

D. Y. Patil Education Society, Kolhapur

(Deemed to be University)

School of Engineering & Management, Kolhapur

Kasaba Bawada, Kolhapur



**D. Y. PATIL
EDUCATION SOCIETY
(DEEMED TO BE UNIVERSITY)**
KOLHAPUR

S.Y. B. Tech.

Structure and Curriculum Sem-III

Department of Electrical Engineering

w.e.f.A.Y.2024-25



Department of Electrical Engineering
(Teaching and Evaluation Scheme from Year 2024-25 (as per NEP-2020))

SEMESTER-III

Course Code	Course Category	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				L	P	T	ISE	MS E	ESE	INT	OE/ PoE		
23ELEU3P01	Program Core Courses	PCC	Electrical Measurement and Instrumentation	3	-	-	20	30	50	-	-	100	
23ELEU3P02			Electric Circuit Analysis	3	-	-	20	30	50	-	-	100	
23ELEU3P03			Applied Mathematics	2	-	-	20	30	50	-	-	100	
23ELEU3P04			Electrical Measurement and Instrumentation Lab	1	-	2	-	-	-	25	25	50	
23ELEU3P05			Electric Circuit Analysis Lab	1	-	2	-	-	-	25	25	50	
23ELEU3F06	Comm. Engg. Project(CEP)/Field Project (FP)	CEP/FP	Society based Mini- Project	2	-	4	-	-	-	50	50		
23ELEU3M07	Multidisciplinary Minor	MDM-1	Fundamental and Architecture of Electric Vehicle	2	-	-	-	-	50	-	50		
23ELEU3V08	Value Education Course	VEC	Personal Values and Ethics	2	-	-	20	30	-	-	50		
23ELEU3O09	Open Elective Course	OEC-1	Basic Electric Circuits(ODL Only) (THEORY)	3	-	-	20	30	50	-	100		
23ELEU3O10	Open Elective Course	OEC-1	Basic Electric Circuits(ODL Only) (PRACTICAL)	1	-	2	-	-	-	25	25		
23ELEU3H11	Humanities Social Science and Management	Entrepreneurship/ Economics/ Management course	Financial Management	2	-	-	50	-	-	-	50		
23ELEU3D12	Mandatory Course	MC	Finishing School Training III	Audit	3*	-	-	50	-	-	Grade		
23ELEU3C13	Co-Curricular Activities	CCA	Liberal Learning-I	2 [#]	-	-	-	-	-	-	-		
23ELEU3C14			Liberal Learning-II	Audit	2 [#]	-	-	50	-	-	-		
23ELEU3C15			Liberal Learning-III	Audit	2 [#]	-	-	50	-	-	-		
Total				22	22	10	250	150	250	125	50	725	

*- Values not included in total, #2000 hrs per club, #4000 hrs per club, Min Marks for passing: 40% of total marks of individual course



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S.Y. B. Tech. Curriculum [A.Y.2024-2025]
(As Per National Education Policy 2020)

Semester-III

Class	S.Y. B. Tech, Semester- III		
Course Code and Course Title	23ELEU3P01, Electrical Measurements and Instrumentation		
Prerequisite/s	Basic Electrical Engineering		
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00		
Credits	03		
Evaluation Scheme	T	ISE / MSE / ESE	20/30/50
	P	INT / OE/POE	00/00/00
		Total	100

Course Description: This course covers the principles and techniques of measuring electrical quantities such as voltage, current, resistance, and power. Students learn about various electrical instruments, their calibration, and their applications in engineering. Topics include measurement errors, sensors, transducers, data acquisition systems, and the interpretation of measurement results.

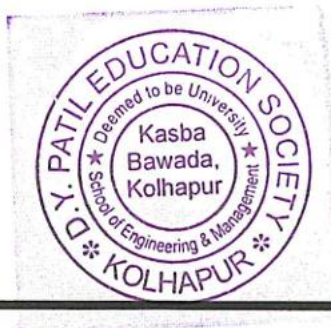
Course Objectives:

1	This course intends to provide basic concepts of errors in measurements and basic fundamentals of Measuring systems. Formal representation, computational methods, notation, and vocabulary of linear models.
2	It is aimed to impart skills to classify bridges, measuring instruments and equipment's and also demonstrates digital instruments, advance instruments.
3	To impart basic knowledge of transducer.

Course Outcomes (COs):

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

23ELEU3P01.1	Grasp fundamental concepts of measurement and identify errors in measurement and its statistics.
23ELEU3P01.2	Explain working principle and mechanism of measuring instrument.
23ELEU3P01.3	Use a proper measuring instrument and modern techniques for measurement of electrical parameters for given application.
23ELEU3P01.4	Implement the instrumentation system for measurement of physical parameters.



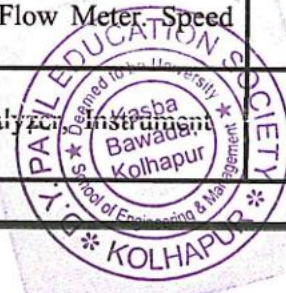


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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
23ELEU3P01.1	3	3											2	2	I
23ELEU3P01.2	3												2	2	II
23ELEU3P01.3	3	3		2	3								2	2	III
23ELEU3P01.4	3	2	2										2	2	III

Content	Hrs.
Unit I: Introduction Units, Dimensions and Standards, Structure of Measurement Systems, Instrument Types- Active, Passive, Examples of Laboratory Instruments, Static Characteristics & Dynamic Characteristics of Instruments, Measurement Errors, Sensors and Transducers - Overview, Definition, Classification, Selection Criteria.	6
Unit II: Measuring Instruments Indicating, Integrating, Recording Instruments, Analog & Digital Ammeter and Voltmeter. Essentials of Indicating Instruments Deflecting, Controlling And Damping Systems. Construction, Working Principle, Torque Equation, Advantages & Disadvantages of Moving Iron (MI) (Attraction And Repulsion), Permanent Magnet Moving Coil (PMMC) & Dynamometer Type Instruments, Range Extension of MI Instruments.	7
Unit III: Measurement of Power and Energy Active And Reactive Power Measurement In Three Phase System for Balanced and Unbalanced Load Using Two Wattmeter Method & One Wattmeter Method. Construction, Working Principle, Torque Equation of Single Phase Conventional (Induction Type) Energy Meter, Calibration of Energy Meter, Digital Energy Meter	7
Unit IV: Measurement of Electrical Quantities Measurement of Low, Medium and High Resistance, Wheatstone Bridge, Kelvin's Double Bridge, Ammeter-Voltmeter Method, Megger, Earth Tester for Earth Resistance Measurement, Maxwell's Bridge, Hay's Bridge, Anderson's Bridge, Schering Bridge and Wien's Bridge.	6
Unit V: Measurement of Non-electrical Quantities Force Measurement Using Strain Gauges, Displacement Measurements Using LVDT, Temperature Measurement Using RTD, Thermistor, Thermocouple, Bellows and Diaphragm. Flow Measurement Using Rotameter, Electromagnetic Flow Meter. Speed Measurement Using Magnetic Pick-Up And Photoelectric Pick-Up.	7
Unit VI: Recent Developments DSO, Power Analyzer, Wave Analyzer, Harmonic Distortion Analyzer, Instrument Transformers, Digital Ammeter & Voltmeter	6



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Text Books:

1	Alan Morris "Principles of measurement and instrumentation", Prentice Hall- India, 2004 ISBN: 0134897099.
2	A. K. Sawhney, "A Course in Electrical and Electronics Measurement and Instrumentation", Dhanapat Rai & Company, New Delhi, reprint, 17th Edition, 2005.
3	Rangan, Mani and Sharma, "Instrumentation Devices and Systems", Tata McGraw Hill, New Delhi, 2nd Edition.
4	Helfrick and Cooper, "Modern Electronic Instrumentation and Measurement Techniques" Pearson, 2007
5	C. D. Johnson, "Process Control Instrumentation Technology", Pearson Education.

Reference Books:

1	M. A. Baldwin, "Fundamentals of Electrical Measurements", Publication – Lyall Book Depot, Ludhiyana.
2	Albert D. Helfric, "Modern Electronics measurement & instruments", PHI Ltd, 2003.
3	Doebelin F. O., "Measurement Systems", McGraw Hill Book Co.
4	Patranabis D, "Sensors and Transducers", Wheeler Publishing Co., Ltd. New Delhi.
5	Murthy D. V. S., "Transducers and Instrumentation", Prentice Hall of India Pvt. Ltd., New Delhi.

Useful Links

1	https://nptel.ac.in/courses/108/105/108105153
2	https://nptel.ac.in/courses/108/105/108105064
3	elearning.vtu.ac.in/ , nptel.iitg.ernet.in/

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Class		S.Y. B. Tech, Semester- III	
Course Code and Course Title		23ELEU3P02, Electric Circuit Analysis	
Prerequisite/s		Engineering Mathematics I	
Teaching Scheme: Lecture/Tutorial/Practical		03/00/00	
Credits		03	
Evaluation Scheme	T	ISE / MSE / ESE	20/30/50
	P	INT / OE/POE	00/00/00
	Total		100

Course Description: Electric Circuit Analysis is a foundational course that explores the principles and techniques for analyzing electrical circuits. It covers topics such as Ohm's law, Kirchhoff's laws, network theorems, and transient and steady-state analysis of AC and DC circuits, equipping students with essential skills for understanding and designing electrical systems

Course Objectives:

1	This course intends to develop an understanding of the fundamental laws and elements of electric circuits.
2	It will make students to learn a number of powerful engineering circuit analysis techniques such as nodal analysis, mesh analysis, theorems, source transformation and several methods of simplifying networks.
3	The course intends to introduce open circuit, short circuit, transmission, hybrid parameters and their interrelationship

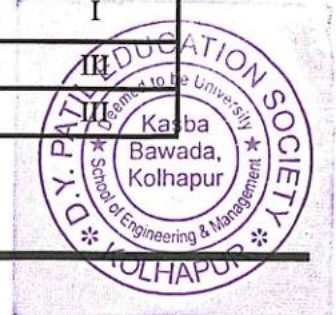
Course Outcomes (COs):

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

23ELEU3P02.1	Determine voltages, currents, powers, and equivalence of a.c. and d.c. circuits using electrical circuit theorems.
23ELEU3P02.2	Calculate the transient and steady state response of first and second order circuits.
23ELEU3P02.3	Analyze the parameters of two port electrical circuits and networks.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
23ELEU3P02.1	3	3	2										2	2	I
23ELEU3P02.2	3	3	3										1	1	II
23ELEU3P02.3	3	3	1										1	1	III





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Content	Hrs.
Unit I: DC Circuits Ohm's law, Kirchhoff's law, dependent and independent sources, nodes, branches, loops, voltage and current division, Wye Delta transformations, nodal analysis, mesh analysis, linearity property, superposition theorem, source transformation, Thevenin's and Norton's theorem, maximum power transfer.	8
Unit II: First Order Circuits Capacitors, Series and Parallel Capacitors, Inductors, Series and Parallel Inductors, Source free RC, RL circuits, step response of RC, RL, circuits	5
Unit III: Second Order Circuits Finding initial and final values, source free series and parallel RLC circuits, step response of series and parallel RLC circuits, general second order circuits.	6
Unit IV: AC Circuits Sinusoids, phasors, impedance and admittance, sinusoidal steady state analysis, nodal and mesh analysis, superposition theorem, source transformation, Thevenin's and Norton's equivalent circuit.	8
Unit V: Power in AC Circuits Instantaneous and Average Power, Maximum Average Power, RMS Value, Apparent Power and Power factor, Complex Power, mutual inductance, dot convention, energy in coupled circuits.	6
Unit VI: Two Port Network Impedance parameters, admittance parameters, hybrid parameters, transmission parameters, series connection of two two-port network, parallel connection of two two-port network, cascade connection of two two-port network	6

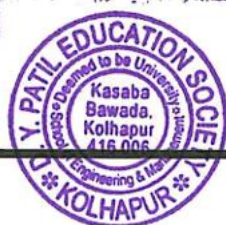
Text Books:

1	C. K. Alexandar and M.O. Sadiku, "Fundamentals of Electric Circuits", McGraw Hill Education/MH, 6th Edition, 2018, ISBN: 9780078028229
2	Hayt, Kemmerly, Durbin, "Engineering Circuit Analysis", TMH, 8th Edition, 2012, ISBN: 9781259098635

Reference Books:

1	James W. Nilsson and Susan A. Riedel "Electric Circuits" Prentice Hall, 10th Edition, 2015, ISBN: 0131989251
2	L.P. Huelsman, "Basic Circuit Theory", Prentice Hall, 3rd Edition, 2009, ISBN: 9788120309715

Useful Links	
1	https://nptel.ac.in/courses/108/106/108106172/
2	https://nptel.ac.in/courses/108/105/108105159/
3	https://nptel.ac.in/courses/108/104/108104139/





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Class	S.Y. B. Tech, Semester- III		
Course Code and Course Title	23ELEU3P03, Applied Mathematics		
Prerequisite/s	Engineering Mathematics I and Engineering Mathematics II		
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00		
Credits	02		
Evaluation Scheme	T	ISE / MSE / ESE	20/30/50
	P	INT / OE/POE	00/00/00
		Total	100

Course Description: Applied Mathematics for Electrical Engineering focuses on the mathematical techniques and tools essential for solving engineering problems. The course covers topics such as differential equations, linear algebra, complex variables, and numerical methods, providing students with a strong mathematical foundation to analyze and model electrical engineering systems

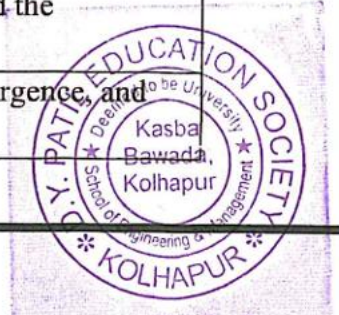
Course Objectives:

1	Equip students with knowledge of how to apply differential equations to real-world problems.
2	Enable students to effectively use Laplace transforms for solving linear differential equations.
3	Teach numerical differentiation and integration techniques, including Newton's forward and backward difference formulas, and the trapezoidal and Simpson's rules.
4	Educate students on vector calculus concepts such as gradient, divergence, and curl, and their applications in analyzing scalar and vector fields.

Course Outcomes (COs):

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

23ELEU3P03.1	Solve linear differential equations using methods for finding complementary functions and particular integrals.
23ELEU3P03.2	Apply Laplace transforms and their inverses to solve differential equations, evaluate integrals, and handle complex problems involving derivatives and integrals.
23ELEU3P03.3	Implement numerical differentiation and integration techniques such as Newton's forward and backward difference formulas, and the trapezoidal and Simpson's rules.
23ELEU3P03.4	Apply vector calculus operations including gradient, divergence, and curl to analyze scalar and vector fields.



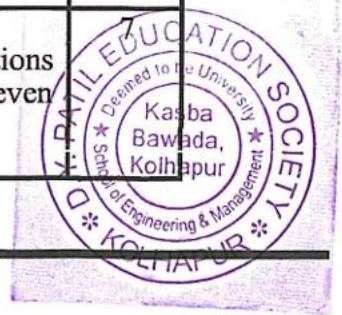


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Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
23ELEU3P03.1	3	3	2	3	2	-									II
23ELEU3P03.2	3	3	2	3	2	-									III
23ELEU3P03.3	2	3	2	3	2	-									IV
23ELEU3P03.4	2	3	2	3	-	2				2					III

Content	Hrs.
Unit 1: Linear differential Equations and Its applications Definitions, complete solutions, operator D, Rules for finding complementary functions, Inverse operator, Rules for finding the particular integral, Applications of linear Differential equations to oscillatory electrical circuit.	7
Unit 2: Laplace transform and Inverse Laplace transforms Introduction, Laplace transform of elementary functions, properties of Laplace transforms, Transforms of derivatives, Transforms of Integrals, Multiplication by t^n , Division by t, Evaluation of Integrals by Laplace transforms, inverse Laplace transforms definition, Inverse Laplace transform by partial fractions, Convolution theorem, Applications of Laplace transform to solve linear differential equations.	7
Unit 3: Numerical Differentiation and Integration Numerical differentiation – Newton's forward difference, Newton's backward difference, Central difference formula (Stirling's formula) Numerical Integration- Trapezoidal rule, Simpson's 1/3 rd and 3/8 th rule	7
Unit 4: Vector Calculus Introduction, Scalar and Vector point functions, vector operator Del applied to scalar point functions, Gradient Directional Derivative, Del applied to vector point functions, Divergence and Curl.	7
Unit 5: Z – Transform Introduction, Definition, Properties, z-transform of basic functions, z- transform of some standard discrete functions, Evaluation of inverse z- transform, Applications to difference equation	7
Unit 6: Fourier series Introduction, Euler's formulae, conditions for a Fourier expansion, Functions having points of discontinuity, change of interval, Expansion of odd or even periodic functions, Half range series.	



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Text Books:

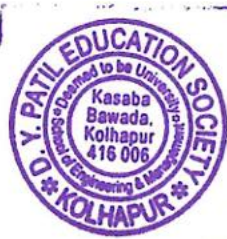
1	Advanced Engineering Mathematics, Erwin Kreyszig Wiley Eastern Ltd. Publication, 1 st Edition, 1978.
2	A Text Book Of Applied Mathematics, Vol I and II , P.N. and J.N. Wartikar, Vidyarthi Griha Prakashan, Pune, 2006.
3	Higher Engineering Maths, B.S.Grewal, Khanna Publication, 39 th Edition, 2005.
4	Fundamental of Mathematical Statistics, Gupta and Kapoor

Reference Books:

1	Advanced Engineering Mathematics, Wylie C.R., Tata McGraw Hill Publication, 8 th Edition, 1999.
2	Advanced Engineering Mathematics, H.K. Dass, S. Chand and company Ltd., 1 st Edition 1988.
3	An Introduction to probability and Statistics, Vijay Rohatgi,

Useful Links

1	https://www.youtube.com/watch?v=lkAvgVUvYvY
2	https://www.youtube.com/watch?v=c9NibpoQjDk





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Class		S.Y. B. Tech, Semester- III	
Course Code and Course Title		23ELEU3P04, Electrical Measurements and Instrumentation Lab	
Prerequisite/s		Basic Electrical Engineering	
Teaching Scheme: Lecture/Tutorial/Practical		00/00/02	
Credits		01	
Evaluation Scheme	T	ISE / MSE / ESE	00/00/00
	P	INT / OE/POE	25/00/25
		Total	50

Course Description: This course covers the principles and techniques of measuring electrical quantities such as voltage, current, resistance, and power. Students learn about various electrical instruments, their calibration, and their applications in engineering. Topics include measurement errors, sensors, transducers, data acquisition systems, and the interpretation of measurement results. Practical sessions focus on hands-on experience with instruments and techniques used in electrical engineering applications.

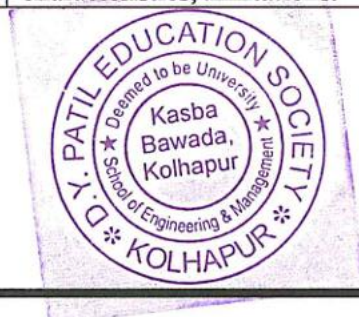
Course Objectives:

1	This course explain and physically identify the parts like moving coil, control system, damping systems, pointer, shunts, multipliers etc. of different types of deflection systems.
2	It aims to develop an ability to select and implement various bridges for measuring electrical quantities.
3	It aims to recognize various transducers and use them in the measurement of various electrical and non-electrical quantities.
4	It intends to develop skills for measurement and instrumentation system.

Course Outcomes (COs):

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

23ELEU3P04.1	Explain the principles and operation of various measurement devices, their characteristics, limitations.
23ELEU3P04.2	Execute measurement of electrical parameters using various bridges.
23ELEU3P04.3	Apply proper method, sensors and transducers for specific applications and measurement.
23ELEU3P04.4	Explain the principles and operation of various measurement devices, their characteristics, limitations.





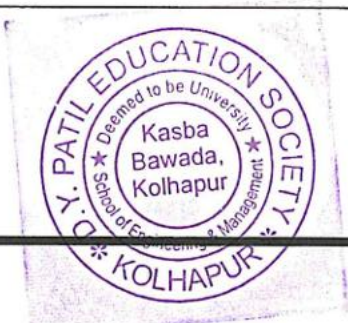
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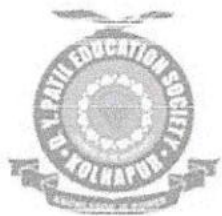
Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
23ELEU3P04.1	3	3			2								2	2	I
23ELEU3P04.2	3	3			3								2	2	III
23ELEU3P04.3	3	2			3								2	2	iii
23ELEU3P04.4	3	2											2	2	II

List of Experiments

Expt. No.	Name of Experiment
1	Study of Moving iron, PMMC and Dynamometer type instruments (Basic moving systems)
2	Measurement of power in three phase balanced and unbalanced circuits by conventional two wattmeter method.
3	Calibration of Single-phase energy meter for energy measurement
4	Measurement of R, L and C Using Different Bridges and confirmation with analytical calculations.
5	Measurement of temperature using RTD
6	Comparative study of temperature measurement using RTD and thermocouple
7	Study of strain gauge and measurement of force using it
8	Study of construction of LVDT and measurement of displacement, force and pressure by using it.
9	Measurement of Light intensity using Lux-meter and to realize the light intensity distribution with change in distance.
10	Speed measurement using photoelectric pick up, magnetic pick up and stroboscope





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Text Books:

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2	A. K. Sawhney, "A Course in Electrical and Electronics Measurement and Instrumentation", Dhanapat Rai & Company, New Delhi, reprint, 17th Edition, 2005.
3	Rangan, Mani and Sharma, "Instrumentation Devices and Systems", Tata McGraw Hill, New Delhi, 2nd Edition.
4	C. D. Johnson, "Process Control Instrumentation Technology", Pearson Education.

Reference Books:

1	Albert D. Helfric, "Modern Electronics measurement & instruments", PHI Ltd, 2003.
2	Doebelin, E. O., "Measurement Systems", McGraw Hill Book Co.
3	Patranabis, D., "Sensors and Transducers", Wheeler Publishing Co., Ltd. New Delhi.
4	Murthy, D. V. S., "Transducers and Instrumentation", Prentice Hall of India Pvt. Ltd., New Delhi.

Useful Links

1	https://nptel.ac.in/courses/108/105/108105153
2	https://nptel.ac.in/courses/108/105/108105064





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Class		S.Y. B. Tech, Semester- III	
Course Code and Course Title		23ELEU3P05, Electric Circuit Analysis Lab	
Prerequisite/s		Basic Electrical Engineering Lab	
Teaching Scheme: Lecture/Tutorial/Practical		00/00/02	
Credits		01	
Evaluation Scheme	T	ISE / MSE / ESE	00/00/00
	P	INT / OE/POE	25/00/25
		Total	50

Course Description: Electric Circuit Analysis Lab provides hands-on experience in building and analyzing electrical circuits. Through practical experiments, students apply theoretical concepts, use measurement instruments, and develop skills in circuit troubleshooting and design, enhancing their understanding of AC and DC circuit behaviors and reinforcing classroom learning

Course Objectives:

1	This course intends to provide basic practical knowledge of electrical circuit theorems.
2	It intends to develop skills to demonstrate transient and steady state response of first and second order electrical circuit.
3	It aims to develop an ability to simulate and implement various basic electrical circuits.
4	It intends to develop skills for measurement and instrumentation system.

Course Outcomes (COs):

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

23ELEU3P05.1	Determine parameters of electrical circuits and two port network using hardware and simulation.
23ELEU3P05.2	Explain the transient and steady state response of first and second order circuit using hardware and simulation.
23ELEU3P05.3	Employ measurement and instrumentation system for measurement of electrical and physical parameters.



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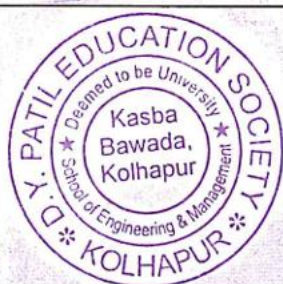
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23ELEU3P05.1	3	3	3		3								2	2	II
23ELEU3P05.2	3	3			3								2	2	I
23ELEU3P05.3	3	2			3								2	2	III

List of Experiments

Expt. No.	Name of Experiment
1	Implementation of Mesh and Node analysis to measure current and voltage in D.C. circuit using software tool PSpice.
2	Verification of Superposition Theorem to measure current and voltage in electrical circuit using hardware and validate the result using software tool PSpice.
3	Verification of Thevenin's and Norton's Theorem to obtain equivalent circuit using hardware and validate the result using software tool PSpice.
4	Determine transient and steady state behaviour of a first order circuit (R-C circuit) on hardware and validate the results using software tool PSpice.
5	Determine transient and steady state behaviour of a second order circuit (R-L-C circuit) using software tool PSpice.
6	Determine Impedance, Admittance, Transmission and Hybrid parameters of two port electrical network using hardware and validate the result manually.
7	Implementation of Mesh and Node analysis to measure current and voltage in A.C. circuit using software tool PSpice.
8	Determine active power using two wattmeter method and reactive power using one wattmeter method in a three-phase circuit and validate the result manually.
9	Determine error in single phase energy meter by calibration.
10	Determine physical parameters using different type of transducers and validate the result manually



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Text Books:

1	C. K. Alexandar and M.O. Sadiku, "Fundamentals of Electric Circuits", McGraw Hill Education, 6 th Edition, 2018, ISBN: 9780078028229
2	H. S. Kalsi "Electronic Instrumentation", McGraw Hill Education, Third edition, 2010, ISBN: 9780070702066

Reference Books:

1	James W. Nilsson and Susan A. Riedel "Electric Circuits" Prentice Hall, 10th Edition, 2015, ISBN: 0131989251
2	A. K. Sawhney, "A Course in Electrical and Electronics Measurement and Instrumentation", Dhanapat Rai & Company, New Delhi, reprint, 19th Edition, 2010, ISBN: 9788177001006

Useful Links

1	https://nptel.ac.in/courses/108/105/108105153/
2	https://nptel.ac.in/courses/108/105/108105064/

G. B. Bawada





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Class	S.Y. B. Tech, Semester- III		
Course Code and Course Title	23ELEU3F06, Society based Mini- Project		
Prerequisite/s			
Teaching Scheme: Lecture/Tutorial/Practical	00/00/04		
Credits	02		
Evaluation Scheme	T	ISE / MSE / ESE	00/00/00
	P	INT / OE/POE	50/00/00
		Total	50

Course Description: This course gives introduction of electric hardware systems and provides hands-on training with identification, testing, assembling, dismantling, and fabrication of societal electrical project

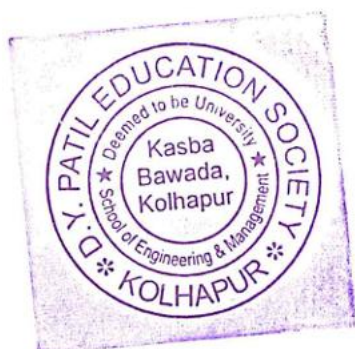
Course Objectives:

1	To design working, reliable electric circuits to meet specifications
2	To understand concepts of interfacing different electric peripherals.
3	To design and implement the solution using hardware / software or both
4	To create an interest in the field of electrics design as a prospective career option.

Course Outcomes (COs):

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

23ELEU3F06.1	Apply the fundamental concepts and working principles of electric devices to design electric circuits to solve Societal problems.
23ELEU3F06.2	Analyze datasheets and select appropriate components and devices.
23ELEU3F06.3	Demonstare simulation using software's.
23ELEU3F06.4	Enable the Students to develop application-based projects and estimate project cost.





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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)		2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
23ELEU3F06.1	3	-	-	-	-	-	-	-	-	-	-	1			III
23ELEU3F06.2	3	1	-	-	1	-	-	-	-	-	-	1			III
23ELEU3F06.3	3	2	3	-	3	-	-	-	-	-	-	1			III
23ELEU3F06.4	3	2	3	-	3	-	-	-	3	-	-	1			IV

Sr. No.	Mini project work should consist of following steps
1	Students should propose societal problem based project ideas & finalize the project idea in consultation with guide. (Problem statement).
2	Students should submit implementation plan to the subject incharge. This will cover weekly activity of project report.
3	Problem definition and specification development in the form of synopsis.
4	Design of circuit with calculation & should include a) Analog part b) digital part c) Power supply d) Test strategy if firmware is required produce flow chart.
5	Simulation of design using tools like eSim, OrCAD, Matlab, etc.
6	Design calculation component selection.
7	Fabrication & assembly of PCB & enclosure.
8	Testing, Measurement of specifications & calibration.
9	Bill of Material.
10	Final Demo and Project Report.

References:

1. The First Book of Electronics Workshop: Can't Beat a Practical Approach - River Publishers Series in Communications.
2. Handbook of Electronic projects, by ArsathNatheem.
3. Fundamentals of Electrical Engineering – BharatiDwivedi and AnurasgTripathi – Willey Precise
4. Electronics Devices and Circuit Theory- Robert L. Boylestad and Louis Nashelsky, Pearson Education Publication





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Class		S.Y. B. Tech, Semester- III	
Course Code and Course Title		23ELEU3M07, Fundamental and Architecture of Electric Vehicle	
Prerequisite/s			
Teaching Scheme: Lecture/Tutorial/Practical		02/00/00	
Credits		02	
Evaluation Scheme	T	ISE / MSE / ESE	00/00/50
	P	INT / OE/POE	00/00/00
	Total		50

Course Description: Fundamentals and Architecture of Electric Vehicles is a course that delves into the core principles and design aspects of electric vehicles. It covers topics such as electric powertrains, battery technology, vehicle dynamics, and charging infrastructure, providing students with a comprehensive understanding of EV systems and their integration.

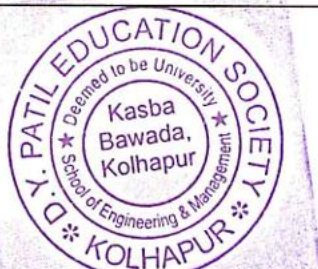
Course Objectives:

1	Understand the fundamental principles of electric vehicle propulsion systems
2	Analyze the architecture and components of electric vehicles
3	Explore the environmental impact and sustainability considerations of electric vehicles compared to traditional internal combustion engine vehicles
4	Evaluate the integration of electric vehicle subsystems
5	Discuss the current trends and future developments in electric vehicle technology
6	Apply theoretical knowledge through practical exercises, including vehicle design simulations, case studies on real-world EV implementations.

Course Outcomes (COs):

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

23ELEU3M07.1	Understand the basic principles of electric vehicle operation.
23ELEU3M07.2	Analyze the components and subsystems of electric vehicles.
23ELEU3M07.3	Evaluate the advantages and limitations of electric vehicle technologies.
23ELEU3M07.4	Design basic electric vehicle architectures.
23ELEU3M07.5	Assess the environmental impacts of electric vehicles.
23ELEU3M07.6	Discuss emerging trends and future prospects in electric vehicle technology





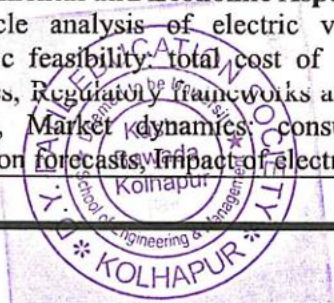
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
23ELEU3M07.1	3												2	2	II
23ELEU3M07.2	3	3											2	2	III
23ELEU3M07.3	3	2	3										2	2	III
23ELEU3M07.4	3	3											2	2	III
23ELEU3M07.5	3	3											2	2	III
23ELEU3M07.6	3	3											2	2	ii

Unit	Contents	Hours
1	Introduction to Electric Vehicles History and evolution of electric vehicles, Types and classifications of electric vehicles: BEVs, PHEVs, and FCEVs, Global market trends and forecasts, Environmental benefits: emissions reduction and sustainability, Challenges and barriers to adoption: range anxiety and infrastructure development	6
2	Electric Vehicle Powertrains Electric motors: types (induction, permanent magnet, synchronous), operation principles, and efficiency characteristics, Power electronics: inverters, converters, and motor controllers, Energy storage systems: lithium-ion batteries, battery management systems (BMS), and thermal management, Fuel cell technology: hydrogen fuel cells, working principles, and applications in FCEVs, Comparison of different powertrain configurations: series, parallel, and series-parallel hybrid systems	7
3	Vehicle Dynamics and Control Systems Chassis design considerations for electric vehicles: weight distribution, center of gravity, and vehicle dynamics, Powertrain integration and optimization for efficiency and performance, Control strategies: regenerative braking systems, traction control, and stability control, Vehicle-to-Grid (V2G) technology: bidirectional power flow and grid stabilization, Impact of electric drivetrains on handling characteristics and driver experience	6
4	Charging Infrastructure and Grid Integration Charging technologies: AC charging (Level 1 and Level 2), DC fast charging (CHAdeMO, CCS, Tesla Supercharger), and wireless charging, Charging standards and protocols: interoperability issues and standardization efforts, Smart charging strategies: peak load management, demand response, and grid-friendly charging, Integration of renewable energy sources with EV charging infrastructure, Business models and investment trends in charging infrastructure development	7
5	Environmental and Economic Aspects Life cycle analysis of electric vehicles: cradle-to-grave environmental impacts, Economic feasibility: total cost of ownership (TCO), payback period, and financial incentives, Regulatory frameworks and government policies promoting electric vehicle adoption, Market dynamics: consumer preferences, adoption rates, and market penetration forecasts, Impact of electric vehicles on urban air quality and noise pollution	6

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	reduction initiatives	
6	Future Trends and Innovations Advances in battery technology: solid-state batteries, graphene-based batteries, and beyond lithium-ion technologies, Autonomous electric vehicles: technologies, challenges, and implications for urban mobility, Connectivity and smart mobility solutions: vehicle-to-everything (V2X) communication, internet of vehicles (IoV), and cloud-based services, Energy management and optimization: predictive analytics, AI-driven algorithms, and energy-efficient routing, Global initiatives and collaborations advancing electric vehicle technology and infrastructure development	7

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	"Electric and Hybrid Vehicles: Design Fundamentals"	Iqbal Husain	CRC Press	2nd	2017
2	"Introduction to Electric Circuits"	Richard C. Dorf, James A. Svoboda	Wiley	9th	2019
3	"Electric Vehicle Technology Explained"	James Larminie, John Lowry	Wiley	2nd	2012
4	"Electric Drives and Electromechanical Systems: Applications and Control"	Richard Crowder	Academic Press	1st	2019
5	"Energy Storage for Sustainable Microgrid"	N. Mithulananthan, D. Srinivasan	Springer	1st	2015
6	"Electric Vehicles: Design and Build Your Own"	Michael Hackleman	McGraw-Hill Education	1st	2013

Reference Books:

01	"Electric Vehicles and Plug-In Hybrids: Advanced Simulation Methodologies"	Gianfranco Pistoia	Elsevier	1st	2017
02	"Electric Vehicle Integration into Modern Power Networks"	Sumedha Rajakaruna, Nick Jenkins	Springer	1st	2013
03	"Battery Management Systems for Large Lithium Ion Battery Packs"	Davide Andrea	Artech House	1st	2010
04	"Introduction to Power Electronics"	Daniel W. Hart	Pearson	1st	2011
05	"Electric Vehicle Technology"	Ching-Yao Chan	CRC Press	1st	2013
06	"Electric Vehicle Technology and Expectations in the Automobile Industry"	Alexander Voronov	IGI Global	1st	2020

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Class	S.Y. B. Tech, Semester- III		
Course Code and Course Title	23ELEU3V08, Personal Values and Ethics		
Prerequisite/s	Personal Communication		
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00		
Credits	02		
Evaluation Scheme	T	ISE / MSE / ESE	20/30/00
	P	INT / OE/POE	00/00/00
		Total	50

Course Description: This course introduces students to the ethical considerations and professional values necessary for a career in electric engineering. It covers foundational principles, ethical decision-making frameworks, responsibilities towards society, and professional conduct

Course Objectives:

1	To understand the importance of professional ethics in engineering.
2	To apply ethical decision-making frameworks to engineering scenarios.
3	To analyze case studies related to ethical dilemmas in Electrical engineering.
4	To develop awareness of societal responsibilities and environmental impact of Electric technologies.

Course Outcomes (COs):

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

23ELEU3V08.1	Identify and analyze ethical issues in electric engineering practices.
23ELEU3V08.2	Apply ethical theories and principles to resolve ethical dilemmas.
23ELEU3V08.3	Evaluate the social and environmental impact of electric technologies.
23ELEU3V08.4	Demonstrate awareness of professional codes of conduct and responsibilities.

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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)			3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
23ELEU3V08.1	2	3	1	-	-	3	-	3	-	1	-	-	1	1	IV
23ELEU3V08.2	2	3	1	-	-	3	-	3	-	1	-	-	1	1	III
23ELEU3V08.3	2	3	2	-	-	3	3	3	-	1	-	-	1	1	IV
23ELEU3V08.4	2	3	1	-	-	3	3	3	1	2	-	2	1	1	III

Content	Hrs
Unit 1 – Introduction to Professional Ethics Importance of ethics in engineering; Professional codes of conduct; Ethical theories and frameworks; Case studies on ethical issues in electric engineering	7
Unit 2 –Ethical Decision-Making Ethical decision-making models; Stakeholder analysis; Handling conflicts of interest; Case studies and role-play exercises	7
Unit 3 - Societal Responsibilities) Social impacts of electronic technologies; Environmental considerations; Sustainable engineering practices; Corporate social responsibility (CSR) in electrical industry.	7
Unit 4-Professional Conduct and Development Professional integrity and honesty; Career development and lifelong learning; Professional organizations and networking; Personal and professional growth in electrical engineering	7

Note: Subject incharge should conduct any of the activities listed

List of Activities:

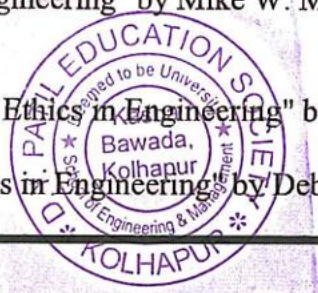
- Group discussions on case studies;
- Debates on ethical dilemmas;
- Guest lectures by industry professionals on CSR and environmental sustainability;
- Field visits to understand real-world implications of electronic technologies

Text Books:

1. "Engineering Ethics: Concepts and Cases" by Charles E. Harris Jr., Michael S. Pritchard, and Michael J. Rabins, Cengage Learning.
2. "Ethics in Engineering" by Mike W. Martin and Roland Schinzinger, McGraw-Hill Education.

Reference Books:

1. "Professional Ethics in Engineering" by William H. Frey and Christopher G. Brusaw, Pearson Education.
2. "Ethical Issues in Engineering" by Deborah G. Johnson and Helen Nissenbaum, IEEE Press.



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Class	S.Y. B. Tech, Semester- III		
Course Code and Course Title	23ELEU3O09, Basic Electric Circuits		
Prerequisite/s			
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00		
Credits	03		
Evaluation Scheme	T	ISE / MSE / ESE	20/30/50
	P	INT / OE/POE	00/00/00
		Total	100

Course Description: Basic Electric Circuits provides a foundational understanding of electrical circuit theory. It covers essential topics such as Ohm's Law, Kirchhoff's Laws, network theorems, and the analysis of AC and DC circuits, equipping students with the skills to analyze and design basic electrical circuits

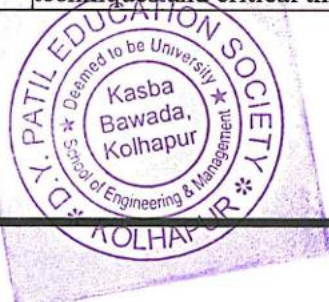
Course Objectives:

1	Understand the fundamental concepts and principles of electric circuits, including voltage, current, power, and energy.
2	Apply Ohm's Law and Kirchhoff's Laws to analyze and solve simple electrical circuits.
3	Learn and implement various network theorems, such as Thevenin's, Norton's, and Superposition Theorem, for circuit simplification and analysis.
4	Analyze AC and DC circuits using phasor and time-domain methods.
5	Develop skills in using circuit analysis techniques to design and troubleshoot basic electrical circuits.
6	Gain practical knowledge through solving real-world circuit problems and applying theoretical concepts to practical scenarios.

Course Outcomes (COs):

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

23ELEU3O09.1	Demonstrate a clear understanding of fundamental electric circuit concepts, including voltage, current, resistance, and power.
23ELEU3O09.2	Apply Ohm's Law and Kirchhoff's Laws effectively to analyze and solve complex electrical circuits.
23ELEU3O09.3	Utilize various network theorems, such as Thevenin's, Norton's, and Superposition Theorem, to simplify and analyze electrical circuits.
23ELEU3O09.4	Analyze both AC and DC circuits using appropriate methods, such as phasor analysis for AC circuits.
23ELEU3O09.5	Design and troubleshoot basic electrical circuits, applying theoretical knowledge to practical situations.
23ELEU3O09.6	Solve real-world electrical circuit problems, demonstrating proficiency in circuit analysis techniques and critical thinking skills





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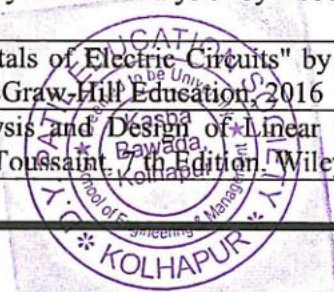
Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
23ELEU3O09.1	3	2											2	2	3
23ELEU3O09.2	3	3	2										2	2	3
23ELEU3O09.3	3	3	2										2	2	3
23ELEU3O09.4	3	2	2										2	2	3
23ELEU3O09.5	3	3	2										2	2	3
23ELEU3O09.6	3	3	2										2	2	3

Content	Hrs.
Unit 1: Introduction to Electric Circuits Overview of Electric Circuits, Basic Electrical Quantities: Voltage, Current, Power, and Energy, Circuit Elements: Resistors, Capacitors, Inductors, and Voltage and Current Sources, Types of Circuits: Series and Parallel Circuits	7
Unit 2: Fundamental Laws and Theorems Ohm's Law and its Applications, Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL), Voltage and Current Division Rules, Mesh Analysis and Nodal Analysis	7
Unit 3: Network Theorems Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power Transfer Theorem, Reciprocity and Millman's Theorem	7
Unit 4: AC Circuit Analysis Introduction to Alternating Current (AC), Sinusoidal Waveforms and Phasors, Impedance and Admittance, AC Circuit Analysis using Phasors, Resonance in AC Circuits	7
Unit 5: Transient Analysis Introduction to Transients in Electric Circuits, RC and RL Circuits: Natural and Forced Response, RLC Circuits: Overdamped, Underdamped, and Critically Damped Responses, Transient Response of AC Circuits	7
Unit 6: Two-Port Networks Introduction to Two-Port Networks, Parameters of Two-Port Networks: Z-parameters, Y-parameters, H-parameters, and ABCD-parameters, Interconnection of Two-Port Networks, Applications of Two-Port Networks	7

Text Books:

1	"Electric Circuits" by James W. Nilsson and Susan Riedel, 11th Edition, Pearson, 2018
2	"Engineering Circuit Analysis" by William H. Hayt, Jack E. Kemmerly, and Steven M. Durbin, 8th Edition, McGraw-Hill Education, 2011
3	"Introductory Circuit Analysis" by Robert L. Boylestad, 13th Edition, Pearson, 2015
4	"Fundamentals of Electric Circuits" by Charles K. Alexander and Matthew N.O. Sadiku, 6th Edition, McGraw-Hill Education, 2016
5	"The Analysis and Design of Linear Circuits" by Roland E. Thomas, Albert J. Rosa, and Gregory J. Toussaint, 7th Edition, Wiley, 2012





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Reference Books:

1	"Circuit Analysis: Theory and Practice" by Allan H. Robbins and Wilhelm C. Miller, 5 th Edition, Cengage Learning, 2012
2	"Basic Engineering Circuit Analysis" by J. David Irwin and R. Mark Nelms, 11 th Edition, Wiley, 2015
3	"Microelectronic Circuits" by Adel S. Sedra and Kenneth C. Smith, 7 th Edition, Oxford University Press, 2014
4	"Linear Circuit Analysis" by Raymond A. DeCarlo and Pen-Min Lin, 2 nd Edition, Oxford University Press, 2001
5	"Schaum's Outline of Electric Circuits" by Mahmood Nahvi and Joseph Edminister, 6 th Edition, McGraw-Hill Education, 2013

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Class	S.Y. B. Tech, Semester- III		
Course Code and Course Title	23ELEU3O10, Basic Electric Circuits (Practical)		
Prerequisite/s			
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02		
Credits	01		
Evaluation Scheme	T	ISE / MSE / ESE	00/00/00
	P	INT / OE/POE	25/00/00
		Total	25

Course Description: The Basic Electric Circuits (Practical) course introduces students to the fundamental principles of electric circuit analysis through hands-on experiments. It covers the study of electrical quantities, circuit elements, laws, network theorems, AC and transient circuit behavior, and two-port network analysis. This course emphasizes practical problem-solving skills and prepares students for advanced studies in electrical engineering

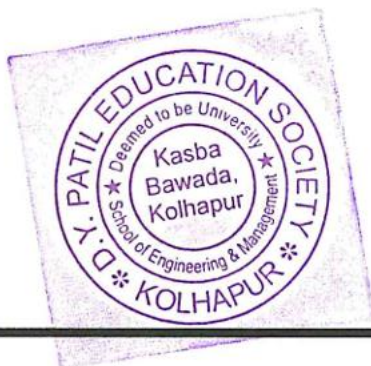
Course Objectives:

1	To develop teamwork skills by engaging in collaborative activities and projects, fostering an essential competency for industrial and research environments.
2	To bridge theoretical knowledge with practical applications by integrating concepts from related courses to address industry-relevant challenges.
3	To enhance communication and presentation abilities through team-based presentations, preparing students for professional and academic scenarios.
4	To cultivate critical evaluation and peer learning by analyzing and assessing the work of other teams, promoting a culture of constructive feedback and continuous improvement.

Course Outcomes (COs):

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

23ELEU3O10.1	Understand and explore hardware components and their operation, including control mechanisms using relevant software tools.
23ELEU3O10.2	Apply theoretical knowledge from related courses to solve practical problems and meet industry requirements.
23ELEU3O10.3	Develop the ability to work collaboratively in teams, fostering essential skills for industrial and professional environments
23ELEU3O10.4	Enhance teamwork-based presentation skills, focusing on effective communication essential for research and industry settings



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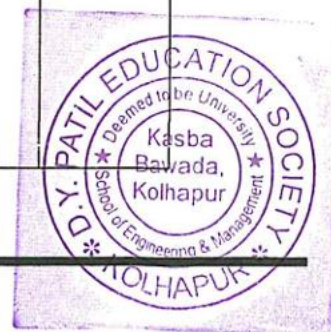


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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
23ELEU3O10.1	2	1						3			2		2	2	II
23ELEU3O10.2	2	2	1		2			3			2		2	2	III
23ELEU3O10.3	2	2	1		2			3			2		2	2	III
23ELEU3O10.4								3		3	3	3	2	2	III

Content	Hrs.
<p>The plan of conducting this course is given below:</p> <p>1. Team Formation Form groups of 4–5 students. Assign roles</p> <p>2. Problem Statement Select a project topic from the list or propose a new idea (subject to faculty approval). Define a clear objective and scope for the project.</p> <p>3. Circuit Design and Simulation Design the circuit using theoretical concepts. Perform simulations using software tools (e.g., MATLAB, Multisim, Proteus).</p> <p>4. Hardware Implementation Assemble the circuit using appropriate components. Test and troubleshoot the circuit for functionality and performance.</p> <p>5. Documentation Prepare a detailed report that includes: Project title Objective and scope Circuit diagram and theoretical background Components used (with specifications) Procedure and observations Results and analysis Challenges faced and solutions Conclusion and future scope</p> <p>6. Presentation Create a concise 10-minute presentation with visuals to showcase your project. Include objectives, methodology, results, and challenges. Each team member must contribute to the presentation.</p>	<p>2</p>





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Text Books:

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2	"Engineering Circuit Analysis" by William H. Hayt, Jack E. Kemmerly, and Steven M. Durbin, 8th Edition, McGraw-Hill Education, 2011
3	"Introductory Circuit Analysis" by Robert L. Boylestad, 13th Edition, Pearson, 2015
4	"Fundamentals of Electric Circuits" by Charles K. Alexander and Matthew N.O. Sadiku, 6th Edition, McGraw-Hill Education, 2016
5	"The Analysis and Design of Linear Circuits" by Roland E. Thomas, Albert J. Rosa, and Gregory J. Toussaint, 7th Edition, Wiley, 2012

Reference Books:

1	"Circuit Analysis: Theory and Practice" by Allan H. Robbins and Wilhelm C. Miller, 5th Edition, Cengage Learning, 2012
2	"Basic Engineering Circuit Analysis" by J. David Irwin and R. Mark Nelms, 11th Edition, Wiley, 2015
3	"Microelectronic Circuits" by Adel S. Sedra and Kenneth C. Smith, 7th Edition, Oxford University Press, 2014
4	"Linear Circuit Analysis" by Raymond A. DeCarlo and Pen-Min Lin, 2 nd Edition, Oxford University Press, 2001
5	"Schaum's Outline of Electric Circuits" by Mahmood Nahvi and Joseph Edminister, 6th Edition, McGraw-Hill Education, 2013





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Class	S.Y. B. Tech, Semester- III		
Course Code and Course Title	23ELEU3H11, Financial Management		
Prerequisite/s			
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00		
Credits	02		
Evaluation Scheme	T	ISE / MSE / ESE	50/00/00
	P	INT / OE/POE	00/00/00
		Total	50

Course Description: Financial Management is a course that explores the principles and techniques of managing an organization's financial resources. It covers topics such as financial planning, budgeting, investment analysis, and risk management, equipping students with the skills to make informed financial decisions and optimize financial performance

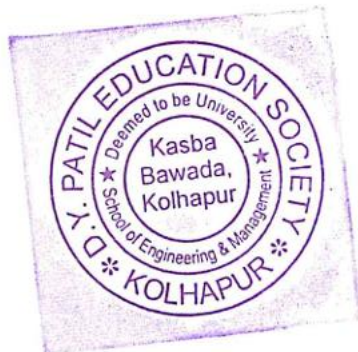
Course Objectives:

1	Overview of Indian financial system, their instruments and market.
2	Basic concepts of Time Value of Money, returns and risks
3	Knowledge about of Corporate Finance & Capital Budgeting, NPV, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR)
4	Knowledge about sources of finance, capital structure, Trade Credit, Bank Finance, Commercial Paper, Project Finance.

Course Outcomes (COs):

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

23ELEU3H11.1	Understand Indian finance system and Financial Markets.
23ELEU3H11.2	Evaluate of Time Value of Money, returns and risks.
23ELEU3H11.3	to apply the knowledge of Corporate Finance & Capital Budgeting, NPV, MIRR, IRR
23ELEU3H11.4	to develop the knowledge about sources of finance & capital structure.



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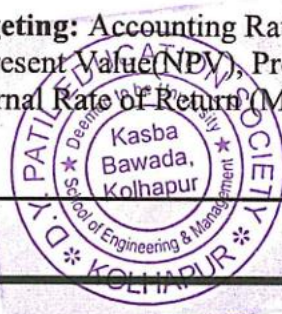


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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
H11.1	2	2	1	1	1	-	-	-	-	-	1	-	1	1	
H11.2	1	1	1	1	1	-	-	-	-	-	2	-	1	1	
H11.3	2	2	1	1	1	-	-	-	-	-	2	-	1	1	
H11.4	2	2	2	2	2	-	-	-	-	-	2	-	1	1	

Content	Hrs
Unit -1 Overview of Indian Financial System Characteristics, Components and Functions of Financial System. Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. Financial Markets: Capital Market, Money Market and Foreign Currency Market Financial Institutions- Commercial Banks, Merchant banks & Stock Exchanges.	4
Unit -2 Concepts of Returns and Risks: Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio. Time Value of Money: Future & present Value of a Lump Sum, Ordinary Annuity. Continuous Compounding and Continuous Discounting.	3
Unit -3 Overview of Corporate Finance: Objectives of Corporate Finance. Financial Ratio Analysis: Overview of Financial Statements—Balance Sheet, Profit and Loss Account, and Cash Flow Statement. Capital Budgeting: Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value (NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR)	4



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Unit -4

Sources of Finance: Long Term Sources—Equity, Debt, and Hybrids; Mezzanine Finance; Sources of Short Term Finance—Trade Credit, Bank Finance, Commercial Paper; Project Finance.

Capital Structure: Factors Affecting an Entity's Capital Structure; Overview of Capital Structure. Relation between Capital Structure and Corporate Value

3

Expt. No.	Name of Experiment	Hrs
1	Find FRA,LR for following financial statements.	2
2	Find efficiency & activity ratio for following financial statements.	2
3	Find rate of return ,PP,DPP for following financial statements.	2
4	Find net present value(NPV)for following financial statements.	2
5	Estimate the working capital for following different businesses.	2
6	Prepare a project report for any one businesses.	2
7	Illustrate bank project finance process in detail.	2
8	Income tax and PF calculation of employee.	2
9	Examples on balance sheet.	2
10	Visit to bank/industry to see FM strategies.	2

Reference Books:

1. Fundamentals of Financial Management, 13th Edition(2015) by Eugene F. Brigham and Joel F.Houston; Publisher: Cengage Publications, NewDelhi.
2. AnalysisforFinancialManagement,10thEdition(2013)byRobertC.Higgins;Publishers:McGraw Hill Education, New Delhi.
3. IndianFinancialSystem,9thEdition(2015)byM. Y.Khan;Publisher:McGrawHillEducation,New Delhi.
4. FinancialManagement,11thEdition(2015)byI.M.Pandey;Publisher:S.Chand(G/L)&CompanyLimited, New Delhi.
5. Financial Management: Theory and Practice Twelfth Edition Eugene F. Brigham and Michael C. Ehrhardt by Thomson.

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Course Title: Liberal Learning Course-I (IoT and Automation Club)	
Course Code: 23ELEU3C13	Semester: III
Teaching Scheme: L-T-P: 2-0-0	Credits: Audit
Evaluation Scheme: ISE: 50, MSE: NA	ESE Marks: NA

Course Description:

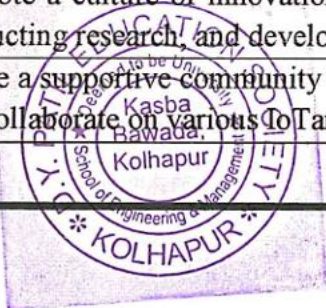
The club has vision to provide a platform for learning, networking, staying updated on the latest advancements in IoT and automation technology and explore, innovate, and collaborate on IoT-Automation related projects.

Aim:

1. Providing members with opportunities to learn about IoT technologies, protocols, and applications through workshops, seminars, and online resources.
2. Encouraging members to explore and develop innovative IoT and automation based projects, fostering creativity and problem-solving skills.
3. Facilitating collaboration among members to work on joint projects, share ideas, and build a supportive community.
4. Creating a platform for members to connect with industry professionals, researchers, and promoting the practical application of IoT and Automation in various domains, encouraging them to work on real-world projects.
5. Enhancing members' skills in programming, data analytics, hardware integration, and other relevant areas crucial for IoT and Automation development.

Course Objectives:

1	To better understand IoT and Automation technologies, applications, and their implications through workshops, seminars, and knowledge-sharing sessions.
2	Provide opportunities for members to acquire and enhance technical skills relevant to IoT including programming, hardware integration, and data analytics.
3	Encourage members to collaborate on IoT and Automation projects, enhancing teamwork and hands-on experience in developing real-world applications.
4	Promote a culture of innovation by supporting members in exploring new ideas, conducting research, and developing novel IoT and automation solutions.
5	Create a supportive community where members can share knowledge, seek advice, and collaborate on various IoT and Automation related endeavors.





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Course Outcomes (COs):

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

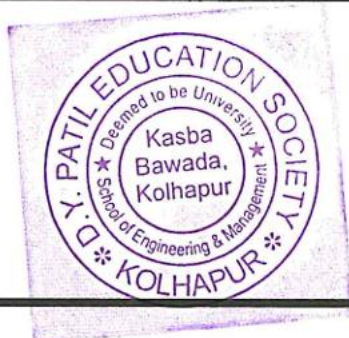
23ELEU3C13.1	Understand IoT and Automation technologies and their applications.
23ELEU3C13.2	Implement the technical skills relevant to IoT and Automation.
23ELEU3C13.3	Analyze and solve the real world problem with innovative thinking.
23ELEU3C13.4	Create the systems by contributing and work as team member.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PS O1	PS O2	BT L
23ELEU3C13.1	3	3		2									3	2	II
23ELEU3C13.2	3	3	2	2	3								3	3	III
23ELEU3C13.3	3	3											2	3	IV
23ELEU3C13.4			3		3				3	3			2	3	VI

Prerequisite: Basic knowledge of programming, cloud computing, automation systems.

Contents	Hours
<ul style="list-style-type: none"> • Seminars • Workshops • Short courses • Certifications • Hackathons • Project competitions • Industrial Projects • Research and Development 	30





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Evaluation Guidelines:

- Attendance: Regular attendance in Expert lectures, workshops, and club meetings.
- Engagement: Active participation in discussions, Q&A sessions, and group activities.
- Teamwork: Collaboration with peers on projects and challenges.
- Technical Proficiency: Ability to operate lot development boards, use relevant software and troubleshoot common issues.
- Project Execution: Successful completion of assigned projects and tasks within the given timeframe.
- Innovation: Demonstration of creativity and innovative thinking in project design and implementation
- Event Participation: Involvement in organizing and participating in competitions, workshops, and awareness campaigns.
- Community Building: Contribution to building a supportive and collaborative club environment.
- Competition Performance: Participation and performance in internal and external competitions.
- Project Showcase: Presentation of completed projects during club meetings or events.
- Awards and Accolades: Recognition received for outstanding work and contributions.

Certification Levels:

1. Beginner Level Certification:

- Attend at least 75% of the boot camps and workshops.
- Complete a basic robotics project (e.g. designing and assembling a simple robot).
- Demonstrate understanding of basic robotics concepts and equipment operation.

2. Intermediate Level Certification:

- Successfully complete multiple robotics projects, including a complex design.
- Participate in at least one internal competition or challenge.
- Show proficiency in troubleshooting and maintaining robotics equipment.

3. Advanced Level Certification:

- Lead a team in a major robotics project or competition,
- Organize or contribute significantly to a club event or workshop.
- Conduct a presentation or seminar on a specialized robotics topic.
- Publish a research article in a Journal or Conference.





D.Y. Patil Education Society, Kolhapur
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Department of Electrical Engineering

Course Title: Liberal Learning Course-II (Drone Club)	
Course Code: 23ELEU3C14	Semester: III
Teaching Scheme: L-T-P: 2-0-0	Credits: Audit
Evaluation Scheme: ISE: 50, MSE: NA	ESE Marks: NA

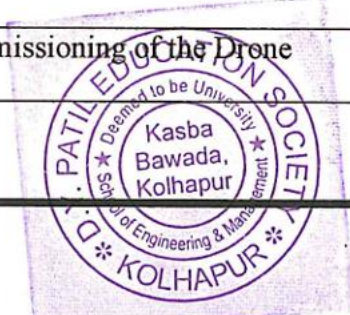
Course Description: This course imparts knowledge of drone parts and components and the principles of flying applied to the drone technology. It takes the technician through the process of understanding the setting up of drone parameters through the use of a simulator. It also imparts the knowledge related to performing testing and quality check on the drone prior to dispatch and commissioning of the Drone.

Aim:

1. Providing members with opportunities to learn about drone technologies, protocols, and applications through workshops, seminars, and online resources.
2. Encouraging members to explore and develop innovative drone projects, fostering creativity and problem-solving skills.
3. Facilitating collaboration among members to work on joint projects, share ideas, and build a supportive community.
4. Creating a platform for members to connect with industry professionals, researchers, and promoting the practical application of drone technology in various domains, encouraging them to work on real-world projects like agro drone, surveillance drone
5. Enhancing members' skills in programming, data analytics, hardware integration, and other relevant areas crucial for drone projects.

Course Objectives:

1	Understanding the components, operational basics of a Drone.
2	Understanding flying principles with a Drone flight Simulation
3	Performing Manufacture, Assembly, Testing and Quality check of the Drone
4	Commissioning of the Drone





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Course Outcomes (COs):

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

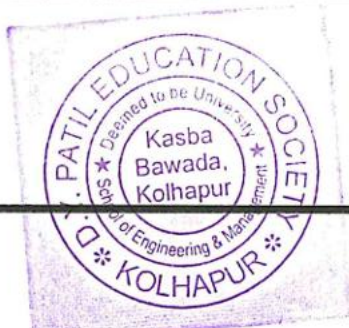
23ELEU3C14.1	To Understanding the components, operational basics of a Drone
23ELEU3C14.2	To Understanding Flying principles with a Drone flight Simulator
23ELEU3C14.3	To Performing Manufacture, Assembly, Testing and Quality check of the Drone

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PS O1	PS O2	BT L
23ELEU3C14.1	3	3			2								3	2	II
23ELEU3C14.2	3	2		3									3	2	III
23ELEU3C14.3	3		3	3	3								3	3	IV

Prerequisite: Basic knowledge of communication System & Circuit Designs

Contents	Hours
<ul style="list-style-type: none"> • Operational basics of a Drone • Flying principles with a Drone flight Simulator • Performing Manufacture, Assembly, Testing and Quality check of the Drone • Seminars • Workshops • Short courses • Certifications • Hackathons • Project competitions • Industrial Projects • Research and Development 	30





**D.Y. Patil Education Society, Kolhapur
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Evaluation Guidelines:

- Attendance: Regular attendance in Expert lectures, workshops, and club meetings.
- Engagement: Active participation in discussions, Q&A sessions, and group activities.
- Teamwork: Collaboration with peers on projects and challenges.
- Technical Proficiency: Ability to operate drone design, use relevant software and troubleshoot common issues.
- Project Execution: Successful completion of assigned projects and tasks within the given timeframe.
- Innovation: Demonstration of creativity and innovative thinking in project design and implementation.
- Event Participation: Involvement in organizing and participating in competitions, workshops, and awareness campaigns.
- Community Building: Contribution to building a supportive and collaborative club environment.
- Competition Performance: Participation and performance in internal and external competitions.
- Project Showcase: Presentation of completed projects during club meetings or events.
- Awards and Accolades: Recognition received for outstanding work and contributions.

Certification Levels:

1. Beginner Level Certification:

- Attend at least 75% of the boot camps and workshops.
- Complete a basic drone designs project (e.g., designing and implementing simple projects).
- Demonstrate understanding of basic drone concepts operations & their components

2. Intermediate Level Certification:

- Successfully complete multiple drone design projects, including a complex design.
- Participate in at least one internal competition or challenge.
- Show proficiency in troubleshooting and maintaining drone technology applications.

3. Advanced Level Certification:

- Lead a team in a major drone technology project or competition.
- Find and work on industrial consultancy & social Projects
- Organize or contribute significantly to a club event or workshop.
- Conduct a presentation or seminar on a specialized drone applications topic.
- Publish a Research Article in Journal or Conference.





D.Y. Patil Education Society, Kolhapur
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Course Title: Liberal Learning Course-III (Robotics Club)	
Course Code: 23ELEU3C15	Semester: III
Teaching Scheme: L-T-P: 2-0-0	Credits: Audit
Evaluation Scheme: ISE: 50, MSE: NA	ESE Marks: NA

Course Description:

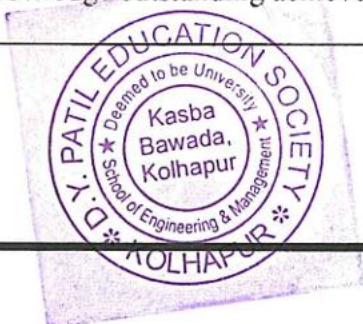
The Robotics Club envisions a dynamic and collaborative environment where students passionately explore and advance the field of robotics. As a student-led initiative within the Electronics and Telecommunication Engineering Department, our mission is to foster innovation, learning, and competition in robotics. By providing structured activities such as boot camps, awareness sessions, and competitions, we aim to cultivate a profound understanding and practical expertise in robotics technologies among our members. Our ultimate goal is to empower students to become leaders in robotics, contributing to technological advancements and solving real-world challenges.

Aim:

1. Cultivate Interest and Enthusiasm: Inspire a passion for robotics among students.
2. Provide Hands-on Experience: Offer practical training with robotics technologies.
3. Encourage Innovation: Foster creativity in design and manufacturing processes.
4. Bridge Theory and Practice: Connect theoretical knowledge with real-world applications.
5. Build a Community. Create a network of individuals passionate about robotics.

Course Objectives:

1	Train students in both fundamental and advanced Robotics techniques.
2	Enable experienced members to guide beginners.
3	Motivate students to undertake cutting-edge projects and research.
4	Foster teamwork and collaborative problem solving through group projects and peer-to-peer learning sessions
5	Create connections with industry professionals and academic experts to enhance learning.
6	Acknowledge outstanding achievements in various robotics challenges.





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Course Outcomes (COs):

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

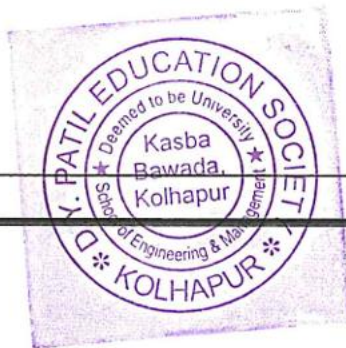
23ELEU3C15.1	Apply foundational knowledge in robotics, programming, and electronics to design and build functional robotic systems.
23ELEU3C15.2	Analyze and solve complex problems through hands-on projects and challenges in robotics.
23ELEU3C15.3	Collaborate effectively with team members, enhancing their communication and teamwork skills through group projects and competitions.
23ELEU3C15.4	Innovative and unique robotic solutions, contributing to advancements in the field.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PS O1	PS O2	BT L
23ELEU3C15.1	3		3		3	2							3	3	II
23ELEU3C15.2	3	3	3	3	2								2	3	III
23ELEU3C15.3	2								3	3			2	3	IV
23ELEU3C15.4	3	2	3	3	2								2	3	VI

Prerequisite: Basic knowledge of Electronics and telecommunication engineering and any programming language.

Contents	Hours
<ul style="list-style-type: none">• Seminars• Workshops• Short courses• Certifications• Hackathons• Project competitions• Industrial Projects• Research and Development	30





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Evaluation Guidelines:

- Attendance: Regular attendance in Expert lectures, workshops, and club meetings.
- Engagement: Active participation in discussions, Q&A sessions, and group activities.
- Teamwork: Collaboration with peers on projects and challenges.
- Technical Proficiency: Ability to operate lot development boards, use relevant software and troubleshoot common issues.
- Project Execution: Successful completion of assigned projects and tasks within the given timeframe.
- Innovation: Demonstration of creativity and innovative thinking in project design and implementation
- Event Participation: Involvement in organizing and participating in competitions, workshops, and awareness campaigns.
- Community Building: Contribution to building a supportive and collaborative club environment.
- Competition Performance: Participation and performance in internal and external competitions.
- Project Showcase: Presentation of completed projects during club meetings or events.
- Awards and Accolades: Recognition received for outstanding work and contributions.

Certification Levels:

1. Beginner Level Certification:

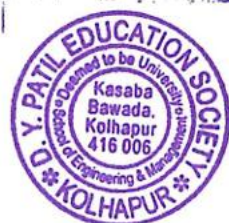
- Attend at least 75% of the boot camps and workshops.
- Complete a basic robotics project (e.g. designing and assembling a simple robot).
- Demonstrate understanding of basic robotics concepts and equipment operation.

2. Intermediate Level Certification:

- Successfully complete multiple robotics projects, including a complex design.
- Participate in at least one internal competition or challenge.
- Show proficiency in troubleshooting and maintaining robotics equipment.

3. Advanced Level Certification:

- Lead a team in a major robotics project or competition,
- Organize or contribute significantly to a club event or workshop.
- Conduct a presentation or seminar on a specialized robotics topic.
- Publish a research article in a Journal or Conference.



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S.Y. B. Tech.
Structure and Curriculum Sem-IV

Department of Electrical Engineering

w.e.f.A.Y.2024-25



**Department of Electrical Engineering
(Teaching and Evaluation Scheme from Year 2024-25 (as per NEP-2020))**

SEMESTER-IV

Course Code	Course Category	Course Type	Course Name	Teaching Scheme				Theory			Practical		
				Credits	L	P	T	ISE	MSE	ESE	INT	OE/POE	
23ELEU4P01			DC Machine and Transformers	3	3	-	-	20	30	50	-	-	100
23ELEU4P02			Power Electronics	3	3	-	-	20	30	50	-	-	100
23ELEU4P03			Generation Transmission & Distributions	2	2	-	-	20	30	50	-	-	100
23ELEU4P04	Program Core Courses	PCC	DC Machine and Transformers Lab.	1		2	-	-	-	-	25	25	50
23ELEU4P05			Power Electronics Lab	1		2	-	-	-	-	25	25	50
23ELEU4M06	Multidisciplinary Minor	M/DM-2	Energy Storage System for Electric Vehicles	2	2	-	-	-	-	50	-	-	50
23ELEU4V07	Value Education Course	VEC (Environmental Study)	Environmental Studies	2	2	-	-	-	-	50	-	-	50
23ELEU4H08	Humanities Social Science and Management	Entrepreneurship/Economics/ Management course	Industrial Management & Startups	2	2	-	-	50	-	-	-	-	50
23ELEU4A09	Ability Enhancement course	AEC	Electronics Workshop	2	1	2	-	-	-	-	25	25	50
23ELEU4O10	Open Elective Course	OEC-II	Basics of Energy Auditing and Management	2	2	-	-	-	-	50	-	-	50
23ELEU4N11	Vocational Skills Enhancement Course	VSEC	Model Based Programming & Simulation	2	1	2	-	25	-	-	25	-	50
23ELEU4D12	Mandatory Course	MC	Finishing School Training I/II	Audit	2*	-	-	50	-	-	-	-	Grade*
23ELEU4C13	Co-Curricular Activities	CCA	Liberal Learning-I	Audit	2 [#]	-	-	50	-	-	-	-	Grade*
23ELEU4C14			Liberal Learning-II		2 [#]	-	-						
23ELEU4C15			Liberal Learning-III		2 [#]	-	-						
23ELEU4Z01	Honors Courses/Double: (Minor)		Transducers and Signal Conditioning	03	3	-	-	20	30	50	-	25	100
23ELEU4Z02	Honors Courses/Double: (Minor)		Transducers and Signal Conditioning Lab	01	-	2	-	-	-	-	-	25	25
				Total	22	8	2	225	90	310	100	175	700



*-Values not included in total, #-2 contact hrs per club, Min Marks for passing: 40% of total marks of individual course

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S.Y. B. Tech. Curriculum.e.f.A.Y.2024-2025
(As Per National Education Policy 2020)

Semester-IV

Class	S.Y. B. Tech, Semester- IV		
Course Code and Course Title	23ELEU4P01, DC Machine and Transformers		
Prerequisite/s	Basic Electrical Engineering		
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00		
Credits	03		
Evaluation Scheme	T	ISE / MSE / ESE	20/30/50
	P	INT / OE/POE	00/00/00
		Total	100

Course Description: DC Machines and Transformers is a specialized course that delves into the principles, construction, and operation of direct current machines and transformers. It covers topics such as electromagnetism, machine dynamics, performance analysis, and applications, equipping students with the knowledge to design, operate, and maintain these critical electrical devices

Course Objectives:

1	This course intends to provide basic concept of DC machines and transformers
2	It intends to develop skills to evaluate ratings of DC machines and transformers for various applications.
3	It intends to solve problems on DC machines and transformers.

Course Outcomes (COs):

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

1	Explain the working principles, Construction, operation and application of DC machines, universal motors and transformers.
2	Discuss numerical problems on DC machines, transformer and universal motor
3	Analyze the performance of DC machines, transformers and universal motor





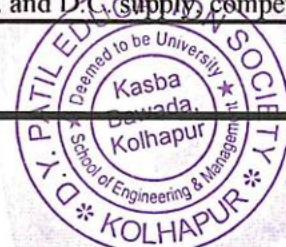
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	3	2										3	2	II
CO2	3	2	1										3	2	III
CO3	3	2	1										3	2	III

Content	Hrs.
Unit I: DC Machines Constructional Details: Construction of D.C. machines, magnetic circuit of DC machines, commutator and brush arrangement, EMF equation, torque equation, power flow diagram of D.C. machines. Armature Winding: Simple lap winding and wave winding, winding diagram and tables, brush position, dummy coils. Armature Reaction: MMF due to armature winding, flux distribution due to armature current and resultant flux distribution in a machine. Demagnetization and cross magnetization ampere turns, principle of compensation, compensating winding and its use in machines.	8
Unit II: D.C. Motors Concept of back e.m.f., characteristics of D.C. motors, Method of speed controls, electro braking, parallel and series operation of motor. Testing of D.C. Machines: Losses and efficiency, Break test, Swinburn's test, Hopkinson's test, Retardation test, Field test on D.C. series motor.	8
Unit III: Single Phase Transformer Construction and type, EMF equation phasor diagram, equivalent circuit, efficiency, losses, regulation, Experimental determination of equivalent circuit parameters and calculation of efficiency and regulation, parallel operation, auto transformer principle and connections.	8
Unit IV: Poly Phase Transformer Construction, single phase bank, polarity test, transformer winding, V-V connection and Scott connection, Vector Grouping YD1, YD11, DY1, DY11, DZ0, DZ6, YZ1, YZ11.	5
Unit V: Performance of Transformers Switching inrush current, on load and off load tap changing, Harmonics in exciting current causes and effects, Harmonics with different transformer connections, tertiary winding, oscillating neutral, Testing of transformer as per IS, heat run test, Sumpner's test and equivalent delta test.	6
Unit VI: Universal Motor Development of torque & power, rotational and transformer emf in commutator winding, commutation in universal motor, complex or diagram, circle diagram, operation on A.C. and D.C. (supply), compensated winding, applications.	4

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Department of Electrical Engineering

Text Books:

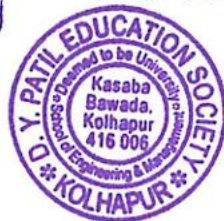
1	A. E. Clayton and Hancock, " <i>The Performance and Design of Direct Current Machines</i> ", CBS Publishers, 1st Edition, 2004.
2	M. G. Say. " <i>The Performance and Design of Alternating Current Machines</i> ", CBS Publishers, 3rd Edition, 2004.
3	O. E. Taylor, " <i>Performance Design of AC commutator motors</i> ", Wheeler Publisher, 15 th Reprint.

Reference Books:

1	Purkait and Bandyopadhyay " <i>Electrical Machines</i> ", Oxford University Press, 1st Edition, 2017.
2	J. B. Gupta, " <i>Theory and Performance of Electrical Machines</i> ", S. K. Kataria and Sons, 1st Edition, 2013.
3	Fitzgerald and Kingsley, " <i>Electric Machines</i> ", Tata McGraw Hill, 7th Edition, 2007.
4	Kothari and Nagrath, " <i>Electric Machines</i> ", McGraw Hill, 5th Edition, 2018.

Useful Links

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





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Department of Electrical Engineering

Class	S. Y. B. Tech, Semester- IV		
Course Code and Course Title	23ELEU4P02, Power Electronics		
Prerequisite/s	Analog and Digital Circuits		
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00		
Credits	03		
Evaluation Scheme	T	ISE / MSE / ESE	20/30/50
	P	INT / OE/POE	00/00/00
		Total	100

Course Description: Power Electronics is a course that explores the principles and applications of electronic devices and circuits used for power conversion and control. It covers topics such as rectifiers, inverters, converters, and their applications in industries, providing students with the knowledge to design and implement efficient power electronic systems

Course Objectives:

1	This course intends to provide basic knowledge of different power electronic devices, rectifiers, converters, inverters and choppers.
2	It is aimed to impart skills of analysis for different types of converters such as rectifiers, controlled converters, inverters and choppers.
3	Make the students acquainted with design of different types of converters such as rectifiers, controlled converters, inverters, choppers and their associated control circuit.

Course Outcomes (COs):

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

1	Describe the basics of semiconductor switches, rectifier, control converter, inverter, choppers, and cyclo-converter and matrix converter circuits.
2	Calculate the performance of semiconductor switches, rectifier, converter, inverter, choppers, and cyclo-converter and matrix converter circuits.
3	Analyze the Power Electronic Circuits such as rectifier, converter, inverter, choppers, and cyclo-converter and matrix converter circuits.



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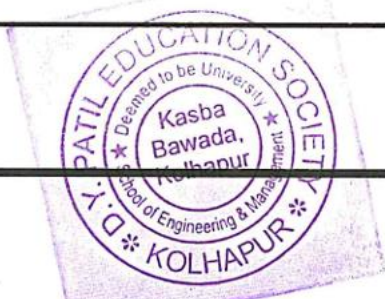
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Department of Electrical Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	2											3	2	II
CO2	2	3											3	2	III
CO3	2	3											3	2	III

Content	Hrs.
Unit I: Power Semiconductor Switches: Characteristics of ideal switch, V-I Characteristics, Rating, protection and cooling of power semiconductor devices such as power diodes, transistor, MOSFET, IGBT and GTO, Study of the driver circuits for thyristor, GTO and IGBT, Introduction to smart power modules, Comparative study of MOSFET, thyristor, GTO, BJT and IGBT.	6
Unit II: Single Phase and Three Phase AC to DC rectifiers Single phase half wave and single-phase full wave diode bridge. Three phase half wave and three phase full wave diode bridge, Transformer power rating for above configurations. Source current and output voltage analysis.	6
Unit III: Phase Controlled AC to DC Converters Classification of converters, Single phase half controlled and fully controlled thyristor converters, three pulse and six pulse controlled converters, operation of converter with freewheeling diode. Effect of source inductance on the performance of the converter, overlap – angle. Performance factors for the converter such as displacement factor, distortion factor, total harmonic distortion, ripple factor and transformer utilization factor. Introduction to 12 pulse converter, single phase and three phase dual converter, firing scheme for 1 phase and three phase converter, Brief introduction to commutation methods. Introduction to PWM converters.	8
Unit IV: DC to DC Converters Control of DC-to-DC converters, step down (buck) converter, Analysis of buck converter with RLE load, step up converter, buck – boost converter, full bridge DC to DC converter, concept of multiphase choppers, cuk converter.	6
Unit V: Switch Mode DC – AC Inverters Basic concepts of switch mode inverters, types: VSI and CSI, single phase half bridge and full bridge inverter, three phase six step inverter, 1200 mode of conduction, 1800 mode of conduction, three phase PWM Inverter, sinusoidal PWM and selective harmonics elimination methods of PWM. Effect of blanking time on output voltage in PWM inverters, auto sequentially commutated CSI, Solar Inverters, Introduction to multilevel inverters.	7
Cycloconverters and Matrix Converter Introduction to Single phase and three phase cycloconverters. Working and topologies of Matrix converter, control methods, performance analysis of matrix converter.	6

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Text Books:

1	M. H. Rashid "Power Electronics, Circuits, Devices and Applications", Pearson Education Inc., 4th Edition, November 2017.
2	P. S. Bhimra, "Power Electronics", 3rd Edition, Khanna Publishers, 2002.

Reference Books:

1	B.K. Bose, "Modern Power Electronics and A.C. Drives", Prentice Hall of India Pvt. Ltd. Publication, 2002.
2	Mohan, UndelandRobins, "Power Electronics, Converter Applications and Design", John Wiley and sons (Asia) Pvt. Ltd., 3rd Edition, 2010.
3	G. K. Dubey and Others "Thyristorised Power Controller", New Edge International Publishers, 1st Edition Reprint, 2005.

Useful Links	
1	NPTEL lectures on Power Electronics
2	
3	





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Class	S.Y. B. Tech, Semester- IV		
Course Code and Course Title	23ELEU4P03, Generation Transmission & Distributions		
Prerequisite/s	Electrical Circuit Analysis		
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00		
Credits	02		
Evaluation Scheme	T	ISE / MSE / ESE	20/30/50
	P	INT / OE/POE	00/00/00
	Total		100

Course Description: Generation, Transmission & Distribution is a course that covers the comprehensive process of electrical power generation, its transmission over long distances, and distribution to end-users. Topics include power plants, grid infrastructure, system reliability, and efficiency, providing students with an understanding of the entire electrical power delivery system

Course Objectives:

1	Power system forms a major part of electrical systems. This course will appraise the students about the structure and performance analysis of power systems.
2	This course will develop analytical skills in the students for investigating issues related to power systems.
3	This course will help students in preparing for competitive examinations.

Course Outcomes (COs):

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

1	Summarize structure and performance parameters of power system
2	Interpret the performance of generation, transmission and distribution system.
3	Scrutinize voltage and power factor control methods for improving performance of transmission and distribution systems





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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	2											3	3	II
CO2	2	3											3	3	II
CO3	2		2										3	3	II

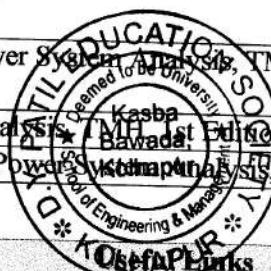
Content	Hrs.
Unit I: Structure of Power Systems and parameters of transmission lines Generation, transmission, distribution and utilization of electrical power, types of lines, types of conductors, voltage levels, R, L, C parameters, Electrical clearances, safety norms, Sag calculations, effect of wind and ice covering of sag, types of insulators, support structures, corona.	7
Unit II: Transmission line representation and performance calculation Single Line Diagram (SLD), String Efficiency of insulators, PU quantities, short, medium and long line models, performance calculations, ABCD constants, Power Circle Diagram.	7
Unit III: Distribution Systems and Underground Cables Types of feeders, distributors, AC and DC distribution systems, sub-stations, UG cables for LT and HT systems.	6
Unit IV: Economic operation of power systems Basics of Economic load sharing, Incremental fuel cost, Economic dispatch neglecting transmissions losses, penalty factor, General Loss Formula, optimum load dispatch considering transmissions losses.	6

Text Books:

1	Ashfaq Husain, Electrical Power Systems, CBS, 5th Edition, 2007.
2	Glover, Sharma, Overbye Power Systems Analysis and Design, Thompson, 5th Ed., 2012.

Reference Books:

1	Nagrath, Kothari, Modern Power Systems Analysis, TMH, 2nd Edition, 2015
2	Hadi Saadat, Power System Analysis, TMH, 1st Edition, 2002.
3	Stevenson W.D., Elements of Power System Analysis, TMH, 4th Edition, 2014.



1	https://nptel.ac.in/courses/108/105/108105104/
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Department of Electrical Engineering

Class		S.Y. B. Tech, Semester- IV	
Course Code and Course Title		23ELEU4P05, Power Electronics Lab	
Prerequisite/s		Analog and Digital Circuits	
Teaching Scheme: Lecture/Tutorial/Practical		00/00/02	
Credits		01	
Evaluation Scheme	T	ISE / MSE / ESE	00/00/00
	P	INT / OE/POE	25/00/25
		Total	50

Course Description: Power Electronics Lab provides practical experience in designing and testing power electronic circuits. Students conduct experiments on rectifiers, inverters, and converters, learning to apply theoretical concepts, use diagnostic tools, and troubleshoot power electronic systems, thereby reinforcing their understanding of power conversion and control techniques.

Course Objectives:

1	This course intends to provide the practical knowledge of different power electronics devices.
2	It is aimed to impart skills of working of different power electronic converter through simulation and experimentation.
3	Make the students acquainted with simulation, analysis and design of power electronic converters.

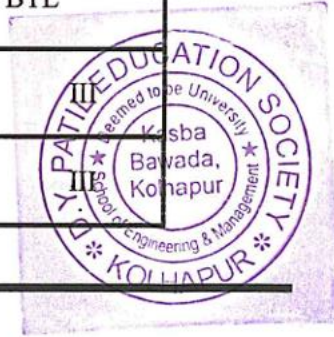
Course Outcomes (COs):

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

1	Demonstrate experiments on basics of converters such as rectifier, inverter, and Chopper etc.
2	Construct different types of converters such as rectifier, inverter and Chopper with their control techniques using simulation.
3	Measure the performance of converters such as rectifier, inverter, and Chopper.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	2	3						2				3	2	
CO2	2	2			3								3	2	



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CO3	1	2	3				2				3	2	III
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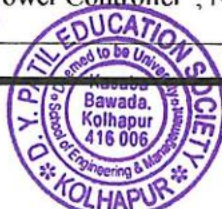
List of Experiments	
Expt. No.	Name of Experiment
1	Verify the Voltage and current relationship in 3 phase full wave diode bridge rectifier and evaluate the input current harmonic spectrum.
2	Evaluate the load side performance of single-phase full wave half control converter.
3	Evaluate the load side performance of single-phase full wave full control converter.
4	Evaluate the load side performance of three phase full wave half-controlled converter.
5	Evaluate the load side performance of three phase full wave full controlled converter.
6	Develop the firing angle control scheme for single phase full wave, half controlled and full controlled converters.
7	Develop the firing angle control scheme for three phase full wave half-controlled converter.
8	Develop the firing angle control scheme for three phase full wave full controlled converter.
9	Evaluate the performance of MOSFET based buck converter.
10	Evaluate the performance of MOSFET based boost converter.
11	Develop the control circuit for single phase PWM Inverter.
12	Develop the control circuit for three phase square wave Inverter.

Text Books:

1	M.H.Rashid "Power Electronics, Circuits, Devices and Applications", Pearson Education Inc., 4 th Edition, November 2017.
2	P. S. Bhimra, "Power Electronics", 3rd Edition, Khanna Publishers, 2002.

Reference Books:

1	B.K. Bose, "Modern Power Electronics and A.C. Drives", Prentice Hall of India Pvt. Ltd. Publication, 2002.
2	Mohan, Undeland and Robins, "Power Electronics, Converter Applications and Design", John Wiley and sons (Asia) Pvt. Ltd., 3rd Edition, 2010.
3	G. K. Dubey and Others "Thyristorised Power Controller", New Edge International Publishers, 1 st Edition Reprint, 2005.





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Class		S. Y. B. Tech, Semester- IV	
Course Code and Course Title		23ELEU4P04, DC Machine and Transformers Lab	
Prerequisite/s		Basic Electrical Engineering Lab	
Teaching Scheme: Lecture/Tutorial/Practical		00/00/02	
Credits		01	
Evaluation Scheme	T	ISE / MSE / ESE	00/00/00
	P	INT / OE/POE	25/00/25
	Total		50

Course Description: DC Machine and Transformers Lab offers practical experience with direct current machines and transformers. Students perform experiments to understand the construction, operation, and performance characteristics of these devices, gaining valuable skills in testing, analysis, and troubleshooting of electrical machinery.

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.

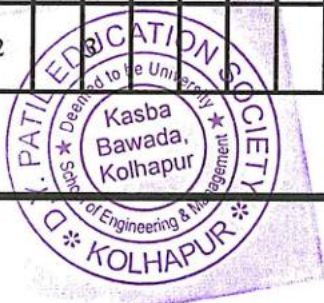
Course Outcomes (COs):

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

1	Experiment for verification of electrical characteristics and performance of DC Machines and transformer.
2	Analyse the performance of DC Machines and transformer.
3	Develop appropriate circuit connections and determine ratings of meters to conduct an experiment as a group activity.
4	Explain the principles and operation of various measurement devices, their characteristics, limitations.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	2	2			3								3	2	III
CO2	1	2											3	2	III



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CO3	2	2	2	1								3	2	III
CO4	3	2										3	2	II

List of Experiments

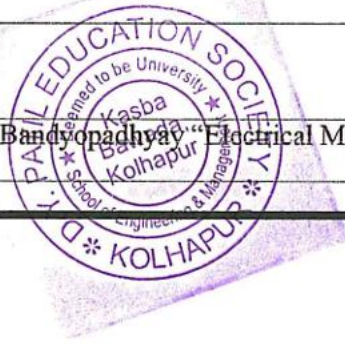
Expt. No.	Name of Experiment
1	Speed control of dc shunt motor (i) Armature control method (ii) Field control method.
2	Determination of efficiency of DC motor by Swinburne's test.
3	Determination of efficiency of DC motor by Hopkinson's test.
4	Brake test on shunt motor to determine its performance and efficiency.
5	Load test on compound motor i) cumulative ii) differential.
6	To perform open circuit and short circuit test for determining equivalent circuit parameters of a single-phase transformer.
7	Parallel operation of single-phase transformer to demonstrate load sharing.
8	Scott connections for converting 3 phase to 2 phase supply.
9	Equivalent Delta test or Heat run Test for determination of temperature rise and efficiency of 3 phasetransformer.
10	Parallel connection of 3 phase DY1 and DY11 transformers to demonstrate load sharing.
11	Load test on transformer (single and three phase) to determine losses and efficiency using Sumpner's test.
12	Develop a circle diagram of Universal motor using load test.

Text Books:

1	A. E. Clayton and Hancock, "The Performance and Design of Direct Current Machines", CBS Publishers, 1st Edition, 2004.
2	M. G. Say. "The Performance and Design of Alternating Current Machines", CBS Publishers, 3 rd Edition, 2004.
3	O. E. Taylor, "Performance Design of AC Commutator motors", Wheeler Publisher, 15th Reprint.

Reference Books:

1	Purkaitand Bandyopadhyay "Electrical Machines", Oxford University Press, 1st Edition, 2017.
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2	J. B. Gupta, "Theory and Performance of Electrical Machines", S. K. Kataria and Sons, 1st Edition, 2013.
3	Fitzerald and Kingsley, "Electric Machines", Tata McGraw Hill, 7th Edition, 2007.
4	Kothari and Nagrath, "Electric Machines", McGraw Hill, 5th Edition, 2018.





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Class		S.Y. B. Tech, Semester- IV	
Course Code and Course Title		23ELEU4M06, Energy Storage System for Electric Vehicles	
Prerequisite/s			
Teaching Scheme: Lecture/Tutorial/Practical		02/00/00	
Credits		02	
Evaluation Scheme	T	ISE / MSE / ESE	00/00/50
		Total	50

Course Description: Energy Storage System for Electric Vehicles delves into the design, operation, and optimization of energy storage systems for electric vehicles. The course covers key topics such as battery technologies, charging infrastructure, energy management strategies, and the integration of renewable energy sources, equipping students with the knowledge to innovate in the rapidly evolving electric vehicle industry.

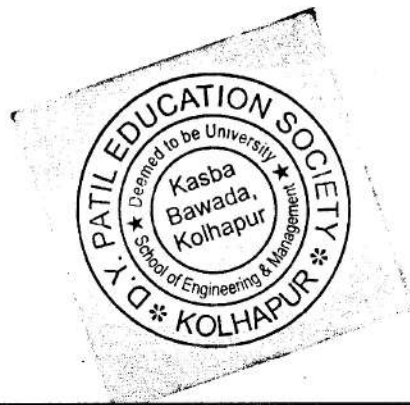
Course Objectives:

1	Identify and describe the fundamental components and types of energy storage systems used in electric vehicles, including various battery technologies.
2	Explain the principles of operation and the chemical processes involved in different battery technologies for electric vehicles.
3	Compare and contrast the performance characteristics of various energy storage systems, evaluating their advantages and limitations for electric vehicle applications.
4	Apply knowledge of energy storage systems to assess and select suitable battery technologies for specific electric vehicle applications based on performance criteria and requirements

Course Outcomes (COs):

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

1	Identify and describe the key components and characteristics of energy storage systems used in electric vehicles.
2	Explain the working principles and chemical processes involved in various battery technologies for electric vehicles.
3	Compare and contrast the advantages and limitations of different energy storage systems for electric vehicle applications.
4	Apply knowledge of energy storage systems to select appropriate battery technology for specific electric vehicle applications.



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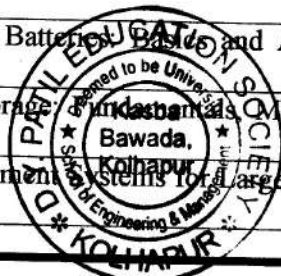
Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	2	2												
CO2	2	2	1												
CO3	1	2	1												

Content	Hrs.
Unit I: Introduction to Energy Storage Systems Overview of Energy Storage in EVs- Importance of energy storage in EVs, Basic principles and terminology, Historical development and current trends, Types of Energy Storage Systems- Batteries, supercapacitors, flywheels, and fuel cells, Key characteristics and applications, Density vs. Power Density- Trade-offs between energy density and power density.	6
Unit II: Battery Technologies for Electric Vehicles Lithium-Ion Batteries (LIBs)- Structure and working principles of LIBs, Advantages and disadvantages, Other Battery Technologies- Nickel-Metal Hydride (NiMH) batteries, Solid-state batteries and emerging technologies, Battery Design and Configuration- Cell, module, and pack design, Series and parallel configurations, Battery Management Systems (BMS)- Purpose and components of a BMS, Thermal management and safety considerations.	7
Unit III: Charging Infrastructure and Technologies Charging Methods- AC vs. DC charging, Slow, fast, and rapid charging technologies, Charging Standards and Protocols- CHAdeMO, CCS, and Tesla Superchargers, Communication protocols between EVs and chargers, Wireless Charging and Future Trends- Inductive charging principles, Future innovations in charging technologies	6
Unit IV: Performance Analysis and Testing Battery Performance Metrics- State of Charge (SOC) and State of Health (SOH), Cycle life and capacity fade, Testing and Diagnostics- Methods for testing battery performance, Tools for diagnostics and analysis, Energy Efficiency and Optimization- Energy recovery systems (e.g., regenerative braking), Strategies for optimizing energy use in EVs	7

Text Books:

1	Sandeep Dhameja. "Electric Vehicle Battery Systems," Newnes, 1st Edition, 2001.
2	Reiner Korthauer. "Lithium-Ion Batteries: Fundamentals and Applications," Springer, 1st Edition, 2018.
3	Robert A. Huggins. "Energy Storage Fundamentals: Materials and Applications," Springer, 2nd Edition, 2015.
4	Davide Andrea. "Battery Management Systems for Large Lithium-Ion Battery Packs," Artech House, 1st Edition, 2010.



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Reference Books:

1	John T. Warner. "The Handbook of Lithium-Ion Battery Pack Design: Chemistry, Components, Types and Terminology," Elsevier, 1st Edition, 2015.
2	Pengwei Du, Ning Lu. "Energy Storage for Smart Grids: Planning and Operation for Renewable and Variable Energy Resources (VERs)," Academic Press, 1st Edition, 2014.
3	Rui Xiong, Wei Liu, Zhongdong Yin. "Advanced Battery Management Technologies for Electric Vehicles," Elsevier, 1st Edition, 2020.
4	Lance Noel, Joshua M. Pearce. "Vehicle-to-Grid: Linking Electric Vehicles to the Smart Grid," Elsevier, 1st Edition, 2019.

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_ee112/preview



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Class	S.Y. B. Tech, Semester- IV		
Course Code and Course Title	23ELEU4V07, Environmental Studies		
Prerequisite/s			
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00		
Credits	02		
Evaluation Scheme	T	ISE / MSE / ESE	00/00/50
	P	INT / OE/POE	00/00/00
		Total	50

Course Description: The main objective of course is to create awareness among students regarding environmental issues and its impact on society. Knowledge regarding environmental components, its degradation and protection of environment is need for sustainable future ahead

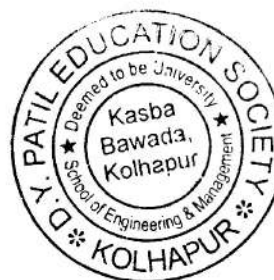
Course Objectives:

1	Understand the scope and importance of Environmental Studies and sustainable development
2	Understand connection between environmental health and developmental activities
3	Understand the importance of Environmental Management for its protection through technical and legislative point of view
4	Acquire problem solving skills through visits to different locations, identifying the Environmental problems and proposing solution for societal benefits

Course Outcomes (COs):

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

1	Understand the scope and importance of Environmental awareness and Sustainable development
2	Understand various Environmental issues due to development
3	Understand various modes of Environmental management through technology and legislation
4	Acquire problem solving attitude through actual field experience, reporting it in the form of Field project work.





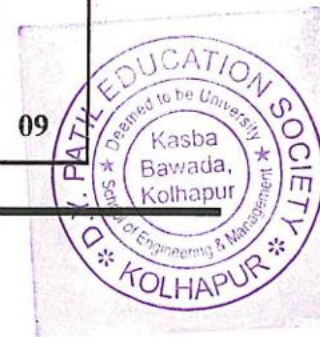
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
CO1	-	-	-	-	-	1	3	2	-	-	-	2	-	-	II
CO2	-	-	-	-	-	1	3	1	-	-	-	2	-	-	II
CO3	-	-	-	-	-	1	3	1	-	-	-	2	-	-	III
CO4	-	-	-	-	-	2	3	1	-	1	1	2	-	-	III

Content	Hours
Unit 1: Our Environment Introduction to Environment, Scope of Environmental studies, importance of environmental awareness, Concept of sustainability, Sustainable Development- history and Goals, environmental ethics, Sustainability ethics, Population growth of world and reduced health content of the environment.	05
Unit 2: Development and Environmental health Natural resources: Types (renewable and non-renewable), developmental benefits Forest-Benefits, problems (Deforestation), Biodiversity-- importance, threats, conservation Ecosystems- importance, problem associated with major ecosystems, ecological restoration Air- Benefits, problems (Pollution, climate change), Water- Benefits, problems (Depletion, pollution), Soil/ Land- Benefits, problems (Degradation, loss of fertility, desertification) Mineral- Benefits, problems (Mining, over exploitation, depletion, pollution), Energy resources- Benefits, problems (depletion, energy crisis) Urbanization and Environmental health (2): Urban problems, Solid waste- Effects of MSW, Plastic waste, Hazardous waste, E- waste	9
Unit 3: Environmental Management Renewable energy technologies- current, new (Bio gas, Bio fuel, hydrogen, etc) (1), Pollution abatement -5R, ZLD, carbon credit, bio remedies (1), Soil/ land reclamation, Sustainable agriculture (1), Concept of EIA, Environmental audit, ISO certification (ISO 14001) (2), Role of CPCB and MPCB in Environmental protection of India (1), Emerging technologies for environmental management- GIS, Remote sensing, Smart bin, IoT integration, Waste-to-	09

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Kasaba Bawada, Kolhapur
Department of Electrical Engineering

Energy Technologies, Recycling Automation, Advanced Data Analytics, Circular Economy Practices, Sustainable Packaging Solutions, Community Engagement and Education, Decentralized Waste Treatment, Zero-Waste Initiatives, Legislative and Regulatory Changes (2), Environmental legislation- Environmental Protection Act, Air Act, Water Act, Solid waste Management Act, Hazardous waste Management Rule, E- Waste (Management) Rules, 2022 (2)	
Unit 4: Field project work Case studies based on site visit (Each candidate has to go for field visit and complete a project work on Environmental issues and probable solutions)	05

Text Books:

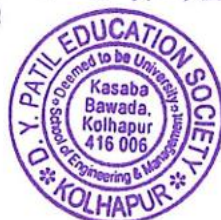
1. Handbook of Environmental Studies by Dr. G. R. Parihar, Publisher: Satyam Publishers and Distributors (1 January 2013), ISBN-10 : 9382664408, ISBN-13 : 978-9382664406
2. Environmental Studies by Anubha Kaushik , New Age International Private Limited (1 January 2007), ISBN-10 : 8122422403, ISBN-13 : 978-8122422405
3. Introduction to Environmental Engineering and Science 3e, by Masters, Publisher : Pearson Education India; 3rd edition (1 January 2015), ISBN-10 : 9332549761, ISBN-13 : 978-9332549760
4. Solid Waste Management in developing countries, by Bhide A. D. and Sundersen B. B.- Indian National Scientific Documentation Centre, New Delhi,

Reference Books:

1. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I &II, Environmental Media
2. Ecology And Environment Pb, by P. D. Sharma, Rastogi Publications (1 January 2011)

Online Resources:

1. Environmentat English Book 1-3-2022 Final Corrected copy_compressed.pdf
2. Manual on Municipal Solid Waste Management- Ministry of Urban Development, Govt. of India





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Department of Electrical Engineering

Class	S.Y. B. Tech, Semester- IV		
Course Code and Course Title	23ELEU4H08, Industrial Management and Start-ups		
Prerequisite/s	Commercial aspects		
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00		
Credits	02		
Evaluation Scheme	T	ISE / MSE / ESE	50/00/00
	P	INT / OE/POE	00/00/00
	Total		50

Course Description: This course covers essential concepts in industrial management and entrepreneurship, including management principles, electronic product design and quality control, and entrepreneurial processes. It also addresses challenges and opportunities for MSMEs and start-ups, highlighting government schemes and incentives. Students will gain the skills to manage effectively and innovate within industrial and startup environments

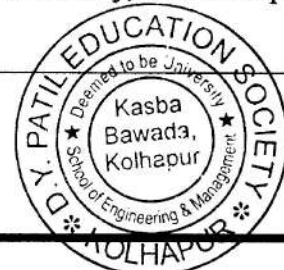
Course Objectives:

1	To understand the core principles and functions of management and their application in various organizational contexts.
2	To learn the comprehensive design process for electronic products, focusing on quality control and various design for Electronic system.
3	To understand the key elements of entrepreneurship and the processes involved in creating and managing a new business venture.
4	To gain knowledge about the challenges and support mechanisms for MSMEs and start-ups, including government schemes and the application process for proposals.

Course Outcomes (COs):

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

1	Explain the fundamental principles of management and effectively analyze and apply these principles within an organizational setting.
2	Design electronic products that meet high standards of quality and reliability while considering factors like cost, manufacturability, and environmental impact.
3	Assess business opportunities, create viable business models, and develop strategies for launching and managing successful entrepreneurial ventures.
4	Identify the challenges of MSMEs, utilize government schemes effectively, and develop well-structured project proposals for new business start-ups.



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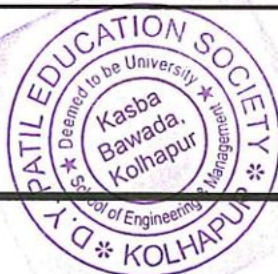
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Kasaba Bawada, Kolhapur
Department of Electrical Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
CO1	-	-	-	2	-	2	2	2	1	1	2	2	1	1	III
CO2	-	-	-	2	-	2	2	2	1	1	2	2	3	3	V
CO3	-	-	-	2	-	2	2	2	1	1	2	2	1	1	IV
CO4	-	-	-	2	-	2	2	2	1	1	2	2	1	1	III

Content	Hrs
<p>Unit 1: Fundamentals of management</p> <p>History of industrial development, Introduction, Definition of management, characteristics of management, functions of management, Principles of Management, Administration and management, Nature and levels of management, managerial skills, managerial roles, Forms of Organization. Forms of ownerships introduction to Globalisation</p>	7
<p>Unit 2: Design Process & Quality Control for Electronic products</p> <p>General Electronic product Design, Process, Design for: Reliability (DFR), Security, Compliance, Supply Chain (DFSC), Cost, Assembly (DFA), Testability (DFT), Manufacturing (DFM), Serviceability (DFS), Environment, Recyclability, Disassembly & Serviceability, Energy Efficiency, Compliance, Managing for Quality in the Electronics Industry: . product quality, reliability, availability, defect level</p>	7
<p>Unit 3: Fundamentals of Entrepreneurship</p> <p>Definition characteristics of entrepreneur Entrepreneurial traits, true motivation & leadership, understanding of the Entrepreneurial process, Opportunity assessment for new ventures, creating a business model with technology differentiators, launching and managing venture, Human resource aspects, understanding of personal aspirations, Entrepreneurial personality development, Entrepreneurial communication, determinants of winning business model, building a balanced team, and sources of capital for creating fixed and working assets including government incentives Entrepreneurship in Indian Scenario and Future prospects in India and emerging economies.</p>	7
<p>Unit 4: MSME, DPIIT and various government schemes for start-ups</p> <p>Challenges of MSMEs, Preventing Sickness in Enterprises Specific Management Problems; Industrial Sickness; Industrial Sickness in India Symptoms, process and Rehabilitation of Sick Units. Various schemes of government for new start-ups, Process of applying for MSME, SSI proposal and writing a project proposal for a new business start-up</p>	7

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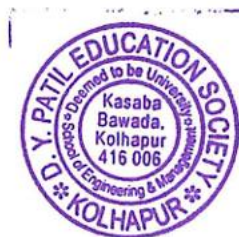




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Reference Books:

1. Stephen P. Robbins, Mary, June 2016, "Fundamentals of Management 9th edition
Pearson Education India.
2. Management: A Global, Innovative, and Entrepreneurial Perspective by Heinz
Weihrich, Mark V.
3. Electronic Product Design by J. D. Andrews
4. Design for Manufacturability and Concurrent Engineering by David M. Anderson
5. Design for Reliability" by Dev G. Raheja and Louis J. Gullo





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Class	S.Y. B. Tech, Semester- IV		
Course Code and Course Title	23ELEU4A09, Electronics workshop (Ability Enhancement Course)		
Prerequisite/s	Society based Mini-Project		
Teaching Scheme: Lecture/Tutorial/Practical	01/00/02		
Credits	02		
Evaluation Scheme	T	ISE / MSE / ESE	00/00/00
	P	INT / OE/POE	25/00/25
		Total	50

Course Description: This course gives introduction of electronic hardware systems and provides hands-on training with familiarization, identification, testing, assembling, dismantling, fabrication and repairing such systems by making use of the various tools and instruments available in the Electronics Workshop.

Course Objectives:

1	To Identify and familiarize with the tools used in electronic shop.
2	To enhance the knowledge of electronics components and their applications.
3	To make students familiar with Interfacing of analog and digital electronics.
4	To enable students to design & fabricate their own Hardware.

Course Outcomes (COs):

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

1	Illustrate the different types of Electronics tools and their application.
2	Analyze the working of semiconductor devices and their application.
3	Integrate the knowledge of basic Sensors and digital electronics.
4	Enable the Students to develop application-based micro-projects and estimate project cost.



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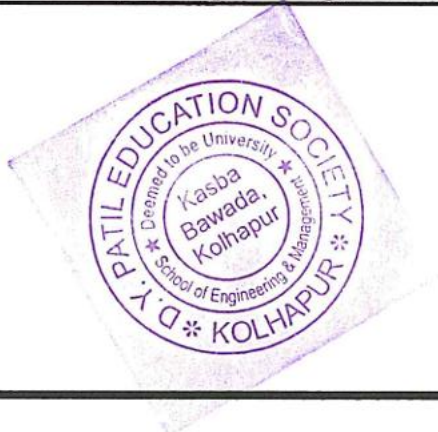


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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
CO1	3	-	-	-	-	-	-	-	-	-	-	1	2	1	IV
CO2	3	-	-	-	-	-	-	-	-	-	-	1	2	1	IV
CO3	3	2	-	-	-	-	-	-	-	-	-	1	2	1	IV
CO4	3	2	1	-	-	-	-	-	1	-	-	1	2	1	IV

Course Contents	Hrs
Unit – I: Safety Measures: Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol, cost etc. [Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals	2
Unit - II : Electronic Component Testing: Testing of electronic components [Resistor, Capacitor, Diode, Transistor, UJT and JFET using multi-meter.] [Multi-meter, Function generator, Power supply, CRO etc.]	2
Unit – III: Applications of Diode and Transistor: To familiarise with diode application like Reverse Current Protection Circuits, Logic Gates using diode, Voltage Multiplier etc. Applications of transistor like switch, transistor as driver, transistor as logic gates etc,	2
Unit No-IV: Applications of Sensor: To familiarise with Sensors like IR Digital Sensor, Colour IR Sensor, Light Sensor, Sound Sensor, Ultrasonic sensor, moisture sensor etc,	2
Unit No –V: PCB Design, Soldering and Circuit Simulation: PCB Design using CAD, Types of soldering, Circuit Simulation using CAD.	2
Unit No- VI: Open Source Hardware Platforms: Overview of Arduino, its Programming, Interfacing.	2





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List of Experiments		
Expt. No.	Name of Experiment	Hrs.
1	To study Testing of Electronic components- resistors, capacitors, inductor, diode, transistor, LED and switches.	2
2	To study Testing of Electronic components- resistors, capacitors, inductor, diode, transistor, LED and switches using multi-meter & C.R.O.	2
3	Familiarization/Application of testing instruments and commonly used tools Multi-meter, Function generator, Power supply, CRO etc.	2
4	To familiarize with diode application like Reverse Current Protection Circuits, Logic Gates using diode, Voltage Multiplier	2
5	To familiarize with Transistor application like switch, transistor as driver, transistor as logic gates etc.	2
6	To familiarizewithIC555 Timer application likeTimer, LED flip flop, LED chaser or sequencer	2
7	To familiarize Logic gates & its applications like Burglar Alarm & Buzzers, Push button switches, lights ON/OFF, Digital Lock, Fire Alarm etc.	2
8	To Familiarize with PCB Design, Simulation of CAD	2
9	To familiarize with Arduino, Introduction to Arduino open source platform, Arduino Simulation software	2
10	To familiarize with Sensors like IR Digital sensor, Color IR sensor, Light sensor, Sound sensor, Ultrasonic sensor, Moisture sensor etc. & its interfacing to Arduino.	2
11	Development of Project to solve real world problem.	4

* Minimum 10 experiments and one Mini project should be performed to cover the entire curriculum of course.

ReferenceBooks:

1. Fundamentals of Electrical Engineering , BharatiDwivedi and AnurasgTripathi, Willey Precise, 2013
2. Electronics Devices and Circuit Theory, Robert L. Boylestad and Louis Nashelsky, Pearson Education 2009

Web Resources:

<https://archive.nptel.ac.in/courses/122/106/122106025/>





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Class		S.Y. B. Tech, Semester- IV	
Course Code and Course Title		23ELEU4010, Basics of Energy Auditing and Management	
Prerequisite/s			
Teaching Scheme: Lecture/Tutorial/Practical		02/00/00	
Credits		02	
Evaluation Scheme	T	ISE / MSE / ESE	00/00/50
		Total	50

Course Description: Basics of Energy Auditing and Management involve understanding how to evaluate and improve energy use in various systems. The course covers fundamental techniques for auditing energy consumption, identifying inefficiencies, and implementing strategies to enhance energy efficiency. It equips learners with the skills to assess energy usage, recommend improvements, and manage energy resources effectively.

Course Objectives:

1	Identify key terms and concepts related to energy auditing and management.
2	Explain the basic steps involved in conducting an energy audit.
3	Apply simple techniques to perform an energy audit.
4	Recognize common energy inefficiencies and suggest ways to improve energy use.

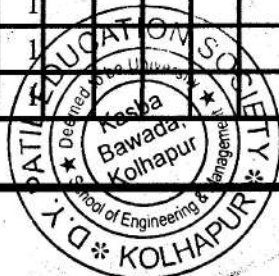
Course Outcomes (COs):

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

1	Identify important terms and concepts related to energy auditing.
2	Explain how to conduct a basic energy audit.
3	Perform a simple energy audit using basic tools and methods.
4	Recognize and suggest improvements for common energy inefficiencies.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcome s (COs) / Program Outcome s (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
CO1	3	2	2										3	3	II
CO2	2	2	1										3	3	II
CO3	2	2	1										3	3	III
CO3	2	2											3	3	II



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Content	Hrs.
Unit I: Introduction to Energy Auditing and Management Introduction to Energy Auditing, Importance of Energy Management, Key Terms and Concepts, Types of Energy Audits, Energy Management Standards and Guidelines, Overview of Energy Audit Process, Case Studies in Energy Management	7
Unit II: Energy Audit Procedures Planning an Energy Audit, Data Collection Methods, Energy Metering and Measurement Techniques, Performing Preliminary Assessments, Conducting Detailed Energy Audits, Documentation and Reporting, Analyzing Audit Results	7
Unit III: Basic Tools and Techniques for Energy Audits Overview of Energy Audit Tools, Using Energy Meters, Thermal Imaging and Inspections, Energy Management Software, Calculating Energy Consumption and Savings,	6
Unit IV: Identifying Energy Inefficiencies Common Sources of Energy Loss, Analyzing Energy Consumption Patterns, Identifying Inefficiencies in Lighting Systems, Identifying Inefficiencies in HVAC Systems, Identifying Inefficiencies in Industrial Processes, Case Studies of Energy Inefficiencies, Exercises on Identifying Inefficiencies	6

Text Books:

1	Frank Kreith and D. Yogi Goswami. "Energy Management and Conservation Handbook," CRC Press, 2nd Edition, 2014.
2	Michael R. Blasnik. "Energy Audits and Retrofits: A Guide for Commercial Buildings," John Wiley & Sons, 1st Edition, 2021.
3	Alberto G. Ruggieri. "Fundamentals of Energy Engineering," CRC Press, 1st Edition, 2017.
4	Moncef Krarti. "Energy Audit of Building Systems: An Engineering Approach," CRC Press, 2nd Edition, 2017.

Reference Books:

1	Albert Thumann and D. Paul Mehta. "Handbook of Energy Audits," Fairmont Press, 8th Edition, 2018.
2	Craig B. Smith and James A. R. McDaniel. "Energy Management: Principles and Practices," Wiley, 3rd Edition, 2015
3	2007 Energy Efficiency Manual, The Fairmont Press, 2nd Edition, 2011.
4	Barney L. Capehart, Wayne C. Turner, and William J. Gorse. "Practical Guide to Energy Management," CRC Press, 7th Edition, 2019.

Useful Links

1	https://archive.nptel.ac.in/courses/108/106/108106022/
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Class	S.Y. B. Tech, Semester- IV		
Course Code and Course Title	23ELEU4N11, Model Based Programming & Simulation		
Prerequisite/s			
Teaching Scheme: Lecture/Tutorial/Practical	01/00/02		
Credits	02		
Evaluation Scheme	T	ISE / MSE / ESE	25/00/00
	P	INT / OE/POE	25/00/00
		Total	50

Course Description: This course will introduce students to computer programming and problem solving using Matlab. It is an introductory course for students aimed at developing their skill in scientific computing. Matlab is a language designed especially for processing, evaluating and graphical displaying of numerical data. The class is lab-focused, so students will spend much more time doing hands-on exercises in computer lab. There are no maths or programming prerequisites; however elementary skills in computer science will be an advantage.

Course Objectives:

1	To introduce the fundamental features of MATLAB and enable students to manage variables, perform basic operations, and control the workspace effectively.
2	To develop skills in using MATLAB for mathematical computations, matrix operations, data visualization, and basic programming.
3	To equip students with the ability to write, debug, and optimize MATLAB scripts and functions for solving engineering and scientific problems.

Course Outcomes (COs):

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

1	Understand the Basics of MATLAB
2	Apply MATLAB Functions for Mathematical and Visualization Tasks
3	Develop MATLAB Scripts and Functions
4	Analyze and Debug MATLAB Programs



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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	2	1		2										II
CO2	2	2	1		2										III
CO3	2	2	1		2										III
CO4	2	2	2		2										III

Course Contents	Hrs
<p>Unit 1 – Introduction to MATLAB</p> <p>Basic features, A minimum MATLAB session , Starting MATLAB, Using MATLAB as a calculator, Quitting MATLAB, Getting started : Creating MATLAB variables, Overwriting variable, Error messages, Making corrections, Controlling the hierarchy of operations or precedence, Controlling the appearance of floating point number, Managing the workspace, Keeping track of your work session, Entering multiple statements per line, Miscellaneous commands, Getting help</p>	4
<p>Unit 2 –MATLAB functions</p> <p>Mathematical functions, Basic plotting: overview, Creating simple plots, Adding titles, axis labels, and annotations, Multiple data sets in one plot, Specifying line styles and colours, Matrix generation: Entering a vector, Entering a matrix, Matrix indexing, Colon operator, Linear spacing, Colon operator in a matrix, Creating a sub-matrix, Deleting row or column , Dimension, Continuation, Transposing a matrix, Concatenating matrices, Matrix generators, Special matrices, Array operations and Linear equations:: Matrix arithmetic operations, Array arithmetic operations, Matrix functions, Matrix inverse</p>	4
<p>Unit 3 –Introduction to programming in MATLAB</p> <p>Introduction, M-File Scripts , M-File functions: Anatomy of a M-File function, Input and output arguments, Input to a script file, Output commands, Control flow and operators: Introduction , Control flow: The “if...end” structure, Relational and logical operators, The “for...end” loop, The “while...end” loop, Other flow structures, Operator precedence</p>	4
<p>Unit 4-Debugging M-files</p> <p>Introduction, Debugging process: Preparing for debugging, Setting breakpoints, Running with breakpoints, Examining values, Correcting and ending debugging, Ending debugging,</p>	4



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Correcting an M-file, Summary of commands

List of Experiment			
Experim ent No.	Name of Experiment	S/O	Hours
1	Introduction to MATLAB Environment	S	2
2	Basic Arithmetic and Variables	O	2
3	Matrix Creation and Indexing	O	2
4	Array Operations (Element-wise Operations)	O	2
5	Plotting Basic Graphs	O	2
6	Using Functions and Scripts	O	2
7	Control Flow with Loops (For and While loops)	O	2
8	Control Flow with Conditional Statements (If-else)	O	2
9	Solving Equations using MATLAB	O	2
10	Vectorization in MATLAB	O	2
11	Basic Statistical Analysis	O	2
12	Basic File I/O Operations	O	2

(S: Study O: Operational)

Text Book:

Introduction to MATLAB for engineering students, School of Engineering and Applied Science (Northwestern University), David Houcque Northwestern University, August 2005

Automatic Control Systems, 8th edition, B. C. Kuo John wiley and son's, 2003

Reference Books:

Introduction to MATLAB for Engineers, 3rd Edition ,William J.Palm III , paperback 2008

MATLAB Programming for Engineers, 4th Edition, Stephen, J.Chapman paperback 2007, paperback Ogata

Modern Control Engineering., 3rd edition, Katsuhiko , Prentice Hall of India Pvt. Ltd.,1998 Modeling & Control Of Dynamic Systems, Narciso F. Macia George J. Thaler, Thomson Publishers



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S.Y. B. Tech. Curriculum.e.f.A.Y.2024-2025
(As Per National Education Policy 2020)

Semester-IV

Class	S.Y. B. Tech, Semester- IV		
Course Code and Course Title	23ELEU4Z01, Transducers and Signal Conditioning (Honors Course)		
Prerequisite/s	Basic Electrical Engineering		
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00		
Credits	03		
Evaluation Scheme	T	ISE / MSE / ESE	20/30/50
	P	INT / OE/POE	00/00/00
		Total	100

Course Description: This course introduces the principles of mechatronics, integrating mechanical, electrical, and electronic systems with control and computing. It covers topics such as sensors, actuators, signal conditioning, microcontrollers, system modeling, and control systems, enabling students to design and analyze intelligent and automated systems.

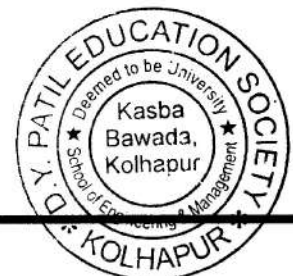
Course Objectives:

1	To introduce the concept of mechatronics, its applications, and the integration of electrical circuits, components, and semiconductor electronics in system design.
2	To explore the principles, performance, and applications of sensors, transducers, actuators, and mechanisms in mechatronic systems.
3	To impart knowledge of system modeling, dynamic response analysis, and the application of transfer functions to evaluate system performance.
4	To understand signal conditioning, closed-loop control systems, and the role of artificial intelligence in modern mechatronic systems.

Course Outcomes (COs):

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

1	Describe mechatronics systems and their components with real-world examples.
2	Demonstrate the ability to choose appropriate sensors and actuators for various applications and explain their working principles.
3	Analyze System Behavior of mechanical, electrical, and fluid systems model
4	Evaluate control systems, including PID controllers and PLCs, and integrate AI concepts for improved system performance.





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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	3	2										3	2	II
CO2	3	2	1										3	2	III
CO3	3	2	1										3	2	III
CO4	2	2											3	2	III

Content	Hrs.
Unit I: Sensors and transducers Introduction, Examples of Mechatronic systems, Electric circuits and components, Semiconductor Electronics, Transistor Applications, Performance terminology of sensors, Displacement, Position & Proximity Sensors-I, Displacement, Position & Proximity Sensors-II, Force, Fluid pressure, Liquid flow sensors, temperature, light sensor, Acceleration and Vibration measurement, Semiconductor sensor and MEM, SAW	7
Unit II: Actuators and mechanisms Mechanical Actuation System, Hydraulic & Pneumatic Actuation System, Electrical Actuation System-I, Electrical Actuation System-II, Data Presentation system	7
Unit III: Signal conditioning Introduction to signal processing & Op-Amp, Op-Amp as signal conditioner, Analogue to Digital Converter, Digital to Analogue Converter, Artificial intelligence	6
Unit IV: Microprocessors and microcontrollers Digital circuits, Microprocessor Micro Controller, Programming of Microcontrollers	7
Unit V: Modeling and system response Mechanical system model, Electrical system model, Fluid system model, Dynamic response of systems, Transfer function and frequency response.	6
Unit VI: Closed loop controllers P,I, PID Controllers, Digital Controllers, Program Logic Controllers, Input/output & Communication systems, Fault findings	6

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Text Books:

1	Intelligent Mechatronic Systems: Modeling, Control and Diagnosis, R. Merzouki, A. K. Samantaray, P. M. Pathak, B. Ould Bouamama, Springer, London
2	Mechatronic system Design; Shetty Dedas, Kolk and Richard
3	Introduction to Mechatronics: D.G. Alciatore & Michael B. Histan; Tata Mc Graw Hill

Reference Books:

1	Mechatronic handbook: Bishop; CRC press
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Useful Links

1	https://onlinecourses.nptel.ac.in/noc25_me91/preview
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Class		S.Y. B. Tech, Semester- IV	
Course Code and Course Title		23ELEU4Z02, Transducers and Signal Conditioning Lab (Honors Course)	
Prerequisite/s		Basic Electrical Engineering Lab	
Teaching Scheme: Lecture/Tutorial/Practical		00/00/02	
Credits		01	
Evaluation Scheme	T	ISE / MSE / ESE	00/00/00
	P	INT / OE/POE	25/00/25
		Total	50

Course Description: The Mechatronics Laboratory provides hands-on experience in integrating mechanical, electrical, and electronic components. Students will experiment with sensors, actuators, microcontrollers, and signal conditioning circuits while learning to model systems, program controllers, and implement closed-loop control strategies.

Course Objectives:

1	To develop a fundamental understanding of various sensors, including temperature, strain, and level sensors, by characterizing their working principles and applications.
2	To enable students to simulate, design, and evaluate sensor-based systems for practical engineering applications.

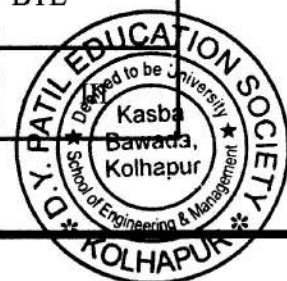
Course Outcomes (COs):

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

1	Describe the operating principles of temperature sensors (RTD, thermocouple), strain gauges, and other common sensors
2	Demonstrate the ability to characterize sensors such as LVDT, RTD, and strain gauges and analyze their performance under different conditions
3	Design application-specific components like orifice plates for flow measurement and evaluate their suitability for given scenarios
4	Simulate the performance of biosensors and chemical sensors, interpreting results for engineering applications

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	2	2			3								3	2	



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D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur
Department of Electrical Engineering

CO2	1	2	3								3	2	III
CO3	2	2	2	1							3	2	III
CO4	3	2									3	2	II

List of Experiments

Expt. No.	Name of Experiment
1	Characterize the temperature sensor (RTD) (To understand the working principle of RTD)
2	Simulate the performance of a bio-sensor (To study the performance of Biosensor (Pulse measurement technique)
3	Measurement of level in a tank using capacitive type level probe (To measure tank level using capacitance level probe)
4	Characterize the LVDT (To understand working principle of LVDT)
5	Design an orifice plate for a typical application (To design an orifice plate for a typical application)
6	Simulate the performance of a chemical sensor (To understand the working principle of chemical sensors)
7	Characterize the strain gauge sensor ((To understand the working principle of Strain gauge)
8	Characterize the temperature sensor (Thermocouple) (To understand the working Principle of Thermocouple.)

Text Books:

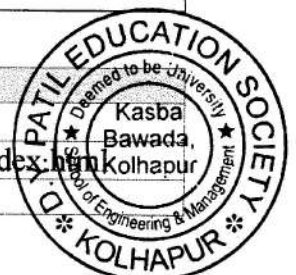
1	Intelligent Mechatronic Systems: Modeling, Control and Diagnosis, R. Merzouki, A. K. Samantaray, P. M. Pathak, B. Ould Bouamama, Springer, London
2	Mechatronic system Design; Shetty Dedas, Kolk and Richard
3	Introduction to Mechatronics: D.G. Alciatore & Michael B. Histan; Tata Mc Graw Hill

Reference Books:

1	Mechatronic handbook: Bishop; CRC press
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Useful Links

1	https://sl-coep.vlabs.ac.in/exp/temperature-sensor/index.html
2	https://ic-coep.vlabs.ac.in/exp/building-blocks-of-signal-conditioning/index.html
3	https://onlinecourses.nptel.ac.in/noc25_me91/preview



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