Annasaheb Dange College of Engineering and Technology

Ashta, Dist: Sangli-416301 (An Autonomous Institute Affiliated to Shivaji University, Kolhapur)

Department of Electrical Engineering

Vision & Mission of Institute

Vision: **To be a Leader in preparing professionally competent engineers**

Mission: **We, at Annasaheb Dange College of Engineering and Technology, Ashta, are committed to achieve our vision by**

Imparting effective outcome based education.

- **Preparing students through skill oriented courses to excel in their profession with ethical values.**
- **Promoting research to benefit the society.**
- **Strengthening relationship with all stakeholders.**

Vision & Mission of Department

Vision: **To be a leader in developing electrical engineering graduate with knowledge, skill & ethics.**

Mission: **We, at department of electrical Engineering, are committed to achieve our vision by,**

- **Facilitating learning through outcomes based education**
- **Cultivating Skills & attitude among graduates to excel in their career**
- **Motivating research approach of graduates to solve real-time problems for benefit of the society**
- **Strengthening relationship with all stakeholders for continues improvement**

Annasaheb Dange College of Engg. & Tech. ASHTA 416301

Head of Department

Head
Electrical Engineering Department
ADCET, Ashta

Annasaheb Dange College of Engineering and Technology

Ashta, Dist: Sangli-416301 (An Autonomous Institute Affiliated to Shivaji University, Kolhapur)

Department of Electrical Engineering

Program Educational Objectives (PEOs)

The graduates of the Department of Aeronautical Engineering at ADCET, Ashta will be able to,

PEO 1:	**Domain Knowledge:- Solve related problems using Electrical Engineering principles, tools and practices.**
PEO 2:	**Core Competency:- Become a practicing Engineer in diversified fields of Electrical Engineering.**
PEO 3:	**lifelong learning:-Engage in lifelong learning for effective adaptation to technological challenges.**
PEO 4:	**Professionalism :-Demonstrate leadership skills at workplace and function professionally in competitive environment.**

Head of Department

Head
Electrical Engineering Department
ADCET, Ashta

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Department of Electrical Engineering

Program Outcomes (POs)

PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	Environment and stainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	Project management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Annasaheb Dange College of Engineering and Technology

Ashta, Dist: Sangli-416301 (An Autonomous Institute Affiliated to Shivaji University, Kolhapur)

Department of Electrical Engineering

Program Specific Outcomes (PSOs)

PSO 1	Ability to apply electrical engineering knowledge, skills for testing, control & maintenance of electrical systems such as Machines, Power Systems, Drives & Automation
PSO 2	Ability to identify problems in the diversified areas of Electrical Engineering and determine the hardware or software solutions to support the Societal, Environmental & Industrial needs.

Head of Department

Head
Electrical Engineering Department
ADCET, Ashta

Annasaheb Dange College of Engg. & Tech. ASHTA 416301

Curriculum

S. Y. B. Tech. Semester -III

HOD Electrical | Dean Academics | Director | Executive Director

Curriculum

S. Y. B. Tech. Semester -IV

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Sant Dnyaneshwar Shikshan Sanstha's
Annasaheb Dange College of Engineering and Technology, Ashta
An Autonomous Institute
Department of Electrical Engineering

B. Tech. Semester- III

Course Code	Course	Teaching Scheme				Evaluation Scheme				
						Scheme	Theory (Marks)		Practical (Marks)	
		L	T	P	Credits		Max	Min. for Passing	Max	Min. for Passing
1EEBS201	Applied Mathematics – III	3	1	-	4	ISE – I	10	-- 40	--	--
						MSE	30		--	--
						ISE – II	10		--	--
						ESE	50	20	--	--
1EEPC202	Electrical Circuit Analysis	3	-	-	3	ISE – I	10	-- 40	--	--
						MSE	30		--	--
						ISE – II	10		--	--
						ESE	50	20	--	--
1EEPC203	Analog Electronics	3	-	-	3	ISE – I	10	-- 40	--	--
						MSE	30		--	--
						ISE – II	10		--	--
						ESE	50	20	--	--
1EEPC204	Electrical Measurements & Instrumentation	3	-	-	3	ISE – I	10	-- 40	--	--
						MSE	30		--	--
						ISE – II	10		--	--
						ESE	50	20	--	--
1EEES205	Electrical Engineering Materials	3	-	-	3	ISE – I	10	-- 40	--	--
						MSE	30		--	--
						ISE – II	10		--	--
						ESE	50	20	--	--
1EEHS206	Industrial Psychology	1	-	-	1	ISE	--	--	25	10
1EEPC251	Electrical Circuit Analysis Laboratory	-	-	2	1	ISE	--	--	25	10
1EEPC252	Analog Electronics Laboratory	-	-	2	1	ISE	--	--	25	10
						ESE	POE		50	20
1EEPC253	Electrical Measurements & Instrumentation Laboratory	-	-	2	1	ISE	--	--	25	10
						ESE	POE		50	20
1EES254	Programming in C++ Laboratory	1	-	2	2	ISE	--	--	50	20
1EEMC207	Environmental Studies	2	-	-	-	ISE	Grade		--	--
	Total	**19**	**1**	**8**	**22**	--	**500**	--	**250**	--
	Total Contact Hours/Week: 28hrs									

Course Category	HS	BS	ES	PC	PE	OE	PR
Credits	01	04	05	12	--	--	--
Cumulative Sum	04	20	26	12	--	--	--

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Annasaheb Dange College of Engg. & Tech. ASHTA 416 301

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Annasaheb Dange College of Engineering and Technology, Ashta

An Autonomous Institute

Department of Electrical Engineering

B. Tech. Semester- IV

Course Code	Course	Teaching Scheme				Evaluation Scheme				
						Scheme	Theory (Marks)		Practical (Marks)	
		L	T	P	Credits		Max	Min. for Passing	Max	Min. for Passing
1EEPC208	Signals & Systems	3	1	-	4	ISE - I	10	-- 40	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPC209	Fundamentals of Power System	3	-	-	3	ISE - I	10	-- 40	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPC210	DC Machines &Transformers	4	-	-	4	ISE - I	10	-- 40	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPC211	Digital Electronics & Microprocessor	4	-	-	4	ISE - I	10	-- 40	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPC212	Electromagnetic Engineering	3	-	-	3	ISE - I	10	-- 40	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPC255	DC Machines &Transformers Laboratory	-	-	2	1	ISE	--	--	25	10
						ESE	POE		50	20
1EEPC256	Digital Electronics and Microprocessor Laboratory	-	-	2	1	ISE	--	--	25	10
						ESE	POE		50	20
1EEES257	MATLAB for Electrical Engineering	-	-	2	1	ISE	--	--	50	20
1EEHS258	English Proficiency	-	-	2	1	ISE	--	--	50	20
	Total	**17**	**1**	**8**	**22**	--	**500**	--	**250**	--
	Total Contact Hours/Week: 26hrs									

Course Category	HS	BS	ES	PC	PE	OE	PR
Credits	01	--	01	20	--	--	--
Cumulative Sum	05	20	27	32	--	--	--

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Department of Electrical Engineering
S. Y. B. Tech. Curriculum

Class	S. Y. B. Tech. Semester-III
Course Code and Course Title	**1EEBS201, Applied Mathematics- III**
Prerequisite/s	1EEBS101,1EEBS106
Teaching Scheme: Lecture/Tutorial/Practical	03/01/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): After successful completion of this course, the students will be able to:	
1EEBS201_1	**Demonstrate** basic knowledge of Laplace transform, Fourier series and Z transforms. **(K^2)**
1EEBS201_2	**Solve** the problems on Fourier Series, Laplace Transform and Z Transform.**(K^3)**
1EEBS201_3	**Make use of** Linear Differential Equation with constant coefficients to solve the Electrical Engineering problem. **(K^3)**
1EEBS201_4	**Solve** the problems of vector calculus. **(K^3)**
1EEBS201_5	**Demonstrate** numerical ability to solve the problem. **(S^2)**

Course Contents:		
Unit 1	**Higher order linear differential equations and its Application** Linear Differential Equations, Definition, Complete solution, Operator D, Rules for finding the Complementary function, Inverse operator, Rules for finding the Particular integral, Working procedure to solve the equation, Applications of Linear Differential Equations to Oscillatory Electrical Circuit.	**07 Hr**
Unit 2	**Laplace Transform** Introduction, Definition; Conditions for existence, Transforms of elementary functions, Properties of Laplace Transform - Linearity property, shifting property, Change of scale property, Laplace Transforms of Periodic functions, Multiplication by t^n, Division by t, Laplace transform of derivatives , Laplace transform of integrals, Unit step function, Unit impulse function.	**07 Hr**
Unit 3	**Inverse Laplace Transform** Inverse Laplace transform - Definition, Standard forms, Methods of finding inverse transforms by Shifting property, Partial fraction, Convolution theorem, Inverse transforms of derivative and integral, Application of Laplace transform to solve Linear Differential Equations.	**07 Hr**
Unit 4	**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.	**07 Hr**
Unit 5	**Z-Transforms** Introduction, Definition, Properties, Z-transforms of basic sequences, Z transforms of some standard discrete functions, Evaluation of inverse Z transforms, Application to difference Equations.	**07 Hr**
Unit 6	**Vector Calculus** Introduction, Scalar and vector point functions - vector operator del, Del applied to scalar point functions - gradient, Directional derivative, Del applied to vector point functions - Divergence and curl, Line integral , Green's theorem in the plane.	**07 Hr**

List of Tutorial:

Tutorial No.	Title of Tutorial	Contact Hrs
1.	Higher order linear differential equations	01
2.	Application of higher order linear differential equations	01
3.	Laplace Transform	01
4.	Inverse Laplace Transform	01
5.	Fourier Series	01

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6.	Fourier Series – Half range series	01
7.	Z Transform	01
8.	Vector Calculus	01

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Higher Engineering Mathematics	Dr. B. S. Grewal	Khanna Publication, New Delhi	Fourth	2007
02	A Text Book of Engineering Mathematics	N. P. Bali, Manish Goyal	Laxmi Publication, New Delhi	Seventh	2007
03	Higher Engineering Mathematics.	B.V. Ramana	Tata McGraw Hill Education Private Limited, Delhi	First	2007
04	Higher Engineering Mathematics.	H. K. Das	S. Chand and Company ltd., New Delhi.	First	2011

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Engineering Mathematics Vol- II.	Kandasamy P., Thilagavathy K. and Gunavathy K.	S. Chand & Company Ltd, New Delhi	Fourth	1999
2.	Engineering Mathematics Vol- I.	Kandasamy P., Thilagavathy K. and Gunavathy K.	S Chand & Company Ltd , New Delhi	Third	2000
3.	Advanced Engineering Mathematics	Potter Merle C.	Oxford University Press	Third	2005
4.	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons, Inc.	Ninth	2007
5.	Advanced Engineering Mathematics.	O Neil Peter V	Cengage Learing India Pvt. Ltd., Delhi	First	2012
6.	Engineering Mathematics Volume I and II	ITL Education	Cengage Learing India Pvt. Ltd., Delhi	First	2015

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Department of Electrical Engineering
S. Y. B. Tech. Curriculum

Class	S. Y. B. Tech. Semester-III
Course Code and Course Title	**1EEPC202, Electrical Circuit Analysis**
Prerequisite/s	1EEES103
Teaching Scheme: Lecture/Tutorial/ Practical	04/00/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Objectives: The course aims to	
01	**Explain** the basic concepts and laws of DC and AC electrical networks and solve them using mesh and nodal analysis techniques.
02	**Study** the fundamental concepts in graph theory.
03	**Explain** concepts of driving point and transfer functions.
04	**Understand** circuit analysis in time and frequency domain.
05	**Study** open circuit, short circuit, transmission, hybrid parameters and their interrelationship.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC202_1	**Use** concepts of electric network topology, nodes, branches, loops to solve circuit problems (K^3)
1EEPC202_2	**Apply** network theorems to analyze various circuits and networks. (K^3)
1EEPC202_3	**Calculate** initial conditions for current and voltage in first order and second order circuits. (K^3)
1EEPC202_4	**Derive** resonance in ac circuits, and analyze various ac circuits and networks (K^3)
1EEPC202_5	**Calculate** and correlate two port network parameters. (K^3)
1EEPC202_6	**Apply** the transform analysis to linear circuits and systems. (K^3)

Course Contents:		
Unit 1	**Analysis of D. C. Circuits:-** Introduction, types of sources, network graph, KCL, KVL, nodal analysis, nodal analysis with voltage sources, mesh analysis, mesh analysis with current sources, star-delta transformation, source transformation.	**10 Hrs.**
Unit 2	**Circuit Theorems** (Applicable to D. C. Circuits)**:-** Introduction, superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer.	**08 Hrs.**
Unit 3	**Analysis of First Order Circuits and Second Order Circuits:** **First Order Circuits:-** Introduction, source free R-C Circuit, source free R-L circuit, singularity functions, step response of R-C Circuit, step response of R-L circuit **Second Order Circuits:-** Introduction, finding initial and final values, source free series RLC circuit, source free parallel RLC circuit, step response of series R-L-C circuit, step response of parallel R-L-C Circuit	**10 Hrs.**
Unit 4	**Sinusoidal Steady State Analysis:-** Introduction, nodal analysis, mesh analysis, superposition theorem, source transformation, Thevenin and Norton equivalent circuits, maximum average power transfer, resonance, series resonance, parallel resonance, three phase circuits, power and power factor in ac circuits.	**12 Hrs.**
Unit 5	**Two Port Networks:-** Introduction, impedance parameters, admittance parameters, hybrid parameters, transmission parameters, relationships between parameters, interconnection of networks.	**08 Hrs.**
Unit 6	**Transform Analysis:-** **Laplace Transform:-** Introduction, definition of Laplace transform, properties of Laplace transform, The inverse Laplace transform, application to integrodifferential equations, circuit element models, circuit analysis, driving point function, transfer functions.	**08 Hrs.**

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fundamentals of Electric Circuits	Charles K Alexander, Mathew N O Sadiku	Tata McGraw-Hill	Third	2008
02	Network Analysis and Synthesis	C.L Wadhwa	New Age International Publishers	Second	2006
03	Circuit Theory (Analysis and Synthesis)	A. Chakrabarti	Dhanpat Rai & Co.	Second	2010
04	"Circuits & Network Analysis & Synthesis"	A. Sudhakaar & Shyanmugam S.Palli	McGraw-Hill Co.	Third	2007

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Network Analysis and Synthesis	Franklin F Kuo	Jhon Wiley and Sons	Second	2009
02	Network Analysis	M.E. Van Valkenburg	Prentice Hall of India	Third	1974
03	Networks and Systems	D.Roy Choudhary	New Age International Publishers	First Reprint	2005
04	Basic circuit theory	L.P.Huelsman	Prentice-Hall	First illustated	2006

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Department of Electrical Engineering
S. Y. B. Tech. Curriculum

Class	S. Y. B. Tech. Semester-III
Course Code and Course Title	**1EEPC203, Analog Electronics**
Prerequisite/s	1EEES108
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE-I / MSE /ISE-II / ESE	10/30/10/50

Course Objectives: The course aims to:	
01	Understand various semiconductor devices
02	Describe BJT and JFET operation
03	Classify feedback amplifiers & analyze various oscillators
04	List ideal op amp characteristics and explain configuration
05	Explain op-amp applications
06	Describe applications of IC 555 timer and PLL

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC203_1	**Explain** various semiconductor devises and its applications. (K2)
1EEPC203_2	**List** op-amp characteristics and distinguish its configurations (K2)
1EEPC203_3	**Classify** feedback amplifiers & analyze various oscillators (K3)
1EEPC203_4	**Compare** BJT and JFET. (K3)
1EEPC203_5	**Explain** various applications of operational Amplifier. (K3)
1EEPC203_6	**Interpret** applications of IC 555 timers and PLL 566.(K3)

Course Contents:		
Unit 1	**Diode Applications –** Review of Diode, Half wave rectifier, centre tap rectifier and full wave rectifier, Performance parameters of rectifier, Filter circuits, clipper, clamper, voltage doublers, Opto-coupler. [Numerical on rectifier circuit and clipper, clamper]	**06 Hrs**
Unit 2	**Transistors:** **Bipolor Junction Transistor (BJT) - Construction and characteristics of BJTs, Transistor** biasing- common base, common emitter and common collector configuration, Load line and operating point of BJT, Bias stability- DC biasing circuits, Numericals Expected **Junction Field Effect Transistors (JFET):** Construction, operation and Characteristics of JFETs	**08 Hrs**
Unit 3	**Feedback Amplifiers and Oscillator Circuits** **Feedback Amplifiers:** Feedback concepts, Barkhausen criterion, classification, Voltage/current series / shunt feedback amplifiers **Oscillator Circuits:** Operation and analysis of RC phase shift, Wien bridge, Hartely, colpitts and crystal oscillators.	**06 Hrs**
Unit 4	**Fundamentals of Operational Amplifier** Op-amp basics, IC741 pin configuration, Open loop & Feedback Modes- Inverting and Non Inverting amplifier, Ideal op-amp characteristics-Non ideal characteristics- DC characteristics – Input bias current-Input offset voltage- Input offset current- Thermal drift-AC characteristics- Frequency response- Frequency compensation- Slew rate. [Numerical]	**08 Hrs**
Unit 5	**Op Amp Applications** Comparator, zero crossing detector, Instrumentation amplifier, Summing amplifier, Difference amplifier, Voltage follower, Differentiator, Integrator, V to I converter, I to V converter, peak detector, precision rectifier, Schmitt Trigger.	**08 Hrs**

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Unit 6	**Timer and Phase Locked Loops Timer** Introduction of Timer and its needs, IC 555 Timer: functional diagram, Mono-stable multivibrator, A-stable multivibrator **Phase Locked Loops** Introduction of PLL and its needs,IC 566 PLL: Functional block diagram, Voltage Controlled Oscillator, frequency detection and synthesis	**06 Hrs**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Electronic Devices and Circuit Theory	Robert L. Boylestad and Louis Nashelsky	PHI/Pearson Education	Eleventh	2015
02	Op-amps & Linear Integrated Circuits	Ramakant A. Gayakwad	PHIPublication New Delhi	Fourth	2015
03	Electronic Devices & Circuits	P. Ramesh Babu	Scitech Pub	Third	December 2009
04	Electronic Devices & Circuits	Milliman, Halkias and Satyabratajit.	McGraw Hill Education India	Third	2012

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Principle of Electronics	V.K.Mehata, RohitMehata	S. Chand	Tenth	2006
02	Electronic Principles	Albert Malvino and David J Bates,	Tata McGraw Hill,	Seventh	2014
03	Electronic Devices and circuits	Allen Mottershead	PHI publication	First	1979
04	Operational amplifiers and linear ICs	David A Bell	Oxford University Press	Third	2011

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Department of Electrical Engineering
S. Y. B. Tech. Curriculum

Class	S.Y. B. Tech, Semester-III
Course Code and Course Title	**1EEPC204, Electrical Measurements and Instrumentation**
Prerequisite/s	1EEES103
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Objectives : The course aims to:	
1	**Introduce** the students with the field of Electrical Measurements and Instrumentation.
2	**Provide** knowledge of solving unknown electrical parameters on various techniques.
3	**Describe** concepts in Analog and Digital measuring instruments.
4	**Explain** the concepts of different Transducers.
5	**Introduce** recent developments in Measurements and instrumentation

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC204_1	**Illustrate** various concepts of measuring instruments (Analog/Digital), their classification, construction, working and range extension technique. (K^2)
1EEPC204_2	**Derive** the equations of different methods for measurement of resistance, inductance and capacitance. (K^2)
1EEPC204_3	**Explain** construction and operation of different transducers.(K^2)
1EEPC204_4	**Describe** various analyzers, its types & modern techniques in measurement. (K^2)
1EEPC204_5	**Apply** conceptual understanding to solve the numericals in Electrical Measurement and Instrumentation. (K^3)

Course Contents:		
Unit 1	**Principles of Analog Measuring Instruments:** Essentials of indicating instruments: deflecting, controlling and damping systems. Construction, working principle, advantages and disadvantages of Moving Iron (MI) (attraction and repulsion), Permanent Magnet Moving Coil (PMMC) & Dynamometer type instruments. Extension of ranges by using shunts, Multipliers (numerical expected), Instrument Transformers.	**08 Hrs**
Unit 2	**Measurement of Resistance, Inductance & Capacitance :** 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 Inductance bridge, Maxwell's Inductance & Capacitance Bridge, Hay's bridge, Anderson's bridge, Owen's bridge, De sauty's Bridge, Schering Bridge.(numerical expected on bridges)	**08 Hrs**
Unit 3	**Measurement of Power and Energy:** Active & reactive power measurement in three phase system for balanced and unbalanced load using three wattmeter method, two wattmeter method & one wattmeter method(numerical expected). Construction, working principle, torque equation, errors and adjustments of single phase conventional (induction type) energy meter, Calibration of energy meter (numerical expected).	**08 Hrs**

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Unit 4	**Principles of Digital Measuring Instruments:** Advantages of digital meters over analogue meters. Resolution & sensitivity of digital meters. Working principles of digital Voltmeter, Ammeter, Energy Meter, Multimeter, Construction and working principle of CRO, measurement of voltage, current, period and frequency by CRO. Phase angle & frequency by Lissajous pattern & numerical. Construction and working principle of DSO, advantages and disadvantages of DSO over CRO.	**07Hrs**
Unit 5	**Transducers:** Transducers: Introduction, classification of transducers. Electrical transducer, Resistive transducer, Resistive position transducer, inductive transducer, Pressure inductive transducer, Pressure capacitive transducer, Piezoelectric Transducers, strain gauge, LVDT and RVDT – construction, working, application.	**07Hrs**
Unit 6	**Recent developments in Measurements and instrumentation:** Wave Analyzers, Power Analyzer, Maximum demand indicator, tri-vector meter, Smart Sensors, Virtual Instrumentation.	**04 Hrs**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	A Course in Electrical and Electronic Measurements & Instrumentation	A. K. Sawhney	Dhanpat Rai& Co.	Nineteenth	2014
02	A Course in Electronics & Electrical Measurements & Instrumentation	J. B. Gupta,	S. K. Kataria & Sons.	Eighth	2012
03	Electronic Instrumentation	H.S.Kalsi	Tata McGraw Hill	Third	2012
04	Electrical Measurement & Instrumentation	U. A. Bakshi V. A. Bakshi	Technical Publication	Third	2015

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Electrical Measurements & Measuring Instruments	E. W. Golding F. C. Widdies	Reem Publications.	Third	2011
02	Introduction to Measurements and Instrumentation	Arun K. Ghosh	PHI Publication	Fourth	2012
03	Electrical Measurement & Instrumentation	RS Sirohi Radhakrisnan	New Age International	Third	2010
04	Instrumentation Measurement and Analysis	B.. K. C. Nakra K Chaudhari,	Tata McGraw Hill.	Second	2009

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Department of Electrical Engineering
S. Y. B. Tech. Curriculum

Class	S. Y. B. Tech. Semester-III
Course Code and Course Title	**1EEPC205,Electrical Engineering Materials**
Prerequisite/s	1EEBS102, 1EEBS107
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE-I / MSE / ISE-II / ESE	10/30/10/50

Course Objectives The course aims to:	
01	Become familiar with Electrical Engineering Material
02	Know the different properties of Conducting, Insulating, Magnetic and Dielectric Materials in the Electrical Engineering
03	Know the various application of the Material in the Electrical Engineering
04	Determine the polarization mechanism use for the Dielectric in the Capacitor
05	Know the construction, working and application of the new methods use for the Direct energy conversion systems
06	Select the particular battery use for various applications

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC205.1	**Understand** the different properties of Conducting, Insulating, Magnetic and Dielectric Materials in the Electrical Engineering(K2)
1EEPC205.2	**Identify** the different Conducting, Insulating, Magnetic and Dielectric Materials for Application (K2)
1EEPC205.3	**Explain** the phenomenon of the polarization mechanism which use for the Dielectric in the Capacitor(K3)
1EEPC205.4	**Evaluate** Conducting, Magnetic and Dielectric Materials use in the Electrical Engineering (K3)
1EEPC205.5	**Explain** the Various materials use for construction, working and application of the Direct energy conversion systems (K3)
1EEPC205.6	**Select** the rating of battery use for various applications(K4)

Course Contents:		
Unit 1	**Conducting Materials:** Introduction of Classification of material into conducting, semi conducting and insulating materials -Resistance and factors affecting it such as alloying and temperature - Classification of conducting material as low resistivity and high resistivity materials, their practical applications, conductors, cable, solder and sheathing materials, electrical properties of these materials, **Photo-conductivity**, Superconductivity.	**09 Hrs.**
Unit 2	**Magnetic Materials:** Magnetization; Atomic Magnetic Moments; Classification of Magnetic Materials; Diamagnetic, Paramagnetic and Ferromagnetic Materials; Ferromagnetic Domains, Magnetization Curve, Soft and Hard Ferromagnetic Materials; Losses in Magnetic Materials, Magnetic materials for electrical devices.	**07 Hrs.**
Unit 3	**Insulating Materials:** Properties of the insulating materials, Liquid insulating materials, Solid insulating materials, Gases insulating materials, Thermal classification of insulating material, insulating materials for electrical devices. **Latest trends in Insulating Materials**	**06 Hrs.**
Unit 4	**Dielectric Materials:** Introduction, Classification of dielectric materials, polarization mechanism, dielectric losses, frequency and temperature effect, dielectric breakdown, Ferro electricity and Piezoelectricity	**05 Hrs.**

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Unit 5	**Materials required for Renewable Sources** Solar cells (Different materials used for plastic, organic and thin-film solar cells), MHD generations, Fuel cells, Thermo electric generator, Thermo ionic converters.	**07Hrs.**
Unit 6	**Batteries:** Introduction to Batteries, Elements of Electro Chemical Cell, Battery classification, Battery Parameters, Factors affecting battery performance, Zero Emission Battery Research Activity (ZEBRA) Batteries, **Different Factors for selection of Battery for Electric Vehicles**, Batteries used in Electric Vehicle (EV) and Electric Hybrid Vehicle (EHV)	**08 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year
01	A Course in Electrical Engineering Materials	S. P. Seth	Dhanpat Rai and Sons publication	Third	2010
02	Electrical Engineering Materials	R.K.Shula, Archana Singh	Tata McGraw Hill publication	First	2012
03	Electrical Engineering Materials	K. B. Raina & S. K. Bhattacharya	S. K. Kataria & Sons.	Third	2010
04	Understanding Batteries	Ronald M. Dell and David A.J. Rand	Royal Society of Chemistry	First	2001

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year
01	Electrical Engineering Materials	C. S. Indulkar & S. Thiruvengadam	S. Chand & Com. Ltd	Fourth	2012
02	A course in Electrical Engineering Materials	R.K.Rajput	University Science Press	First	2009
02	Non-Conventional Energy Sources	S.Hasan Saeed D.K.Sharma	S. K. Kataria & Sons.	Third	2012
03	Handbook of Batteries	Linden and Reddy	New York McGraw Hill	First	2002

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SY-EE-10134

Department of Electrical Engineering
S. Y. B. Tech. Curriculum

Class	B. Tech. Sem.-III
Course Code and Course Title	**1EEHS206, Industrial Psychology**
Prerequisite/s	-
Teaching Scheme: Lecture/Tutorial/Practical	01/00/00
Credits	01
Evaluation Scheme: ISE	25

Course Objectives The course aims to:	
01	Understand theoretical underpinnings of industrial psychology.
02	Identify theoretical foundation of leadership.
03	Understand the motivation and job satisfaction.
04	Understand the group behavior and its different models.
05	Realize different aspects of well-being and its impact on work.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEHS206_1	Explain theoretical underpinnings of industrial psychology.
1EEHS206_2	Explain theoretical foundation of leadership.
1EEHS206_3	Demonstrate the importance of motivation ad involvement in determining satisfaction at work
1EEHS206_4	Explain and understand group behavior.
1EEHS206_5	Demonstrate aspects of well-being and forms of dysfunctional behavior.

Course Contents:		
Unit 1	**Introduction and History of Industrial Psychology,** the science and practice of industrial psychology, World War I, Great depression years and World War II, Industrial Psychology Today and in the future	**01 Hrs.**
Unit 2	**Leadership,** importance of leadership, theories of leadership	**03Hrs.**
Unit 3	**Motivation and Satisfaction,** theories of motivation and its application, influential factors on job satisfaction, relationship between job satisfaction, motivation and performance	**04 Hrs**
Unit 4	**Group Behavior,** importance of groups, models of group behavior	**03 Hrs.**
Unit 5	**Well Being and dysfunctional behavior at work,** positive and negative aspects of well-being, causes of work-related well-being, Interventions, forms of dysfunctional behavior	**03 Hrs.**

Reference Books:

Sr. No	Title	Author/s	Publisher	Edition	Year
01	Emotional Intelligence	Daniel Goleman	Time magazine	Sixth	2016
02	Organizational and work Psychology	Ian Rothmann And Cary Cooper	Hodder Education	First	2008
03	Introduction to Industrial/ organizational psychology	Ronald E. Riggio	Pearson	Third	2013

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54-GBP-11134

Class	S. Y. B. Tech. Semester-III
Course Code and Course Title	**1EEPC251, Electrical Circuit Analysis Laboratory**
Prerequisite/s	1EEES153
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE / ESE	50/00

Course Objectives The course aims to:	
01	**Read** circuit schematics and construct linear circuits using resistors, capacitors, inductors.
02	**Measure** resistance, DC and AC voltages, current, and power, and experimentally verify the results for a variety of electrical circuits.
03	**Understand** DC analysis, Transient analysis of a given electrical circuit.
04	**Test** circuits, analyze data and compare measured performance to theory and simulation.
05	**Study** open circuit, short circuit, transmission, hybrid parameters and their interrelationship.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC252_1	**Apply** the knowledge of network solution techniques and theorems to solve a variety of electrical circuits.(K^3)
1EEPC252_2	**Experiment** network solution techniques and theorems on linear DC and AC electrical circuits. (S^2)
1EEPC252_3	**Use** modern tools/software (like PSPICE) to **Simulate** DC analysis, AC analysis and Transient analysis for a variety of electrical circuits.(S^2)
1EEPC252_4	**Communicate** effectively about laboratory work both orally and in writing. (S^2)
1EEPC252_5	**Work** effectively in groups by sharing responsibilities and collaborating on findings. (A^2)

List of Experiments:

Sr. No	Title of Experiments
1.	Study of ladder network.
2.	Verification of nodal and mesh analysis.
3.	Verification of star delta transformation.
4.	Verification of superposition theorem.
5.	Verification of Norton's and Thevenin's Theorem
6.	Verification of maximum power transfer theorem.
7.	Simulation of DC circuits using PSPICE
8.	Study of network theorems to DC and AC circuits and verification using PSPICE.
9.	Study of step response of R-C, R-L and R-L-C series circuit and verification using PSPICE.
10.	Simulation of AC circuits using PSPICE.
11.	Study of series and parallel resonance.
12.	Calculations of Z, Y, ABCD and hybrid parameters of two port network.

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S4-Ele-12134

Department of Electrical Engineering
S. Y. B. Tech. Curriculum

Class	S. Y. B. Tech. Semester-III
Course Code and Course Title	**1EEPC252, Analog Electronics Laboratory**
Prerequisite/s	1EEES156
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE / ESE	50/50

Course Objectives	
The course aims to:	
1	**Understand** the fundamental principles, characteristics of semiconductor p-n junction diode, transistors- BJT, JFET, and linear integrated circuits- OP-AMP741.
2	**Identify** various semiconductor devices, characteristics, useful for various industrial applications.
3	**Analyze** small signal circuits using various semiconductor devices by applying fundamentals of mathematics, Basic Electrical knowledge and Network theory.
4	**Develop** the skills of simulation, analysis and design of small signal circuits.
5	**Communicate** effectively, think critically and creatively.

Course Outcomes (COs):	
Upon successful completion of this course, the student will be able to:	
1EEPC252_1	**Select** suitable semiconductor device for particular application. (K^3)
1EEPC252_2	**Plot** various characteristic of semiconductor devices.(K^3)
1EEPC252_3	**Simulate** various electronic circuits using MATLAB.(S^2)
1EEPC252_4	**Demonstrate** operation of semiconductor devices. (S^2)
1EEPC252_5	**Work** in groups for performing practices in Analog electronics laboratory. (A^2)

List of Experiments:

Sr. No.	Title of Experiment
1.	Plot V-I characteristics of pn junction diode (1N4007).
2.	Design and test half wave, Rectifier circuits with & without LC filter and determines the Ripple factor & Efficiency.
3.	Find performance parameters of the full wave, centre tap and bridge type rectifier circuits with & without LC filter.
4.	Study of the clipper circuit using Diodes.
5.	Draw the waveform and determine the output response of the clamper circuit.
6.	Study the input and output characteristics of a transistor in Common Emitter configuration.
7.	Study of Operational Amplifier as Inverting amplifier
8.	Study of Operational Amplifier as Non-Inverting amplifier
9.	Analysis of operational amplifier as adder and Substractor.
10.	Analysis of operational amplifier as zero crossing detector.
11.	Analysis of operational amplifier as V-I converter or I to V converter.
12.	Simulation of clipper & clamper circuits using MATLAB simulink.

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Department of Electrical Engineering
S. Y. B. Tech. Curriculum

Class	S.Y.B. Tech. Semester-III
Course Code and Course Title	**1EEPC253, Electrical Measurements and Instrumentation Laboratory**
Prerequisite/s	1EEES153
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE / ESE	50/50

Course Objectives : The course aims to:	
1.	**Introduce** the students with the field of Electrical Measurements and Instrumentation Laboratory.
2.	**Demonstrate** electrical measuring instruments.
3.	**Introduce** skills in handling Analog and Digital measuring instruments.
4.	**Select** proper electrical measuring instrument for particular application.
5.	**Introduce** Recent developments in Measurements and instrumentation.

Course Outcomes (COs) Upon completion of this course, students will be able to	
1EEPC253_1	**Demonstrate** mechanism of various measuring instruments. (K^3)
1EEPC253_2	**Conduct** different measuring methods to measure various electrical parameters. (K^3)
1EEPC253_3	**Select** proper instrument for measurement of electrical parameters. (S^2)
1EEPC253_4	**Respond** Effectively in the form of oral and writing journal.(S^2)
1EEPC253_5	**Examine** the observations and determine the result of experiment. (A^2)

List of experiments:

Expt. No.	Title of Experiment
1	Demonstration of various analog measuring instruments
2	Measurement of active power in three phase circuit by using two wattmeter method
3	Measurement of reactive power in three phase circuit by using one wattmeter method
4	Calibration of single phase induction type energy meter.
5	Measurement of resistance by ammeter voltmeter method.
6	Measurement of resistance using Wheatstone's/Kelvin's double bridge.
	Measurement of Inductance using appropriate bridge
7	Measurement of capacitance using appropriate bridge
8	Measurement of voltage, current, time period and frequency using CRO & frequency measurement by Lissajous pattern.
9	Displacement measurement using Linear Variable Differential Transducer.
10	Measurement of weight using Strain Guage.
11	Study of Power Analyser.

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Department of Electrical Engineering
S. Y. B. Tech. Curriculum

Class	S.Y.B. Tech. Semester-III
Course Code and Course Title	**1EEES254, Programming in C++**
Prerequisite/s	1BSES112
Teaching Scheme: Lecture/Tutorial/Practical	01/00/02
Credits	02
Evaluation Scheme: ISE / ESE	50/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEES254_1	**Design** an algorithm for given problem by applying logical ability to provide solution. **(K^4)**
1EEES254_2	**Use** C++ programming development environment, compiling, debugging, linking for executing a program **(S^2)**
1EEES254_3	**Build** the programming by using in built functions, customized functions, loops and structure.(**S^3**)
1EEES254_4	**Create** and execute C++ programs to solve given engineering problems **(S^3)**
1EEES254_5	**Communicate** effectively both orally and in writing**(S^3)**
1EEES254_6	**Practice** professional and ethical behavior during performance in the laboratory. **(A^2)**

Course Contents		
Unit 1	**Introduction to Object Oriented Programming:** Characteristics of Object oriented programming, structure of C++, Functions in C++, , Memory Allocation functions	**3 Hr**
Unit 2	**Functions** Returning values from functions. Reference arguments. Overloaded function. Inline function. Default arguments. Returning by reference.	**2Hr**
Unit 3	**Pointers** Addresses and pointers. The address of operator and pointer and arrays. Pointer and Faction pointer and C-types string. Memory management: New and Delete, pointers to objects,	**2Hr**
Unit 4	**Array and string** Arrays (Initialization, Declaration, One dimensional and Two dimensional arrays), String (String operations, String Arrays), Simple programs, sorting, searching, matrix operations	**2 Hr**
Unit 5	**Classes & Objects** Introduction, declaration of class, defining member function, making an outside function inline, Nesting member function, private member function, creating the objects	**2 Hr**
Unit 6	**Overloading and Templates** Overloading unary operations. Overloading binary operators, data conversion, conversion keywords. Function templates.	**3 Hr**

List of Experiments

Sr. No.	Title of Experiment
1	Introduction to software engineering and basic concepts used in C++.
2	Program on sample code,
3	Program on one and multidimensional array
4	Program on conditional statements and loops.
5	Programs on category of functions
6	Programs on functions, value/reference/address parameters.
7	Programs by using class and object
8	Programs on Static data members in C++/ Static member functions in C++
9	Program on Overloading and Template.
10	Program using Virtual functions, pure virtual functions, container classes.
11	Program on struct, class and data hiding.
12	Program using constructors, dynamic allocation of data members, **new** and **delete.**

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St-ae-15/34

Text Books:

Sr. No.	Title of Book	Author	Publisher	Edition	Year
1	Object Oriented Programming with C++	E Balagurusamy	Tata MCGraw-Hill	Fourth	2010
2	Let Us C++	Yashwant Kanetkar	BPB	Second	2008
3	The C Programming language	Kernighan B.W and Ritchie D.M.	Pearson Education	Second	2006
4	The C Programming Language	Brian W. Kernighan Dennis M. Ritchie	Prentice Hall, Englewood Cliffs, New Jersey	Second	2006
5	C++: How to Program	H. M. Deitel and P. J. Deitel	Prentice Hall,	Fifth	2012
6	Data Abstraction and Problem Solving with C++	Carrano& Prichard,	Addison Wesley,	Fourth	2016

Reference Books:

Sr. No.	Title of Book	Author	Publisher
1	Programming with C++	Byron S Gottfried	TMH
2	How to Solve it by Computer	R.G. Dromey	Pearson Education
3	C++ programming Laboratory	Nadini S. Sidnal	Wiley

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Department of Electrical Engineering
S. Y. B. Tech. Curriculum

Class	S. Y. B. Tech. Semester-III
Course Code and Course Title	**1EEMC207, Environmental Studies**
Prerequisite/s	--
Teaching Scheme: Lecture	02
Credits	--
Evaluation Scheme: ISE	50 (Grade)

Course Outcomes (COs)	
Upon successful completion of the course students will be able to:	
1EEMC207_1	Explain importance of environmental studies with necessary of acts.(K^2)
1EEMC207_2	Explain importance of public awareness on environmental problems (K^2)
1EEMC207_3	Write a technical report in team regarding course and impacts of environment related issues.(S^2)
1EEMC207_4	Discuss current concern of environment issues.(A^2)
1EEMC207_5	Describe the need of environment protection and ethics.(A^2)

Course Contents		
Unit 1	Definition, scope and importance. Multidisciplinary nature of environmental studies, Need for public awareness.	**2 Hrs**
Unit 2	a) Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people; b) Water resources: Use and over-utilization of surface and groundwater, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources. d) Food resources: World food problem, changes caused by agriculture effect of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewable and non renewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy, f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources.	**4 Hrs**
Unit 3	Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following ecosystem :- a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem d)Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	**4 Hrs**
Unit 4	Introduction- Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega- diversity nation. Western Ghat as a biodiversity region. Hot-spots of biodiversity. Threats to biodiversity habitat loss, poaching of wildlife, man- wild life conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	**5 Hrs**
Unit 5	Definition: Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.	**4 Hrs**
Unit 6	Disaster management: floods, earthquake, cyclone, tsunami and landslides Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issue and possible solutions. Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products.	**3 Hrs**
Unit 7	From Unsustainable to Sustainable development Environmental Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Population Growth and Human Health, Human Rights	**6 Hrs**

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SY-EIE-17134

Mini Project	**Mini project based on :** Environmental assets River/Forest/Grassland/Hill/Mountain. OR A local polluted site Urban/Rural/Industrial/Agricultural. OR Study of common plants, insects, and birds. OR Study of simple ecosystems - ponds, river, hill slopes, etc. **(Mini Project report is Mandatory.)**

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Class	S. Y. B. Tech. Semester- IV
Course Code and Course Title	**1EEPC208, Signals and Systems**
Prerequisite/s	1EEBS201, 1EEPC202
Teaching Scheme: Lecture/Tutorial/Practical	04/00/00
Credits	04
Evaluation Scheme: ISE I / MSE/ ISE II/ ESE	10/30/10/50

Course Objectives (COs): The course aims to:	
1	**Understand** various mathematical operations on signals.
2	**Describe** the signals and systems in different domains as time, frequency, s- domain, z-domain.
3	**Study** the analysis of continuous time & discrete time signals in time and frequency domain
4	**Study** the analysis of linear time-invariant systems using Laplace Transform & Z- Transform
5	**Compute** response of a linear time-invariant system for the given input.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC208_1	**Classify** different types of signals & systems. (K^2)
1EEPC208_2	**Develop** total response of linear time invariant systems by differential equations. (K^3)
1EEPC208_3	**Construct** the signals using various operations (K^3)
1EEPC208_4	**Solve** the response of linear systems in time domain. (K^3)
1EEPC208_5	**Utilize** Fourier Transform technique for continuous & discrete signals. (K^3)

Course Contents:		
Unit 1	**Introduction to signals & systems:** Classification of signals, standard test signals, Basic operation on signals, Classification of systems, Representing CT signals by samples, Sampling DT signals, and Correlation, Energy and power spectral density of signals.	**10 Hr**
Unit 2	**Time domain analysis of discrete and continuous time signals:** Zero state response, Zero input response, Impulse response, Step response, Convolution sum and convolution integral, Graphical representation of convolution, Direct form I &Direct form II, FIR and IIR systems	**08Hr**
Unit 3	**System Analysis using Laplace transform:** Introduction, ROC, S-plane, properties of Laplace and inverse Laplace transform, transfer function analysis, solution of LTI differential equation, Poles And Zeros, Analysis of electrical networks.	**08Hr**
Unit 4	**System analysis using Z-transform:** A brief introduction to Z–transform, its properties & inverse – Z transform ROC, connection between Laplace transform and Z–transform, transfer function analysis, solution of LTI difference equation, and stability in Z-domain.	**10Hr**
Unit 5	**Fourier analysis of continuous signals:** Periodic representation by trigonometric Fourier series, Fourier spectrum, Dirichlet's condition, Exponential Fourier Series, Exponential Fourier Spectra, Fourier transform and its properties, Sampling theorem, Nyquist criterion, Relation between Fourier and	**10Hr**

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	Laplace Transform, Fourier spectrum	
Unit 6	**Fourier analysis of discrete signal:** Introduction , properties of D.T. F. T., Relation between DTFT & Z-transform, Frequency response of first and second order system,T.F , DFT, Zero padding, FFT , IDFT using FFT algorithm, Ideal & Non-ideal Filters, Fourier Spectrum Analysis of Voltage & Current waveforms.	**10 Hr**

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Linear systems and signals	B. P. Lathi	Oxford University Press	Second	2005
2	Signals and systems	Simon Haykin,	Wiley Publications	Second	2007
3	Signals and systems	M. J. Roberts	Tata McGraw Hill publications	Second	2012
4	Signals and systems	Allan V Oppenheim	PHI Learning pvt. ltd-New Delhi	Second	1997

Reference Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Signals and systems	C. T. Chen	Oxford Publications,	Third	2004
2	Analog Signal Processing: Analysis & Synthesis	AlokBarua,	Wiley Publications	First	2014
3	Signals & Linear Systems	Gabel	Wiley Publications	Third	1986
4	Signals and Systems	Krishnaveni	Wiley Publications	First	2012

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SY-EE-2034

Department of Electrical Engineering
S. Y. B. Tech. Curriculum

Class	S. Y. B. Tech. Semester- IV
Course Code and Course Title	**1EEPC209, Fundamentals of Power System**
Prerequisite/s	1EEES103
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Objectives The course aims to:	
01	Introduce electrical power system and its components.
02	Introduce economics aspects of electricity generation.
03	Understand the Electrical distribution systems.
04	Introduce physical components& structures of the overhead transmission lines and underground cables.
05	Solve numerical to determine the electrical parameters of the transmission lines.
06	Know importance of power factor of the system & its improvement methods.

Course Outcomes (COs) Upon successful completion of this course, the student will be able to:	
1EEPC209_1	**Describe** the Electrical power generation methods & major power system components. (K^2)
1EEPC209_2	**Explain** the terms involved in generation cost & different tariff systems. (K^2)
1EEPC209_3	**Discuss** the power factor improvement methods in electrical power systems.(K^2)
1EEPC209_4	**Calculate** the voltage drop of distributor for given parameters (K^3)
1EEPC209_5	**Apply** knowledge of overhead & underground transmission system elements to calculate the parameters in mechanical construction of lines. (K^3)
1EEPC209_6	**Analyze** the different electrical parameters of overhead transmission lines. (K^3)

Course Contents:		
Unit 1	**Generation of Electrical Power** AC power system Single line diagram, India's electricity scenario, Thermal power plant, Hydro power plant, Nuclear power plant, Diesel power plant, Wind power plant, solar power plant, Tidal power plant schematic diagram, Selection of site, Advantages & Disadvantages. **Power System Elements:** Brief description of power system elements such as Synchronous Machine, Transformer, Bus bar, Circuit Breaker, Isolator, CT, PT.	**7 Hrs**
Unit 2	**Economics of Generation:** Load curve, Load duration curve, Maximum demand, Average Load, Load factor, Demand factor, Diversity factor, Plant capacity factor, Plant use factor (Numerical) Economics of generation, Cost of the generation, Fixed cost, Semi fixed cost and running cost, Methods of determining depreciation. Tariff, Desirable characteristics of tariff, Tariff methods – two part tariff, Three part tariff & Power factor tariff methods.	**6 Hrs**
Unit 3	**Distribution system** Distribution system introduction, Feeder & Distributor, Classification of distribution systems, Connection schemes of distribution schemes, Voltage drop calculation (Derivation & Numerical) to AC distribution systems of radial and ring system, Substation, Indoor & Outdoor substation, Substation layout.	**7 Hrs**
Unit 4	**Mechanical Design of Transmission system** Main elements of transmission lines, Types of Conductors (ACSR, Expanded ACSR, ACAR, Bundle conductor), Line supports, Types of line supports, Insulators, Types of insulators, Potential distribution over suspension insulators, String efficiency, Methods to improve string efficiency, Sag, Calculation of sag (Numerical), Corona, Factors affecting the corona, Advantages and disadvantages of corona, Methods to reduce the corona. Underground cable, Construction & Classification of single – phase and three – phase cables, method of laying underground cables, Grading of underground cables	**8 Hrs**

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Unit 5	**Electrical Design of transmission system:** Resistances, Calculation of resistance, Inductance, Flux linkage of the single conductor, Inductance of single phase two – wire line, Three phase line and Double circuit line, Skin effect, Proximity effect, Capacitance, Capacitance of two – wire line, Three phase line with equilateral space, Capacitance of line with unequal spacing, Numerical	**8 Hrs**
Unit 6	**Power factor improvement & Trends in power system:** Power factor, Disadvantages of low power factor, Causes of low power factor, Methods of improving power factor – static capacitor, Synchronous condensers, Calculations of power factor, Most economical power factor for KW and KVAR loads, Numerical problems, **Trends in power system-** Alternate sources of power generation, Introduction to wireless power transmission system, Super capacitor.	**6 Hrs**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Principles of Power system	V K Mehta &Rohit Mehta	S. Chand company PVT LTD	Fourth	2007
02	Electrical power systems	AshfaqHussain	CBS publications	Fifth	2007
03	Electrical Power Generation, Transmission & Distribution	S N Singh	PHI learning PVT LTD	Second	2003
04	Modern Power system Analysis	D P Kothari &I J Nagrath	Tata McGraw – Hill	Third	2009
05	Generation of Electrical Energy	B. R. Gupta	S. Chand Publication	Fifth	2007

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Electrical Power System	Weedy B M, Cory B J	John Wiley Publication	Fifth	2013
02	Electrical Power Generation, Transmission & Distribution	Leonard L. Grigsby	CRC Press	Third	2012
03	Electrical Power systems	C L Wadhwa	New age International (P) Limited	Sixth	1997
04	Transmission & Distribution electrical engineering	Dr. C R Bayliss& B J Hardy	Newnes	Third	2007

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Department of Electrical Engineering
S. Y. B. Tech. Curriculum

Class	S. Y. B. Tech. Semester- IV
Course Code and Course Title	**1EEPC210, DC Machines and Transformers**
Prerequisite/s	1EEES103
Teaching Scheme: Lecture/Tutorial/Practical	04/00/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II/ ESE	10/30/10/50

Course Objectives: The course aims to:	
1	**Learn** the different parts of DC machines, Transformer and its principle of operation.
2	**Understand** the circuit parameters and its effect on the performance characteristics of DC machines& Transformer.
3	**Study** the different types of starters and speed control methods
4	**Find the** numerical solution for the performance of the machines based on its parameters.
5	**Understand the** different type of test conducted on DC machines& Transformer

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC209_1	**Explain** the constructional details and working principle of DC machines& Transformer (K^2)
1EEPC209_2	**Describe** the effects of system parameters on performance of DC machines& Transformer. (K^2)
1EEPC209_3	**Solve** numerical to determine the performance parameters of DC machines& Transformer.(K^3)
1EEPC209_4	**Select** the suitable starter & speed control method for specific application.(K^3)
1EEPC209_5	**Analyze** the performance of a DC machines& Transformer by using appropriate testing methods.(K^4)

Course Contents:		
Unit 1	**DC Generator** Construction details, Working Principle, Armature winding and its factors EMF equation, Power Stages in DC Generator.Types and Characteristics of DC generators, armature reaction and its effects , commutation &methods to improve commutation, Applications of DC generator	**08 Hr**
Unit 2	**D.C. Motors** Working principle of DC motor, Back EMF & its significance, Power stages in DC motor, Voltage equation, power equation, Speed Equation, Torque Equation, shaft torque, Break horse power, Types, characteristics & applications of DC Motors, Need & types of starter, Speed control methods, reversing direction of rotation and Braking Methods, Special Purpose motors: PMDC, BLDC, Stepper Motors, Servo Motors	**12 Hr**
Unit 3	**Performance of DC machines** Losses and Efficiency, OCC of DC Generator, IS standards for testing, Brake test on DC motor, Swinburne's test on DC motor, Regenerative or Hopkinson's test on DC motor	**08 Hr**
Unit 4	**Single phase Transformer** Construction details, working principle, types, Concept of ideal transformer, EMF equation, Exact and approximate equivalent circuit referred to either side, General Phasor diagrams on no load and load. Voltage Regulation, , transformer rating, Special Purpose Transformers: Autotransformers, Welding Transformer, Isolation Transformer, Grounding transformer.	**12 Hr**
Unit 5	**Three – Phase Transformers** Poly-phase Transformers-connecting a bank of three identical single phase transformer for three phase transformation, Standard connections for three phase transformers, their voltage Phasor diagrams, Phasor groups, Parallel operation of transformers, conditions to be satisfied, load sharing under various conditions, Open delta or V-V connection, application and vector diagram, Scott connection for three phases to two phase transformation and vice-versa, applications.	**08Hr**

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Unit 6	**Performance of Transformer** Losses& Efficiency, maximum efficiency, all day efficiency, IS standards for testing,Polarity Test, Load Test, OC and SC test, Sumpner's Test, Separation of Eddy current & hysteresis losses.	08Hr

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Principles of Electric Machine	V. K. Mehta	Tata Mcgraw Hill	Second	2009
2	Electric Machinery	BimbhraP.S	Khanna Publisher	Seventh	2011
3	Alternating Current Machines	M. G. Say	Wiley	Fifth	1983
4	Electric Machinery	A.E Fitzgerald Stephen Kingsly	Tata Mcgraw Hill	Fourth	1983

Reference Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Electric Machines	Ashfaq Husain	Dhanpatrai	Third	2016
2	Generalized Machine Theory,	Bimbhra P.S	Khanna Publisher	Fourth	1987
3	Electric Machines	M.V. Deshpande	PHI	First	2011
4	Electric Machines	Samarjit Ghosh	Pearson	Second	2012

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SY-EE-24|34

Department of Electrical Engineering
S. Y. B. Tech. Curriculum

Class	S. Y. B. Tech. Semester-IV
Course Code and Course Title	**1EEPC211, Digital Electronics & Microprocessor**
Prerequisite/s	1EEES108
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives: The course aims to:	
1	Understand number representation and conversion between different representation in digital electronic circuits
2	Transform Boolean equation for less number of logic gates
3	Analyze logic processes and formulate logic operations using combinational logic circuits
4	Understand the architecture of microprocessor and the concept of memory organization, assembly language programming
5	Study interfacing of microprocessor with peripheral devices

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC211_1	**Attempt** conversions among various number systems (K^2)
1EEPC211_2	**Transform** given Boolean equation for minimum number of logic gates(K^2)
1EEPC211_3	**Formulate** combinational logic circuits(K^2)
1EEPC211_4	**Explain** architecture and working of 8085 microprocessor and peripherals(K^2)
1EEPC211_5	**Interface** 8085 microprocessor with various peripheral devices(K^3)
1EEPC211_6	**Design** a microprocessor based system for given applications (K^4)

Course Contents:		
Unit 1	**Number System, Logic Gates and Boolean Algebra** Decimal, Binary, Octal, Hexadecimal, conversions, BCD code, Gray code, Weighted codes, Signed Magnitude Representation Logic gates, Universal gates, Logic families, Performance parameters, Boolean theorem, Boolean algebra	**10 Hrs**
Unit 2	**Combinational Logic Circuit Design-** K- map, SOP and POS form, Half adder, Full adder, Subtractor, Magnitude Comparator, Code converter, Multiplexer, De-multiplexer, Encoder, Decoder	**07 Hrs**
Unit 3	**Sequential Logic Circuit Design-I** Latches- S-R Latch, Gated Latch- Gated S-R Latch, Gated D Latch, Flip flops-Edge triggered-S-R & Edge triggered-J-K flip flop	**05 Hrs**
Unit 4	**Sequential Logic Circuit Design- II** Counters-mod n asynchronous counter, Shift Registers- Serial-In, Serial-Out, Serial-In, Parallel-Out, Parallel-In, Serial-Out,, Parallel-In, Parallel-Out.	**05 Hrs**
Unit 5	**Analog to Digital Conversion & Digital to Analog Conversion-** Working principle and operation of different types of ADC & DAC, Detailed study of ADC and DAC 0808,0809	**05 Hrs**
Unit 6	**Microprocessor 8085: Architecture, Interfacing, Applications** Architecture, Instruction set, Addressing modes, Memory, Assembly language programming, Interrupt, Interrupt service routine, Address decoding, Memory interfacing, Recent Trends in Microprocessor based system design	**10 Hrs**

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Text Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	A Textbook of Digital Electronics	R.S. Sedha	S.Chand	Second	2005
02	Advanced Microprocessor& Peripherals	K.M.Bhurchandi A.K.Ray	Tata Mc-Graw Hill	Third	2006
03	Microprocessor 8085 Architecture, Programming Interfacing	Anil Sawarnkar	Genius	Second	2009
04	Fundamentals of Digital Electronics	A.Anand Kumar	PHI	Fourth	2016

Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Digital Electronics Principles & Applications	Anil Maini	Wiley	Second	2007
02	Modern Digital Electronics	R.P.Jain	Mcgraw Higher Ed	Fourth	2009
03	Microprocessor and its applications	B.Ram	Tata Mc-Graw Hill	Sixth	2008
04	Digital Design	Morris Mano	Pearson	Fifth	2012
05	Microprocessor Architecture, Programming & Application with 8085	Ramesh Gaonkar	Penram International	Third	1997

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SY-EE-26-134

Department of Electrical Engineering
S. Y. B. Tech. Curriculum

Class	S. Y. B. Tech. Semester-IV
Course Code and Course Title	**1EEPC212, Electromagnetic Engineering**
Prerequisite/s	1BSES103, 1EEPC202
Teaching Scheme : Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Objective : The course aims to:	
01	**Introduce** the concept of vector analysis and different coordinate systems in the electromagnetic fields
02	**Differentiate** knowledge on electrostatic field, electrical potential, energy density and their applications.
03	**Familiar** with concepts of magnetostatic field, magnetic potential and its energy density.
04	**Explore** the numerical solution for vector quantities associated with electrostatic, magnetostatic and time varying fields.
05	**Understand** the existence of Maxwell's Equations and propagation of electromagnetic waves

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC212_1	**Apply** different technique of vector analysis and appropriate coordinate systems for physical quantities dealt in Electromagnetic Fields. **(K^3)**
1EEPC212_2	**Derive** the physical quantities of electromagnetic fields in different Engineering Problems.**(K^3)**
1EEPC212_3	**Determine** the Energy, Potential, Capacitance, Inductance and Energy Densities. **(K^3)**
1EEPC212_4	**Illustrate** the boundary conditions at the interfaces of different media **(K^3)**
1EEPC212_5	**Apply** the Maxwell's equations in different forms **(K^3)**
1EEPC212_6	**Examine** the electromagnetic wave propagation in different media and its means for transporting energy or information **(K^4)**

Course Contents:		
Unit 1	**Vector Analysis and Coordinate Systems:** Scalars and Vectors, need for 3D coordinate systems, rectangular, cylindrical and spherical coordinate systems, transformation between coordinate systems, vector calculus - gradient, divergence and curl, line, surface and volume integrals, divergence theorem, stroke's theorem.	**08 Hrs**
Unit 2	**Electrostatic Fields** Coulomb's law, electric field intensity, field due to point and continuous charges, electric field due to finite line charge, circular disc and infinite sheet of charge, electric flux density, gauss's law and its applications, energy and potential, potential gradient, potential field of a point charge and system of charges, electric dipole, equi-potential surfaces.	**08 Hrs**
Unit 3	**Electric Fields in Material Space** Current density, continuity of current, properties of conductors and dielectric materials - Boundary conditions between two dielectric media. Capacitance and Capacitors : parallel plate capacitor with single and two dielectric, cylindrical cable, two wire transmission line, Energy and Energy density - Poisson's and Laplace's equations	**06 Hrs**
Unit 4	**Magnetostatic Fields** Biot-Savart's law, magnetic field intensity due to infinite long straight conductor, finite length of conductor, circular loop, solenoid and toroid, Magnetic flux density, Ampere's circuital law, infinite sheet of current, boundary conditions, Lorentz Force, force and torque on a closed circuit, Inductance of solenoid, toroid and coaxial cable, Energy and Energy density in a Magnetic Field.	**08 Hrs**
Unit 5	**Time-Varying Fields and Maxwell's Equations:** Faraday's laws - transformer and motional emf, conduction and displacement current, Modified Ampere's law, Maxwell's equations in differential and integral forms, Relation between Circuit Theory and Field Theory	**06 Hrs**
Unit 6	**Electromagnetic Wave Propagation:** Electromagnetic wave equations, uniform plane wave, wave parameters, wave propagation in free space, lossy and lossless dielectrics, wave propagation in conductors, skin depth, poynting vector and poynting theorem.	**06 Hrs**

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Principle of Electromagnetics	Matthew N.O. Sadiku, S.V. Kulkarni	Oxford University Press	Sixth	2015
2.	Engineering Electromagnetics	William H. Hayt, John A Buck	Tata McGraw-Hill Publication	Eighth	2014
3.	Electromagnetics with Applications	John Kraus Daniel Fleisch	Tata McGraw-Hill Publication	Fifth	2017
4.	Foundation of Electromagnetic Theory	J. R. Reitz, F. J. Milford R. W. Christie	Pearson Education	Fourth	2010

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Electromagnetics	Joseph.A.Edminister	Schaum's Outline Series	Second	2007
2.	Elements of Electromagnetic Fields	S.P.Seth	Dhanpat Rai & CO	First	2016
3.	Electromagnetic Theory & Applications	Ashutosh Pramanik	PHI Learning Private Limited	Fifth	2009
4.	Electromagnetic Field Theory	K A Gangadhar P.M.Ramanathan	Khanna Publishers	Eighth	2015

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SY-EIE-28134

Class	S. Y. B. Tech. Semester- IV
Lab Code and Lab Title	**1EEPC255, DC Machines and Transformers Laboratory**
Prerequisite/s	1EEES152
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE / ESE	50/50

Course Objectives: The course aims to:	
1	**Understand** electro mechanical energy conversion process.
2	**Learn** different types of starters used to start DC machines.
3	**Find** suitable testing method to determine performance of particular machine.
4	**Outline** test setup for different machines
5	**Determine** performance of particular machine from experiment results.

Course Outcomes (COs) Upon successful completion of this Lab, the student will be able to:	
1EEPC255_1	**Determine** performance parameters of DC machines& Transformer by using appropriate testing methods. (K^3)
1EEPC255_2	**Demonstrate** different tests and speed control methods of DC machines. (S^2)
1EEPC255_3	**Perform** different tests on Transformer to find performance parameters. (S^2)
1EEPC255_4	**Communicate** effectively in the form of oral and writing journal.(S^2)
1EEPC255_5	**Practice** safety precautions while performing experiments in Laboratory.(A^2)

List of Experiments:

Expt. No.	Title of Experiment
1	Determination of OCC characteristics of d.c generator.
2	Speed control of D.C shunt motor by armature and field control.
3	Determination of performance of DC shunt Motor by Load test
4	Determination of performance of DC shunt Motor by Swinburne's test
5	Determination of performance of DC Motor by Hopkinson's Test.
6	Determination Polarity and Ratio test on single phase transformer/three phase transformer.
7	Determination of performance of single phase & three phase transformer by Open circuit and short circuit test on
8	Determination of performance of single phase & three phase transformer by Load test
9	Parallel operation of single phase transformer.
10	Determination of performance of1Φ Transformer by Sumpner's Test
11	Separation of iron loss into hysteresis and eddy current loss components in a1Φ Transformer.
12	Mini Project: Working Model of DC machine, Working Model of Transformer, Different hand tools by using DC motor

Note: Lab should consist of minimum

1. Eight Experiments
2. One mini project.
3. Industrial Visit

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ST-EE-29/34

Department of Electrical Engineering
S. Y. B. Tech. Curriculum

Class	S. Y. B. Tech. Semester- IV
Course Code and Course Title	**1EEPC256, Digital Electronics & Microprocessor Laboratory**
Prerequisite/s	1EEES156
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE / ESE	50/ 50

Course Objectives: The course aims to:	
01	Acquire the knowledge of digital logic levels and their pin functions
02	Perform design and analysis of various digital electronic circuits
03	Tabulate observations and correlate results and provide valid conclusions
04	Perform testing of circuits along with simulation software like Proteus and acquire the knowledge of writing assembly language program for Microprocessor based practical
05	Acquire the experience of working individually and in team for troubleshooting of simple circuits
06	Follow professional ethics and responsibilities during conduction of lab sessions

Course Outcomes (COs) Upon successful completion of this Lab, the student will be able to:	
1EEPC256_1	**Identify** electronic components their pin functions and packages (K^1)
1EEPC256_2	**Demonstrate** digital electronics circuit on experimental set ups (K^4)
1EEPC256_3	**Tabulate** observations and communicate conclusion and results in oral as well as written form(S^2)
1EEPC256_4	**Develop** the skill of writing assembly language program for Microprocessor based practical (S^2)
1EEPC256_5	**Acquire** experience of working individually as well as a team in designing, building and troubleshooting simple analog electronic circuits(A^2)

Experiment List:

Expt. No.	Title of Experiment
1.	Identify and draw the basic logic gates and electronic components and their pin functions
2.	Design of Half adder & Full adder
3.	Design of Combinational logic circuit from SOP or POS equation
4.	Design of Combinational logic circuit using Multiplexer &De multiplexer
5.	Design of mod n asynchronous counter
6.	Design of basic logic gates in Proteus Software
7.	Design of Half adder & Full adder in Proteus Software
8.	Design of Combinational logic circuit from SOP or POS equation in Proteus Software
9.	Assembly language programming of 8085 microprocessor for arithmetic instructions
10.	Assembly language programming of 8085 microprocessor for looping instructions

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ST-EE-20134

Class	S. Y. B. Tech. Semester- IV
Course Code and Course Title	**1EEES257, Simulations for Electrical Engineering**
Prerequisite/s	1EEES158, 1EEES254
Teaching Scheme: Lecture/Tutorial /Practical	00/00/02
Credits	01
Evaluation Scheme: ISE/ESE	50/50

Course Objectives: The course aims to:	
01	To introduce various features and tools available in software package for Electrical Engineering.
02	To explain the significance of programming and simulations in Electrical Engineering.
03	To understand the different functions and commands required for programming.
04	To study system performance with the help of programming and simulation.
05	To motivate the students to provide the solutions for electrical circuits or problems by applying the knowledge of software packages.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEES257_1	**List** various features and tools available in software MATLAB for Electrical Engineering. (K^2)
1EEES257_2	**Apply** the Knowledge to solve electrical engineering problems using MATLAB programming or simulation. (K^3)
1EEES257_3	**Analyze** the system parameters using various functions. (K^4)
1EEES257_4	**Implement** the simulations of transformer, DC machines, Rectifiers, Inverters, Resonant circuits etc.(S^2)
1EEES257_5	**Execute** the system operations using MATLAB (S^2)
1EEES257_6	**Perform** individually or in a team to solve open ended problems in Electrical Engineering and communicate effectively to represent. (A^2)

List of Experiments:

Expt. No.	Title of the Experiments
1	Matrix Manipulation Using MATLAB
2	Signal Manipulation & Plotting of Continuous and Discrete signals in MATLAB
3	Programming of Newton Raphson method to solve nonlinear equations using MATLAB
4	Programming of Secant method to solve nonlinear equations using MATLAB
5	Simulation of Electric RLC Circuit and Resonant circuit using MATLAB Simulation
6	Simulation of DC Machine And Evaluation of its Performance Using MATLAB
7	Simulation of Single Phase Transformer and evaluation of system performance
8	Simulation of Gate Pulse Generation and analysis of waveforms
9	Simulation and Analysis of Rectifier and inverter Using MATLAB
10	Measurement of active and reactive power for given circuit
11	Analysis of Network Theorems.

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Text Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Getting started with MATLAB	Rudra Pratap	Oxford Publications	Third	2005
2	MATLAB: An Introduction with Applications	Rao V. Dukkipati	New Age International Publishers	First	2010
3	MATLAB & Simulink For Engineers	Agam Kumar Tyagi	Oxford Publications	First	2012
4	MATLAB: A Practical Approach	Stormy Attaway	Elsevier	Second	2009

Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	A Guide to MATLAB (R) : For Beginners and Experienced Users	Brian R. Hunt, Ronald L. Lipsman, Jonathan M. Rosenberg	Cambridge University Press	Third	2014
2.	Essential MATLAB for Engineers and Scientists	Brian Hahn, Valentine, Daniel T.	Academic Press	Fifth	2013
3.	MATLAB for Engineers	Holly Moore	Pearson	Fourth	2013
4.	MATLAB for Beginners: A Gentle Approach	Peter I. Kattan	Createspace Independent Pub	Second	2008

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SY-EE.-32134

Department of Electrical Engineering
S. Y. B. Tech. Curriculum

Class	S. Y. B. Tech. Semester- IV
Course Code and Course Title	**1EEHS258, English Proficiency**
Prerequisite/s	1EEHS158
Teaching Scheme: Lecture/Tutorial /Practical	00/00/02
Credits	01
Evaluation Scheme: ISE / ESE	50/00

Course Objectives: The course aims to:	
01	To motivate and guide students to perform better in formal communicative events.
02	To encourage students to prepare and deliver power point presentation.
03	To develop student's team spirit for effective participation in team.
04	To make students familiar with formal situations by using Language Lab software to understand and perform in their professional life.
05	To improve student's performance in written communication, necessary in profession.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEHS258_1	**Prepare** and **perform** better in formal communicative events. (S3)
1EEHS258_2	**Prepare** and deliver power point presentation effectively. (S3)
1EEHS258_3	**Strengthen** their team spirit and perform effectively in a team. (A3)
1EEHS258_4	**Improve** their intonation, vocabulary and communicative performance. (S1)
1EEHS258_5	**Write** application letter and resume effectively. (S3)

List of Practical:

Sr. No.	Name of Practical
01	Elocution
02	Group Discussion I
03	Language Lab Session I
04	Debate
05	Group Discussion II
06	Language Lab Session II
07	Application Letter & Resume Writing
08	Extempore
09	PPT
10	Mock Interview

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	The Fundamental Aspects of Communication Skills	Prajapati Prasad	S.K. Katariya and Sons	Fifth	2012
02	Effective Technical Communication	Ashraf Rizvi	Tata McGraw Hills	Fifth	2018
03	Group Discussion: A Practical Guide to Participation and Leadership	Julia T. Wood, Gerald M. Phillips	Waveland Press	Fourth	2007

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	High-school English Grammar and Composition	Wren and Martin	S. Chand and Co., New Delhi	First	2011
02	The Ace of Soft Skills	Gopalswami Ramesh, Mahadevan Ramesh.	Pearson Publication, Delhi.	Second	2011
03	Business Communication	P. Shubha Rao, B. Anita Kumar, C. Hima Bindu	Cengage Learning India	Third	2017
04	Business Correspondence and Report Writing	R. C. Sharma, Krishna Mohan	Tata McGraw Hills	Fifth	2016

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SY-EC-34/34

Sant Dnyaneshwar Shikshan Sanstha's
Annasaheb Dange College of Engineering and Technology, Ashta
An Autonomous Institute
Department of Electrical Engineering

Curriculum
T. Y. B. Tech. Semester- V

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Sant Dnyaneshwar Shikshan Sanstha's
Annasaheb Dange College of Engineering and Technology, Ashta
An Autonomous Institute
Department of Electrical Engineering

B. Tech. Semester-V

Course Code	Course	Teaching Scheme				Evaluation Scheme				
						Scheme	Theory (Marks)		Practical (Marks)	
		L	T	P	Credits		Max	Min. for Passing	Max	Min. for Passing
1##OE###	Open Elective- I	3	-	-	3	ISE - I	10	--	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPC303	Control Systems	4	-	-	4	ISE - I	10	--	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
EPC304	AC Machines	4	-	-	4	ISE - I	10	--	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPC305	Power Electronics	4	-	-	4	ISE - I	10	--	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPC308	Power Systems Analysis	4	-	-	4	ISE - I	10	--	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPC351	Control Systems Laboratory	-	-	2	1	ISE	--	--	25	10
1EEPC352	AC Machines Laboratory	-	-	2	1	ISE	--	--	25	10
						ESE	POE		50	20
1EEPC353	Power Electronics Laboratory	-	-	2	1	ISE	--	--	25	10
						ESE	POE		50	20
1EEPC354	Power Systems Analysis Laboratory	-	-	2	1	ISE	--	--	25	10
EMC309	Constitution of India	2	-	-	-	ISE	Grade		--	--
	Total	**20**	**-**	**8**	**23**	--	**500**	--	**200**	--
	Total Contact Hours/Week: 28hrs									

Course Category	HS	BS	ES	PC	PE	OE	PR
Credits	--	--	--	20	--	03	--
Cumulative Sum	05	20	27	52	--	03	--

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Annasaheb Dange College of Engg. & Tech. * ASHTA 416 301

[1##OE###] Open Elective – I

Course Code	Course Name	Course Offered by
1ME0E101	Machines and Mechanisims	Mechanical Engineering
1ME0E102	Manufacturing Engineering	
1CSOE301	Database Essentials	Computer Science and Engineering
1CSOE302	Software Engineering and Project Management	
1CSOE303	Data Structures and Algorithms	
1EEOE301	Electrical Technology	Electrical Enginnering
1EEOE302	Electrical and Electronics Measurements	
1CVOE301	Air Pollution & Control	Civil Enginnering
1CVOE302	Remote Sensing & GIS Applications	
1AUOE301	Product design and development	Automobile Engineering
1AUOE302	Automotive Refrigeration and air conditioning	
1AEOE101	Introduction to Aerospace Engineering	Aeronautical Enginnering
1AEOE102	Drone Pilotting	

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Annasaheb Dange College of Engg. & Tech. ASHTA 416 301

Sant Dnyaneshwar Shikshan Sanstha's

Annasaheb Dange College of Engineering and Technology, Ashta

An Autonomous Institute

Department of Electrical Engineering

Class	T.Y. B. Tech, Sem.-V
Course Code and Course Title	1EEOE301, **Electrical Technology**
Prerequisite/s	1EEES103
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEOE301_1	**Explain** the construction & working of electric motors.
1EEOE301_2	**State** the applied principles of electrical engineering.
1EEOE301_3	**Classify** electrical heating methods for industrial furnaces.
1EEOE301_4	**Choose** suitable types of motors for industrial applications of electrical drives.
1EEOE301_5	**Select** suitable starter & speed control methods for electrical motors.
1EEOE301_6	**Solve** numerical to determine the different parameters of electrical motors & energy conversion.

Course Contents:		
Unit 1	**DC motors:** Construction, working, types, back emf, speed equation, torque equation, speed torque characteristics, power losses in D.C. motors, need of starter, 3 point starter, 4 point starter, speed control of D.C. shunt and series motor (numerical treatment on speed control methods). reversal rotation of D.C motor, electric braking of shunt and series motor	**10 Hrs.**
Unit 2	**Three Phase Induction Motor:** Construction, types, working, speed equation, torque equation, starting torque, full load torque, torque speed characteristics, power stages in motor (Numerical treatment on power stages), advantages of 3- phase Induction motor.	**07 Hrs.**
Unit 3	**Three Phase Induction Motor Control:** Need of starter, star delta starter, DOL starter, autotransformer starter, rotor resistance starter. speed control methods- pole changing, voltage control, frequency control, block diagram of VFD (v/f) control, reversal rotation 3- phase Induction motor	**07 Hrs.**
Unit 4	**Special Purpose Motors:** Construction, working, characteristics and applications of single phase Induction motor, AC servo motor, DC servo motor, stepper motor (VR type and PM type), Introduction to BLDC motor and linear induction motor, universal motor	**06 Hrs.**
Unit 5	**Electrical Drives:** Advantages of electrical drives, types – individual & group drive, nature of mechanical loads with respect to speed–torque variation, nature of mechanical loads with respect to duty period, 4 quadrant operation of DC motor, criteria for selection of motors for applications like lathe, traction, pumps, conveyors, lift.	**06 Hrs.**
Unit 6	**Electric Heating:** Types of electrical heating, construction and working of - direct & indirect resistance heating, direct arc furnace, indirect arc furnace, core type induction furnace, coreless induction furnace. (numerical treatment on electrical to thermal energy conversion) Recent trends in Electrical Technology.	**06 Hrs.**

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1.	Textbook of Electrical Technology, Vol.-II	B. L. Theraja	S. Chand Publication	First	2012
2.	Electrical Technology	H. Cotton	CBS Publishers & Distributors Pvt. Ltd.	First	2005
3.	Principles of Electrical Machines	V. K. Mehta, Rohit Mehta	S. Chand Publication	Second	2016
4.	Utilization of Electric Power & Electric Traction	J. B. Gupta	S. K. Kataria& Sons	Ninth	2011
5.	Fundamentals of Electrical Engineering & Electronics	B. L. Theraja	S. Chand Publication	First	2009
6.	Electrical Technology	U. A. Bakshi	Technical Publication Pune	Fourth	2009

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1.	Electrical Technology: Machines and Measurements, Vol-II	Surinder Pal Bali	Pearson	First	2013
2.	Electrical and Electronic Technology	Edward Hughes: Revised by John Hiley, Keith Brown, Ian McKenzie Smith	Pearson Education	Ninth	2009
3.	Utilization of Electric Power & Traction	Tanmoy Deb	Ane Books Pvt. Ltd.	First	2012
4.	Utilisation of Electric Power: Including Electric Drives and Electric Traction	N. V. Suryanarayana	New Age International	First	2007
5.	Electrical Power	S. L. Uppal	Khanna	Thirteenth	1988

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Class	T.Y. B. Tech, Sem.-V
Course Code and Course Title	**1EEOE302, Electrical and Electronics Measurement**
Prerequisite/s	1EEES103
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEOE302_1	**Illustrate** various concepts of measuring instruments (Analog/Digital), their classification, construction, working and range extension technique.
1EEOE302_2	**Explain** construction and operation of different transducers.
1EEOE302_3	**Describe** various analyzers, its types & modern techniques in measurement.
1EEOE302_4	**Derive** the equations of different methods for measurement of Various Electrical Parameters.
1EEOE302_5	**Solve** numerical to determine different electrical parameters in Electrical and Electronics Measurement.

Curriculum Content :		
Unit 1	**Principles of Analog Measuring Instruments:** Static and dynamic characteristics, electrical Standards, Types of Errors. Essentials of indicating instruments: deflecting, controlling and damping systems. Construction, working principle, advantages and disadvantages of Moving Iron (MI) (attraction and repulsion), Permanent Magnet Moving Coil (PMMC) & Dynamometer type instruments. Extension of ranges by using shunts, Multipliers (numerical expected).	**08 Hrs.**
Unit 2	**Measurement of Resistance, Inductance & Capacitance :** Measurement of low, medium and high resistance. Wheatstone bridge, Kelvin's double bridge, ammeter-voltmeter method, Megger, Maxwell's Inductance bridge, Maxwell's Inductance & Capacitance Bridge, Hay's bridge, Owen's bridge, De sauty's Bridge, Schering Bridge, Weins Bridge. (numerical expected on bridges)	**08 Hrs.**
Unit 3	**Measurement of Power and Energy:** Active & reactive power measurement in three phase system for balanced and unbalanced load using three wattmeter method, two wattmeter method & one wattmeter method (numerical expected). Construction, working principle, Calibration of single phase induction type energy meter.	**08 Hrs.**
Unit 4	**Principles of Digital Measuring Instruments:** Advantages of digital meters over analogue meters. Resolution & sensitivity of digital meters. Working principles of digital Voltmeter, Multimeter, Construction and working principle of CRO, measurement of voltage, current, period and frequency by CRO, Lissajous pattern, Construction and working principle of DSO, advantages and disadvantages of DSO over CRO.	**07 Hrs.**
Unit 5	**Transducers:** Transducers: Introduction, classification of transducers. Electrical transducer, Resistive transducer, Inductive transducer, Capacitive transducer, Piezoelectric Transducers, strain guage, LVDT and RVDT, Digital Transducers.	**07 Hrs.**

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Unit 6	**Recent developments in Electrical and Electronics Measurements:** Wave Analyzers, Power Analyzer, Smart Sensors, Virtual Instrumentation.	04 Hrs.

Textbooks:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	A Course in Electrical and Electronic Measurements & Instrumentation	A. K. Sawhney	DhanpatRai& Co.	Nineteenth	2014
02	A Course in Electronics & Electrical Measurements & Instrumentation	J. B. Gupta	S. K. Kataria& Sons.	Eighth	2012
03	Electronic Instrumentation	H.S.Kalsi	Tata McGraw Hill	Third	2012
04	Measurement Systems	Ernest. O Doeblin, Dhanesh N. Manik	Tata McGraw Hill	Fifth	2008

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Electrical Measurements & Measuring Instruments	E. W. Golding F. C. Widdies	Reem Publications.	Third	2011
02	Introduction to Measurements and Instrumentation	Arun K. Ghosh	PHI Publication	Fourth	2012
03	Electrical Measurement & Instrumentation	R.S SirohiRadhakrisnan	New Age International	Third	2010
04	Instrumentation Measurement and Analysis	B.. K. C. Nakra K Chaudhari,	Tata McGraw Hill.	Second	2009

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Class	T.Y. B. Tech, Sem.-V
Course Code and Course Title	**1EEPC303, Control Systems**
Prerequisite/s	1EEPC208
Teaching Scheme: Lecture/Tutorial/Practical	03/01/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC303_1	**Explain** different components and controllers used in control system along with its transfer function
1EEPC303_2	**Apply** the state space for representation for different control system.
1EEPC303_3	**Determine** the transfer function using block diagram reduction and signal flow graph.
1EEPC303_4	**Compute** the performance parameters for given system
1EEPC303_5	**Analyze** the stability of the given system in time &frequency domain.

Course Contents:		
Unit 1	**Introduction to Control System and Mathematical Modeling** Introduction, types of systems, feedback control system, modeling of electrical, mechanical systems, Force Voltage and Force current analogy, Determination of the transfer function using block diagram reduction and signal flow graph, Mason's Gain formula.	**08 Hrs.**
Unit 2	**Components of Control Systems** Error detectors, potentiometer, synchros, optical rotary encoders, DC and AC servomotors, stepper motor, gear trains, AC and DC taco-generators, transfer function of components of control system and its applications.	**06 Hrs.**
Unit 3	**Time Domain Analysis of Control system** Response of first and second order system, generalized second order system, steady state error, static error constants and type of system, steady state error specifications, Routh-Hurwitz criteria for stability, Introduction of PID Controller.	**10 Hrs.**
Unit 4	**Root Locus** Definition of root locus, rules for plotting root loci, root contour, stability analysis using root locus, Determination of gain from root locus, effect of addition of pole and zero on root locus.	**05 Hrs.**
Unit 5	**Frequency Response Analysis of Control system** Introduction to frequency response, frequency domain performance specifications, stability analysis of system using Bode plots, Obtaining transfer function from Bode plot, Polar plot, Nyquist plot, stability criterion, co-relation between time domain and frequency domain.	**05 Hrs.**
Unit 6	**State Space Representation** Introduction to State space, phase variable form, canonical form, conversion of transfer function to state space and vice versa, state transition matrix and its significance, Eigen values, Eigen vectors, solution of state equations, controllability and Observability.	**08 Hrs.**

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Control System Engineering	I.J. Nagrath M. Gopal	New Age International Publication	Fifth	2009
02	Control System Engineering	Norman Nise	Wiley Publication	Sixth	2013
03	Modern Control Engineering	Ogata	Prentice Hall	Fifth	2010
04	Feedback Control Systems	U. A. Bakshi& S. C. Goyal	Technical Publications	Second	2008

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Automatic Control System	Kuo&Golnaraghi	Wiley	Ninth	2013
02	Control Systems: Theory and Applications	Smarajit Ghosh	Pearson Education	Second	2012
03	Control Systems	N. C. Jagan	B. S. Publications	Second	2008
04	Feedback Control Systems	C.L. Phillips, R.D. Harbor,	Prentice Hall	Fourth	1999

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Department of Electrical Engineering

Class	T.Y. B. Tech, Sem.-V
Course Code and Course Title	**1EEPC304, AC Machines**
Prerequisite/s	1EEES103, 1EEPC210
Teaching Scheme: Lecture/Tutorial/Practical	04/00/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC304_1	**Explain** the constructional details and working principle of AC machines
1EEPC304_2	**Describe** the effects of system parameters on performance of AC Machines.
1EEPC304_3	**Solve** numerical to determine the performance parameters of AC machines.
1EEPC304_4	**Select** the suitable starter & speed control method for specific application.
1EEPC304_5	**Analyze** the performance of a AC machine by using appropriate testing methods.

Course Contents:		
Unit 1	**Three Phase Induction Motor** Construction Details, Production of Rotating magnetic field and Principle of operation, Types of rotors, Rotor quantities (emf, current, frequency, pf),Torque Equation, Torque-Slip Characteristics, Necessity of starters for 3 ph. Induction motors, types of starters (DOL, autotransformer, star-delta, rotor resistance starter), Speed control methods from stator side (Stator voltage control, Stator Frequency control, Pole changing) & rotor side (rotor resistance control, Cascade control, EMF injection control), Braking Methods, Applications of 3 ph. Induction motors to Electric vehicle (Numerical Expected)	**10 Hrs.**
Unit 2	**Performance of Induction Motor** Standards for testing (IEC, IS), Losses and Efficiency, Direct load test, No load & blocked rotor test, equivalent circuit of 3 phase induction motor, power flow diagram, Phasor diagram of 3 phase induction motor, performance of 3 phase induction motor using circle diagram, crawling & cogging, Induction motor as induction generator, Double cage induction motor and its characteristics, (Numerical Expected)	**12 Hrs.**
Unit 3	**Three Phase Alternator** Construction Details, principle of operation, Emf equation, parameters of armature winding (Resistance & leakage reactance), armature reaction (at unity, lagging zero and leading zero power factor), concept of synchronous reactance and synchronous impedance. Equivalent circuit of 3 phase alternator, alternator on load (resistive, inductive & capacitive)(Numerical Expected)	**08 Hrs.**
Unit 4	**Performance of Alternator** Standards for testing (IEC, IS), Direct load test,OC test & SC test on 3 Phase alternator, voltage regulation methods (EMF, MMF, ZPF and direct loading method), Losses and efficiency, Necessity for parallel operation of alternators, conditions for parallel operation, synchronizing procedures, hunting and oscillation in alternators(Numerical Expected)	**10 Hrs.**

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Unit 5	**Synchronous Motor** Construction and principle of operation, necessity of starters, Starting methods of synchronous motors, Phasor Diagrams of three phase synchronous motor at Unity, lagging and leading power factor, Effect of Varying Field Current and Load, V & inverted V Curves, Operation of Synchronous motor as Synchronous Condenser, Hunting	**08 Hrs**
Unit 6	**Single phase induction motors and Special Purpose Motors** Single Phase Induction Motor- Double field Revolving theory, Equivalent Circuit, Split phase induction motor, Capacitor start induction motor, Capacitor start capacitor run induction motor (two value capacitor method), shaded pole induction motor, AC Servo motor, universal motor, linear induction motor, switched reluctance motor, Permanent magnet Synchronous motor, Applications to electric vehicle	**08 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Electric Machinery	Bimbhra P.S	Khanna Publisher	Seventh	2011
2	Principles of Electric Machine	V. K. Mehta	Tata Mcgraw Hill	First	2006
3	Electric machines	Ashfaq Husain	Dhanpatrai And Co.Publication	Third	2016
4	Electric Machinery	A.E Fitzgerald Stephen Kingsly	Tata Mcgraw Hill	Fourth	1983

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Generalized Machine Theory,	Bhimra P.S	Khanna Publisher	Fourth	1987
2	Electric Machines	Kothari D.P Nagrath I.J	THM Publications	Fourth	2010
3	Electric machines	M.V.Deshpande	PHI Publication	First	2011
4	Electric machines	Samarjit Ghosh	Pearson	Second	2012

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Department of Electrical Engineering

Class	T.Y. B. Tech, Sem.-V
Course Code and Course Title	**1EEPC305, Power Electronics**
Prerequisite/s	1EEES108,1EEPC203,
Teaching Scheme: Lecture/Tutorial/Practical	04/00/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC305_1	**Describe** construction, working and operation of power semiconductor devices.
1EEPC305_2	**Draw** performance characteristics of power semiconductor devices.
1EEPC305_3	**Discuss** power electronic converters with respect to the power circuit, working and waveforms for different loads.
1EEPC305_4	**Estimate** the performance parameters of power electronic converters.
1EEPC305_5	**Solve** numerical to determine performance parameters ofpower electronic converters.
1EEPC305_6	**Apply** the knowledge of power electronic converters for advanced applications.

Course Contents:		
Unit 1	**Power Semiconductor Devices and Commutation Circuits** Configuration, principle of operation, characteristics of power semiconductor devices (Power Diodes, SCR, TRIAC, Power MOSFET, IGBT, GTO), triggering methods and commutation techniques.	**10 Hrs.**
Unit 2	**Diode Rectifiers** Construction, working, performance analysis of single phase half wave rectifiers with R, RL load with and without freewheeling diodes, single phase full wave rectifier with R, RL load with and without freewheeling diodes, three phase half wave rectifiers with R load, three phase bridge rectifiers with R load.	**09 Hrs.**
Unit 3	**Single Phase Controlled Converters** Construction, working, performance analysis of single phase half and full wave controlled converter with R, RL load, single phase half bridge controlled converter with R, RL load, single phase full bridge controlled converter with R load, R-L load, effects of source inductance. **Dual Converters:** Construction, working, performance analysis of single phase and three phase dual converter with R, RL load.	**09 Hrs.**
Unit 4	**Three Phase Controlled Converters** Construction, working, performance analysis of three phase half bridge controlled converter with R, RL load, Three phase full bridge controlled converter with R, RL load. **Cycloconverters:** Principle, working and performance analysis of single phase and three phase cycloconverters, Introduction to Matrix Converter	**09 Hrs.**
Unit 5	**DC-DC Converter: Chopper** Introduction to DC to DC converter, configurations of Chopper, Principle, working and performance analysis of step-up and step-down Chopper, Control strategies of Chopper, types of Chopper, Buck-Boost Converter, Applications of Chopper	**07 Hrs.**
Unit 6	**DC-AC Converters and Advanced Topic in Power Electronics:** **DC-AC Converters: Inverters** Introduction to inverters, working principle and operation of Single Phase half and full Bridge inverter, Voltage Source Inverter (VSI), three-phase- six step	**12 Hrs.**

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	(120/180 degree mode of operation), principle of operation for Current Source Inverter (CSI) **Advanced Topic in Power Electronics:** PWM techniques-Single, Multiple and Sinusoidal PWM. Dual active bridge converter, Solid State Transformer principle, types and applications. Uninterruptable Power Supply (UPS).	

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Power Electronics: Devices, Circuits and applications	Muhammad H. Rashid	Prentice Hall of India	Fifth	2013
02	Power Electronics	P.S. Bimbhra	Khanna Publishers, New Delhi	Third	2012
03	Electrical Machines & Drives, A First course	Ned Mohan	Wiley Publications	First	2012
04	Power Electronics	M. D. Singh & K. B. Kanchandhani	Tata McGraw - Hill Publishing	First	1998

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Power Electronics: Principles and Applications	Joseph Vithayathil	McGraw Hill Publication	first	2010
02	Power Electronics	B.W.Williams	John Willey	Second	2009
03	Power Electronics, Converter Applications and Design",	Mohan, Undel and and Robins	John Wiley and sons (Asia) Pvt. Ltd.	Third	2001
04	Thyristorised Power Controllers	G.K. Dubey, S. R. Doradla, A. Joshi and R. M., K. Sinha	New Age International (P) Limited Publishers	First	1999.

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Department of Electrical Engineering

Class	T. Y. B. Tech, Sem.- V
Course Code and Course Title	**1EEPC308, Power System Analysis**
Prerequisite/s	1EEPC202, 1EEPC209
Teaching Scheme: Lecture/Tutorial/Practical	04/00/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC308_1	**Explain** the fundamentals of power systems analysis under steady state and fault conditions.
1EEPC308_2	**Model** power system components under steady state condition to study the system performance.
1EEPC308_3	**Calculate** power system parameters under steady state conditions.
1EEPC308_4	**Draw** various kinds of network diagram required for power system analysis.
1EEPC308_5	**Derive** an equation of system parameters under steady state and fault condition on transmission lines.
1EEPC308_6	**Determine** the system parameters under various kinds of fault on transmission lines.

Course Contents		
Unit 1	**Performance of Transmission Lines** Introduction and classification of transmission lines, short, medium, long transmission lines, generalized constants of transmission lines, Ferranti effect, surge impedance loading, tuned power lines, complex power flow through a transmission line, receiving end power circle diagram for transmission line (assuming ABCD constants are already given), numerical treatment expected, one case study of short/medium/long distance transmission line in Maharashtra.	**10 Hrs.**
Unit 2	**Per unit Representation of Power system & its Components** Introduction, single phase representation of balanced 3 phase networks, single line diagram, impedance & reactance diagram, introduction of per unit system, P.U. representation of transformer, representation of generator, P.U. impedance diagram of power system, representation of loads, numerical based on network reduction by using per unit system, one case study of power transmission/distribution substation in Maharashtra.	**06 Hrs.**
Unit 3	**Load flow analysis** Load flow analysis introduction and its importance, bus classifications, nodal admittance matrix (Y_{BUS}) formation, development of load flow equations, load flow solution using iterative techniques like Gauss Seidel, Newton Raphson method, Decoupled and Fast Decoupled methods. Comparison of Load Flow methods, Algorithms & flow charts numerical treatment expected, one case study of power transmission/distribution substation in Maharashtra.	**11 Hrs.**
Unit 4	**Symmetrical Fault Analysis** Introduction to fault, types of faults, transient on transmission line, short circuit current and reactance's of synchronous machine on no load and loaded condition, short circuit MVA, algorithm for short circuit studies, Z- bus formulation (step by step method without mutual coupling), selection of circuit	**10 Hrs.**

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	breakers and current limiting reactors and their location in power system, numerical treatment expected, one case study of power transmission/distribution substation in Maharashtra.	
Unit 5	**Symmetrical Components** Introduction to symmetrical components, symmetrical component transformation, phase shift in star-delta transformers, sequence impedances and sequence network of transmission line, synchronous machine and transformer, power invariance, construction of sequence network of a power system, numerical treatment expected.	**10 Hrs.**
Unit 6	**Unsymmetrical Fault Analysis** Introduction to unsymmetrical fault analysis, symmetrical component analysis of unsymmetrical faults, single Line to Ground (L-G) fault, Line to Line (L-L) fault, Double Line to Ground (L-L-G) fault, open conductor faults, bus impedance matrix for analysis of unsymmetrical shunt faults, numerical treatment expected,one case study of power transmission/distribution substation in Maharashtra.	**09 Hrs.**

Text Book:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Power System Engineering	D.P. Kothari, I. J. Nagrath	Mc-Graw Hill Publications	–	2019
02	Modern Power System Analysis	D.P. Kothari, I. J. Nagrath	Mc-Graw Hill Publications	Fourth	2011
03	Electrical Power Systems	AshfaqHussain	CBS publishers, New Delhi	Third	2007
04	Power System Analysis	HadiSaadat	Tata Mc-Graw Hill	First	2002
05	Power System Analysis	A.R. Bergen and Vijay Vittal	Pearson Education	Second	2009

Reference Book:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Power System Analysis	Grainger John J and W D Stevenson	McGraw Hill	First	1994
02	Power System Analysis	P S R Murhty	BS Publication	First	2007
03	Electrical Power Systems	D. Das	New Age international	First	2010
04	Electric Power Systems: A first course	Ned Mohan	Wiley Publication	First	2012

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Class	T.Y. B. Tech, Sem.-V
Course Code and Course Title	**1EEPC351, Control Systems Laboratory**
Prerequisite/s	1EEPC208
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE / ESE	25/00

Course Outcomes (COs) Upon successful completion of this course, the student will be able to:	
1EEPC351_1	**Sketch** the response of system for a given transfer function.
1EEPC351_2	**Analyze** the performance of system in time and frequency domain.
1EEPC351_3	**Demonstrate** relationship between transfer function and state space using MATLAB.
1EEPC351_4	**Communicate** effectively about laboratory work orally and through writing journals.
1EEPC351_5	**Practice** professional and ethical behavior to carry forward in their life.

Expt. No.	Title of Experiment
1	Generate and plot standard test signals by using MATLAB
2	Creation of transfer function
3	Block diagram reduction using MATLAB
4	Time domain specifications of a system
5	Stability of control system using Root locus by using MATLAB
6	Stability of control system in frequency domain by using MATLAB
7	Conversion of Transfer Function to State space and vice- versa by using MATLAB
8	Controllability and Observability of given system by using MATLAB
9.	DC Motor Speed Controller
10	DC Voltage regulator as closed loop control system.
11.	DC position control system.

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Class	T.Y. B. Tech, Sem.-V
Lab Code and Lab Title	**1EEPC352, AC Machines Laboratory**
Prerequisite/s	1EEES152, 1EEPC255
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE / ESE	25/50

Course Outcomes (COs) Upon successful completion of this Lab, the student will be able to:	
1EEPC352_1	**Implement** the working principle of AC machines in a practical manner
1EEPC352_2	**Demonstrate** different tests on Induction machines.
1EEPC352_3	**Perform** different tests on Synchronous Machines.
1EEPC352_4	**Respond** Effectively in the form of oral and writing journal.
1EEPC352_5	**Justify** the result of the experiment from the observations.

List of Experiments:

Expt. No..	Title of Experiment
1	Speed control methods of three phase induction motor
2	Efficiency & speed regulation of 3 phase Sq. cage induction motor (SCIM) by direct loading method
3	Efficiency & speed regulation of 3 phase SCIM by indirect loading method
4	Efficiency & speed regulation of 1 phase induction motor.
5	Efficiency of Alternator by direct loading method
6	Voltage regulation of Alternator by direct loading method
7	Voltage regulation of an alternator by EMF, MMF, ZPF method
8	Determination of load sharing by parallel operation
9	Synchronization of Alternator
10	Determination of efficiency of synchronous motor by direct loading
11	Determination of V and Inverted V curves of a synchronous motor
Industrial Visit	

The lab must contains minimum 8 experiments and a industrial visit

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Class	T.Y. B. Tech, Sem.-V
Course Code and Course Title	**1EEPC353, Power Electronics Laboratory**
Prerequisite/s	1EEES156, 1EEPC252
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE / ESE	25/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC353_1	**Select** a suitable power converter for given application.
1EEPC353_2	**Plot** operating characteristics of various Power Semiconductor Devices.
1EEPC353_3	**Implement** different power electronic circuits.
1EEPC353_4	**Simulate** various power electronic converters using MATLAB
1EEPC353_5	**Work** in groups for perforating experiment.
1EEPC353_6	**Demonstrate** acceptable presentation skills through experiment report.

List of Experiments

Expt. No.	**Title of the Experiment**
1	V-I Characteristics of Various Power Semiconductor Devices
2	Gate Firing circuits for SCR's (R, RC, UJT, ramp and pedestal.)
3	Single Phase Half-Wave Controlled Rectifier with R and RL load
4	Single Phase Full controlled bridge converter with R and RL loads.
5	Three Phase Half -Wave Converter with R Load.
6	Three Phase Full-Wave Bridge Converters with R Load.
7	Dual Converter.
8	D.C. Chopper.(Step up and Step Down)
9	Simulation of single phase controlled converter with R-L Load
10	Simulation of three phase controlled converter with R Load
11	Simulation of single phase inverter
12	Simulation of dual active bridge converter.
Mini Project on Converter Design	
Design any one Converter in a group of maximum 5 students in each batch	

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Class	T.Y. B. Tech, Sem.-V
Course Code and Course Title	**1EEPC354, Power System Analysis Laboratory**
Prerequisite/s	1EEES152, 1EEPC251, 1EEES257
Teaching Scheme Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE /ESE	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC354_1	**Develop** the MATLAB program to determine the power system parameters.
1EEPC354_2	**Demonstrate** the performance of transmission line using transmission line trainer kit.
1EEPC354_3	**Use** the modern software like ETAP/ Power World Simulator/ MATPOWER to understand the concepts of the power system under steady state and fault conditions
1EEPC354_4	**Present** the technical report effectively.
1EEPC354_5	**Practice** the safety rules in the laboratory and behave ethically in time standards.

List of Experiments

Expt. No.	Title of Experiment
1.	Measurement of ABCD parameters of a medium/long transmission line.
2.	Efficiency and voltage regulation of Short/medium/long transmission line.
3.	Ferranti Effect on transmission line.(Using transmission line trainer kit)
4.	Y- Bus matrix of a power system using MATLAB.
5.	Gauss-Seidal method using MATLAB.
6.	Newton-Raphson method using MATLAB.
7.	Transients in series R-L circuit &synchronous generator behavior under symmetrical fault
8.	Symmetrical fault analysis of a 3-bus system using MATLAB.
9.	Conversion of phasors to symmetrical components and vice versa using MATLAB
10.	positive, negative and zero sequence impedances of transformer (hardware)
11.	Power System operation using ETAP/power world simulator.
12.	Unsymmetrical fault analysis for LL, LG, LLG Faults using MATLAB /ETAP /Power world simulator

**Minimum eight experiments should be performed in laboratory.

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Department of Electrical Engineering

Class	T.Y. B. Tech, Sem.-V
Course Code and Course Title	**1EEMC309, Constitution of India**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00
Credits	02
Evaluation Scheme: ISE I / MSE / ISE II / ESE	Grade

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEMC309_1	**Explore** the basic features and modalities about Indian constitution
1EEMC309_2	**Differentiate** the functioning of Indian parliamentary system at the center and state level
1EEMC309_3	**Describe** different aspects of Indian Legal System and its related bodies
1EEMC309_4	**Discuss** different laws and regulations related to engineering practices
1EEMC309_5	**Correlate** role of engineers with different organizations and governance models

Course Contents:		
Unit 1	**Introduction and Basic Information about Indian Constitution** Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 194,Enforcement of the Constitution, Indian Constitution and its Salient Features, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Parliamentary System, Federal System, Centre-State Relations, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government	**06 Hrs.**
Unit 2	**Union Executive and State Executive** Powers of Indian Parliament Functions of Rajyasabha, Functions of Loksabha, Powers and Functions of the President, Powers and Functions of the Prime Minister, Lokpal, Lokayukta. State Executives-Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature	**05Hrs.**
Unit 3	**Introduction and Basic Information about Legal System** Sources of Law and the Court Structure: Enacted law -Acts of Parliamentary of primary legislation, Common Law or Case law, Judicial Activism, Contract law, The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation, The Court System in India (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court)	**05 Hrs.**
Unit 4	**Intellectual Property Laws** Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents, Copyright and its Ownership, Infringement of Copyright, Civil Remedies for Infringement	**03 Hrs.**
Unit 5	**Regulation to Information** Regulation to Information Introduction, Right to Information Act, 2005, Information Technology Act, 2000, Electronic Governance, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act.	**04Hrs**

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Unit 6	**Business Organizations and E-Governance** Sole Traders, Partnerships Companies: The Company's Act: Introduction, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up. E-Governance and role of engineers in E-Governance, Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in a few states creating hurdles in Industrial development.	**05 Hrs.**

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Introduction to the Constitution of India	Dr.Durga Das Basu	Butterworth Wadhwa	Twentieth	2011
2	The Constitution of India	Government of India Ministry of Law And Justice	Government of India Ministry of Law And Justice	First	2007
3	Introduction to the Indian Constitution	Brij Kishore Sharma	PHI Learning Pvt. Ltd.	Eighth	2011
4	The Indian Constitution	MadhavKhosla	Oxford University Press	First	2012

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	The Constitution of India	PM Bakshi	Universal Law Publishing.	First	2015
2	Law Relating to Intellectual Property Rights	V.K. Ahuja	Lexisnexis	First	2007
3	Our Constitution: An Introduction to India's constitution and constitutional Law,	Subhash C. Kashyap	NBT	First	2018
4	Patents,Trademarks, Designs and Geological Indications	BL Wadehra	Universal Law Publishing -	First	1999

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Curriculum

T. Y. B. Tech. Semester- VI

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T. Y. B. Tech. Semester- VI

Course Code	Course	Teaching Scheme				Evaluation Scheme				
						Scheme	Theory (Marks)		Practical (Marks)	
		L	T	P	Credits		Max	Min. for Passing	Max	Min. for Passing
1##OE###	Open Elective- II	3	-	-	3	ISE - I	10	-- 40	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPC310	Electrical Machine and Power System Design	2	1	-	3	ISE - I	10	-- 40	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEES311	Microcontroller and Its Applications	4	-	-	4	ISE - I	10	-- 40	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPE3**	Professional Elective- I	4	-	-	4	ISE - I	10	-- 40	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPE3**	Professional Elective- II	4	-	-	4	ISE - I	10	-- 40	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPC355	Electrical Machine and Power System Design Laboratory	-	-	2	1	ISE	--	--	25	10
						ESE	POE		50	20
1EEES356	Microcontrollers and Its Applications Laboratory	-	-	2	1	ISE	--	--	25	10
						ESE	POE		50	20
1EEPE3**	Professional Elective- I Laboratory	-	-	2	1	ISE	--	--	25	10
1EEPR360	Mini Project	-	-	4	2	ISE	--	--	75	30
	Total	17	1	10	23	--	500	--	250	--
	Total Contact Hours/Week: 28hrs									

Course Category	HS	BS	ES	PC	PE	OE	PR
Credits	--	--	05	04	09	03	02
Cumulative Sum	05	20	32	56	09	06	02

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EE-ST-03

➢ **Professional Elective -I**

Sr. No.	Course Code	Professional Elective –I	Sr. No.	Laboratory Course Code	Professional Elective - I Laboratory
1	1EEPE312	Control System Design	1	1EEPE357	Control System Design Laboratory
2	1EEPE313	Electrical Drives	2	1EEPE358	Electrical Drives Laboratory
3	1EEPE314	Power Systems Dynamics and Control	3	1EEPE359	Power Systems Dynamics and Control Laboratory

➢ **Professional Elective -II**

Sr. No.	Course Code	Professional Elective -II
1	1EEPE315	Digital Signal Processing
2	1EEPE316	Electric Vehicles and Smart Grid
3	1EEPE317	Analog and Digital Communication

➢ **[1##OE###] Open Elective – II**

Open Elective-II (Semester-VI)		
Courses Code	**Course Name**	**Department**
1AEOE321	Lighter Than Air Systems	Aeronautical Engineering
1AEOE322	Airline and Airport Management	
1AEOE323	Flight Scheduling and Operations	
1AUOE310	Vibration based fault diagnosis	Automobile Engineering
1AUOE311	Engineering Tribology	
1CVOE310	Operation Research	Civil Engineering
1CVOE311	Economics And Management	
1CSOE311	Internet of Things	Computer Science and Engineering
1CSOE312	Cyber Laws and Ethical Hacking	
1EEOE306	Electrical Wiring Harnessing	Electrical Engineering
1EEOE307	Electrical Economics & Energy Audit	
0FTOE321	Process Modeling and Simulation	Food Engineering
1MEOE304	Industrial Management and Operation Research	Mechanical Engineering
1MEOE305	Non-Destructive Testing	
1MEOE306	Computational Fluid Dynamics	

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Department of Electrical Engineering

Class	T.Y. B. Tech, Sem.-VI
Course Code and Course Title	**1EEOE306, Electrical Wiring Harness**
Prerequisite/s	1EEES103
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	*03*
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEOE306_1	**Understand** the various electrical principles and tools use in vehicles.
1EEOE306_2	**Explain** the basics of automotive wiring.
1EEOE306_3	**Describe** different components used in automotive wiring.
1EEOE306_4	**Discuss** the advanced installations and interfaces of automotive wiring.
1EEOE306_5	**Solve** the different problems in automotive wiring.

Course Contents:		
Unit 1	**Electrical Principles and Simple Circuits :** High Current/Low Voltage, Ohm's Law, The Power Formula, Combinations, Kirchhoff's Law, Circuit Basics, Wire Resistance Chart, and Example: Installing an Electric Fuel Pump, Hazards Presented by On-Board Computers, Disconnecting the Battery—When? **The Right Tools for the Job Required** : Tools, Test Light, Digital Multi-Meter Basic Functionality	**08 Hrs.**
Unit 2	**The Fundamentals of Automotive Wiring :** Basic Connections, Crimp-Style Connections, Fundamentals of Crimping, Soldering Irons and Guns How to Insulating Connections, Temporary, Mechanical Connectors, Distribution-Type Connectors, Connectors and Plugs Basics for AWG Wire 8 and Larger	**08 Hrs.**
Unit 3	**Ignition Switches, Wiring Harnesses and Controllers :** The Ignition Switch, The Wiring Harness, Controllers: The Basics, Power Door Lock Circuits, Power Window Circuits, The Charging System	**07 Hrs.**
Unit 4	**Troubleshooting** Understanding Flowcharts, Typical Problems, Circuit Inoperable, Circuit Works, but Blows Fuses: Scenario 1, Circuit Works, but Blows Fuses: Scenario 2, Wiring is Burned Up, Battery is Drained Overnight,	**07 Hrs.**
Unit 5	**Advanced Installations and Interfaces :** Interfacing with Power Door Lock and Power Window Circuits, Factory Wiring Diagrams, Interfacing with Power Sunroof and Convertible Top Circuits, Upgrading Headlights to Higher Power Units, Adding an Auxiliary Battery, Adding an Accessory Fuse Panel.	**08 Hrs.**
Unit 6	**Building a Wiring Harness :** Harness Basics, Building a Harness from Scratch Harness Construction Project	**04 Hrs.**

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Automotive wiring and electrical system	Tony Candela	Brook lands Books Ltd.	First	2009
2	Automotive Electrical Performance Project	Tony Candela	Car Tech Books	First	2011
3	Automotive Electrical Equipment	P L Kohli	McGraw Hill	First	2017
4	Automotive Electrical and Electronics	A K Babu	Khanna Publication	Second	2018

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Automotive Electricity and Electronics: Classroom Manual	Barry Hollembeak	Delmar, Cengage Learning	Fifth	2010
2	Automobile Mechanical and Electrical Systems	Tom Denton	BH Publication	First	2011
3	Custom Auto Wiring & Electrical	Strong Matt	Penguin Putnam Inc	First	2010
4	Modern Automotive Technology	James E. Duffy	Goodheart-Willcox	Eighth	2014

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Class	T.Y. B. Tech, Sem.-VI
Course Code and Course Title	**1EEOE307, Electrical Economics and Energy Audit**
Prerequisite/s	1EEES103
Teaching Scheme (Lecture/Practical/Tutorial)	03/00/00
Credits	03
Evaluation Scheme: ISE I/MSE/ISE II/ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEOE307_1	**Explain** economics of electrical distribution system.
1EEOE307_2	**Describe** economics of various types of power generation.
1EEOE307_3	**Explain** energy audit terms and various instruments for energy audit.
1EEOE307_4	**Use** of illumination for lighting system.
1EEOE307_5	**Illustrate** various ways of energy conservation in applications.
1EEOE307_6	**Analyze** various parameter of energy audit for different systems.

Course Contents:		
Unit 1	**Economics of Electrical Distribution System** Introduction to electrical power Supply System, Electricity Billing, Tariff Structure, Electrical Load Management and maximum Demand control, Power Factor Improvement and Benefits, Distribution losses in industrial System, Demand side Management, Analysis of Electrical Power System.	**06 Hrs**
Unit 2	**Economics of Power Generation** Introduction, Energy sources and their availability, Net metering concept, Present status and future trends in power generation, Economics of Diesel Generator, Economics of Solar Power Generation, Economics of wind Energy, Battery as storage system, Application of Non-Conventional and Renewable Energy Sources	**07 Hrs**
Unit 3	**Energy Conservation in Applications** Introduction, Energy conservation opportunities, Importance of Star Rating a) Motive power (motor and drive system). b)Efficient Pumping system operation (Municipal, Agricultural, Industrial etc) c) Heating systems (boiler and steam systems) c) Ventilation(Fan, Blower, Compressors) and Air Conditioning systems d) Pumping System e) Cogeneration and waste heat recovery systems f) Utility industries (T and D Sector)	**07 Hrs**
Unit 4	**Energy Management & Audit** Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments.	**06 Hrs**
Unit 5	**Lighting System** Introduction, Basic parameters and terms in lightning system, Light source and lamp types, Recommended Illumination for various tasks/activities/locations, Method for calculating IL luminance – Lighting design for Interiors, General energy Saving Opportunities, Energy efficient lightening controls. Lightning Case study. Energy conservation in Buildings: Energy Conservation Building Codes (ECBC): Green Building, LEED rating.	**07 Hrs**

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Unit 6	**Financial Management and Case Studies** Investment-need, Appraisal and criteria, Financial analysis techniques-Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis; Financing options, Energy performance contracts and role of ESCOs. Energy audit case studies such as IT sector, Textile, Municipal corporations, Educational Institutes, T and D Sector and Thermal Power stations.	**09 Hrs**

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Energy Management, Audit and Conservation	Barun Kumar	Vriand Publication	Second	2007
2	Generation and utilization of Electrical Energy	B.R. Gupta	S. Chand Publication	First	1983
3	Energy Auditing made simple	Balasubramanian	Bala Consultancy Services	Second	2013

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Success stories of Energy Conservation	Bureau of Energy Efficiency Bureau of Energy Efficiency	Bureau of Energy Efficiency Bureau of Energy Efficiency -	----	2020
2	Energy Management	W.R. Murphy and Mackay Reed	Elsevier India Private Limited	Second	2009
3	Utilization of electrical energy	S.C. Tripathi	Tata McGraw Hill	First	1991

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Department of Electrical Engineering

Class	T.Y. B. Tech, Sem.-VI
Course Code and Course Title	**1EEPC310, Electrical Machines and Power System Design**
Prerequisite/s	1EEPC209, 1EEPC210, 1EEPC304
Teaching Scheme: Lecture/Tutorial/Practical	02/01/00
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC310_1	**Identify** the various materials use for Electrical Machines.
1EEPC310_2	**Create** the various parts of the single and three phase Transformers.
1EEPC310_3	**Develop** the various parts of the DC Machines and Induction Motors
1EEPC310_4	**Discuss** the various cooling methods use for the Electrical Machines
1EEPC310_5	**Draft** the Regulator, Starters and Control panels for the Particular System.
1EEPC310_6	**Layout** the various parts of Substation.

Course Contents:		
Unit 1	**Basic Design concept :** Limitations of design, modern trends in design of electrical machines, Electrical properties of conducting, magnetic and Insulating Materials and its Classifications, Reasons for generation of heat in electrical machines. Concept of load and no load losses, Heating and cooling of electrical machines, Specific magnetic and electric loading and their choice, Effect of type and quality of insulation on limits of allowed temperature rise and life of machine, Output coefficient of DC and AC machine, Factor affecting size of machines	**05 Hrs.**
Unit 2	**Design of Transformers** Core design Winding design ,Window area ,Problem design of single phase transformer for 230V 50hz supply to deliver (3 to 5) amp at (12 to 50) volt Design Parameter of Three Phase Transformer ,Power and distribution transformer from design point of view, Specifications-Rating and performance expectation, Output equation. Choice of Specific magnetic and electric loading, Core losses and copper losses, Design of core, winding and main dimensions of frame, Electrical parameter -resistance, reactance, Magnetizing current, Design criteria for tank, Procedural steps for design of transformer	**05 Hrs.**
Unit 3	**Design of DC Machines** Introduction & Applications, classification, Constructional Details, Stator, Armature, Commutator, Brush Gear, Design output Equation, Interdependence of specific &Electrical loadings, Selection of no of poles, Core Length, Armature diameter, Length of air gap, No of Armature coils, No of Armature Slots, Cross Section of Armature Conductors, Insulation of armature winding, Slots Dimensions, Poles Design (Area of poles, Height of Poles), length ofInter poles, Losses & Efficiency (Rotational Losses, Cu. Losses Stray load losses, Efficiency).Design of commutator and brush	**05 Hrs.**
Unit 4	**Design of Induction Motor** Single phase induction motor - Design considerations and specification, Material of core, conductor and insulation, Design of core diameter and axial length, Choice of air gap, number of stator slots, rotor slots. ,Design of main winding, Maximum torque, Reactance, Procedural steps for designing capacitor start	**05 Hrs.**

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	induction run motor, Sample examples Three phase induction motor - Basic consideration for design, Frame, Rating, Duty and rating. ,Temperature rise, Output equation, choice of specific electric loading, Relation between L and D for best power factor, Procedural steps for design of a 3 Phase Squirrel Cage Induction	
Unit 5	**Design Parameters of Starters, Field Regulator and Control Panel** Design parameters of choke, Design parameters of A.C. and D.C. motor starters, Design parameters of Field regulator, Design of general purpose control panels	**04 Hrs.**
Unit 6	**Design of Substations** CT/ VT sizing calculations, lighting system design calculations, Grounding system design calculations. Lightning (shielding) protection layout and details, Indoor/outdoor lighting layout details, Small power distribution layout details, Floor opening – switchgear control building layout details.	**04 Hrs.**

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	A Course in Electrical Machine Design	A.K. Sawhney,	DhanpatRai& sons New Delhi	Sixth	2006
2	Theory and Performance and Design of A.C. Machines	M.G. Say,	ELBS London	Third	1992
3	Principles of Electrical Machine Design,	R. K. Agarwal	S. K. Katariya and sons.	Fifth	2014
4	Substation Design and Equipment	Satnam P.S.	Dhanpat Rai & Sons,	Third	2012

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Computer Aided Electrical Drawing	M. Yogesh, B. S. Nagaraja, N. Nandan	PHI Learning	First	2014
2	Electrical Machine Design Data	A Shanmugasundaram, G. Gangadharan, R. Palani,	Wiely Eastern Ltd., New Delhi	Third	2003
3	Computer Aided Design for Electrical Machines	K.M. Vishnu Murthy	B.S. Publications.	First	2008
4	Design for Electrical Machines	V.N.Mittle	Standard Publisher, New Delhi	Third	1992

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Class	T.Y. B. Tech, Sem.-VI
Course Code and Course Title	**1EEES311, Microcontroller and Its Applications**
Prerequisite/s	1EEPC211
Teaching Scheme: Lecture/Tutorial/Practical	04/00/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEES311_1	**Outline** architecture and basic concepts in microcontroller.
1EEES311_2	**Interface** external peripherals with 8051 microcontroller to run various applications
1EEES311_3	**Write** assembly language program for given application of 8051.
1EEES311_4	**Choose** an advanced and efficient microcontroller for a given application.
1EEES311_5	**Design** circuit for a microcontroller based application.
1EEES311_6	**Develop** an algorithm for advanced microcontrollers to execute a given application.

Course Contents		
Unit 1	**Microcontroller Architecture** Introduction to microcontroller, comparison of microprocessor and microcontroller, features of microcontroller, block diagram, architecture of 8051, pin configuration, 40 pin dip of 8051, I/O ports, serial port, timer / counter, interrupt structure, Special Function Registers (SFRs), code memory and data memory, stack and stack pointer.	**12 Hrs.**
Unit 2	**Assembly language programming- I** **Addressing modes and instruction set** – assembler directives, data transfer, logical, arithmetic, jump and call, stack and machine cycle control instructions, **Simple assembly language programming examples-** delay generation, square wave, shift block, numbers sorting, and Fibonacci series.	**10 Hrs.**
Unit 3	**Assembly language programming- II** I/O port programming, serial communication programming, timer/counter programming, interrupts and ISRs programming	**06 Hrs.**
Unit 4	**Microcontroller Interfacing Applications** Switch, push button, Relay, ADC 0808, DAC 0809, LCD, 7-Segment LED display, Automatic power factor controller, DC Motor Interfacing, Stepper Motor Interfacing, Weighing Balance, Temperature Controller.	**09 Hrs.**
Unit 5	**Advanced Microcontrollers- I** **ARM Controller** The RISC design philosophy, ARM design philosophy, embedded system hardware- AMBA Bus protocol, embedded system software- applications. **PIC Microcontrollers** PIC16 Microcontrollers, block diagram, PIC16 MCU configuration, peripherals, serial interfaces	**09 Hrs.**
Unit 6	**Advanced Microcontrollers-II** **Arduino** Introduction to Arduino Pin configuration and architecture. Device and platform features. Concept of digital and analog ports. Familiarizing with the Arduino Interfacing Board. Introduction to Embedded C and Arduino platform	**10 Hrs.**

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	16-bit Microcontrollers XC164 On-chip system architecture, block diagram, CPU, Program Management Unit (PMU), Data Management Unit (DMU), Interrupt and PEC system structure, block diagram, External Bus Controllers (EBC)	

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Microcontroller: Theory and Applications	Ajay Deshmukh	Tata McGraw-Hill	Fifth	2006
02	8051 Microcontroller: Hardware, Software and Applications	V Udayshankara, M S MallikarjunaSwamy	McGraw-Hill Education India	Eighth	2014
03	8051 Microcontroller- Internals, Instructions, Programming & Interfacing	SubrataGhoshal	Pearson Publication	First	2014
04	8051 Microcontroller and Embedded Systems	Sampath K Vyankatesh	SK Kataria& Sons	First	2013

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	8051 Microcontroller and Embedded Systems: Using Assembly and C	M. A. Mazidi	Pearson Publication	Second	2008
02	Microcontrollers: Principles & Applications	Ajit Pal	PHI Publications	Second	2008
03	The 8051 Microcontroller	Kenneth Ayala	Cengage Learning	Third	2007
04	C And The 8051	Thomas W Schultz	Wood Island Prints	Fourth	2008

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Class	T.Y. B. Tech, Sem.-VI
Course Code and Course Title	**1EEPE312, Control System Design**
Prerequisite/s	1EEPC208, 1EEPC303
Teaching Scheme: Lecture/Tutorial /Practical	04/00/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE312_1	**Describe** the type of controllers and their effects on system performance
1EEPE312_2	**Compute** the z- transform and the relation between z-domain & s-domain for a digital control system.
1EEPE312_3	**Apply** the different approaches for analyzing nonlinear control systems.
1EEPE312_4	**Design** the compensators in time and frequency domain
1EEPE312_5	**Develop** a controller in state space using various techniques

Course Contents:		
Unit 1	**Introduction to Controllers** Different types of controllers, Effects of controllers on system performance, tuning of PID controller using Ziegler-Nichols method, and modifications of PID control scheme.	**08 Hrs**
Unit 2	**Design of Compensator in Time Domain** Review of Root Locus, concept of Lead, Lag, Lag- Lead Compensator, Design of Lead compensator, Lag compensator, and Lag- Lead compensator based on Root Locus approach.	**10 Hrs**
Unit 3	**Design of Compensator in Frequency Domain** Review of Bode Plot, Design of Lead compensator , Lag compensator, Lag- Lead compensator based on frequency domain approach	**10 Hrs**
Unit 4	**Design of Control Systems in State Space** **Pole placement technique:** Introduction, Controller design, State Feedback Law, Pole placement technique by Transformation Method, Direct Substitution Method and Ackermann's formula. **State Observers**: Introduction, Full Order State Observer, Transformation Approach, Direct Substitution Approach and Ackermann's formula to obtain observer gain matrix	**12 Hrs**
Unit 5	**Digital Control Systems** Introduction, Block diagram of digital control systems, Difference equation, Review of Z-transform, Z-transform Analysis of Sampled Data Control System, Relation between Z domain and S domain.	**08 Hrs**
Unit 6	**Nonlinear Control Systems** Introduction, difference between linear and nonlinear systems, common physical nonlinearities, Approaches for analysis of non-linear systems: Describing Function Analysis-Dead zone and Saturation nonlinearity, Phase Plane Analysis-Concept of phase plane, Phase trajectory, Singular Points.	**08Hr**

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Modern Control Engineering	K. Ogata	Prentice Hall India	Fifth	2010
02	Control System Engineering	Norman Nise	Wiley Publication	Sixth	2013
03	Feedback Control Systems	C.L. Phillips, R.D. Harbor,	Prentice Hall India	Fourth	1999
04	Introduction to Control Engineering: Model, Analysis & Design	A. K. Mandal	New Age International Pulishers	First	2006
05	Advanced Control Theory	Nagoor Kani	RBA Publication	Second	-

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Automatic Control System	Kuo&Golnaraghi	Wiley-India	Ninth	2013
02	Control System Engineering	I.J. Nagrath M. Gopal	New Age International Publication	Fifth	2009
03	Control Systems	N. C. Jagan	B. S. Publications	Second	2008
04	Discrete Time Control Systems	K. Ogata	Prentice Hall International Inc.	Second	1995

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Department of Electrical Engineering

Class	T.Y. B. Tech, Sem.-VI
Course Code and Course Title	**1EEPE313, Electrical Drives**
Prerequisite/s	1EEPC210, 1EEPC303, 1EEPC304, 1EEPC305
Teaching Scheme: Lecture/Tutorial /Practical	04/00/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE313_1	**Discuss** the concepts in electrical drives with respect to steady state and dynamic conditions, nature of load and parts of drives.
1EEPE313_2	**Apply** the knowledge of power electronics converters, electrical machines, and control systems for given applications of AC and DC drives.
1EEPE313_3	**Solve** numerical to find different parameters related to electrical drives.
1EEPE313_4	**Sketch** performance characteristics of rectifier and chopper fed DC Drives.
1EEPE313_5	**Draw** performance characteristics of inverter and Cyclo-converter fed AC Drives.
1EEPE313_6	**Apply** the knowledge of electrical drives for various industrial applications.

Course Contents		
Unit 1	**Electrical Drives: Fundamentals and Dynamics** Drives, Concept of Electrical drive, Classification of Electrical drives, Block Diagram of Electrical Drive, Parts of Electrical drive, Nature of loads and their characteristics, Motor load systems, Dynamic conditions in Electrical drives, Stability of electrical drives	**08 Hrs.**
Unit 2	**DC Drives: AC to DC Converter Fed DC Drives** Introduction, review of dc motors with respect to classification, speed control and electric braking, Single phase half and full controlled converter fed dc motor drives, dc series motor drives, Introduction to four quadrant operation and single phase dual converter fed dc motor drive, Three phase half and full converter fed dc motor drive, four quadrant operation and three phase dual converter fed dc motor drive. Closed Loop Control of Converter fed dc drives.	**11 Hrs.**
Unit 3	**DC Drives: Chopper Fed DC Drives** Introduction, review of chopper operation with respect to its principle, configuration and classification. One, Two and Four quadrant Chopper Fed Separately Excited dc motors drive, Chopper Fed Series dc motors drive. Closed Loop Control of Chopper fed dc drives.	**09 Hrs.**
Unit 4	**AC Drives: Stator Side Control Induction Motor Drives** Introduction, review of types of Three phase induction motors with respect to methods of speed control and torque-speed characteristic, Three phase AC voltage controller fed induction motor drive, Variable Frequency Characteristics, Block Diagram of Variable Frequency Speed Control, V/f control, Voltage Source Inverter (VSI) fed induction motor drive, Closed Loop Control of VSI fed induction motor drive, Current Source Inverter (CSI) fed induction motor drive, Closed Loop Control of CSI fed induction motor drive, comparison of VSI and CSI drives.	**12 Hrs.**

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Unit 5	**AC Drives: Rotor Side Control Induction Motor Drives** Introduction, Conventional Rotor Resistance Control, Rotor Resistance Control using power converters, Concept of Slip Power Recovery, Slip Power Recovery Schemes, Static Kramer drive, Static Scherbius drive. Special Purpose Electric Motor Drives: Introduction to Synchronous Motor Drives, SRM Drives, BLDC Motor Drives	**10 Hrs.**
Unit 6	**Advanced Topic in Electrical Drives** Battery powered drives for vehicles, Configurations of EV, Performance of EV, Concept of hybrid electric drive trains, architecture of HEV drive trains, design the converter for given application. (Electrical Vehicle, electric drive trains)	**06 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fundamentals of Electrical Drives	G. K. Dubey	CRC Press	Second	2002
02	Electric Drives	N. K. De, P. K. Sen	PHI, Delhi	Third	2007
03	Electric Drives: Concepts & Applications	Vedam Subrahmanyam	Tata Mc-Graw Hill	Second	2011
04	Power Semiconductor Drives	S. Sivanagaraju, M. B. Reddy, A. M. Prasad	PHI, Delhi	Second	2009
05	Modern Electric, Hybrid Electric and Fuel Cell Vehicles	Meherdad Ehsani, Yimin Gao, Sabestien E Gay, Ali Emadi	CRC Press	First	2016

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Power Electronics: Converters, Applications & Design	Ned Mohan	Wiley Publications	Third	2003
02	Power Electronics & Variable frequency drives: Technology & applications	Dr. B. K. Bose	Wiley Publications	First	1996
03	Principles of Electric Machines & Power Electronics	P. C. Sen	Wiley Publications	Second	2013
04	Electric and Hybrid Vehicles	Iqbal Husain	CRC Press	Second	2010
05	Power Electronics: Circuits, Devices, and Applications	M. H. Rashid	Prentice Hall	Third	2003

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Department of Electrical Engineering

Class	T.Y. B. Tech, Sem.-VI
Course Code and Course Title	**1EEPE314, Power System Dynamics and Control**
Prerequisite/s	1EEPC209, 1EEPC308
Teaching Scheme: Lecture/Tutorial /Practical	04/00/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE314_1	**Describe** fundamental concepts in power system stability and control.
1EEPE314_2	**Explain** appropriate method to improve power system stability.
1EEPE314_3	**Model** power system components to study the system performance.
1EEPE314_4	**Solve** numerical on dynamics of synchronous machine, power system control and economical load dispatch.
1EEPE314_5	**Derive** the equations for optimal operation of generation dispatching schemes for thermal and hydro units.
1EEPE314_6	**Examine** stability of power system by numerical and graphical solution technique under different contingencies.

Course Contents:		
Unit 1	**Introduction to Power System Stability & Control** Introduction to power system stability, classification power system stability, relationship between reliability, security, and stability, dynamics of synchronous machine (swing equation), power angle equation, node elimination technique.	**06 Hrs.**
Unit 2	**Power System Stability** Simple systems- machine connected to infinite bus, two machine systems, steady state stability, transient stability, factors affecting transient stability, equal area criteria- sudden change in mechanical input, effect of clearing time on stability, sudden loss of one of parallel lines, sudden short circuit on one of parallel lines, numerical solution of swing equation by point by point method.	**12 Hrs.**
Unit 3	**Methods of Improving Stability** Introduction, transient stability enhancements:- high speed fault clearing, reduction of transmission system reactance, regulated shunt compensation, dynamic braking , reactor switching, controlled system separation & load shedding, high speed excitation & control, discontinuous excitation control, small signal stability enhancement-power system stabilizers, supplementary control of SVC, methods of improving voltage stability.	**08 Hrs.**
Unit 4	**Power System Control** Introduction, load frequency control (single area case) – turbine speed governing system, model of speed governing system, turbine model, generator load model, complete block diagram representation of load frequency control of an isolated power system, steady state analysis, dynamic response, control area concept, PI-LFC, load frequency control and economic dispatch control, automatic voltage control.	**10 Hrs.**

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Unit 5	**Economic Operation and Security of Power Systems** Introduction, generator operating cost, performance curves, load forecasting, optimal unit commitment- economic load dispatch neglecting losses, economic load dispatch including generator limits, economic load dispatch including losses, Challenges to secure operation of today's power systems, comprehensive approach to system security, system state classification, security analysis, contingency analysis, sensitivity factors	**12 Hrs.**
Unit 6	**Major grid blackouts: analysis, classification, and prevention** Introduction, Description of Some Previous Blackouts, Analysis of Blackouts, Economical and Social Effects, Recommendations for Preventing Blackouts, On Some Defense and Restoration Actions, Survivability/vulnerability of Electric Power Systems, Conclusions. **Restoration processes after blackouts:** Introduction, Overview of The Restoration Process, Black-Start-Up Capabilities of Thermal Power Plant: Modeling and Computer Simulations, Description of Computer Simulators, Concluding Remarks	**08 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Modern Power System Analysis	D.P.Kothari, I.J. Nagrath	Mc-Graw Hill Publications	Fourth	2011
02	Handbook of Electrical Power System Dynamics: Modeling, Stability, and Control	Mircea Eremia (Editor), Mohammad Shahidehpour (Editor)	Wiley-IEEE Press	First	2013
03	Power System Stability and Control	Prabha Kundur	TMH Publications.	Second	1994
04	Power System Dynamics	KR Padiyar	BS Publications	Second	2008
05	Power System Analysis	Hadi Saadat	Tata Mc-Graw Hill	First	2002
06	Power System Operation and Control	Dr. K Uma Rao	Wiley India Publication	First	2012

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Power System Analysis	Grainger John J and W D Stevenson	McGraw Hill	First	1994
02	Power System Analysis and Design	J. Duncan Glover and Mulukuta S. Sarma	Prentice Hall	Third	2002
03	Power Generation, Operation And Control	Allen J Wood, Wollenberg	Wiley India	Second	1996
04	Power System Analysis	A.R. Bergen and Vijay	Pearson	Second	2009

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Class	T.Y. B. Tech, Sem.-VI
Course Code and Course Title	**1EEPE315, Digital Signal Processing**
Prerequisite/s	1EEPC208, 1EEPC211
Teaching Scheme: Lecture/Tutorial/ Practical	04/00/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE315_1	**Compute** DFT and IDFT of various signals using its properties
1EEPE315_2	**Describe** modern signal processing tools
1EEPE315_3	**Apply** the knowledge of DFT to find the computational complexity and convolution for long duration sequences.
1EEPE315_4	**Use** fast and efficient algorithms for computing DFT, IDFT and FFT of a given sequence
1EEPE315_5	**Construct** the structures of FIR & IIR filters in different forms.

Course Contents:		
Unit 1	**Discrete-time Signals and Systems** Introduction to DSP system, Representation of Discrete time signals, Classification of Discrete time signals, Operations on signals, Classification of Discrete time systems, Sampling and aliasing, Advantages and limitations of DSP, Application of DSP	**06 Hrs.**
Unit 2	**The Discrete Fourier Transform** Introduction, DFT, Linear convolution, Circular convolution, Methods to evaluate circular convolution, Comparison between Circular and Linear convolution algorithm, Filtering long duration sequence- overlap-save and overlap add-method	**10 Hrs.**
Unit 3	**The Fast Fourier Transform** Introduction to FFT, Twiddle factor, Radix-2 DIT- FFT algorithm for the computation of DFT, IDFT using FFT algorithm – decimation-in-time and decimation-in-frequency algorithms, Circular convolution using FFT.	**10 Hrs.**
Unit 4	**IIR Filter Design** Structure for IIR Systems: Direct form, Cascade form, Parallel form structures. IIR filter design: Characteristics of commonly used analog filters – Butterworth and Chebyshev filters, Frequency transformations in analog domain, Design of IIR Filters using impulse invariance technique and Bilinear transformation.	**10 Hrs.**
Unit 5	**FIR Filter Design** Fourier series method of designing FIR filters, Design of FIR filters using window - Rectangular, Hanning, Hamming, Realization of FIR filters.	**10 Hrs.**
Unit 6	**Modern Trends in Digital Signal Processing** Digital Signal Processors- Introduction, Architecture of TMS320C50, Multirate Signal Processing and introduction to Wavelet Transform	**10 Hrs.**

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Digital Signal Processing Principles, Algorithms and Applications	John G, Proakis	Pearson Education	Second	2008
2	Digital Signal Processing	SanjeetMitra	TMH Pub.	First	2006
3	Digital Signal Processing	Dr P Ramesh Babu	Scitech Publications	Third	2011
4	Understanding Digital Signal Processing	Richard G. Lyons.	Prentice-Hall	Third	2010

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Discrete Time Signal Processing	Oppenheim and R. W. Schafer	PHI Pub.	First	2005
2	Digital Signal Processors	Venkatramani, Bhaskar	TMH Pub.	First	2006
3	Wavelet Transform	Raghuveer Rao, Bopardikar,	Pearson Education	First	2000
4	Digital Signal Processing	Alan V. Oppenheim, Ronald W. Schafer	Prentice-Hall	second	2011

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Class	T. Y. B. Tech. Sem. –VI
Course Code and Course Title	**1EEPE316, Electric Vehicles and Smart Grid**
Prerequisite/s	1EEPC210, 1EEPC303, 1EEPC304, 1EEPC305
Teaching Scheme: Lecture/Tutorial/Practical	04/00/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE316_1	**Explain** vehicle mechanics & impact on environment of traditional transportation system. (K^2)
1EEPE316_2	**Describe** suitable energy storage & regeneration system for Electric Vehicles (K^2)
1EEPE316_3	**Discuss** implementation of chagrining facility for electric vehicles(K^2)
1EEPE316_4	**Select** appropriate propulsion system for Electric Vehicles (K^3)
1EEPE316_5	**Identify** impact of electric vehicles on power grid (K^3)

Course Contents:		
Unit 1	**Environmental Impact and Vehicle Fundamentals** Petroleum resources, induced cost, air pollution, global warming, , importance of different transportation development, history of electric and hybrid electric vehicles, general description of vehicle movement vehicle resistance, power train tractive effort and vehicle speed, vehicle performance, operating fuel economy, braking performance	**08Hrs.**
Unit 2	**Electric Propulsion Systems** DC Motor Drives- Principle of operation and performance, combined armature and voltage control, chopper control of DC motor drives, Induction motor drive- Basic operating principle, Volt/hertz control, power electronic control, field oriented control, BLDC motor drive- Basic principle, Control of BLDC drive, SRM drive- SRM drive controller, Modes of operation	**10 Hrs.**
Unit 3	**Energy Storage and Regeneration** Electrochemical batteries and its types- Electrochemical reaction, thermodynamic voltage, specific energy, power , efficiency, applications of different battery technologies in EV and HEV, Battery Management System **Ultra capacitors-** Features, Basic operating principle, Performance, applications of different ultra capacitor technologies in EV and HEV **Ultra high speed flywheels-** operating principle, power capacity, applications of different flywheel technologies in EV and HEV Fundamentals of regenerative braking- Energy consumption in braking, braking power and energy on front and rear wheels, brake system for EV and HEV	**10 Hrs.**
Unit 4	**Electric Vehicles (EV)** Configurations of EV, Performance of EV, Traction motor characteristics, tractive effort and transmission requirement, vehicle performance, tractive effort in normal driving, energy consumption, Concept of hybrid electric drive trains, architecture of HEV drive trains, series hybrid, parallel hybrid- Torque coupling	**10 Hrs.**

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	drive trains, speed coupling drive trains, speed and torque coupling drive trains.	
Unit 5	**Electric Vehicles in Smart Grid** Identification of EV demand, EV penetration level for different scenarios, classification based on penetration level, EV impacts on system demand Impact of charging strategies, Impact of EV charging on power grid, effect ofEV charging on generation and load profile	**10 Hrs.**
Unit 6	**EV Charging Facility Planning** EV charging options and infrastructure,Smart charging technologies,Energy generation scheduling, different power sources, fluctuant electricity, centralized charging schemes, decentralized charging schemes, energy storage integration into Micro grid, Design of V2G Aggregator.	**08 Hrs**

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Modern Electric, Hybrid Electric and fuel cell vehicles	MehrdadEhsani, Yimin Gao	CRC Press	First	2005
2	Electric and Hybrid Vehicles	Iqbal Husain	CRC Press	Second	2010
3	Electric Vehicle Technology Explained	James Larminie, John Lowry	Wiley	First	2003
4	Smart Grid: Technology and Applications	JanakaEkanayake, Kithsiri Liyanage, et.al.	Wiley	First	2012

Reference Books

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Fundamentals of Electrical Drives	G. K. Dubey	CRC Press	First	2002
2	How Your Car Works: Your Guide to the Components & Systems of Modern Cars, Including Hybrid & Electric Vehicles	Arvid Linde	Rac Handbook	Second	2011
3	Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives	Chris Mi, M. Abul Masrur and David Wenzhong Gao	Willey Publications	Second	2011
4.	Smart Grid: Fundamentals of Design and Analysis	James Momoh	A John Wiley & Sons, Inc. Publication	First	2012

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Department of Electrical Engineering

Class	T.Y. B. Tech, Sem.-VI
Course Code and Course Title	**1EEPE317, Analog and Digital Communication**
Prerequisite/s	1EEES108, 1EEPC203, 1EEPC211
Teaching Scheme: Lecture/Tutorial/ Practical	04/00/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE317_1	**Explain** the types and differences between analog and digital modulation techniques.
1EEPE317_2	**Apply** different analog and digital modulation schemes for signal transmission..
1EEPE317_3	**Select** the appropriate method of error detection and error correction for data transmission
1EEPE317_4	**Understand** various pulse modulation techniques for different pulse communication system
1EEPE317_5	**Discuss** various error detection and correction codes for digital signal transmission.
1EEPE317_6	**Analyze** the performance of modern communication systems such as 2G, 3G and 4G cellular wireless communication systems.

Course Contents:		
Unit 1	**Introduction to Analog Communication system** Noise: Source of Noise – External Noise- Internal Noise- Noise Calculation. Introduction to Communication Systems: Modulation – Types – Need for Modulation. Theory of Amplitude Modulation – Evolution and Description of SSB Techniques – Theory of Frequency and Phase Modulation – Comparison of various Analog communication (AM – FM – PM)..	**10 Hrs.**
Unit 2	**Digital communication system** Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) Minimum Shift Keying (MSK) –Phase Shift Keying (PSK) – BPSK – QPSK – 8 PSK – 16 PSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital communication system (ASK – FSK – PSK – QAM)..	**10 Hrs.**
Unit 3	**Data Communication** Data Communication: History of Data Communication – Standards Organizations for Data Communication- Data Communication Circuits – Data Communication Codes – Error Detection and Correction Techniques – Data communication Hardware – serial and parallel interfaces.	**08 Hrs.**
Unit 4	**Pulse Communication** Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) – Comparison of various Pulse Communication System (PAM – PTM – PCM).	**08 Hrs.**
Unit 5	**Source And Error Control Coding** Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, channel coding theorem, Error Control Coding, linear block codes, cyclic codes, convolution codes, viterbi decoding algorithm.(Numerical Expected)	**10 Hrs.**

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Unit 6	**Multi-User Radio Communication** Advanced Mobile Phone System (AMPS) – Global System for Mobile Communications (GSM) – Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse – Channel Assignment and Hand – Overview of Multiple Access Schemes – Satellite Communication – Bluetooth.	**10 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Advanced Electronic Communication Systems	Wayne Tomasi	Pearson Education	Sixth	2009
2	Modern Analog and Digital Communication Systems	B. P.Lathi	Oxford University Press	Third	2007
3	Wireless Communications: Principles and Practice	Rappaport T.S	Pearson Education	Second	2007
4	Digital Communication Fundamentals and Applications	B.Sklar	Pearson Education	Second	2007

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Communication Systems	Simon Haykin	John Wiley & Sons	Fourth	2004
2	Principles of Communication	H.Taub, D L Schilling and G Saha	Pearson Education	Third	2007
3	Analog and Digital Communication System	Martin S.Roden	Prentice Hall of India	Third	2002
4	An Introduction to Analog and Digital Communications	Simon Haykin , Michael Moher	John Wiley & Sons, Inc	Second	2006

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Class	T.Y. B. Tech, Sem.-VI
Course Code and Course Title	**1EEPC355, Electrical Machine and Power System Design Laboratory.**
Prerequisite/s	1EEPC255, 1EEPC352, 1EEPC354
Teaching Scheme: Lecture/Tutorial/Lab.	00/00/02
Credits	01
Evaluation Scheme: ISE /ESE	25/ 50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC355_1	Identify the material to be used for the various parts of Electrical Machines
1EEPC355_2	Design layout for AC Machine, DC Machine & Transformer Using AutoCAD
1EEPC355_3	Develop AC & DC Winding by using AutoCAD
1EEPC355_4	Develop layout Substation party by using AutoCAD
1EEPC355_5	Prepare Industrial Visit Report.

List of Experiments:

Expt. No.	Title of Experiment
1	Identify the Various Parts of Electrical Machines
2	Introduction to AutoCAD software for Electrical Machines Design
3	Details and layout of DC Wave winding with design report using Auto-Cad
4	Details and layout of DC Lap winding with design report using Auto-Cad
5	Details and layout of AC winding with design report using AutoCAD
6	Design of HV and LV Windings OF Transformer by using AutoCAD
7	Details and Complete layout on core type Three Phase Transformer with design report
8	Complete layout on core type Three Phase Transformer using AutoCAD
9	Complete layout on Start-delta Starter by using AutoCAD
10	Details and Complete Layout of Squirrel cage Induction Motor with design report
11	Details and Complete Layout of Slip-Ring Induction Motor with design report
12	Draw Single Line diagram of substation & shows the position of CT, PT, Isolating Switches, Lightning arrestor, CB.
13	Draw Earthling diagram of Power Substation using AutoCAD
14	Report based on Industrial visit to a manufacturing unit. (Transformer or Induction motor)

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Class	T.Y. B. Tech, Sem.-VI
Course Code and Course Title	**1EEES356, Microcontroller and Its Applications Laboratory**
Prerequisite/s	1EEPC256
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE/ ESE	25/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEES356_1	**Develop** programming logic by writing instructions sequentially
1EEES356_2	**Execute** a given program in Kiel software environment.
1EEES356_3	**Demonstrate** peripheral interfacing applications with microcontroller
1EEES356_4	**Simulate** a microcontroller based system in Proteus software
1EEES356_5	**Follow** professional ethics and responsibilities during conduction of lab sessions

List of Experiments

Expt. No.	Title of Experiment
1	Data transfer between IO ports
2	Assembly language programming of arithmetic and logic operations
3	Push button / key interfacing for LED f lashing / running
4	7 segment display interfacing with microcontroller
5	LCD interfacing to microcontroller
6	ADC interfacing to microcontroller
7	DAC interfacing to microcontroller
8	RTC interfacing to microcontroller
9	ON – OFF temperature controller
10	Design of automatic power factor controller
11	DC Motor interfacing to microcontroller
12	Stepper Motor interfacing to microcontroller

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Class	T.Y. B. Tech, Sem.-VI
Course Code and Course Title	**1EEPE357, Control System Design Laboratory**
Prerequisite/s	1EEPC351, 1EEES257
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE / ESE	25/00

Course Outcomes (COs) Upon successful completion of this course, the student will be able to:	
1EEPE357_1	**Obtain** the responses of lead compensators and lag compensators.
1EEPE357_2	**Determine** controller and observer gain in state space by using MATLAB.
1EEPE357_3	**Demonstrate** the effect of controllers on system performance.
1EEPE357_4	**Communicate** effectively about laboratory work orally and through writing journals.
1EEPE357_5	**Practice** professional and ethical behavior to carry forward in their life.

List of Experiment:

Expt. No.	Title of Experiment
1	Effect of controllers on system performance.
2	Design of lead compensator using Root Locus Method.
3	Design of lag compensator using Root locus Method.
4	Design of lead compensator using Bode Plot Method.
5	Design of lag compensator using Bode Plot Method.
6	Design of pole placement by using MATLAB.
7	Design of observer by using MATLAB.
8	Design of PID Controller for speed control of DC Motor System.
9	Simulation kit to study effect of compensation.
10	Nonlinear system simulation using Mat labSimulink.

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Annasaheb Dange College of Engineering and Technology, Ashta

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Department of Electrical Engineering

Class	T.Y. B. Tech, Sem.-VI
Laboratory Course Code and Course Title	**1EEPE358, Electrical Drives Laboratory**
Prerequisite/s	1EEPC255, 1EEPC351, 1EEPC352, 1EEPC353
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE/ESE	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE358_1	**Apply** the knowledge of power electronics converter to control DC Drives.
1EEPE358_2	**Implement** ASD and VSD to control speed & frequency of Induction Motor Drives.
1EEPE358_3	**Perform** individually and in a team to learn the practices inElectrical Drives & Control Library
1EEPE358_4	**Simulate** the simple models of drive using MATLAB Simulink browser.
1EEPE358_5	**Follow** professional ethics and responsibilities during conduct of laboratory practice

List of Experiment:

Expt. No.	Title of Experiment
1	Four Quadrant operation of Electrical Drives
2	DC Drive Trainer to observe modes of operation and dynamic braking of DC Machine.
3	1-phase half converter to fed DC Drives
4	1-phase full converter to fed DC Drives
5	3-phase full converter to fed DC Drives and draw the characteristics.
6	Chopper to control DC series motor Drive
7	Chopper Controller using MOSFET/IGBT to control DC motor
8	3-Phase IM Controller to control speed of IM using (V/f) scheme.
9	3- Phase IM Speed Control by SPR scheme
10	One Quadrant Chopper fed DC drives- MATLAB Simulation
11	Two quadrant Rectifier fed DC drive- MATLAB Simulation
12	Six step VSI induction motor drive- MATLAB Simulation

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Department of Electrical Engineering

Class	T.Y. B. Tech, Sem.-VI
Course Code and Course Title	**1EEPE359, Power System Dynamics & Control Laboratory**
Prerequisite/s	1EEPC351, 1EEPC354, 1EEES257
Teaching Scheme: Lecture/Tutorial /Practical	00/00/02
Credits	01
Evaluation Scheme: ISE/ESE	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE359_1	**Evaluate** the parameters for dynamic operation and optimal power flow operation in power system
1EEPE359_2	**Sketch** the response of synchronous machine, ALFC and AVR under disturbances.
1EEPE359_3	**Use** modern tools/software (like MATLAB/POWER WORLD SIMULATOR/ ETAP) to find response of synchronous machine, ALFC and AVR under disturbances
1EEPE359_4	**Communicate** effectively about laboratory work both orally and in writing journals
1EEPE359_5	**Practice** professional and ethical behavior to carry forward in their life

List of Experiment

Expt. No.	**Name of the Experiment** Following Experiments are performed on MATLAB/Simulink/ETAP
1	Dynamics of synchronous machine.
2	Swing Equation in Simulink
3	Dynamics of synchronous machine using Point-by-Point Method.
4	The power angle curve of SMIB system under transient instabilities.
5	The natural response of the rotor angle and frequency of SMIB system under small disturbance.
6	Equal area criteria to sudden change in power.
7	Step response of automatic load frequency control (ALFC) system of single area case.
8	The step response of the automatic voltage regulator (AVR) of a generator.
9	The optimal dispatch and the total cost in Rs/h of three thermal plants by neglecting line losses and generator limits.
10	Step response of automatic load frequency control (ALFC) system of two area case
11	Study of role of load dispatch center.
12	Design working prototype model of any one of method of improving stability in a group.

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Department of Electrical Engineering

Class	T.Y. B. Tech, Sem.-VI
Course Code and Course Title	**1EEPR360, Mini Project**
Prerequisite/s	1EEPC252, 1EEPC257,1EEES356
Teaching Scheme: Lecture/Tutorial/Practical	00/00/04
Credits	02
Evaluation Scheme: ISE / ESE	75/00

Course Outcomes (COs):

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

1EEPR360_1	**Explain** the theme of mini project.
1EEPR360_2	**Illustrate** the facts and ideas by giving description with stating ideas.
1EEPR360_3	**Examine** and break information into parts by identifying motives
1EEPR360_4	**Evaluate** the defend theme by making judgments about information, validity of ideas, or quality of work based on a set of criteria.
1EEPR360_5	**Build** by combining elements in a new pattern or proposing alternative solutions by creating something innovative.

Course Contents:

- Students should form group of three to four students in respective class.
- Selection of mini project must be based on resent technology, innovative ideas, useful for society, etc.
- Mini project should be a working model based the level of their knowledge, understanding and practices.
- Continuous evaluation of mini project will be through presentation, demonstration and report writing.
- Assessment of Mini project will be done by a panel of three examiners appointed by DAC.
- Participation in various competitions like project competition, paper & poster presentation etc., will be consider for evaluation.

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Department of Electrical Engineering

B. Tech. Semester- VII

Course Code	Course	Teaching Scheme				Evaluation Scheme				
						Scheme	Theory (Marks)		Practical (Marks)	
		L	T	P	Credits		Max	Min. for Passing	Max	Min. for Passing
1##OE###	Open Elective- III	3	-	-	3	ISE - I	10	--	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPC403	Switchgear & Protection	3	-	-	3	ISE - I	10	-	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPC404	High Voltage Engineering	3	-	-	3	ISE - I	10	--	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEHS405	Economics for Engineers	2	-	-	2	ISE - I	10	--	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPE4**	Professional Elective-III	3	-	-	3	ISE - I	10	--	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPC451	Switchgear & Protection Laboratory	-	-	2	1	ISE	--	--	25	10
						ESE	POE		50	20
1EEPC452	High Voltage Engineering Laboratory	-	-	2	1	ISE	--	--	25	10
1EEPE4**	Professional Elective-III Laboratory	-	-	2	1	ISE	--	--	25	10
1EEPR456	Internship / Industrial Training	-	-	-	1	ISE	--	--	25	10
1EEPR457	Project Phase – I	-	-	4	4	ISE	--	--	100	40
						ESE	POE		50	20
		14	**-**	**10**	**22**	--	**500**	--	**300**	--
Total Contact Hours/Week: 24 hrs										

Course Category	HS	BS	ES	PC	PE	OE	PR
Credits	02	--	--	08	04	03	05
Cumulative Sum	07	20	32	64	13	09	07

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- **Professional Elective –III**

Sr. No.	Course Code	Professional Elective –III	Sr. No.	Laboratory Course Code	Professional Elective - III Laboratory
1	1EEPE406	Industrial Automation and SCADA	1	1EEPE453	Industrial Automation and SCADA Laboratory
2	1EEPE407	Embedded System	2	1EEPE454	Embedded Systems Laboratory
3	1EEPE408	Computer Methods in Power Systems	3	1EEPE455	Computer Methods in Power Systems Laboratory

- **[1##OE###] Open Elective – III**

➢ **Open Elective-III (Semester-VII)**		
Courses Code	**Course Name**	**Department**
1AEOE421	Air Traffic Control and Airport Design	Aeronautical Engineering
1AEOE422	Aircraft General Engineering Maintenance	
1AEOE423	Design of Fixed wing unmanned aerial vehicles	
1AUOE401	Vehicle maintenance and safety	Automobile Engineering
1AUOE402	Vehicle Aerodynamics	
1CVOE401	Structural Auditing	Civil Engineering
1CVOE402	Disaster Management	
1CSOE401	Introduction to image processing and computer vision	Computer Science and Engineering
1CSOE402	Introduction to machine learning	
1EEOE401	Electric Vehicles	Electrical Engineering
1EEOE402	Wind and Solar Energy Systems	
0FTOE411	Process Optimization	Food Technology
0FTOE412	Cold Storage and Supply Chain Management	
1MEOE401	Total Quality Management	Mechanical Engineering
1MEOE402	Reliability engineering	
1MEOE403	Renewable Energy Engineering	

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Department of Electrical Engineering

B. Tech. Semester- VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme				
						Scheme	Theory (Marks)		Practical (Marks)	
		L	T	P	Credits		Max	Min. for Passing	Max	Min. for Passing
1EEHS409	Project Management and Finance	2	-	-	2	ISE - I	10	--	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPE4**	Professional Elective-IV	4	-	-	4	ISE - I	10	--	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPE4**	Professional Elective-V	4	-	-	4	ISE - I	10	--	--	--
						MSE	30		--	--
						ISE - II	10		--	--
						ESE	50	20	--	--
1EEPR458	Project Phase- II / Internship	-	-	16	8	ISE	--	--	100	40
						ESE	POE		100	40
	Total	**10**	**-**	**16**	**18**	--	**300**	--	**200**	--
Total Contact Hours/Week:26 hrs										

Course Category	HS	BS	ES	PC	PE	OE	PR
Credits	02	--	--	--	08	--	08
Cumulative Sum	09	20	32	64	21	09	15

Cumulative Sum of Credits- 170

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- **Professional Elective -IV**

Sr. No.	Course Code	Professional Elective -IV
1	1EEPE410	Energy Storage Systems
2	1EEPE411	Industrial Drives
3	1EEPE412	FACTS

- **Professional Elective -V**

Sr. No.	Course Code	Professional Elective -V
1	1EEPE413	Power Quality Issues and Mitigation
2	1EEPE414	Electrical Installation, Testing and Maintenance
3	1EEPE415	HVDC Systems

- **Comparison of AICTE & Institute Curriculum**

Course Category	HS	BS	ES	PC	PE	OE	PR	Total
AICTE	12	26	20	53	18	18	11	158
Department of Electrical Engineering	09	20	32	64	21	9	15	170
AICTE (%)	7.5	16.4	17.0	33.5	11.4	11.4	6.9	100
Department of Electrical Engineering (%)	5.2	11.7	19.0	38.0	12.3	5.2	8.8	100

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Annasaheb Dange College of Engineering and Technology, Ashta

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Department of Electrical Engineering

Class	B. Tech. Semester - VII
Course Code and Course Title	**1EEOE401, Electric Vehicles**
Prerequisite/s	-
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEOE401_1	**Interpret** vehicle mechanics & impact on environment of traditional transportation system.
1EEOE401_2	**Choose** appropriate propulsion system for Electric and Hybrid Electric Vehicles.
1EEOE401_3	**Select** suitable energy storage & regeneration system for Electric and Hybrid Electric Vehicles.
1EEOE401_4	**Classify** configurations of Electric and Hybrid Electric Vehicles.
1EEOE401_5	**Describe** operating principle and performance characteristics of fuel cell vehicle.
1EEOE401_6	**Discuss** energy management and infrastructure requirement for EV charging.

Course Contents:		
Unit 1	**Environmental Impact and Vehicle Fundamentals** Petroleum resources, induced cost, air pollution, global warming, importance of different transportation development, history of electric and hybrid electric vehicles, general description of vehicle movement vehicle resistance, power train tractive effort and vehicle speed, vehicle performance, operating fuel economy, braking performance	**07 Hrs**
Unit 2	**Propulsion Systems** **IC Engine:** Spark ignited IC engines- Operating principle, operating parameters, Compression ignition IC engines **Electrical Drives:** DC Motor Drives - Principle of operation and performance, combined armature and voltage control, chopper control of DC motor drives, Induction motor drive- Basic operating principle, Volt/hertz control, power electronic control, field-oriented control, BLDC motor drive- Basic principle, Control of BLDC drive, SRM drive- SRM drive controller, Modes of operation	**07 Hrs**
Unit 3	**Energy Storage and Regeneration** Electrochemical batteries and its types - Electrochemical reaction, thermodynamic voltage, specific energy, power , efficiency, applications of different battery technologies in EV and HEV, Battery Management System **Ultra capacitors** - Features, Basic operating principle, Performance, applications of different ultra-capacitor technologies in EV and HEV **Ultra high speed flywheels** - operating principle, power capacity, applications of different flywheel technologies in EV and HEV	**07 Hrs**

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	Fundamentals of regenerative braking- Energy consumption in braking, braking power and energy on front and rear wheels, brake system for EV and HEV	
Unit 4	**Electric Vehicles (EV)** Configurations of EV, Performance of EV, Traction motor characteristics, tractive effort and transmission requirement, vehicle performance, tractive effort in normal driving, energy consumption, Concept of hybrid electric drive trains, architecture of HEV drive trains, series hybrid, parallel hybrid-Torque coupling drive trains, speed coupling drive trains, speed and torque coupling drive trains.	**07 Hrs**
Unit 5	**Fuel Cell Vehicles (FCV)** Operating Principles of Fuel Cells, Fuel Cell System Characteristic, Fuel Supply-Hydrogen Storage and production, Configuration of (FCV), Control Strategy, Parametric Design	**07 Hrs**
Unit 6	**E- Mobility and Charging facilities** Energy Management Strategies, Automotive networking and communication, EV charging standards, Connected Mobility and Autonomous Mobility- case study, E-mobility Indian Roadmap Perspective. Policy: EVs in infrastructure system, integration of EVs in smart grid, social dimensions of EVs, Types of EV charging connector	**07 Hrs**

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Modern Electric, Hybrid Electric and fuel cell vehicles	Mehrdad Ehsani, Yimin Gao	CRC Press	First	2005
2	Electric and Hybrid Vehicles	Iqbal Husain	CRC Press	Second	2010
3	Electric Vehicle Technology Explained	James Larminie, John Lowry	Wiley	First	2003
4	Hybrid and Alternative Fuel Vehicles	James D. Halderman and Tony Martin	Professional Technician	Second	2010

Reference Books

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Fundamentals of Electrical Drives	G. K. Dubey	CRC Press	First	2002
2	How Your Car Works: Your Guide to the Components & Systems of Modern Cars, Including Hybrid & Electric Vehicles	Arvid Linde	RAC Handbook	Second	2011
3	Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives	Chris Mi, M. Abul Masrur and David Wenzhong Gao	Willey Publications	Second	2011
4	Storage Batteries	Vinal. G.W	John Wiley & Sons Inc	Fourth	2012

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Department of Electrical Engineering

Class	B. Tech. Semester - VII
Course Code and Course Title	**1EEOE402, Wind and Solar Energy Systems**
Prerequisite/s	1EEES103
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE I/MSE/ISE II/ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEOE402_1	**Determine** needs of Renewable energy Sources and their utilization.
1EEOE402_2	**Describe** solar power generation systems, characteristics, associated terminologies and algorithms to maximize energy extraction
1EEOE402_3	**Examine** the generation aspects of wind resource assessment and characterization.
1EEOE402_4	**Explain** grid integration of renewable energy sources and its economic aspects.
1EEOE402_5	**Focus** energy storage in grid integration of renewable energy sources and smart grid system.
1EEOE402_6	**Design** the standalone wind and solar energy system.

Unit 1	**Introduction to Renewable Energy Sources (RES)** Global and Indian scenario of RES, need for alternative energy sources, advantages and disadvantages of RES, classification of RES and comparison, key factors affecting RES.	**04 Hrs**
Unit 2	**Solar Energy** Introduction, Fundamentals Solar Radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability. Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a Photo Voltaic cell (PV cell), PV module, array, basics of PV cell, materials used for PV cell, efficiency of PV cell, equivalent electrical circuit, open circuit voltage and short circuit current, I-V and P-V curves, effects of different electrical parameters on I-V & P-V curves Solar thermal power generation, solar photovoltaic power generation, Maximum Power Point Tracking (MPPT) algorithms.	**09 Hrs**
Unit 3	**Wind Resource Assessment** History of wind power, Indian and Global statistics, Wind physics - aerodynamics of wind turbines, airfoil, lift & drag characteristics, power coefficient, Betz limit, Tip speed ratio, stall and pitch control, capacity factor, Wind speed statistics-probability distributions, Wind speed and power - cumulative distribution functions, site selection and layout of wind farm, Fixed and Variable speed wind turbines quality standards for wind turbines, review of modern wind turbine technologies.	**08 Hrs**

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Unit 4	**Integration of renewable energy sources to the grid and storage system** Grid Connected Photo voltaic power generation system, off-grid system (Standalone system). Grid Connected wind mill, off-grid system (standalone system), Micro grid Concept Wind and Solar Hybrid Micro grid, Wind farm behavior during grid disturbances, power system interconnection experience in the world, Economic aspects. **Storage System** Introduction, need for storage for RES, traditional energy storage system-battery, fuel cell, principle of operation, types of fuel cell.	**10 Hrs**
Unit 5	**Emerging Trends in Renewable Energy** Introduction to Smart Grid, Smart grid in Indian context, architecture of Smart Grid, advantages &disadvantages, key challenges for Smart Grid, Smart Grid technologies, standards & codes for grid integration of DG systems. Recent trends in Wind and solar systems.	**04 Hrs**
Unit 6	**Case Study on wind and Solar System** Design of standalone system by utilizing PV system. Design of standalone system by utilizing wind system. Integration of wind and Solar System. Configuration of PV and wind System.	**07 Hrs**

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Solar Photovoltaics	Chetan Singh Solankhi	PHI Publication	Third	2015
2	Solar Energy	S.P. Sukhatme	Tata McGraw Hill	Fourth	2017
3	Renewable and Efficient Electric Power Systems	Gilbert M. Masters	John Wiley and Sons	Third	2004
4	Solar Energy : Fundamentals, Design, Modeling and Applications	G.N. Tiwari	Narosa Publishing House Pvt. Ltd	Revised	2013

Reference Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Wind Power in Power Systems	Thomas Ackermann	John Wiley and Sons Ltd	Second	2012
2	Grid Integration of Wind Energy: Onshore and Offshore Conversion Systems	Siegfried Heier,	John Wiley and Sons Ltd	Third	2014
3	Wind and Solar Power Systems	Mukund R Patel	CRC Press	Second	2006
4	Wind Energy Handbook	Tony Burton	John Wiley and Sons Ltd	Second	2011

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Department of Electrical Engineering

Class	B. Tech. Semester - VII
Course Code and Course Title	**1EEPC403, Switchgear & Protection**
Prerequisite/s	1EEPC209, 1EEPC210, 1EEPC304, 1EEPC308,
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC403_1	**Explain** the working principle of Circuit breakers, fuses and Arc Interruption process
1EEPC403_2	**Discuss** the operation of numerical relay and phase measurement unit
1EEPC403_3	**Describe** modern protection schemes like microprocessor-based relays for the protection of the power system equipment's
1EEPC403_4	**Distinguish** between relays according to their characteristics and its applications
1EEPC403_5	**Select** the reference level for Relay using Plug Setting multiplier and Time Multiplier.
1EEPC403_6	**Analyze** performance of protection scheme of Transformer, Generator, Busbar and Transmission line.

Course Contents:		
Unit 1	**Arc Interruption Process** Voltage - current characteristics of arc, Principles of DC and AC arc interruption, high resistance and current zero interruption, arc voltage, Transient Restriking Voltage (TRV), Recovery voltage, RRRV, current chopping, resistance switching, capacitive current interruption.	**06 Hrs**
Unit 2	**Circuit Breakers & Fuses** Classification of circuit breakers, construction and working of Air break and Air Blast CB, SF6 and Vacuum CB, HVDC Circuit breakers, MCB, ratings of CB and testing of CB, **Fuse** – Rewireable and HRC fuse, fuse characteristics, application, and selection of fuse.	**07 Hrs**
Unit 3	**Over Current Relays** Plug Setting, TSM, construction and working of electromagnetic relays. Time current characteristics of over current relay, Directional relay, Microprocessor based over current relay, Directional over current relay, drawbacks of over current schemes.	**08 Hrs**
Unit 4	**Transformer Protection** Circulating current and opposed voltage principles, percentage differential relay, line protection, carrier aided protection scheme, Problems associated with percentage differential protection, Harmonic Restraint and Harmonic blocking schemes, Restricted Earth fault protection, Buchholz relay for incipient faults	**08 Hrs**

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	Generator and Induction Motor Protection: Differential protection of generator, stator and rotor protection schemes of Generator, Loss of Excitation, Prime Mover Failure protection, Induction motor stator and rotor protection	
Unit 5	**Transmission line Protection** Impedance, reactance and admittance characteristics, relay settings for 3 zone protection, out of step blocking scheme, blinder relay, numerical relays for transmission line protection, microprocessor-based impedance, Reactance and Mho relays **Bus Bar protection:** Frame Leakage protection of bus bar, Circulating current protection of bus bar, High impedance protection of busbar.	**07 Hrs**
Unit 6	**Recent Developments in Protection** Introduction to numerical/digital relay. Data Acquisition System (DAS), Numerical Overcurrent Protection, Numerical Differential Protection, Numerical Distance Protection, Phase Measurement Unit (PMU).	**06 Hrs**

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Power System Protection and Switchgear	Badri Ram, Vishwakarma	Tata McGraw Hill	Fifteenth	2001
2	A Tex book of Power System Engineering.	R.K. Rajput	Laxmi Publications	First	2007
3	Principles of Power system	V.K. Mehta	S Chand	Third	2005
4	Switchgear and Protection	Sunil S. Rao	Khanna publishers, New Delhi	Second	1986

Reference Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Switchgear and Protection	J.B.Gupta	S.K.Kataria & Sons	Second	2004
2	Fundamentals of Power System Protection	Y. G. Paithankar, S. R. Bhide	PHI	Second	2013
3	Power System Protection & Switchgear	Oza, Nair, Mehta and Makwana	MGH pub	Second	2011
4	Protective Relaying	J. Lewis Blackburn, Thomas J. Domin	CRC Press	Third	2006

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`Class	B. Tech. Semester - VII
Course Code and Course Title	**1EEPC404, High Voltage Engineering**
Prerequisite/s	1EEPC305, 1EEPC310
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC404_1	**Choose** the appropriate circuit for generation of high DC/AC impulse voltages and currents.
1EEPC404_2	**Apply** suitable techniques used in the measurement of high DC/AC impulse voltages and currents.
1EEPC404_3	**Illustrate** the mechanism of breakdown processes in gases and vacuum.
1EEPC404_4	**Summarize** the breakdown mechanisms in liquid and solid insulating materials.
1EEPC404_5	**Solve** the numerical on impulse generator, electrostatic voltmeter, Rogowski coil and breakdown voltages
1EEPC404_6	**Analyze** testing methods of high voltage electrical power apparatus.

Course Contents:		
Unit 1	**Electric Breakdown in Gases and Vacuum** **Ionization and Decay Processes:** Ionization by Collision, Photo-ionization and Secondary Ionization Processes. **Electric Breakdown in Gases:** Townsends Breakdown Mechanism, Breakdown in Electronegative Gases, Time Lags for Breakdown, Streamer Mechanism of Spark, Paschen's Law, Gaseous Breakdown in Non-uniform Fields, Corona Discharges, Practical Considerations using Gases for Insulation Purposes, Mechanisms for Breakdown in Vacuum Insulation.	**07 Hrs**
Unit 2	**Electric Breakdown in Liquids and Solids** **Electric Breakdown in Liquids:** Properties of Liquid Dielectrics, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids: Suspended Particle Mechanism, Cavitation and Bubble Mechanism, Stressed Oil Volume Mechanism. **Breakdown in Solids**: Electromechanical Breakdown, Thermal Breakdown, Electrochemical Breakdown, Breakdown due to Treeing and Tracking, Breakdown due to Internal Discharges, Breakdown in Composite Insulation.	**06 Hrs**
Unit 3	**Generation of High DC Voltages:** Voltage Doubler Circuit, Cockcroft Walton Voltage Multiplier Circuit, Van de Graff Generator. **Generation of High Alternating Voltages:** Cascade Transformers, Resonant Transformers **Generation of High Frequency AC High Voltages:** Tesla Coils	**08 Hrs**

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Unit 4	**Generation of Impulse Voltages:** Standard Lightning& Switching Impulse Wave shape, Single Stage and Multistage Impulse Voltage Generation, Switching Impulse Voltage Generation Circuits **Generation of Impulse Currents -** Wave shape – Analysis of Impulse Current Generator.	**07 Hrs**
Unit 5	**Measurement of High Voltages and High Currents** Resistance Potential Dividers, Electrostatic Voltmeters, Chubb Fortescue Method, Surge Recorder, Sphere Gaps for Measurement of High DC, AC and Impulse Voltage Measurements, Hall Generator, Rogowski Coils.	**08 Hrs**
Unit 6	**High Voltage Testing and Insulation Coordination** Testing of Insulators, Testing of Bushings, Testing of Isolators and Circuit Breakers, Testing of Cables, Testing of Transformers, Testing of Surge Arresters, Insulation Coordination	**06 Hrs**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	High Voltage Engineering	M.S.Naidu and V.Kamaraju	Tata McGraw Hill Education (India) Pvt. Ltd.	Fifth	2013
2	High Voltage Engineering	C.L.Wadhwa	New Age International Pvt. Ltd.	Third	2012
3	High Voltage Engineering Fundamentals	E. Kuffel, W. S. Zaengl, J. Kuffel	Elsevier	Second	2012
4	Fundamentals of High-Voltage Engineering	Ravindra Arora and Bharat Singh Rajpurohit	Wiley	First	2019

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	An Introduction to High Voltage Engineering	Subir Ray	Prentice Hall India Learning Private Limited	Second	2013
2	High Voltage Technology	L.L. Alston	Oxford University Press,	First	2011
3	High Voltage Engineering	E.Kuffel and M. Abdullah,	Pergamon Press	First	2013
4	High-Voltage Engineering: Theory and Practice	Mazen Abdel-Salam, Hussein Anis, Ahdab El-Morshedy, RoshdyRadwan	Marcel Dekker, New York	Second	2000

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Annasaheb Dange College of Engineering and Technology, Ashta

An Autonomous Institute

Department of Electrical Engineering

Class	B. Tech. Semester - VII
Course Code and Course Title	**1EEHS405, Economics for Engineers**
Prerequisite/s	-
Teaching Scheme (Lecture/Practical/Tutorial)	02/00/00
Credits	02
Evaluation Scheme: ISE I/MSE/ISE II/ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEHS405_1	**Explain** terms in microeconomics and macroeconomics.
1EEHS405_2	**Illustrate** law of supply and law of demand for managerial Decision making.
1EEHS405_3	**Describe** financial System in India.
1EEHS405_4	**Classify** taxes according to direct, indirect taxes, Import and Export Management and its impact on economy.
1EEHS405_5	**Analyze** market structure and economic theory for firms.
1EEHS405_6	**Select** financial tools for personal portfolio management

Unit 1	**Introduction to Economics** Definition, Nature and Scope of Economics, Micro Economics and Macro Economics, Managerial Economics and its relevance in business decisions. Per Capita Income, Gross Domestic Product, Gross National Product, Fiscal policy, Foreign Reserve. Different sectors and their contribution to economy. Flow in an economy, Engineering efficiency, Economic efficiency, Scope of engineering economics.	**04 Hrs**
Unit 2	**Demand and Supply Analysis.** Law of supply and demand, Correlation of Engineering and Economics, Theory of Demand, Types of Demand. Determinants of demand, Demand Function, Demand Schedule, and Demand curve, Law of Demand, Elasticity of Demand. Price Elasticity, Income Elasticity, Arc Elasticity. Cross Elasticity and Advertising Elasticity. Uses of Elasticity of Demand for managerial decision making, Demand forecasting. Supply Analysis; Law of Supply, Supply Elasticity; Analysis and its uses for managerial decision making. Price of a Product under demand and supply forces. Case Studies	**05 Hrs**
Unit 3	**Financial System** Components of Monetary and Financial System, Central Bank – Commercial Banks & their functions; Monetary and Fiscal Policy Tools (CRR, SLR ,Repo rate, Reverse repo rate, Bank rate) & their impact on the economy. Inflation-meaning, Causes of Inflation, and its impact.	**05 Hrs**
Unit 4	**Taxation System and Import Export.** Introduction of taxation system, Direct tax (basic concepts, Types of Direct Taxes) and Indirect taxes (Goods Service Tax, Excise, Custom, and Value Added Tax).India's Import and Export.	**04 Hrs**

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Unit 5	**Market Structure and Economic Theory** Meaning of Market, Types of Market – Perfect Competition, Monopoly, Oligopoly, And Monopolistic Competition. The Firm in Theory and Practice Economic Theory of the Firm, The Behavioral Theory of the Firm, Managerial Theories of the Firm, Profit concepts & analysis, Game Theory and Asymmetric Information. Case Studies.	**05 Hrs**
Unit 6	**Personal Finance** Introduction of personal finance, goal setting, Planning, Different investment options – Fixed deposit, Recurring deposit, Shares, Non-convertible Debentures (NCD), National Pension Schemes (NPS), Public provident fund (PPF), Employee Provident Fund (EPF), Mutual Fund (MF) etc. Insurance – types of insurance, term insurance, life insurance, health insurance. Portfolio Management. Case Study.	**05 Hrs**

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Fundamentals of Engineering Economics	Pravin Kumar	Wiley Precise Text book	First	2015
2	Principles of Economics	Mankiw Gregory	Thompson Asia	First	2002
3	Managerial Economics	V. Mote, S. Paul, G. Gupta	Tata McGraw Hill	Third	2004
4	Textbook of Business Economics	Pareek Saroj	Sunrise Publishers	Second	2003

Reference Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Engineering Economics,	R.Paneer Selvan	PHI	Second	2015
2	Engineering Economy	Sullivan and Wicks	Pearson	First	2020
3	Economics for Engineers	James L.Riggs, David D. Bedworth, Sabah U. Randhawa	Tata McGraw Hill	Third	2010
4	Engineering Economics Analysis	Michael R Lindeburg	Professional HUB	Second	2016

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Department of Electrical Engineering

Class	B. Tech. Semester - VII
Course Code and Course Title	**1EEPE406, Industrial Automation and SCADA**
Prerequisite/s	1EEES108 ,1EEES156,1EEPC211
Teaching Scheme: Lecture/Tutorial/ Practical	03/00/00
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE406_1	**Summarize** the fundamental principles of industrial automation
1EEPE406_2	**Apply** the concepts of fundamentals of logic for various processes of automation.
1EEPE406_3	**Analyze** and formulate the requirements of appropriate ladder programs to provide solutions using PLCs.
1EEPE406_4	**Construct**, debug and test the programs developed for digital and analog operations.
1EEPE406_5	**Build** architecture of SCADA and explain the importance of SCADA in critical infrastructure
1EEPE406_6	**Propose** the knowledge of PLC, SCADA and DCS with industrial networking protocols for process industries.

Course Contents:		
Unit 1	**Introduction to Automation:** Fundamentals of industrial automation, Definition and Goals of Automation, need and role of automation, evolution of automation. Types of processes, comparison, evolution of PLC, Types of Automation	**05 Hrs**
Unit 2	**Fundamentals of Logic:** Number systems and codes, Boolean Algebra, Logic Gates, Karnaugh map, Combinational Logic circuits-code conversion, Combinational logic optimization and design-SOP and POS form, reduction techniques	**07 Hrs**
Unit 3	**Programmable Logic Controller:** Hardware Components, Basic PLC structure, Types of PLC, Inputs and Outputs, Factors to consider in selecting PLC, General PLC Programming Procedure, PLC Programming Languages, Processor Memory Organization, Creating ladder diagram for real time task, Mnemonic Programming Code	**09 Hrs**
Unit 4	**PLC Functions:** Programming Timers, Programming Counters, Program control instructions, Data Manipulation Instructions, Math Instructions, Sequence rand Shift Register Instructions, Creating ladder diagram from process control descriptions, program editing, commissioning and monitoring, preventive maintenance and troubleshooting	**09 Hrs**

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Unit 5	**Introduction to SCADA Systems:** Introduction, definitions and history of Supervisory Control and Data Acquisition, typical SCADA system Architecture, Communication requirements, Desirable Properties of SCADA system, features, advantages, disadvantages and applications of SCADA. SCADA Architectures (First generation - Monolithic, second generation - Distributed, Third generation – Networked Architecture),	**06 Hrs**
Unit 6	**SCADA Protocols and SCADA Systems in Industries:** Open systems interconnection (OSI) Model, TCP/IP protocol, DNP3 protocol, IEC61850 layered architecture, Control and Information Protocol (CIP), Device Net, Control Net, Ether Net/IP, Flexible Function Block process (FFB), Process Field bus (Profibus), Implementation of SCADA Systems and related various applications.	**06 Hrs**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Programmable Logic Controllers: Principles and Application	John Webb, Resis Ronald,	Prentice Hall of India	Fifth	2007
2	Programmable Logic Controllers: Programming Methods and Applications	Hackworth	Pearson India	First	2008
3	Programmable Logic Controllers	Frank Fetruzella	Elsevier India	Third	2007
4	Concept of SCADA System and its Evolution	Mini S. Thomas, John Douglas, McDonald	CRC Press	First	2015

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Real Time Computer Control	Bennett Stuart	Prentice Hall	First	1988
2	Measurement Systems	Doebelin E. O.	McGraw-Hill International Editions	Fourth	1990
3	Practical Modern SCADA Protocols	Gordan Clark, Deem Reynders	Elsevier	First	2004
4	Programmable Logic Controllers with Applications	P. K. Srivastava	BPB Publications	First	2004

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Department of Electrical Engineering

Class	B. Tech. Semester - VII
Course Code and Course Title	**1EEPE407, Embedded Systems**
Prerequisite/s	1EEPC211, 1EEES311
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE407_1	**Describe** the building blocks of embedded systems, processors, integration of hardware and software and design technologies.
1EEPE407_2	**Utilize** the memory organization techniques and memory devices appropriate for an embedded system.
1EEPE407_3	**Select** appropriate Embedded Networking protocols based on the distance, speed, size of data for Data transmission and reception in embedded system.
1EEPE407_4	**Apply** the knowledge of Embedded Design Life Cycle and operate embedded development strategies.
1EEPE407_5	**Organize** the Real Time Operating System for embedded system design.
1EEPE407_6	**Adapt** the real-world Embedded System Applications and Case Studies

Course Contents:		
Unit 1	**Introduction to Embedded Systems:** Definition and classification – Overview of Processors – Hardware Units in an Embedded System –Software Embedded into System – Design Technologies: Embedded Systems on Chip (SoC), Design Process and Challenges	**07 Hrs.**
Unit 2	**Memory Organization and Devices** Memory Devices – Shared Memory - DMA – Interfacing Processor - Memory and I/O Units - Memory Management Methods- Cache Mapping Techniques-Dynamic Allocation – Fragmentation- Timer and Counting Devices, Watchdog Timer, Real Time Clock, I/O Device Ports & Buses.	**07 Hrs.**
Unit 3	**Embedded Networking Protocols** Communication Protocols: **RS232, RS422, RS485 –** Standard, Signalling/communication Techniques, advantages, applications; Inter Integrated Circuits (**I^2C**) - Master-Slave Communication, Multi-Master Communication, **CAN** bus Protocols: Overview, Frame formats of Standard and Extended CAN, Arbitration Field, Message Types, Error Checking and Fault Confinement, CAN Bus Traffic, CMRR.	**07 Hrs.**
Unit 4	**Embedded Firmware Development Environment** Embedded Product Development Life Cycle- Objectives, Different Phases of *EDLC*, Modelling of EDLC; Issues in Hardware- Software Co-design, Data Flow Graph, State Machine Model, Sequential Program Model, Concurrent Model, Object-Oriented Model.	**07 Hrs.**

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Unit 5	**RTOS Based Embedded System Design** Introduction to basic concepts of RTOS - Interrupt handling in RTOS, Task and Threads, Multiprocessing and Multitasking, Scheduling, Task communication -Message Passing - Inter Process Communication – Synchronization between processes-Semaphores, Mailbox, Pipes, Priority Inversion Problem	**07 Hrs.**
Unit 6	**Embedded System Application and Case Studies** Automatic Washing Machine, Digital Clock, Audio Player - Drone with Camera – Case Studies on Embedded System for an Adaptive Cruise Control System in a Car, Chocolate Vending Machine and Smart Card.	**07 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Embedded System - Architecture Programming and Design	P.Raj Kamal	McGraw Hill Education	Third	2017
2	Introduction to Embedded Systems	Shibu. K.V	McGraw Hill Education India Private Limited	Second	2017
3	Embedded Systems-An Integrated Approach	Lyla B Das	Pearson Education India	First	2013
4	Embedded / Real-Time Systems: Concepts, Design and Programming	Prasad K. V. K. K.	Dreamtech Press India Pvt. Ltd	New	2003

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Embedded System Design: A Unified Hardware/Software Introduction	Frank Vahid and T ony Givargis	John Wiley & Sons	Third	2006
2	Computers as Components: Principles of Embedded Computing System Design	Wyne Wolf	Wiley India Pvt. Ltd	Second	2008
3	Embedded Systems Architecture	Tammy Noergaard	Newnes	Second	2012
4	An Embedded Software Primer	David E. Simon	Pearson Education India	First	2004

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Department of Electrical Engineering

Class	B. Tech. Semester - VII
Course Code and Course Title	**1EEPE408, Computer Methods in Power Systems**
Prerequisite/s	1EEPC202, 1EEPC209, 1EEPC308
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II/ ESE	10/30/10/50

Course Outcomes (COs): (Theory) Upon successful completion of this course, the student will be able to:	
1EEPE408_1	**Illustrate** rules of writing incidence matrices and methods of obtaining network matrices of an electrical network.
1EEPE408_2	**Construct** incidence matrices of an electrical network.
1EEPE408_3	**Compute** admittance and impedance matrices of an electrical network by applying appropriate method.
1EEPE408_4	**Determine** the unknown parameters at buses for power network by applying numerical methods for formulating load flow problems.
1EEPE408_5	**Develop** equations for power network faults using two-port network theory and the two-component method.
1EEPE408_6	**Calculate** the unknown parameters of power network under kinds of faults.

Course Contents:		
Unit 1	**Network Topology** Introduction, basic principles in power system analysis, elementary graph theory, incidence matrices, connectivity, primitive network, numerical treatment expected	**05 Hrs.**
Unit 2	**Computer Solution Methods Using Admittance Matrix** Introduction, formation of Y_{bus} by singular transformation, non-singular transformation, inspection- modeling of transmission lines, modeling of transformer, modeling of shunt elements, modeling of loads, modeling of generator internal impedance, step by step algorithm for formation of Y_{bus}, numerical treatment expected, case study of power transmission/distribution substation in Maharashtra.	**09 Hrs.**
Unit 3	**Computer Solution Methods Using Impedance Matrix** Introduction, impedance matrix in shunt fault computations, impedance matrix algorithm, adding a radial impedance to the reference node, adding a radial branch to a new node, closing a loop to the reference, closing a loop not involving the reference, numerical treatment expected, and case study of power transmission/distribution substation in Maharashtra.	**07 Hrs.**
Unit 4	**Computer Techniques for Load flow analysis** Introduction, impact of computers, orientation of engineering problems to computers, power flow equation, classification of buses, operating constraints, data for load flow, modelling for load flow studies, numerical methods for load flow analysis, case study of power transmission/distribution substation in Maharashtra.	**07 Hrs.**

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Unit 5	**Simultaneous Faults** Introduction to Simultaneous faults by two-port network theory- Two port networks, interconnection of two port networks, simultaneous fault connection of sequence networks, series-series connection (Z-type faults), parallel -parallel connection (Y-type faults), series-parallel connection (H-type faults), simultaneous faults by matrix transformations- constraint matrix for Z-type faults, constraint matrix for Y-type and H-type faults, numerical treatment expected.	**07 Hrs.**
Unit 6	**Analytical Simplifications by Two Component Method** Introduction to two component method, Shunt Faults- Single Line to Ground Fault, Line to Line Fault, Double Line to Ground Fault, Three Phase Fault, Series Faults- Two Line Open Fault, One Line Open Fault, Numerical treatment expected.,	**07 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Circuit Theory (Analysis and Synthesis)	A. Chakrabarti	Dhanpat Rai & Co.	First	2010
02	Advanced Power System Analysis & Dynamics	L.P. Singh	New Age International Publishers	Fifth	2008
03	Power System Analysis	Grainger, J.J. and Stevenson, W. D.	Tata McGraw-Hill Edition	First	1994
04	Computer Techniques and Models in Power Systems	K. Uma Rao	I.K. International Publishing House Pvt Ltd	Second	2014

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Analysis of Faulted Power Systems	Paul.M. Anderson	IEEE Press Power Systems Engineering Series	First	1973
02	Introduction to Matrices & Power System	R.Bruce Shipley	Wiley Eastern Ltd	First	2007
03	Computer methods in Power System Analysis	Stagg G.W. & E.L. Abiad	McGraw-Hill	Ninth	1983
04	Operation and Control in Power Systems	Prof. P. S. R. Murty	B.S. Publications	First	2008

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Annasaheb Dange College of Engineering and Technology, Ashta

An Autonomous Institute

Department of Electrical Engineering

Class	B. Tech. Semester - VII
Course Code and Course Title	**1EEPC451, Switchgear & Protection Laboratory**
Prerequisite/s	1EEPC255, 1EEES257
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE / ESE	25/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPC451_1	**Relate** different power system protection components and schemes.
1EEPC451_2	**Examine** performance of different types of relays.
1EEPC451_3	**Make use of** Power World Simulator for relay setting and MATLAB for designing of relay.
1EEPC451_4	**Communicate** effectively about laboratory work both orally and writing.
1EEPC451_5	**Practice** professional and ethical behavior to carry forward in their life.

Expt. No.	Title of Experiment
1	Drawing sheet showing construction of Circuit Breakers.
2	Drawing sheet showing construction of Generator and Transformer protection schemes.
3	Study of construction and working of Induction Disc type relay
4	Analyze the performance of electro-mechanical over current relay.
5	Verify the main function of electro-mechanical over voltage relay.
6	Experimental study of Microprocessor based Over Current Relay
7	Experimental study of Microprocessor Based Over voltage relay
8	Experimental study of Microprocessor Based Under voltage Relay.
9	Experimental study of microprocessor Based Impedance Relay
10	Power World Simulator for Relay Setting
11	Perform the simulation of three phase differential protection relay for power transformer

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Department of Electrical Engineering

Class	B. Tech. Semester - VII
Lab Code and Lab Title	**1EEPC452, High Voltage Engineering Laboratory**
Prerequisite/s	1EEPC202,1EEPC253,1EEES257
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE / ESE	25/00

Course Outcomes (COs):- After successful completion of this course, the student will be able to,	
1EEPC452_1	**Illustrate** generation and measurement of high voltage and current
1EEPC452_2	**Demonstrate** electrical breakdown voltage of air & transformer oil
1EEPC452_3	**Implement** field mapping using Electrolyte Tank
1EEPC452_4	**Demonstrate** insulation strength of solid dielectric material in cables
1EEPC452_5	**Communicate** effectively, both orally and in writing journals
1EEPC452_6	**Follow** professional and ethical principles during laboratory work

Expt. No.	Title of Experiment
1	Study the characteristic parameters of lighting and switching impulse wave shape.
2	Measurement of Impulse voltages using 5-stage 150kV 225J impulse generator
3	Measurement of DC breakdown voltage of air, using sphere gap assembly
4	Measurement of AC breakdown voltage of air, using sphere gap assembly
5	Determine breakdown voltage of transformer oil
6	Insulation Testing using 5 kV AC High Voltage Tester.
7	Measurement of Insulation Resistance by Megger
8	Simulation of voltage doubler circuit for generation of high DC voltages using MATLAB
9	Simulation of Cockroft Walton voltage multiplier circuit for generation of high voltages using MATLAB
10.	Simulation of Impulse Voltage Generator Using MATLAB Simulink

Note: Visit to High Voltage Substation

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Annasaheb Dange College of Engineering and Technology, Ashta

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Department of Electrical Engineering

Class	B. Tech. Semester - VII
Course Code and Course Title	**1EEPE453, Industrial Automation and SCADA Laboratory**
Prerequisite/s	**1EEES108, 1EEES156 ,1EEPC256**
Teaching Scheme : Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE / ESE	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE453_1	**Understand** all the important components such as PLC, SCADA, I/O modules and field devices of an industrial automation system.
1EEPE453_2	**Develop** PLC program in different languages for industrial applications.
1EEPE453_3	**Experiment** with hands on experience in interfacing transmitters and final control elements (Actuators) with PLC/SCADA
1EEPE453_4	**Use** modern tools/software (RsLogix, Proficy) to simulate PLC and SCADA programs for a various process control description.
1EEPE453_5	**Communicate** effectively about laboratory work both orally and in writing.
1EEPE453_6	**Work** effectively in groups by sharing responsibilities and collaborating on findings.

Expt. No.	Title of Experiment
1.	Assemble various modules and component of PLC to make a PLC system.
2.	Examine INPUT-OUTPUT modules.
3.	Execute ladder diagram for basic and universal logic gates
4.	Prepare ladder diagram for different Arithmetic operations.
5.	Execute ladder diagram for logical operations along with truth table.
6.	Develop Ladder program for timing applications
7.	Develop Ladder program for counting applications
8.	Execute/Prepare all over ladder diagram for industrial process and control.
9.	Use of advanced instruction for application in PLC
10.	Configuring Screens, Graphics and Creating a Project and tags in SCADA_1
11.	Configuring Screens, Graphics and Creating a Project and tags in SCADA_2
12.	HMI (Human Machine Interface) interfacing with PLC

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Department of Electrical Engineering

Class	B. Tech. Semester - VII
Lab Code and Lab Title	**1EEPE454, Embedded Systems Laboratory**
Prerequisite/s	1EEPC256, 1EEES356
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE / ESE	25/50

Course Outcomes (COs) Upon successful completion of this Lab, the student will be able to:	
1EEPE454_1	**Illustrate** the programming concepts of microcontroller.
1EEPE454_2	**Choose** appropriate microcontroller for the design specification with reference to a real time problem
1EEPE454_3	**Implement** the interfacing of peripheral devices with embedded processors.
1EEPE454_4	**Design** and develop the programming using IDE
1EEPE454_5	**Justify** the result of the experiment from the observations.

Expt. No.	Title of Experiment
1	8051 Microcontroller Programming in Embedded C using Keil for LED Blinking / Sensor Interfacing
2	8051 Microcontroller Programming in Embedded C using Keil for Square Wave and PWM Generation.
3	8051 Microcontroller Programming in Embedded C using Keil to use interrupts for fast processing
4	Programming with Raspberry Pi Microcontroller Board
5	Study on process Controller modeling in PLC/SCADA
6	Programming & Simulation in Simulators/Tools – Proteus / ORCAD
7	Programming with wired / wireless communication protocol/Network Simulators
8	Study of one type of Real Time Operating Systems (RTOS)
9	Programming compilers in Freeware software's / Platforms
10	Programming & Simulation in Python Simulators /Tools

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Department of Electrical Engineering

Class	B. Tech. Semester - VII
Course Code and Course Title	**1EEPE455, Computer Methods in Power System Laboratory**
Prerequisite/s	1EEPC202, 1EEPC354
Teaching Scheme: Lecture/Tutorial /Practical	00/00/02
Credits	01
Evaluation Scheme: ISE/ESE	25/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE455_1	**Illustrate** rules and methods of writing various incidence and network matrices of electrical network.
1EEPE455_2	**Apply** numerical methods for power flow solution.
1EEPE455_3	**Use** modern tools/software (MATLAB/POWER WORLD SIMULATOR) to model and solve power flow problems.
1EEPE455_4	**Communicate** effectively about laboratory work both orally and in writing journals.
1EEPE455_5	**Practice** professional and ethical behavior to carry forward in their life.

Expt. No.	**Name of the Experiment** Following Experiments are performed on MATLAB/Simulink/ETAP
1	Draw directed graph for given power system network.
2	Formation of Y_{BUS} (without/with half line charging admittance) by direct inspection method.
3	Formation of Y_{BUS} (without/with half line charging shunt admittance/with mutual impedance) by singular transformation method
4	Formation of Y_{BUS} by singular transformation method.
5	Y_{BR} and Z_{BR} by singular Transformation.
6	Z_{LOOP} by singular Transformation.
7	Z_{LOOP} and Z_{BR} by non- singular Transformation.
8	Y_{LOOP} and Y_{BR} by non- singular Transformation.
9	Z_{BUS} building algorithm.
10	Graph theory approach to electrical circuits.
11	Load Flow Analysis using ETAP Software.
12	Load Flow Analysis using Power World Simulator Software.

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Department of Electrical Engineering

Class	B. Tech. Semester - VII
Course Code and Course Title	**1EEPR456, Internship / Industrial Training**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	00/00/00
Credits	01
Evaluation Scheme: ISE / ESE	25/00

Course Outcomes (COs):

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

1EEPR456_1	**Demonstrate** competency in relevant engineering fields through problem identification and formulation
1EEPR456_2	**Apply** appropriate techniques, resources, and modern engineering tools to solve industrial problems.
1EEPR456_3	**Communicate** on actual industrial environment, showing engineering & management principles.
1EEPR456_4	**Present** an ability to write technical documents and give oral related to the work completed
1EEPR456_5	**Demonstrate** the knowledge of professional and ethical responsibilities.

Guidelines

- The students have to undergo an Internship / Industrial Training of minimum period of two weeks in an industry preferably dealing with Electrical Engineering during the semester vacation after sixth semester and complete before the start of seventh semester.
- The students have to submit a report of the training undergone which includes brief overview of the industry, product details, production practices, management principles, modern engineering tool usage, types of electric supply and its utilization, electric tariff, safety measures, maintenance practices and energy auditing etc.
- An internal evaluation will be carried out for examining the quality and authenticity of contents of the report.
- Student should give the presentation based on the Internship / Industrial Training undergone.
- A viva voce / discussion which include comprehensive questions based on Internship / Industrial Training is expected.

COs correlated with three learning domains will be assessed during the semester through rubrics based on student's performance in Internship / Industrial Training**.**

Assessment Tools: Internal OE, Internship / Industrial Training Assessment Rubrics.

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Department of Electrical Engineering

Class	B. Tech. Semester - VII
Course Code and Course Title	**1EEPR457 Project Phase I**
Prerequisite/s	All relevant Courses.
Teaching Scheme: Lecture/Practical/Tutorial	00/08/00
Credits	04
Evaluation Scheme: ISE / ESE	100/50

Course Outcomes (COs):- After successful completion of this course, the student will be able to,	
1EEPR457_1	**Identify** the real time application, social, local industrial problems relevant to the societal and environmental issues for sustainable development using survey and literature review.
1EEPR457_2	**Analyze** complex engineering problems and give cost-effective, optimal solution considering societal, health, legal, and safety.
1EEPR457_3	**Design** of system components or processes that meet the specified needs by using advance tools/ techniques/ resources.
1EEPR457_4	**Demonstrate** effectively as an individual or as a team for understanding of the engineering and management principles and apply these to manage projects for maintaining professional and ethical principles.
1EEPR457_5	**Communicate** effectively on complex engineering activities, write effective reports, documentation and make effective presentations.
1EEPR457_6	**Recognize** independent and life-long learning in the broadest context of technological change.

Course Contents:	
The project work should be based on hardware assembly. In Project Phase-I the batch of maximum 4 students should finalize. Identification of Problem for the project should finalize with consultation of guide.	**09 Hrs.**
Literature review: Literature survey, quality of literature and Interlink of literature survey with problem.	**10 Hrs.**
Synopsis: must contain identification of problem, literature review, proposed work, method and methodology, budget and work plan for complete year.	**09 Hrs.**
Simulation/Hardware Analysis/Proof of Concept: At least software design or simulation of project must be there with result. Also hardware design along with components selection for layout of hardware.	**20 Hrs.**
Project Phase-I Report: The circuit should be finalized and the results of simulation shall be presented in the report of project phase I. Project Phase-I report should contains Introduction, Literature review, Proposed work, Design Calculation, simulation model and results.	**08 Hrs.**

COs correlated with Psychomotor and Affective domains will be assessed at the end of semester through various rubrics based on student's performance throughout the semester.

Assessment Tools: External OE, Project Synopsis Assessment Rubric, Project Phase I-Assessment Rubric

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Department of Electrical Engineering

Class	B. Tech. Semester - VIII
Course Code and Course Title	**1EEHS409, Project Management and Finance**
Prerequisite/s	1EEHS405
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00
Credits	02
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEHS409_1	**Demonstrate** the principle, function, planning and organization of industrial management.
1EEHS409_2	**Describe** production concept, cost concept and their impact on business decision.
1EEHS409_3	**Utilize** the concept of Human Resource management and system at various level in general organization
1EEHS409_4	**Classify** financial sources for business management.
1EEHS409_5	**Illustrate** the idea of wage schemes and incentives.
1EEHS409_6	**Select** application of financial analysis methods for project management.

Course Contents:		
Unit 1	**Industrial Management**: Principles of management, Importance of management, Functions of management, planning, Organization, staffing, directing, Public relation	**05 Hrs.**
Unit 2	**Production Management** Production and cost, types of cost and cost control, Budgetary control, purchasing, storekeeping	**05 Hrs.**
Unit 3	**Personnel Management** Definition and concept, Aims, Objective and Functions of Personnel Management, Principles of good Personnel policy	**04 Hrs.**
Unit 4	**Financial Management** Types of Capital, Source of finance, Capital building, Institutions of Industrial finance, cash flow, balance sheet.	**04 Hrs.**
Unit 5	**Wage Administration** Definition of Salary, different wage schemes, Advantages and disadvantages, Incentive, need, types, its merits and demerits.	**04 Hrs.**
Unit 6	**Project Financial Analysis Methods** Need of Investment analysis, Break-even Point, Types of Investment analysis methods NPV, ROI, IRR, Payback Period, Time value of money (Case study). Financial Statement analysis –Cash flow, Balance sheet.	**06 Hrs.**

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Business organization and management	M.C. Shukla	S. Chand	Twelfth	1972
2	ISO 900 quality systems	A. N. Singh	Dolphin Book N Delhi	Fourth	2011
3	Fundamentals of Engineering Economics	Pravin Kumar	Wiley Precise Text book Series	First	2015
4	Principles of Economics	Mankiw Gregory	Thompson Asia	First	2002

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Industrial Engineering and Management	O.P. Khanna	Dhanpatrai and Company	Seventeenth	2018
2	Management Information Systems	G.B. Davis, M.H. Olson	Mc Graw Hill	First	1985
3	Managerial Economics	V. Mote, S. Paul, G. Gupta	Tata McGraw Hill	Third	2004
4	Textbook of Business Economics	Pareek Saroj	Sunrise Publishers	Second	2003

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Annasaheb Dange College of Engineering and Technology, Ashta

An Autonomous Institute

Department of Electrical Engineering

Class	B.Tech. Semester - VIII
Course Code and Course Title	**1EEPE410, Energy Storage Systems**
Prerequisite/s	1EEBS102,1EEBS107,1EEES205
Teaching Scheme: Lecture/Tutorial/Practical	04/00/00
Credits	04
Evaluation Scheme: ISE-I / MSE / ISE-II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE410_1	**Determine** the requirements of energy storage systems.
1EEPE410_2	**Describe** the recent trends in energy storage system.
1EEPE410_3	**Develop** the possibilities of deployment of energy storage systems in smart cites and electric vehicles.
1EEPE410_4	**Illustrate** the design aspects of energy storage systems.
1EEPE410_5	**Evaluate** an efficient energy storage system in electric transportation.
1EEPE410_6	**Outline** real time applications in transportation and utility

Course Contents:		
Unit 1	**Introduction:** Introduction- Impacts and requirements of Electrical Energy Storage system, Classification of Energy Storage Systems, Energy costs and load analysis. Grid Applications of Energy Storage systems, Ancillary Services from Energy storage. Traditional generation costs and optimizations. Economics of energy and power, tied electrical rates and demand response.	**10 Hrs.**
Unit 2	**Electrochemical Energy Storage Batteries:** Introduction to battery storage including lead acid, lithium ion, flow Comprehensive analysis of design considerations and application specific needs. Impacts on system cost in terms of life cycle, environmental, and reliability of the end solutions. Recycle battery technology.	**09 Hrs.**
Unit 3	**Advance Energy Storages:** Ultra-Capacitors: Introduction to ultra-capacitors including operation, applications, and emerging technologies Super Conducting Magnetic Energy Storage (SMES): Introduction to Super Conducting Magnetic Energy Storage (SMES) operation, theory of usage and emergent research, with focus on large utility scale energy storage facilities. Case Study on Ultra capacitors use for elevator system.	**09 Hrs.**
Unit 4	**Energy Storage**: Advantages and disadvantages of mobile vs. stationary energy storage, Mechanical Energy Storage - Models for pumped hydro, capacity and availability, System cost, conversion efficiency. Compressed Gas: Compressed gas storage technologies as bulk energy storage, Models for compressed gas, capacity, efficiency and availability, System cost, conversion efficiency, Applications in carbon capture and appropriation, Case study based on hydro pumps.	**10 Hrs.**

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Unit 5	**Flywheel:** Flywheel energy storage system, Models for flywheel capacity, availability, efficiency, and self-discharge, Applications in transportation, uninterruptible power supply (UPS), pulse power, and bulk storage, Selection and design of flywheels for safety and availability in various applications. Case Study on flywheel energy storage system application for frequency regulation of Micro Grid.	**09Hrs.**
Unit 6	**Thermal:** Introduction to thermal storage in residential and utility scale applications including molten salts, cold reservoirs, and phase change materials, Analysis of design considerations, material selection, and application specific constraints, Applications in renewable energy at utility scale solar and geothermal power production.	**09 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Energy Storage	R. Huggins, Robert	Springer	Third	2010
02	Integration and Control of Renewable Energy in Electric Power System,	Ali Keyhani Mohammad Marwali and Min Dai,	John Wiley	Second	2010
03	Non-Conventional Energy Sources	S.Hasan Saeed D.K.Sharma	S. K. Kataria & Sons.	Third	2012
04	Understanding Batteries	Ronald M. Dell and David A.J. Rand	Royal Society of Chemistry	First	2001

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of
01	Handbook of Energy Storage Demand, Technologies, Integration	Michael Sterner, Ingo Stadler	Springer Berlin Heidelberg	First	2014
02	Thermal, Mechanical, and Hybrid Chemical Energy Storage Systems	Klaus Brun, Timothy C. Allison, Richard Dennis	Elsevier Science	First	2020
03	Electric Energy Storage Systems Flexibility Options for Smart Grids	Pio Lombardi, Przemyslaw Komarnicki, and Zbigniew A. Styczynski	Springer Berlin Heidelberg	First	2017
04	Handbook of Batteries	Linden and Reddy	New York McGraw Hill	First	2002

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Department of Electrical Engineering

Class	B.Tech. Semester - VIII
Course Code and Course Title	**1EEPE411, Industrial Drives**
Prerequisite/s	1EEPC210, 1EEPC303, 1EEPC304, 1EEPC305
Teaching Scheme: Lecture/Tutorial/Practical	04/00/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE411_1	**Classify** the electric drives systems based on the nature of loads, and list the factors affecting the selection of electrical drives.
1EEPE411_2	**Outline** performance parameters of DC drives fed from AC to DC converters.
1EEPE411_3	**Analyze** performance parameters of DC drives fed from DC-to-DC converters operating in multi-quadrant operations.
1EEPE411_4	**Illustrate** the performance characteristics of electrical AC drives.
1EEPE411_5	**Apply** the dynamic operations and characteristics to compute the performance parameters of the induction motors.
1EEPE411_6	**Propose** suitable drive components and special electrical drives for industrial drive application.

Course Contents		
Unit 1	**Electrical Drives: Fundamentals and Dynamics** Introduction to electrical drives, classification of electrical drives, block diagram of electrical drive, parts of electrical drive, nature of loads and their characteristics, motor load systems, dynamic conditions in electrical drives, stability of electrical drives.	**09 Hrs.**
Unit 2	**DC Drives: Rectifier Fed DC Drives** Introduction, review of dc motors concerning classification, speed control, and electric braking, single-phase half and full controlled converter fed dc motor drives, dc series motor drives, introduction to four-quadrant operation and single-phase dual converter fed dc motor drive, three-phase half and full converter fed dc motor drive, four-quadrant operation and three-phase dual converter fed dc motor drive, closed-loop control of converter fed dc drives.	**10 Hrs.**
Unit 3	**DC Drives: Chopper Fed DC Drives** Introduction, review of chopper operation concerning its principle, configuration, and classification, one, two, and four-quadrant chopper fed separately excited dc motors drive, chopper fed series dc motors drive, closed-loop control of chopper fed dc drives.	**09 Hrs.**
Unit 4	**AC Drives: Stator Side Control of Induction Motor Drives** Introduction, review of types of three-phase induction motors concerning methods of speed control and torque-speed characteristic, three-phase ac voltage controller fed induction motor drive, variable frequency characteristics, block diagram of variable frequency speed control, V/f control, voltage source inverter (VSI) fed induction motor drive, closed-loop control of VSI fed induction motor drive. (Numerical Expected)	**10 Hrs.**

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Unit 5	**AC Drives: Rotor Side Control of Induction Motor Drives** Introduction, conventional rotor resistance control, rotor resistance control using power converters, the concept of slip power recovery, slip power recovery schemes, static Kramer drive, static scherbius drive. (Numerical Expected)	**09 Hrs.**
Unit 6	**Synchronous Machine Drives** Synchronous motor variable speed drive, Electric braking **Special Electric Drives:** Stepper motor drive- types, torque vs. stepping rate characteristics, Servomotor drive, BLDC motor drive, comparison of stepper motor and servomotor drive, and BLDC drive, Switched Reluctance motor drive, Control Schemes of PMDC Drive.	**09 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fundamentals of Electrical Drives	G. K. Dubey	CRC Press	Second	2002
02	Electric Drives	N. K. De, P. K. Sen	PHI, Delhi	Third	2007
03	Electric Drives: Concepts & Applications	Vedam Subrahmanyam	Tata Mc-Graw Hill	Second	2011
04	Theory and performance of Electrical Machines	J. B. Gupta	S. K. Katariya & Sons	Second	2015

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Power Electronics: Converters, Applications & Design	Ned Mohan	Wiley Publications	Third	2003
02	Power Electronics & Variable frequency drives: Technology & applications	Dr. B. K. Bose	Wiley Publications	First	1996
03	Principles of Electric Machines & Power Electronics	P. C. Sen	Wiley Publications	Second	2013
04	Power Electronics: Circuits, Devices, and Applications	M. H. Rashid	Prentice Hall	Third	2003

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Class	B.Tech. Semester - VIII
Course Code and Course Title	**1EEPE412, FACTS**
Prerequisite/s	1EEPC303, 1EEPC305, 1EEPC308
Teaching Scheme: Lecture/Tutorial	04/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE412_1	**Describe** reactive power compensation and FACTS devices on system requirements.
1EEPE412_2	**Analyze** the performance of shunt compensators based on operating principle, control schemes and loss vs output.
1EEPE412_3	**Detect** the Power and control circuits of Series Controllers GCSC, TSSC and TCSC
1EEPE412_4	**Apply** load compensation to the electrical system.
1EEPE412_5	**Illustrate** phase angle and voltage regulation in power system.
1EEPE412_6	**Select** the converter-based controllers for reactive power compensation.

Course Contents:		
Unit 1	**FACTS Concept and General:** General concept about reactive power compensation, Transmission Interconnections, What Limits the Loading Capability, Power flow in AC Systems, Basic Types of FACTS Controllers, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Benefits from FACTS Technology, Compare HVDC and FACTS.	**10 Hrs.**
Unit 2	**Static Shunt Compensators:** Objectives of Shunt Compensation, Types of shunt compensators, Operation, Control Scheme, VI and loss vs VAR output characteristics of FC, TSC, TSR & TCR, FC-TCR, TSC-TCR, TBSC, TBSR & TBSC-TBSR.	**09 Hrs.**
Unit 3	**Static Series Compensators:** Objectives of Series Compensation, Type of Series Compensators, Operation & Control Scheme of GCSC, TSSC, TCSC,	**09 Hrs.**
Unit 4	**Load Compensation:** Significance in load compensation, ideal compensator, Practical considerations, Power factor correction and Voltage Regulation in single phase systems, Approximate reactive power characteristics with example, Load compensator as a voltage regulator, Phase balancing and power factor correction of unsymmetrical loads.	**10 Hrs.**

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Unit 5	**Static Phase angle and voltage regulator:** Objective of voltage and phase angle regulators, thyristor-controlled voltage and phase angle Regulator, switching converter-based voltage and phase angle regulators, Autotransformer and Tap changing transformer.	**08 Hrs.**
Unit 6	**Converter Based controllers:** Basic operating principles of Static Synchronous Compensator (STATCOM), Static Synchronous Series Compensator (SSSC), Unified Power Flow Controller (UPFC) and Interline Power Flow Controller (IPFC), Comparison Between STATCOM and SVC, Comparison of UPFC & IPFC.	**10 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Concept and Technology of Flexible AC Transmission Systems	Narain G. Hingorani and Laszol Gyugyi	IEEE Press, A John Wiley & Sons	Second	2011
2	Thyristor-Based Facts Controllers For Electrical Transmission Systems	R. Mohan Mathur Rajiv K. Varma	IEEE Press, A John Wiley & Sons	First	2002
3	Facts Controller In Power Transmission And Distribution	K.R.Padiyar	New Age International	First	2012
4	Reactive Power Control in Electric Systems	Timothy J. E. Miller	Wiley India Edition	Second	2010

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Power System Stability and Control	P. Kundur	Mc Graw Hill, Inc.	Second	2008
2	EHVAC and HVDC Transmission Engineering and Practice	S. Rao	Khanna publication	Second	2008
3	Power Quality Enhancement Using Custom Power Devices	A. Ghosh and G. Ledwich	Kluwer Academic Publishers,	First	2002
4	Flexible AC Transmission Systems: Modelling and Control (Power Systems)	Xiao-Ping Zhang, Christian Rehtanz, Bikash Pal	Springer	Second	2012

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Department of Electrical Engineering

Class	B.Tech. Semester - VIII
Course Code and Course Title	**1EEPE413, Power Quality Issues and Mitigation**
Prerequisite/s	1EEPC305, 1EEPC308, 1EEPC310
Teaching Scheme: Lecture/Tutorial	04/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE413_1	**Describe** different power quality related issues, causes and their effects on power system equipment.
1EEPE413_2	**Identify** the causes of transient overvoltage and protection devices
1EEPE413_3	**Classify** the harmonics in three phase and single-phase system.
1EEPE413_4	**Distinguish** the different methods for mitigation of voltage sags and interruptions.
1EEPE413_5	**Evaluate** the different power quality monitoring techniques.
1EEPE413_6	**Design** the filter for suppression of current harmonics.

Course Contents:		
Unit 1	**Introduction to Power Quality:** What is power quality, power quality related issues in distribution system, loads and their characteristics, electromagnetic phenomena, power quality evaluation procedure, CBEMA and ITI Curves	**10 Hrs.**
Unit 2	**Voltage Sag, Interruptions and Mitigation:** End user issues, ups system, Ferro-resonant transformers, super conducting storage devices, dynamic voltage restorer and application of DSTATCOM.	**08 Hrs.**
Unit 3	**Transient Over-Voltage:** Sources of Transient Overvoltage's Principles of Overvoltage Protection Devices for Overvoltage Protection Utility Capacitor-Switching Transients Utility System Lightning Protection Managing Ferro resonance Switching Transient Problems with Loads Computer Tools for Transients Analysis	**10 Hrs.**
Unit 4	**Power Quality Monitoring, Wiring and Grounding:** Monitoring considerations, power quality measurement equipment, and assessment of power quality, power quality monitoring and standard, Reasons for grounding, typical wiring and grounding problem, solution to wiring and grounding problem.	**10 Hrs.**
Unit 5	**Fundamentals of Harmonics:** Sources of harmonics, effect of harmonics, types and characterization, THDs, influence on power factor, interference with communication network, harmonic indices, and synthesis of harmonic waveform originating from non-linear loads with the help of Fourier analysis. Power definitions and components-single phase circuits and three phase circuits.	**09 Hrs.**

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Unit 6	**Harmonic Suppression Filters:** Shunt passive filters, design considerations case studies, voltage/ current source active filters- types: shunt, series and hybrid types, comparison.	**09 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Electrical Power System Quality	Roger C. Dugan, Mark F. McGranaghan, Surya Snatoso, H. Wayne Beaty	Tata McGraw -Hill	First	2012
2	Electrical Power System Quality	J. Arnillaga , D A Bradey & P S Bodger	John Wiley Sons	First	2000
3	Power System Harmonics	George J. First Wakileh	Springer	First	2007
4	Power Quality Primer	Barry W. Kennedy	Mc Graw Hill	First	2000

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Uninterrupted Power Supplies and Active filters	Ali Emadi, Abdolhorien Nasiri & Stoyon B Bekiarov	CRC Press	Second	2010
2	Handbook of Power Quality	Angelo Baggini	John Wiley Sons	First	2008
3	Power Quality in Electrical Systems	Alexander Kusko & Marc T.Thompson	Mc Graw Hill	First	2017
4	Power Electronic Converter Harmonics	Derek A. Paice	IEEE Press	First	1997

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Department of Electrical Engineering

Class	B.Tech. Semester - VIII
Course Code and Course Title	**1EEPE414, Electrical Installation, Testing & Maintenance**
Prerequisite/s	1EEPC204, 1EEPC209, 1EEPC210, 1EEPC304
Teaching Scheme: Lecture/Tutorial/Practical	04/00/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE414_1	**Choose** appropriate tools and accessories for Electrical Installation, Testing & Maintenance and safety measures.
1EEPE414_2	**Identify** electric accidents and artificial respiration methods.
1EEPE414_3	**Describe** laying methods of underground cables and tools used for installation.
1EEPE414_4	**Classify** methods of Electrical Installation, Testing & Maintenance for electrical equipment.
1EEPE414_5	**Summarize** common troubles in electrical machines, Transmission and Distribution System, Transformers & Grid Substations.
1EEPC414_6	**Outline** earthing system for electrical installations and trouble-shooting charts.

Course Contents:		
Unit 1	**Safety Measures & Prevention of Accidents** Concept of electrical safety, electrical accidents, its causes & preventions. Safety signs and symbols used in industry. Electrical shocks and factors affecting the severity of it, method of rescuing electrocuted person & different methods of artificial respiration. Electrical safety as per I.E. Rules 1956. Do's & Don'ts regarding safety while working on electrical installations. Precautions to be taken to avoid fire due to electrical reasons, operation of fire extinguishers, types of fire extinguishers.	**10 Hrs.**
Unit 2	**Installation of Transmission and Distribution Lines:** Ejection of steel structures, connecting of jumpers, tee-off points, joints and dead ends: crossing of roads, streets, power/telecommunication lines and railway crossings clearances: earthing of transmission lines and guarding, spacing and configuration of conductors, Arrangement for suspension and strain insulators, bird guards anti-climbing devices and danger plates. Sizes of conductor earth wire and guy wires. Testing and Commissioning Laying of service lines and earthing, provision of service fuses.	**10Hrs.**
Unit 3	**Underground Cables:** Types of cables as per material used, Inspection on Arrival of underground cable, cable handling equipment's, methods of laying underground cable, causes of cable fault, cable joints and terminations, testing and commission	**08 Hrs.**

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Unit 4	**Testing of Electrical Machines and Transformer** Objectives of testing. Roles of Bureau of Indian Standards (BIS) in testing of electrical equipment's. Types of tests: Routine, type, supplementary & special. Concepts of tolerances. Tolerances for rotating machines. Testing of three-phase Induction motor. Testing of single-phase induction motor. Tolerances for power transformers, testing of transformer- Routine tests, Type tests and Special tests. BDV test of transformer oil.	**10 Hrs.**
Unit 5	**Maintenance of Electrical Machines:** Concept of maintenance, types of maintenance, Routine, preventive & breakdown maintenance. Causes of failure of electrical machines. Preventive maintenance Advantages, Procedure for developing preventive maintenance, schedules for electrical machines. Factors affecting preventive maintenance schedules. Identification of different types of faults developed such as mechanical, electrical and magnetic faults due to poor maintenance. Maintenance schedules of the following as per I.S.S. Single phase & three phase Induction motors	**08 Hrs.**
Unit 6	**Maintenance of Transformers:** Transformer maintenance Checking of insulation resistance, transformer oil level and, measurement of earth resistance. **Common Troubles in Electrical Equipment's and Machines:** Preparation of trouble shooting charts for D.C. Machines, AC Machines, Transformers **Earthing:** Importance of earthing, Difference between installation earthing & system grounding, Types of earthing, Earthing resistance values for different types of installations, Factors affecting earth resistance, Methods of reducing earth resistance, Provision of earthing as per I.E. rule-61 & I.E.rule-90	**10 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Installation commissioning & maintenance.	Tarlok singh	Katariya & sons.	Second	2002
2.	Preventive Maintenance of Electrical Apparatus	SK Sharotri, Katson	Publishing House Ludhiana	Sixth	2013
3.	Testing, Commissioning Operation and Maintenance of Electrical Equipment	S Rao, Khanna	Technical Publication, New Delhi.	Third	2006
4.	Electrical Workshop	R. P. Singh	I K International Publishing House	Third	2012

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Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Operation & Maintenance of Electrical Equipment's Vol-I & II	B.V.S. Rao	Media promoters and publisher Ltd. Mumbai	First	1967
2.	Electrical Power Equipment Maintenance and Testing.	Paul Gill	CRC press	Second	2011
3.	Testing & Maintenance Of Electrical Machines	B P Patil	Technical Publication	Second	2011
4.	Electrical Systems Design	M.K. Giridharan	I K International Publishing House Pvt. Ltd	First	2010

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Class	B.Tech. Semester - VIII
Course Code and Course Title	**1EEPE415, HVDC Systems**
Prerequisite/s	1EEPC303, 1EEPC305, 1EEPC308
Teaching Scheme: Lecture/Tutorial	04/00
Credits	04
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
1EEPE415_1	**Develop** the concepts of High Voltage Direct Current Systems and HVDC Converters
1EEPE415_2	**Analyze** voltage & current characteristics for converters and relate with HVDC systems.
1EEPE415_3	**Demonstrate** the over voltage protection and fault clearing technology in HVDC system.
1EEPE415_4	**Analyze** the harmonics generated by the converters and role of filters.
1EEPE415_5	**Describe** the reactive power requirement in HVDC systems.
1EEPE415_6	**Illustrate** the MTDC system configurations and HVDC light.

Course Contents:		
Unit 1	**General Background:** Trends in transmission Voltages, Hierarchical Levels in transmission and distribution, Standard rated voltage of EHV-AC and HVDC, General aspects HVDC Transmission: Constitution of EHVAC and DC links, Kinds of DC links, HVDC projects in India and abroad, limitations and advantages of HVDC transmission over EHVAC, Layout of HVDC station. Deep Hole Ground Electrode, Electrolytic Corrosion, factors for General Design of Electrodes.	**10 Hrs.**
Unit 2	**Grid Control and Characteristics:** Grid control of thyristor, valve-Analysis with grid control with no overlap, overlap less than 60◦ and overlap greater than 60◦. Basic means of control, Power reversal, manual control and its limitations-constant current versus constant voltage Control, desired features of control, actual control characteristics-constant minimum ignition angle, current and extinction angle controls –power control and current limits. Voltage Dependent Current Limiter (VDCOL), Comparison of Converters - CSC & VSC systems.	**10 Hrs.**
Unit 3	**Protection:** Disoperation of converters-short circuit on a rectifier – commutation failure, causes and remedies – Protection of HVDC system, d.c. rectors, damper circuits, Over current protection and over-voltage protection, clearing fault and reenergizing the line.	**08 Hrs.**
Unit 4	**Harmonics and Filters:** Characteristic and uncharacteristic harmonics-causes, consequences and suppression-Troubles caused by harmonics, Harmonic filters- Types, Location, series or shunt, sharpness of tuning, Quality Factor Q for L, C & RLC filter.	**09 Hrs.**

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Unit 5	**Reactive Power Compensation:** Reactive Power Requirement of HVDC Converter- reactive Power balance in HVDC substations-Effect of angle of advance and extinction angle on reactive power requirement of converters.	**09 Hrs.**
Unit 6	**Multi-terminal DC Systems & HVDC Light:** Introduction, Configurations and Types of MTDC Systems, Control and Protection of MTDC Systems Configurations and Types of MTDC Systems, Reversal of Power in MTDC System, Comparison between MTDC and AC Interconnections HVDC Light :- Introduction to VSC transmission & Structure , Introduction to HVDC light technology	**10 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	EHVAC and HVDC Transmission Engineering and Practice	S. Rao	Khanna Publication	Second	2008
2	HVDC power transmission systems	K R Padiyar	New Age International (p)Ltd	Third	2014
3	Direct Current Transmission	Edward Wilson Kimbark	Wiley publication Inter Science	First	1971
4	HVDC Transmission	S Kamakshaiah, V Kamaraju	Mc Graw Hill	Second	2020

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Power System Stability and Control	P. Kundur	Mc Graw Hill, Inc.	Second	2008
2	HVDC Transmission	J. Arrillaga	Wiley publication Inter science	First	2007
3	High Voltage Direct Current Transmission: Converters, Systems and DC Grids	Dragan Jovcic, Khaled Ahmed	Wiley publication	Second	2019
4	HVDC Transmission	SIA	SIA Publishers & Distributors Pvt Ltd	Latest 20-21 Edition	2021

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Sant Dnyaneshwar Shikshan Sanstha's

Annasaheb Dange College of Engineering and Technology, Ashta

An Autonomous Institute

Department of Electrical Engineering

Class	B.Tech. Semester - VIII
Course Code and Course Title	**1EEPR458, Project Phase II / Internship**
Prerequisite/s	-
Teaching Scheme: Lecture/Practical/Tutorial	00/16/00
Credits	08
Evaluation Scheme: ISE / ESE	100/100

Course Outcomes (COs):- After successful completion of this course, the student will be able to,	
1EEPR458_1	**Apply** the knowledge of engineering and science to demonstrate the understanding relevant to the previous work.
1EEPR458_2	**Develop** the hardware/software solution to the problem determined with concerns of societal, environmental and Industrial needs.
1EEPR458_3	**Apply** the knowledge and skills to do analyzing and interpretation of data for the testing and control the designed electrical systems.
1EEPR458_4	**Function** effectively as an individual or as a team to understand the engineering and management principles and apply the same to manage projects by maintaining professional and ethical principles.
1EEPR458_5	**Solve** complex engineering activities, write effective reports and documentation, and make effective presentations.
1EEPR458_6	**Engage** in independent and life-long learning in the broadest context of technological change.

Course Contents:	
The assembly of components shall be done in project phase II. The testing shall be completed and necessary changes, if required shall be made.	**40 Hrs.**
Demo: The project should be presented before the external examiner in working condition along with documents.	**42 Hrs.**
Report writing	**15 Hrs.**
Participation in state/ National level project competition. A journal/conference paper published/ presented on project work is expected. The project batch shall be eligible to get more than 80% of marks in term work/ external examination if above conditions are satisfied.	**15 Hrs.**

COs correlated with Psychomotor and Affective domains will be assessed at the end of semester through various rubrics based on student's performance throughout the semester.

Assessment Tools: External OE, Project Phase-II Assessment Rubrics

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