students will be able to use Maximum Power Transfer theorem to analyze a circuit.
Experiment No.7-The students will be able to relate time constant with transient and steady state behavior of a first order circuit (R-C circuit).
Experiment No.8-The students will be able to relate time constant with transient and steady state behavior of a first order circuit (R-L circuit).
Experiment No.9-The students will be able to co- relate Z, Y, ABCD and Hybrid parameters of two port network.
Experiment No.10 -The students will be able to analyze A.C circuits using Mesh and Node analysis

Title of the Course: Analog Electronics Lab Course Code: UELPC0333	L	T	P	Credit
	-	-	2	1

Course Pre-Requisite: Basic understanding of circuit theory, including Ohm's Law, Kirchhoff's Laws, and basic semiconductor physics.

Course Description: This course aims to help the students understand practical use and implementation of the theoretical concepts of semiconductor devices and circuits. The students are exposed to different analog electronic components and circuits, their practical feasibility, capability and limitations regarding their best utilization in a specific situation. The course emphasizes circuit design and analysis skills that require the student to create and analyze circuits that meet customer/user specifications as industry professional or entrepreneur.

Course Objectives

1. Understanding the basic working of semiconductor devices.
2. Comprehensive exposure and skills to develop different types of amplifiers and oscillators.
3. Design and implement the various real-time applications using analog IC's.

Course Outcomes:

COs	After completion of the course the students will be to	Bloom's Level	Descriptor
CO1	**Understand** semiconductor devices and their characteristics.	II	Understand
CO2	**Analyze** device characteristics to determine important device and circuit parameters.	IV	Analyze
CO3	**Implement** circuits using BJTs and OPAMPs.	V	Design
CO4	**Implement** different oscillators based on the output frequency required using fundamental electronic components.	V	Design

PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2										1	1	
CO2		1		1	3						1	2	
CO3		2	1	2	3	1	1	1		1	1	2	1
CO4	1	1				1	1	1	1		1	1	

Assessments:

Teachers' assessment

Assessment	Marks
ISE	25

List of Experiments

EXPERIMENT 1:-- To plot the diode characteristics and find it's dynamic resistance and cut-in voltage.	**2 Hrs**
EXPERIMENT 2:-- To use Zener diode as a shunt voltage regulator.	**2 Hrs.**
EXPERIMENT 3:-- To design a Half Wave and a Full Wave Rectifier.	**2 Hrs**
EXPERIMENT 4:-- To plot the Input and output characteristics of a BJT	**2 Hrs**
EXPERIMENT 5:-- Implementation of an Inverting amplifier using an OPAMP.	**2 Hrs**
EXPERIMENT 6:-- Implementation of a Non-Inverting amplifier using an OPAMP.	**2 Hrs**
EXPERIMENT 7:-- To design a Wien bridge oscillator for a desired frequency.	**2 Hrs**
EXPERIMENT 8:-- To design a RC-phase shift oscillator for a desired frequency.	**2 Hrs**
EXPERIMENT 9:-- To plot the frequency response of a single stage RC coupled CE amplifier and determine its bandwidth (Software based).	**2 Hrs**
EXPERIMENT 10:-- To observe the effect of negative feedback (Emitter bypass capacitors) on the frequency response of an amplifier (Software based).	**2 Hrs**

Textbooks:

1. Analog Electronics (Basic Analog Electronics) by J. B. Gupta.
2. Electronic Devices and Circuit Theory by Robert Boyelstead and Boylestad Louis Nashelsky.
3. Electronic Principles by Albert Malvino and David Bates.

References:

Fundamentals of Microelectronics - Behzad Razavi.

1. Micro Electronics Circuit by - Sedra & Smith.

Experiment wise Measurable Students Learning Outcomes:

1. Students will be able to visualize the forward and reverse bias characteristics of a PN junction diode.
2. Students will be able to use the zener diode in reverse bias conditions and regulate the voltage across a sensitive load.
3. Students will be able to construct a half and a full wave uncontrolled rectifier using PN junction diodes.
4. The students will be able to plot the characteristics of a Bipolar Junction Transistor (BJT) for any configuration (i.e., CE, CB, CC)
5. Students will be able to use an OPAMP as an inverting amplifier.
6. Students will be able to use an OPAMP as a non-inverting amplifier.
7. The students will be able to design a Wien bridge oscillator for a particular oscillation frequency.
8. The students will be able to design a RC-phase shift oscillator for a particular oscillation frequency.
9. The students will be able to study the frequency response of a single stage RC coupled CE amplifier and determine its bandwidth using a simulation-based software preferably MATLAB.
10. The students will be able to observe the effect of negative feedback (Emitter bypass capacitors) on the frequency response of an amplifier using a simulation-based software preferably MATLAB.

Title of the Course: Introduction to Robotics & Automation Course Code: UELMM0341	L	T	P	Credit
	02	-	-	02

Course Prerequisite: Knowledge of Engineering Mathematics, Engineering Mechanics.

Course Description: This course provides an understanding of the technologies and the standards relating to the robotics and automation.

Course Objectives:

1. To understand principles of robotics& automation.
2. To learn the concepts of robotics, kinematics of robotics.
3. To know the methods of automated flow lines assembly line balancing concept.

Course Outcomes:

COs	After the completion of the course the students will be able to	Blooms level	Descriptor
CO1	Learn fundamentals of robotic components& its manipulator kinematics.	II	Understanding
CO2	Relate automation in production and manufacturing along with process control	IV	Analyzing
CO3	Apply the knowledge of flow lines and system assembly line balancing techniques in its analysis.	III	Apply

PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	2			1				2	1	1	1
CO2	1	2	1	2		2	1				1	1	1
CO3	1	1	1	2		1		1		1	1	1	1

Assessments:

Teachers' assessment-

It consists of one End Semester Examination (ESE) having 100% weight.

Assessment	Marks
ESE	100

ESE: Assessment is based on 100% course content with 100% weightage for course content

Course Contents: **Unit 1: Introduction to Industrial Robotics**: Classification of Robot Configurations, functional line diagram, degrees of freedom, Components common types of arms, joints grippers ,factors to be considered in designing of grippers. Robot Actuators and Feedback Components: actuators, pneumatic, hydraulic actuators, electric and stepper motors, comparison.	**7Hrs.**
Unit 2: Manipulator Kinematics: Homogenous transformation as applicable to rotation and transition- DH notations, Forward inverse kinematics. Manipulator Dynamics: Differential transformations, Jacobians, Langarange-Euler and Newton-Euler formations, Trajectory Planning: Trajectory planning and avoidance of obstacles, path planning, skew motion, joint integrated motion – straight line motion.	**7Hrs.**
Unit 3:Introduction to Automation: Need, Types, Basic elements of an automated system, manufacturing industries, types of production, functions in manufacturing, organization and information processing in manufacturing, automation strategies and levels of automation, hardware components for automation and process control, mechanical feeders ,hoppers, orienters, high speed automatic insertion devices.	**6Hrs.**
Unit 4: Automated flow lines: Part transfer methods and mechanisms, types of flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines.	**5Hrs.**
Unit 5: Assembly Line Balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance flexible assembly lines.	**5Hrs.**

Texts books:

1) Automation, Production Systems and CIM, M.P.Groover/Pearson Edu.
2) Industrial Robotics-Mikell P.Groover and Mitchell Weiss, Roger N.Nagel,NicholasG.Odrey-McGraw Hill.

References:

1) Robotics and Control- R.K.Mittal and I J Nagrath, Tata Mc Graw Hill
2) Introduction to Robotics –John J.Craig, Pearson Edu.
3) Fundamental concepts and analysis – Asitava Ghoshal,Oxford University Press

Unit wise Measurable students Learning Outcomes:

1. The students will be able to learn the various components in the anatomy of robot.
2. The students will be able to relate the application of various types of end effectors and sensor devices along with homogenous transformations.
3. The students will be able to understand basics of automation, types of automation, components of automation, strategies and levels of automation.
4. The students will be able to acquire knowledge of types of flow lines, quantitative analysis of flow lines
5. The students will be able to analyze how assembly is carried out on automated flow line without interruption and how to balance the line and flexible assembly lines.

SEMESTER IV

									Component			
1	PC	UELPC0401	Electrical Power Systems	2	-	-	2	2	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
2	PC	UELPC0402	AC Machines	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
3	PC	UELPC0403	Power Electronics	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
4	PC	UELPC0404	Electrical Measurements & Instrumentation	2	-	-	2	2	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
5	PC	UELPC0405	Electromagnetic Field Theory	3	-	-	3	3	ISE1 MSE ISE2 ESE	10 30 10 50	 20	40
6	VEC	UELVE0401	Constitution of India	2	-	-	2	2	ISE	50	20	20
7	PC	UELPC0431	AC Machines Laboratory	-	-	2	2	1	ISE ESE (POE)	25 25	10 10	
8	PC	UELPC0432	Power Electronics Laboratory	-	-	2	2	1	ISE ESE (POE)	25 25	10 10	
9	OJT (PBL)	UELIL0471	Mini Project-I	-	-	2	2	1	ISE	25	10	
10	VSEC	UELVS0431	Electrical Wiring Practices	-	-	2	2	1	ISE	25	10	
11	CC	UELCC0431	Co -Curricular Activities-II	-	-	2	2	1	ISE	50	20	
12	MM	U**MM0***	Multi Disciplinary Minor -II	3	-	-	3	3	ESE	100	40	40
			Total:				**28**	**23**	**Total Marks: 850 Total Credit: 23**			

Title of the Course: Electrical Power System Course Code: UELPC0401	L	T	P	Credit
	02	-	-	02

Course Pre-Requisite:
Power Generation, Various insulating materials and properties, Knowledge of fundamentals of electrical circuit components and engineering mathematics.

Course Description: This course deliberates the various aspects of tariff in power system, key emphasis on transmission and distribution of electrical power.

Course Objectives: This course will

1. To learn the basic structure of electrical power systems, various electrical terms related with power system and understand various types of tariffs.
2. To understand the specifications and applications of various major electrical equipment present in power plant.
3. To understand the specifications and applications of various major electrical equipment present in power plant.
4. To learn representation of transmission lines for performance evaluation.

Course Outcomes:

COs	After the completion of the course the students will be able to	Blooms level	Descriptor
CO1	Recognize different patterns of load curve and calculate associated different factors with it and tariff.	II	Understand
CO2	Draft specifications of electrical equipment in power station. Design electrical and mechanical aspects in overhead transmission and underground cables.	IV	Create
CO3	Evaluate the parameter of the transmission line configurations.	IV	Create
CO4	Analyze the performance of short and medium transmission lines.	IV	Performance

PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3						1						1
CO2	3	3	3		1		1			1		3	3
CO3	3	3	3	3	1		1			1		3	3
CO4	3	3	3	3	1		1			1		3	3

Assessments:

Teachers' assessment-
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc. MSE: Assessment is based on 50% of course content. (Normally first three modules) ESE: Assessment is based on 100% course content with 60-70% weight-age for course content. (Normally last three modules covered after MSE.)	
Course Contents: **Unit 1: Structure of Electrical Power Systems and Tariff** **A) Structure of Electrical Power Systems:** 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, Advantages of interconnected grid system, **B) Tariff:** Introduction of Tariff, Tariff setting principles, desirable characteristics of tariff, various consumer categories and implemented tariff such as two-part tariff, three-part tariff(Numerical on two part and three-part tariff), Time of day tariff for H.T and L.T industrial and commercial consumers, Introduction to Availability based tariff (ABT), kVAh tariff (Descriptive treatment only).	**6 Hrs.**
Unit 2: Major Electrical Equipment's in Power Station **A) Major Electrical Equipment's in Power Station:** Descriptive treatment of ratings of various equipment used in power station, Special features, field of use of equipment like alternators, necessity of exciters, various excitation systems such as dc excitation, ac excitation and static excitation systems, Power transformers, voltage regulators, bus-bars, current limiting reactors, circuit breakers, protective relays. Current transformers, potential transformers, Lightning arresters, earthing switches, isolators, Carrier current equipment's (P.L.C.C), Control panels, battery rooms, and other control room equipment in generating station**.** Classification of cables, XLPE cables.	**6 Hrs.**
Unit 3: Mechanical Design of Overhead lines and Insulators: **A) Mechanical Design of Overhead lines:** 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. **B) 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, (Numerical on string efficiency and up to four discs only), Methods of improving string efficiency (Descriptive treatment only).	**6 Hrs.**
Unit4: Resistance and Inductance of Transmission Line: Resistance of transmission line, Skin effect and proximity effect, Internal and external flux linkages of single conductor, Inductance of single phase two wire line, Necessity of transposition, Inductance of three phase line with symmetrical and unsymmetrical spacing with transposition, Concept of G.M.R and G.M.D, Inductance of bundled conductors.	**6 Hrs.**
Unit 05: Capacitance of Transmission Line: Basic concept of Capacitance of single-phase line, Capacitance of single-phase line with effect of earth's surface on electric field, Concept of G.M.R and G.M.D for capacitance calculations, Capacitance of three phase line with symmetrical and unsymmetrical spacing with transposition.	**5 Hrs.**

Unit 06: Performance of Transmission Line: Classification of lines based on length and voltage levels such as short, medium and long lines, Performance of short transmission lines with voltage current relationship and phasor diagram, Representation of medium lines as 'Nominal Π' and 'Nominal T' circuits using R,L and C parameters, Ferranti effect, Representation of 'T' and 'Π' models of lines as two port networks, Evaluation and estimation of generalized circuit constants (ABCD) for short and medium lines.	**6 Hrs.**

Text Books:

1. V.K.Meheta, Rohit Mehta, "Principles of Power System", S. Chand Publication.
2. J.B.Gupta, "Transmission and Distribution", S.K.Kataria and Sons, New Delhi.
3. J.B.Gupata,"Generation and Economic Considerations",S.K.Kataria& Sons, New Delhi.
4. Dr.B.R.Gupta, "Generation of Electrical Energy", S. Chand Publication.
5. A Chakraborty, M.L.Soni, P.V. Gupta, U.S.Bhatnagar,"A text book on Power System Engineering", Dhanpatrai& Co, Delhi.
6. S.N.Singh, "Electric Power Generation, Transmission and Distribution", Prentice Hall of India

Reference Books:

1. Nagrath & Kothari, "Power System Engineering", Tata McGraw Hill Publications
2. D. Das," Electrical Power System", New Age Publication
3. W.D.Stevenson, "Power System Analysis", Tata McGraw Hill Publications.
4. M.V.Deshpande," Elements of Power Station Design", Wheeler Publishing.
5. I.J. Nagrath and D.P.Kothari," Modern Power System Analysis", Tata McGraw Hill
6. NPTEL course on Power System Engineering, IIT Kharagpur
7. https://nptel.ac.in/courses/108/105/108105104/
8. NPTEL course on Power System Analysis, IIT Kharagpur
9. https://nptel.ac.in/courses/108/105/108105067/
10. https://wss.mahadiscom.in/wss/wss?uiActionName=getEnergyBillCalculator.
11. Maharashtra Electricity Regulatory Commission www.merc.gov.in

Unit wise Measurable students Learning Outcomes:

At the end of the course the student will be able to:

1. Recall the fundamental concept of electrical power system and Tariff.
2. To explain the Major Electrical Equipment's in Power Station & Underground Cables
3. To design of an overhead line.
4. To find performance parameters of transmission line.
5. To explain transmission line parameter.
6. To understand performance of transmission line and analysis.

Title of the Course: AC Machines Course Code: UELPC0402	L	T	P	Credit
	03	-	-	03

Course Prerequisite: Basic Electrical Engineering.

Course Description: This course contains detailed information about construction, working, testing and controlling of AC machines.

Course Objectives:

1. This course intends to provide details of operation and performance of asynchronous and synchronous machines.
2. It intends to develop application skills to operate asynchronous and synchronous machines.
3. It intends to develop a skill to determine asynchronous and synchronous machines.

Course Outcomes:

COs	After the completion of the course the students will be able to	Blooms level	Descriptor
CO1	**Explain** the construction and operation and performance induction Motor.	II	Understanding
CO2	**Evaluate** characteristics parameters of Induction motor using different tests.	IV	Analyzing
CO3	**Explain** the construction and operation and performance Synchronous Generator.	II	Understanding
CO4	**Explain** the construction and operation and performance induction Motor.	II	Understanding

PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3					3					3	1	
CO2	3	1	2	2	3	3					2	1	3
CO3	3	2	1	3	2	3					2		

Assessments:

Teachers' Assessment:

It consists of two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weight-age for course content. (Normally last three modules) covered after MSE.

Course Contents:

Unit 1: ---Three Phase Induction Motor Construction, Principle of operation, Phasor diagram, equivalent circuit, analysis based on approximate equivalent circuit, Speed control, Torque equation, speed equation, speed torque curve, No load test, Blocked rotor test, and circle diagram, starting and types of starter, ratio of starting torque to full load torque cogging and crawling, Braking.	**9 Hrs**
Unit 2: --- Special Induction Motor High efficiency Induction Motor, Double cage Induction motor, Deep Bar Induction motor.	**6 Hrs.**
Unit 3: --- Single Phase Induction Motor Types, Construction, Principle of operation, phasor diagram, equivalent circuit, Experimental determination of parameter, application.	**6 Hrs.**
Unit 4: --- Armature Winding of Synchronous Machine Introduction, ac machine windings, winding factors, the emf equation, harmonics in generated EMF, causes of harmonics and their suppressions	**8Hrs**
Unit 5: --- Synchronous Generator Construction, Principle of operation, EMF equation, armature reaction, armature resistance and reactance, synchronous reactance, field excitation system, damper winding, Voltage regulation by synchronous Impedance method, zero power factor method, MMF method, efficiency and losses, method of synchronizing, hunting, damping, Short Circuit Ratio & its significance.	**8 Hrs.**
Unit 6: --- Synchronous Motor Method of starting, Phasor diagram, torque and torque angles equation, V–curves and experimental setup, hunting and damping, synchronous condenser.	**8 Hrs.**

Textbooks:

1. I. J. Nagrath and D. P. Kothari. "Electric Machines", McGraw Hill Education,2010.
2. A. E. Clayton, "DC Machines", Mc Graw Hill publication, 3rd Edition.
3. M. G. Say. "Performance Design of AC Machines", CBS Publishers, 3rd Edition.
4. B. L. Theraja, A. K. Theraja, S. Chand "A textbook of Electrical Technology, Vol I and Vol II"
5. O. E. Taylor, "Performance Design of AC commutator motors", Wheeler Publisher, 15th Reprint.

References:

1. S. K. Bhattacharya, "Electrical Machines", Tata Mc Graw Hill, New Delhi
2. J. B. Gupta, "Electrical Machines", S K Kataria and Sons, New Delhi.
3. Fitzerald and Kingsley, "Electric Machine", Tata McGraw Hill.

Unit wise Measurable students Learning Outcomes:

1. The students will be to evaluate the performance rating of Three phase Induction motor..
2. The students will be to understand Special Induction Motor.
3. The students will be to Armature Winding of Synchronous Machine.
4. The students will be able to understand working and be able to test the transformer.
5. The students will be to determine the performance of the synchronous generator.
6. The students will be to determine the performance of the single-phase induction motor and synchronous motor.

Title of the Course: Power Electronics Course Code: UELPC0403	L	T	P	Credit
	03	--	--	03

Course Pre-Requisite: Basics of Electrical and electronics circuits and devices. Analog and digital circuits and devices

Course Description: This course discusses the Power electronics circuits, consists of Power semiconducting devices and its characteristics. It deals with conversion & control of electrical power along with switching transitions in thyristor, MOSFETS and IGBTs. Three major areas of Electrical Engineering power, electronics and control. Under controlled power conditions, load performs better. So there has always been a popular demand to have power modulators. Various types of power Modulators are discussed; Students are expected to apply these modulators to solve various practical problems..

Course Objectives:

1. Understandthepowersemiconductordevicescharacteristicsitsapplications.
2. Analyzethepowerconvertercircuitsanddeterminetheperformanceparameters.
3. Apply the control techniques for power converter to control performance parameters and solve the Practical problems.

Course Outcomes

COs	After completion of the course the students will be to	Bloom's Level	Descriptor
CO1	**Understand** the power semiconductor devices characteristics & its applications	II	Understanding
CO2	**Evaluate** the power converter circuits and **analyze** the performance parameters.	V	Evaluate
CO3	**Design** the control techniques for power converter control performance parameters and solve the practical problems	VI	Creating

POMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3			2				3			2	1	1
CO2	3			3				3			2	1	1
CO3	3			4				3			2	1	1

Assessments:

Teacher's assessment-

Two components of In Semester Evaluation (ISE),One Mid Semester Examination(MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment isbasedon100%coursecontentwith60-70%weight-ageforcoursecontent. (Normally last three modules) covered after MSE.

Course Contents:

Unit 1: ---Introduction to Power Electronics-Power electronic system, Applications of Power Electronics, Power semiconductor devices/switches, classification of switches, characteristics of switches, Power diode-types, Switching & Reverse Recovery Characteristics. Construction and working of Power MOSFET, IGBT and characteristics. Datasheet reading of Power diode SCR, MOSFET, IGBT	**7Hrs.**
Unit 2: ---Thyristors- Construction and working of Thyristor, Static V-I characteristics of Thyristor, Thyristor Turn-on methods, Two-Transistor Model of SCR, Switching Characteristics of SCR, Gate Characteristics of SCR, Protection of SCR, firing/gating circuits for Thyristor, Heating and cooling circuit of SCR, Series & Parallel Operation of SCR.	**7Hrs.**
Unit 3: ---Controlled Rectifiers-Single phase half wave-controlled rectifier with R load, RL load, freewheeling diode. Single phase full wave (B-2 connection) controlled rectifier with RLE load. Single phase semi converter. Single phase symmetrical and asymmetrical semi converter. Numerical on performance of full and semi-converter. Three-phase half wave-controlled rectifiers R, RL, RLFWD load. Three-phase full-controlled converter. Three phase semi-converters. Effect of Source inductance on performance of single phase and three phase converters. Dual converter.	**8Hrs.**
Unit4:--- Cycloconverters & AC Voltage Converter- **AC Voltage Controllers-**Introduction, Principle of phase control & Integral cycle control, Single-Phase Full- Wave Bidirectional Controller with Resistive Loads and Inductive Load, Single Phase Transformer Static Tap Changer, AC Voltage controller with TRIAC, Three Phase Full Wave Bidirectional Controller. **Cycloconverters-** Introduction, Classification, Single Phase Bridge Type Cycloconverter, Single Phase Step-up Cycloconverter, Three Phase To Single Phase & Three phase to Three phase Cycloconverter.	**7Hrs.**
Unit5:--- DC to DC Converters (Choppers)- Principle of Chopper Operation, Classification, Control Strategies, Types of Chopper Circuits, Buck, Boost and Buck-Boost Converters, Thyristor Chopper Circuits, Voltage and Current-commutated Chopper, Load Commutated Chopper, Series Turn off Chopper, Single ACR Chopper, Morgan Chopper, Jones Chopper, Multiphase Chopper.	**8 Hrs.**

Unit 6:---Inverter & Applications of Power Electronics- Introduction, Classification, Bridge Inverters, Three Phase Bridge Inverter (180 Degree mode & 120 Degree mode), Current Source Inverter, Voltage Control in Inverters (External Control & Internal Control Techniques), PWM Techniques, **Applications of Power Electronics-** Switched Mode Power Supply (SMPS), Uninterruptible Power Supplies, Static Switches, Static Circuit Breakers, Solid State Relays, Resonant Converters- Zero-current Switching Resonant Converters, Zero- voltage- switching Resonant Converters.	**8 Hrs.**

Textbooks:

1. Power Electronics by Dr. P.S.Bimbhra- Khannapublishers,4th edition.
2. Power Electronics circuits, devices and applications by M.H.Rashid, third edition Prentice Hall of India New Delhi, 2000
3. Power Electronics–by M. D.Singh & K. B. Kanchandhani, TataMcGraw –Hill Publishing Company, 1998.

References:

1. Introduction to Power Electronics", by Mohan, Undeland, Robbins,"JohnWilley & Sons. 3rd edition.
2. Modern power electronics and drives by Bimal K. Bose, Pearson

Unit wise Measurable students Learning Outcomes:

After completion of the course students will be able to

1. Explain the power semiconductor devices characteristics & its applications.
2. Explain the Thyristor characteristics and circuit configurations with its applications.
3. Analyze the single phase and three phase circuit configurations by using thyristor.
4. Analyze the AC voltage controller and cyclo converters circuits.
5. Analyze the Chopper and Inverter circuits.
6. Apply the Converter circuits for practical applications.

Kolhapur Institute of Technology's
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Title of the Course Electrical Measurement & Instrumentation **Course Code: UELPC0404**	**L**	**T**	**P**	**Credit**
	02	**-**	**-**	**02**

Course Prerequisites: Basics of Electrical and Electronics engineering.

Course Description:

A course on measurement and instruments typically aims to equip students with the knowledge and skills necessary to understand various measurement techniques and instruments used in scientific, engineering, and industrial applications.

Course Objectives:

1. Exploring different types of measurement systems, such as analog and digital, and understanding their components and operation.
2. Introducing students to various measuring instruments.

Course Outcomes:

COs	After completion of the course the students will be to	Bloom's Level	Descriptor
CO1	Explain various concepts of measuring instruments.	II	Understand
CO2	Determine different methods for measurement of resistance, inductance & Capacitance.	III	Apply
CO3	Describe various methods for measurement of Power & energy.	IV	Analyze
CO4	Illustrate & describe concept of displacement measurement and various modern techniques used in measurement.	IV	Analyze

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	1	2	1							1	1
CO2	2	2	1	2	1							2	1
CO3	2	2	1	2	1							2	1
CO4	2	2	1	2	1							2	1

Assessments:

Teachers' assessment-

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with 60-70% weight-age for course content.(Normally last three modules) covered after MSE.

Course Contents:

Unit 1: Principle of Measuring Instruments: Types of Error in Measurement, Absolute and Secondary instruments, Types of Secondary Instruments: Indicating, Integrating Instruments Difference between Indicating and Integrating Instruments. Construction, working principle, torque equation, Permanent Magnet Moving Coil (PMMC) & Dynamometer type instruments. Shunts, multipliers.	**06 Hrs**
Unit 2: Measurement of Resistance, Inductance & Capacitance: Measurement of low, medium and. high resistance Wheatstone bridge, Kelvin's double bridge, Megger, Earth tester for earth resistance measurement. Maxwell's Inductance & Capacitance Bridge, Hay's bridge, Anderson's bridge, Campbell's Bridge, Owen's bridge, Schering Bridge	**07 Hrs**
Unit 3: Measurement of Power: Power & Its types (Active, Reactive & Apparent Power), Power in DC & AC Circuits, Power factor. 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.	**06 Hrs**
Unit 4: Measurement of Energy: Energy meter- Construction, working principle, torque equation, errors and adjustments of single phase conventional (induction type) energy meter, Calibration of energy meter. Digital Energy Meter, Block diagram and operation of electronic energy meter. Three phase energy meters. Testing of energy Meters.	**06 Hrs**
Unit 5: Transducers & Displacement Measurement: Construction and working principle of CRO& DSO, advantages and disadvantages of DSO over CRO. Transducers: Introduction, classification, basic requirements for transducers. Selection of Transducer, Displacement Measurement- LVDT&RVDT construction, working, application, advantages, disadvantages.	**04 Hrs**
Unit 6: Recent Development in Measurements: Wave Analyzers & Harmonic Distortion, Power Analyzer, Computer aided measurements, Instrument Transformers: Construction, connection of CT & PT in the circuit.	**04 Hrs**

Text Books:

1. A Course in Electrical and Electronic Measurements & Instrumentation by A. K. Sawhney, Dhanpat Rai& Co. 9th edition, 2014.
2. A Course in Electronics & Electrical Measurements & Instrumentation by J. B. Gupta, S. K. Kataria & Sons. 8th edition, 2012.

References:

1. Electrical Measurements & Measuring Instruments by E. W. Golding F. C. Widdies, Reem Publications 3rd edition, 2011.
2. Electrical Measurement & Instrumentation R.S. Sirohi Radhakrisnan, New Age International, 3rd edition, 2010.

Unit wise Measurable students Learning Outcomes:

1. To identify errors in the instruments.
2. To identify unknown electrical parameters by using various methods.
3. To solve the numerical on range extension of meters.
4. To discuss various methods of measurement of Power & Energy.
5. To demonstrate digital and advance instruments.
6. To examine theoretically the performance of CT's and PT's.

Title of the Course: Electromagnetic Field Theory Course Code: UELPC0405	L	T	P	Credit
	3	-	-	3

Course Pre-Requisite: Vector Algebra, Calculus, Basic knowledge of electric and magnetic fields.

Course Description: Electromagnetic Field Theory is a foundational course in electrical engineering that explores the fundamental principles governing electromagnetic phenomena. This course delves into Maxwell's equations, which form the cornerstone of classical electromagnetism, and examines their applications in understanding the behavior of electromagnetic fields.

Course Objectives

1. To introduce the basics of scalar and vector fields using scalar and vector algebra and coordinate systems.
2. To provide an understanding of electric fields in free space and in material space using Maxwell's equations.
3. To provide an understanding of magnetic fields in free space and material space using Maxwell's equations.

Course Outcomes:

COs	After completion of the course the students will be to	Bloom's Level	Descriptor
CO1	**Understand** vector algebra and vector calculus using different coordinate systems.	II	Understand
CO2	**Understand** the behavior of electric fields in different media.	II	Understand
CO3	**Analyze** the behavior of electric fields in different material spaces using Maxwell's equations.	IV	Analyze
CO4	**Understand** the behavior of magnetic fields in different media.	II	Understand
CO5	**Analyze** the behavior of magnetic fields in different material spaces using Maxwell's equations.	IV	Analyze

PO MAPPING

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

Assessments:

Teachers' assessment-

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with 60-70% weight-age for course content.(Normally last three modules) covered after MSE.

Course Content

Unit 1:--- Vector Analysis Vector Algebra, Rectangular Coordinate System, Vector Component, Vector Field, Dot Product, Cross Product, Circular and Cylindrical Coordinate System, Vector Calculus, Del Operator, Gradient of Scalar, Divergence of Vector and Divergence Theorem, Curl of a Vector and Stroke's Theorem, Classification of Vector Fields.	**10 Hrs**
Unit 2:--- Electrostatic Fields Coulombs law and Field intensity, Electric fields due to continuous charge distributions, Electric flux density, Gauss's law, Maxwell's equation, Electric potential, Relationship between E and V, Electric dipole and flux lines, Energy density in electrostatic fields.	**8 Hrs**
Unit 3:--- Conductors and Dielectrics Linear, isotropic, frequency dependent and homogeneous electric material. Current density, Convection and conduction current, Relation between Current density, Electric potential & Volume charge density, Continuity equation, Conductors-relaxation time, effect of field on conductor, Ohms law, effect of field on dielectric, Boundary conditions.	**6 Hrs**
Unit 4:--- Poisson's and Laplace's Equations Introduction, Resistance and capacitance, Derivation of Poisson's and Laplace's equations, General procedures for solving Poisson's and Laplace's equations, Uniqueness theorem, Method of images.	**6 Hrs**
Unit 5:--- Magnetostatics Current distributions, Biot- Savart law, Ampere's Circuital Law in integral and differential form, Magnetic flux & Magnetic flux density ,Scalar & vector magnetic potentials, Derivation of steady magnetic field laws.	**8 Hrs**
Unit 6:--- Magnetic Forces, Materials and Devices Forces due to magnetic fields, Magnetic torque and moment, magnetic dipole, Magnetization in materials, Classification of magnetic materials, Magnetic boundary conditions, Inductors and Inductances, Magnetic energy, Magnetic circuits, Force of magnetic materials, Faraday's Law.	**7 Hrs**

Textbooks

1. Principles of Electromagnetics by Matthew N.O. Sadiku and S. V. Kulkarni.
2. Engineering Electromagnetics by William. H. Hayt Jr and John. A. Buck.
3. Electromagnetics by Joseph. A. Edminister.

References

1. Introduction to Electrodynamics by David. J. Griffiths.
2. Lectures on Electromagnetic Field Theory by Weng Cho Chew, Fall 2020, Purdue University.

Unit wise Measurable Students Learning Outcomes:

1. The students will be able to perform numerical operations based on vector calculus.
2. The students will be able operate in different coordinate systems.
3. The students will be able to understand the behavior of electric fields in free space and in different materials using Maxwell's equations.
4. The students will be able understand the behavior of magnetic fields in free space and in different materials using Maxwell's equations.

Kolhapur Institute of Technology's
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Title of the Course: Constitution of India	L	T	P	Credit
Course Code: UELVE0401	2	-	--	2

Course Pre-Requisite: Basics of Indian History, Independence Movement, Fundamentals of Civics.

Course Description: This Course is an introduction of Indian Constitution and basic concepts highlighted in this course for understanding the Constitution of India. This course is structured to give a deeper insight for making the nexus between the other law subjects.

Course Objectives

At the end of the course the student is expected to have acquired:

1. A basic understanding of Constitution of India.
2. Builds the ability to apply the knowledge gained from the course to current social legal issues.
3. Ability to understand and solve the contemporary challenges.
4. Understanding constitutional remedies.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	**Explain** the significance of Indian Constitution as the fundamental law of the land	II	Understand
CO2	Exercise his fundamental rights in proper sense at the same time **Identifies** his responsibilities in national building.	II	Applying
CO3	**Analyze** the Indian political system, the powers and functions of the Union, State and Local Governments in detail	II	Understand
CO4	**Understand** Electoral Process, Emergency provisions and Amendment procedure.	II	Understand

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2
CO						3	3				3		
CO						3	3	3	3		3		
CO						3		3			3		
CO						3		3			3		

Assessments:

Teacher Assessment:

One End Semester Examination (ESE) having 100% weights respectively.

Assessment	Marks
ISE	50

ESE: Assessment is based on 100% course content.

Course Contents:	
Unit 1:- Constitution – Structure and Principles 1.1: Meaning and importance of Constitution 1.2: Making of Indian Constitution – Sources 1.3: Salient features of Indian Constitution	**03 Hrs.**
Unit 2:- Fundamental Rights and Directive Principles 2.1: Fundamental Rights & Fundamental Duties 2.2: Directive Principles of State Policy	**10 Hrs.**
Unit 3:- Union Government & Executive 3.1: President of India – Qualification, Powers and Impeachment 3.2: Lok Sabha & Rajya Sabha Sabha- Composition, Powers & Functions, Scope to amendment in Constitution	**04 Hrs.**
Unit 4:- State Government & Executive 4.1: Governor – Qualification, Appointment, Powers & Functions 4.2: Legislative Assembly & Legislative Council – Composition, Powers & Functions	**03 Hrs.**
Unit 5:- The Judiciary 5.1: Features of Judicial System in India 5.2: Hierarchy of Courts, Composition and Jurisdiction	**03 Hrs.**
Unit 6:- Local Self Government and other constitutional Organizations 6.1: 73rd and 74th Constitutional Amendments 6.2: Public Service Commission, Election Commission, CAG, National Commissions for SC, ST etc.	**03 Hrs.**

Textbooks:

1. M.P. Jain, Indian Constitutional Law
2. M.P. Singh (ed.),V.N. Shukla, Constitutional Law of India
3. D.D. Basu, Commentary on the Constitution of India
4. S.S. Desai, Constitutional Law--I & II

References:

1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)
2. J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th edn.)
3. Shripad Shridhar Desai, Constitutional Law--I, S.S. Law Publication, 2021
4. Shripad Shridhar Desai, Constitutional Law --II, S.S. Law Publication, 2021
5. Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf
6. Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa, 2015

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Title of the Course: AC Machines Laboratory Course Code: UELPC0431	L	T	P	Credit
	-	-	02	01

Course Prerequisite: Basic Electrical Engineering, DC machines.

Course Description: This course contains experimentation to familiarize and operate and control electric machines studied in electric machines theory course.

Course Objectives:

1. This course intends to demonstrate performance operation of synchronous and asynchronous machines.
2. It intends to develop skills to analyze operation and performance of asynchronous and synchronous machines.

Course Outcomes:

COs	After the completion of the course the students will be able to	Blooms level	Descriptor
CO1	**Find** electrical characteristics of AC Machines in real life.	III	Applying
CO2	**Analyze** the performance of AC Machines.	IV	Analyzing
CO3	**Control** the AC Machines as per requirement.	IV	Analyzing

PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3			1	2			3	3		2	2	
CO2	3				3			2			1	2	
CO3	3			1	3			3	2		2	2	

Assessments:

Teachers' assessment-

Assessment	Marks
ISE	25
ESE(POE)	25

ISE is based on at least two of the assessment tools like performance of students in laboratory, experimental write-up, presentation, oral, and test (surprise/declared/quiz). ESE Assessment is based on performance in a practical examination and oral test thereafter, at the end of the semester.

Course Contents:

Experiment No.1: --- Starters for 3 phase induction motor.	**2Hrs**
Experiment No.2: --- No load and Blocked rotor test on 3 phase induction motor and circle diagram.	**2Hrs**
Experiment No.3:--- Direct load test on 3 phase induction motor.	**2Hrs**
Experiment No.4: --- Speed control of 3 phase induction motor using VFD	**2Hrs**
Experiment No.5: ---Effect of speed on frequency & emf of alternator	**2Hrs**
Experiment No.6: --- Voltage regulation of alternator using Synchronous Impedance method.	**2Hrs**
Experiment No.7: --- Voltage regulation of alternator using MMF method.	**2Hrs**
Experiment No.8: --- Voltage regulation of alternator using direct load method.	**2Hrs**
Experiment No.9: --- Synchronization of alternators.	**2Hrs**
Experiment No.10: --- V Curves & Inverted V Curves of Synchronous Motor.	**2Hrs**

Textbooks:

1. M. G. Say. "Performance Design of AC Machines", CBS Publishers, 3rd Edition.
2. O. E. Taylor, "Performance Design of AC commutator motors", Wheeler Publisher, 15th Reprint

References:

1. 1. J. Chapman, "Electrical Machine", 3/E, S McGraw Hill.
2. J. B. Gupta, "Electrical Machines", SK Kataria and Sons, New Delhi.
3. Fitzerald and Kingsley, "Electric Machine", Tata McGraw Hill.

Experiment wise Measurable students Learning Outcomes:

Experiment No.1- The students will compare performance of different starters for the induction motor.
Experiment No.2- The students will be to draw a circle diagram of the induction motor and evaluate performance parameters from it.

Experiment No.3- The students will be to perform a direct load test Induction motor.
Experiment No.4- The students will be to control the speed of 3 phase induction motor using VFD
Experiment No.5- The students will be able to study the effect of speed on frequency and emf of alternator
Experiment No.6- The students will be to determine voltage regulation of alternator using Synchronous Impedance method.
Experiment No.7- The students will be to determine of voltage regulation of alternator using MMF Method.
Experiment No.8- The students will be to calculate voltage regulation of alternators using direct load method.
Experiment No.9-The students will be to synchronize two alternators.
Experiment No 10-The students will be able to draw V and inverted V curves of the synchronous motor.

Title of the Course: Power Electronics Laboratory Course Code: UELPC0432	L	T	P	Credit
	-	-	2	01

Course Pre-Requisite:
Basics of Electrical and electronics circuits and devices, Basic Semiconductor physics, Electric circuit analysis Operating skill of measuring devices.

Course Description: This course discusses with evaluation of characteristics and performance parameters analysis of Power semiconductor devices like SCR, MOSFET, IGBT. Circuit configuration of various type of Power modulator and its analysis.

Course Outcomes:

COS	After the completion of the course the students will be able to	Bloom's level	Descriptor
CO1	**Understand** the Characteristics of semiconductor switches and evaluates its performance parameters.	II IV	Understanding
CO2	**Analyze** the controlled converter circuit configurations to determine the output voltage.	VI	Analyze
CO3	**Design** the control techniques to Chopper and inverter circuit to control the output voltage.	II IV	Apply

POMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3			2				3			2	1	1
CO2	3			3				3			2	1	1
CO3	3			3				3			2	1	1

Assessments:
Teachers' assessment-
In Semester Evaluation (ISE) and End Semester Examination(ESE) having 50% weight age each

Assessment	Marks
ISE	25
ESE(POE)	25

ISE is based on at least two of the assessment tools like performance of student in laboratory, experimental write-up, presentation, oral, and test (surprise/declared/quiz). ESE Assessment is based on performance in a practical examination and oral test thereafter, at the end of the semester.

Course Contents: The student should perform minimum 10 experiments from the following list.	
ExperimentNo.1:---Static VI characteristics of SCR	**2Hrs**
ExperimentNo.2:---Characteristics of MOSFET	**2Hrs**
ExperimentNo.3:---Characteristics of IGBT	**2Hrs**
ExperimentNo.4: ---Gating/triggering circuits for SCR	**2Hrs**
ExperimentNo.5:--Single phase fully controlled bridge rectifier with R & RL load	**2Hrs**
ExperimentNo.6:---Three phase half-controlled bridge converter with R load	**2Hrs**
ExperimentNo.7:---Three phase half wave controlled rectifier with R load	**2Hrs**
Experiment No.8:-- Single phase Dual converter with R & RL load	**2Hrs**
Experiment No.9:- Single phase Cyclo-converter (Hardware/Simulation)	**2Hrs**
ExperimentNo.**10:---**MOSFET/IGBT based buck converter (Hardware/Simulation)	**2Hrs**
ExperimentNo.11: ---MOSFET/IGBT based boost converter (Hardware/Simulation)	**2Hrs**
ExperimentNo.12: ---Single Phase PWM Inverter (Hardware/Simulation)	**2Hrs**

Textbooks:

1. Power Electronics by M. H. Rashid, PHI Publishers, New Delhi, 3rd edition, 2007.
2. Power Electronics P. S. Bimbhra, Khanna Publishers, New Delhi, 3rd edition, 2008.
3. Power Electronics–by M. D. Singh & K. B. Kanchandhani, Tata McGraw –Hill Publishing Company, 1998.

References:

1. Mohan, Undeland, Robbins, "Introduction to Power Electronics", John Willey & Sons.

Experiment wise Measurable students Learning Outcomes:

Experiment No.1- The students will be able to obtain the characteristics of SCR.
Experiment No.2-The students will be able to obtain the characteristics of MOSFET.
Experiment No.3- The students will be able to obtain the characteristics of IGBT.
ExperimentNo.4-The students will be able to compare different gating/triggering circuit of SCR.
Experiment No.5- The students will be able to control Single phase fully controlled bridge rectifier with R & RL load.
Experiment No.6- The students will be able to control Three phase half-controlled bridge converter with R load.
Experiment No.7- The students will be able to control Three phase full wave-controlled rectifier with R load.
ExperimentNo.8- The students will be able to control Single phase dual converter with R & RL load.
ExperimentNo.9-The students will be able to control Single phase Cyclo converter operation
Experiment No.10- The students will be able to evaluate the operation of MOSFET based buck converter
Experiment No.11- The students will be able to evaluate the operation of MOSFET based boost converter
ExperimentNo.12- The students will be able to control Single Phase PWM Inverter operation.

Title of the Course: Mini Project-I Course Code: UELIL0471	L	T	P	Credit
	-	-	02	01

Course Pre-Requisite: Smart Grid, Electric Vehicle, Wireless Power Transmission, Artificial Intelligence, Energy Saving Lighting Technologies, Internet of Things (IOT), Sustainable Energy, Energy Storage and Battery Management, Robotics.

Course Description:

This lab prepares students to develop thinking process to solve social problems by application of science and engineering in innovative manner. The group of students not more than 3 should identify social problems, perform requirement analysis. After interactions with course coordinator and based on comprehensive literature survey/need analysis, the student shall identify the title and define the aim and objectives of micro-project. As per requirements the group should develop specifications of final outcome of the project. The students should think critically and undertake design of the project with skills available with them to meet the requirements and specifications. The group is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester. The student is expected to exert on design, development and testing of the proposed work as per the schedule. The working model of the project will be demonstrated for internal submission. Completed micro project and documentation in the form of micro project report is to be submitted at the end of semester. The project should complete in 12 weeks including field trails if any. At the end of project the guide should advise students to protect Intellectual Property either in the form of Patent or registration of design or publish paper on work completed or participate in project competition.

Course Objectives:

1. **Identify** the problem statement.
2. **Understand** the methodology to troubleshoot the small circuit
3. **Convert** idea in to product.
4. **Work** in a group to implement the idea.
5. **Communicate** effectively to present theme of mini-project.

Course Outcomes:

COs	After completion of the course the students will be to	Bloom's Level	Descriptor
CO1	**Apply** the knowledge of advanced Electric and Electronic fundamental for problem definition.	IV	Analyzing
CO2	**Develop** methodology to troubleshoot circuit.	IV	Analyzing
CO3	**Test** the outcomes for desired results.	V	Evaluating
CO4	**Work** in groups to assemble Mini Project circuits.	V	Evaluating
CO5	**Demonstrate** presentation skills through Mini Project report.	IV	Analyzing

CO-PO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO 2
CO1	3	3	2	3	2	2	1					3	3
CO2	3	3	2	3	2	2	1					3	3
CO3	2	3	3	3	3			1			2	2	3
CO4	1	2			2		2	3	2	3	3	2	2
CO5		2			2		2	3	2	3	3	2	2

Assessments:

Teachers' assessment-

In Semester Evaluation (ISE), and End Semester Examination (ESE) having 50%weightage each

Assessment	Marks
ISE	25

ISE is based on performance of student in laboratory, experimental write-up, presentation, oral, and test (surprise/declared/quiz).

Course Contents:

- Environment protection, global warming, safe drinking water, waste management, renewable energy utilities, biomedical engineering, accident prevention, enabling weaker section of society, efficiency/cost/ time improvements, human hardship reduction, prosthesis, smart city, smart transportation, energy audit and saving.
- Students should form groups of maximum four in respective practical batch.
- Mini project should be a working model based upon their knowledge, understanding and practices.
- Evaluation of mini project will be through presentation, demonstration and report writing.

1. Smart Grids

Unlike in the past, whereby consumers solely depended on a local electrical power company, today, they have many options. With the ability to even generate their own power, some consumers also now want to sell their surplus. As a result, the electricity delivery infrastructure has to change. In response to these demands, most Energy Departments around the world are placing smart devices throughout their networks, right up to customers' homes, offices, and factories. The smart grid collects valuable data to allow both consumers and suppliers a higher degree of control over multiple power sources. It also enables them to predict surges in usage and instantly detect outages. By allowing end-to-end communication between distribution sites, power plants, and the end user's electrical point-of-presence, smart grids significantly raise efficiency and reduce costs. Soon, it's inevitable that electrical engineers will frequently come across smart grids and or be asked to help develop one.

2. Electric Vehicle

Tesla recently hit the $100 billion milestone, making itself the first publicly listed US carmaker in history to do so. This is a good sign that electric vehicles have come to stay. Experts predict that by 2030, there would be over 125 million electric vehicles on the road. Considering the millions of EVs that are already roaming the streets, this is not so much of a long-short. Many EV manufacturers are investing hard into the tech, and consumers can expect better batteries, improved charging tech, more accurate autonomous driving, solar-powered EVs, and even electric planes.

3. Wireless Power Transmission

Wireless power transfer is in its primitive stages, but the future is bright. In future, we expect better wireless charging for laptops, smart phones, earphones, and other smart devices. Shortly, however, we expect much more. Soon, wireless charging will also become the standard for electric cars. Instead of the large charging docks, drivers will be able to park on a charging spot without needing to plug in. Expects predict that a few years from now, it will also be possible to charge your electric vehicle while it's moving.

4. Artificial Intelligence

If artificial intelligence has penetrated large industries like armaments and medicine, surely the Electrical Engineering landscape cannot be an exception. Electrical Engineers are expected to do much better with AI. By blending their prowess and skill with the know-how of AI and machine learning, electrical engineers are contributing the following:

- Create complex algorithms for data interpretation
- Generate new codes or revamping existing codes
- Build massive AI and machine learning platforms
- Develop comprehensive strategies in the field of electronics

Most notably, artificial intelligence is going to help electrical engineers with image processing. Leveraging AI, engineers can invent complex image processing algorithms to help machines detect electrical or structural abnormalities on a framework and quickly send feedback or suggest rectifications. Ultimately, this helps to improve the workplace safety of electrical engineers who are often involved in hazardous and massive electronic production lines.

5. Energy Saving Lighting Technologies

Gone are the days when LED bulbs were only for those willing to pay the top dollar. LED lamps are becoming the standard de facto light bulb. Today, with prices as low as Rs 150/- per bulb or even less, LED bulbs are now possibilities for the average consumer. Due to their energy-saving capabilities, the bulbs pay for themselves in a matter of months. On average, they can save each household Rs 3000 to Rs 5000 per year in utility bills. With more advances in smart technology, these lights are expected to become even more efficient and easy to install in the near future.

5. Internet of Things (IOT)

IoT impacts many different areas of the electrical engineering landscape. From smart grids to smart lighting and Visible Light Communication (VLC), among many others, IoT is now interlinked with the Electrical Engineering industry. As a result, it's now imperative that every electrical engineer becomes "IoT literate." Apart from the smart grid benefits like monitoring, distribution and automation implemented in electrical utilities, IoT applications in the field of electrical energy also include smart inverters, advanced metering infrastructure (AMI), remote control operation of energy-consuming devices and SCADA (supervisory control and data acquisition.)

5. Sustainable Energy

With Scientist making their firm stand for intense action towards climatic change, it's certainly not the best time for the energy sector to rely on fossil fuels and other environmentally unfriendly energy sources. The drive for sustainable energy sources is at its peak. The implementation of utility-scale renewable fuels such as solar, wind, and hydropower is, at its peak increase all around the world.

5. **Energy Storage and Battery Management**

While wind and solar power are excellent sources of sustainable energy, they are not always there. Therefore, consumers can only "make hay when the sun shines." They have to do their best to save energy from the wind, the sun, or any other renewable sources for later use. To meet this demand, Electrical Engineers all around the world are working towards better batteries and energy storage. Distributed Energy Resource (DER), grid parity, AI and sustainable energy, block chain, and cyber security. Generally, 2020 is an exciting year for the electrical engineering landscape.

6. **Robotics**

While robotics-based technologies are often ridiculed for stealing people's jobs in most industries, it's a different case in electrical engineering. Robotics significantly helps to improve safety. For instance, remotely controlled, wireless underground cable cutters can be used instead of putting humans at life-threatening risk.

Experiment wise Measurable students Learning Outcomes:

1. The students will develop sensitivity towards advanced social problems.
2. The students will be able to develop thinking process to solve advanced social problems by application of Science and engineering in innovative manner.
3. The students will be able to think critically and undertake design of the project with skills.
4. The students will be able to design, develop and test any assigned work.

Title of the Course: Electrical Wiring Practices Lab	L	T	P	Credit
Course Code: UELVS0431	-	-	2	1

Course Pre-Requisite: Nil

Course Description: This course is intended to impart skills to plan and carry out simple electrical wiring. It is essential for the practicing engineers to identify the basic practices and safety measures in electrical wiring.

Course Objectives:

1. To introduce wiring components.
2. To introduce different types of tools used during wiring.
3. To learn different types of connection diagrams.
4. To know the use of various accessories used for different application.

Course Outcomes:

CO	After the completion of the course the student should be able to	Blooms level	Descriptor
CO1	Demonstrate safety measures against electric shocks.	III	Applications
CO2	Identify the tools used for electrical wiring, electrical accessories, wires, cables, batteries and standard symbols.	II	Comprehension
CO3	Develop the connection diagram; identify the suitable accessories and materials necessary for wiring simple lighting circuits for domestic buildings.	V	Synthesis

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						3					1		
CO2	2								1				
CO3	2			1		1	1	2	2		2		

Course Contents

Expt. No	Course Content	Hours
1	A) Demonstrate The Precautionary Steps Adopted In Case Of Electrical Shocks. B) Identify Different Types of Cables, Wires, Switches, Fuses, Fuse Carriers, MCB, ELCB And MCCB With Ratings.	02
2	Wiring of Simple Light Circuit for Controlling Light/ Fan Point. (PVC Conduit Wiring)	02
3	Wiring of Light/Fan Circuit Using Two Way Switches. (Staircase Wiring & Godown Wiring)	02
4	Wiring of Fluorescent Lamps and Light Sockets (6A) With A Power Circuit for Controlling Power Device. (16A Socket)	02

5	Wiring of Power Distribution Arrangement Using Single Phase MCB Distribution Board with ELCB, Main Switch and Energy Meter.	02
6	To Study House Wiring i.e., Batten, Cleat, Casing-Capping And Conduit Wirings.	02
7	Identify Different Types of Batteries with Their Specifications.	02
8	Demonstrate The Pipe And Plate Earthing Schemes Using Charts/Site Visit.	02
9	To Study Circuit of SMPS.	02
10	To Study Moving Iron, Moving Coil, Electrodynamic and Induction Type Meter.	02
11	To Study Circuit And Working of UPS.	02
12	To Study Circuit And Working of Domestic Inverter.	02
*Students should perform any ten experiments from above list.		

Kolhapur Institute of Technology's
College of Engineering Kolhapur (Empowered Autonomous)

Title of the Course: Co -Curricular Activities- II **Course No.: UELCC0431**	**L**	**T**	**P**	**Credits**
	---	---	02 hours per week	01

Course Pre-Requisite:

None: This course is open to all second-year engineering students interested in enhancing their personal and professional development through co-curricular activities.

Course Description:

Co-Curricular activities are an integral part of curriculum which provides educational activities to the students and thereby help in broadening their experiences. Co-Curricular activities can be defined as the activities that enhance and enrich the regular curriculum during the normal college hours. All Co-Curricular activities are organized with specific purpose which may according to the nature and form of activities. This course introduces students to a variety of co-curricular activities aimed at enhancing their professional and personal development within the field of engineering and technology. Through practical projects, competitions, workshops, and community engagement, students will develop teamwork, leadership, communication, and technical skills essential for success in their careers.

Course Learning Objectives (CLOs):

1. To encourage students to showcase their intellectual and independent thinking skills.
2. To imbibe a sense of confidence and managerial capabilities among students.
3. To promote the ability to work in team, organize and analyse available resources.
4. To build responsiveness among students about the social and cultural responsibilities.

Course Outcomes (COs):

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

CO1:	**Demonstrate** the ability to critically analyse information and apply independent judgment in decision-making within the context of the activity.
CO2:	**Apply** principles of management and organizational skills to plan, coordinate, and execute tasks related to the co-curricular activity.
CO3:	**Collaborate** effectively with peers to achieve common goals and objectives within the co-curricular activity.
CO4:	**Reflect** on their roles and responsibilities as members of a diverse community, fostering empathy and inclusivity.

Assessments:

Assessment	Weightage (Marks)
ISE	50

ISE:

Assessment is based on the student's participation in various Co-Curricular Activities and Guidelines given in "Rules for Assigning Activity Points: Activity – Event Grade Point Scheme" Policy Document.

Course Guidelines:

1. Students are entitled to gain academic knowledge in this fast-paced environment, but it is also necessary for them to develop their personalities in both internal and external situations.
2. Co-curricular activities help students grow and develop their personalities. These activities contribute to a student's total personality development.
3. Not every student is intellectually inclined. Similarly, not all pupils are interested in co-curricular activities. Therefore, there is a need to provide a solid balance of co-curricular and extra-curricular activities in order to achieve the course learning objectives.
4. It primarily refers to intellectual, physical, emotional, and social growth that can be attained by a careful mix of academic, co-curricular, and extra-curricular activities.
5. So, keeping the course learning objectives the "Rules for Assigning Activity Points: Activity – Event Grade Point Scheme" Policy Document is proposed.

6. Student participation is assessed and reflected in the final activity performance report in order to get most students involved in extra-curricular activities (Group A) and co-curricular activities (Group B) as shown in Table 1 in the Policy Document.
7. All undergraduate students must choose at least ONE activity/event from each group i.e. (Group A and B).
8. Students shall choose one activity/ event from Group A and One from Group B that take place on-campus or off-campus.
9. Freedom shall be given to the students to take part in more than one activity under the group.
10. Students are expected to actively participate in activities, participate in contests, and earn grade points.
11. One student in each group must earn up to 50 grades in one semester so that they can achieve up to 100 grades in one year.
12. Grades for each semester are awarded based on the points achieved by the student, as shown in Table 2 in the Policy Document.

Course Structure: ***(Refer Rules for Assigning Activity Points: Activity – Event Grade Point Scheme)***

Sr. No.	Initiatives	Criteria, Activities and Assignments
1	Introduction to Co-Curricular Activities	Orientation, Induction, Course Overview
2	National Initiatives Participation	Participation, Achievement Levels and Assigned Activity Points in NCC, NSS, Unnat Bharat/ Unnat Maharashtra Abhiyan, Ek Bharat Shreshtha Bharat (EBSB)
3	Sports and Games Participation	Participation, Achievement Levels and Assigned Activity Points in Sports and Games
4	Cultural Activities Participation	Participation, Achievement Levels and Assigned Activity Points in Music, Performing Arts, Literary Arts
5	Professional Self Initiatives	Participation, Achievement Levels and Assigned Activity Points in 1. Technical Events/Quiz/Paper Contest/Project Contest / Model Making etc. 2. MOOC/ NPTEL/ SWAYAM/ Coursera etc. 3. Competitions/ Events Conducted by Professional Societies (ISTE, IEI, CSI, IEEE, IETE, SAE, ISRO-IIRS, SWE, ISHRAE, ASM, ISNT etc.) 4. Attending Full time Conference/ Seminars/ Exhibitions/ Workshop/ STTP Conducted at IITs/ NITs/ Reputed Institutes/ Universities 5. Attending Full time Conference/ Seminars/ Exhibitions/ Workshop/ STTP Conducted at KITCoEK 6. Paper Presentation in National/ International Conference of High Repute 7. Poster Presentation in National/ International Conference of High Repute 8. Paper Publication in National/ International Journal of High Repute 9. Industrial Training/ Internship (at least for 04 Weeks) 10. Participation in Institute Level Student Clubs

6	Entrepreneurship and Innovation	Participation, Achievement Levels and Assigned Activity Points in 1. Prototype Developed and Tested 2. Awards for Products Developed 3. Innovative Technologies Developed and Used by Industries 4. Got Funding from Government/ Industry for Innovative Ideas 5. Patent-Filed/ Published/ Approved/ Licensed 6. Social Innovations
7	Leadership & Management of Clubs/ Activities	Participation, Achievement Levels and Assigned Activity Points in 1. Elected Student Representative of Student Council (University Representative, General Secretary, Cultural, Sports, NSS Secretary, Ladies Representative, Academic Toppers, Invitee Members) 2. Office Bearer of Professional Society Chapter (ISTE, IEI, CSI, IEEE, IETE, SAE, ISRO-IIRS, SWE, ISHRAE, ASM, ISNT etc.) 3. Office Bearer of Institute Level Student Club (Developer Student Club, Gaganvedhi, Walk With World, Team Mavericks, Cultural Club, Aura, Amateur Write Club, Rotaract Club of KIT Sunshine, Women Development and Gender Equality Cell, Shourya, Lead India etc.) 4. Office Bearer of Departmental Student Association 5. Office Bearer of ECell, Digital Content Lab etc. 6. Student Ambassador for Mayura AICTE IDEA Lab/ NIDHI iTBI etc. 7. Editorial Board Member of Annual Magazine 8. Editorial Board Member of E-Newsletter 9. Member of Governance Committee/ Statutory Committee
8	Culminating Event and Reflection	Final Presentations, Course Reflection, Documentation, Assessment and Evaluation

Participation Levels:

1. Level: I College Level Events
2. Level: II District/ Central/ Zonal Level Events
3. Level: III State Level Events
4. Level: IV National Level Events
5. Level: V International Level Events

Approval Documents:

1. Certificate
2. Letter from Authorities
3. Appreciation recognition letter
4. Documentary evidence
5. Legal Proof

Grading Scheme:

Grade Range	Grade	Academic Performance
90-100	O	Outstanding
71 to 90	A+	Excellent
68-71	A	Very Good
65-68	B+	Good
60-65	B	Average
55-60	C	Below Average
50-55	D	Marginal
< 50	F1	Fail due to Poor Performance

Title of the Course: Sensors in Automation Course Code: UELMM0441	L	T	P	Credit
	03	-	-	03

Course Prerequisite: Basics of Robotics & Automation.

Course Description: This course provides an understanding of the sensors and the standards relating to the Automation.

Course Objectives:

1. To understand the concepts of measurement and various sensors.
2. To learn various sensor materials and technology used in designing sensors.
3. To demonstrate different sensors working principle.

Course Outcomes:

COs	After the completion of the course the students will be able to	Blooms level	Descriptor
CO1	Learn fundamentals of sensors, advanced sensors and its standards.	II	Understanding
CO2	Relate electronic circuits utilized for different application.	IV	Analyzing
CO3	Apply industrial standards in the design consideration of sensors	III	Apply

PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	2			1				2	1	1	1
CO2	1	2	1	2		2	1				1	1	1
CO3	1	1	1	2		1		1		1	1	1	1

Assessments:

Teachers' assessment-

It consists of one End Semester Examination (ESE) having 100% weight.

Assessment	Marks
ESE	100

ESE: Assessment is based on 100% course content with 100% weightage for course content

Course Contents:

Unit 1: Sensors Fundamentals and Industry Standards: Basics of measurement–Calibration techniques–Errors in measurement–Generalized measurement system–Modules of Measurements-Sensors and Transducers–Classification of transducer–Static and dynamic characteristics of transducer–Sensor calibration techniques. Introduction to standards IEC 61511/ISA-84 (Safety Instrumented Systems for the Process Industries),ISA-88 (Batch Control). **9Hrs.**

Unit 2: Physical Principles of Sensing: Electric Charges Fields, and Potentials; Capacitance; Magnetism; Induction; Resistance; Piezoelectric Effect; Hall Effect; Temperature and Thermal Properties of Material; Heat Transfer; Light; Dynamic Models of Sensor Elements.	**9Hrs.**
Unit 3: Interface Electronic Circuits: Input Characteristics of Interface Circuits, Amplifiers, Excitation Circuits, Analog to Digital Converters, Direct Digitization and Processing, Bridge Circuits , Data Transmission, Batteries for Low Power Sensors**.**	**9Hrs.**
Unit 4: Sensors in Different Application: Area Occupancy and Motion Detectors; Position, Displacement, and Level; Velocity and Acceleration; Force, Strain, and Tactile Sensors; Pressure Sensors, Temperature Sensors.	**9Hrs.**
Unit 5: Advanced Sensor Technology : Smart sensors, MEMS based sensors, Innovations in sensor technology Actuators and its selection while designing a robot system. Types of transmission systems. Introduction to standards ISA-101 (Human-Machine Interfaces)ISA-106 (Procedural Automation),ISA-108 (Intelligent Device Management),Interoperability StandardsISA-95/IEC 62664 (Enterprise-Control Systems Integration)Operational StandardsISA-62443 (Industrial Automation and Control Systems Security).	**9Hrs.**

Texts books:

1. D. Patranabis, "Sensors and Transducers", PHI Publication, New Delhi,2019.
2. Ganesh S. Hegde, "Mechatronics", Laxmi Publication Private Limited, India,2016.
3. Sawhney A K and Puneet Sawhney, "A Course in Mechanical Measurements and Instrumentation and Control", 12th edition, Dhanpat Rai & Co, New Delhi, 2013

References:

1. J. Fraden, "Handbook of Modern Sensors: Physical, Designs, and Applications", AIP Press, Springer
2. Jon S. Wilson, "Sensor Technology Handbook", Elsevier, 2005.
3. Devdas Shetty, Richard A. Kolk, "Mechatronics system design", 2nd Edition, Cengage Learning, 2011.
Braünl, T., "Embedded robotics: mobile robot design and applications with embedded systems", 3rd edition Berlin;Heidelberg: Springer, 2008. ISBN 9783540705338.

Unit wise Measurable students Learning Outcomes:

1. The students will be familiar with various measurements, calibration techniques and types of transducers and Industrial standards.
2. The students will be gain knowledge of working of different types of sensors.
3. The students will be able to Interfacing of electronic circuits with different sensors for its applications in different fields.
4. The students will be able to select suitable sensors for all applications.
5. The students will be able to analyze innovations and Industrial standards in sensor technology.

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