Sant Dnyaneshwar Shikshan Sanstha's

Annasaheb Dange College of Engineering and Technology, Ashta

An Autonomous Institute

Department of Electrical Engineering

Curriculum & Structure

Revision 2

B. Tech (Electrical Engineering)

Vision of the Institute

To be a leader in producing professionally competent Engineers.

Mission of the Institute

We, Annasaheb Dange College of Engineering & Technology, Ashta, are committed to achieve our vision by,

M-1. Imparting effective outcome-based education

M-2. Preparing students through skill-oriented courses to excel in their profession with ethical values

M-3. Promoting research to benefit the society

M-4. Strengthening relationship with all the stakeholders

Core Values

- Excellence
- Collaboration
- Integrity
- Innovation
- Respect
- Responsibility

Vision of the Department

To be a leader in developing Electrical Engineering graduates with knowledge, skills & ethics.

Mission of the Department

We, at the Department of Electrical Engineering, are committed to achieve our vision by,

M-1. Facilitating learning through outcome based education

M-2. Cultivating skills & attitude among graduates to excel in their career

M-3. Motivating research approach of graduates to solve real-time problems for benefit of the society

M-4. Strengthening relationship with all stakeholders for continuous improvement

Program Educational Objectives (PEOs)

The graduate of Electrical Engineering program will be able to,

PEO-1: Domain Knowledge: Solve problems related to Electrical Engineering by applying its 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

Program Outcomes (PO's) and Program Specific Outcomes (PSO's)

The graduates of electrical engineering program will be able to demonstrate

1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
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.
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.
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.
6. **The Engineer and Society**: Demonstrate understanding of contemporary knowledge of engineering to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
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.

Program Specific Outcomes (PSO's)

PSO1. Ability to apply electrical engineering knowledge, skills for testing, control & maintenance of electrical systems such as Machines, Power Systems, Drives & Automation.

PSO2. 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.

NEP

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

Annasaheb Dange College of Engineering and Technology, Ashta

An Autonomous Institute

Department of Electrical Engineering Curriculum Structure

Revision 2

B. Tech.

SEMESTER I – VIII
(To be implemented from 2023-2024 Academic Years onwards)

Annasaheb Dange College of Engineering and Technology, Ashta											
Department of Electrical Engineering											ADCET
B. Tech. Program with One Major and One Minor (170 Credits)											
Course Category		**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Total**	**ADCET**
Basic Sciences	BS	4	9	4	0	0	0	0	0	**17**	**14-16**
Engineering Science	ES	10	3	0	0	0	0	0	0	**13**	**14-12**
Program Core	PC	4	4	13	14	13	9	8	0	**65**	**74-80**
Program / Professional Elective	PE	0	0	0	0	0	4	3	4	**11**	
Minor	**	0	0	0	2	3	3	3	3	**14**	**14**
Open Elective	OE	0	0	0	0	3	3	2	0	**8**	**8**
Humanities and Social Sciences	HS	3	1	4	3	1	0	2	0	**14**	**14**
Vocational and Skill Enhancement Courses	VS	0	2	1	1	1	0	1	0	**6**	**8**
Co-Curricular Courses	CC	0	0	1	1	1	1	0	0	**4**	**4**
Experential Learning Courses	EL	0	0	0	1	1	2	4	10	**18**	**18**
Total		**21**	**19**	**23**	**22**	**23**	**22**	**23**	**17**	**170**	**170**

Head of Department **Dean Academics** **Director** **Executive Director**

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

Annasaheb Dange College of Engineering and Technology, Ashta

Department of Electrical Engineering ADCET

Teaching and Evaluation Scheme

F. Y. B. Tech, Semester I

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2EEBS101	Applied Mathematics -I	3	1	0	4	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2EEPC102	Basic Electrical Engineering	3	0	0	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2EEES103	Applied Mechanics	2	0	0	2	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2EEES104	Basic Mechanical Engineering	2	0	0	2	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2EEES105	Programming for Problem Solving	2	0	2	3	-	-	-	-	-	-	-	50	20	50*	20	100	40	100
2EEHS106	Professional Communication Skills	0	0	4	2	-	-	-	-	-	-	-	50	20	-	-	50	20	50
2EEPC107	Basic Electrical Engineering Lab	0	0	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
2EEES108	Applied Mechanics Lab	0	0	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
2EEES109	Design Thinking	1	0	2	2	-	-	-	-	-	-	-	50	20	-	-	50	20	50
2EEHS110	Value Added Course -I	0	0	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
Total		13	1	14	21														750
Total Contact Hours		28																	

* Internal Institute Faculty as an Examiner

Head of Department **Dean Academics** **Director** **Executive Director**

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

Annasaheb Dange College of Engineering and Technology, Ashta

Department of Electrical Engineering

Teaching and Evaluation Scheme

F. Y. B. Tech, Semester II

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2EEBS111	Applied Mathematics -II	3	1	0	4	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2EEBS112	Applied Physics & Chemistry	4	0	0	4	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2EEPC113	Analog Electronics	3	0	0	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2EEES114	Engineering Graphics	2	0	0	2	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2EEVS115	Object Oriented Programming	1	0	2	2	-	-	-	-	-	-	-	50	20	50*	20	100	40	100
2EEBS116	Applied Physics & Chemistry Lab	0	0	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
2EEPC117	Analog Electronics Lab	0	0	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
2EEES118	Engineering Graphics Lab	0	0	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
2EEHS119	Value Added Course - 2	0	0	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
Total		13	1	10	19														700
Total Contact Hours		24																	

* Internal Institute Faculty as an Examiner

On exit at the end of first year

Course Code	Course Name	L	T	P	C
2EEEX101	Electrical Wiring	0	0	8	4
2EEEX102	Installation & Maintenance of appliances	0	0	8	4

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Annasaheb Dange College of Engineering and Technology, Ashta

Department of Electrical Engineering

Teaching and Evaluation Scheme

S. Y. B. Tech, Semester III

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2EEBS201	Applied Mathematics -III	3	1	0	4	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2EEPC202	Electrical Measurements and Instrumentation	3	0	2	4	40	16	30	30	24	100	40	50	20	50	20	100	40	200
2EEPC203	Electric Circuit Analysis	3	0	2	4	40	16	30	30	24	100	40	50	20	-	-	50	20	150
2EEPC204	Digital Electronics & Modern Integrated Circuits	4	0	2	5	40	16	30	30	24	100	40	50	20	50	20	100	40	200
2EEHS205	Universal Human Values	2	0	0	2	50	20	-	-	-	50	20	-	-	-	-	-	-	50
2EEHS206	Environmental Studies	2	0	0	2	50	20	-	-	-	50	20	-	-	-	-	-	-	50
2EEVS207	Python Programming Lab	0	0	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
2EECC208	Aptitude and Reasoning Part - I	0	0	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
		17	1	10	23														850
Total Contact Hours		28																	

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Annasaheb Dange College of Engineering and Technology, Ashta

Department of Electrical Engineering

Teaching and Evaluation Scheme

S. Y. B. Tech, Semester IV#

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2EEPC209	Signal Processing	3	0	2	4	40	16	30	30	24	100	40	50	20	50	20	100	40	200
2EEPC210	DC Machines and Transformers	3	0	2	4	40	16	30	30	24	100	40	50	20	50	20	100	40	200
2EEPC211	Electromagnetic Field Theory	3	0	0	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2EEPC212	Generation Transmission and Distribution	3	0	0	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2EE**2##	Minor Course - I	2	0	0	2	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2EEHS215	Psychology	2	0	0	2	50	20	-	-	-	50	20	-	-	-	-	-	-	50
2EEHS216	Constitution of India	1	0	0	1	50	20	-	-	-	50	20	-	-	-	-	-	-	50
2EEVS217	Simulation Laboratory	0	0	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
2EEEL218	Innovation and Prototype	0	0	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
2EECC219	Aptitude and Reasoning Part - II	0	0	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
Total		17	0	10	22														950
Total Contact Hours		27																	

#	All students should undergo minimum of 15 days Internship / Industrial training during IV semester vacation. The assessment will be carried out in semester V

On exit at the end of second year

Course Code	Course Name	L	T	P	Credits
2EEEX201	PCB Design and Soldering	0	0	8	4
2EEEX202	Solar Technician	0	0	8	4

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

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Annasaheb Dange College of Engineering and Technology, Ashta

Department of Electrical Engineering

Teaching and Evaluation Scheme

T. Y. B. Tech, Semester V

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2EEPC301	Feedback Control Systems	3	1	2	5	40	16	30	30	24	100	40	50	20	50	20	100	40	200
2EEPC302	AC Machines	3	0	2	4	40	16	30	30	24	100	40	50	20	50	20	100	40	200
2EEPC303	Power System Analysis	3	0	2	4	40	16	30	30	24	100	40	50	20	-	-	50	20	150
2EEOE3**	Open Elective - I	3	0	0	3	50	20	-	-	-	50	20	-	-	-	-	-	-	50
2EE**3##	Minor Course - II^	3	0	0	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2EEHS306	Entrepreneurship	0	0	2	1	-	-	-	-	-	-	-	25	-	-	-	25	10	25
2EEVS307	CAD for Electrical Machine Design	0	0	2	1	-	-	-	-	-	-	-	50		-	-	50	20	50
2EEEL308	Industrial Training / Internship*	0	0	0	1	-	-	-	-	-	-	-	50		-	-	50	20	50
2EECC309	Aptitude and Reasoning Part - III	0	0	2	1	-	-	-	-	-	-	-	50		-	-	50	20	50
Total		15	1	12	23														875
Total Contact Hours		28																	

^	Minor courses project work continuously assessed from Semester V. The final submission will be at VIII semester
*	Assessment of Industrial Training / Internship to be completed at the beginning of Semester V

Head of Department **Dean Academics** **Director** **Executive Director**

Annasaheb D[illegible]age College of Engineering and Technology, A[illegible]a

Department of Electrical Engineering

Teaching and Evaluation Scheme

T. Y. B. Tech, Semester VI

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2EEPC310	Power Electronics	3	1	2	5	40	16	30	30	24	100	40	50	20	50	20	100	40	200
2EEPC311	High Voltage Engineering	3	0	2	4	40	16	30	30	24	100	40	50	20	-	-	50	20	150
2EEPE3**	Professional Elective - I	3	0	2	4	40	16	30	30	24	100	40	50	20	50	20	100	40	200
2EEOE3**	Open Elective - II	3	0	0	3	50	20	-	-	-	50	20	-	-	-	-	-	-	50
2EE**3##	Minor Course - III	3	0	0	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2EEEL318	Mini Project	0	0	4	2	-	-	-	-	-	-	-	50	-	-	-	50	20	50
2EECC319	Aptitude and Reasoning Part - IV	0	0	2	1	-	-	-	-	-	-	-	50	-	-	-	50	20	50
Total		15	1	12	22														800
Total Contact Hours		28																	

Professional Elective - I[&@]		
Track	**Course Code**	**Course Name**
Power Engineering	2EEPE312	Switchgear Protection & Industrial Electrical Systems
Control Engineering	2EEPE313	Control System Design
Embedded Systems	2EEPE314	Embedded Systems
E Mobility	2EEPE315	Electric Vehicles

&	Students are permitted to choose all the professional electives from particular track or from different track
@	E Mobility track in Professional Elective, and Honors in E Mobility are same. The students those who are choosing Honors in E mobility are not eligible to choose E Mobility track in Professional Elective and vice versa. Therefore students are advised to opt right choice during the selection of the Professional Elective and Honors in E Mobility.

On exit at the end of third year

Course Code	Course Name	L	T	P	C
2EEEX301	Electric Vehicle Maintenance	0	0	8	4
2EEEX302	Control Panel Design	0	0	8	4

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

Annasaheb Dange College of Engineering and Technology, Ashta

Department of Electrical Engineering

Teaching and Evaluation Scheme

Final Year. B. Tech, Semester VII

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2EEPC401	Electrical Drives	3	0	2	4	40	16	30	30	24	100	40	50	20	50	20	100	40	200
2EE**4##	Minor Course - IV	3	0	0	3	40	16	30	30	24	100	-	-	-	-	-	-	-	100
2EEPE4##	Professional Elective - II	3	0	0	3	40	16	30	30	24	100	-	-	-	-	-	-	-	100
2EEPC408	Industrial Automation and SCADA	3	0	2	4	40	16	30	30	24	100	40	50	20	-	-	50	20	150
2ILOE4**	Open Elective - III	2	0	0	2	50	20	-	-	-	50	20	-	-	-	-	-	-	50
2EEHS409	Project Management and Finance	2	0	0	2	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2EEEL410	Project Work	0	0	8	4	-	-	-	-	-	-	-	50	20	50	20	100	40	100
2EEVS411	Renewable Energy Systems Simulation Lab	0	0	2	1	-	-	-	-	-	-	-	50	20	-	-	50	20	50
Total		16	0	14	23														850
Total Contact Hours		30																	

Professional Elective - II[&]

Track	Course Code	Course Name
Power Engineering	2EEPE404	Utilization and Conservation of Electrical Energy
Control Engineering	2EEPE405	Special Electrical Machines
Embedded System	2EEPE406	Smartgrid
E Mobility	2EEPE407	Battery Management System
&	Students are permitted to choose all the professional electives from particular track or from different track	

Member Secretary-BoS **Chairman -BoS** **Member Secretary-AC** **Chairman-AC**

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

Annasaheb Dange College of Engineering and Technology, Ashta																			
Department of Electrical Engineering																			
Teaching and Evaluation Scheme																			
Final Year B. Tech, Semester VIII																			
Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2EEPE4**	Professional Elective - III (MOOC)+	2	0	0	2	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2EEPE4**	Professional Elective - IV (MOOC)+	2	0	0	2	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2EE**420	Minor Project	0	0	0	3	-	-	-	-	-	-	-	100	-	-	-	100	40	100
2EEEL421	Internship	0	0	20	10	-	-	-	-	-	-	-	100	-	-	-	100	40	100
		4	0	20	17														400
	Total Contact Hours	4 + Internship																	

Professional Elective - III		Professional Elective - IV	
Course Code	Track	Course Code	Track
2EEPE412	Power Engineering	2EEPE416	Power Engineering
2EEPE413	Control Engineering	2EEPE417	Control Engineering
2EEPE414	Embedded System	2EEPE418	Embedded System
2EEPE415	E Mobility	2EEPE419	E Mobility

Member Secretary-BoS Chairman -BoS Member Secretary-AC Chairman-AC

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

Annasaheb Dange College of Engineering and Technology, Ashta

Department of Electrical Engineering

Professional Elective (III & IV) Buckets - MOOC Courses+

Track - 1: Power Engineering

Course Code	Course Name	L	T	P	Credits
2EEPE412 & 2EEPE416	Power Management Integrated Circuits	0	0	0	2
	Recent Advances in Transmission Insulators	0	0	0	2
	Introduction to Smart Grid	0	0	0	2
	Advances in UHV Transmission and Distribution	0	0	0	2
	Electrical Distribution System Analysis	0	0	0	2
	Artificial Intelligence Applications to Power System	0	0	0	2
	Distributed Generation and Microgrid	0	0	0	2
	EHV AC and DC Transmission	0	0	0	2
	FACTS Devices	0	0	0	2
	Power Quality	0	0	0	2

Track -2: Control Engineering

Course Code	Course Name	L	T	P	Credits
2EEPE413 & 2EEPE417	Non-Linear Adaptive Control	0	0	0	2
	Advance Power Electronics & Control	0	0	0	2
	Digital Control Systems	0	0	0	2
	Industrial Instrumentation	0	0	0	2
	Logic and Distributed Control Systems	0	0	0	2
	Sensors and Actuators	0	0	0	2
	Electrical Machine Design	0	0	0	2

Transducers for Instrumentation

Track 3: Embedded Systems

Course Code	Course Name	L	T	P	Credits
2EEPE414 & 2EEPE418	Integrated Circuits and Applications	0	0	0	2
	Fuzzy sets, logic, and Systems Applications	0	0	0	2
	Introduction to Robotics	0	0	0	2
	Embedded Processors	0	0	0	2
	Embedded Sensing, Actuation and Interfacing Systems	0	0	0	2
	Artificial Neural Networks	0	0	0	2

Track 4: E Mobility

Course Name		L	T	P	Credits
2EEPE415 & 2EEPE419	EV Part -I	0	0	0	2
	EV - Vehicle Dynamics and Electric Motor Drives	0	0	0	2
	Intelligent Autonomous Vehicles	0	0	0	2
	Vehicle Dynamics and Control	0	0	0	2
	Electric Vehicle Design	0	0	0	2
	Charging Infrastructure	0	0	0	2

+	Based on the availability of the course at the time of offering BoS Chairman & Course Chairman will decide on the course upon student option

Member Secretary-BoS Chairman -BoS Member Secretary-AC Chairman-AC

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

Annasaheb Dange College of Engineering and Technology, Ashta

ADCET

Department of Electrical Engineering

Details of Minor, Specialization Minor and Honors Program

Minor Courses

Track - 1: Electric Vehicle

Course Code	Course Name	L	T	P	Credits
2EE**213	Fundamentals and Architecture of Electric Vehicles	2	0	0	2
2EE**304	Energy Storage Systems for Electric Vehicles	3	0	0	3
2EE**316	Electric Drives and Controllers for Electric Vehicles	3	0	0	3
2EE**402	Plug in Electric Vehicles in Smartgrid	3	0	0	3
2EE**414	Minor Project	0	0	0	3
Total		**11**	**0**	**0**	**14**

Track -2: Control Engineering

Course Code	Course Name	L	T	P	Credits
2EE**214	Transducers and Signal Conditioning	2	0	0	2
2EE**305	Control Systems	3	0	0	3
2EE**317	Process Control Engineering	3	0	0	3
2EE**403	Industrial Automation	3	0	0	3
2EE**414	Minor Project	0	0	0	3
Total		**11**	**0**	**0**	**14**

Specialization Minor in Sustainable Energy

Course Code	Course Name	L	T	P	Credits
2EE**416	Energy and its Resources	2	0	0	2
2EE**417	Energy Storage Systems for Renewables	3	0	0	3
2EE**418	Electronics for Renewables	3	0	0	3
2EE**419	Solar Energy Technologies and System Design	3	0	0	3
2EEEL420	Specialization Minor Project	0	0	0	3
Total		**11**	**0**	**0**	**14**

Honors with Research

Course Name		L	T	P	Credits
2EEHR421	Research Methodology	4	0	0	4
2EEHR422	Dissertation in Sem VII and Sem VIII	0	0	0	14
Total		**4**	**0**	**0**	**18**

Honors in E Mobility@

Course Name	Course Name	L	T	P	Credits
2EEHN417	Electric Vehicles (MOOC -1)	3	0	0	3
2EEHN418	Battery Management System (MOOC -2)	3	0	0	3
2EEHN419	MOOC - 3	2	0	0	2
2EEHN420	MOOC - 4	2	0	0	2
2EEEL421	Honor Project	0	0	0	8
Total		**10**	**0**	**0**	**18**

@	E Mobility track in Professional Elective, and Honors in E Mobility are same. The students those who are choosing Honors in E mobility are not eligible to choose E Mobility track in Professional Elective and vice versa. Therefore students are advised to opt right choice during the selection of the Professional Elective and Honors in E Mobility.

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An Autonomous Institute

Department of Electrical Engineering

Class	F.Y. B. Tech, Semester -I
Course Code and Course Title	2EEBS101 **Applied Mathematics - I**
Prerequisite	--
Teaching Scheme: Lecture / Tutorial / Practical	03/01/00
Credits	04
Evaluation Scheme: ISE / MSE/ ESE	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEBS101 _1	**Solve** the system of linear equations by using matrix method and numerical techniques.
2EEBS101 _2	**Calculate** Eigen values and Eigen vectors and power of matrix by using Cayley-Hamilton theorem.
2EEBS101 _3	**Fit** the curves for bivariate data by **applying** least square techniques
2EEBS101 _4	**Apply** Taylor series to find the expansion of functions.
2EEBS101 _5	**Compute** the n^{th} power and roots of the complex number by using De-Moivre's Theorem.

Course Contents		**Hours**
Unit 1	**Matrices and Solution of Linear System Equations:** Rank of a matrix, Normal form of a matrix, echelon form, Consistency of linear system of equations (system of homogeneous and non- homogeneous linear equation).	**07**
Unit 2	**Eigen Values and Eigen Vectors:** Vectors, Linear dependence and linear independence of vectors, Eigen values, Properties of Eigen values, Eigen vectors, Properties of Eigenvectors, Cayley-Hamilton Theorem (Inverse and Higher powers of matrix).	**08**
Unit 3	**Numerical Solution of System of Simultaneous Linear Equations:** Gauss Elimination Method, Gauss-Jordan Method, Iterative Method –Gauss Jacobi method and Gauss Seidel method, Eigen value using Power method.	**06**
Unit 4	**Statistics and Curve fitting:** Method of Least Squares, Fitting of Straight Line, Fitting of Parabola, Fitting of exponential curves, Lines of Regression.	**06**
Unit 5	**Calculus:** Taylor's series, Maclaurin's series, Standard expansions, Expansion of function using Standard series, Indeterminate forms.	**07**
Unit 6	**Complex Numbers:** De Moivre's theorem, Roots of a complex number, Expansion of sin(nx) and cos(nx) in powers of sinx and/or cosx, Circular functions of a complex variable, Hyperbolic functions, relation between circular and hyperbolic functions, Inverse Hyperbolic functions.	**08**

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Numerical Methods in Engineering & Science	Dr. B. S Grewal	Khanna Publishers	9th	2010
02	Advanced Engineering Mathematics	H. K. Das	S. Chand	22nd	2018
03	A textbook of Applied Mathematics	P.N. Wartikar & J. N. Wartikar	Pune Vidyarthi Griha Prakashan	1st	2008
04	Higher Engineering Mathematics	B. V. Ramana	TMH	6th	2010

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Higher Engineering Mathematics	Dr. B. S. Grewal	Khanna Publishers	44th	2018
02	Advanced Engineering Mathematics	N. P. Bali Manish Goyal	Infinity Science Press	7th	2010
03	Advanced Engineering Mathematics	Erwin Kreyszig	Wiley Publishers	10th	2017
04	Numerical Methods	Dr. P. Kandasamy Dr.K.Thilagavathy Dr. K. Gunavathi	S. Chand	1st	2010

List of Tutorial:

Sr. No.	Title of Tutorials
1	Matrices and Solution of Linear System Equations :Normal form, system of homogeneous linear equation
2	System of non- homogeneous linear equation
3	Eigen Values and Eigen Vectors
4	Cayley-Hamilton Theorem
5	Numerical Solution of System of Simultaneous Linear Equations
6	Curve Fitting I: Fitting of Straight Line and Fitting of Parabola
7	Curve Fitting II: Fitting of exponential curves and Lines of Regression
8	Expansion of function

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Department of Electrical Engineering

Class	F.Y.B. Tech. Semester-I
Course Code and Course Title	2EEPC102 **Basic Electrical Engineering**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial /Practical	03/00/00
Credits	03
Evaluation Scheme: ISE / MSE/ ESE	40/30/30

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEPC102_1	**Explain** basic terminologies related to DC, AC and magnetic circuits to relate the operations of electrical devices using electrical laws.
2EEPC102_2	**Relate** the concepts of AC fundamentals to single-phase and three-phase AC circuits to describe the generation of AC with phasor representation.
2EEPC102_3	**Interpret** the relationship between line and phase quantities in three-phase AC circuits using star and delta connection for industrial loads
2EEPC02_4	**Demonstrate** wiring circuits and illumination schemes using circuit diagrams on the basis of recent trends and applications.
2EEPC102_5	**Apply** conceptual understanding of AC & DC parameters to solve electrical circuits and provide a solution

Course Contents		**Hours**
Unit 1	**Fundamentals of DC Circuits** EMF, voltage, current, work, power, energy, Ohm's law, its application and limitations, series and parallel circuit, temperature coefficient of resistance, voltage & current source, Kirchhoff's laws, Star-delta transformations, electrical energy conversion with mechanical & thermal quantities.	**08**
Unit 2	**Magnetic Circuits** Concept of the magnetic circuit, comparison between electric and magnetic circuit, series magnetic circuit, self-inductance and mutual inductance, magnetization (B-H) curve, Hysteresis curve, magnetic leakage and fringing.	**06**
Unit 3	**AC Fundamentals** Faraday's law of Electromagnetic Induction, Statically Induced EMF. Dynamically Induced EMF, Generation of Sinusoidal EMF, RMS value, Average value, Form Factor, Peak factor, Graphical and Mathematical representation of Phasor	**07**
Unit 4	**Single Phase AC Circuits** Introduction to AC circuit, parameters of AC circuits, Analysis of R, L, C, R-L, R-C, R-L-C series circuit, R-L & R-L-C parallel circuit, Series Resonance, Parallel Resonance, Power in AC circuit, Power factor and power factor improvement by shunt capacitor.	**08**

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Unit 5	**Three Phase AC Circuits** Generation of three phase A.C voltage, advantages of three phase systems, Types of supply system and load connections, balanced three phase system, Relation between line and phase quantities, Three Phase Power measurement using Two Wattmeter Method [Theoretical treatment only]	**07**
Unit 6	**Wiring Circuits, Lamps &Emerging Trends** **Wiring:** Simple wiring, Staircase wiring, Godown wiring **Lamps:** Incandescent lamp, Fluorescent Tube, CFL, Mercury Vapour Lamp, Sodium Vapour Lamp, LED, comparison of lamps. **Emerging Trends**: Introduction of Electric Vehicles (EV), Energy Storage Systems.	**06**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Basic Electrical Engineering	V. K. Mehta Rohit Mehta	S. Chand	5th	2016
02	A Text book of Electrical Technology	B L Theraja & A K Theraja	S. Chand	1st (Reprint)	2016
03	Basic Electrical Engineering	J. M. Kharade, M. D. Patil, D. B. Kanase	Wiley India	1st	2018
04	Basic Electrical Engineering	I.J. Nagrath D. P. Kothari	Tata McGraw Hill	3rd	2013

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Electrical Engineering Concepts and Applications	P. V Prasad & S. Shivanaraju	Cengage Learning	1st	2012
02	Fundamentals of Electrical Engineering	Bharati Dwivedi Anurag Tripathi	Wiley	2nd	2014
03	Electrical Engineering Fundamental	Vincent Del Toro	Pearson	2nd	2003
04	Fundamentals of Electrical Engineering	Ashfaq Husain	Dhanpat Rai & co.	3rd	2008
05	Basic Electrical & Electronics Engineering	S. K. Bhattarachya	Pearson	1st	2012

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Department of Electrical Engineering

Class	F. Y. B. Tech, Semester- I
Course Code and Course Title	2EEES103 **Applied Mechanics**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00
Credits	02
Evaluation Scheme: ISE / MSE/ ESE	40/30/30

Course Outcomes (COs):
After successful completion of this course, the student will be able to:

2EEES103_1	**Interpret** the resultant force for a force system using resolution and composition.
2EEES103_2	**Use** the free body diagram of the force system by applying concept of equilibrium.
2EEES103_3	**Identify** the reactions at support of the beam by applying equilibrium conditions.
2EEES103_4	**Choose** the Centroid and center of gravity of different compound shapes using method of geometric decomposition.
2EEES103_5	**Calculate** moment of inertia for a composite plane lamina by using parallel and perpendicular axis theorem.

Course Contents		**Hours**
Unit 1	**Introduction to Applied mechanics** Basic concepts - Particle, body, rigid body, force, types of force systems, law of transmissibility of force, moment of a force, couple, resolution of a force, resultant force, composition of forces, triangle law, parallelogram law, polygon law of forces.	**04**
Unit 2	**Analysis of force systems** Introduction to concurrent and non-concurrent force systems, magnitude and direction of concurrent force systems, Varignon's theorem, magnitude and direction of non-concurrent force systems.	**05**
Unit 3	**Equilibrium of forces** Concept of equilibrium, conditions of equilibrium, free body diagram, Lami's theorem.	**05**
Unit 4	**Beam** Types of load, types of support, types of beam, reactions at support, analysis of simple and compound beams using conditions of equilibrium.	**05**
Unit 5	**Centroid** Introduction to Centroid and Centre of Gravity, Centroid of standard figures, Centroid of composite figures.	**04**
Unit 6	**Moment of Inertia** Moment of Inertia, Moment of Inertia of Standard shapes from first principle, Parallel and perpendicular axis theorem, Moment of Inertia of plain and composite figures, Radius of Gyration.	**05**

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Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Basic Civil Engineering	G. K. Hiraskar	Dhanpatrai Publications	1st	2008
02	Surveying	N. Basak	Tata Mac Graw Hill., Publications	1st	2008
03	Engineering Mechanics	S. Ramamrutham	DhanpatRai Publishing Company (P). Ltd	9th	2010
04	Engineering Mechanics	R.S. Khurmi	S. Chand	Revised	2006
05	Engineering Mechanics	R. K. Bansal and Sanjay Bansal	Laxmi Publications Pvt. Ltd.	6th	2013
06	Engineering Mechanics	K. L. Kumar	Tata McGraw Hill Education	4th	2012
07	Engineering Mechanics	S. B. Junnarkar	Charotar Publications	16th	2011
08	Engineering Mechanics	S.S. Bhavikatti	New Age International Pvt. Ltd.	4th	2012

Reference Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Civil Engineering Handbook	P. N. Khanna	Engineer's Publishers	17th	1999
02	The A to Z of Practical Building Construction and its Management	Sandeep Mantri	Satya Prakashan	1st	2010
03	Engineering Mechanics	Timoshenko and Young	McGraw Hill	3rd	2006
04	Engineering Mechanics	Irving H. Shames	Prentice Hall of India, New Delhi	5th	2011
05	Vector Mechanics for Engineers Vol.-I and II	F. P. Beer and E. R. Johnson	Tata McGraw Hill Education	6th	2011
06	Engineering Mechanics: Statics & Dynamics	Ferdinand Singer	Harper and Row	9th	2009
07	Fundamentals of Engineering Mechanics	S. Rajasekaran	Vikas Publishing House Pvt. Ltd.	3rd	2005

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Department of Electrical Engineering

Class	F. Y. B. Tech, Semester - I
Course Code and Course Title	2EEES104 **Basic Mechanical Engineering**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial /Practical	02/00/00
Credits	02
Evaluation Scheme: ISE / MSE/ ESE	40/30/30

Course Outcomes (COs): Upon successful completion of this course, the student will be able to	
2EEES104_1	**Classify** the different processes for manufacturing based on different criteria.
2EEES104_2	**Describe** generation processes to generate electricity from different energy sources.
2EEES104_3	**Explain** the basic concept of IC engines and Gas laws by using PV-TS Curves.
2EEES104_4	**Discuss** various refrigeration and air conditioning system depending upon the application areas.
2EEES104_5	**Select** an appropriate mechanical and energy conversion device for a specific application.
2EEES104_6	**Calculate** the operating and geometric parameters for power transmission systems by considering various factors.

Course Contents		**Hours**
Unit 1	**Energy Sources &Power Plants** Introduction, Renewable and non-renewable energy sources, Solar collector - Solar-flat plate collector, concentric collector - Parabolic and cylindrical, Photovoltaic cell, Wind Power Plant, Hydro-Electric power plant.	**05**
Unit 2	**Internal Combustion Engine** Introduction of IC Engine, Classification, Basic Components of IC Engines and Terminology of IC Engines, Four stroke and Two stroke engines, Difference in SI and CI Engine.	**05**
Unit 3	**Refrigeration &Air conditioning system** Introduction to refrigerator, ton of Refrigeration, COP, Refrigerant and its types, Vapor compression Refrigeration system and Vapor absorption Refrigeration system, Carnot Refrigerator	**04**
Unit 4	**Mechanical systems and Energy conversion devices** Introduction to Mechanical devices, Pump – Centrifugal Pump, Reciprocating Pump, Compressors – Centrifugal Compressor, Reciprocating Compressor, Hydraulic turbines – Impulse Turbine-Pelton, Reaction Turbine-Francis and Kaplan	**05**
Unit 5	**Power Transmission** Introduction to Power Transmission device, Belt drives –Open belt drive, Cross belt drive, and gears drive- Spur, Helical, Bevel, Rack and Pinion (Numerical on belt tensions, gear ratio, and velocity ratio).	**05**

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Unit 6	**Manufacturing Processes** Introduction, Casting process -Sand casting, Steps in sand casting Process, Metal joining processes - Arc welding, Gas welding, soldering and brazing, Metal Removing Process- Operations in Metal Cutting process.	**04**

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Solar Energy	Dr. S. P. Sukathame	Tata Mc- Graw Hill	4th	2012
02	Non-Conventional Sources of Energy	G. D. Rai	Khanna Publication	5th	2012
03	IC Engines	V. Ganesan	Tata Mc- Graw Hill	4th	2013
04	Refrigeration and Air Conditioning	R.S.Khurmi J.K.Gupta	S. Chand	1st	2012

Reference Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Manufacturing Technology	P. N. Rao	Tata Mc-Graw Hill	4th	2014
02	Theory of machines	S.S. Ratan	Tata-McGraw Hill	3rd	2012
03	Thermal engineering	P.L Ballaney	Khanna	24th	2012
04	Refrigeration and Air Conditioning	Arora	Tata Mc-Graw Hill	8th	2019

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

Class	F. Y. B. Tech, Semester - I
Course Code and Course Title	2EEES105 **Programming for Problem Solving**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	02/00/02
Credits	03
Evaluation Scheme: ISE/ESE	50/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEES105_1	**Prepare** an algorithm and draw a flowchart to accurately solve various mathematical problems by using structured approach.
2EEES105_2	**Apply** the fundamental concepts like data types, operators to solve mathematical problems by using the C language.
2EEES105_3	**Apply** the decision and looping constructs to solve the problems related to decision, repetitive statements for real time problem statement using C language.
2EEES105_4	**Develop** a C program to demonstrate the modular approach by using the concept of function, structure, pointer, file handling.
2EEES105_5	**Design** and exhibit micro project for real time problems by using C language

Course Contents		**Hours**
Unit 1	**Basics of Programming** The meaning of algorithms, Flowcharts, Pseudo codes, writing algorithms and drawing flowcharts for simple exercises, Memory concepts, C Program development environment.	**03**
Unit 2	**C Fundamentals** Importance of 'C' Language, History, Structure of 'C' Program, Sample 'C' Program, Constants, variables and data types, Enumeration. Operators and expressions, managing input / output operations, Control Statements-Decision making, Case control & Looping Constructs.	**07**
Unit 3	**Array** The meaning of an array, one dimensional and two-dimensional arrays, declaration and initialization of arrays, reading, writing and manipulation of above types of arrays, multidimensional arrays. Strings-Declaring and initializing character array, reading and writing string to/from terminal, string handling functions.	**04**

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Unit 4	**Functions** Need of user defined functions, elements of User defined functions, defining functions, return values and their types, function calls, function declaration, methods of parameter passing, Scope rule of functions, user defined and library functions.	**04**
Unit 5	**Structure & Pointers** Need of Structure, defining a structure, declaring and accessing structure variables, structure initialization, copying and comparing structure variables, array of structures, structures and functions, Unions. Understanding pointers, accessing the address space of a variable, declaring and initialization pointer variables, accessing a variable through its pointer, pointer expressions, Types of pointer: Void pointer, generic pointer, null pointer, dangling pointer, pointer to a function, Calling A function through function pointer.	**06**
Unit 6	**File Handling** Defining and opening a file, closing a file, input/output operations on files, error handling during I/O operations, random access files, command line arguments, C preprocessor.	**04**

Experiment List	
1	Write an algorithm and draw flowchart for given problem statements.
2	Implement a program using different data types and operators in C.
3	Implement a program using decision-control statements
4	Implement a program using repetitive control statements (for, while, do-while)
5	Implement a program using selection control statement
6	Implement a program using nested loop (for, while loop)
7	Implement a program to demonstrate 1D array and 2D array
8	Implement a program using user defined functions in C
9	Implement a program to demonstrate concept of structures in C
10	Implement a program to demonstrate concept of array of structures in C
11	Implement a program to demonstrate concept of pointers in C
12	Implement a program to demonstrate concept of file handling in C

Note: Minimum TEN experiments should be performed from the above list

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Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Programming and Problem-Solving Using C Language	ISRD Group	McGraw-Hill	-	2012
02	Let Us C	Yashwant Kanetkar	BPB	3rd	2011
03	C How to Program	Harvey M. DeitelPaul J. Deitel, Abbey Deitel	Pearson	2nd	2009
04	Programming in ANSI C	E. Balguruswamy	TMH	4th	2008

Reference Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	The 'C' Programming Language	D. M. Ritchie	Pearson	2nd	1998
02	C Programming Laboratory: Handbook for Beginners	Sidnal	Wiley India Limited	1st	2012
03	Understanding pointers in C	Yashwant Kanetkar	BPB	4th	2001
04	Test your C Skills	Yashwant Kanetkar	BPB	5th	2013

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Department of Electrical Engineering

Class	F. Y. B. Tech. Semester-I
Course Code and Course Title	2EEHS106 **Professional Communication Skills**
Prerequisite/s	12th Standard English Grammar
Teaching Scheme: Lecture/Tutorial/ Practical	00/00/04
Credits	02
Evaluation Scheme: ISE	50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

2EEHS106_1	**Exhibit** the skill of sentence construction considering the frame of English language rules accurately for effective and sound communication
2EEHS106_2	**Present** their portfolio confidently considering SWOT analysis by using digital tools convincingly as per the corporate expectations
2EEHS106_3	**Write** formal letters proficiently by following required techniques that helps in maintaining professional affairs at workplace
2EEHS106_4	**Produce** professional presentations proficiently on assigned topics in convincing manner using necessary tools and techniques
2EEHS106_5	**Justify** own role in communicative events with balanced zeal, in well-organized manner

List of Practical's	
01	Checking My English Communication
02	Self - Introduction
03	Presenting my Career Choices
04	Preparing my Portfolio
05	Enriching Vocabulary
06	Avoiding Common Errors
07	Presenting My Portfolio
08	Note Making
09	Getting Smart with Technical Description of charts/ Images/ Processes
10	Delivering Professional Presentation
11	Application and Resume Writing
12	Email Writing
13	GD (General)
14	Introducing Guest/ Friend
15	Extempore
16	GD (Technical)
17	Mock Interview
18	Organizing an Event

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Reference Books

Textbook					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	The Professional: Defining the New Standard of Excellence at Work	Subroto Bagchi	Penguin Books India Pvt. Ltd.	Revised Edition	2011
2	Cambridge Guide to IELTS	Pauline Cullen, Amanda French	Cambridge University Press	Reprint	2017
3	A Practical Course in Effective English Speaking Skills	J. K. Gangal	PHI Learning Private Limited, New Delhi	Print	2012
4	Personality Development and Soft Skills	Barun K. Mitra	Oxford University Press, New Delhi, India	Seventh Impression	2012

Reference Books					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	High-school English Grammar and Composition	Wren and Martin	S. Chand and Co., New Delhi	1st	2015
2	The Ace of Soft Skills	Ajai Chowdry, Bala Balchandran	Pearson Publication, Delhi	8th	2013
3	Effective Technical Communication	M. Ashraf Rizvi	Mc Graw Hill Education, Chennai	Second Edition	2017
4	Business Communication	Hory Sankar Mukerjee	Oxford University Press, New Delhi, India	Second Edition	2013

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

Class	F. Y. B. Tech, Semester – I
Course Code and Course Title	2EEPC107 **Basic Electrical Engineering Laboratory**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs): Upon completion of this course, students will be able to,	
2EEPC107_1	**Identify** electrical components, equipment, Lamps and different illumination schemes using electrical apparatus & symbols to handle it properly for experimentation
2EEPC107_2	**Measure** electrical parameters with appropriate measuring instruments on the basis of ratings and type of connections
2EEPC107_3	**Demonstrate** the circuital law's, perform testing on electric machine to find the solutions with the help of various instruments for domestic and industrial applications
2EEPC107_4	**Correlate** and comment the observations and results of experiment with different laws to provide solution for given system
2EEES107_5	**Practice** safety precautions in day to day life & communicate effectively with ethics about laboratory work both orally and in writing

List of Experiments

Expt. No.	Title of Experiment
1	Study of Electrical Components, Laboratory Tools, Measuring Instruments, Energy Meter
2	Electrical Safety Precaution and Earthling
3	Kirchhoff's Voltage and Current Law
4	B-H Curve for Magnetic Material
5	RLC Series Circuit
6	Power Factor Improvement
7	Demonstration of Wiring Circuits
8	Lamps and Illumination Schemes
9	Three phase power measurement (Two Wattmeter Method)
10	Effect of temperature on resistance
11	LED lamp assembling, testing & maintenance.
12	Introduction to single phase energy meter and sample calculation of electricity bill.

Note: Minimum TEN experiments should be performed from the above list

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Class	F. Y. B. Tech, Semester - I
Course Code and Course Title	2EEES108 **Applied Mechanics Lab**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial /Practical	00/00/02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes: Upon successful completion of laboratory work, the student will be able to	
2EEES108_1	**Compute** resultant and moments of a force system to verify the laws of forces for static state of body
2EEES108_2	**Choose** the position of centroid for a plane lamina by experimental method
2EEES108_3	**Relate** the magnitude of support reactions of a simply supported beam using experimental and analytical method
2EEES108_4	**Interpret** the resultant force and reactions at support for a force system based on concepts of resolution and composition
2EEES108_5	**Calculate** moment of inertia for a composite plane lamina by using parallel and perpendicular axis theorem
2EEES108_6	**Exhibit** communication skill and ethical behavior as an Engineer while performing experiments in laboratory based on written, oral communication and professional behavior

List of Experiments	
Exp. No.	**Title of Experiments**
1	To verify triangle law of forces using force table
2	To verify law of polygon of forces using force table
3	To verify lami's theorem using force table
4	To verify law of moments using Bell crank lever
5	To calculate support reactions of beam
6	To compute centroid of plain lamina
7	Solve numerical on force system and beam
8	Solve numerical on moment of inertia

Note: All EIGHT experiments should be performed in the laboratory

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Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Basic Civil Engineering	G. K. Hiraskar	Dhanpat Rai	1st	2008
02	Surveying	N. Basak	Tata Mac Graw Hill	1st	2008
03	Engineering Mechanics	S. Ramamrutham	Dhanpat Rai	9th	2010
04	Engineering Mechanics	R.S. Khurmi	S. Chand	Revised	2006
05	Engineering Mechanics	R. K. Bansal and Sanjay Bansal	Laxmi	6th	2013
06	Engineering Mechanics	K. L. Kumar	Tata McGraw Hill	4th	2012
07	Engineering Mechanics	S. B. Junnarkar	Charotar	16th	2011
08	Engineering Mechanics	S.S. Bhavikatti	New Age International Pvt. Ltd.	4th	2012

Reference Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Engineering Mechanics	Irving H. Shames	Prentice Hall of India, New Delhi	5th	2011
02	Vector Mechanics for Engineers Vol.-I and II	F. P. Beer and E. R. Johnson	Tata McGraw Hill Education	6th	2011
03	Engineering Mechanics: Statics & Dynamics	Ferdinand Singer	Harper and Row Publications	9th	2009
04	Fundamentals of Engineering Mechanics	S. Rajasekaran	Vikas Publishing House Pvt. Ltd.	3rd	2005
05	Mechanics of Materials	Dr. B.C. Punmia	Laxmi	Reprint	2010

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

Class	F. Y. B. Tech. I Semester
Course Code and Course Title	2EEES109 **Design Thinking**
Prerequisite/s	---
Teaching Scheme: Theory/Tutorial/Practical	01/00/02
Credits	02
Evaluation Scheme: ISE	50

Course Outcomes: After successful completion of this course the students will be able to	
2EEES109_1	**Apply** the design thinking techniques to empathize the customer through arranging survey and/or interviews.
2EEES109_2	**Identify** and formulate the solution for real world problem using design thinking technique.
2EEES109_3	**Create** a Prototype for defined problem using design thinking approach.
2EEES109_4	**Test** developed prototype to meet user's requirements through customer feedback or prototype exhibitions.
2EEES109_5	**Adapt** ethical practices and professional skills to provide a reliable solution for defined real world problem through participating in team activities.

Syllabus: Design Thinking

Course Contents		**Hours**
Unit 1	Introduction to Design Thinking, Design Thinking Process	**02**
Unit 2	Empathize Phase: Empathy and Ethics, User Perspective, Activities – Empathy Map, Planning, Persona building.	**02**
Unit 3	Customer Journey Mapping, Observation of stakeholders, Defining and Conceptualization of problem	**02**
Unit 4	Ideation, Activities –5 Whys & 1 How, Story boarding, Brainstorming.	**02**
Unit 5	Prototype – Types, Mindsets, Tools.	**02**
Unit 6	Testing – Scenario, Methods, Refinements & Recommendations.	**02**

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Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Understanding Design Thinking, Lean, and Agile	Jonny Schneider	O'Reilly	---	2017
2	Introduction to Design Thinking	S.Salivahanan, S.Suresh Kumar, D.Praveen Sam,	Tata Mc Graw Hill,	---	2019
3	Karmic Design Thinking - A Buddhism-Inspired Method to Help Create Human-Centered Products & Services	Prof. Bala Ramadurai,	Self-Published	--	2020
4	Design: Creation of Artifacts in Society	Prof. Karl Ulrich, U. Penn	University of Pennsylvania	--	2011

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Design for How People Think	John Whalen	O'Reilly	---	2019
2	Change by Design	Tim Brown	HarperCollins	---	2009
3	Creative Confidence: Unleashing the Creative Potential Within Us All	Kelley, D. & Kelley, T	New York: William Collins	---	2014
4	Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days	Jack Knapp and others	Simon & Schuster	---	2009

Other Books/E-material

Sr. No	Title	Instructor	Publisher
01	NPTEL Course- Design Thinking A Primer	Prof. Ashwin Mahalingam& Prof. Bala Ramadurai	www.nptel.ac.in
02	NPTEL Course- Innovation by Design	Dr. B.K. Chakravarthy	www.nptel.ac.in

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List of Experiments

Expt. No	Title of the Experiment
1	Identification and Selection of Problems
2	Designing of Empathy Map
3	Customer Survey and Analysis
4	Persona Building
5	Customer Journey Map
6	Defining the problem
7	Poster Presentation
8	Ideation
9	Prototype Building
10	Testing

Note: All TEN experiments should be performed in the laboratory

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Class	F.Y. B. Tech, Semester.-I
Course Code and Course Title	2EEHS110_A, **Badminton**
Prerequisite/s	----------
Teaching Scheme: Lecture/Tutorial/ Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

2EEHS110_A1	**Improve** physical fitness.
2EEHS110_A2	**Understand** the basic rules and how they can play the game of badminton.
2EEHS110_A3	**Provide** opportunities for playing modified games to promote student learning
2EEHS110_A4	**Develop** students' critical thinking skills, problem solving skills, self-management skills, collaboration skills, risk assessment etc.
2EEHS110_A5	**Learn** various technical motor skills in badminton and how you can move better in the court.
2EEHS110_A6	**Acquiring** a satisfactory level of knowledge and experience of the sport, to enable students to play by themselves for recreation.

Course Contents

Unit No.	Title	Hours
Unit 1	Introduction to badminton – Aim – Objectives – Short reference in Badminton history Understand the basic rules and how they should play normal game.	**04**
Unit 2	Skills - Service, Net shot, Clear, Drop, Smash. Skills - Service Forehand & Backhand, Net shot, Drive (Presentation and practice to the court)	**06**
Unit 3	Skills – Clear, Drop, Smash Implementation of singles rules	**05**
Unit 4	Footwork 1 Footwork 2	**05**
Unit 5	Implementation of doubles rules. Forehand strokes. Motor skills practice 1	**06**
Unit 6	Motor skills practice 2 Motor skills practice 3 Motor skills practice 4	**04**

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Class	F.Y. B. Tech, Semester.-I
Course Code and Course Title	2EEHS110_B, **Volley Ball**
Prerequisite/s	----------
Teaching Scheme: Lecture/Tutorial/ Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

2EEHS110_B1	**To send** the ball over the net, according to the regulations, to the ground on the opponent's ground
2EEHS110_B2	The ball is put into **play** through the service right back player within the service zone
2EEHS110_B3	**The Ball** must hit with one hand or one arm and directly send over the net opponent's court.
2EEHS110_B4	**To valley** the ball over the net before it touches on the ground
2EEHS110_B5	The players **use** their hands to volley the ball.

Course Contents

Unit No.	Title	Hours
Unit 1	Introduction & understand basic volleyball rules, terminology, and scoring procedures.	**04**
Unit 2	Demonstrate basic skills associated with volleyball, including passing, setting, serving, attacking (spiking), and blocking.	**06**
Unit 3	Demonstrate the ability to perform individual offensive and defensive skills and strategies.	**05**
Unit 4	Demonstrate an understanding of the typical game sequencing: serve, pass, attack, defense, transition, and defense.	**05**
Unit 5	Understand and apply the knowledge of basic rules of volleyball. Skill Practice	**06**
Unit 6	Demonstrate proper etiquette and good sportsmanship. And Skill related Practice. Skill Practice	**04**

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Class	F.Y. B. Tech, Semester.-I
Course Code and Course Title	2EEHS110_C, **Kabaddi**
Prerequisite/s	----------
Teaching Scheme: Lecture/Tutorial/ Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

2EEHS110_C1	**Acquire,** analyze and interpret basic skills
2EEHS110_C2	**Appraise** the rules and regulation.
2EEHS110_C3	**Demonstrate** and assess various basic skills/techniques and game strategies.
2EEHS110_C4	**Develops** confidence, concentration and tolerance in players.
2EEHS110_C5	This game also **Provides** an opportunity for healthy competitions among equal players and help them make friends.

Course Contents

Unit No.	Title	Hours
Unit 1	Introduction to Kabaddi – Aim – Objectives – Short reference in Kabaddi history Understand the basic rules and how they should play normal game.	**04**
Unit 2	Demonstrate basic skills associated with Kabaddi, including pushing, Bonus, Tackling, attacking, and blocking	**06**
Unit 3	Demonstrate an understanding of the typical game sequencing: service, Bonus, attack, defense, Raiding and defense.	**05**
Unit 4	Demonstrate the ability to perform individual offensive and defensive skills and strategies. Stepping Practice.	**05**
Unit 5	Skill Demo – Stepping, Bonus, Foot touch, Toe touch, Thrust, Squat leg, Kicks & Practice.	**06**
Unit 6	Skill Practice and Shadow Practice	**04**

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Class	F.Y. B. Tech, Semester.-I
Course Code and Course Title	2EEHS110_D, **Foot Ball**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/ Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

2EEHS110_D1	**By applying** these principles through active participation, students develop the necessary Skills and knowledge to play football.
2EEHS110_D2	**Provides** students with opportunities to improve physical fitness acquire knowledge of fitness concepts and practice positive personal and social skills.
2EEHS110_D3	**Students** will gain an understanding of how a wellness lifestyle affects one's health, fitness and physical performance

Course Contents:

Unit No.	Title	Hours
Unit 1	Introduction to Football – Aim – Objectives – Short reference in Football history Understand the basic rules and how they should play normal game.	**04**
Unit 2	Introduce students to the basic skills and knowledge associated with football. Understand basic football rules, terminology, and safety concerns.	**06**
Unit 3	Demonstrate the basic football skills of passing, three-point stance, catching, blocking, hand-offs, punting, the carry and kicking & Practice.	**05**
Unit 4	Demonstrate the ability to perform individual offensive and defensive skills and strategies.	**05**
Unit 5	Improve personal fitness through participation in yoga, muscular strength, muscular endurance, and flexibility activities & Practice.	**06**
Unit 6	Successfully participates in skill improvement and offensive game strategies & Practice	**04**

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Class	F.Y. B. Tech, Semester.-I
Course Code and Course Title	2EEHS110_E, **Bharatnatyam Classical Dance**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/ Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

2EEHS110_E1	**Interpolation** of Indian classical dance forms & basic types of Bharatnatyam.
2EEHS110_E2	**Subdivide** bharatnatyam in terms of Nrutt, Nrutya & Nattya.
2EEHS110_E3	**Show** the perform base on signal & combine hand posture in terms of Ganesh Vandana & Mahalaxmi Ashtak

Course Contents:

Unit No.	Title	Hours
Unit 1	History of Bharatnatyam Dance style & information about all Indian classical dance forms.	**01**
Unit 2	Basic types of Bharatnatyam :- Tatty Advu, Natty advu, Vishru advu, Kuddit Mett advu, Mett advu, tatti kuddit mett advu & Tirmanam (small). Study of Navras Abhinay. Singal Hand posture , Footwork , Shirobhed(head movement),	**10**
Unit 3	Combine Hand posture. Meaning of Guruvandna, Ganesh, mahalaxmi shlok. Definition of Nrutt, Nrutya & Nattya.	**06**
Unit 4	Practical session of Ganesh vandna Shlok in classical music.	**06**
Unit 5	Practice Sessions. & Presentation of Ganesh vandna	**06**
Unit 6	History of Bharatnatyam Dance style & information about all Indian classical dance forms.	**01**

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Class	F.Y. B. Tech, Semester.-I
Course Code and Course Title	2EEHS110_F, **Harmonium Classical Music**
Prerequisite/s	----------
Teaching Scheme: Lecture/Tutorial/ Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

2EEHS110_F1	**Outline** in History Harmonium & different Raags.
2EEHS110_F2	**Perform** on different songs
2EEHS110_F3	**Role play** the different music by means of harmonium.

Course Contents

Unit No.	Title	Hours
Unit 1	History & Introduction of Harmonium.	**02**
Unit 2	Harmonium presentation of Raag:- Bhoop raag / Bhimpalash raag.	**12**
Unit 3	Practice sessions.	**03**
Unit 4	Practice song notations & Harmonium Dhoon (percussion)	**08**
Unit 5	Practice sessions & students' presentations	**05**
Unit 6	History & Introduction of Harmonium.	**02**

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Class	F.Y. B. Tech, Semester.-I
Course Code and Course Title	2EEHS110_G, **Indian Folk Dance**
Prerequisite/s	----------
Teaching Scheme: Lecture/Tutorial/ Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEHS110_G1	**Discuss** different types in Indian Folk dance.
2EEHS110_G2	**Demonstrate** Navras Abhinay, Tribal dance, Dhangari & Lavni dance.
2EEHS110_G3	**Compose** dance on different folk-dance style.

Course Contents

Unit No.	Title	Hours
Unit 1	Introduction to Indian Folk dance & its forms.	**02**
Unit 2	Basic steps of folk-dance styles.	**03**
Unit 3	Importance of expressions (Acting) in dance, Navras Abhinay & its types. (9 types of navras)	**03**
Unit 4	Tribal dance, & it's different styles.	**06**
Unit 5	Practice sessions.	**04**
Unit 6	History of Dhangari & Lavni dance. Types of dhangari & lavni dance.	**01**
Unit 7	Steps (dance composition) of Dhangari & Lavni dance.	**07**
Unit 8	Practice sessions & Students performance	**04**

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Class	F.Y. B. Tech, Semester.-I
Course Code and Course Title	2EEHS110_H, **Karaoke Singing.**
Prerequisite/s	----------
Teaching Scheme: Lecture/Tutorial/ Practical	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEHS110_H1	**Understand** notation of the songs.
2EEHS110_H2	**Perform** happy, sad, love deviational, patriotic songs.
2EEHS110_H3	**Compose** songs in many variations.

Course Contents

Unit No.	Title	Hours
Unit 1	Song Notation	**04**
Unit 2	Happy song / Sad song (classical & semi classical)	**08**
Unit 3	Love song / Deviational song / Patriotic songs	**08**
Unit 4	Song composition	**05**
Unit 5	Practice session & students' presentation	**05**

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Curriculum

First Year B.Tech - Semester – II

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Class	F.Y. B. Tech, Semester -II
Course Code and Course Title	2EEBS111 **Applied Mathematics- II**
Prerequisite/s	2EEBS101
Teaching Scheme: Lecture/Tutorial/Practical	03/01/00
Credits	04
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes: After successful completion of this course, the students will be able to:	
2EEBS111_1	**Solve** problems on partial derivatives by using fundamental concepts of derivative and apply it to find Jacobian, Maxima and Minima of functions of several variables.
2EEBS111_2	**Solve** Ordinary Differential Equation by using analytical method and numerical techniques.
2EEBS111_3	**Use** technique of finite difference and interpolation to compute the value of function for given data
2EEBS111_4	**Apply** the concept of Special Functions to evaluate improper integrals.
2EEBS111_5	**Evaluate** proper and improper type of multiple integrals by using fundamental concepts of integration and apply it to find Area and Mass of a given region.

Course Contents		**Hours**
Unit 1	**Partial Differentiation and Its Applications:** Function of two or more variables, Partial derivatives, Euler's theorem, Change of variables, Jacobin, Maxima and minima of functions of two variables.	**08**
Unit 2	**Ordinary Differential Equation (First order and First degree):** Linear differential equation, Equation reducible to linear differential equation, Exact differential equation, Equation reducible to exact equation, Simple electrical circuits.	**07**
Unit 3	**Numerical Solution of Ordinary Differential Equation (First order and First degree):**Picard's method, Taylor's series method, Euler's method, modified Euler's method, Runge-kutta method.	**06**
Unit 4	**Finite Differences and Interpolation:** Finite differences, Newton's Interpolation formulae, central difference interpolation formulae (stirling formula), interpolation with unequal interval (Lagrange's formula)	**06**
Unit 5	**Special Functions:** Gamma function, Properties of Gamma function, Beta function, Properties of Beta function, Relation between Beta and Gamma functions.	**07**
Unit 6	**Multiple Integral and It's Applications:** Double Integrals, Triple integral, Change of Order of Integration, Change to polar, Applications to Area and Mass of plane lamina.	**08**

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Higher Engineering Mathematics	Dr. B. S. Grewal	Khanna Publishers	44th	2018
02	Advanced Engineering Mathematics	N. P. Bali, Manish Goyal	Infinity Science Press	7th	2010
03	Advanced Engineering Mathematics	H. K. Das	S. Chand	22nd	2018
04	Numerical Methods in Engineering & Science	Dr. B. SGrewal	Khanna Publishers	9th	2010

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	A textbook of Applied Mathematics	P.N. Wartikar& J.N. Wartikar	Pune Vidyarthi Griha Prakashan	1st	2008
02	Higher Engineering Mathematics	B. V. Ramana	TMH	6th	2010
03	Advanced Engineering Mathematics	Erwin Kreyszig	Wiley Publishers	10th	2017
04	Numerical Methods	Dr. P. Kandasamy Dr. K. Thilagavathy Dr. K. Gunavathi	S. Chand	1st	2010

List of Tutorial:

Sr. No.	Title of tutorials
1	Partial Differentiation and homogeneous function
2	Applications of Partial Differentiation
3	Linear and non-differential equation.
4	Exact and non-differential equation and Simple electrical circuits.
5	Numerical Solution of Ordinary Differential Equation
6	Newton's Interpolation formulae: forward and backward difference formulae
7	Central difference interpolation formulae (stirling formula), and Lagrange's interpolation formula.
8	Special functions

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Class	F. Y. B. Tech, Semester - II
Course Code and Course Title	2EEBS112 **Applied Physics and Chemistry**
Prerequisite/s	.....
Teaching Scheme: Lecture/Tutorial /Practical	04/ 00/00
Credits	04
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEBS112_1	**Apply** suitable optical theory to determine wavelength, characteristics and properties of monochromatic and polychromatic sources of light using relevant optical methods of testing.
2EEBS112_2	**Calculate** the interplaner spacing, lattice constant and properties of unit cell for a given crystal system based on the crystallographic study using laws of material science.
2EEBS112_3	**Use** concept of Nanotechnology to express Production technique and tools of nano-material using different methods and microscopes
2EEBS112_4	**Solve** the problems on total hardness of water and calorific values of the fuels by using fundamental equations
2EEBS112_5	**Categorize** the given fuels on the basis of their characteristic properties and applications by using recent needs of the industries
2EEBS112_6	**Select** engineering materials on the basis of properties and applications with their chemical composition.

Course Contents		**Hours**
	Applied Physics	
Unit 1	**Wave optics and Laser:** **Diffraction:-**Introduction, construction of plane diffraction grating, Diffraction at multiple slits, Determination of wavelength of particular colour using plane diffraction grating, Resolving power of grating, Positive and Negative crystals, Optical activity, Laurent's Half Shade Polarimeter, Numericals. **LASER:** Introduction to laser, Interaction of radiation with matter- Absorption, Spontaneous emission, Stimulated emission, Pumping- Three level and four level, Population inversion, Metastable state, Laser beam Characteristics, Solid State laser (Ruby Laser), Industrial and medical applications of laser.	**10**
Unit 2	**Structure of Solids and its Characterization:** Crystalline state, Lattice, Space lattice, Basis and crystal structure, Unit cell, lattice parameters, Crystal system in brief, (Cubic, Monoclinic, Triclinic), Fourteen Bravais lattices, Properties of unit cell (number of atoms per unit cell, coordination number, atomic radius, packing fraction), Calculation of lattice constant(Relation between lattice constant and density), Symmetry elements in cubic crystal, Miller indices:- Procedure, Features and Sketches for different planes. **X-ray diffraction** (Laue method), Bragg's law, Bragg's X-ray diffractometer, Numerical.	**10**

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Unit 3	**Nano Physics:** Introduction, Concept of nanotechnology, Production techniques:- Top-down (eg. Ball milling) and Bottom-up (eg. Sol-gel process), Tools – Scanning Electron Microscope (SEM) and Atomic Force Microscope (AFM), Applications of nano- materials, Carbon Nano Tube (CNT).	**08**
	Applied Chemistry	
Unit 4	**Water Chemistry:** Introduction, impurities in natural water, Water Testing: Total solids, acidity, alkalinity and chlorides, hardness of water (definition, causes and significance), Calculations of total hardness, disadvantages of hard water. Scale and sludge: formation in boilers and removal, Treatment of hard water by ion exchange process, Desalination of brackish water by Reverse Osmosis.	**09**
Unit 5	**Energy Science:** Introduction, classification, characteristics of good fuels, comparison between solid, liquid and gaseous fuels, types of calorific value (higher and lower), Bomb calorimeter and Boy's calorimeter. Numerical on Bomb and Boy's calorimeter. Photo catalysis of water for H2 generation, introduction to solar cells, biomass energy. **Batteries:** Introduction, Characteristics of a battery, Rechargeable Li- ion batteries (Diagram, charging-discharging reactions, advantages and applications). **Fuel Cells:** Introduction, H_2-O_2 Fuel cell (Construction, working and applications), applications of fuel cells.	**09**
Unit 6	**Advanced Materials:** Metallic materials: Introduction, alloy definition and classification, purposes of making alloys. Ferrous alloys: Plain carbon steels (mild, medium and high), Nonferrous alloys: Nickel alloy (Nichrome), Aluminum alloy (Duralumin and Alnico), Tin alloy (Solder metal). **Polymers:** Introduction, plastics, thermo softening and thermosetting plastics, industrially important plastics like phenol formaldehyde, urea formaldehyde. Conducting polymers, biodegradable polymers (preparation, properties and applications). **Composites:** Introduction, composition, properties and uses of fiber reinforced plastics (FRP) and glass reinforced plastic (GRP).	**10**

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Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Engineering Physics	P. K. Palanisamy	Sci Tech pub. (P) Ltd.	2nd	2009
02	Engineering Physics	G Vijayakumari	Vikas Pub. House (P) Ltd	3rd	2009
03	Introduction to Nano science and Nanotechnology:	K.K. Chattopa dhyayand A.N. Banerjee,	PHI Learning	3rd	2009
04	A Text Book of Engineering Chemistry	S. S. Dara	S. Chand & Co. Ltd., New Delhi.	11th	2008
05	A Text Book of Engineering Chemistry	Shashi Chawala	Dhanpat Rai Publishing Co. New Delhi.	3rd	2007

Reference Books

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Engineering Physics	Resnick Halliday, Krane,	John Wiley & Sons Pub.	8th	2008
02	Introduction to Solid State Physics	Charles Kittle,	Wiley India Pvt. Ltd	7th	2008
03	Solid State Physics	S. O. Pillai	New Age International	6th	2007
04	Engineering Chemistry	Jain & Jain	Dhanpat Rai Publishing Co., New Delhi.	15th	2010
05	Computers and their Applications to Chemistry	Ramesh Kumari	Narosa Publishing House Pvt. Ltd.	2nd	2005

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Class	F.Y. B. Tech. Semester - II
Course Code and Course Title	2EEPC113 **Analog Electronics**
Prerequisite/s	2EEPC102
Teaching Scheme: Lecture/Tutorial/Practical	03/00 /00
Credits	03
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEPC113_1	**Analyze** the various solid state device models and its applications
2EEPC113 _2	**Perform** analysis of BJT biasing in DC circuits
2EEPC113_3	**Classify** feedback amplifiers & analyze various oscillators
2EEPC113_4	**Analyse** the characteristics and operation of operational amplifier
2EEPC113_5	**Apply** the knowledge of OP-AMP in several operational amplifier circuit.
2EEPC113_6	**Design** a timer circuits using IC 555 and Phase Lock Loop circuit using IC566.

	Course Contents	**Hours**
Unit 1	**Semiconductor Diode and its Applications** Diode, Type of Diodes – p-n junction diode, Zener diode, tunnel diode, photodiode, LED. **Applications of rectifier circuits:** Half wave rectifier, Full wave rectifier, Bridge rectifier with filters, clipper and clamper. Numerical on rectifier circuits.	**08**
Unit 2	**Bi-polar Junction Transistor & JFETs** BJT- Construction, Operation, Configuration of transistor - CB, CE and CC configuration, Load line analysis of BJT, DC biasing analysis, numerical on DC biasing methods. **Junction Field Effect Transistors (JFET):** Construction, operation and Characteristics of JFETs	**08**
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 tuned RC phase shift, Hartley, Colpitts and crystal oscillators.	**06**

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Unit 4	**Fundamentals of Operational Amplifier** Op-amp basics, IC741 pin configuration, Block diagram of op-amp, 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,	**08**
Unit 5	**Op Amp Applications** Comparator, Zero-crossing detector, Summing amplifier, Difference amplifier, Voltage follower, Differentiator, Integrator, V to I converter, I to V converter	**06**
Unit 6	**Timer and Phase Locked Loops** **Timer** Introduction of Timer and its needs, IC 555 Timer: functional diagram, Mono-stable multivibrator, Astable multivibrator **Phase Locked Loops** Introduction of PLL and its needs, IC 566 PLL: Functional block diagram, Voltage Controlled Oscillator, frequency detection and synthesis	**08**

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 Publication	Third	December 2009
04	Principle of Electronics	V.K. Mehata, Rohit Mehata	S. Chand	Tenth	2006

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Electronic Devices & Circuits	Milliman, Halkias and Satyabratajit.	McGraw Hill Education India	Third	2012
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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Class	F.Y.B. Tech, Semester - II
Course Code and Course Title	2EEES114 **Engineering Graphics**
Teaching Scheme: Lecture/Tutorial	02/00/00
Credits	02
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEES114_1	**Sketch** projection of simple geometries [point, line, planes]
2EEES114_2	**Sketch** projection of solids inclined to reference plane
2EEES114_3	**Prepare** sectional view of solids.
2EEES114_4	**Produce** the isometric projection.
2EEES114_5	**Produce** the orthographic projection.

Course Contents:		**Hours**
Unit 1	**Fundamental of engineering graphics: Introduction** to drawing instrument and their uses. Different types of lines used in drawing practice, the dimensioning system as per BSI. **Projection of lines:** Introduction to First angle and third angle methods of projection. Projections of points on regular and auxiliary reference planes. Projections of lines (horizontal, frontal, oblique and Profile lines) on regular and auxiliary reference planes. The true length of a line, Point View of a line, angles made by the line with reference planes. Projections of intersecting lines, Parallel lines, perpendicular lines, and skew lines, grade and bearing of a line.	**06**
Unit 2	**Projection of plane:** Projections on regular and on auxiliary reference planes. Types of planes (horizontal, frontal, oblique and Profile planes), Edge view and True shape of a Plane. Angles made by the plane with Principle reference planes. Projection of plane figure inclined to both the plane. (Circle and regular polygon).	**04**
Unit 3	**Projection of solid:** Projection of solids such as Prisms, Pyramids, Cylinder and Cones inclined to both reference plane (excluding frustum and sphere).	**04**
Unit 4	**Sections of solids:** Prisms, Pyramids, Cylinders and Cones, in simple positions and inclined to one reference plane and parallel to others.	**06**
Unit 5	**Orthographic projection-I:** Lines used, selection of views, the spacing of views, dimensioning and section. Drawing required views from given pictorial views (conversion of pictorial views into orthographic views). Including sectional orthographic views	**04**
Unit 6	**Isometric projection:** Introduction to Isometric. Isometric scale, Isometric projections, and Isometric views / drawings. Circles in isometric view. Isometric views of simple solids and objects.	**04**

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Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Engineering Drawing	N D Batt & V M Panchal	Charotor Publication House Bombay	50th	2010
02	Engineering Drawing	Dhananjay A Jhole	Tata Mc-Graw Hill	5th	2011
03	Fundamentals of Engineering Drawing	Warren. J. Luzadder	Prentice-Hall of India.	11th	1999
04	Engineering Drawing	P S Gill	Katson books	9th	2012

Reference Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Engineering Drawing & Graphics	K. Venugopal	New Age	5th	2012
02	Engineering Drawing	M. B. Shaha and B. C. Rana	Pearson	2nd	2012
03	ABC's of Auto CAD	George Omura	BPB	-	1999
04	Engineering graphic with Auto CAD 2002	Bethune	Pearson	-	2012

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

Class	F.Y. B. Tech, Semester - II
Course Code and Course Title	2EEVS115 **Object Oriented Programming**
Prerequisite/s	2EEES105
Teaching Scheme: Theory/Tutorial/Practical	01/00/02
Credits	02
Evaluation Scheme: ISE/ESE	50/50

Course Outcomes: After successful completion of this course the students will be able to,	
2EEVS115_1	**Explain** the fundamental concepts of OOP using real life examples.
2EEVS115_2	**Develop** a solution for the given problem using the concepts like class, object, array & pointers
2EEVS115_3	**Develop** a solution for the given problem using the concepts like inheritance and polymorphism
2EEVS115_4	**Build** an application to solve real world problem statements by making use of various library utilities and stream classes
2EEVS115_5	**Communicate** effectively to present the results or solutions, both orally and in writing
2EEVS115_6	**Adapt** professional and ethical principles to solve given problem during practical performance and during implementation of micro project

Course Contents		**Hours**
Unit 1	**Fundamentals of Object-Oriented Programming:** The Origins of C++, key words, Abstraction, Encapsulation, Polymorphism, Inheritance.	**02**
Unit 2	**Classes & Objects:** Relation of Classes and objects, Friend Functions, Friend Classes, Inline Functions, Constructors and Destructors, Parametrized Constructors, Scope resolution operators.	**02**
Unit 3	**Arrays & Pointers:** Arrays, Pointers, Arrays of objects, Pointers to objects, This Pointer. **Dynamic Memory Allocation Operators:** Introduction to new & delete operators. Function Overloading, Copy Constructors, Operator Overloading and Operator overloading using friend function.	**03**
Unit 4	**Inheritance:** Single Inheritance, Multilevel inheritance, Multiple inheritance, Hierarchical inheritance. Hybrid inheritance.	**02**
Unit 5	**Polymorphism-** Virtual base classes, Virtual functions, Pure virtual function, Abstract classes, Early vs Late binding.	**03**
Unit 6	**File and Streams:** Overview of C++ Stream classes, Read File using stream classes, Write into file using stream classes.	**02**

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Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Programming with C++	E Balagurusammy	TMGH	4th	2010
02	The Complete Reference: C++	Herbert Schildt,	TMGH	4th	2010
03	Object Oriented Programming in Turbo C++	Robert Lafore	Galgotia	4th	2010
04	Programming with C++	D. Ravichandran,	TMGH	3rd	2011

Reference Books

Sr. No	Title	Author	Publisher	Editio n	Year of Edition
01	C++ Programming with language	Bjarne Stroustrup	AT & T	4th	2013
02	C++ Programming	John Thomas	PHI	2nd	1992
03	Object oriented programming in C++	Rajesh K Shukla	Willey	1st	2008
04	Test your C++ Skills	Yashwant	BPB	1st	2010

List of Laboratory Experiments

Expt. No.	Title of Experiment
1	Implement student grading system using class and object concept in C++.
2	Implement concept of function overloading
3	Implement concept constructor overloading
4	Implement program for Operator Overloading
5	Implement Single level and Multilevel inheritance concept.
6	Implement Multiple inheritance concept
7	Implement concept of Hierarchical inheritance
8	Implement concept of Hybrid Inheritance.
9	Implement program for Friend Function.
10	Implement program for Friend Class.
11	Implement Virtual Function concept in C++
12	Implement Virtual Class concept in C++
13	Implement program for File Handling. (Read Write Operations)

Note: Minimum TEN experiments should be performed from the above list

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Department of Electrical Engineering

Class	F. Y. B. Tech, Semester - II
Course Code and Course Title	2EEBS116 **Applied Physics and Chemistry Laboratory**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes: The students will be able to,	
2EEBS116_1	**Apply** suitable optical theory to calculate wavelength and divergence of monochromatic and polychromatic sources of light using plane diffraction grating.
2EEBS116_2	**Calculate** band gap energy and Specific rotation for a given semiconductor and sugar solution using appropriate theories and formulae.
2EEBS116_3	**Determine** quality of a given water sample accurately on the basis of it shardness, alkalinity, chloride contents by use of principles of volumetric analysis and participate during laboratory.
2EEBS116_4	**Analyze** given materials accurately for choosing them in domestic and industrial applications with the help of various instruments
2EEBS116_5	**Communicate** effectively about laboratory work both orally and writing
2EEBS116_6	**Practice** professional and ethical behavior to carry forward in their life

List of Experiments

Expt. No	Title of the Experiment
1	Plane Diffraction Grating
2	Laurent's Half Shade Polarimeter
3	Wavelength of LASER
4	Divergence of The LASER Beam
5	Seven Crystal System
6	Inverse Square law
7	Determination of alkalinity of water (Acid- Base Titration).
8	Determination of chloride content of water by Mohr's method. (Precipitation Titration)
9	Determination of total hardness of water by EDTA method (Complexometric Titration)
10	Preparation of urea formaldehyde resin
11	Determination of pH of sample solution.
12	Demonstration of H_2-O_2 fuel cell/ battery.

Note: Minimum TEN experiments should be performed from the above list

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Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Engineering Physics	P. K. Palanisamy	Sci Tech Pub. (P) Ltd.	2nd	2009
2	Engineering Physics	G Vijayakumari	Vikas Pub. House (P) Ltd	3rd	2009
3	A Text Book of Engineering Chemistry	S. S. Dara	S. Chand & Co. Ltd.	11th	2008
4	A Text Book of Engineering Chemistry	Shashi Chawala	Dhanpat Rai Publishing Co.	3rd	2007

Reference Books

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Solid State Physics:	S. O. Pillai	New Age International	6th	2007
2	Materials Science and Engineering –	V. Raghvan	PHI Learning.	5th	2006
3	Engineering Chemistry	Jain & Jain	Dhanpat Rai Publishing Co., New Delhi.	16th	2015
4	Industrial Chemistry	B. K. Sharma	Goel publication (P) Ltd.	10th	1999

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Class	F. Y. B. Tech, Semester - II
Course Code and Course Title	2EEPC117 **Analog Electronics Laboratory**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes: Upon successful completion of this course, the students will be able to	
2EEPC117_1	**Select** suitable semiconductor device for particular application
2EEPC117_2	**Plot** various characteristic of semiconductor devices.
2EEPC117_3	**Simulate** various electronic circuits using MATLAB
2EEPC117_4	**Demonstrate** operation of Semiconductor devices
2EEPC117_5	**Work** in groups for performing practices in analog electronics laboratory.

LIST OF EXPERIMENTS

Expt. No	Title of the Experiment
1	Plot V-I characteristics of p-n junction diode (1N4007)
2	Design and test half wave and full wave rectifier with & without C filter
3	Design, assemble and test the wave shaping circuit using diode- clipping circuits
4	Design, assemble and test the wave shaping circuit using diode- clamping circuits
5	Determine the performance characteristics of BJT using DC biasing analysis of CE on hardware or on proteus.
6	Obtain drain and transfer characteristics of JFET
7	Analysis of OP-AMP as inverting amplifier in closed loop configuration on software tool
8	Analysis of OP-AMP as non-inverting amplifier in closed loop configuration on software tool
9	Analysis and application of active circuits using OP-AMP: Summing amplifier and subtractor on software tool
10	Analysis and application of active circuits using OP-AMP: Zero crossing detector on software tool
11	Analysis and Application of active circuits using OP-AMP: Differentiator, Integrator on software tool
12	Operate timer IC 555 / 556 as i. Monostable, ii. Astable mutivibrator

Note: Minimum TEN experiments should be performed from the above list

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Class	F.Y.B. Tech, Semester – II
Course Code and Course Title	2EEES118 **Engineering Graphics Laboratory**
Teaching Scheme: Lecture/Tutorial / Practical	00/00/02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs):

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

2EEES118_1	**Draw** the projections of different lines, planes
2EEES118_2	**Draw** different vies of solids having axis inclined to reference planes.
2EEES118_3	**Prepare** sectional views of solid cut by cutting plane in different positions
2EEES118_4	**Produce** Isomeric drawing of simple objects.
2EEES118_5	**Prepare** Sectional Orthographic views of simple objects.

Expt. No.	Title of Experiment	Optional / Compulsory	Planned week
1.	**Projection** of Straight lines	Compulsory	1st& 2nd
2.	**Projection** of Planes	Compulsory	3rd& 4th
3.	**Projection** of Solids	Compulsory	5th& 6th
4.	**Sections** of Solids	Compulsory	7th& 8th
5.	**Orthographic** projections	Compulsory	9th& 10th
6.	**Isometric** projections	Compulsory	11th& 12th

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Class	F.Y. B. Tech, Semester.-II
Course Code and Course Title	**2EEHS119_A, Table –Tennis**
Prerequisite/s	----------
Teaching Scheme: Lecture/Tutorial	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs):

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

2EEHS119_A1	The students **define** table tennis game.
2EEHS119_A2	**Willingly** participates in Table Tennis as a component of an active lifestyle.
2EEHS119_A3	The students **explain** foot- work in forehand and backhand spin.

Course Contents

Unit No.	Title	Hours
Unit 1	Introduction & Understand basic Table Tennis rules, terminology, safety concerns, and scoring procedures.	**04**
Unit 2	Demonstrate proper court etiquette and good sportsmanship.	**06**
Unit 3	Demonstrate basic skills associated with table tennis including forehand, backhand, spins, grips & serves.	**05**
Unit 4	Demonstrate Exposition and Applying forehand and backhand straight strike.	**05**
Unit 5	Assess current personal fitness levels & Practice.	**06**
Unit 6	Use a variety of stroke placements to keep opponent moving during a table tennis match. Practice.	**04**

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Class	F.Y. B. Tech, Semester.-II
Course Code and Course Title	**2EEHS119_B, Kho-Kho**
Prerequisite/s	----------
Teaching Scheme: Lecture/Tutorial	00/ 00 / 02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEHS119_B1	**Helps** in Motor Development.
2EEHS119_B2	It **helps** in social and mental development of the student
2EEHS119_B3	Kho-Kho **helps** the student to off depression, anxiety, stress and, increase self-esteem.
2EEHS119_B4	It **develops** team spirit and leadership skill.
2EEHS119_B5	It **improves** physical fitness.

Course Contents		
Unit No.	**Title**	**Hours**
Unit 1	Introduction to Kho-Kho – Aim – Objectives – Short reference in Kho-Kho history Understand the basic rules and how they should play normal game.	**04**
Unit 2	Demonstrate basic skills associated with Kho-Kho, including Fundamental Skills. Chasing Skills- a) Giving Kho b) Taking Direction c) Sudden Change d) Tapping	**06**
Unit 3	Demonstrate basic skills associated with Kho-Kho, including Fundamental Skills. Chasing Skills-e) Turning Round the Post f) Trapping g) Diving h) Fake Kho i) Late kho & Practice.	**05**
Unit 4	Demonstrate basic skills associated with Kho-Kho, including Running Skills a) Position on the court b) Avoiding Trapping c) Positioning near post d) Dodging	**05**
Unit 5	Demonstrate basic skills associated with Kho-Kho, including Running Skills a) Front Dodge b) Back Dodge c) Round the post dodge & Practice	**06**
Unit 6	Kho-Kho Skills Practice & Matches.	**04**

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Class	F.Y. B. Tech, Semester.-II
Course Code and Course Title	**2EEHS119_C, Basket Ball**
Prerequisite/s	----------
Teaching Scheme: Lecture/Tutorial	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEHS119_C1	**Introduce** students to the basic skills and knowledge associated with basketball.
2EEHS119_C2	**By applying** these principles through active participation, students develop the necessary skills and knowledge to play basketball
2EEHS119_C3	**Provides** students with opportunities to improve physical fitness, acquire knowledge of fitness concepts and practice positive personal and social skills
2EEHS119_C4	Students **will gain** an understanding of how a wellness lifestyle affects one's health, fitness and physical performance.

Course Contents		
Unit No.	**Title**	**Hours**
Unit 1	Introduction & Understand basic basketball rules, terminology, and safety concerns.	**04**
Unit 2	Demonstrate the six basic basketball skills of a) Running b) Jumping c) Passing d) catching e) Dribbling and f) Shooting.	**06**
Unit 3	Demonstrate the ability to perform individual offensive and defensive skills and strategies.	**05**
Unit 4	Understand and apply the knowledge of basic rules of basketball. Skills Practice.	**05**
Unit 5	Demonstrate proper etiquette and good sportsmanship. Successfully participates in skill improvement and offensive game strategies.	**06**
Unit 6	Identify and apply injury prevention principles related to aerobic activities. Practice & Matches.	**04**

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Class	F.Y. B. Tech, Semester.-II
Course Code and Course Title	**2EEHS119_D, Hand Ball**
Prerequisite/s	----------
Teaching Scheme: Lecture/Tutorial	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

2EEHS119_D1	The student has a **basic knowledge** of the team values of sports games
2EEHS119_D2	**Acquainting** with the characteristics and trends in the development of the discipline.

Course Contents:

Unit No.	Title	Hours
Unit 1	Introduction & Understand basic Handball rules, terminology, and safety concerns.	**04**
Unit 2	Health and safety rules. Rules for obtaining credit for the course, Reminder of the history, methodology and basic rules of the game, Exercises to improve passing, grips and throws. The game. Reminder of the refereeing rules.	**06**
Unit 3	Improving the technique of passing and grips in a team setting. Individual ways of freeing oneself from the opponent and the organization of positional attacks with their use	**05**
Unit 4	Exercises improving feints and individual defense technique. Everyone's defense system. Principles of individual defense & Practice.	**05**
Unit 5	Improving the technique of passing and grips in a team setting. Individual ways of freeing oneself from the opponent and the organization of positional attacks with their use. The game & Practice.	**06**
Unit 6	Identify and apply injury prevention principles related to aerobic activities, Practice & Matches	**04**

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Class	F.Y. B. Tech, Semester.-II
Course Code and Course Title	**2EEHS119_E, Katthak Classical Dance**
Prerequisite/s	----------
Teaching Scheme: Lecture/Tutorial	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEHS119_E1	**Explain** Importance of katthak with respect to Indian culture.
2EEHS119_E2	**Demonstrate** Guruvandana, Tatkar.
2EEHS119_E3	**Compose** Katthak dance with consideration of classical & semi classical music.

Course Contents:		
Unit No.	**Title**	**Hours**
Unit 1	Introduction to Classical dance katthak & its importance.	**01**
Unit 2	Guruvandana & Tatkaar. (teen taal)	**03**
Unit 3	Chakri & Hast-sanchalan	**03**
Unit 4	Tode. (Tigida-tigdig-thai)	**03**
Unit 5	Practice sessions.	**02**
Unit 6	Paran & Tihaei	**05**
Unit 7	Classical dance on Song	**05**
Unit 8	Practice sessions.	**08**

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Class	F.Y. B. Tech, Semester.-II
Course Code and Course Title	**2EEHS119_F, Tabla Classical instruments**
Prerequisite/s	----------
Teaching Scheme: Lecture/Tutorial	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEHS119_F1	**Discover** History of table wadan.
2EEHS119_F2	**Demonstration** of different Taal in table wadan.
2EEHS119_F3	**Develop** notation on new music with help of table wadan.

Course Contents

Unit No.	Title	Hours
Unit 1	Hostory & Introduction to Tabla Wadan.	**01**
Unit 2	Tabla presentation of Taal. Tritaal/ Dadra/ Zaptaal/ Kerwa/ Bhajni	**05**
Unit 3	Practice sessions.	**06**
Unit 4	Practice with notation, & Set one song with tabla	**08**
Unit 5	Practice sessions & students' presentations.	**10**

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Class	F.Y. B. Tech, Semester.-II
Course Code and Course Title	**2EEHS119_G, Western Dance**
Prerequisite/s	----------
Teaching Scheme: Lecture/Tutorial	00 / 00 / 02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEHS119_G	**Describe** History of Western dance & basic of western dance.
2EEHS119_G	**Organize** western dance individually as well as group with help of western music.
2EEHS119_G	**Compose** western dance on songs.

Course Contents:

Unit No.	Title	Hours
Unit 1	History of Western dance style & information about western dance.	**02**
Unit 2	Basic types of western dance: - worm-up, Hand- legs movements.	**04**
Unit 3	Teaching Basic style (focus on dance / music / movements, how to control body, emotion/feeling of music/ dance.)	**06**
Unit 4	Training western dance with music (original dance form of western, free style dance)	**08**
Unit 5	Dance composition.	**05**
Unit 6	Practice session, & Students Presentation	**05**

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Class	F.Y. B. Tech, Semester.-II
Course Code and Course Title	**2EEHS119_H, Yoga**
Prerequisite/s	----------
Teaching Scheme: Lecture/Tutorial	02 / 00 / 00
Credits	00
Evaluation Scheme: ISE-1/MSE/ ISE-II /ESE	Audit

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

2EEHS119_H1	**Discus** importance of Yoga with respect to different forms of exercise.
2EEHS119_H2	**Perform** Different styles of Yoga.

Course Contents:

Unit No.	Title	Hours
Unit 1	Introduction, importance of yoga, Basic exercise, sun salutation, shavasana taught yogic & excises types	**06**
Unit 2	Omkar & sleeping position seats (aasn yogic excise type) to teach omkar in a scientific way, to teach mercatasan, makrasan, setubandhan,	**04**
Unit 3	Opposite sleeping position. Shalabhasan, chakras an, Bhungasan, Makrasan.Pranayam;- Anulom-Vilom,,Bhasarika, Sheetkari, Bhramari, shitali pranayam. Rapid respiration (jalad shwasan)	**05**
Unit 4	Practice sessions	**05**
Unit 5	Seats in the sitting position: - padmasan, Wajrasan, Wakrasan, Ardh-machindrasana, Urshtrasan.	**04**
Unit 6	Seats in Fine Position. (Dand stithi): - Ekpaad vrukrashasan, Veerasan, Patangasan,Trikonasan.	**06**

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Department of Electrical Engineering

Class	S.Y. B. Tech, Semester - III
Course Code and Course Title	2EEBS201 **Applied Mathematics - III**
Prerequisite/s	2EEBS101, 2EEBS111
Teaching Scheme: Lecture / Tutorial	03 / 01
Credits	04
Evaluation Scheme: ISE / MSE / ESE	40 / 30 / 30

Course Outcomes : After successful completion of this course, the students will be able to:	
2EEBS201_1	**Apply** the concept of Vector calculus to calculate area and volume of given surface.**(K^3)**
2EEBS201_2	**Solve** the Electrical engineering problems using Linear Differential Equation.**(K^3)**
2EEBS201_3	**Make use of** Laplace and inverse Laplace transform to solve Electrical problems. **(K^3)**
2EEBS201_4	**Construct** the Fourier Series for the any functions by using Euler's Formulae.**(K^3)**
2EEBS201_5	**Calculate** velocity and area of the given data by using Numerical Differentiation and Integration.**(K^3)**
2EEBS201_6	**Use** of basic knowledge of Z-transforms to solve problems on Signal system. **(K^2)**

Unit	Contents	Hours
1	**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.	06
2	**Linear Differential Equations and Its Application** Definitions, Complete solution, Operator D, Rules for finding Complementary function, Inverse operator, Rules for finding the Particular integral, Applications of Linear Differential Equations to Oscillatory Electrical Circuit.	07
3	**Laplace Transform & Inverse Laplace transforms** Introduction, Laplace transform of elementary functions. Properties of Laplace Transforms, Transforms of derivatives, Transforms of integrals, Multiplication by t^n, Division by t, Evaluation of integrals by Laplace Transforms. Inverse Laplace transforms Definition, Inverse Laplace transforms by Partial Fractions, convolution Theorem, Applications of Laplace transform to solve linear differential equations.	06
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
5	**Numerical Differentiation and Integration:** Numerical Differentiation – Newton's Forward Difference, Newton's Backward Difference, Central Difference (Stirling's Formula) Numerical Integration - Trapezoidal Rule, Simpson's 1/3rd And 3/8th Rule.	07

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6	**Z-Transforms** Introduction, Definition, Properties, Z-transform of basic functions, Z-transform of some standard discrete functions, Evaluation of inverse Z-transfrm, Application to difference Equations.	06

List of Tutorial:

Sr. No.	Title of tutorials
1	Del applied to scalar point functions - gradient, directional derivative
2	Del applied to vector point functions - Divergence and curl, Line integral
3	Rules for finding the Particular integral
4	Properties of Laplace Transforms, Transforms of derivatives, Transforms of integrals
5	Inverse Laplace transforms by Partial Fractions, convolution Change of interval
6	Expansion of odd or even periodic functions
7	Numerical Differentiation & Numerical Integration
8	Properties, Z-transform of basic functions, Z-transform of some standard discrete functions, Evaluation of inverse Z-transform

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Higher Engineering Mathematics	Dr. B. S. Grewal	Khanna Publication	44th	2017
02	Higher Engineering Mathematics.	H. K. Das	S. Chand and company ltd.,	1st	2011
03	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley &Sons,Inc.	10th	2017
04	Numerical Methods in Engineering & Science	Dr. B. SGrewal	Khanna Publishers	9th	2010

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Higher Engineering Mathematics.	B.V. Ramana	Tata McGraw Hill Education Pvt., ltd.	1st	2007
02	Advanced Engineering Mathematics.	Potter Merle C.	Oxford University Press,	3rd	2005
03	A text book of Applied Mathematics Vol. I and Vol. II	P. N. Wartikar J. N. Wartikar	Pune Vidyarthi Griha Prakashan, Pune	9th	Reprint 2010
04	Advanced Engineering Mathematics.	O'Neil Peter V	Cengage Learning India Pvt. Ltd.	1st	2012

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Class			S.Y. B. Tech, Semester - III
Course Code and Course Title			**2EEPC202, Electrical Measurements and Instrumentation**
Prerequisite/s			2EEPC102
Teaching Scheme: Lecture / Tutorial / Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE / MSE / ESE**	40 / 30 / 30
	P	**ISE / ESE**	50 / 50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEPC202_1	**Describe** the construction and working principles of PMMC and Moving Iron type instruments and their torque relationships under standard electrical conditions.
2EEPC202_2	**Examine** the appropriate methods to calibrate and extend the range of ammeters and voltmeters using shunts, multipliers, and instrument transformers.
2EEPC202_3	**Relate** the use of single-phase dynamometer-type wattmeters and induction-type energy meters for measuring active and reactive power in balanced and unbalanced three-phase systems.
2EEPC202_4	**Apply** bridge circuit principles to measure resistance, inductance and capacitance using DC and AC bridges.
2EEPC202_5	**Demonstrate** the working principle of a Digital Measuring Instruments, Transducers and Advanced measuring Instruments to measure and interpret parameters in electrical systems.

Unit	**Contents**	**Hours**
1	**Introduction to Measuring Instruments:** Classification - deflection, control and damping torques, Ammeters and Voltmeters – PMMC, Moving Iron type Instruments- Expression for deflecting torque and control torque,- Errors in measurements, Calibration of Ammeter and Voltmeters. Range extension using shunts and multipliers (numerical expected), Instrument Transformers.	**07**
2	**Measurement of Power and Energy:** Single phase dynamometer type wattmeter, expression for deflection and control torques, 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). Single phase induction type energy meter- Construction, working principle, driving and braking torques, errors and adjustments - testing by phantom loading using RSS meters. Three phase energy meter.	**06**

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3	**DC & AC bridges** 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, Schering Bridge (numerical expected on bridges)	**06**
4	**Digital Measuring Instruments:** Advantages of digital meters over analogue meters. Resolution & sensitivity of digital meters. Working principles of digital voltmeter, ammeter, 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.	**07**
5	**Transducers:** Transducers: Introduction, classification of transducers. Electrical transducer, Resistive transducer, Inductive transducer, Capacitive transducer, Piezoelectric Transducers, Strain gauge, LVDT and RVDT –construction, working, application.	**07**
6	**Advanced Measurements and Instrumentation:** Wave Analyzers, Power Analyzer, Maximum demand indicator, Tri-vector meter, Smart Sensors, Virtual Instrumentation.	**06**

List of experiments:

Exp. No.	Title of experiments
1	Demonstration of various analog measuring instruments
2	Calibration of Ammeters and Voltmeters
3	Measurement of active power in three phase circuit by using two wattmeter method
4	Measurement of reactive power in three phase circuit by using one wattmeter method
5	Calibration of single phase induction type energy meter.
6	Measurement of resistance by ammeter voltmeter method.
7	Measurement of resistance using Wheatstone's / Kelvin's double bridge.
8	Measurement of inductance and Capacitance using Maxwell's Inductance Capacitance and Schering bridge.
9	Measurement of voltage, current, time period and frequency using CRO & frequency measurement by lissajous pattern.
10	Displacement measurement using Linear Variable Differential Transducer.
11	Measurement of weight using Strain Gauge.

Note: Minimum ten experiments should be performed from the above list

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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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Class			S. Y. B. Tech, Semester. - III
Course Code and Course Title			2EEPC203 **Electric Circuit Analysis**
Prerequisite/s			2EEPC102
Teaching Scheme : Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme:	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE**	50

Course Outcomes (COs):

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

2EEPC203_1	**Apply** the concept of fundamental laws, circuit analysis techniques and theorems to solve for circuit parameters of direct current and alternating current circuits. (K^3)
2EEPC203_2	**Solve** differential equations to describe the behaviour of second order time dependent circuit, including the use of initial conditions by Laplace transform. (K^3)
2EEPC203_3	**Determine** the six sets of two-port parameters for any given two-port network to characterize their interrelations and interconnections using circuit analysis techniques. (K^3)
2EEPC203_4	**Use** Laplace transformation to convert linear circuits of time domain into *s*-domain and laplace domain with prescribed initial conditions to solve for complete solution. (K^3)
2EEPC203_5	**Build** linear electrical circuits / two port networks and compute the circuit / network parameters through simulation of DC, AC and Transient analysis using MATLAB software proficiently. (K^3, S^3)
2EEPC203_6	**Develop** skills sets to communicate and work effectively both oral and in writing by sharing responsibilities and collaborating on findings. (A^3)

Unit	Contents	Hours
1	**Methods of Analysis (DC Circuits)** Introduction, Review of Fundamental Laws, Dependent and Independent Sources, Nodal Analysis, Nodal Analysis with Voltage Sources, Mesh Analysis, Mesh Analysis with Current Sources, Nodal & Mesh Analysis by Inspection.	07
2	**Circuit Theorems (DC Circuits):-** Introduction, Source Transformation, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem.	06
3	**Second Order Circuits:** Introduction, Finding Initial and Final Values, Source Free Series RLC circuit, Source Free Parallel RLC Circuit, Step Response of Series RLC Circuit, Step Response of Parallel RLC Circuit	06

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4	**Sinusoidal Steady State Analysis:** Introduction, Nodal Analysis, Mesh Analysis, Superposition Theorem, Source Transformation, Thevenin and Norton Equivalent Circuits, Maximum Average Power Transfer.	07
5	**Two Port Networks:** Introduction, impedance parameters, admittance parameters, hybrid parameters, inverse hybrid parameters, transmission parameters, inverse transmission parameters, relationships between parameters, interconnection of networks.	07
6	**Advanced Circuit Analysis:** Introduction, Application of Laplace Transform to linear integro-differential equations, circuit element models for time to s-domain transformation and circuit analysis, transfer functions, State variable method, network stability.	06

List of Experiments

S. No	Name of the Experiment
1	Simulation and experimental Verification of Nodal and Mesh Analysis.
2	Simulation and experimental Verification of Superposition Theorem.
3	Simulation and experimental Verification of Thevenin's and Norton's Theorem
4	Simulation and experimental Verification of Maximum Power Transfer Theorem.
5	Simulation and experimental Validation on step response of second order circuits
6	Simulation and experimental Verification of Circuit Transients.
7	Frequency Response of Series and Parallel Resonance Circuit Using MATLAB
8	Compute Z, Y, ABCD and hybrid parameters of two port network using MATLAB.
9	Simulation of three phase balanced and unbalanced star and delta networks using MATLAB.
10	Simulation of State space model of an electric circuits using MATLAB
Note: Expt No 1 to 6 – Hardware implementation is being used for verification, and MATLAB will be used for validation.	

Note: All ten experiments should be performed

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Fundamentals of Electric Circuits	Charles K Alexander, Mathew N O Sadiku	McGraw Hill Education	Fifth	2013
2.	"Circuits & Network Analysis & Synthesis"	A. Sudhakar & Shyammohan S. Palli	McGraw-Hill Co.	Fifth	2015
3.	Networks and Systems	Ashfaq Husain	Khanna Book Publishing Co. (P) Ltd.	Second	2019
4.	Networks and Systems	D.Roy Choudhary	New Age International Publishers	Second	2013

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Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Problems & Solutions of Electric Circuit Analysis	R.K. Mehta , A.K. Mal	CBS Publishers and distributors Pvt Ltd	Kindle Edition	2015
2.	Circuit Theory (Analysis and Synthesis)	Abhijit Chakrabarti	Dhanpat Rai & Co.	Second	2021
3.	Network Analysis and Synthesis	C.L Wadhwa	New Age International Publishers	Third	2018
4.	Network Analysis and Synthesis	Franklin F Kuo	John Wiley and Sons	Second	2006

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Department of Electrical Engineering

Class			S.Y. B. Tech. Semester - III
Course Code and Course Title			**2EEPC204, Digital Electronics & Modern Integrated Circuits**
Prerequisite/s			**2EEPC113, 2EEPC117**
Teaching Scheme: Lecture/Tutorial/Practical			04 / 00 / 02
Credits			05
Evaluation Scheme	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE / ESE**	50/50

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEPC204_1	**Apply** the principles of number systems, Logic gates and Boolean algebra.
2EEPC204_2	**Classify** the various combinational and sequential digital circuits using logic gates.
2EEPC204_3	**Explain** architecture, functionalities of Microprocessor (8085) and Microcontroller 8051.
2EEPC204_4	**Develop** assembly language program for given Microprocessor (8085) and Microcontroller (8051) base system including interfacing of peripheral devices
2EEPC204_5	**Illustrate** the architecture, pin configuration, and digital-analog port concepts of Arduino, along with the basics of Embedded C programming.

Unit	Contents	Hours
1	**Number System, Logic Gates and Boolean Algebra** Number systems - Decimal, Binary, Octal, Hexadecimal and its conversions, BCD code, Gray code, Logic gates, Boolean algebra, K- map and it's reduction technique	09
2	**Combinational and Sequential Logic Circuit Design** Half adder, Full adder, Magnitude comparator, Binary to Gray converter, Gray to Binary converter, Multiplexer, De-multiplexer, Latch, Flip flops: Edge-triggered S-R flip flop, D flip flop, J-K flip flop, T- flip flop, Counter- Mod n asynchronous counter, Shift Registers	09
3	**Microprocessor 8085 and its 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.	08
4	**Microcontroller 8051 and its Applications** Introduction to microcontroller, comparison of microprocessor and microcontroller, features of microcontroller, block diagram, architecture of 8051, pin configuration of 8051, Addressing modes Special function registers (SFRs), Memory Organisation, Recent Trends in Microcontroller based system design.	09

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5	**Assembly Language Programming and Peripheral Interfacing** Assembly Language programming of Arithmetic and Logical instruction set of 8085 Microprocessor. of ADC 0808, DAC 0809, LCD, 7 segment LED display, DC motor interfacing, Stepper motor Interfacing with 8051 Microcontroller.	**10**
6	**Arduino** Introduction to Arduino Pin configuration and architecture, Device and platform features, Concepts of digital and analog ports, Familiarizing with the Arduino Interfacing Board, Introduction to Embedded C and Arduino platform	**07**

List of Experiments

Expt. No	Title of the Experiment
1	Identification and verification of truth table of all logic gates
2	Design of combinational logic circuit using SOP or POS equation.
3	Design of Half adder & Full adder.
4	Implementation and verification of 4-bit magnitude comparator using IC-7485.
5	Design of Combinational logic circuit using Multiplexer 74151 & Demultiplexer 74138.
6	Design of mod n asynchronous counter.
7	Assembly language programming of 8085 microprocessor for arithmetic instructions.
8	Assembly language programming of 8085 microprocessor for logical instructions.
9	ADC interfacing to Microcontroller.
10	DAC interfacing to Microcontroller.
11	DC Motor interfacing to Microcontroller.
12	Stepper Motor interfacing to Microcontroller.

Note: Minimum ten experiments should be performed from the above list

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	A Textbook of Digital Electronics	R. S. Sedha	S. Chand	Second	2005
2	Fundamentals of Digital Electronics	A. Anand Kumar	PHI	Fourth	2016
3	Advanced Microprocessor & Peripherals	K. M. Bhurchandi A. K. Ray	Tata Mc-Graw Hill	Third	2006
4	Microprocessor 8085 Architecture, Programming Interfacing	Anil Sawarnkar	Genius	Second	2009
5	8051 Microcontroller: Hardware, Software and Applications	V Udayshankara, M S Mallikarjuna Swamy	McGraw- Hill Education India	Eighth	2014
6	8051 Microcontroller: Internal, Instructions, Programming & Interfacing	Subrata Ghoshal	Pearson Publication	First	2014
Reference Books:					
01	Digital Electronics Principles & Applications	Anil Maini	Wiley	Second	2007
02	Digital Design	Morris Mano	Pearson	Fifth	2012
03	Microprocessor and its applications	B.Ram	Tata Mc-Graw Hill	Sixth	2008
04	Microprocessor Architecture, Programming & Application with 8085	Ramesh Gaonkar	Penram International	Third	1997
05	The 8051 Microcontroller	Kenneth Ayala	Cengage Learning	Third	2007
06	The 8051 Microcontroller and Embedded Systems,	M. A. Mazadi,J. G. Mazadi,	Pearson Education, Asia	Fourth	2008

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Class	B. Tech, Semester III
Course Code and Course Title	2EEHS205 **Universal Human Values**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	2/0/0
Credits	2
Evaluation Scheme: ISE I / ISE II	25/25

Course Outcomes (COs):
Upon successful completion of this course, the student will be able to:

2EEHS205_1	**Understand** the Harmony in human being, family, society and nature /existence, based on methods to fulfill human aspiration (K^1)
2EEHS205_2	**Integrate** the process of self-exploration to achieve Harmony in the human being's based on Holistic perspective of value education (K^3)
2EEHS205_3	**Apply** the human values for maintaining the relationships with oneself and others using the principals of harmony (K^3)
2EEHS205_4	**Adopt** the methods of maintaining harmony with the society, nature, and its existence by utilizing the human order systems (K^3)

Unit	Contents	Hours
1	**Introduction to Value Education** Introduction , Need, Purpose and motivation for the course, recapitulation from Universal Human Values-I **Self-Exploration**–what is it? - Its content and process; 'Natural Acceptance' and **Experiential Validation**- as the process for self-exploration. **Continuous Happiness and Prosperity**- A look at basic Human Aspirations, **Right understanding**, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.	04
2	**Understanding Happiness and Prosperity** **Understanding Happiness** and Prosperity correctly, **Prevailing sources of happiness,** Prosperity and its implications Method to fulfil the human aspirations: understanding and living in harmony at various levels.	04
3	**Understanding Harmony in the Human Being - Harmony in Myself** **Understanding human** being as a co-existence of the sentient 'I' and the material 'Body', **Understanding the needs of Self ('I') and 'Body'** - happiness and physical facility **Understanding the Body as an instrument of 'I'** (I being the doer, seer and enjoyer) **Understanding the characteristics and activities of 'I' and harmony in 'I'**	05

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	Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Health.	
4	**Understanding Harmony in the Family - Harmony in Human-Human Relationship** **Understanding values in human-human relationship**; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; **Trust and Respect** as the foundational values of relationship **Understanding the meaning of Trust**; Difference between intention and competence **Understanding the meaning of Respect**, Difference between respect and differentiation; **Peer Pressure** the Concerns and its Resolution the other salient values in relationship.	**06**
5	**Understanding Harmony in the Society** **Understanding the harmony in society**: Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals **Human order systems** and dimensions	**04**
6	**Understanding Harmony in the Nature and Existence** **Understanding the harmony in the Nature,** Inter-connectedness and mutual fulfilment among the four orders of nature, recyclability and self-regulation in nature	**03**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Understanding Human Being, Nature and Existence Comprehensively	UHV Team	UHV	1st	2022
2	A Foundation Course in Human Values and Professional Ethics	R. R. Gaur, R Asthana,G P Bagaria	Excel Books	2nd	2019
3	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics	R. R. Gaur, R Asthana, G P Bagaria	Excel Books	2nd	2019
4	Human Values	A.N Tripathy	New Age International	2nd	2006

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Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	A Foundation Course in Human Values and Professional Ethics	R.R. Gaur, R. Sangal, G.P. Bagaria	Excel Books	3rd	2010
2	Indian Ethos and Modern Management: Amalgam of the Best of the Ideas from the East and the West	B.L. Bajpai	New Royal Book	1st	2004
3	Small Is Beautiful	E. FSchumacher.	Hartley & Marks	1st	1999
4	An Introduction to Ethics	William Lilly	Allied	1st	1967

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Department of Electrical Engineering

Class	S. Y. B. Tech, Semester.-III
Course Code and Course Title	2EEHS206 **Environmental Studies**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial	2/0
Credits	2
Evaluation Scheme: ISE 1 / ISE II	25/25

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEHS206_1	**Comprehend** the concepts and principles of sustainable development and its importance in environmental preservation. **(K^2)**
2EEHS206_2	**Explain** ethical and legal responsibility of an engineer and his role in effective implementation of sustainable activities through EIA and EMS in the corporate sector. **(K^2)**
2EEHS206_3	**Predict** impact of contemporary issues (Population Explosion, Climate change, Environmental pollution) on the environment. **(K^2)**
2EEHS206_4	**Classify and analyze** different types of environmental pollution, understand their causes and effects, and propose control measures. **(K^4)**
2EEHS206_5	**Prepare** a technical report highlighting importance of environment in human life by using techniques like survey, case studies, mini project. **(K^4)**

Course Contents:

Unit	Contents	Hours
1	**Introduction to Environment and concept of Sustainable development:** Natural and Built Environment, Environmental Education: Definition, Scope, Objectives and importance. Components of the Environment: Atmosphere, Hydrosphere, Lithosphere and Biosphere. Biological Diversity: Introduction, Values of biodiversity, Threats to biodiversity, Conservation of biodiversity. Sustainable development goals, pillars of sustainable development.	04
2	**Energy and Natural Resources** Energy Scenario: Future projections of Energy Demand, Utilization of various Energy Sources, Conventional Energy Sources and Non- Conventional Energy Sources, Urban problems related to energy. Natural Resources: Food, Water, Forest, Geological, Equitable Use of Resources for Sustainable lifestyle. Concept of life cycle analysis, Case studies.	04
3	**Introduction to global environmental issues, Impact of modernization** Climate change: Global warming, Ozone depletion, Acid Rain etc. Environmental Impact: Impact of Modern agriculture on the Environment, Impact of Mining on the Environment, Impact of Large dams on the Environment. Environmental pollution: Air, Water, Soil, Noise, Marine, classification of pollutants, their causes, effects and control measures. Case studies.	04

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4	**Environmental Pollution** Definition: Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Solid waste Management: Causes, effects and control measures of urban and industrial wastes. E waste management. Role of an individual in prevention of pollution.	**04**
5	**Environmental Management and Legislation** Environmental ethics: Introduction, Ethical responsibility, issues and possible solutions. Environmental Management: Introduction to Environmental Impact Assessment, Environmental Management System: ISO 14001Standard, Environmental Auditing, National and International Environmental protection agencies pertaining to Environmental Protection. Introduction to Environmental Legislation.	**04**
6	**Cleaner technology:** Consumerism and Waste Products, Green buildings, Green products, Minimization of Hazardous Products, Reuse of Waste, By-products, Rainwater Harvesting, Translocation of trees. Some Success Stories. Role of Information Technology in Environment protection.	**04**

Assessment methods:

01. Mini Project: **15 marks**

02. Seminar : **10 Marks**

Topic should be from the content of the course.

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Environmental Studies	Anindita Basak	PEARSON	First edition	2017
02	Environmental Studies	N.K Uberoi,	Excel Books Publications New Delhi,	First edition	2005.
03	Environmental Studies from crisis to cure	R. Rajagopalan,	Oxford University Press,	Second edition	2011

Reference Books / Handbooks

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Environmental Science: A Global Concern	William Cunningham and Barbara Woodworth Saigo	WCB/McGraw Hill Publication	Fifth Edition	1999

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Reference Books / Handbooks					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
02	Peter. H. Raven, Linda. R. Berg, George. B. Johnson	Environment	McGraw Hill Publication	Second Edition	1998
03	Adaptive Environmental Management	Catherine Allan & George H. Stanley (Editors),	Springer Publications.	--	2009.
04	Elements of Environmental Science and Engineering	P. Meenakshi	Prentice Hall of India Private Limited, New Delhi	-	2006

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Department of Electrical Engineering

Class	S.Y. B. Tech. Semester - III
Course Code and Course Title	**2EEVS207, Python Programming Lab**
Prerequisite/s	2EEES105, 2EEVS115
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	02
Evaluation Scheme: ISE	50

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEVS207_1	**Interpret** the fundamental concepts of Python to provide a foundation in programming for engineering problems
2EEVS207_2	**Develop** the python program for Python operators and Control Statements using IDE
2EEVS207_3	**Explain** the concepts of sequence type like List, Set, Tuple and Dictionary to solve various problems related with Data Structures.
2EEVS207_4	**Apply** the concept of OOP and File Handling to read and write the data files using IDE
2EEVS207_5	**Analyze** the concept of modules to develop modular code using IDE

LIST OF EXPERIMENTS

Expt. No	Title of the Experiment
1.	Installation and Introduction of Python and their data types.
2.	Program based on operators: Arithmetic Operators, Logical Operators, Bitwise Operators
3.	Program based on Control Statements with Python collections
4.	Write Python code to perform operations on Lists
5.	Write Python code to perform operations on Tuples
6.	Write Python code to perform operations on Dictionaries
7.	Write Python code to perform operations on Sets
8.	Develop a program based on the concept of module
9.	Program based on OOP concepts in python
10.	Program based on the concept of file handling in python
11.	Program Based on Exception Handling

Minimum **Ten** experiments should be performed from the above list.

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Introduction to computing and Problem Solving with Python	Jeeva Jose and Sojan Lal	Khanna Book Publishing Co. (P) Ltd	1	2016
2	Programming Python	Mark Lutz	O'reilly	2	2001

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Introducing Python Modern Computing in Simple Packages	Lubanovic Bil	O'reilly	1st	2014

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Class	S Y B. Tech Semester III
Course Code & Course Title	2EECC208 **Aptitude and Reasoning Part- I**
Prerequisite/s	-
Teaching Scheme (Lecture/Practical/Tutorial)	0/2/0
Total Contact Hours: Theory/Practical/Tutorial)	0/2/0
Credits	1
Evaluation Scheme: ISE	50

Course Outcomes (COs) : The students will be able to:	
2EECC208_1	**Solve** problems based on Vedic Mathematics, Calendar, Average, Age
2EECC208_2	**Solve** problems based on Speed Time distance and equations
2EECC208_3	**Solve** problems based on Blood Relations, Directions, Time Rate Work, Pipes and Tanks, Percentage, Profit and Loss
2EECC208_4	**Solve** Problems based on Spot the Error and Jumbled Para

Course Contents:

Unit No	Unit Name	Contact Hours
Unit 1	Vedic Mathematics, Calendar	4
Unit 2	Average, Ages	4
Unit 3	Speed Time Distance, Equations	4
Unit 4	Blood Relations, Directions, Time Rate Work, Pipes and Tanks	4
Unit 5	Percentage, Profit and Loss	4
Unit 6	Spot the Error, Jumbled Para	4
	Self-Study Module	6

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	R.S. Agarwal (Quantitative aptitude)	R.S.Agarwal	S Chand	-	2019
2	R.S. Agarwal (Verbal & Non-verbal Reasoning)	R.S.Agarwal	S Chand	-	2010
3	Wren & Martin (Verbal, Grammar)	P.C.Wren	S Chand	-	2017

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	APTIPEDIA (Quantitative, Logical, Verbal Aptitude)	Face	Wiley	-	2017
2	Wiley (Quantitative Aptitude)	P.A.Anand	Maestro	-	2015
3	Arun Sharma (Verbal Ability)	Meenakshi Upadhyay	McGraw Hill	-	2020

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Curriculum

Second Year B.Tech - Semester – IV

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Class			S. Y. B. Tech. Semester- IV
Course Code and Course Title			**2EEPC209, Signal Processing**
Prerequisite/s			2EEBS201
Teaching Scheme: Lecture / Tutorial / Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE / MSE / ESE**	40 / 30 / 30
	P	**ISE / ESE**	50 / 50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEPC209_1	**Understand** the fundamentals of signals, systems, and their time-domain representation and operations.
2EEPC209_2	**Apply** Laplace and Z-transform techniques for analyzing and realizing systems.
2EEPC209_3	**Apply** the Fourier series and Fourier transform for the representation of continuous time signals.
2EEPC209_4	**Apply** DFT and FFT algorithms for frequency analysis of discrete signals.
2EEPC209_5	**Illustrate** the digital signal processing concepts like sampling, quantization, and aliasing, with applications in signal reconstruction.

Unit	Contents	Hours
1	**Introduction to signals and systems** Representation of signals, Basic Operation on Signals, Classification of signals, Classification of Systems	06
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, Linear and Circular convolution	07
3	**System analysis using Laplace and z-transform.** Introduction to Laplace and z transform, Inverse Laplace and Inverse Z transform, Poles & Zeros, Block diagram representation and system realization	06
4	**Frequency domain analysis of CT signals** Periodic representation by trigonometric Fourier series, Fourier spectrum, , exponential Fourier series, Fourier transform	06
5	**Fourier Analysis of Discrete Fourier Transform** Overview of DTFT, Frequency analysis of Signals using DFT and IDFT, Fast Fourier Transform (FFT) algorithm:- DIT and, DIF-FFT Algorithm	07
6	**Digital Signal Processing and its Applications** Basic Digital signal processing operation- Sampling Theorem, Sampling and Reconstructions of signals, Aliasing, Quantization, Introduction to Digital Signal Processing and its applications	07

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List of experiments

Expt. No.	Title of the Experiment
1	Introduction to simulation tools (MATLAB) for Signal Processing Lab
2	Generation of elementary continuous and discrete time signals
3	Performs various operations on signals and sequences such as addition, multiplication, scaling, shifting, folding, computation of energy and average power.
4	Study of Linear Convolution and circular convolution
5	Compute auto correlation and cross correlation between signals
6	Perform waveform synthesis using Laplace Transform and Z Transform of a given signal
7	Locate the zeros and poles and plotting the pole zero maps in s-plane and Z-plane for the given transfer function
8	Study Fourier Transform of a given signal and plot its magnitude and phase spectrum
9	Calculate Discrete Fourier Transform and Inverse Discrete Fourier Transform of given digital signal.
10	Study of Fast Fourier Transform
11	Verification of sampling signal
12	Introduction of Image Processing toolbox

Note: Minimum ten experiments should be performed from the above list

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Signals and Systems	Babu, R	Scitech Publications Pvt Ltd	Fourth	2011
2	Linear systems and signals	B. P. Lathi	Oxford University Press	Second	2005
3	Signals & Systems	Simon Haykin	Wiley Publications	Second	2007
4	Signals & Systems	M. J. Roberts	Tata McGraw Hill	Second	2012
5	Signals & 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	Third	2004
2	Analog Signal Processing: Analysis & Synthesis	Alok Barua	Wiley	First	2014
3	Signals and Linear systems	Gabel	Wiley	Third	1986
4	Signals and systems	Krishnaveni	Wiley	First	2012

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Class			S. Y. B. Tech. Semester- IV
Course Code and Course Title			2EEPC210 **DC Machines and Transformers**
Prerequisite/s			2EEES102
Teaching Scheme: Lecture / Laboratory			03/02
Credits			04
Evaluation Scheme	**T**	**ISE / MSE / ESE**	40 / 30 / 30
	P	**ISE / ESE**	50/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEPC210_1	**Explain** the constructional details and working principle of DC machines & Transformer. (K^2)
2EEPC210_2	**Describe** the effects of system parameters on performance of DC machines & Transformer. (K^2)
2EEPC210_3	**Solve** numerical to determine the performance parameters of DC machines & Transformer. (K^3)
2EEPC210_4	**Analyze** the performance of a DC machines & Transformer by using appropriate testing methods. (K^4)
2EEPC210_5	**Perform** different tests on DC machines & Transformer to find performance parameters. (S^2)
2EEPC210_6	**Practice** safety precautions while performing experiments in Laboratory. (A^2)

Unit	Contents	Hours
1	**DC Generator** Construction details, working principle, armature winding, EMF equation, power stages in DC generator, armature reaction and its effects, commutation & methods to improve commutation, applications of DC generator.	06
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	08
3	**Testing & Performance of DC machines** Losses and efficiency of DC machines, OCC test of DC generator, Brake test on DC motor, Swinburne's test on DC motor, Regenerative or Hopkinson's test on DC motor, IS standards for testing	05
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.	08

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5	**Testing & Performance of Single Phase Transformer** Losses & efficiency, maximum efficiency, all day efficiency, IS standards for testing, polarity test, load test, OC and SC test, separation of eddy current & hysteresis losses.	**05**
6	**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, applications.	**07**

List of Experiments:

Expt. No.	Title of Experiment
1	Determination of OCC & load characteristics of DC 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
7	Determination of performance of single phase transformer by Open circuit and short circuit test for finding efficiency & voltage regulation
8	Determination of performance of single phase transformer by Load test
9	Determination of performance of three phase transformer by Load test
10	Parallel operation of single phase transformer.
11	Determination of performance of 1Φ Transformer by Sumpner's Test
12	Mini Project: Working Model of DC machine, Working Model of Transformer, Different hand tools by using DC motor

Note: Minimum ten experiments should be performed from the above list

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Principles of Electrical Machines	V. K. Mehta	S. Chand	Second	2009
2	Electric Machinery	Bimbhra P.S	Khanna	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

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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	Fourth	1987
3	Electric Machines	M.V. Deshpande	PHI	First	2011
4	Electric Machines	Samarjit Ghosh	Pearson	Second	2012

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Class	S. Y. B. Tech, Semester.- IV
Course Code and Course Title	2EEPC211 **Electromagnetic Field Theory**
Prerequisite	-
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE / MSE / ESE	40 /30 /30

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEPC211_1	**Apply** different technique of vector analysis and appropriate coordinate systems for physical quantities dealt in electromagnetic fields. **(K^3)**
2EEPC211_2	**Derive** the physical quantities of electromagnetic fields in different engineering problems.**(K^3)**
2EEPC211_3	**Determine** the Energy, Potential, Capacitance, Inductance and its energy densities. **(K^3)**
2EEPC211_4	Illustrate the boundary conditions in interfaces of different media **(K^3)**
2EEPC211_5	**Apply** the Maxwell's equations in different forms **(K^3)**
2EEPC211_6	**Examine** the electromagnetic wave propagation in different media and its means for transporting energy or information **(K^4)**

Unit	Contents	Hours
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.	07
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, equipotential surfaces	07
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.	05

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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**
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, applications	**06**
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**

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	2004
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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Class	S.Y. B. Tech. Semester - IV
Course Code and Course Title	2EEPC212 **Generation, Transmission and Distribution**
Prerequisite/s	2EEPC102
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE / MSE / ESE	40 / 30 / 30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEPC212_1	**Describe** the electrical power generation methods to generate electricity using schematic diagram.(K^2)
2EEPC212 _2	**Relate** the terms involved in generation cost to calculate rate of electricity using tariff methods. (K^3)
2EEPC212_3	**Use** the knowledge of distribution system to calculate voltage drop of distributor for given parameters. (K^3)
2EEPC212_4	**Apply** the conceptual understanding of overhead & underground transmission system elements to correlate the mechanical construction parameters of line. (K^3)
2EEPC212_5	**Analyse** the different electrical parameter of overhead transmission lines(K^4)
2EEPC212_6	**Discuss** the alternate methods of generation, transmission & distribution on the basis of recent trends. (K^2)

Unit	Contents	Hours
1	**Generation of Electrical Power** AC power system Single line diagram, India's electricity scenario, Thermal power plant, hydro 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	06
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-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. Understanding of residential Electricity Bill.	07

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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.	**06**
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, Introduction of Sag, Corona, factors affecting the corona, advantages and disadvantages of corona, methods to reduce the corona, skin effect, proximity effect	**07**
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, capacitance, capacitance of two – wire line, three phase line with equilateral space, capacitance of line with unequal spacing, Numerical	**08**
6	**Underground Cables & Trends in Power System** Construction of Underground cable, method of laying underground cables Trends in power system- Alternate Sources of Power Generation, Introduction to Wireless Power Transmission system, Super capacitor, Distributed generation systems	**5**

Industrial Visit to Substation or Generating Station

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	Ashfaq Hussain	CBS publications	Fifth	2007
03	Electrical Power Generation, Transmission & Distribution	S N Singh	---	Second	2003
04	Modern Power system Analysis	D P Kothari & I J Nagrath	PHI learning Pvt Ltd	Third	2009
05	Generation of Electrical Energy	B. R. Gupta	S. Chand Publication	Fifth	2007

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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 Limited	Sixth	1997
04	Transmission & Distribution	Dr. C R Bayliss Hardy	Newnes	Third	2007

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Minor Course – I, Track I : Electric Vehicle	
Class	S. Y. B. Tech. Semester- IV
Course Code and Course Title	**2EEEV213, Fundamentals and Architecture of Electric Vehicles**
Prerequisite/s	--
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:	
2EEEV213_1	**Identify** the structure of Electric Vehicle along with vehicle resistance and vehicle performance parameters
2EEEV213_2	**Differentiate** the features of Hybrid Electric Vehicle layouts
2EEEV213_3	**Distinguish** the design and sizing of power train components of Electric Vehicles and Hybrid Electric Vehicles
2EEEV213_4	**Apply** the AC and DC motor characteristics suitable for Electric Vehicles propulsion
2EEEV213_5	**Analyze** the operation of AC & DC power electronic converters

Unit	Contents	Hours
1	**Electric Vehicles** History, Components of Electric Vehicle (EV), General Layout of EV, EV classification Comparison with Internal combustion Engine: Technology, Advantages & Disadvantages of EV.	4
2	**Vehicle Fundamentals** Vehicle resistance, Types: Rolling Resistance, grading resistance, Aerodynamic drag vehicle performance, Calculating the Acceleration Force, maximum speed, Finding the Total Tractive Effort, Torque Required on The Drive Wheel, Transmission: Differential, clutch & gear box, Braking performance.	5
3	**Hybrid Electric Vehicles** History, Components of Hybrid Electric Vehicle, General Layout of Hybrid EV, Comparison with Electric Vehicles, Advantages & Disadvantages of Hybrid EV.	5
4	**Vehicle Architecture & Design** Hybrids Based on Architecture, Hybrids Based on Transmission Assembly, Hybrid Based on Degree of Hybridization. Power Train Component Sizing: EV Powertrain sizing, HEV Powertrain Sizing, HEV Powertrain sizing Example.	5
5	**Motors** Principle and working of DC Motor, Characteristics & Types of DC Motors-Overview, Speed Torque characteristics of Permanent magnet Motor, BLDC Motor, Induction motor, Comparison of all motors.	4
6	**Converter** Introduction of DC-DC, AC-AC, AC-DC, DC-AC converters, Four quadrant operation, Driver circuits.	5

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Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Electric Vehicle Technology	John Lowry and James Larminie	John Wiley and Sons,	1st	2012
2	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, External, and Design	Mehrdad Ehsani and Yimin Gao	CRC Press	3rd	2018
3	Electric and Hybrid Vehicles: Design Fundamentals	Iqbal Hussain	CRC Press	2nd	2011
4	Build Your Own Electric Vehicle	Seth Leitman and Bob Brant	Mc Graw Hills	1st	2008

Reference Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Electric and Hybrid Electric Vehicles	I.Husain	CRC Press	Second	2003
2	Vehicle Propulsion Systems: Introduction to Modeling and Optimization	L.Guzzella and A. Sciarretta	Springer	Fifth	2007
3	Automotive Transmissions: Fundamentals, Selection, Design and Application	G. Lechner and H. Naunheimer	Springer	Third	1999

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Minor Course – I : Students can choose either Track 1 or Track 2 course	
Class	S.Y. B. Tech. Semester - IV
Course Code and Course Title	**Track - 2: Control Engineering** 2EE**214 **Transducers and Signal Conditioning**
Prerequisite/s	----
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00
Credits	02
Evaluation Scheme: ISE / MSE / ESE	40 / 30 / 30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EE214_1**	**Illustrate** the working of measurement systems using the model of input-output configuration (K^3)
2EE214_2**	**Summarize** the various sensors and transducers by understanding their principle, construction, and accuracy (K^3)
2EE214_3**	**Compare** resistive, capacitive, and inductive type transducers based on the various parameters, such as construction, power requirement, accuracy etc (K^3)
2EE214_4**	**Apply** the knowledge of operational amplifiers to design the signal conditioning circuits for sensors (K^3)
2EE214_5**	**Explain** the role of signal converters, like radiometric, logarithmic, voltage to current and frequency to voltage with sensors and transducers (K^3)

Syllabus

Unit	Contents	Hours
1	**Introduction**: Basic block diagram of generalized instrumentation system, general input- output configuration, definition of transducer, classification of transducers.	04
2	**Resistive transducers**: Potentiometers, metal and semiconductor strain gauges, strain gauge applications, load and torque measurement, digital displacement sensors, Resistance Temperature Detectors (RTDs), Thermistors, Thermocouples	04
3	**Inductive and Capacitive Transducers**: Measurement of self and mutual inductance, Linear Variable Differential Transformer (LVDT), Variable reluctance transducers, capacitive transducers: frequency response, advantages and disadvantages and uses of capacitive transducers Capacitance pick up, Condenser microphones, Differential capacitor pick up.	05
4	**Miscellaneous measurements**: Seismic transducer and its dynamic response, photoelectric transducers, Hall effect sensors, magnetostrictive transducer, optic sensors, eddy current transducers, proximity sensors, tacho-generators and stroboscope.	05
5	**Introduction to signal conditioning:** Concept of signal conditioning, Op-amp circuits used in instrumentation, summer, buffer, integrator, differentiator, instrumentation amplifiers, analogue-digital sampling, signal filtering, averaging	04

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6	**Signal Converters**: Radiometric converters, logarithmic converters, Voltage Controlled Oscilloscope (VCO), Phase Locked Loops (PLL), voltage to frequency converter, frequency to voltage converter, voltage to current converter, and current to voltage converter.	04

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	A Course on Electrical and Electronic Measurements and Instrumentation	A.K. Sawhney and Puneet Sawhney	Dhanpat Rai	--	2012
2	Electronic Instrumentation and Measurement	David A Bell	Oxford University Press	Third	--
3	A Course in Electronic and Electrical Measurements & Instrumentation	J.B Gupta	S K Kataria and Sons	--	--
4	Semiconductors Sensors	S.M Sze	John Wiley & Sons Inc	Third	2006

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Sensors and Transducers	Patranabis	Prentice Hall	Second	2003
02	Electronic Instrumentation	H. S. Kalsi	Tata McGraw Hill	--	2006
03	Elements of electronic instrumentation and measurement	Joseph J Carr	Pearson Education	--	2005

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Class	S. Y. B. Tech. Semester- IV
Course Code and Course Title:	2EEHS215 **Psychology**
Prerequisite/s:	-
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00
Credits:	02
Evaluation Scheme: ISE I/ISE II	25/25

Course Outcomes:	
2EEHS215_1	**Explain** using psychology theories, the necessity and significance of various parts of psychology (K^2)
2EEHS215_2	**Describe** importance of psychology in the organization and human nature that takes place in a group or individually within an organization (K^2)
2EEHS215_3	**Apply** emotional intelligence, time management, and stress management techniques in their daily activities (K^3)
2EEHS215_4	**Analyze** different case studies that use different leadership styles and approaches (K^3)

Course Contents:

Unit	Contents	Hours
1	**Psychology** – Introduction and Need of psychology in the organization, Organizational Behavior	02
2	**Emotional Intelligence (EI)** – Definition of EI, components of EI, Activities	05
3	**Time Management**– Need and importance of Time management for an individual, Effective steps of Time Management, role of procrastination in Time management, Types of Procrastination, Effects of Procrastination, Techniques to stop procrastination, activities	06
4	**Leadership** – importance of leadership, styles of leadership, The Leader Trait Approach, The Behavior Approach, Path-Goal Theory: How Leaders Motivate Followers, Leader and Mood, Gender and Leadership, Ethical Leadership	05
5	**Attitude and Job Satisfaction** – Components of Attitude, Relationship between Attitude and Behavior, Job attitude, Causes of Job satisfaction, outcomes of Job satisfaction, Impact of Job dissatisfaction, activities	02
6	**Stress Management** – meaning of stress, sources and consequences of stress nature of stressors, Stress Management Techniques, activities	06

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Text Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Organizational Behavior- An Evidence-Based Approach	Fred Luthan	McGraw-Hill/Irwin	12th	2011
2	Essentials of Organizational Behavior	Stephen P. Robbins Timothy A. Judge Katherine E. Breward	Pearson	-	2018
3	Essentials of organizational Behavior	Stephen P. Robbins	Prentice Hall	7th	2002
4	Understanding and Managing Organizational Behavior	Jennifer M. George Gareth R. Jones	Pearson	6th	2012
5	Emotional Intelligence at Work A Professional Guide	Dalip Singh	Response Books: A division of Sage Publications	3rd	2006

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Emotional Intelligence at Work A Professional Guide	Dalip Singh	Response Books A division of Sage Publications	3rd	2006
2	Positive Psychology Applications in Work, Health and Well-being	Updesh Kumar Archana Vijay Parkash	Pearson India Education	-	2016

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Class	S. Y. B. Tech. Semester- IV
Course Code and Course Title	2EEHS216 **Constitution of India**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	01/00/00
Credits	01
Evaluation Scheme: ISE I / ISE II	25/25

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEHS216_1	**Explain** the meaning, important acts and history related to Indian constitution (K^2)
2EEHS216_2	**Illustrate** the features of Indian constitution and interpretation of Preamble (K^2)
2EEHS216_3	**Interpret** fundamental rights and duties of the Indian Citizen to inculcate morality and their social responsibilities (K^3)
2EEHS216_4	**Identify** different laws and regulations based upon Information Acts (K^3)
2EEHS216_5	**Distinguish** the functioning of Indian parliamentary system and legislative system at the centre and state level (K^3)

Unit	Contents	Hours
1	**Constitution: Basic Structure** Meaning of the constitution law and constitutionalism, Historical perspective of the constitution of India, Government of India Act of 1935 and Indian Independence Act of 1947.	02
2	**Making of Indian Constitution :** Enforcement of the Constitution, Meaning and importance of Constitution, Making of Indian Constitution – Sources, Salient features of Indian Constitution, Preamble.	02
3	**Fundamental Rights:** Fundamental Rights – Features and characteristics, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies.	03
4	**Fundamental Duties:** Directive Principles-Definition and Meaning, 42nd Constitutional Amendment Act, List and Importance of Fundamental Duties.	02
5	**Regulation to Information :** Introduction, Right to Information Act:2005, Information Technology Act 2000, Electronic Governance in India, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Limitations of an Information Technology Act	02

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6	**Government of The Union and States:** President of India – Election and Powers, Prime Minister of India - Election and Powers, Loksabha - Structure, Rajyasabha – Structure, Governor of State, Chief Minister and Council of Ministers in a state.	02

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Indian Polity	M.Laxmikanth	Mc Graw Hill Publications Delhi	7th	2023
2	The Constitution of India	P.M. Bakshi	Lexis Nexis	19th	2023
3	Introduction to the Constitution of India	Durga Das Basu	Lexis Nexis	26th	2022
4	Governance in India	M. Laxmikanth	Mc Graw Hill Publications Delhi	3rd	2021

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Constitution of India	V.N.Shukla	EBC	14th	2022
2	The Constitutional Law of India,	J.N. Pandey	Allahabad; Central Law Agency	59th	2022
3	Constitution of India	V.N.Tripathi	Premier Publishing Company	9th	2021
4	India's Constitution	M.V.Pylee	S. Chand Publications New Delhi	18th	2020

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Class	S. Y. B. Tech. Semester- IV
Course Code and Course Title	2EEVS217 **Simulation Lab**
Prerequisite/s	2EEES105, 2EEVS115, 2EEVS207
Teaching Scheme: Lecture/Tutorial /Practical	00/00/02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEPC217_1	**List** various features of simulation software tools to perform basic operations related to electrical engineering.
2EEPC217_2	**Apply** the knowledge of electrical engineering systems to implement simulations for given specifications.
2EEPC217_3	**Demonstrate** the circuital laws to calculate electrical parameters using network theorems.
2EEPC217_4	**Simulate** the electrical engineering systems to analyze system performance with the help of measurement blocks.
2EEPC217_5	**Perform** individually or in a team to provide solution to electrical engineering problems and communicate effectively to represent.

List of Experiments:

Expt. No.	Title of the Experiment
1	Introduction to simulation tools for Electrical Engineering (LabVIEW, ETAP)
2	Study of Logic Gates using LabVIEW
3	Water level detector using LabVIEW
4	Temperature Conversion in LabVIEW
5	DC Motor Speed control using LabVIEW
6	Simulation of RLC series circuit using LabVIEW
7	Load Characteristics of a Self-excited DC shunt Generator in LabVIEW
8	To design single line diagram of power system using ETAP
9	Modelling and simulation of power flow in ETAP
10	Sizing of Capacitor using ETAP
11	Short Circuit analysis using ETAP
12	Study of built-in library examples of electrical engineering with ETAP

Note: Minimum ten experiments to be performed from the above list

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Lecture Notes in LabVIEW and Data Acquisition	Fadhil Ali	Kindle	Reprint	2021
2.	LabVIEW for Electrical Engineers and Technologists	Stephen P. Tubbs	Stephen P. Tubbs	First	2011
3.	SKM, ETAP, & EDSA Power System Analysis Tutorials	Stephen Philip Tubbs	Stephen P. Tubbs	First	2009
4.	Virtual Instrumentation using LabVIEW	Sanjay Gupta, Joseph John	McGraw-Hill Education India	Second	2009

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Virtual Instrumentation Using LabVIEW	Jovitha Jerome	PHI	First	2010
2.	LabVIEW: A Flexible Environment for Modeling and Daily Laboratory USE	Riccardo de Asmundis	Intech Open	First	2021
3.	Learning with LabView	Robert H. Bishop	Blackwell North America, Inc.	First	1997
4.	Power Systems Analysis Illustrated With MATLAB And ETAP	Hemchandra M. Shertukde	Taylor & Francis Inc	First	2019

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Class	S.Y. B. Tech. Semester.-IV
Course Code and Course Title	2EEEL218 **Innovation and Prototype**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEEL218_1	**Discriminate** the design process and its stage (K^2)
2EEEL218_2	**Analysis** the design process, function and its stage (K^4)
2EEEL218_3	**Design** the Plan of prototyping activities considering factors such as time, cost, and resources, utilizing appropriate technologies (K^6)
2EEEL218_4	**Develop** a prototype and design report (K^6)
2EEEL218_5	**Formulate** the value proposition views of different stake holders (K^5)

LIST OF EXPERIMENTS

Expt. No	Title of the Experiment
1	Identification of Problem, design process and conceptualization
2	Functional Analysis (Function, Constraints, Functional Decomposition)
3	Concept Development (Appropriate Investigation and Selection)
4	Project Development (Project Planning, Cost Estimation, Managing Property Issues)
5	Prototype culminating and Ideation
6	Model Building Making
7	Testing of the Model
8	Customer product unveiling and report
9	Pros Cons of Model identification and scope Analysis
10	Effective Report Making

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Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Product Design: Technique in Reverse Engineering and New Product Development	Kevin Otto, Kristin Wood	Prentice Hall Edition	First	2013
2	Product design and development.	Eppinger, S., & Ulrich, K	Mc Graw-Hill Higher Education.	Fifth	2017
3	Engineering Design Process	Yousef Haik	Florida State University	Fourth	2010
4	Product design and Manufacturing	A.K. Chitale, R. C. Gupta	PHI Publication	Fourth	2009
5	Engineering Design Process	Yousef Haik, T. M. M. Shahin	Cengage Learning	Second	2010

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Product Design	Kevin Otto, Kristin Wood	Pearson Education Indian Reprint	--	2004
2	Engineering Design	George E.Dieter, Linda C.Schmidt	McGraw-Hill International	Fourth	2009
3	Engineering Design: A Project-based Introduction	Clive L.Dym, Patrick Little	John Wiley & Sons	Third	2009
4	Product Design and Development	Anita Goyal, Karl T Ulrich, Steven D Eppinger	Tata McGraw-Hill Education	Fourth	2009

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Class	S Y B. Tech Semester - IV
Course Code & Course Title	2EECC219 **Aptitude and Reasoning Part- II**
Prerequisite/s	2EECC208
Teaching Scheme (Lecture/Practical/Tutorial)	0/2/0
Credits	1
Evaluation Scheme: ISE	50

Course Outcomes (COs) : The students will be able to:	
2EECC219_1	**Solve** problems based on HCF, LCM, Interest, Clock, Cubes and Puzzles
2EECC219_2	**Solve** problems based on Coding and Decoding, Seating Arrangements and Venn diagrams.
2EECC219_3	**Solve** problems based on Ratio Proportion, Partnership, Allegation, Divisibility and Number Theory
2EECC219_4	**Demonstrate** presentations using concepts delivered on confidence building and time management skills.

Unit No	Unit Name	Contact Hours
1	HCF LCM, Simple Interest, Compound Interest	4
2	Coding- Decoding, Seating Arrangement Venn Diagrams	4
3	Clocks, Cubes, Puzzles,	4
4	Ratio Proportion, Partnership	4
5	Confidence Building, Time Management	4
6	Allegation, Divisibility and Number Theory	4
	Self-Study Module	6

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	R.S. Agarwal (Quantitative aptitude)	R.S.Agarwal	S Chand	-	2019
2	R.S. Agarwal (Verbal & Non-verbal Reasoning)	R.S.Agarwal	S Chand	-	2010
3	Wren & Martin (Verbal, Grammar)	P.C.Wren	S Chand	-	2017

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Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	APTIPEDIA (Quantitative, Logical, Verbal Aptitude)	Face	Wiley	-	2017
2	Wiley (Quantitative Aptitude)	P.A.Anand	Maestro	-	2015
3	Arun Sharma (Verbal Ability)	Meenakshi Upadhyay	McGraw Hill	-	2020

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Class			T.Y. B. Tech. Semester - V
Course Code and Course Title			**2EEPC301, Feedback Control Systems**
Prerequisite/s			2EEBS201, 2EEPC209
Teaching Scheme: Lecture/Tutorial/Practical			03/01/02
Credits			05
Evaluation Scheme	T	ISE / MSE / ESE	40/30/30
	P	ISE / ESE	50/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to,	
2EEPC301_1	**Determine** the transfer function using block diagram reduction and signal flow graph.
2EEPC301_2	**Analyze** the mathematical model of electrical and mechanical systems.
2EEPC301_3	**Compute** the transient and steady state response parameters of systems.
2EEPC301_4	**Analyze** the stability of system in time & frequency domain.
2EEPC301_5	**Analyze** the control system using state space representation.
2EEPC301_6	**Implement** controllers for simple control systems.

Unit	Course contents	Hours
1	**Introduction to Control System and Mathematical Modeling** Introduction, types of systems, feedback control system, Mathematical modeling of electrical, mechanical systems, force voltage and force current analogy, Determination of the transfer function using block diagram reduction and signal flow graph, components of control systems and its transfer function, pole zero concept.	7
2	**Time Domain Analysis and Stability** Time response of first order systems, second order systems, analysis of steady state error, static error constants and type of system, time response specifications, concept of stability, Routh-Hurwitz criteria for stability.	6
3	**Root Locus Technique** Definition of root locus, rules for plotting root loci, root contour, stability analysis using root locus, effect of addition of pole and zero on root locus.	6
4	**Frequency Response Analysis of Control system** Introduction to frequency response, frequency domain performance specifications, stability analysis of system using bode plots, polar plot, nyquist plot, co-relation between time domain and frequency domain.	7
5	**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.	7
6	**PID Controller** Introduction to P, PI, PID controller, Ziegler and Nicholas rules for controller tunning, PID controller applications: Temperature control system, motion control system, level control system.	6

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List of experiments

Expt. No.	Title of Experiment
1	Generation & plotting of standard test signals.
2	Determine the transfer function using block diagram reduction.
3	Determine transient and steady state response specifications of system.
4	Determine the stability of control system using Root locus and analyze the effect of addition of poles and zeros on the performance of system
5	Determine the stability of control system using frequency domain analysis.
6	Conversion of transfer function to state space and vice- versa.
7	Determine the controllability and observability of given system.
8	Speed control of DC motor using PID controller.
9	Analysis of DC position control system.
10	Analysis of temperature control system

All experiments should be performed from the above list.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Control System Engineering	Norman Nise	Wiley Publication	Seventh	2014
02	Control System Engineering	I.J. Nagrath M. Gopal	New Age International Publication	Fifth	2020
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	2014
02	Control Systems: Theory and Applications	Smarajit Ghosh	Pearson Education	Second	2012
03	Control Systems	N. C. Jagan	B. S. Publications	Third	2015
04	Feedback Control Systems	C.L. Phillips, R.D. Harbor	Prentice Hall	Fifth	2011

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Class			T.Y. B. Tech. Semester - V
Course Code and Course Title			**2EEPC302, AC Machines**
Prerequisite/s			2EEES102, 2EEPC210
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	T	**ISE / MSE / ESE**	40/30/30
	P	**ISE / ESE**	50/50

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEPC302_1	**Explain** the constructional details and working principle of AC machines
2EEPC302_2	**Describe** the effects of system parameters during steady state and dynamic conditions
2EEPC302_3	**Solve** numerical problems to determine the essential parameters of machines at steady state and dynamic conditions
2EEPC302_4	**Analyze** the performance of a AC machine by using appropriate testing methods
2EEPC302_5	**Select** the suitable types of speed control methods and starting methods for rotating machines

Unit	Course Contents	Hours
1	**Three Phase Induction Motor** Principle of operation, Construction details, Torque-Slip Characteristics, Necessity of starters, types of starters (DOL, star-delta, rotor resistance starter), Speed control methods from stator side (Stator voltage control, Stator frequency control) & rotor side (rotor resistance control), V/f method, Braking Methods, Applications	7
2	**Testing & Performance of Induction Motor** 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	7
3	**Three Phase Alternator** Principle of operation, Construction details, 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)	6
4	**Testing & Performance of Alternator** Direct load test, OC test & SC test on 3 Phase alternator, voltage regulation methods (EMF, MMF and direct loading method), Losses and efficiency, Necessity for parallel operation of alternators, conditions for parallel operation, synchronizing procedures, hunting and oscillation in alternators	7

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5	**Synchronous Motor** Principle of operation, Construction details, 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	6
6	**Single phase induction motors** Principle of operation, Construction details, Equivalent Circuit, Split phase induction motor, Capacitor start induction motor, Capacitor start capacitor run induction motor (two value capacitor method), shaded pole induction motor, universal motor	6

List of experiments

Expt. No	Title of the Experiment
1.	Speed control of 3 Ph. Squirrel Cage Induction Motor (SCIM) by using stator voltage control
2.	Speed control of 3 Ph. Slip Ring Induction Motor (SRIM) by using rotor resistance control.
3.	Determination of efficiency & speed regulation of 3 Phase SCIM by conducting No Load & Blocked Rotor Test.
4.	Determination of efficiency & speed regulation of 3 phase SCIM by direct loading method
5.	Determination of efficiency & speed regulation of 3 phase SCIM by indirect loading method
6.	Determination of efficiency & speed regulation of 1 phase induction motor by direct loading method.
7.	Determination of Voltage regulation of an alternator by EMF method.
8.	Determination of Voltage regulation of an alternator by MMF method.
9.	Determination of voltage regulation of Alternator by direct loading method
10.	Determination of V and Inverted V curves of a synchronous motor.
11.	Synchronization of three phase alternator
12.	Mini /Micro Project

Minimum **ten** experiments should be performed from the above list.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Electric Machinery	Bimbhra P.S	Khanna Publisher	Seventh	2021
2	Electric machines	Ashfaq Husain	Dhanpatrai And Co.Publication	Third	2024
3	Electric Machinery	A.E Fitzgerald Stephen Kingsly	Tata Mcgraw Hill	Seventh	2014
4	Principles of Electrical Machines	V. K. Mehta	S. Chand	Second	2009

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Electric Machines	Kothari D.P Nagrath I.J	THM Publications	Fifth	2017
2	Generalized Machine Theory	Bhimra P.S	Khanna Publisher	Seventh	2021
3	Electric machines	M.V.Deshpande	PHI Publication	First	2011
4	Electric machines	Samarjit Ghosh	Pearson	Second	2012

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Class			T.Y. B. Tech. Semester - V
Course Code and Course Title			**2EEPC303, Power System Analysis**
Prerequisite/s			2EEPC102, 2EEPC212
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE/ MSE / ESE**	40/30/30
	P	**ISE**	50

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEPC303_1	**Explain** the fundamentals of power systems analysis under steady state and fault conditions.
2EEPC303_2	**Model** power system components under steady state condition using per unit systems.
2EEPC303_3	**Draw** network diagram required for power system analysis using symmetrical Component theory.
2EEPC303_4	**Calculate** power system parameters under steady state conditions using power system analysis techniques
2EEPC303_5	**Analyze** expressions of system parameters under fault condition on transmission lines using Sequence network study.

Unit	Course Contents	Hours
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 & surge impedance loading, tuned power lines, complex power flow through a transmission line, Travelling wave equations, reflection & refraction coefficient	7
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	6
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 (Gauss Seidel, Newton Raphson method)	7
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)	7

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5	**Symmetrical Components for Fault Analysis** 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.	6
6	**Unsymmetrical Fault Analysis** Introduction to 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	6

List of experiments

Expt. No	Title of the Experiment
1	Determination of efficiency and voltage regulation of Short/medium/long transmission line.
2	Demonstration of Ferranti effect on transmission line by using transmission line trainer kit
3	Measurement of ABCD parameters of a medium/long transmission line.
4	Study of per unit representation of power system network by using MATLAB.
5	Formation of Y- Bus matrix of a power system using MATLAB.
6	Load flow analysis using Gauss-Seidel method.
7	Load flow analysis using Newton-Raphson method.
8	Study of Transients behaviour in series R-L circuit & synchronous generator under symmetrical fault
9	Symmetrical fault analysis of a 3-bus system using MATLAB.
10	Conversion of phasors to symmetrical components and vice versa using MATLAB
11	Determination of Positive, negative and zero sequence impedances of transformer (hardware)
12	Load flow analysis using ETAP/power world simulator.
13	Unsymmetrical fault analysis for LL, LG, LLG Faults using MATLAB /ETAP /Power world simulator

Minimum **ten** experiments should be performed from the above list.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Power System Engineering	D.P. Kothari, I. J. Nagrath	Mc-Graw Hill Publications	Third	2019
2	Electrical Power Systems	Ashfaq Hussain	CBS publishers, New Delhi	Third	2007
3	Power System Analysis	Hadi Saadat	Tata Mc-Graw Hill	First	2002

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Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Power System Analysis	Grainger John J and W D Stevenson	McGraw Hill	First	1994
2	Power System Analysis	P S R Murthy	BS Publication	First	2007
3	Electrical Power Systems	D. Das	New Age international	First	2010
4	Electric Power Systems: A first course	Ned Mohan	Wiley Publication	First	2012

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Minor Course – II, Track I : Electric Vehicle	
Class	T.Y. B. Tech. Semester – V
Course Code and Course Title	**2EEEV304, Energy Storage Systems for Electric Vehicles**
Prerequisite/s	**2EEEV213**
Teaching Scheme: Lecture/Tutorial/Practical	03/00 /00
Credits	03
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEEV304_1	**Apply** knowledge of EV drivetrain architectures to describe components and their functions in various electric drivetrains
2EEEV304_2	**Apply** knowledge to describe characteristics of different battery types
2EEEV304_3	Use battery specifications to explain chemical-to-electrical energy conversion and assess battery efficiency, electrical parameters, and heat generation.
2EEEV304_4	**Apply** performance criteria to assess battery requirements for EV propulsion
2EEEV304_5	Use concepts of energy storage systems to design a battery pack
2EEEV304_6	**Implement** knowledge of chemical and structural material properties to improve battery safety and design

Unit	Course Contents	Hours
1	**Electric Vehicle Mechanism** Basics of vehicle mechanisms, Electric Vehicle Drivetrain, Energy Storage and Management, Charging Infrastructure, Power/Energy supply requirements.	6
2	**Cells and Batteries fundamentals** Cells and Batteries- conversion of chemical energy to electrical energy- Battery Specifications: Variables to characterize battery operating conditions and Specifications to characterize battery nominal and maximum characteristics; Efficiency of batteries; Electrical parameters, Heat generation	7
3	**Battery types and ultracapacitors** Batteries: Lead Acid Battery, Nickel based batteries, Sodium based batteries, Lithium based batteries – Li-ion & Li-poly, Metal Air Battery, Zinc Chloride battery; Super capacitors and Ultra capacitors.	6
4	**Battery Performance** Performance criteria for Electric vehicles batteries; Vehicle propulsion factors- Power and energy requirements of batteries- Meeting battery performance criteria- setting new targets for battery performance.	6

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5	**Battery monitoring and management** Selection of battery for EVs & HEVs, Traction Battery Pack design, Requirement of Battery Monitoring, Battery State of Charge Estimation methods, Battery Cell equalization problem, thermal control, protection interface, SOC Estimation, Energy & Power estimation, Introduction to Battery Management System.	7
6	**Battery testing & recycling** Battery testing, limitations for transport and storage of cells and batteries, Recycling, disposal and second use of batteries. Explosions: Causes of battery explosions, explosive process, Thermal Runway: High discharge rates, Short circuits, charging and discharging. Environment and Human Health impact assessments of batteries, General recycling issues and drivers, methods of recycling of EV batteries.	7

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Electric vehicle battery systems	Sandeep Dhameja	Newnes	--	2010
2	Electric Vehicle Technology Explained	John Lowry, James Larminie	Wiley	2nd	2012
3	Electric & Hybrid Vehicles Design fundamentals	Iqbal Husain	Taylor & Francis Group	2nd	2010
4	Energy storage: A new approach	Ralph Zito	Wiley	---	2010

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Used Battery Collection and Recycling	Pistoia, J.P. Wiaux, S.P. Wolsky	Elsevier	---	2001
2	Hybrid electric Vehicle-Principles & Applications with Practical Properties	Chris Mi, Abul Masrur& David Wenzhong Gao	WILEY	---	2011
3	Recycling of Lithium-Ion Batteries: The LithoRec Way	Arno Kwade, Jan Diekmann	Springer	---	2018
4	Thermal Management of Electric Vehicle Battery Systems	Ibrahim Dinçer, Halil S. Hamut and Nader Javani	John Wiley& Sons	---	2016

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Minor Course – II, Track – II : Control Engineering	
Class	T.Y. B. Tech, Semester -V
Course Code and Course Title	**2EECE305, Control Systems**
Prerequisite/s	**2EECE214**
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme: ISE / MSE / ESE	40/30/30

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EECE305_1	**Summarize** the fundamentals of control systems and the associated terms along with its transfer function.
2EECE305_2	**Develop** mathematical models for given dynamic systems.
2EECE305_3	**Determine** the transfer function using block diagram reduction and signal flow graph.
2EECE305_4	**Compute** the performance parameters of control system.
2EECE305_5	**Assess** the stability of the system in time domain and frequency domain.
2EECE305_6	**Analyze** the control systems using state space model.

Unit	Course Contents	Hours
1	**Introduction to Control System** Introduction, classification of control system, feedback control system, Components of control systems and its transfer function, Pole zero concept.	6
2	**Control System Representation** Mathematical representation of electrical, mechanical systems, Force Voltage and Force current analogy, Block diagram representation and reduction, Signal flow graph.	7
3	**Time Domain Analysis and Stability** Time response of first order systems, second order systems, Analysis of steady state error, static error constants and type of system, Time response specifications, Concept of stability, Routh-Hurwitz criteria for stability.	7
4	**Root Locus** Definition of root locus, rules for plotting root loci, root contour, stability analysis using root locus, effect of addition of pole and zero on root locus.	6
5	**Frequency Response Analysis** Introduction to frequency response, frequency domain performance specifications, stability analysis of system using Bode plots, Polar plot, Nyquist plot, co-relation between time domain and frequency domain.	7
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, controllability and observability.	6

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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 & Gol Naraghi	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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Class	T.Y B.Tech., Sem - V
Course Code and Course Title	**2EEHS306 - Entrepreneurship**
Prerequisite/s	NIL
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme: ISE	50

Course Objectives:

1. This course aims to equip engineering students with the knowledge and skills to identify opportunities, develop innovative solutions, and launch successful engineering-based ventures.

Course Outcomes (COs):	
After successful completion of this course, the student will be able to:	
2EEHS306_1	**Identify** and evaluate potential business opportunities in the engineering domain.
2EEHS306_2	**Conduct** market research and analyze the competitive landscape.
2EEHS306_3	**Craft** a comprehensive business plan, including financial projections.
2EEHS306_4	**Understand** the fundamentals of marketing, sales, and operations for engineering ventures.
2EEHS306_5	**Pitch** their business ideas to potential investors.
2EEHS306_6	**Grasp** the legal and ethical considerations of starting a business.

Course Contents:

1. The Entrepreneurial Ecosystem
2. Idea Identification and Prototyping
3. Testing, Validation and Commercialisation
4. Market Analysis and Competitive Landscape
5. Legal Procedure to setup an Startup Business
6. Understanding Finance Basics
7. Business Planning and Development
8. Marketing and Sustainability
9. Pitching and Fundraising
10. Startup Case Studies

Assessment activities

Assessment 1 : Business Plan

Assessment 2 : Peer Review of Business Plan

Assessment 3 : Elevator Pitch Competition

Assessment 4 : "Shark Tank" Simulation

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Reference Materials:

1. https://www.startupindia.gov.in/content/sih/en/international/go-to-market-guide/indian-startup-ecosystem.html
2. https://www.startupindia.gov.in/content/sih/en/learning-and-development_v2.html
3. https://oulinecourses.nptel.ac.in/noc24_mg93/preview

Assessment Modes:

Sl. No	Method/ Technique	Course Outcomes						Marks		Weightage
		1	2	3	4	5	6	Max	Min	
1	ISE : BP	☑	☑	☑	☑	☐	☑	10	20	20 %
2	ISE : PR	☑	☑	☑	☑	☐	☑	10		20 %
3	ISE :EPC	☑	☑	☐	☑	☑	☐	10		20 %
4	ISE : STS	☑	☑	☑	☑	☑	☑	20		40 %

- ISE - In-Semester Examination,
- BP - Business Plan, PR - Peer Review of Business Plan
- EPC - Elevator Pitch Competition, STS - "Shark Tank" Simulation

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Class	T.Y. B. Tech. Semester - V
Course Code and Course Title	**2EEVS307, CAD for Electrical Machine Design**
Prerequisite/s	2EEES104, 2EEPC210
Teaching Scheme: Lecture/Tutorial/Practical	00/00 /02
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEVS307_1	**Explain** the basic concepts of electrical machine design.
2EEVS307_2	**Design** machine elements by suitable method using CAD.
2EEVS307_3	**Determine** the overall dimensions of the Electrical Machine.
2EEVS307_4	**Implement** and develop CAD of transformer and induction motor.
2EEVS307_5	**Prepare** a well-organized report employing elements of technical writing and critical thinking

List of experiments

Expt. No	Title of the Experiment
1.	Introduction to computer aided drafting for Electrical Design.
2.	Design a DC lap winding with a design report using Auto-Cad
3.	Design a DC wave winding with a design report using Auto-Cad
4.	Design an AC winding with a design report using Auto-Cad
5.	Design of a Core of Transformer by using AutoCAD
6.	Design a DC machine with a design report using Auto-Cad • Numerical Solving • Design using AutoCAD
7.	
8.	Design a AC machine with a design report using Auto-Cad • Numerical Solving • Design using AutoCAD
9.	
10.	Design of Transformer by using AutoCAD • Numerical Solving • Design using AutoCAD
11.	
12.	Industrial Visit

Minimum **ten** experiments should be performed from the above list.

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1.	A Course in Electrical Machine Design	A.K. Sawhney,	Dhanpat Rai & 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. Semester-V
Course Code and Course Title	**2EEEL308, Industrial Training / Internship**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial/ Practical	00/00/00
Credits	01
Evaluation Scheme: ISE	50

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEEL308_1	**Explain** the knowledge acquired in a given field during industrial training
2EEEL308_2	**Demonstrate** competency in relevant engineering fields through case study
2EEEL308_3	**Apply** the fundamental knowledge of engineering to given industrial problems/ task using appropriate techniques, resources and modern engineering tools
2EEEL308_4	**Communicate** effectively, both orally and in writing report related to given field showing engineering & management principles.

Course Contents:

Industrial Training Requirement:

- Duration: Minimum two weeks during the semester break after the fourth semester.
- Completion: Within 15 calendar days before the start of the fifth semester.
- Industry Preference: Students should seek internships in industries related to electrical engineering to ensure the experience is relevant and beneficial
- The report should demonstrate practical application of course-related knowledge and skills.
- After completion of training, each student has to submit following documents to training in charge:

1. Industry Evaluation Rubric filled by industry
2. Report of the training (Minimum 25 pages contents of the report with Case Study)
3. Completion original Certificate of Training by Industry.
4. Photocopy of Institute application letter to industry.
5. GPS Images and Photos: Each student must give a hard copy of the Internship Glimpse This template consists of two pages dedicated to showcasing the highlights of your internship through photographs, ensure that the template is separate from the internship report document
6. Attendance Sheet

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Report Submission Guidelines

As part of the internship program, students are required to submit a detailed report documenting their experiences and learnings during the internship.

The following guidelines outline the requirements for the report submission:

Content Requirements:

1. The report should include an introduction that provides an overview of the internship, including the company name, duration, and objectives.
2. Students should describe the tasks and projects they were involved in, detailing the specific roles and responsibilities they undertook.
3. The report should highlight key observations and insights gained from the internship, focusing on industry practices, technologies, and methodologies encountered.
4. Students are encouraged to analyze and discuss any challenges faced during the internship and how they were addressed or overcome.
5. The conclusion should summarize the overall experience, emphasizing the practical skills and knowledge acquired, and reflecting on how the internship has contributed to their professional development.

Formatting and Structure:

1. The report should be well organized, clearly written, and free of grammatical errors.
2. It should include a title page, table of contents, and properly formatted sections and subsections.
3. Any diagrams, charts, or photographs included should be relevant and appropriately labelled.

Evaluation Process:

Individual student must undergo presentation of training content before the evaluation committee constituted by the department. An internal evaluation will be conducted for examining the quality and authenticity of contents of the report. Marks will be awarded after the end of the presentation and submission of report

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Class			TY B.Tech, Semester -V
Course Code and Course Title			**2EECC309, Aptitude and Reasoning Part -III**
Prerequisite/s			2EECC208, 2EECC219
Teaching Scheme: Lecture/Tutorial/Practical			00/00/02
Credits			01
Evaluation Scheme:	**T**	**ISE/MSE/ESE**	00/00/00
	P	**ISE/ ESE**	50/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EECC309_1	Solve problem based on basic and advance Permutation and Combination
2EECC309_2	Solve problem based on Probability, Application of Probability, Cubes, Dices, cube painting and Syllogism
2EECC309_3	Solve problem based on Mensuration 3D, Circle & Triangle
2EECC309_4	Demonstrate on Resume writing skill, closed, advanced grammar, Synonyms and Antonyms

Unit	Course Contents	Hours
1	• Basic Permutation and Combination • Advance Permutation and Combination	04
2	• Probability • Application of Probability	04
3	• Cubes, Dices & cube painting • Syllogism	04
4	• Mensuration 3D • Circle & Triangle	04
5	• Resume writing & resume making • Interview Techniques	04
6	• Closed Test & advanced Grammar • Synonyms & Antonyms	04

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	R.S. Agarwal	R.S. Agarwal	S Chand		2019
02	R.S. Agarwal (Verbal & Non-verbal Reasoning)	R.S. Agarwal	S Chand		2010
03	Wren & Martin(Verbal, Grammar)	P.C.Wren	S Chand		2017

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Class			T.Y. B. Tech. Semester - VI
Course Code and Course Title			**2EEPC310 - Power Electronics**
Prerequisite/s			2EEPC113
Teaching Scheme: Lecture/Tutorial/Practical			03/01/02
Credits			05
Evaluation Scheme	T	ISE / MSE / ESE	40/30/30
	P	ISE / ESE	50/50

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEPC310_1	**Analyze** semiconductor devices with suitable triggering mechanism and commutation techniques
2EEPC310_2	**Demonstrate** the performance of single-phase half controlled and fully controlled AC to DC converter
2EEPC310_3	**Analyze** the performance of semi controlled and fully controlled three phase AC to DC converter
2EEPC310_4	**Differentiate** cyclo converters & AC voltage regulators
2EEPC310_5	**Compare** isolated and non-isolated DC to DC converters, along with their hard and soft switching device
2EEPC310_6	**Analyze** the performance of inverters using various pulse width modulation techniques.

Unit	Course Contents	Hours
1	**Power semiconductor devices, triggering and commutation circuits** Structure, working, static and dynamic characteristics of current controlled devices and voltage-controlled devices - SCR, GTO, MOSFET and IGBT. RC and UJT Triggering circuits, triggering TRIAC using DIAC, SCR commutation circuits, Design of gate drive and snubber circuits, Design of heat sinks, series and parallel operation of SCR	7
2	**Single phase AC to DC Converter** Performance analysis of single-phase half controlled and fully controlled converter with R and RL load under continuous and discontinuous conduction modes, inverter mode operation, harmonics, concept of freewheeling diodes. Effect of source inductance	7
3	**Three phase AC to DC Converter** Performance analysis of three phase half controlled and fully controlled converter with R and RL load under continuous and discontinuous conduction modes, inverter mode operation, harmonics, capacitor and LC filters.	6
4	**Dual converter and AC to AC converters** Construction, working of single phase dual converter: Non circulating and circulating model. Construction, working of single phase cyclo converter: step up and step down cyclo-converters, Single phase AC voltage regulator, matrix converters	6

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5	**DC to DC Converters** Construction, working and types of chopper, Classification of various quadrants choppers, control strategies of chopper, buck converter, boost converter, buck-boost converter, Isolated topologies -forward DC to DC converter, basic of resonant converter.	6
6	**Inverters** Construction, working and types of single phase and three phase voltage source inverter -120 degree and 180 degree modes of operations, operation of current source inverter, PWM techniques, fundamentals of electrical drives.	7

List of Experiments

Expt. No	Title of the Experiment
1	Plot the static characteristics of current controlled devices (SCR & TRIAC)
2	Plot the static characteristics of voltage controlled devices (MOSFET & IGBT)
3	Generate SCR gate pulses using R, RC and UJT triggering circuits
4	Performance of single phase fully controlled rectifier with R and RL loads
5	Performance of three phase fully controlled rectifier with R load
6	Performance of DC to DC step up and step down choppers with R load
7	Simulation of single phase controlled rectifier with R and RL load
8	Simulation of single phase dual converter with R load
9	Simulation of three phase semi controlled rectifier
10	Simulation of buck converter
11	Simulation of 180/120 degree conduction mode voltage source inverter
12	Simulation of cyclo converter with R load

Minimum **ten** experiments should be performed from the above list.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Power Electronics: Devices, Circuits and Applications	Muhammad H.Rashid,	Pearson Education	4th	2017
2	Power Electronics	Hart, Daniel W	Tata McGraw Hill Publication	2nd	2011
3	Power Electronics	P.C.Sen	Tata McGraw Hill Publication	2nd	2016
4	Power electronics systems - Theory and design	Agrawal Jai. P.	Pearson education	1st	2011

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Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Power electronics: Essentials and applications,	L.Umanand	Wiley	1st	2009
2	Power Electronics with Matlab	Kumar L.Ashok	Cambridge University Press.	1st	2022
3	Power Electronic Design: A Practitioners Guide	Keith H.Sueker	Elsevier Publication	1st	2022
4	SCR Manual	A.P.Connolly, R.W. Fox, F.B. Golden, et al.	General Electric Electronics Park,	5th	1972

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Class			B. Tech. Semester-VI
Course Code and Course Title			**2EEPC311, High Voltage Engineering**
Prerequisite/s			2EEPC210, 2EEPC212
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE/ MSE /ESE**	40/30/30
	P	**ISE**	50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEPC311_1	**Make use of** fundamental concepts of breakdown processes in gases, liquids, and solid dielectric media in uniform and non-uniform fields under diverse physical conditions.
2EEPC311_2	**Analyze** the generators and circuits used for generation of high impulse currents and high DC, AC, and impulse voltages as prescribed by national or international standards to study the insulation behavior under all conditions
2EEPC311_3	**Focus** the techniques of measuring high impulse currents and high DC, AC, and impulse voltages functional for the testing of HV equipment ensuring safety to the personnel and equipment.
2EEPC311_4	**Examine** the withstand capability of HV power apparatus using overvoltage as per IS/IEC/IEEE standards and coordinate the insulation level of the power system.

Unit	Course Contents	Hours
1	**Breakdown Mechanisms in Gaseous Dielectrics** Gases as Insulating Media, Ionization Processes, Townsends Mechanism, Streamer Mechanism of Spark, Paschen's Law, Breakdown in Electronegative Gases, Gaseous Breakdown in Non-uniform Fields and Corona Discharges, Practical Considerations using Gases for Insulation Purposes, alternate green gases and mixture of gases, Breakdown in Vacuum Insulation.	7
2	**Breakdown Mechanisms in Liquid and Solid Dielectrics** **Liquids Dielectrics:** Conduction and Breakdown in Pure and Commercial Liquids, Suspended Solid Particle Mechanism, Cavity Breakdown, Stressed Oil Volume Mechanism, Dissolved Gas Analysis. **Solids Dielectrics:** Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown, Electrochemical Breakdown, Breakdown due to Treeing and Tracking, Breakdown due to Internal Discharges, Breakdown in Composite Insulation.	7
3	**Generation of High DC and AC Voltages** Generation of HV DC by Single Phase Rectifier Circuits, Cockcroft Walton Voltage Multiplier Circuit – Voltage Regulation and Ripple Factor Calculation – Vande Graff Generator - Generation of HV AC by Cascade Transformers - equivalent circuit of cascaded transformer – Resonant Transformers and Tesla Coils.	6

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4	**Generation of Impulse Voltages and Currents** Standard Lightning & Switching Impulse Wave shape, Single Stage and Multistage Impulse Voltage Generation, Switching Impulse Voltage Generation Circuits, Generation of High Impulse Currents – Standard Waveshapes and Analysis.	5
5	**Measurement of High Voltages and High Currents** Resistance Potential Dividers, Generating Voltmeter - Electrostatic Voltmeters, Chubb Fortescue Method, Sphere Gaps for Peak Voltage Measurement of High DC, AC and Impulse Voltage Measurements, Hall Generator, Rogowski Coils. Measurement of loss angle, High Voltage Schering bridge, and partial discharge measurement techniques.	7
6	**High Voltage Testing and Insulation Co-Ordination** Objectives of High Voltage Testing, Testing of Insulators and Bushings, Testing of Isolators and Circuit Breakers, Testing of Cables, Testing of Transformers, Testing of Surge Arresters, Insulation Resistance Test, Testing of Breakdown Strength of Oil, Standard BILs, Insulation Coordination.	7

Expt. No	Title of the Experiment
1.	Measurement of DC breakdown characteristics of air using sphere gap assembly
2.	Measurement of AC breakdown characteristics of air using sphere gap assembly
3.	Testing of Breakdown Strength of Transformer Oil.
4.	Dielectric Strength Test on Solid Insulation using 5kV AC HV Tester.
5.	Analysis and Simulation of Voltage Doubler Circuit for HV DC generation using MATLAB / Circuit simulation package.
6.	Analysis and Simulation of Cockcroft-Walton Multiplier for HV DC generation using MATLAB /Circuit simulation package.
7.	Generation and Measurement of Standard Impulse Voltage using 5-Stage 150kV 225J Impulse Generator.
8.	Analysis and Simulation of Two stage Standard Marx impulse voltage generator using MATLAB / Circuit simulation package.
9.	Measurement of Insulation Resistance Using Megger.
10.	Substation Insulation Coordination for Lightning and Switching Surges – A Case Study

Note: Visit to HV Substation.

All experiments should be performed from the above list.

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

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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
5.	An Introduction To High Voltage Engineering	Subir Ray	Prentice Hall India Learning Private Limited	Second	2013
6.	High Voltage Technology	L.L. Alston	Oxford University Press,	First	2011
7.	High Voltage Engineering	E.Kuffel and M. Abdullah,	Pergamon Press	First	2013
8.	High-Voltage Engineering: Theory and Practice	Mazen Abdel-Salam, Hussein Anis, Ahdab El-Morshedy, RoshdyRadwan	Marcel Dekeer, New York	Second	2000

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Annasaheb Dange College of Engineering and Technology, Ashta

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Department of Electrical Engineering

Professional Elective, Track I: Power Engineering			
Class			T.Y. B. Tech. Semester - VI
Course Code and Course Title			**2EEPE312 Switchgear Protection & Industrial Electrical Systems**
Prerequisite/s			2EEPC210, 2EEPC212, 2EEPC302
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	T	ISE/MSE/ESE	40/30/30
	P	ISE/ESE	50/50

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEPE312_1	**Describe** the arc interruption process in circuit breakers
2EEPE312_2	**Analyze** the various relays based on their characteristics and applications
2EEPE312_3	**Examine** the various relays using digital protection and power world simulator
2EEPE312_4	**Apply** the appropriate protection scheme for various power system components like transformer, generator, and induction motor
2EEPE312_5	**Apply** the appropriate protection scheme for busbar and transmission line
2EEPE312_6	**Analyze** the electrical systems for protection of lightning, earthing, design of elevators, UPS and battery banks

Unit	Course Contents	Hours
1	**Arcing Phenomena** Voltage - current characteristics of arc, principles of DC and AC arc interruption, high resistance and current zero interruption, arc voltage, Transient restriking voltage, recovery voltage, repetitive reverse recovery voltage, current chopping, resistance switching, capacitive current interruption.	7
2	**Circuit Breakers** Air - break and air blast circuit breaker, oil – minimum oil and bulk oil circuit breaker, SF6 and vacuum circuit breaker, HVDC circuit breakers, MCB, ratings and testing of circuit breaker.	6
3	**Relays** Electromagnetic and its types, time current characteristics, plug setting multiplier, time setting multiplier, directional relay, protection of parallel feeders, protection of ring mains, static over current relays, digital overcurrent relay and numerical over current relays	7
4	**Transformer, Generator & Motor Protection** Transformer protection: Differential protection, carrier aided protection scheme, harmonic restraint and harmonic blocking schemes, restricted earth fault protection, Buchholz Relay Generator protection: Differential protection of generator, stator and rotor protection schemes of generator, loss of excitation, prime mover failure protection.	7

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	Motor protection: Induction motor stator and rotor protection	
5	**Protection of lines** **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, digital impedance, Reactance and Mho relays **Bus bar protection:** Frame leakage protection of bus bar, circulating current protection of bus bar, high impedance protection of bus bar	6
6	**Industrial Systems** Industrial loads, motors, starting of motors, lightning phenomenon, methods of earthing, electrical systems for the elevators, selection of UPS and battery banks.	6

List of Experiments

Expt. No	Title of the Experiment
1	Drawing sheet showing construction of circuit breakers.
2	Drawing sheet showing construction of generator and transformer protection schemes.
3	Perform the simulation of restriking and recovery voltage
4	Analyse the performance of electro-mechanical over current relay
5	Analyse the performance of electro-mechanical over voltage relay
6	Characteristics of over current relay
7	Characteristics of over voltage relay
8	Characteristics of under voltage relay
9	Characteristics of impedance relay
10	Study of gas actuated Buchholz relay for oil filled transformer in virtual lab
11	Virtual lab / Simulation of induction motor protection using relay
12	Power world simulator for relay setting
13	Perform the simulation of three phase differential relay for power transformer

Minimum ten experiments should be performed from the above list.

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 Text book of Power System Engineering	R.K. Rajput	Laxmi Publications,	First	2007
3	Switchgear and Protection	Sunil S. Rao,	Khanna publishers, New Delhi	Second	1986
4	Electrical estimating and costing	S. Singh and R. D. Singh	Dhanpat Rai and Co.	First	1997

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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	Electrical Power Systems (Generation, Transmission, Distribution, Protection and Utilization of Electrical Energy)	S.L. Uppal, Sunil S. Rao	Khanna publishers, New Delhi	Fifteenth	1987

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Department of Electrical Engineering

Professional Elective, Track II: Control Engineering			
Class			T.Y. B. Tech. Semester - VI
Course Code and Course Title			**2EEPE313, Control System Design**
Prerequisite/s			2EEPC301
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	T	ISE / MSE / ESE	40/30/30
	P	ISE / ESE	50/50

Course Outcomes (COs): Upon successful completion, the student will be able to:	
2EEPE313_1	**Design** of compensators in time and frequency domain.
2EEPE313_2	**Design** of control system in state space using pole placement and state observer.
2EEPE313_3	**Compute z-** transform and analyze the relation between z & s-domain for a digital control system.
2EEPE313_4	**Analyze** describing function and phase plane analysis methods for non-linear control systems.
2EEPE313_5	**Analyze** advanced control system methods such as MRAC, fuzzy logic and sliding mode control.

Unit	**Course Contents**	**Hours**
1	**Control system design in time domain** Review of root locus, concept of lead, lag, lag- lead compensator, design of lead, lag and lag- lead compensators based on root locus approach.	7
2	**Control system design in frequency domain** Review of bode plot, design of lead, lag and lag- lead compensators based on frequency domain approach	7
3	**Control system design 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.	6
4	**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 and S domains.	7
5	**Nonlinear control systems** Introduction, difference between linear and nonlinear systems, common physical non-linearities: Dead-zone, saturation, friction. Approaches for analysis of non-linear systems: Describing function analysis-phase plane analysis, concept of phase plane, phase trajectory, singular points.	6

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6	**Advanced control systems** Introduction, model reference adaptive control systems, controller structure, self-tuning regulators, concept of fuzzy logic and sliding mode control.	6

List of Experiments

Expt. No.	Title of Experiment
1.	Design of lead compensator using root locus method.
2.	Design of lag compensator using root locus method
3.	Design of lead-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 lead-lag compensator using bode plot method
7.	Determination of state feedback gain matrix using pole placement approach
8.	Determination of observer gain matrix using state observer approach.
9.	Analysis of digital control system using MALAB
10.	Analysis of non-linear control system using MATLAB.

All experiments should be performed from the above list.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Control System Engineering	Norman Nise	Wiley Publication	6th	2013
02	Modern Control Engineering	K. Ogata	Prentice Hall India	5th	2010
03	Feedback Control Systems	C.L. Phillips, R.D. Harbor,	Prentice Hall India	4th	1999
04	Introduction to Control Engineering: Model, Analysis & Design	A. K. Mandal	New Age International Pulishers	1st	2006

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Automatic Control System	Kuo & Golnaraghi	Wiley-India	9th	2013
02	Control System Engineering	I.J. Nagrath M. Gopal	New Age International Publication	5th	2009
03	Control Systems	N. C. Jagan	B. S. Publications	2nd	2008
04	Discrete Time Control Systems	K. Ogata	Prentice Hall International Inc.	2nd	1995

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Department of Electrical Engineering

Professional Elective, Track III: Embedded Systems			
Class			B. Tech. Semester-VI
Course Code and Course Title			**2EEPE314, Embedded Systems**
Prerequisite/s			2EEPC204
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE / ESE**	50/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to	
2EEPE314_1	**Describe** the components, architecture, characteristics of given embedded systems
2EEPE314_2	**Develop** the algorithm, flowchart and c code for data transfer, decision control, looping operations, timer/counter, serial communication & interrupt controllers
2EEPE314_3	**Explain** the modes of communication, control signals used in RS232 and communication protocols
2EEPE314_4	**Apply** the programming knowledge to interface the input and output devices
2EEPE314_5	**Discuss** the concepts of real time operating system for embedded system design in terms of characteristics, functions and features.

Unit	Course Contents	Hours
1	**Introduction to Embedded Systems** Block diagram of embedded system with hardware components. Harvard and Von-Neumann architecture. RISC and CISC processors. Characteristics of embedded system: Processor, power, memory, operating system, reliability, performance, power consumption, NRE cost, unit cost, size, flexibility, time-to-prototype, time-to-market, maintainability, correctness and safety. Classification of Embedded System: Small scale, medium scale, sophisticated, stand-alone, reactive/real time (soft and hard real time). Features of PIC, AVR and ARM microcontrollers with their applications.	9
2	**Programming using Embedded C** Data transfer, arithmetic and logical operations, decision control & looping. Timer/Counter, Serial communication and Interrupt control programming with embedded C for microcontroller.	6
3	**Communication standards** Modes of data communication: Simplex, duplex, half duplex, serial, parallel, synchronous and asynchronous communication. Serial communication standards: RS232. MAX232 bidirectional level converter.	5
4	**Communication protocols** Serial communication protocol: I²C, CAN, USB, Serial Peripheral Interface (SPI), Synchronous Serial Protocol (SSP). Parallel Communication Protocol: PCI, PCI-X. Overview of advanced serial protocol: IrDA, Bluetooth, Zigbee.	6

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5	**Interfacing Input and Output Devices** Programming and Interfacing of switches, keys, push-button, and sensors. Programming and interfa5cing of 7 segment LED, relay programming, interfacing of matrix keyboard and LCD. Programming and Interfacing of stepper motor, DC motor and 8-bit ADC/DAC	7
6	**Real Time Operating Systems** Operating System: General and real time operating system. Characteristics of Real time operating system: Consistency, reliability, scalability, performance, predictability. Functions of RTOS: Task management, scheduling, resource allocation and interrupt handling. Features of RTOS: Watchdog timer, semaphore, deadlock	6

List of Experiments

Expt. No.	Title of Experiment
1	Execute the C program to perform arithmetic operations on 8-bit data: addition, subtraction, multiplication, and division for microcontroller
2	Execute the C program to perform transfer of data from source to destination internal data memory location
3	Execute the C program to turn on LED with respect to Switches connected to port pins of 8051
4	Execute the C program to display numbers 0 to 9 on 7-segment display with some delay.
5	Interface 16 x 2 LCD to 8051, Execute embedded C language program to display string on it
6	Interface a 4 x 4 matrix keyboard and 7-segment display to 8051. Execute C language program to read and display key code on 7- segment display.
7	Interface 8-bit ADC to 8051. Execute C language program to read data of ADC and store the converted digital data in memory.
8	Interface 8-bit DAC to 8051. Execute C language program to generate square, saw tooth and triangular waveforms.
9	Interface stepper motor to 8051. Execute C language program to rotate stepper motor with different speed in clockwise and counter clockwise direction
10	Generate the triangular waveform using DAC and observe the status of control signals using IDE tool (Micro ProC, Keil)

All experiments should be performed from the above list.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year
1.	Embedded System - Architecture Programming and Design	P.Raj Kamal	McGraw Hill Education	Third	2017
2.	Introduction to Embedded Systems	Shibu. K.V		Second	2017
3.	Fundamentals of Embedded Software	Daniel W Lewis	PHI	First	2013

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1.	Embedded System Design: A Unified Hardware/Software Introduction	Frank Vahid and Tony 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

Professional Elective, Track IV: E Mobility			
Class			T.Y. B. Tech. Semester - VI
Course Code and Course Title			**2EEPE315, Electric Vehicles**
Prerequisite/s			2EEPC210, 2EEPC302
Teaching Scheme: Lecture/Tutorial/Practical			03/00/02
Credits			04
Evaluation Scheme	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE / ESE**	50/50

Course Outcomes (COs): After successful completion of this course, the student will be able to,	
2EEPE315_1	**Identify** the difference between conventional and electric vehicle operation
2EEPE315_2	**Select** proper propulsion motor for EV by understanding the power train requirement
2EEPE315_3	**Choose** the type and size of battery & ultra-capacitor for EV
2EEPE315_4	**Describe** the operation and design aspects of fuel cell and hybrid electric vehicle
2EEPE315_5	**Perform** tests on 2W, 3W & 4W electric drive trains and batteries
2EEPE315_6	**Develop** EV battery packs by series parallel arrangement of cells and spot welding

Unit	**Course Contents**	**Hours**
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	7
2	**Propulsion systems** IC Engine: Spark ignited IC engines- operating principle, operating parameters, Electrical Drives: DC motor drives - principle of operation and performance, chopper control of DC motor drives, Induction motor drive- Basic operating principle, Volt/hertz control, BLDC motor drive- basic principle, control of BLDC drive, SRM drive- SRM drive controller, PMSM drive controller	7
3	**EV and HEV configurations** 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.	6
4	**Control of hybrid drive train** Drive train configuration - speed-coupling analysis, drive train configuration, drive train control methodology - control system, engine speed control approach, traction torque control approach, drive train control strategies, engine speed control strategy, traction torque control strategy, regenerative braking control, drive train parameters design	7

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5	**Electric Energy Storage Systems** Energy Storage Requirements for Electrified Vehicles, Electrochemical Cells and types, Ultracapacitor Cells, Characteristic Terminology and Performance Parameters, Packs and Management Systems	6
6	**Fundamentals of Chargers** Charger Classification and Standards, Charger Requirements, Topology Selection for Level 1& level 2 AC Chargers and Level 3 DC Chargers, Wireless Chargers, Range extended EVs, Solar Electric Vehicle, Electric Bicycle	6

List of Experiments

Expt. No	Title of the Experiment
1.	Drawing of wiring harness diagram of high voltage and low voltage circuits in 2 wheeler and identify their components and specifications.
2.	Power and speed measurement of 2 wheeler electric vehicle power train
3.	Speed and power measurement of BLDC and IM electric vehicle power train.
4.	Data analysis of 4W Induction motor drive at different vehicle speed conditions
5.	Data analysis of BMS for Li-I prismatic cells using CAN
6.	Li-I battery status and performance monitoring under different load conditions using CAN
7.	Analysis of charging, discharging and cell balancing in cylindrical Li-I cells
8.	Design of battery pack using LFP cells, spot-welding machine and verify with BMS
9.	Design of battery pack using NMC cells, spot-welding machine and verify with BMS
10.	Study of V2G concept and the solar PV integration
11.	Study of combined operation of engine and motor under hybrid mode in HEV
12.	Study of level 2 AC charging unit

Minimum **ten** experiments should be performed from the above list.

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	2009
2	Advanced Electric Drive Vehicles	Ali Emadi	CRC Press	First	2015
3	Electric and Hybrid Vehicles	Iqbal Husain	CRC Press	Second	2011
4	Electric Vehicle Technology Explained	James Larminie, John Lowry	Wiley	First	2016

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Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Modern Electric Vehicle Technology,	C.C Chan, K.T Chau	Oxford University Press Inc., NY	First	2001
2	Electrochemical Power Sources: Primary & Secondary Batteries	M. Barak (Ed.), T. Dickinson, U. Falk, J.L. Sudworth, H.R. Thirsk, F.L. Tye	IEE Energy Series 1, A. Wheaton &Co, Exeter	First	1980
3	Switched Reluctance motor drives	R.Krishnan	CRC press	First	2001
4	Brushless magnet and Reluctance motor drives	T.J.E. Miller	Claredon press, London	First	1989

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An Autonomous Institute

Department of Electrical Engineering

Minor Course – III, Track – I: Electric Vehicle		
Class		T.Y. B. Tech. Semester - VI
Course Code and Course Title		**2EEEV316, Electric Drives and Controllers for Electric Vehicles**
Prerequisite/s		2EEEV213
Teaching Scheme: Lecture/Tutorial/Practical		03/00/00
Credits		03
Evaluation Scheme:	**ISE / MSE/ ESE**	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEEV316_1	**Apply** knowledge of electric drive systems and their components, including the selection process and fundamental torque equations, to analyse and determine suitable drive solutions.
2EEEV316_2	**Elucidate** the modes of operation and closed loop control of an electric drive systems.
2EEEV316_3	**Analyse** vehicle performance under different conditions, considering factors such as acceleration, road gradients, and velocity profiles.
2EEEV316_4	**Evaluate** the impact of drivetrain design choices on vehicle velocity, acceleration, and gradability.
2EEEV316_5	**Analyse** the performance and impact of control schemes for AC/DC motor drives.

Unit	**Course Contents**	**Hours**
1	**Electric Drives System**, parts of electric drives, choice of electric drives, Fundamental torque equation, multi-quadrant operation, Equivalent values of drive parameters, classification and components of load torques, load equalization.	6
2	**Control of Electrical Drives** Mode of operation, drive classifications, Closed loop control of drives-current-limit control, torque control, speed control, speed sensing, current sensing, PLL control, position control.	7
3	**Vehicle mechanics** Roadway fundamentals, laws of motion, vehicle kinetics, dynamics of vehicle motion, propulsion power, force-velocity characteristics, maximum gradability, velocity and acceleration, constant FTR, level road, velocity profile, distance traversed, tractive power, energy required, nonconstant FTR, general acceleration, propulsion system design	6
4	**Design of electric vehicle drivetrain** EV transmission configurations, transmission components, gears, automobile differential, clutch, brakes, ideal gearbox: steady state model, gear ratio (GR), torque-speed characteristics, EV motor sizing, initial acceleration, rated vehicle velocity, maximum velocity, maximum gradability **Design of an HEV**	6

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	Hybrid drivetrains, sizing of components, rated vehicle velocity, initial acceleration, maximum velocity, maximum gradability	
5	**EV Motors Drive Topologies -1:** DC Motor Control - Single phase uncontrolled rectifiers, half and fully controlled rectifiers, chopper control, open and closed loop control. Current Loop Control, Speed Control Loop. Four quadrant operation. Basic principles of BLDC Motor, motor construction, Types of BLDC motors, DC Motor dynamics, Characteristic Curves; BLDC Motor Control: Trapezoidal back EMF BLDC motor control, sensored control.	7
6	**EV Motors Drive Topologies -2:** AC Motors control: Induction motor control- constructional details and Characteristic Curves; Variable-Voltage Variable-Frequency Control (VVVF), Field-Oriented Control (FOC), Direct Torque Control (DTC); Field Weakening Control. PM Synchronous Motor Control: Field-Oriented Control of PMSM, Flux-Weakening Control of PMSM, Position Sensor less Control of PMSM	7

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Electric and Hybrid Vehicles: Design Fundamentals	Iqbal Husain	CRC Press	3rd	2021
2	Electric and Hybrid Electric Vehicles	James D. Halderman, Curt Ward	Pearson	1st	2023
3	Electric Vehicle Technology Explained	James Larminie John Lowry	John Wiley & Sons,Ltd	2nd	2012
4	Electric and Hybrid Vehicles	A. K. Babu	CRC PRess	2nd	2022

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles	JG Hayes G. Abas Goodarzi	Wiley	1st	2018
2	Emerging Power Converters for Renewable Energy and Electric Vehicles	Md. Rabiul Islam, Md. Rakibuzzaman Shah, Md. Hasan Ali	CRC Press	1st	2021
3	Electric and Hybrid Vehicles	Tom Denton, Hayley Pells	Institute of the Motor Industry	3rd	2024

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Department of Electrical Engineering

Minor Course – III, Track – II : Control Engineering	
Class	T.Y. B. Tech. Semester - VI
Course Code and Course Title	**2EECE317, Process Control Engineering**
Prerequisite/s	---
Teaching Scheme: Lecture/Tutorial/Practical	03/00 /00
Credits	03
Evaluation Scheme: ISE/MSE/ESE	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EECE317_1	**Illustrate** the concept of fundamental control system and the process control
2EECE317_2	**Develop** the controller for the process control by inferring the knowledge of different control modes
2EECE317_3	**Apply** various tuning methods to determine the controller parameters
2EECE317_4	**Explain** the principles and characteristics of pneumatic, hydraulic & electrical actuators and control valves
2EECE317_5	**Apply** the knowledge of control system to construct the multi-loop control schemes for process control

Unit	Course Contents	Hours
1	**Introduction to control systems** Basic Terminologies: Control variable and manipulated variable, measured variable, plants, process, systems, disturbances, feedback control, close-loop control system and open-loop control system, transfer function, standard test signals: step signal, impulse signal, ramp signal, parabolic signal, sinusoidal signal, types of input and steady-state error, basic control action: on-off control.	6
2	**Concept of process control** Process Control Principle: Human aided control & automatic control, process-control block diagram, control system evaluation: stability, steady-state regulation, transient regulation, evaluation criteria, process characteristics: process equation, process load, process lag & self-regulation, control system parameters - error, variable range, control parameter range, control lag, dead time, cycling.	6
3	**Modes of control and controllers** Discontinuous controller modes: two position, multi-position, floating control modes; continuous controller modes: proportional, integral, derivative; composite controller modes: PI, PD, PID; electronic controllers: design of discontinuous, continuous and composite controller modes. Pneumatic controllers (displacement type).	7
4	**Controller tuning** One-quarter decay ratio criteria, time integral performance criteria, process loop tuning: open-loop transient response method, Ziegler-Nichol's method, cohen-coon method, direct synthesis method.	7

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5	**Final control elements** Pneumatic actuators: spring actuator, hydraulic actuators: piston actuator, electrical actuators: solenoid, electro-pneumatic actuators, control valves: types of control valves and its characteristics, sliding-stem control valves, rotating-shaft control valves, selection of control valves, control-valve sizing, and pneumatic valve positioner.	7
6	**Multi loop control schemes** Cascade control, ratio control, feed forward control, over-ride, split range, case study on distillation column: principle control scheme- constant top product, constant bottom product and reflex rate, constant reflex rate and steam rate.	6

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Process Control Instrumentation Technology	Curtis D. Johnson	Pearson Education, New Delhi	7th	2002
2	Modern Control Engineering	Katsuhiko Ogata	Pearson Education, Inc.	5th	2015
3	Process Control: Modeling, Design, and Simulation	B. Wayne Bequette	Prentice Hall PTR	---	2002
4	Process Control	K. Krishnaswamy	New Age International	2nd	2009

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Process Control	Peter Harriot	TMH (McGraw-Hill)	---	
2	Process Dynamics and Control	Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, Francis J. Doyle III	WILEY	4th	2016
3	Principles of Process Control	Patranabis	TMH	---	1981

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Department of Electrical Engineering

Class	T.Y. B. Tech. Semester – VI
Course Code and Course Title	**2EEEL318, Mini Project**
Prerequisite/s	All courses
Teaching Scheme: Lecture/Tutorial/Practical	00/00 /04
Credits	02
Evaluation Scheme: ISE	50

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEEL318_1	**Implement** electrical engineering concepts and techniques in the building and testing of their project.
2EEEL318_2	**Utilize** engineering tools and laboratory equipment to design, development, and testing of their project.
2EEEL318_3	**Use** of modern tools and integrate industry 4.0 wherever necessary.
2EEEL318_4	**Create** comprehensive report of the project and present their findings effectively through oral presentations.

Course Contents

- A group of students 3 to 4 may take up to design and fabricate a mini project
- Selection of mini project must be based on recent technology, innovative ideas, useful for society, etc.
- The work will involve appropriate literature survey and design calculations. The skill sets like PCB design, hands on fabrication, testing using available instruments and completion level of Mini project will be considered for due weightage.
- Mini project should be a working model based the level of their knowledge, understanding and practices.
- Evaluation of mini project will be through presentation, demonstration and report writing.

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Department of Electrical Engineering

Class			T. Y. B. Tech. Semester-VI
Course Code and Course Title			**2EECC319, Aptitude and Reasoning Part -IV**
Prerequisite/s			2EECC208, 2EECC219, 2EECC309
Teaching Scheme: Lecture/Tutorial/Practical			00/00/02
Credits			02
Evaluation Scheme	**T**	**ISE/MSE/ESE**	00/00/00
	P	**ISE/ESE**	50/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EECC319_1	Solve problem based on basic and advance probability, Permutation and Combination
2EECC319_2	Solve problem based on Syllogism, graphs, data interpretations
2EECC319_3	Solve problem based on gaming round
2EECC319_4	Demonstrate on Resume writing skill, closed, advanced grammar, Synonyms and Antonyms

Unit	Course Contents	Hours
1	**Advance Probability, Advance Permutation, Combination**	04
2	Statement Assumption, Syllogism	04
3	Mixed Bar Graph, Pie Chart Data Interpretation(Avg & Ratio Proportion based)	04
4	Gaming Round OR Capgemini Part 1 Gaming Round OR Capgemini Part 2	04
5	Company Specific Revision for Arithmetic (S.T.D., Time Rate Work) Revision of Calendar Reminder theorem Power Cycle	04
6	Verbal Ability Revision Part 1, Verbal Ability Revision Part 2 Interview Etiquettes & Grooming	04

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	R.S. Agarwal	R.S. Agarwal	S Chand		2019
02	R.S. Agarwal (Verbal & Non-verbal Reasoning)	R.S. Agarwal	S Chand		2010
03	Wren & Martin (Verbal, Grammar)	P.C.Wren	S Chand		2017

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Department of Electrical Engineering

Class			Final Year B. Tech. Semester - VII
Course Code and Course Title			**2EEPC401 - Electrical Drives**
Prerequisite/s			2EEPC210, 2EEPC302, 2EEPC310
Teaching Scheme: Lecture/Tutorial/Practical			03/00 /02
Credits			04
Evaluation Scheme	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE / ESE**	50/50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to,	
2EEPC401_1	**Explain** the principles of electrical drive system, components, types, multi-quadrant dynamics.
2EEPC401_2	**Perform** the controlled converter fed DC motor drives including their respective electrical braking methods.
2EEPC401_3	**Implement** control strategies for special-purpose motor drives in industrial applications
2EEPC401_4	**Distinguish** the operation and control strategies of one quadrant, two quadrant and four quadrant chopper fed DC motor drives
2EEPC401_5	**Investigate** the methods of stator and rotor side speed control in induction motor drives.

Unit	Course contents	Hours
1	**Fundamental of Electrical Drives** Block diagram of electrical drive, Types of electrical drives, Equivalent values of drive parameters, Speed-torque conventions in multi quadrant dynamics: acceleration, deceleration, starting and stopping, classification of load torques and their characteristics, choice of electrical drives, steady state stability.	7
2	**Converter fed DC motor Drives** Classification of electric braking, Single phase half and fully controlled converter fed DC motor, Three phase half and fully controlled converter fed DC motor, Supply harmonics, Power factor and ripples in motor current, Single phase dual converter fed DC drive, Closed loop control of converter fed DC drive.	7
3	**Chopper fed DC motor Drives** Chopper operation and principle, Control strategy, Configurations of chopper fed DC drives (one quadrant, two quadrants and four quadrant choppers), Closed loop control of chopper fed DC drive.	6
4	**Induction Motor Drives** Stator voltage control, Energy efficient drive, V/F control, Field weakening mode, Vector control strategies, AC voltage controller fed induction motor drive, Closed loop control of AC drive, Voltage source inverter fed induction motor drive, Rotor resistance control using power converter, Concept of slip power recovery - Static Kramer drive and Static Scherbius drive.	8
5	**Special Motor Drives** Construction, working and characteristics: Switched reluctance motor drive, Brushless direct current motor drive, Permanent magnet synchronous motor drive, Universal motor drive	5

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6	**Drives for Industrial Application** Battery powered drives for vehicles, Traction drives, Servo motor based motion control in smart agricultural robots, Stepper motors based automated conveyor systems, Challenges in industrial drive –Protection and electromagnetic inference.	6

List of experiments

Expt. No.	Title of Experiment
1	Four quadrant operation of DC electrical drive
2	Modes of operation and braking of DC drive
3	Single phase half-controlled converter fed DC drive
4	Single phase fully controlled converter fed DC drive
5	Three phase half and fully controlled converter fed DC drive
6	Chopper controlled DC series motor drive
7	Chopper controlled DC shunt motor drive
8	Speed control of three phase induction motor drive using V/F method
9	Simulation of single-phase half and fully controlled converters fed DC drives
10	Simulation of three-phase half and fully controlled converters fed DC drives
11	Simulation of one quadrant (Class A & Class B) chopper fed DC drives
12	Simulation of VSI fed induction motor drive
13	Simulation of three phase slip ring induction motor drive using rotor resistance control
14	Simulation of three phase slip ring induction motor drive using slip power recovery model

Minimum **ten** experiments should be performed from the above list.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fundamentals of electrical drives	G K Dubey	CRC Press	Second	2017
02	Electrical drives	NK De, PK Sen	PHI Delhi	Third	2011
03	Electrical drives concepts and applications	Vedam Subrahmanyam	McGraw- Hill	Second	2016

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Power Electronics: Converters, Applications and design	Ned Mohan	Wiley Publication	Third	2009
02	Power electronics & Variable frequency drives technology and applications	Dr.B.K. Bose	Wiley Publication	First	2022
03	Power Electronic Design: A Practitioners Guide	Keith H.Sueker	Elsevier Publication	First	2022

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Department of Electrical Engineering

Minor Course – IV, Track I: Electric Vehicle			
Class			Final Year B. Tech. Semester-VII
Course Code and Course Title			**2EEEV402, Plug in Electric Vehicles in Smart grid**
Prerequisite/s			2EEPE315, 2EEEV304, 2EEEV316
Teaching Scheme: Lecture/Tutorial/Practical			03/00/00
Credits			03
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEEV402_1	**Explain** the architecture of Plug-in Electric Vehicle, charging infrastructure and grid issues
2EEEV402_2	**Analyze** the operation and challenges of conductive chargers and wireless chargers
2EEEV402_3	**Categorize** the possibilities from EVs for frequency and voltage support in grid
2EEEV402_4	**Correlate** the integration of EV and smart grid with distributed energy resources.
2EEEV402_5	**Apply** the concepts of centralized and decentralized charging schemes.

Syllabus

Unit	Contents	Hours
1	**Plug-In Electric Vehicle Technologies** PEV Technologies, PEV Systems, impacts in distribution power network, Technical Issues in EV battery and charging, Smart Charging Infrastructure, Integration of PEVs to Electric Grid, Types of Incentives	7
2	**Integrated Battery Chargers for Electric Vehicles** Introduction, Classifications of chargers, Integrated charging system, Assessment of existing integrated charging circuits, Working of integrated converter, Design of the battery-charging converter, Control strategy and result analysis, Power Quality control for battery charger	6
3	**Wireless Chargers for Electric Vehicles** Introduction, Inductive wireless power transfer, Modelling of coils, types of coils, Compensation networks, Power transfer and efficiency, Standards of wireless power charging	6
4	**Smart Grid Using PEV's** The Smart Grid and Microgrid, Impact of PEVs on Distributed Energy Resources in the Smart Grid, V2G Technology and PEVs Charging Infrastructures, Impact of Estimated EVs on Electrical Network, Standardization & Plug-and-Play	7
5	**Distributed Energy Resource With PEV** Introduction, Distributed Energy Sources in smart grid: Solar, Wind, Fuel Cells, Electric vehicles, Backup Power Supplies, MPPT Strategies for PV Based Microgrids, Microgrid Topologies	7

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6	**EV Charging Facility Planning** Energy generation scheduling, different power sources, fluctuant electricity, centralized charging schemes, decentralized charging schemes, energy storage integration into Microgrid, Design of V2G Aggregator	6

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Plug In Electric Vehicles in Smart Grids, Integration Techniques	Sumedha Rajakaruna Farhad Shahnia Arindam Ghosh	Springer	First	2015
2	Plug In Electric Vehicles in Smart Grids, Energy Management	Sumedha Rajakaruna Farhad Shahnia Arindam Ghosh	Springer	First	2015
3	Vehicle-to-Grid: Linking Electric Vehicles to the Smart Grid	Junwei Lu and Jahangir Hossain	The IET	First	2015
4	Electric Vehicle Components and Charging Technologies	Sanjeev Singh, Sanjay Gairola and Sanjeet Dwivedi	The IET	First	2023

Reference Books

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles,	M. Ehsani, Y. Gao, S. Longo, K. Ebrahim,	CRC Press	Third	2018
2	Electric and Hybrid Vehicles: Design Fundamentals	Husain	CRC Press	Second	2010
3	Intelligent Control of Connected Plug-in Hybrid Electric Vehicles	Amir Taghavipour Mahyar Vajedi Nasser L. Azad	Springer	First	2019
4	Technologies and Applications for Smart Charging of Electric and Plug-in Hybrid Vehicles	Ottorino Veneri	Springer	First	2017

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Minor Course – IV, Track II: Control Engineering		
Class		Final year B. Tech. Semester – VII
Course Code and Course Title		**2EECE403, Industrial Automation**
Prerequisite/s		2EECE214, 2EECE305, 2EECE317
Teaching Scheme: Lecture/Tutorial/Practical		03/00/00
Credits		03
Evaluation Scheme	**ISE/MSE/ESE**	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EECE403_1	**Explain** the evolution, necessity, and architecture of industrial automation.
2EECE403_2	**Illustrate** the architecture and functional modes of PLCs with basic programming structures.
2EECE403_3	**Configure** PLC systems with electrical control panels for advanced industrial automation.
2EECE403_4	**Analyze** the use of PLC programming techniques for industrial processes.
2EECE403_5	**Apply** SCADA system features for Industrial automation.

Unit	Contents	Hours
1	**Introduction to Industrial Automation** Definition of Industrial Process, Meaning of Automation and Control, Necessity and Evolution of Automation, Architecture of Industrial Automation Network, Types of Automation Systems, Process Automation with Smart and Intelligent Instruments, Industry 1.0 to Industry 5.0.	6
2	**Fundamentals of Programmable Logic Controller (PLC)** PLCs: Invention, Definition, Architecture of PLC, Classifications, Sustainability and its Features, Role of PLC in Process Automation, Input output modules and Its Devices, Major PLC Vendors and their Products, PLC installation, Trouble shooting and maintenance.	6
3	**PLC Programming** Analog and digital Input output signals, Variables and Data Types, Register, Timer, Counter, Arithmetic Function, Advanced PLC Functions, Data Handling Functions, PID Control with PLC, Logic Development using ladder diagram for industrial applications, Case study.	8
4	**Electrical Control Panel** Electrical control panel drawing and its types, Components used in electrical panels, Panel testing, Cold and hot testing, Trouble shooting and maintenance, Project life cycle, Examples of industrial processes with PLC.	6
5	**Supervisory Control and Data Acquisition System** Definitions and history of Supervisory Control and Data Acquisition, Typical SCADA system Architecture, Communication requirements, Desirable	7

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	Properties of SCADA system, Features, Advantages and disadvantages, Applications of SCADA, Open systems interconnection model.	
6	**Elements of SCADA** Master Terminal Unit, Remote Terminal Unit – Topology, Requisites, Hardware and Functionality, Software Functions, Operation, Field Data Devices and Interfacing, Human Machine Interface, Human Computer Interface, Data Historian, Alarm Handling.	6

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year
1	Industrial Automation Technologies	Chanchal Dey, Sunit Kumar Sen	CRC Press	First	2020
2	Programmable Logic Controllers	W. Bolton	ELSEVIER	Fourth	2006
3	PLCS & SCADA Theory and Practice	Rajesh Mehra, Vikrant Vij	University Science Press	---	2011
4	Industrial Automation Using PLC SCADA & DCS	R.G.Jamka	Global Education Limited	Second	2018

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year
1	Introduction to Industrial Automation	Stamatios Manesis	CRC Press	First	2018
2	Programmable Logic Controllers: Principles and Applications	John W. Webb, Ronald A. Reis	Pearson India	Fifth	2015
3	Industrial Automation Handbook	Frank Lamb	McGraw-Hill Education	---	2013

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Department of Electrical Engineering

Professional Elective II, Track I: Power Engineering		
Class		Final Year B. Tech. Semester - VII
Course Code and Course Title		**2EEPE404, Utilization and Conservation of Electrical Energy.**
Prerequisite/s		2EEPC210, 2EEPC212, 2EEPC302, 2EEPC310
Teaching Scheme: Lecture/Tutorial/Practical		03/00/00
Credits		03
Evaluation Scheme	**ISE/MSE/ESE**	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEPE404_1	**Use** principles of illumination to design effective lighting systems.
2EEPE404_2	**Identify** various electric heating and welding methods, their advantages and equipment used in different applications.
2EEPE404_3	**Explain** the working principles, components, and troubleshooting of refrigeration and air conditioning systems.
2EEPE404_4	**Describe** principles of traction systems and train mechanics to analyze and evaluate different motor applications in transportation.
2EEPE404_5	**Develop** the plan for energy audit in specific industry using appropriate methodologies.

Unit	Contents	Hours
1	**Illumination Engineering** Nature of light, Visibility spectrum curve of relative sensitivity of human eye and wave length of light, Terms used in illumination, Laws of illumination, Different type of lamps, types of lighting systems, Design of illumination system, Lighting scheme, Energy efficient lamps	8
2	**Electric Heating** Advantages of Electric Heating, Modes of heat transfer, Classification of electrical heating methods, Resistance heating, Arc furnaces, Induction heating, Dielectric Heating, High Frequency eddy current heating.	6
3	**Electric Welding** Advantages of electric welding, Resistance welding, Arc welding, Power supply of Resistance and arc welding, Electrical welding equipment, Comparison between Resistance and arc welding	5
4	**Refrigeration and Air Conditioning** Refrigeration system –Types of refrigerants Domestic refrigerator, Water coolers, Air conditioning systems, Air conditioning cycle, Classification of air conditioning systems, Central system, Unitary systems, Load estimation, Heating of building.	7

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5	**Electric Traction** Review of existing electric traction systems in India, Advantages of electrical traction, Different systems of electric tractions, Train movement and energy consumption, Types of traction motors, Traction Motor control, Track equipment and collection gear, Mechanics of train movement, Speed-time curves for different services.	7
6	**Electrical Energy Audit** Benefits and procedure for energy audit, Instruments for energy audit, Methodology, Case study.	6

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Utilization Electric power and Electric Traction	J. B. Gupta	S. K. Kataria and Sons	Second	2000
2	Art and Science of Utilisation of Electrical Energy	H. Partab,	Dhanpat Rai and Co. New Delhi	Second	2015
3	A course in electrical power	Soni, Gupta and batnagar	Dhanpat Rai	Ninth	1987
4	Utilization of electrical Energy	Openshaw Taylor	Orient blockswan	First	2006

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
1	Generation, Distribution and Utilization of Electrical Energy	C L Wadhwa	New Age International (P) limited	First	2004
2	Electrical Drives: Concept and applications	Vedam Subrahmanyam	THM	Frist	1999
3	A Text book of electrical Power	Dr. S. L. Uappal	Khanna Publication	Eighth	2017
4	Energy Conservation And Audit	M A Choudhari	Wiley	Frist	2000

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Professional Elective II, Track II: Control Engineering			
Class			Final year B. Tech. Semester - VII
Course Code and Course Title			**2EEPE405, Special Electrical Machines**
Prerequisite/s			2EEPC210, 2EEPC302, 2EEPC310
Teaching Scheme: Lecture/Tutorial/Practical			03/00/00
Credits			03
Evaluation Scheme	**T**	**ISE / MSE / ESE**	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEPE405_1	**Demonstrate** the performance characteristics of special electrical machines
2EEPE405_2	**Analyze** the control strategies and operating modes of special electrical machines
2EEPE405_3	**Investigate** the design considerations of special electrical machines
2EEPE405_4	**Identify** industrial and household applications of special electrical machines
2EEPE405_5	**Apply** recent power electronic control techniques in the field of special electrical machines.

Unit	**Course Contents**	**Hours**
1	**Permanent Magnet Synchronous Machines** Definition and importance, Difference between conventional and special machines, Construction, working principle and types, Industrial and household applications, Mathematical Modelling of PMSM: d-q axis theory, voltage and torque equations, Control Techniques: Vector control, Field-oriented control, Power factor and efficiency optimization.	7
2	**Stepper Motors** Introduction to Stepper Motors, Construction, types, and working principles (Variable reluctance, permanent magnet, hybrid), Operating Modes: Full step, half step, and micro-stepping, Drive Techniques: Open-loop and closed-loop control of stepper motors, Applications.	7
3	**Switched Reluctance Motors** SRM Fundamentals: Construction, operating principles, and rotor position sensing, Performance Characteristics: Torque production, speed-torque curves and efficiency, Control Methods: Voltage control, Current control and torque ripple minimization, Applications.	6
4	**Brushless DC Motors** Introduction to BLDC Motors: Construction, types, Operating Principles: Electronic commutation and performance characteristics Mathematical Modeling and Control: PWM control, Drive circuits for BLDC motors, Applications.	6

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5	**Linear Machines** Linear Induction Machines (LIM): Principle of operation, construction and performance. Linear Synchronous Machines (LSM): Principle of operation, construction, Types and control methods. Design Considerations: Efficiency and power factor improvement Applications: Maglev trains, conveyor systems and elevators	7
6	**Recent Advances and Applications of Special Electrical Machines** Recent Innovations: New materials, advancements in machine design, and control techniques, Smart Applications. Modelling and Simulation: Introduction to simulation tools for analysing special electrical machines	6

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year
1	Electric Machinery	Bimbhra P.S	Khanna Publisher	Seventh	2021
2	Electric machines	Ashfaq Husain	Dhanpatrai and Co.	Third	2024
3	Electric Machinery	A.E Fitzgerald Stephen Kingsly	Tata Mcgraw Hill	Seventh	2014

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year
1	Electric Machines	Kothari D.P Nagrath I.J	THM Publications	Fifth	2017
2	Principles of Electric Machines and Power Electronics	P. C. Sen	Wiley	Third	2013
3	Special Electrical Machines	K. Venkataratnam	Universities Press	First	2008
4	Switched Reluctance Motor Drives: Modeling, Simulation, Analysis, Design, and Applications	R. Krishnan	CRC Press	First	2001

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Professional Elective II, Track III: Embedded Systems			
Class			Final Year B. Tech. Semester - VII
Course Code and Course Title			**2EEPE406, Smart Grid**
Prerequisite/s			2EEPC212, 2EEPC303
Teaching Scheme: Lecture/Tutorial/Practical			03/00/00
Credits			03
Evaluation Scheme:	**T**	**ISE / MSE / ESE**	40/30/30

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEPE406_1	**Discuss** the importance of smart grids, including their need, opportunities, and challenges.
2EEPE406_2	**Explain** smart metering devices to enhance transparency, efficiency, and sustainability in energy consumption through their associated technologies
2EEPE406_3	**Analyze** the impact of smart grid technologies on transmission and distribution systems.
2EEPE406_4	**Utilize** strategies to address the operational, control and protection challenges in microgrid systems
2EEPE406_5	**Apply** power quality management techniques in the smart grid to enhance reliability and ensure compliance with regulatory standards

Unit	Course Contents	Hours
1	**Introduction to Smart Grid** Concept, Definitions & need, Difference between conventional grid and smart grid, Opportunities & challenges in smart grid, National and International Initiatives in Smart Grid.	5
2	**Smart Metering** Introduction to Advanced Metering Infrastructure (AMI), Drivers and benefits, AMI protocols, Standards and initiatives, AMI needs in the smart grid, Real time management and control, Phasor Measurement Unit (PMU).	7
3	**Smart Grid Technologies in Transmission System** Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: Energy Management System, Wide area monitoring, Protection and control.	7
4	**Smart Grid Technologies in Distribution System** Distribution Management System, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Impact of electric vehicles charging on smart grid.	6
5	**Microgrids** Integration of distributed energy sources, Hybrid power system, Microgrid Concept, Layout, Advantages and challenges in Microgrid system,	7

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	Interconnection issues, AC and DC Microgrid, Comparison, Operation, Control and Protection Issues of Microgrid	
6	**Power Quality Management in Smart Grid** Power Quality & Electromagnetic Compatibility in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.	7

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year
1	Smart Grids Advanced Technologies and Solutions	Stuart Borlase	CRC	Second	2018
2	Smart Grid: Technology and Applications	Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, Nick Jenkins	Wiley	First	2012
3	The Advanced Smart Grid: Edge Power Driving Sustainability	Andres Carvallo, John Cooper	Artech House	Second	2015

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Big data analytics in future power systems	Ahmed F. Zobaa, Trevor J. Bihl,	CRC press	First	2018
2	Smart Grid: Fundamentals of Design and Analysis	James Momoh	A John Wiley & Sons, Inc. Publication	First	2012
3	Integration of Green and Renewable Energy in Electric Power Systems	Ali Keyhani, Mohammad N. Marwali, Min Dai	Wiley	--	2009

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Professional Elective II, Track IV: E Mobility			
Class			Final Year B. Tech. Semester - VII
Course Code and Course Title			**2EEPE407, Battery Management System**
Prerequisite/s			2EEPE315
Teaching Scheme: Lecture/Tutorial/Practical			03/00/00
Credits			03
Evaluation Scheme	T	**ISE/MSE/ESE**	40/30/30

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEPE407_1	**Explain** the constructional aspects of electric vehicle batteries.
2EEPE407_2	**Describe** the battery characteristics and operating parameters relevant to electric vehicle and battery modelling for simulation studies.
2EEPE407_3	**Identify** the suitable battery management system for a particular electric vehicle battery pack.
2EEPE407_4	**Design** electric vehicle chargers and provide report on charging infrastructures.
2EEPE407_5	**Analyze** the suitable second use applications of electric vehicle battery and recycling methods.

Unit	**Contents**	**Hours**
1	**Electric Vehicle Batteries** Lead Acid Batteries, Special characteristics of lead acid batteries, Battery life and maintenance, Battery charging, Nickel-based Batteries, Nickel cadmium, Nickel metal hydride batteries, Sodium-based Batteries, Sodium sulphur batteries, Sodium metal chloride (Zebra) batteries, Lithium Batteries, The lithium polymer battery, The lithium-ion battery, Metal Air Batteries, The aluminium air battery, The zinc air battery	7
2	**Battery Characteristics and Parameters** Battery Specifications: Variables to characterize battery operating conditions and Specifications to characterize battery nominal and maximum characteristics; Efficiency of batteries, Electrical parameters- Heat generation- Battery design, Performance criteria for Electric vehicles batteries- Vehicle propulsion factors, Power and energy requirements of batteries- Meeting battery performance criteria, setting new targets for battery performance	6
3	**Battery Modelling** General approach to modelling batteries, simulation model of a rechargeable Li-ion battery, simulation model of a rechargeable NiCd battery, Parameterization of the NiCd battery model, Simulation examples.	6
4	**Battery Pack and Battery Management System** Selection of battery for EVs & HEVs, Traction Battery Pack design, Requirement of Battery Monitoring, Battery State of Charge Estimation methods, Battery Cell equalization problem, thermal control, protection interface, SOC Estimation, Energy & Power estimation, Battery thermal	7

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	management system, Battery Management System: Definition, Parts: Power Module, Battery Standards & Tests.	
5	**Electric Vehicle Charging** **Battery Chargers:** Charge equalization, Conductive (Basic charger circuits, Microprocessor based charger circuit. Arrangement of an off-board conductive charger, Standard power levels of conductive chargers, Inductive charging, Battery indication methods **Charging Infrastructure:** Domestic Charging Infrastructure, Public Charging Infrastructure, Normal Charging Station, Occasional Charging Station, Fast Charging Station, Battery Swapping Station, Move-and-charge zone.	7
6	**Battery Recycling** Battery testing, limitations for transport and storage of cells and batteries, Recycling, disposal and second use of batteries. Explosions: Causes of battery explosions, explosive process, Thermal Runway: High discharge rates, Short circuits, charging and discharging. Environment and Human Health impact assessments of batteries, General recycling issues and drivers, methods of recycling of EV batteries.	6

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year
1	Electric and Hybrid Vehicles: Design Fundamentals	Iqbal Hussein	CRC Press	2nd	2003.
2	Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design	Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi	CRC Press	1st	2004
3	Electric Vehicle Technology Explained	James Larminie, John Lowry	Wiley	1st	2003
4	Used Battery Collection and Recycling	G. Pistoia, J.P. Wiaux, S.P. Wolsky	Elsevier	1st	2001

Reference Books:

Sr. No.	Title	Author	Publisher	Edition	Year
1	Reuse and Recycling of Lithium-Ion Power Batteries	Guangjin Zhao	John Wiley & Sons	4th	2017
2	Battery Reference Book	T R Crompton	Newnes- Reed Educational	3rd	2018
3	Thermal Management of Electric Vehicle Battery Systems	Ibrahim Dinçer, Halil S. Hamut i	JohnWiley& Sons	3rd	2016
4	Recycling of Lithium-Ion Batteries: The LithoRec Way	Arno Kwade, Jan Diekmann	Springer	2nd	2018

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Annasaheb Dange College of Engineering and Technology, Ashta

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Department of Electrical Engineering

Class			Final Year B. Tech. Semester - VII
Course Code and Course Title			**2EEPC408, Industrial Automation & SCADA**
Prerequisite/s			2EEPC204
Teaching Scheme: Lecture/Tutorial/Practical			3/0/2
Credits			4
Evaluation Scheme	**T**	**ISE/MSE/ESE**	40/30/30
	P	**ISE/ESE**	50/0

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEPC408_1	**Utilize** the SCADA system's features to monitor and control industrial processes effectively.
2EEPC408_2	**Configure** PLC systems with electrical control panels for advanced industrial automation solutions.
2EEPC408_3	**Demonstrate** DCS architectures, explaining their functionalities and assessing redundancy concepts.
2EEPC408_4	**Analyze** the principles and evolution of automation technologies to differentiate various industrial processes and automation methods.
2EEPC408_5	**Evaluate** PLC architectures and programming techniques for effective control system design and implementation.

Unit	Contents	Hours
1	**Fundamentals of Automation** Fundamentals of industrial automation, Definition and Goals of Automation, Need and role of automation, Evolution of automation, Types of processes, Types of Automation, Industry 1.0 to Industry 5.0.	5
2	**Programmable Logic Controller** Definition, overview of PLC systems, General PLC programming procedures, Programming on-off outputs, Basic PLC functions, Register basics, Timer functions, Counter functions, Arithmetic functions, PLC Advanced functions, PID functions, Alternate programming languages.	7
3	**Electrical Control Panel** Electrical control panel drawing and its types, Components used in electrical panels, Panel testing, Cold and hot testing, PLC installation, Trouble shooting and maintenance, Project life cycle, Examples of industrial processes with PLC.	7
4	**Supervisory Control and Data Acquisition systems** Definitions and history of Supervisory Control and Data Acquisition, Typical SCADA system Architecture, Communication requirements, Desirable Properties of SCADA system, Features, Advantages and disadvantages, Applications of SCADA. Open systems interconnection model, TCP/IP protocol, DNP3 protocol, Control and Information Protocol.	6

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5	**Distributed Control Systems** Introduction of DCS, Different architectures, Building blocks, Detailed descriptions and functions of local control units, Basic elements & functions, Operator stations, Data highways, Redundancy concepts, Logic development for different applications using functional block diagram.	7
6	**Communication Facilities and Applications** DCS communication Facilities, Communication system requirements, Architectural issues, Protocol issues, Communication system standards, Operator interfaces, Low level and high-level operator interfaces, Operator Displays, Engineering interfaces, Applications of DCS, Case Study.	7

LIST OF EXPERIMENTS

Expt. No	Title of the Experiment
1.	Input and Output modules for PLC.
2.	Ladder diagram for basic and universal logic gates.
3.	Ladder diagram for different arithmetic operations.
4.	Ladder diagram for timing and counting applications.
5.	Ladder diagram for industrial process and control.
6.	Human Machine Interfacing with PLC.
7.	Configuring Screens, Graphics and Creating a Project and tags in SCADA.
8.	Simulation and Configuration of Redundant Controllers with Non-Redundant and Redundant Input Output Buses for AI, DI, AO, and DO Modules.
9.	Create analog tags in logic configuration for industrial process and control.
10.	Create digital tags in logic configuration for industrial process and control.
11.	Design and Simulation of Process Mimic with Alarms, Reports, and Trends in SCADA.
12.	Control Logic Configuration for Manual and Auto Operation with Push Buttons, Counter Display, and Upper/Lower Limits

Minimum **ten** experiments should be performed from the above list.

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year**
1	Programmable Logic Controllers: Principles and Applications	John W. Webb, Ronald A. Reis	Prentice Hall	Fifth	2007
2	Programmable Logic Controllers: programming methods and applications.	John R. Hackworth	Pearson India	First	2008
3	SCADA: Supervisory Control and Data Acquisition	Stuart A. Boyer	ISA , International Society of Automation	First	2020
4	Distributed Control Systems: Principles and Applications	G. J. Hwang	Springer	First	2022

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Programmable Controllers	Batten G L	McGraw Hill	Second	1989
2	Practical Modern SCADA Protocols	Gordan Clark	Elsevier	First	2004
3	SCADA Systems: Fundamentals and Applications	S. A. Shaikh, A. G. Khanna	PHI Learning	First	2023
4	Distributed Control Systems: A Practical Approach to DCS Design and Applications	S. V. L. Narasimham	Springer	First	2023

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Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2EEHS409, Project Management and Finance**
Prerequisite	NIL
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00
Credits	02
Evaluation Scheme : ISE/MSE/ESE	40 / 30 / 30

Course Objectives:

1. To equip students with an understanding of the significance of economics and its related policies.
2. To empower students to manage professional tasks through knowledge of relevant procedures.
3. To inculcate an understanding of the importance of economics in the context of management.

Course Outcomes (CO's): After successful completion of this course, the student will be able to,

CO 1	Apply project management principles to initiate, plan, execute, monitor, and control projects.
CO 2	Analyze project feasibility considering technical, economic, and financial aspects.
CO 3	Estimate project costs, schedule tasks, and allocate resources effectively.
CO 4	Identify and mitigate project risks using appropriate techniques.
CO 5	Apply financial principles to project budgeting, cash flow management, and investment appraisal.
CO 6	Effectively communicate project plans, progress, and results to stakeholders.

Course Contents:

Unit 1	**Project Fundamentals**	**04**
Definition and characteristics of a project, Project life cycle and its phases, Project management methodologies (e.g., Agile, Waterfall, Scrum), Stakeholder analysis and management, Introduction to Project Management Professional (PMP) framework		
Unit 2	**Project Planning & Scheduling**	**04**
Work Breakdown Structure (WBS) development, Activity definition and sequencing, Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT), Resource allocation and leveling, Project scheduling tools (e.g., Gantt charts, MS Project)		
Unit 3	**Project Cost & Risk Management**	**05**

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Cost estimation techniques (e.g., Parametric, Analogous, Bottom-up), Cost budgeting and control, Earned Value Management (EVM), Cost-benefit analysis and return on investment (ROI), Risk identification and assessment, Qualitative and quantitative risk analysis technique, Risk response planning (mitigation, avoidance, transference, acceptance), Contingency planning and reserves		
Unit 4	**Project Execution and Control**	**04**
Activity Planning, Team Building and Management, Stakeholder Engagement, Project Monitoring & Control Performance Measurement, Change Management, Issue Resolution, Quality Management : Quality Planning, Quality Assurance, Continuous Improvement, Project Challenges and Solutions		
Unit 5	**Project Communication & Finance**	**04**
Communication planning and channels, Stakeholder communication strategies, Report writing and presentations, Conflict resolution and negotiation, Time value of money concepts, Capital budgeting techniques (e.g., NPV, IRR, Payback period), Sources of project finance (e.g., loans, equity, grants), Financial statement analysis for project evaluation		
Unit 6	**Project Closure & Review**	**05**
Project completion and handover, Project closure procedures, Post-project evaluation and lessons learned Project audits and reviews, Professional ethics and responsibilities in project management		

Text Books:

Sl.No	Title	Authors	Publisher	Edition	Year
1	A Guide to the Project Management Body of Knowledg	-	Project Management Institute (PMI)	7th	2021
2	Project Management: The Managerial Process	Erik W. Larson & Clifford F. Gray	McGraw Hill	6th	2017
3	Project Finance: In Theory and Practice	Stefano Gatt	Academic Press	-	2007

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Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2EEEL410,Project Work**
Prerequisite	NIL
Teaching Scheme: Lecture/Tutorial/Practical	0/00/08
Credits	04
Evaluation Scheme : ISE/ESE	50/50

Course Objectives:

1. To define and plan a major engineering project.
2. To apply fundamental engineering principles to solve complex problems.
3. To conduct research, analyze data, and interpret results.
4. To develop and implement a project plan effectively.
5. To effectively communicate project goals, methodology, and outcomes through written and oral presentations.
6. To Demonstrate critical thinking, problem-solving, and design skills.
7. To gain experience in working independently and as part of a team.

Course Outcomes (CO's): After successful completion of this course, the student will be able to,

CO 1	Define and plan a major engineering project, considering feasibility, resources, and ethical implications.
CO 2	Apply fundamental engineering principles and relevant theories to solve complex engineering problems within the project scope.
CO 3	Conduct thorough research, analyze data effectively, and interpret results to inform project decisions and optimize solutions.
CO 4	Develop and implement a comprehensive project plan, including timelines, budgets, risk management strategies, and quality control measures.
CO 5	Communicate project goals, methodology, and outcomes effectively through written reports, presentations, and technical documentation.
CO 6	Demonstrate critical thinking, problem-solving, and design skills throughout all phases of the project, adapting to challenges and making informed decisions.
CO 7	Gain practical experience in working independently and collaboratively within a team environment, fostering effective communication and teamwork.

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General Guidelines:

1. **Project Scope:** The major project will involve the development and execution of a significant engineering undertaking. This may encompass a wide range of activities, including:
   - **Design Projects:** Creating novel solutions to engineering problems, such as designing new devices, systems, or processes.
   - **Experimental Studies:** Conducting research through experimentation, collecting and analyzing data, and drawing conclusions.
   - **Computer Simulations:** Utilizing computational models and simulations to investigate and analyze engineering phenomena.

   All projects must focus on topics relevant to the specific Department's specialization, ensuring a strong connection to the core curriculum and industry practices.

2. **Project Components:** The successful completion of the major project necessitates the integration of several critical components:
   - **Problem Identification & Definition:** Clearly identifying and defining an engineering problem or challenge within the project scope.
   - **Literature Review:** Conducting thorough research on existing knowledge, methodologies, and best practices related to the project.
   - **Problem Formulation:** Translating the identified problem into a well-defined set of engineering objectives and constraints.
   - **Design & Development:** Designing, developing, and implementing solutions, which may include:
     - Conceptual design and ideation
     - Detailed design and prototyping
     - System integration and testing
   - **Utilization of Modern Tools & Techniques:** Employing relevant and contemporary engineering tools and techniques throughout the project, such as:
     - Computer-Aided Design (CAD) software
     - Simulation and analysis software (e.g., FEA, CFD)
     - Data acquisition and analysis tools
     - Project management software
3. **Project Synopsis Submission**: Students are required to submit a project synopsis outlining the proposed major project. This synopsis must include the following:
   - **Project Scope:** A clear and concise description of the project, including its objectives, boundaries, and relevance to the chosen area of specialization.
   - **Project Objectives:** Specific, measurable, achievable, relevant, and time-bound (SMART) objectives that the project aims to achieve.
   - **Methodology:** A detailed description of the project approach, including:
     - Research methodology (e.g., literature review, experimental design, simulation methods)
     - Design and development process (if applicable)

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- Data collection and analysis methods
- **Resources & Tools:** A list of anticipated resources, including:
  - Software (e.g., CAD, simulation, data analysis)
  - Equipment and materials
  - Access to facilities (e.g., laboratories, workshops)
- **Expected Results:** A clear statement of the anticipated outcomes of the project, including:
  - Measurable results (e.g., performance data, design specifications, research findings)
  - Potential impact and contributions
- **Project Timeline:** A realistic and detailed project schedule, including key milestones and deadlines for completion.

The project synopsis submission serves as a crucial step in the project planning process, ensuring that students have a well-defined plan before commencing their work.

4. **Project Duration**: The project work is structured to be completed over four semesters (6 - 7), with the same group continuing to work under the guidance of the assigned project guide throughout this period.

5. **Group Formation**: Students will typically work in groups of 2 to 4 members to complete the major project. The maximum group size is strictly limited to 4 members.

6. **Assessment**

- **Project Synopsis & Progress Presentations:** The project synopsis and progress presentations will be evaluated using established rubrics.
- **Project Diary & Report** - The project diary, meticulously maintained throughout the project duration, will be a crucial component of the overall assessment.The final project report will be assessed during the End-Semester Examination (ESE).
- **Project Presentations** - Students will make three presentations before the project evaluation committee. These presentations will be collectively assessed.

In Semester Evaluation	
Particulars	**Marks**
Synopsys Presentation	10
Progress Presentation-I	10
Progress Presentation-II	15
Progress Presentation-III	15
End Semester Examinations	
Project Work Report	25
Viva-Voce Examination	25

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7. Submission Requirements

➔ **Project Work Diary**

- **Maintenance:** Meticulously maintained by the group throughout the project duration.
- **Entries:** Reflects daily or weekly efforts, including project selection, literature review, experimental work, data analysis, and any other relevant activities.
- **Countersignature**: Weekly countersigned by the assigned project guide.

➔ **Project Synopsis:**

- ★ Format: Submitted in the prescribed format, including:
  - Project Title
  - Student Names & URNNumbers
  - Guide's Name & Department
  - Project Relevance & Significance
  - Comprehensive Literature Review (minimum 10 peer-reviewed journal articles)
  - Proposed Work: Objectives, Methodology, and Approach
  - Expected Outcomes
  - Detailed Budget Estimate
  - References (in the specified format)
- ★ Approval:
  - Signed by each group member.
  - Approved by the project guide.
  - Endorsed by the Head of the Department.

➔ **Project Report:**

- Format:
  - Typed report of minimum 50 and maximum 100 pages.
  - Adheres to the standardized format for page size, margins, font, and spacing
  - References: All references (journal articles, books) must be cited correctly in the specified format.

➔ **Project Presentations:**

- **Presentations:** Students must present their project progress to faculty members and review panel members during scheduled reviews.
- **Submission:** Soft copies of all presentation slides (PowerPoint/PPT) must be submitted to the project guide.

➔ **Project Documentation:**

The Project Coordinator shall maintain a separate file with following documents

- Approved Project Synopsis
- Project Review Schedule
- Soft Copies of all presentation slides in Google Drive
- Assessment marks for each review, along with the corresponding rubrics.

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Annasaheb Dange College of Engineering and Technology, Ashta

An Autonomous Institute

Department of Electrical Engineering

Class			B. Tech., Sem.-VII
Course Code and Course Title			**2EEVS411, Renewable Energy Systems Simulation Lab**
Prerequisite/s			2EEPC301, 2EEPC303
Teaching Scheme: Lecture/Tutorial/Practical			00/00/02
Credits			01
Evaluation Scheme:	**P**	**ISE**	50

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
2EEVS411_1	**Demonstrate** Photo Voltaic systems with MPPT techniques to assess performance in various environmental conditions.
2EEVS411_2	**Simulate** single-phase and three-phase Phase Locked Loops for grid synchronization and stability.
2EEVS411_3	**Design** power converters for efficient energy conversion and battery charging/discharging.
2EEVS411_4	**Implement** grid-connected Photo Voltaic systems to evaluate grid stability and efficiency.
2EEVS411_5	**Investigate** Vehicle to Grid and Grid to Vehicle operations for energy storage and grid management.

List of Experiments	
1	Modelling of PV system
2	Simulation of Phase Locked Loop (PLL) for Single Phase and Three Phase
3	Simulation of PV MPPT (P&O and Incremental Conductance Method) using Boost Converter.
4	Simulation of Three Phase Grid Connected Inverter
5	Simulation of Grid connected PV MPPT (P&O) single stage
6	Simulation of Grid connected PV MPPT (P&O) double stage.
7	PV based Battery Charging using Buck Converter
8	PV Based Bidirectional Converter for Battery Charging/Discharging.
9	Simulation of V2G / G2V operation in Electric Vehicle Charger
10	Simulation study of wind energy generation

Minimum **Seven** experiments should be performed from the above list.

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1.	MATLAB and Simulink In-Depth	Priyanka Patankar Swapnil Kulkarni	BPB Publications	1st	2022
2.	Renewable Energy Systems: Simulation with Simulink and Sim Power Systems	Viktor Perelmuter	CRC Press	-	2016
3.	Modeling and Simulation Using MATLAB - Simulink	Dr. Shailendra Jain	Wiley India Pvt. Limited	2nd	2015
4.	Renewable Energy Systems: Design and Analysis with Induction Generators	Mukund R. Patel	CRC Press	2nd	2012

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1.	Photovoltaic Power System: Modeling, Design, and Control"	Weidong Xiao	Wiley	1st	2017
2.	Power Electronics: Converters, Applications, and Design	Ned Mohan, Tore M. Undeland, and William P. Robbins	Wiley	3rd	2002

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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			Final Year, B. Tech. Semester - VIII
Course Code and Course Title			**2EEPE412, PE - III – Power Quality**
Prerequisite/s			Circuit and Networks, Basic Electrical Engineering, Power Electronics, Power System, and Linear Control System
Teaching Scheme: Lecture/Tutorial/Practical			02/00/00
Credits			02
Evaluation Scheme	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE / ESE**	00/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to,	
2EEPE412_1	**Apply** power quality concepts, standards, and monitoring techniques to identify and assess power quality disturbances.
2EEPE412_2	**Analyze** passive compensation and filtering methods for improving power quality in electrical systems.
2EEPE412_3	**Analyze** the operating principles and control strategies of active power quality compensators.
2EEPE412_4	**Evaluate** the performance of advanced power quality devices in mitigating voltage and current disturbances.
2EEPE412_5	**Apply** appropriate power quality improvement techniques to practical electrical system applications.

Week	**Course contents**
1	Power quality: An Introduction
2	Power quality standards and monitoring
3	Passive Shunt and Series Compensation
4	Active Shunt Compensation: DSTATCOM
5	Active Series Compensation: DVR
6	Passive Power Filters
7	Shunt Active Power Filters
8	Series Active Power Filters

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Power Quality: Problems and Mitigation Techniques	Bhim Singh, Ambrish Chandra and Kamal Al-Haddad	John Wiley & Sons Ltd., U.K.	First	2015
02	Electric Power Systems Quality	R. C. Dugan, M. F. McGranaghan and H. W. Beaty	McGraw-Hill, New York	Second	2006
03	Electrical Power Quality	J. B. Dixit and Amit Yadav	University Science Press, New Delhi	-	2010
04	Electric Power Quality	S. Chattopadhyay, M. Mitra and S. Sengupta,	Springer-Verlag, London	-	2011

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	FACTS Controllers in Power Transmission and Distribution	K. R. Padiyar	New Age International	First	2008
02	Electrical Power Quality Control Techniques	W. E. Kazibwe, M. H. Sendaula	Van Nostrand Reinhold	-	1993
03	Power Electronic Converters – AC/DC Conversion	G. Seguier	McGraw-Hill	-	1986
04	Control of power inverters in renewable energy and smart grid integration	Q.-C. Zhong and T. Hornik	John Wiley & Sons Ltd., U.K	-	2013
05	Power Theories for Improved Power Quality,	G. Benysek and M. Pasko.	Springer-Verlag London	-	2012

Course Coordinator

BOS Secretory

BOS Chairman

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Annasaheb Dange College of Engineering and Technology, Ashta

An Autonomous Institute

Department of Electrical Engineering

Class			Final Year, B. Tech. Semester - VIII
Course Code and Course Title			**2EEPE413, PE- III Sensors and Actuators**
Prerequisite/s			https://onlinecourses.nptel.ac.in/noc26_ee13/preview
Teaching Scheme: Lecture/Tutorial/Practical			02
Credits			02
Evaluation Scheme	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE / ESE**	0/0

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEPE413_1	**Explain** the fundamental principles of energy transformation and the basic concepts of sensors, transducers, and actuators.
2EEPE413_2	**Discuss** the thin film materials, their properties, and common deposition techniques used in electronic and sensor devices.
2EEPE413_3	**Describe** microfabrication processes such as photolithography, etching, and thin film patterning.
2EEPE413_4	**Explain** the working principles and applications of gas sensors, microsensors, microfluidic devices, and micro-actuators.
2EEPE413_5	**Apply** simulation tools and basic interfacing techniques to analyze, test, and evaluate sensor and actuator performance.

Week	Contents
1	**Basics of Sensors and Energy Conversion**
2	**Understanding of thin film physics**: Application in MOSFET and its variants
3	**Thin Films and MOS Devices**- Properties of thin films (electrical, mechanical, optical, thermal) MOSFET basics and operation Role of thin films in electronic and sensor devices
4	**Thin Film Deposition Techniques**-Overview of thin film deposition methods Chemical Vapor Deposition (CVD), Physical Vapor Deposition (PVD) Applications of deposited thin films in electronics and sensors
5	**Microfabrication Processes**-Basics of photolithography, Mask design and pattern transfer, Wet etching techniques, Dry etching techniques, Basic microfabrication process flow
6	**Sensors, Actuators, and Microsystems**-Gas sensors: Metal oxide sensors, Optical sensors, FET-based gas sensors, Polymer gas sensors
7	**Actuators and Microsystem Components**-Piezoelectric actuators, Piezoresistive actuators, Micropumps, Micro-actuators and their applications
8	**Simulation, Interfacing, and Sensor Performance**-Introduction to COMSOL Multiphysics, Simulation of basic sensor structures, Sensor interfacing with microprocessors. Static and dynamic characteristics of sensors, Sensor calibration techniques

Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	MEMS and Microsystems: Design and Manufacture	Tai-Ran Hsu	McGraw-Hill Science	1st	2001
2	**MEMS and Microsystems (Alternate / later edition)**	Tai-Ran Hsu	John Wiley & Sons	2nd	2008
3	Sensors and Transducers	D. V. S. Murthy	PHI Learning / Prentice Hall India	2nd	2008
4	**VLSI Technology** – B **Author:** B. G. Streetman, Sanjay Banerjee	. G. Streetman & Sanjay Banerjee	Pearson education	4th	2000
5	**Microelectronics Circuits**	**S. Salivahanan, N. Suresh Kumar, A. Vallavaraj**	**McGraw Hill Education**	**4th**	**2017**

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	**Sensors and Signal Conditioning,**	Jacob Fraden	Wiley-Blackwell,	1st	2008
2	**Piezoelectric Sensors and Actuators: Fundamentals and Applications**	**Senturia S.D.**	**Springer**	1st	**2018**
3	**Microsystem Design**	J.D. Plummer, M.D. Deal, P.G. Griffin	Kluwer Academic Publisher	1st	2001

Course Coordinator

BOS Secretary

BOS Chairman

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Annasaheb Dange College of Engineering and Technology, Ashta

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Department of Electrical Engineering

Class			Final Year, B. Tech. Semester - VIII
Course Code and Course Title			**2EEPE414, PE- III – Integrated Circuits and Applications**
Prerequisite/s			Basic Circuit Theory
Teaching Scheme: Lecture/Tutorial/Practical			02/00/00
Credits			02
Evaluation Scheme	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE / ESE**	00/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to,	
2EEPE414_1	**Explain** the fundamentals of integrated circuits, ideal and practical operational amplifiers and their characteristics
2EEPE414_2	**Analyze** active filters and sine wave oscillators
2EEPE414_3	**Apply** operational amplifiers in non-linear applications
2EEPE414_4	**Describe** the operation and applications of timer ICs, PLL IC 565, and three-terminal voltage regulators
2EEPE414_5	**Implement** basic CMOS inverter circuits and CMOS-based combinational and sequential digital circuits for practical electronic applications.

Week	**Course contents**
1	Integrated circuits basics, Operational Amplifiers: Introduction to ideal and practical Op. amps, Characteristics, Modes of operation
2	Active filters: Low pass, High pass, Band pass and Band reject filters
3	Sine wave Oscillators: RC phase shift, Wien bridge Oscillators
4	Non-linear applications of Op. amp: Comparators, Zero crossing detectors and Schmitt trigger, waveform generator
5	555 Timer: Operation, Monostable and Astable modes
6	IC 565 PLL: Operation and applications
7	IC 78xx/79xx Voltage regulators: Features, three terminal voltage regulators
8	CMOS inverter, CMOS combinational and sequential circuits

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Linear Integrated Circuits	D.Roy Choudhry, Shail Jain	New Age International Pvt. Ltd	5th	2018
02	Design with Operational Amplifiers and Analog Integrated Circuits	Sergio Franco	Tata Mc Graw-Hill	4th	2016
03	Introduction to VLSI Circuits and Systems	John P. Uyemura	Wiley	-	2006

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Operational Amplifiers and Linear IC	Ramakant A. Gayakwad	Prentice Hall / Pearson Education	4th	2015
02	Operational Amplifiers and Linear Integrated Circuits	Robert F.Coughlin, Frederick F.Driscoll	PHI	6th	2001
03	System design using Integrated Circuits	B.S.Sonde	New Age Pub	2nd	2001
04	Analysis and Design of Analog Integrated Circuits	Gray and Meyer	Wiley International	5th	2009
05	Operational Amplifiers with Linear Integrated Circuits	William D.Stanley	Pearson Education	4th	2001
06	Linear Integrated Circuits	S.Salivahanan & V.S. Kanchana Bhaskaran	TMH	4th	2016

Course Coordinator | BOS Secretory | BOS Chairman

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Class			Final Year, B. Tech. Semester - VIII
Course Code and Course Title			**2EEPE415, PE- III – EV Vehicle Dynamics & Electric Motor Drives**
Prerequisite/s			https://www.youtube.com/playlist?list=PL425060D3C78350E1
Teaching Scheme: Lecture/Tutorial/Practical			02/00/00
Credits			02
Evaluation Scheme	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE / ESE**	00/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to,	
2EEPE412_1	**Explain** the fundamentals and architecture of electric vehicles.
2EEPE412_2	**Analyze** and model vehicle dynamics for EV applications.
2EEPE412_3	**Explain** modeling and control of DC motor drives using power electronics.
2EEPE412_4	**Discuss** the operation and control of induction motor drives with PWM techniques.
2EEPE412_5	**Analyze** and implement vector control of PMSM drives for high-performance electric vehicle applications.

Week	**Course contents**
1	Introduction to Electric Vehicle
2	Vehicle Dynamics: Modeling and Simulation
3	Fundamental of Drives and Power Electronics for DC Drives
4	Modeling and Control of DC Motor Drives
5	Basics of Induction Motor and V/f Control
6	Realization of Power Electronic Converters and PWM for IM drives
7	Modeling of PMSM Drives
8	Vector Control of PMSM Drives

Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	ELECTRIC and HYBRIDVEHICLES, Design Fundamentals	Iqbal Husain	CRC Press	-	2003
02	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles	M. Ehsani, Y. Gao, S. Gay and A. Emadi	CRC Press	-	2005
03	Electric Motor Drives: Modeling, Analysis, and Control	R. Krishnan	Prentice Hall / Pearson Education	1st	2015
04	Modern Power Electronics and AC Drives	Bimal N. Bose	Prentice Hall / Pearson Education	-	2015

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Vehicle Dynamics and Control	Rajesh Rajamani	Springer	1st	2006
02	Power Electronics and Motor Drives: Advances and Trends	Bimal K. Bose	Academic Press	2nd	2021
03	Permanent Magnet Synchronous and Brushless DC Motor Drives	R. Krishnan	CRC Press / Taylor & Francis Group	1st	2010

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Class			Final Year, B. Tech. Semester - VIII
Course Code and Course Title			**2EEPE417, PE-IV Transducers for Instrumentation**
Prerequisite/s			Basic Electronics
Teaching Scheme: Lecture/Tutorial/Practical			02/00/00
Credits			02
Evaluation Scheme	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE / ESE**	-

Course Outcomes (COs): Upon successful completion of this course, the student will be able to,	
2EEPE412_1	**Explain** the fundamentals of transducers, sensors, characteristics, and measurement errors.
2EEPE412_2	**Explain** the operating principles of thermal sensors and thermal–electrical networks.
2EEPE412_3	**Interpret** the working of optical sensors, sources, and detectors
2EEPE412_4	**Differentiate** acoustic and magnetic sensors with basic signal conditioning concepts.
2EEPE412_5	**Explain** radiation sensing principles, detector types, and smart sensor concepts.

Week	**Course contents**
1	**Introduction to Transducers, Sensors and Actuators**. Transduction Principles and Classification. Static and Dynamic Characteristics of Transducer. Accuracy vs Precision. Errors in Measurement and Instrumentation, Propagation of Errors.
2	**Thermal Sensors:** Equilibrium and Predictive measurements Thermocouples, RTDs and Thermistors Electrical vs Thermal Networks
3	**Thermal Sensors:** Thermal RC Networks Novel Thermal Sensors Optical Sensors: Basic Principles and Operations
4	**Optical Sensors**: Interferometric Sensors Distributed and Braggs Grating based Sensors Working Principles of Optical Detectors
5	**Optical Sensors**: Working Principles of Optical Sources Acoustic Sensors: Piezo-electricity and Propagation Modes Surface Acoustic Wave (SAW) Sensors
6	**Acoustic Sensors:** Bulk Acoustic Wave (BAW) Sensors ,Magnetic Sensors: Magnetostriction and Magnetic-Elastic Sensors Magnetic Sensors: Magneto-resistive Sensors
7	**Magnetic Sensors**: Hall Sensors,Linear Amplifier and Schmitt Trigger , Radiation Sensor: Introduction to Radiation Sensing, Spectroscopy
8	**Radiation Sensor**: Gas Filled and Solid-State Detectors, Organic and Inorganic Scintillators, Smart Sensors: Introduction

Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Transducers and Instrumentation	Dr. V. S. Murty	PHI Learning Private Limited	2nd Edition	2008
02	Sensors and Transducers	D. Patranabis	PHI Learning Private Limited (Delhi)	2nd Edition	2003
03	Measurement, Instrumentation, and Sensors Handbook	John G. Webster & Halit Eren	CRC Press / Taylor & Francis Group	2nd Edition	2014
04	Principles of Industrial Instrumentation	D. Patranabis	Tata McGraw-Hill (TMH)	1st Edition	2015

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Transducers for Instrumentation	M. G. Joshi	Laxmi Publications	1st Edition	2015
02	Transducers and Instrumentation	Dr. V. S. Murty	PHI Learning Private Limited	2nd Edition	2022
03	Measurement Systems and Sensors	Waldemar Nawrocki	Artech House Publishers	2nd Edition	2015
04	Measurement and Instrumentation: Theory and Application	Reza Langari	Elsevier	2nd Edition	2015

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Class			Final Year, B. Tech. Semester - VIII
Course Code and Course Title			**2EEPE416, PE-IV- FACTS Devices**
Prerequisite/s			Advance power electronics and Control - https://nptel.ac.in/courses/108107128
Teaching Scheme: Lecture/Tutorial/Practical			02/00/00
Credits			02
Evaluation Scheme	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE / ESE**	00/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to,	
2EEPE416_1	**Explain** the fundamental concepts of FACTS and the role of power electronic controllers and PWM techniques in improving power system performance.
2EEPE416_2	**Apply** the operating principles of Static Shunt Compensators (SVC and STATCOM) to analyze reactive power control and voltage regulation in transmission systems.
2EEPE416_3	**Analyze** the performance of Static Series Compensators (TCSC, SSSC) and Static Voltage and Phase Angle Regulators for power flow control and system stability improvement.
2EEPE416_4	**Evaluate** the effectiveness of UPQC and UPFC in mitigating power quality issues and controlling power flow under different operating conditions.
2EEPE416_5	**Design and recommend** appropriate FACTS devices, including IPFC, for specific power system applications based on technical and operational requirements.

Week	**Course contents**
1	FACTS: Concept & Power Electronic Controllers.
2	Power Electronic Controllers and PWM techniques.
3	Static Shunt Compensators
4	Static Shunt Compensators
5	Static Series Compensators
6	Static Series Compensators and Static Voltage and Phase Angle Regulators.
7	Unified Power quality Conditioner (UPQC) and Unified Power Flow Controller (UPFC).
8	Interline Power Flow Controller (IPFC) and application of FACTS device.

BOOKS AND REFERENCES

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems	Narain G. Hingorani, Laszlo Gyugyi	IEEE Press / Wiley	1st	2000
02	Flexible AC Transmission Systems (FACTS)	Yong Hua Song, Allan T. Johns	Institution of Electrical Engineers (IEE)	-	1999
03	Power Electronics for Renewable and Distributed Energy Systems	Sudipta Chakraborty, Marcelo G. Simões, William E. Kramer	Springer	1st	2013
04	Power System Stability and Control	Prabha Kundur	McGraw-Hill	-	1994

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Flexible AC Transmission Systems: Modelling and Control	K. R. Padiyar	BSP Books	1st	2007
02	Power System Dynamics: Stability and Control	Jan Machowski, Janusz W. Bialek, James R. Bumby	Wiley	2nd	2008
03	Power Electronics in Smart Electrical Energy Networks	Ryszard M. Golebiowski	Springer	1st	2008

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Class			Final Year, B. Tech. Semester - VIII
Course Code and Course Title			**2EEPE418, PE- IV – Embedded Sensing, Actuation and Interfacing Systems**
Prerequisite/s			Fundamentals of Electrical Circuits and Basic Electronics
Teaching Scheme: Lecture/Tutorial/Practical			02/00/00
Credits			02
Evaluation Scheme	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE / ESE**	00/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to,	
2EEPE418_1	**Explain** the architecture, characteristics, applications, and components of embedded control systems.
2EEPE418_2	**Classify** and explain the working principles of various sensors and actuators.
2EEPE418_3	**Design and implement** signal conditioning and interfacing circuits for embedded controllers.
2EEPE418_4	**Analyze** sensor interfacing non-idealities and apply linearization and error-reduction techniques.
2EEPE418_5	**Develop** advanced direct interfacing schemes for smart sensors and sensor arrays.

Week	**Course contents**
1	**Introduction:** Overview of embedded system; Importance of sensors, actuators and interfacing circuits in embedded control system; Characteristics; Applications.
2	**Embedded Sensors and Actuators:** Various types of important sensors, actuators and their working principles: e.g, thermal, mechanical, electrical, magnetic, optical, chemical, smart material and meta material based.
3	**Interfacing Aspects of Sensors and Actuators to Embedded Controller and their Communication Protocols:** Signal conditioning circuits; Various Op-Amp based interfacing circuit implementation: Amplifier, Filter, ADC, DAC etc.; Various Serial Communication protocols for interfacing.
4	**Advancement in Interfacing Schemes of Resistive Sensors for Linearity Improvement and Error Reduction:** Resistive sensor examples; non-idealities in basic interfacing circuits; Linearization techniques; Error reduction schemes due to environmental effects and remote communication.
5	**Advanced Techniques for Direct Interfacing of Resistive Sensors with Embedded controller:** Embedded controller-based excitation system; Direct interfacing schemes of various resistive sensors topologies (e.g., single, differential and bridge type) to

	microcontrollers; Interfacing scheme for sensor array.
6	**Advanced Techniques for Direct Interfacing of Capacitive Sensors with Embedded Controller:** Capacitive sensor examples; Interfacing scheme for different capacitive sensor configurations; Direct interfacing schemes.
7	**Advancement in Design of Interfacing Circuits for Lossy Capacitive Sensors:** Lossy Capacitive sensor characteristics; Various advanced interfacing schemes for lossy capacitive sensor.
8	**Miniaturization Technology for Smart Sensors and Actuators:** Background of miniaturization; Miniaturized device fabrication process technology for Smart sensors and actuators.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Sensors, Actuators, and their Interfaces	Nathan Ida	SciTech Publishing	1st	2014
02	Analog Interfacing to Embedded Microprocessor Systems	Stuart R. Ball	Elsevier,	-	2004
03	Advanced Interfacing Techniques for Sensors	B. George, J. Roy, V. Jagadeesh Kumar, S. C. Mukhopadhyay	Springer	1st	2017
04	Sensors and Signal Conditioning	John G. Webster and Ramón Pallás-Areny	John Wiley & Sons	2nd	2000

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fundamentals of Microfabrication and Nanotechnology	Marc Madou	CRC press	3rd	2018
02	Smart Sensors and MEMS	S. Nihtianov, A. Luque	Elsevier	1st	2014
03	Instrument Engineers Handbook	CRC press	CRC press	4th	2003

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Class			Final Year, B. Tech. Semester - VIII
Course Code and Course Title			**2EEPE419, PE- IV – Charging Infrastructure**
Prerequisite/s			Electrical Vehicle Power Electronics
Teaching Scheme: Lecture/Tutorial/Practical			02/00/00
Credits			02
Evaluation Scheme	**T**	**ISE / MSE / ESE**	40/30/30
	P	**ISE / ESE**	00/00

Course Outcomes (COs): Upon successful completion of this course, the student will be able to,	
2EEPE419_1	**Identify** the building blocks, essential components and functional aspects of AC & DC EV chargers
2EEPE419_2	**Evaluate** the performance parameters of single phase bridge and bridgeless rectifiers for EV charger applications
2EEPE419_3	**Analyze** the performance parameters and suitability of closed loop control of AC-DC PFC converters in CCM & DCM
2EEPE419_4	**Estimate** the performance of three phase AC-DC converters and isolated DC-DC converters with advanced PWM techniques for high power EV charger applications
2EEPE419_5	**Justify** suitable DAB Converter and HFT for isolated DC-DC converters in AC Type 2 and DC charging applications

Week	Course Contents
1	Introduction to the EV Charging System , Building Blocks of an AC EV Charger, Building Blocks of an DC EV Charger, Review of EV Charger Types and Nomenclatures Revisiting , Diode Bridge Rectifier
2	Revisiting Diode Bridge Rectifier - II Revisiting Diode Bridge Rectifier with Capacitive Filter - I Revisiting Diode Bridge Rectifier with Capacitive Filter - II Single-phase Boost PFC Converter - I Single-phase Boost PFC Converter - II
3	Single-phase Boost PFC Converter - III Single-phase Boost PFC Converter - IV Closed Loop Control of Single-phase Boost PFC Converter Closed Loop Control of Single-phase Boost PFC Converter - II Closed Loop Control of Single-phase Boost PFC Converter - III
4	Closed Loop Control of Single-phase Boost PFC Converter-IV Bridgeless PFC Converter Totem pole PFC Converter Totem pole PFC Converter-II DCM operation of Boost PFC Converter
5	Flyback Based PFC Converter Pulse Width Modulation Three Phase AC-DC Converter Three Phase AC-DC Converter-II Three Phase AC-DC Converter-III

6	Revisiting Isolated DC-DC Converters-II Revisiting Isolated DC-DC Converters-III Switching Loss Soft Switching In Half Bridge Configuration Modulation Strategies for PWM Full Bridge Converter
7	Small Signal Modelling of PSFB-III Dual Active Bridge Converter-I Dual Active Bridge Converter-II Transformer Design for Isolated DC-DC Converter-I Transformer Design for Isolated DC-DC Converter-II
8	Transformer Design for Isolated DC-DC Converter - III Filter Inductor Design AC Type-2 Charging - I AC Type-2 Charging - II DC Charging (CCS2)-I

Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles	Mehrdad Ehsani, Yimin Gao, Stefano Longo, Kambiz Ebrahimi	CRC Press	3rd Edition	2018
2	Transformer and Inductor Design Handbook	Colonel Wm. T. McLyman	CRC Press	4th Edition	2011
3	Power Electronics	Muhammad H. Rashid	Pearson Education	4th Edition	2014

Reference Books:					
Sr. No.	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
1	Power Electronics: Converters, Applications, and Design	Ned Mohan, Tore M. Undeland, William P. Robbins	John Wiley & Sons	3rd Edition	2003
2	Fundamentals of Power Electronics	Robert W. Erickson, Dragan Maksimović	Springer	2nd Edition	2001
3	Switching Power Supply Design	Abraham I. Pressman, Keith Billings, Taylor Morey	McGraw-Hill Education	3rd Edition	2009
4	Transformer and Inductor Design Handbook	Colonel Wm. T. McLyman	CRC Press	4th Edition	2011
5	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles	Mehrdad Ehsani, Yimin Gao, Stefano Longo, Kambiz Ebrahimi	CRC Press	3rd Edition	2018
6	Electric Vehicle Integration into Modern Power Networks	Ibrahim Dincer, Canan Ozgur Colpan, Ozan Yilmaz	Springer	1st Edition	2015

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Course Details:

Class			Final Year B. Tech. Semester – VIII
Course Code and Course Title			**2EEEL415, Internship**
Prerequisite/s			2EEEL218, 2EEEL308, 2EEEL318, 2EEEL410
Teaching Scheme: Lecture/Tutorial/Practical			00/00/00
Credits			10
Evaluation Scheme	**P**	**ISE/ESE**	100/00

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
2EEEL415_1	**Utilize** engineering concepts to engage in real-world projects within a professional environment
2EEEL415_2	**Operate** industry-specific tools, software, and equipment efficiently.
2EEEL415_3	**Exhibit** strong teamwork skills by working alongside industry professionals, peers, and mentors to successfully meet project goals, ensuring compliance with industry regulations and standards
2EEEL415_4	**Analyze** challenges encountered in industrial processes, proposing innovative and effective solutions.
2EEEL415_5	**Create** comprehensive reports, including case studies, and deliver impactful presentations that effectively convey insights and outcomes from projects and learning experiences.

Internship Requirements:

- All students are required to complete an internship at a research organization, university, or industry to gain practical exposure through meaningful projects that align with their academic learning. This internship must be approved by the Head of the Institution and has duration of a **minimum of 12 weeks and a maximum of 24weeks**, as specified in the curriculum.
- The tables below represent the outline of the internship guidelines and student responsibilities: For detailed guidelines and procedures, refer to the Institute Internship Policy Document.

Internship Guidelines:

1. Request Letter	Obtain a request letter from the institute, signed by the Institute Director, addressed to the HR manager or relevant authority.
2. Confirmation Letter	Submit the confirmation letter from the industry or organization to the Internship Coordinator and Department Office.

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3. Mentorship	• A faculty member will act as a mentor for a group of students to monitor, evaluate, and guide their internship activities. • The mentor will visit the internship location at least once or twice during the internship period and provide feedback to the Internship Coordinator.
4. Progress Reports	Submit progress reports every two weeks to the mentor, along with a final report to the Internship Coordinator.
5. Evaluation	The mentor and an assessment panel will evaluate student performance post-internship, submitting an evaluation report to the Department Office.
6. Internship Certificate	Obtain and submit an Internship Certificate from the organization to the Internship Coordinator.
7.Presentation and Term Work	Deliver a presentation on internship work as part of term assessments; submit an internship diary and report for evaluation.

Student Responsibilities

Category	Responsibilities
Professionalism	Adherence to workplace rules, ethical conduct, professional communication
Engineering Skills	Apply engineering fundamentals, use tools and software, conduct experiments, solve problems
Industry Knowledge	Learn industry standards, observe practices, understand project management
Professional Development	Improve communication, teamwork, problem-solving, time management, build network, enhance employability
Learning & Growth	Seek learning opportunities, apply classroom knowledge, maintain a journal, gain insights into career paths

Internship Evaluation Process

The Internship of students will be assessed in three key stages:

1. **Evaluation by Industry**
   - Punctuality
   - Willingness to learn
   - Daily diary maintenance
   - Skill test performance
   - Supervisor's remarks

2. **Evaluation by Faculty Mentor of Student performance and Internship Report**
   - Faculty Mentor will evaluate students based on their attendance, participation, and engagement during the internship.
   - The quality and completeness of the internship report will also be assessed.

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3. Seminar Presentation/Viva-Voce at the Institute

- Students will present a seminar based on their internship report before an expert committee formed by the relevant department, in accordance with institute norms.
- The evaluation criteria for the seminar presentation will include:
  - Quality of content presented
  - Planning and organization of the presentation
  - Effectiveness of delivery
  - Depth of knowledge and skills demonstrated
  - Attendance record, daily diary entries, and departmental reports will also be reviewed alongside the internship report.

This seminar presentation serves as an opportunity for students to share their knowledge and experiences with peers and faculty, enhancing their communication skills and building confidence.

Final Evaluation During the final evaluation, the student shall prepare and submit a report and give a presentation & Viva voce before his/her Department Committee at the college.

In-Semester Evaluation			
Criteria	**Evaluated By**	**Weightage (%)**	**Description**
Student Performance	Industry Supervisor	20%	Evaluated based on a rubric and feedback form, focusing on punctuality, eagerness to learn, skill tests, and professionalism
Submission of Internship Report with Certificate	Institute	20%	Assesses the quality, structure, and content of the report submitted by the student, reviewed by the mentor, along with the internship certificate.
Internship Diary, Attendance Record, and Industry-Faculty Interaction	Institute (During and End of Internship)	10%	Evaluates consistency and detail in maintaining the diary, adherence to attendance, and meaningful engagement during interactions with mentors.
Presentation, Demonstration, or Case Studies	Institute	20%	Assesses the student's ability to effectively communicate insights, demonstrate practical learning outcomes, or analyze and present case studies.
Viva-Voce	Institute	30%	Tests the student's depth of understanding, analytical skills, and ability to articulate their internship experience during an oral evaluation.

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