B.V.V.S

Scheme and Syllabus

B.E. in
Electrical and Electronics Engineering

For 2023-24 Admitted Batch

Dept. of Electrical and Electronics Engg.

Basaveshwar Engineering College
Bagalkote-587102

B.V.V.S

Vision of the Institute

To be an institution of excellence in education, research and innovation for a sustainable future

Mission of the Institute

1. Develop globally competent professionals for future talent requirements
2. Nurture a culture of research, innovation and entrepreneurship
3. Promote collaborations, extension and outreach programs for addressing industrial and societal needs
4. Imbibe moral and ethical values
5. Foster ecological and environmental consciousness

B.V.V.S

Vision of the Department of E&EE

To be in the global forefront of education, research and innovation in Electrical and Electronics Engineering to meet energy, ecology, industrial and societal needs

Mission of the Department of E&EE

1. Develop globally competent professionals adapting to technological transformations in the field of Electrical and Electronics Engineering
2. Promote collaborations with higher learning institutes and industries for research, innovation and entrepreneurship
3. Imbibe moral & ethical values and render empathetical services to energy, ecology & environmental issues.

B.V.V.S

PEOs of the Department of E&EE

1. The graduates will be able to design the solutions to industrial challenges
2. The graduates will be able to take up higher studies and research
3. The graduates will be able to engage in multi-disciplinary innovation and entrepreneurship activities
4. The graduates will be able to adopt emerging technologies to provide solutions to the societal and environmental issues

PSOs of the Department of E&EE

1. Graduates shall be able to specify, formulate and analyze concepts used in power systems and electrical machines as per requirements of power & energy sector
2. Graduates shall be able to identify, analyze, design and test technologies used in power electronics, electronic & signal processing circuits and control systems
3. Graduates shall be able to apply conventional concepts and contemporary tools to design, simulate and analyze electrical and electronic systems for real time applications through hands on learning gained in SCADA, energy systems and power electronics laboratories

B.V.V.S

Program Outcomes

Engineering Graduates will be able to:

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:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
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 with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
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.

B.V.V.S

Program Outcomes (As per NBA 2025 onwards)

Engineering Graduates will be able to:

Program Outcomes (POs)

PO1: **Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: **Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: **Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: **Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: **Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: **The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5 and WK7).

PO7: **Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: **Individual and Collaborative Team work:** Function effectively as an individual and as a member or leader in diverse/multi-disciplinary teams.

PO9: **Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language and learning differences

PO10: **Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team and to manage projects and in multidisciplinary environments.

PO11: **Life-Long Learning:** Recognize the need for and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

B.V.V.S

Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Scheme of Teaching and Evaluation for B.E Electrical and Electronics Engineering

2023-24 (admitted batch), 2024-25 (sem 3&4), 2025-26 (sem 5&6), 2026-27 (sem 7&8).

Total Credits for BE=160 (as per VTU/AICTE)

Table-1: Breakdown of Credits suggested by the VTU Belagavi/AICTE New Delhi

Sl.	Category	VTU	AICTE	BEC
1.	HSMC: HSS (2 English, 1 Kannada, 1 UHV, 1 Constitution, 1 EV), 3 HRM (Offered by Dept) = 9 AEC (1 Scientific foundations of Health, 1 Innovation and design Thinking, 2 SS, 3 MOOCS, 3 Dept. specific) = 10	16	15	19 (20)
2.	BSC: Basic Science Courses (Physics, Chemistry and Mathematics)	22	23	22 (22)
3.	ESC/ETC: Engineering Science Courses (BasicElect./Electronics/Computer/Mechanics/Workshop/Drawing…)	24	17	18 (24)
4.	PCC: Professional Core Courses	59	61	56 (49)
5.	PEC: Professional Elective Courses relevant to the branch with at least one course either fully or partially supported by industry	12	12	12 (12)
6.	OEC: Open Electives Courses/ Subjects from other technical/Arts/ Commerce (3 MOOCS + 6)	09	12	09 (09)
7.	Mini (2) and Major projects (12)/ Industrial Internships (10)	20	20	24 (24)
8.	Mandatory Course: PE, Yoga, NSS, Bridge course Maths 1 and 2 (lateral Entry)	00	00	00
	Total	160		160

Table-2: Semester wise Breakdown of Credits

Sem.	BSC	ESC/ETC	HSSM	AEC	PCC	PEC	OEC	Proj.	Int.	Total
1.	(08)	(09)	(02)	(01)						20
2.	(08)	(09)	(02)	(01)						20
3.	(03)	(03)	(01)	(01)	(12)					20
4.	(03)	(03)	(01)	(01)	(12)					20
5.			(01)	(02)	(09)	(03)	(03)	(02)		20
6.			(01)		(13)	(03)	(03)			20
7.			(03)		(03)	(06)		(12)		24
8.				3 (MOOCS)			3 (MOOCS)		(10)	16
Tot.	22	24	11	09	49	12	09	14	10	160

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-1 **CAY 2023-24 (160 Credits 2023-24 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	ASC (IC)	22UMA101C	Mathematics for Electrical Sciences-I	4	3	0	2	50	50	100
2.	ASC (IC)	22UPH105C	Physics for Electrical Sciences	4	3	0	2	50	50	100
3.	ESC	22UEE115C	Elements of Electrical Engineering	3	3	0	0	50	50	100
4.	ESC - I	22UxxxxxN	Engineering Science Course - I	3	3	0	0	50	50	100
5.	ETC - I	22UxxxxxB	Emerging Technology Course - I	3	3	0	0	50	50	100
6.	HSSC	22UHS124C	Communicative English	1	1	0	0	50	50	100
7.	HSSC	22UHS125C	Constitution of India	1	1	0	0	50	50	100
8.	AEC	22UHS128C	Scientific Foundations of Health	1	1	0	0	50	50	100
			Total	20						

Semester-2 **CAY 2023-24 (160 Credits 2023-24 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	ASC (IC)	22UMA201C	Mathematics for Electrical Sciences-II	4	3	0	2	50	50	100
2.	ASC (IC)	22UCH209C	Chemistry for Electrical Sciences	4	3	0	2	50	50	100
3.	ESC	22UME223C	CAED	3	2	0	2	50	50	100
4.	ESC - II	22UxxxxxN	Engineering Science Course - II	3	3	0	0	50	50	100
5.	PLC - I	22UxxxxxB	Programming Language Course-I	3	2	0	2	50	50	100
6.	HSSC	22UHS224C	Professional Writing Skills in English	1	1	0	0	50	50	100
7.	HSSC	22UHS226C 22UHS227C	Samskruthika Kannada* Balake Kannada**	1	1	0	0	50	50	100
8.	AEC	22UHS229C	Innovation and Design Thinking	1	1	0	0	50	50	100
			Total	20						

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

(ESC - I) Engineering Science Courses - I				
Code	Title	L	T	P
22UME122N/222N	Introduction to Mechanical Engineering	3	0	0
22UCV118N/218N	Introduction to Civil Engineering	3	0	0
22UEE116N/216N	Introduction to Electrical Engineering	3	0	0
22UEC114N/214N	Introduction to Electronics Engineering	3	0	0
22UCS120N/220N	Introduction to 'C' Programming	2	0	2

(ETC - I) Emerging Technology Courses - I				
Code	Title	L	T	P
22UEC134B/234B	Introduction to Embedded Systems	3	0	0
22UEC135B/235B	Introduction to Communication Technology	3	0	0
22UEE136B/236B	Renewable Energy Sources	3	0	0
22UCV138B/238B	Green Buildings	3	0	0
22UCV139B/239B	Waste Management	3	0	0
22UCS140B/240B	Introduction to Internet of Things (IOT)	3	0	0
22UCS141B/241B	Introduction to Cyber Security	3	0	0
22UME142B/242B	Composite Materials	3	0	0
22UME143B/243B	Introduction to Robotics	3	0	0
22UBT148B/248B	Biomass and Bio-energy	3	0	0

(PLC - I) Programming Language Courses - I				
Code	Title	L	T	P
22UCS130B/230B	Introduction to Web Programming	2	0	2
22UCS131B/231B	Introduction to Python Programming	2	0	2
22UCS132B/232B	Basics to JAVA programming	2	0	2
22UCS133B/233B	Introduction to C++ Programming	2	0	2

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-3 **CAY 2024-25 (160 Credits 2023-24 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	ASC	22UMA313C	Mathematics –III for EE Engineering	3	3	0	0	50	50	100
2.	IPCC	22UEE325C	Electric Circuit Analysis	4	3	0	2	50	50	100
3.	IPCC	22UEE326C	Analog Electronic Circuits	4	3	0	2	50	50	100
4.	PCC	22UEE327C	Transformers and Generators	3	3	0	0	50	50	100
5.	PCCL	22UEE328L	Transformers and Generators Laboratory	1	0	0	2	50	50	100
6.	ESC	22UEE33XC	ESC/ETC/PLC	3	3	0	0	50	50	100
7.	UHV	22UHS317L	Social Connect and Responsibility	1	0	0	2	100	--	100
8.	AEC	22UEE34XL	Ability Enhancement Course - III	1	0	0	2	50	50	100
9.	ASC	22UMA300C	Bridge Course Mathematics - I	0	3	0	0	50	50	100
10.	MC	22UHS001M	Yoga	0	0	0	2	25	-	25
		22UHS002M	National Service Scheme	0	0	0	2	25	-	25
		22UHS003M	Physical Education and Sports	0	0	0	2	25	-	25
		22UHS004M	Music	0	0	0	2	25	-	25
			Total	20						

All students have to register for any one of the courses namely National Service Scheme, Physical Education (Sports and Athletics), and Yoga with the concerned coordinator of the course during the first week of III semester. The activities shall be carried out between III semesters to VI semester (for 4 semesters). The accumulated marks are considered for CIE. Successful completion of the registered course is mandatory for the award of the degree.

Semester-4 **CAY 2024-25 (160 Credits 2023-24 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	22UEE425C	Electric Motors	3	3	0	0	50	50	100
2.	PCC	22UEE426C	Transmission and Distribution	4	4	0	0	50	50	100
3.	IPCC	22UEE427C	Microcontrollers	4	3	0	2	50	50	100
4.	PCCL	22UEE428L	Electric Motors Laboratory	1	0	0	2	50	50	100
5.	ESC	22UEE43XC	ESC/ETC/PLC	3	3	0	0	50	50	100
6.	ESC	22UEE44XL	Ability Enhancement Course - IV	1	0	0	2	50	50	100
7.	BSC	22UBT441C	Biology For Engineers	3	3	0	0	50	50	100
8.	HSMC	22UHS424C	Universal Human Values - II	1	1	0	0	50	50	100
9.	ASC	22UMA400C	Bridge Course Mathematics - II	0	3	0	0	50	50	100
10	MC	22UHS001M	Yoga	0	0	0	2	25	-	25
		22UHS002M	National Service Scheme	0	0	0	2	25	-	25
		22UHS003M	Physical Education and Sports	0	0	0	2	25	-	25
		22UHS004M	Music	0	0	0	2	25	-	25
			Total	20						

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

22UEE33XC: Codes started with 331C up to the number of courses offered in list of ESC/ETC/PLC.
22UEE34XL: Codes started with 341L up to the number of courses offered in the list of AEC. 'L' is mentioned in view that all listed courses are laboratory courses in AEC.

Engineering Science Course (ESC/ETC/PLC)			
22UEE331C	Digital Logic Circuits	22UEE333C	Electromagnetic Field Theory
22UEE332C	Electrical Measurements and Instrumentation	22UEE334C	Physics of Electronic Devices
Ability Enhancement Course – III			
22UEE341L	SCI LAB/MATLAB for Transformers and Generators	22UEE343L	555 IC Laboratory
22UEE342L	Circuit Laboratory using P Spice	22UEE344L	Electrical Hardware Laboratory

22UEE43XC: Codes started with 431C up to the number of courses offered in list of ESC/ETC/PLC.
22UEE44XL: Codes started with 441L up to the number of courses offered in the list of AEC. 'L' is mentioned in view that all listed courses are laboratory courses in AEC.

Engineering Science Course (ESC/ETC/PLC)			
22UEE431C	Electrical Power Generation and Economics	22UEE433C	Engineering Materials
22UEE432C	Op-Amp and LIC	22UEE434C	Object Oriented Programming
Ability Enhancement Course – III			
22UEE441L	Basics of VHDL Lab	22UEE443L	Sci Lab / MATLAB for Electrical and Electronic Measurements
22UEE442L	PCB Design Laboratory	22UEE444L	Aurdino & Rasberry PI based Projects

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-5 **CAY 2025-26 (160 Credits 2023-24 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	22UEE525C	Power System – II	3	3	0	0	50	50	100
2.	PCC	22UEE526C	Power Electronics	3	3	0	0	50	50	100
3.	PCC	22UEE520L	Power Electronics Laboratory	1	0	0	2	50	50	100
4.	PCC	22UEE521L	AutoCAD Electrical Laboratory	1	0	0	2	50	50	100
5.	PCC	22UEE522L	Logic Design Laboratory	1	0	0	2	50	50	100
6.	PEC	22UEE5xxE	Professional Elective Course – I	3	3	0	0	50	50	100
7.	OEC	22Uxx5xxN	Open Elective Course – I	3	3	0	0	50	50	100
8.	Proj	22UEE528P	Mini Project	2	0	0	4	50	50	100
9.	AEC	22UHS522C	Quantitative Aptitude and Professional Skills	2	2	0	0	50	50	100
10.	HSMC	22UBT523C	Environmental Studies	1	1	0	0	50	50	100
11.	MC	22UHS001M	Yoga	0	0	0	2	25	-	25
		22UHS002M	National Service Scheme	0	0	0	2	25	-	25
		22UHS003M	Physical Education and Sports	0	0	0	2	25	-	25
		22UHS004M	Music	0	0	0	2	25	-	25
			Total	20						

Semester-6 **CAY 2025-26 (160 Credits 2023-24 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	22UEE625C	Power System – III	3	3	0	0	50	50	100
2.	PCC	22UEE626C	Control Systems	4	4	0	0	50	50	100
3.	PCC	22UEE627C	Digital Signal Processing	4	4	0	0	50	50	100
4.	PCC	22UEE620L	Power System – II Laboratory	1	0	0	2	50	50	100
5.	PCC	22UEE621L	Control Systems Laboratory	1	0	0	2	50	50	100
6.	PEC	22UEE6xxE	Professional Elective Course – II	3	3	0	0	50	50	100
7.	OEC	22Uxx6xxN	Open Elective Course – II	3	3	0	0	50	50	100
8.	HSMC	22UHS600C	Indian Knowledge Systems	1	1	0	0	50	50	100
9.	MC	22UHS001M	Yoga	0	0	0	2	25	-	25
		22UHS002M	National Service Scheme	0	0	0	2	25	-	25
		22UHS003M	Physical Education and Sports	0	0	0	2	25	-	25
		22UHS004M	Music	0	0	0	2	25	-	25
			Total	20						

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-7[#] **CAY 2026-27 (160 Credits 2023-24 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	22UEE725C/825C	Power System – IV	3	3	0	0	50	50	100
2.	PEC	22UEE7xxE/8xxE	Professional Elective Course-III	3	3	0	0	50	50	100
3.	PEC	22UEE7xxE/8xxE	Professional Elective Course-IV	3	3	0	0	50	50	100
4.	Proj	22UEE728P /828P	Project Work	12	0	0	12	50	50	100
5.	HSMC	22UHS721C/821C	Research Methodology and IPR	3	3	0	0	50	50	100
			Total	24						

Semester-8[#] **CAY 2026-27 (160 Credits 2023-24 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	INT	22UEE825I/725I	Internship	10	0	0	--	50	50	100
2.	AEC	22UEE7xxO/8xxO	MOOCs*	3	--	--	--	--	--	--
3.	OEC	22UEE7xxO/8xxO	MOOCs*	3	--	--	--	--	--	--
			Total	16						

[#] Semester 7 & 8 are flippable (swapped)

Criteria for Bachelor Degree: A student has to earn a minimum of 160 credits for award of Bachelor of Engineering (B.E) at the end of fourth year.

Criteria for Bachelor Degree (Honors): A student has to earn a minimum of 178 [160 + 18 (online)] credits for award of Bachelor of Engineering (B.E honors) at the end of fourth year.

Criteria for Bachelor Degree (with minor degree): A student has to earn a minimum of 178 [160 + 18* (blended)] credits for award of Bachelor of Engineering (B.E) with major and minor streams at the end of fourth year.

Subject Code Indication for Elective Courses: 21UEE741E
21-Year of course introduction/ modification: UEE–UG in E&EE: 7–Semester in which course is being offered: 4-Electives group number: 1-Serial number of course in elective group: E-Elective course

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-5

List of subjects for Professional Elective Course – I (Sem-V)		
1.	22UEE511E	Electrical Machine Design
2.	22UEE512E	Electrical Engineering Materials
3.	22UEE513E	Testing and Commissioning of Electrical Equipment
4.	22UEE514E	Data Base management Systems
5.	22UEE515E	Operation Research
6.	22UEE516E	Field Theory

List of subjects for Open Elective Course I		
1.		Electric Vehicle
2.		Fundamentals of Wind Energy Conversion System

Semester-6

List of subjects for Professional Elective Course – II (Sem-VI)		
1.	22UEE621E	Integration of Distributed Generation
2.	22UEE622E	Automotive Electronics
3.	22UEE623E	Intelligent Instrumentation
4.	22UEE624E	VLSI Design
5.	22UEE625E	Electric Machine Drives
6.	22UEE626E	Modern Control Theory

List of subjects for Open Elective Course II		
1.		Electrical Safety for Engineers
2.		Energy Storage Systems

Semester-7

List of subjects for Professional Elective Course – III (Sem-VII)		
1.	22UEE731E	Smart Grids
2.	22UEE732E	Electric Vehicles
3.	22UEE733E	Solar Photovoltaic System Design
4.	22UEE734E	Reactive Power Management
5.	22UEE735E	Power System Planning
6.	22UEE736E	HVDC Transmission

List of subjects for Professional Elective Course – IV (Sem-VII)		
1.	22UEE741E	Flexible AC Transmission Systems
2.	22UEE742E	Battery Management Systems
3.	22UEE743E	Energy Conservation, Audit and DSM
4.	22UEE744E	Energy Efficient Motors
5.	22UEE745E	Wind Energy Conversion Systems
6.	22UEE746E	AI Applications to Power Systems

Syllabus for

B.E. I/II - Semester

for academic year 2023 – 2024

(For students admitted to I year in 2023-24)

Syllabus for B.E- I/II Semester for academic year 2023 – 2024

(For students admitted to I year in 2023-24)

22UEE136B	**Renewable Energy Sources**	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

Course Objectives:

- To identify the parameters required for solar, wind, biomass, geothermal and ocean energy conversion systems.
- To apply and analyze concepts and theory related to solar, wind, biomass, geothermal and ocean energy conversion systems.
- To derive power output of solar and wind energy conversion systems based on the corresponding solar irradiation and wind speed respectively.
- To analyze pros and cons of solar, wind, biomass, geothermal and ocean energy conversion systems.

UNIT – I	**(10 Hours)**
Introduction to Energy Sources: Classification of energy resources, conventional energy resources – availability and their limitations; non-conventional energy resources – classification, advantages, limitations; comparison of conventional and non-conventional energy resources. **Solar Energy Basics:** Introduction, solar constant, basic sun-earth angles – definitions and their representation; solar radiation geometry, solar radiation data measuring instruments – Pyranometer and Pyrheliometer.	
UNIT – II	**(10 Hours)**
Solar Thermal Systems: Principle of conversion of solar radiation into heat, solar water heaters (Flat plate collectors); solar cookers – box type, concentrating dish type; solar driers, solar still. **Solar Electric Systems:** Solar thermal electric power generation – solar pond and concentrating solar collector (parabolic trough, parabolic dish, central tower collector), advantages and disadvantages; solar photovoltaic – solar cell fundamentals, module, panel and array; solar PV systems – street lighting, domestic lighting and solar water pumping systems.	
UNIT – III	**(10 Hours)**
Wind Energy: Wind and its properties, history of wind energy, basic principles of Wind Energy Conversion Systems (WECS), wind data measuring instrument, classification of WECS, parts of a WECS, power in the wind; Vertical axis wind turbine generator - Savinous and Darrius types, advantages and limitations of WECS. **Biomass Energy:** Introduction, photosynthesis process, biomass conversion technologies, biomass gasification – principle and working of gasifiers; biogas - production of biogas, factors affecting biogas generation; types of biogas plants–KVIC and Janata model.	
UNIT – IV	**(10 Hours)**
Geothermal Energy: Introduction, classification, conversion technologies, applications, advantages and limitations of geothermal resources.	

Energy from Ocean:
Principle of tidal power, components of Tidal Power Plant (TPP), classification, advantages and limitations of TPP.
Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, types of OTEC power generation, block diagram, applications, advantages and limitations.

Reference Books:

1. B. H. Khan, "Conventional Energy Resources", Tata McGraw-Hill Education Private Limited, New Delhi, 3rd Edition, 2007.
2. G. D. Rai, "Non-conventional Energy sources", Khanna Publication, 4th Edition, 2015.
3. G. N. Tiwari and M K. Ghosal, "Fundamentals of Renewable Energy Resources", Alpha Science International Ltd, 1st Edition, 2007.
4. Shobh Nath Singh, "Non-Conventional Energy Resources", Pearson Education, 2nd Edition 2018.
5. Bent Sorensen, "Renewable Energy", Academic Press, 5th Edition, 2017 (e-book).
6. David Buchla, Thomas Kissell and Thomas Floyd, "Renewable Energy Systems", Pearson, 1st Edition, 2014 (e-book).
7. Roland Wengenmayr, Thomas Buhrke, "Renewable Energy: Sustainable Energy Concepts for the Future", Wiley-VCH, 2nd Edition, 2008 (e-book).

Course Outcomes:

After completion of the course the students will be able to,

1. Identify electrical and mechanical devices of solar, wind, biomass, geothermal and ocean energy conversion systems.
2. Measure performance parameters related to solar, wind, biomass, geothermal and ocean energy conversion systems.
3. Compute the power generation of wind and solar energy correspond to variable data.
4. Compare the features of solar, wind, biomass, geothermal and ocean energy conversion systems.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE136B.1	3	1	1			1	1	1		1	1	1	3	1	
2	22UEE136B.2	3	1	1	1		1	1	1		1		1	2	3	
3	22UEE136B.3	3	2	3	1							1	1	1	1	
4	22UEE136B.4	3	3	3	2				1				1	1		1

Syllabus for B.E- I/II Semester for academic year 2023 – 2024

(For students admitted to I year in 2023-24)

22UEE115C	**Elements of Electrical Engineering**	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

Course Objectives:

- To identify various components of Hydel, Thermal and Nuclear power plants and explain the overall operation of the power plants
- To make use of the basic concepts of magnetic circuits, electromagnetism, single phase & three phase circuits and apply them to analyse given electrical circuit.
- To make use of mesh current analysis and node voltage analysis to find the current and voltages of a given electric circuit.
- To calculate different parameters related to magnetic circuits, single phase & three phase AC circuits and energy consumption.
-

UNIT – I	**(10 Hours)**
Electrical Power Generation: Hydel plant, thermal plant, nuclear plant - working principle, site selection parameters, merits and demerits. **Electromagnetism:** Faraday's laws of electromagnetic induction, Lenz's law, Fleming's rules, statically and dynamically induced emf, concepts of self and mutual inductance, coefficient of coupling, energy stored in magnetic field.	
UNIT – II	**(10 Hours)**
DC Circuits: Ohm's law and Kirchhoff's laws, analysis of series, parallel and series-parallel circuits, current and voltage sources, source transformation and shifting, dependent and independent sources, mesh current analysis, node voltage analysis.	
UNIT – III	**(10 Hours)**
Single-Phase AC Circuits: Generation of sinusoidal voltage, average and rms values, form factor and peak factor, phasor representation of alternating quantities, analysis of R, L, C, R-L, R-C, R-L-C circuits with phasor diagrams, real power, reactive power, apparent power, power factor, series, parallel and series-parallel circuits. **Three-Phase AC Circuits:** Advantage of 3-phase system, generation of 3-phase power, relationship between line and phase values of balanced star and delta connections, power in balanced 3-phase circuits, measurement of 3-phase power by 2-wattmeter method.	
UNIT – IV	**(10 Hours)**
Domestic Wiring: Requirements, Types of wiring, Two way and three way control of loads. **Electrical Energy Calculation:** Power rating of household appliances, two-part electricity tariff, calculation of electricity bill for domestic consumers. **Electrical Safety Measures:** Equipment: Types of equipment, voltage and current issues, safety. Human: Electric shock, effect of shock on body, factors affecting severity of shock, safety precautions.	
Reference Books: 1. B.L Theraja, "Fundamentals of Electrical Engineering and Electronics", S. Chand Publications, 27th Edition, 2014. 2. D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 10th Edition, 2019. 3. Edward Hughes, "Electrical and Electronic Technology", Pearson Publications, 10th Edition, 2010.	

4. Rajendra Prasad, "Fundamentals of Electrical Engineering", 2nd Edition, PHI Learning, 2009.
5. V.N.Mittle & A.Mittal, "Basic Electrical Engineering", Tata McGraw-Hill Education, 2005
6. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", 2nd Edition, Pearson Publications, 2017.

Course outcomes:

After completion of the course the students will be able to,

1. Suggest suitable site for Hydro –electric, Thermal and Nuclear power plants by understanding the working principle and pros & cons
2. Apply the fundamental concepts of electromagnetism to assess the parameters of magnetic circuits
3. Apply electric circuit theorems to DC and AC (single phase and three phase) circuits to determine current, voltage, and power in various branches
4. Identify the safety aspects in different types of wiring mechanisms and evaluate the energy consumption in domestic loads

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE115C.1	3											1	1		
2	22UEE115C.2	3	2	2	2								1	2		1
3	22UEE115C.3	3	3	2	2	1	1						1	1		
4	22UEE115C.4	3	3	1	3	1	1		1		1		2	1		1

Syllabus for B.E- I/II Semester for academic year 2023 – 2024

(For students admitted to I year in 2023-24)

22UEE116N	**Introduction to Electrical Engineering**	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

Course Objectives:

- To understand the working of Hydro –electric, Thermal and Nuclear power plants
- To determine current, voltage, and power in various branches by applying electric circuit theorems to DC and AC (single phase and three phase) circuits
- To analyze the working principle and construction to identify the suitable applications of DC generators, motors and transformers by identifying the specifications
- To identify the safety aspects in different types of wiring mechanisms and evaluate the energy consumption in domestic loads

UNIT – I	**(10 Hours)**
Introduction: General structure of electrical power systems using single line diagram approach. **Power Generation:** Hydel, thermal, nuclear power plants (block diagram approach). **DC Circuits:** Ohm's law and its limitations, KCL & KVL, series, parallel, series-parallel circuits. Simple Numerical.	
UNIT – II	**(10 Hours)**
AC. Fundamentals: Equation of AC voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor (only definitions), voltage and current relationship with phasor diagrams in R, L, and C circuits, concept of impedance, analysis of R-L, R-C, R-L-C series circuits, active power, reactive power and apparent power, concept of power factor. (Simple Numerical). **Three Phase Circuits:** Generation of three phase AC quantity, advantages and limitations, star and delta connection, relationship between line and phase quantities (excluding proof)	
UNIT – III	**(10 Hours)**
DC Generator, DC Motor, Transformers: Working principle, construction, equations, types and classifications, specifications, applications, cost. Simple numerical.	
UNIT – IV	**(10 Hours)**
Domestic Wiring: Requirements, Types of wiring, Two way and three way control of loads. **Electrical Energy Calculation:** Power rating of household appliances, two-part electricity tariff, calculation of electricity bill for domestic consumers. **Electrical Safety Measures:** Equipment: Types of equipment, voltage and current issues, safety. Human: Electric shock, effect of shock on body, factors affecting severity of shock, safety precautions.	
Reference books: 1. B.L Theraja, "Fundamentals of Electrical Engineering and Electronics", S. Chand Publications, 27th Edition, 2014 2. D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 10th Edition, 2019.	

3. Edward Hughes, "Electrical and Electronic Technology", Pearson Publications, 10th Edition, 2010
4. Rajendra Prasad, "Fundamentals of Electrical Engineering", 2nd Edition, PHI Learning, 2009
5. V.N.Mittle & A.Mittal, "Basic Electrical Engineering", Tata McGraw-Hill Education, 2005

Course Outcomes:

After completion of the course the students will be able to,

1. Understand the working of Hydro –electric, Thermal and Nuclear power plants
2. Apply the electric circuit theorems to DC and AC (single phase and three phase) circuits to determine current, voltage, and power in various branches
3. Analyze the working principle and construction to identify the suitable applications of DC generators, motors and transformers by identifying the specifications
4. Identify the safety aspects in different types of wiring mechanisms and evaluate the energy consumption in domestic loads

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE116N.1	3											1	1		
2	22UEE116N.2	3	1	1	1								1	2		1
3	22UEE116N.3	3	1	1	1								1	2		1
4	22UEE116N.4	3	1	1	1				1		1		1	1		1

Syllabus for

B.E. III - Semester

for academic year 2024 – 2025

(For students admitted to I year in 2023-24)

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Mathematics –III for Electrical and Electronics Engineering Stream	
Course Code: 22UMA313C	**Credits: 03 (3:0:0:0)**
Teaching Hours/Week: 3:0:0:0	**Total Hours: 40 hours Theory**
CIE Marks: 50	**SEE Marks: 50**

Module-1: Ordinary Differential Equations of Higher Order (8 Hours)
Importance of higher-order ordinary differential equations in Electrical & Electronics Engineering applications. Higher-order linear ODEs with constant coefficients - Inverse differential operator, problems. Linear differential equations with variable Coefficients-Cauchy's and Legendre's differential equations - Problems. Applications: Application of linear differential equations to L-C circuit and L-C-R circuit. Self-Study: Finding the solution by the method of undetermined coefficients and method of variation of parameters.
Module-2: Curve Fitting, Correlation and Regressions (8 Hours)
Principles of least squares, Curve fitting by the method of least squares in the form $y = a + bx$, $y = a + bx + cx^2$, and $y = ab^x$ Correlation, Co-efficient of correlation, Lines of regression, Angle between regression lines, rank correlation **Self-study:** Fitting of curves in the form $y = ae^{bx}$
Module-3: Fourier Series (8 Hours)
Periodic functions, Dirchlet's condition, conditions for a Fourier series expansion, Fourier series of functions with period 2π and with arbitrary period. Half rang Fourier series. Practical harmonic analysis. Application to variation of periodic current. Self-study: Typical waveforms, complex form of Fourier series
Module-4: Fourier Transforms and Z – Transforms (8 Hours)
Infinite Fourier transforms: Definition, Fourier sine, and cosine transform. Inverse Fourier transforms Inverse Fourier cosine and sine transforms. Problems. **Z-transforms:** Definition, Standard z-transforms, Damping, and shifting rules, Problems. Inverse z-transform and applications to solve difference equations Self-study: Convolution theorems of Fourier and z-transforms
Module-5: Probability Distributions (8 Hours)
Review of basic probability theory, Random variables-discrete and continuous Probability distribution function, cumulative distribution function, Mathematical Expectation, mean and variance, Binomial, Poisson and Normal distribution (without proofs for mean and SD) – Problems. **Joint probability distribution:** Joint probability distributions for discrete random variable expectation, covariance and correlation. **Markov chain:** Introduction, Probability vectors, Stochastic Matrices, Fixed Points and Regular stochastic Matrices, Markov chain, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states. **Self-study:** Joint probability distributions for continuous random variable.

References:

Text Books:

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2021.
2. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 10th Eidition, 2018.

Reference Books:

3. V. Ramana, "Higher Engineering Mathematics", McGraw-Hill Education, 11th Edition, 2017.
4. Srimanta Pal & Subodh C.Bhunia, "Engineering Mathematics", Oxford University Press, 3rd Edition, 2016.
5. N.P Bali and Manish Goyal, "A Textbook of Engineering Mathematics", Laxmi Publications, 10th Edition, 2022.
6. C. Ray Wylie, Louis C. Barrett, "Advanced Engineering Mathematics", McGraw – Hill Book Company, New York, 6th Edition, 2017.
7. Gupta C.B, Sing S.R and Mukesh Kumar, "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education (India) Pvt. Ltd. 2015.
8. H.K. Dass and Er. Rajnish Verma, "Higher Engineering Mathematics" S.Chand Publication, 3rd Edition, 2014.
9. James Stewart: "Calculus" Cengage Publications, 7th Edition, 2019.

Course Outcomes:

After completion of the course the students will be able to,

1. Understand that physical systems can be described by differential equations and solve such equations
2. Make use of correlation and regression analysis to fit a suitable mathematical model for statistical data
3. Demonstrate the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing, and field theory.
4. To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z-Transform techniques to solve difference equations
5. Apply discrete and continuous probability distributions in analyzing the probability models arising in the engineering field.

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	2											1		
2	CO-2	3	2											1		
3	CO-3	3	2											1		
4	CO-4	3	2											1		
5	CO-5	3	2											1		

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Electric Circuit Analysis	
Course Code: 22UEE325C	**Credits: 04 (3:0:1:0)**
Teaching Hours/Week: 3:0:2:0	**Total Hours: 40 Hours Theory + 10 Lab Slots**
CIE Marks: 50	**SEE Marks: 50**

Module-1 (8 Hours)
The concepts and analysis techniques of AC and DC circuits: Voltage and current sources (Both ideal and practical sources), Series and parallel combinations of sources, Active and passive elements, Series and parallel combinations of elements, Voltage and current division, Source transformations, Delta- Star conversions, Nodal and mesh analysis for AC and DC circuits with independent and dependant sources, Concept of super-mesh and super node analysis, Duality.
Module-2 (8 Hours)
Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, (Problems with independent AC and DC sources only).
Module-3 (8 Hours)
Resonance: Analysis of simple series RLC and parallel RLC circuits under resonances. Bandwidth and quality factor at resonance. **Transient Analysis:** Behaviour of circuit elements under switching action, Evaluation of initial conditions.
Module-4 (8 Hours)
Laplace Transformation: Laplace transformation (LT) and inverse Laplace transformation (ILT), Initial and Final value theorems, S-domain impedance and admittance, the s-domain models for initially charged capacitor and initially fluxed inductor, determination of the complete s-domain model for a given circuit, Circuit analysis using LT.
Module-5 (8 Hours)
Unbalanced Three Phase Systems: Analysis of three phase systems, (3-wire and 4-wire systems), calculation of real and reactive powers. **Two Port networks:**Short circuit admittance parameters, Open-circuit impedance parameters, transmission parameters.
Laboratory- Experiments
1. Study of the effect of Open and Short circuits in simple circuits. 2. Determination of resonant frequency, bandwidth, and Q of a series circuit. 3. Determination of resonant frequency, bandwidth, and Q of a parallel circuit. 4. Verification of Thevenin's theorem. 5. Verification of Norton's theorem. 6. Verification of Superposition theorem. 7. Verification of maximum Power transfer theorem. 8. Measurement of time constant of an RC circuit. 9. Calculation of and verification of ABCD parameters of two-port network. 10. Measurement of power in three phase Circuits using two-watt meter method.

References:

Text Books:

1. M.E. Van Valkenburg, "Network Analysis," Pearson Education, 3rd Edition, 2019.
2. William H. Hayt, Jr. Jack E. Kemmerly, Steven. M. Durbin, "Engineering Circuit Analysis", TMH, 8th Edition, 2013.
3. Charles K. Alexander, Matthew N. O. Sadiku, “Fundamentals of Electric Circuits,” McGraw Hill Publications, 5th Edition, 2013.

Reference Books:

4. Roy Chowdhary, "Network and Systems", 2nd Edition, New age International Publications, 2010.
5. Abhijit Chakrabarti, “Circuit Theory-Analysis and Synthesis”, 7th Edition, Dhanpat Rai Technical Publishers, 2016.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply basic concepts, laws and analyze DC and AC networks in time domain and Laplace domain.
2. Solve complex electric circuits using network theorems.
3. Analyze electric circuits under resonance and switching conditions.
4. Analyze 3-phase systems and two-port circuit behavior.

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	3	2	2									2	2	1
2	CO-2	3	3	2	2									2	2	1
3	CO-3	3	3	2	2									2	2	1
4	CO-4	3	3	2	2									2	2	1

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Analog Electronic Circuits	
Course Code: 22UEE326C	**Credits: 04 (3:0:1:0)**
Teaching Hours/Week: 3:0:2:0	**Total Hours: 40 Hours Theory + 10 Lab Slots**
CIE Marks: 50	**SEE Marks: 50**

Module-1 (8 Hours)
Diode Circuits: Introduction to the PN Junction diodes, diode clipping and clamping circuits. **Transistor Biasing and Stabilization:** The operating point, load line analysis, DC analysis and design of fixed bias circuit, emitter stabilized bias circuit, collector to base bias circuit, voltage divider bias circuit, modified DC bias with voltage feedback. Bias stabilization and stability factors for fixed bias circuit, collector to base bias circuit and voltage divider bias circuit, bias compensation, Transistor switching circuits.
Module-2 (8 Hours)
Transistor at Low Frequencies: Hybrid model, h-parameters for CE, CC and CB modes, mid-band analysis of single stage amplifier, simplified hybrid model, analysis for CE, CB and CC (emitter voltage follower circuit) modes, Millers Theorem and its dual, analysis for collector to base bias circuit and CE with un bypassed emitter resistance. **Transistor frequency response:** General frequency considerations, effect of various capacitors on frequency response, Miller effect capacitance, high frequency response, hybrid – pi model, CE short circuit current gain using hybrid pi model, multistage frequency effects.
Module-3 (8 Hours)
Multistage amplifiers: Cascade connection, analysis for CE-CC mode, CE-CE mode, CASCODE stage-unbypassed and bypassed emitter resistance modes, Darlington connection using h-parameter model. **Feedback Amplifiers:** Classification of feedback amplifiers, concept of feedback, general characteristics of negative feedback amplifiers, Input and output resistance with feedback of various feedback amplifiers, analysis of different practical feedback amplifier circuits.
Module-4 (8 Hours)
Power Amplifiers: Classification of power amplifiers, Analysis of class A, Class B, Class C and Class AB amplifiers, Distortion in power amplifiers, second harmonic distortion, harmonic distortion in Class B amplifiers, cross over distortion and elimination of cross over distortion. **Oscillators:** Concept of positive feedback, frequency of oscillation for RC phase oscillator, Wein Bridge oscillator, Tuned oscillator circuits, Hartley oscillator, Colpitt's oscillator, crystal oscillator and its types.
Module-5 (8 Hours)
FETs: Construction, working and characteristics of JFET and MOSFET (enhance and Depletion type), Biasing of JFET and MOSFET, Fixed bias configuration, self-bias configuration, voltage divider biasing, Analysis and design of JFET (only common source configuration with fixed bias) and enhanced mode MOSFET amplifier.
Laboratory- Experiments
1. Experiments on series, shunt and double ended clippers and clampers.

2. Design, simulation and Testing of Full wave – center tapped transformer type and Bridge type rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency.
3. Static Transistor characteristics for CE, CB and CC modes and determination of h parameters.
4. Frequency response of single stage BJT and FET RC coupled amplifier and determination of half power points, bandwidth, input and output impedances.
5. Design and testing of BJT -RC phase shift oscillator for given frequency of oscillation.
6. Design, simulation (MATLAB) and testing of Wien bridge oscillator for given frequency of oscillation
7. Design and testing of Hartley and Colpitt's oscillator for given frequency of oscillation
8. Determination of gain, input and output impedance of BJT Darlington emitter follower with and without bootstrapping.
9. Design and testing of Class A and Class B power amplifier and to determine conversion efficiency.
10. Design and simulation of Full wave – centre tapped transformer type and Bridge type rectifier circuits with and without Capacitor filter using MATLAB. Determination of ripple factor, regulation and efficiency.

References:

Text Books:

1. Jacob Milliman, Christos C. Halkias, Chetan D. Parikh, Integrated Electronics-Analog and Digital Circuits and Systems, 2ndEdition, Tata McGraw Hill Education Private Limited, New Delhi, 2015.
2. G. K. Mithall, Electronic Devices and Circuits, Khanna Publishers, New Delhi, 1998.
3. Electronic Devices and Circuit Theory, Robert L Boylestad and Louis Nashelsky, Pearson, 11th Edition, 2015
4. Electronic Devices and Circuits, Millman and Halkias, Mc Graw Hill, 4th Edition, 2015
5. Electronic Devices & Circuits, David A Bell, Oxford University Press, 5th Edition, 2008.

Reference Books:

6. Electronic Devices and Circuits, Anil K. Maini, ,VashaAgarval, Wiley, 1st Edition, 2009.
7. Electronic Devices and Circuits, S. Salivahanan, Suresh, Mc Graw Hill, 3rd Edition, 2013.
8. Fundamentals of Analog Circuits, Thomas L Floyd, Pearson, 2nd Edition, 2012.

Course Outcomes:

After completion of the course the students will be able to,

1. Demonstrate clipper and clamper circuits using diode.
2. Design and analyze various biasing circuits for transistor.
3. Evaluate the characteristics of transistor for different applications.
4. Design and analyze JFET and MOSFET circuits.

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	3	3	3								2		3	
2	CO-2	3	3	3	3								2		3	
3	CO-3	3	3	3	3								2		3	
4	CO-4	3	3	3	2								2		2	

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Transformers and Generators	
Course Code: 22UEE327C	**Credits: 03 (3:0:0:0)**
Teaching Hours/Week: 3:0:0:0	**Total Hours: 40 Hours Theory**
CIE Marks: 50	**SEE Marks: 50**

Module-1 (8 Hours)
Single phase Transformers: Necessity of transformer, principle of operation, Types and construction, EMF equation, equivalent circuit, Operation of practical transformer under no-load and on-load with phasor diagrams. Losses and methods of reducing losses, efficiency and condition for maximum efficiency. Polarity test, Sumpner's test. Open circuit and Short circuit tests, calculation of equivalent circuit parameters. Efficiency, voltage regulation and its significance. Numerical.
Module-2 (8 Hours)
Three-phase Transformers: Introduction, Constructional features of three-phase transformers. Transformer connection for three phase operation- Labelling of three-phase transformer terminals and vector groups, star/star, delta/delta and star/delta, delta/star. Scott connection and Phase conversion. **Parallel Operation of Transformers:** Necessity of Parallel operation, conditions for parallel operation- Single phase and three phase. Load sharing in case of similar and dissimilar transformers. Numerical. **Auto transformers and Tap changing transformers:** Construction, working principle, saving of copper and applications.
Module-3 (8 Hours)
Synchronous Generators: Construction, working, Armature windings, EMF equation. Distribution winding (K_d) and chorded coils (K_c), Harmonics-causes, reduction and elimination. Armature reaction, Synchronous reactance, Equivalent circuit. **Synchronous Generators Analysis:** Open circuit and short circuit characteristics, Assessment of reactance-short circuit ratio, Alternator on load. Voltage regulation. Voltage regulation by EMF and MMF methods. Excitation control for constant terminal voltage. Numerical.
Module-4 (8 Hours)
Synchronous Generators (Salient Pole): Effects of saliency, two-reaction theory, Parallel operation of generators and load sharing. Methods of Synchronization, Synchronizing power. **Performance of Synchronous Generators:** Power angle characteristic (salient and non salient pole), power angle diagram, reluctance power, Capability curve for large turbo generators. Hunting and damper windings. Numerical.
Module-5 (8 Hours)
Wind power Generator -Basic components of wind energy conversion system, types of wind generators- Horizontal and vertical axis. Advantages and disadvantages of WECS. **Solar power generator -** principle of solar cell, Basic Solar Photo voltaic, system for power generation, Advantages and disadvantages.

References:

Text Books:

1. I J Nagarath and DP Kothari, "Electrical machines", 5th - Edition, TMH, New Delhi, 2020
2. Ashfaq Hussain, "Electrical Machines", Dhanpat Rai & Co. Publications, 3rd Edition, 2017
3. P.S. Bhimbhra, "Electrical Machinery", Khanna publishers, 7th Edition 2018
4. G D Rai, Non-conventional Energy sources, Khanna Publishers, 2014.

Reference Books:

5. Mulukuntla S. Sarma, "Electric Machines", Cengage, 1st Edition, 2009.
6. Theodore Wildi, "Electrical Machines, Drives and Power systems", Pearson, 6th Edition, 2014.
7. P.S. Bhimbhra, "Generalized Theory of Electrical Machines", Khanna publishers, 2014
8. V.K Mehta, Rohit Mehta, "Principles of Electrical Machines", S Chand, 2nd Edition, 2009.
9. Web links and Video Lectures (e-Resources):
   https://nptel.ac.in/courses/108102146
   https://nptel.ac.in/courses/108105131
   https://nptel.ac.in/courses/108105155
   https://nptel.ac.in/courses/10810607

Course Outcomes:

After completion of the course the students will be able to,

1. Apply fundamental concepts of transformers and synchronous generators to analyze their construction, operation, performance parameters, and testing methods.
2. Analyze the working principles, equivalent circuits, and performance characteristics of transformers and synchronous generators under different operating conditions, including parallel operation and load sharing.
3. Evaluate the efficiency, voltage regulation, and synchronization of transformers and synchronous generators, while proposing optimization techniques to improve their performance.
4. Create innovative renewable energy-based solutions by integrating wind and solar power systems, while comparing their operational features and sustainable advantages.

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	3	1	2		1	1						3		1
2	CO-2	3	3	2	3		1	1						3		3
3	CO-3	3	3	3	2									3		
4	CO-4	3	2	3	2									3	2	

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Transformers and Generators Lab	
Course Code: 22UEE328L	**Credits: 01 (0:0:1:0)**
Teaching Hours/Week: 0:0:2:0	**Total Hours: 10 Lab Slots**
CIE Marks: 50	**SEE Marks: 50**

Experiments

1. Open Circuit and Short circuit tests on single phase step up or step-down transformer and pre- determination of (i) Efficiency and regulation (ii) Calculation of parameters of equivalent circuit.
2. Sumpner's test on similar transformers and determination of combined and individual transformer efficiency
3. Parallel operation of two dissimilar single-phase transformers of different kVA and determination of load.
4. Polarity test and connection of 3 single-phase transformers in star – delta and determination of efficiency and regulation under balanced resistive load.
5. Comparison of performance of 3 single-phase transformers in delta – delta and V – V (open delta) connection under load.
6. Separation of hysteresis and eddy current losses in single phase transformer. .
7. Investigate the voltage and current ratios of a multi-tapped transformer and verify the ideal transformer ratio
8. Voltage regulation of an alternator by EMF and MMF methods.
9. Power angle curve of synchronous generator or Direct load test on three phase synchronous generator to determine efficiency and regulation
10. Performance of synchronous generator connected to infinite bus, under constant power and variable excitation & vice - versa
11. Model transformer in Simscape for Automatic Voltage Regulation.
    Simulate power angle curve of generator in MATLAB.

References:

Text Books:

1. D. P. Kothari, B. S. Umre, "Laboratory Manual for Electrical Machines", 2nd edition, Wiley Publishers.
2. I J Nagarath and DP Kothari, "Electrical machines", 5th - Edition, TMH, New Delhi, 2020.
3. Ashfaq Hussain, "Electrical Machines", Dhanpat Rai & Co. Publications, 3rd Edition, 2017
4. P.S. Bhimra, "Electrical Machinery", Khanna publishers, 7th Edition 2018
5. P.S. Bhimra, "Generalized Theory of Electrical Machines", Khanna publishers, 2014

Reference Books:

6. Mulukuntla S. Sarma, "Electric Machines", Cengage, 1st Edition, 2009.
7. Theodore Wildi, "Electrical Machines, Drives and Power systems", Pearson, 6th Edition, 2014.
8. V.K Mehta, Rohit Mehta, "Principals of Electrical Machines", S Chand, 2nd Edition, 2009.
9. Web links and Video Lectures (e-Resources):
   i. https://nptel.ac.in/courses/108102146

ii. https://nptel.ac.in/courses/108105131
iii. https://nptel.ac.in/courses/108105155
iv. https://nptel.ac.in/courses/10810607

Course Outcomes:

After completion of the course the students will be able to,

1. Apply testing and analytical methods to evaluate the performance parameters of transformers and synchronous generators through practical experiments.
2. Analyze the operational characteristics and interconnections of transformers and synchronous generators, including parallel operation, efficiency, regulation, and load sharing under varying conditions.
3. Simulate advanced transformer and generator models using computational tools to study voltage regulation, power angle curves

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	2	1	2	2	1			3			1	3		2
2	CO-2	3	2	2	2	2	1			3			1	3		2
3	CO-3	3	2	3	2	3	2			3			1	3		2

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Digital Logic Circuits	
Course Code: 22UEE331C	**Credits: 03 (3:0:0:0)**
Teaching Hours/Week: 3:0:0:0	**Total Hours: 40 Hours Theory**
CIE Marks: 50	**SEE Marks: 50**

Module-1 (8 Hours)
Principles of Combinational Logic: Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3,4,5 variables, Incompletely specified functions (Don‘t care terms) Simplifying Max term equations, Quine-McCluskey minimization technique, Quine-McCluskey using don‘t care terms, Reduced prime implicants Tables.
Module-2 (8 Hours)
Analysis and Design of Combinational logic: General approach to combinational logic design, Decoders, BCD decoders, Encoders, digital multiplexers, Using multiplexers as Boolean function generators, Adders and subtractors, Cascading full adders, Look ahead carry, Binary comparators.
Module-3 (8 Hours)
Flip-Flops: Basic Bistable elements, Latches, Timing considerations, The master-slave flip-flops (pulse triggered flip-flops): SR flip-flops, JK flip-flops, Edge triggered flip- flops, Characteristic equations.
Module-4 (8 Hours)
Flip-Flops Applications: Registers, binary ripple counters, synchronous binary counters, Counters based on shift registers, Design of a synchronous counter, Design of a synchronous mod-n counter using clocked T, JK, D and SR flip-flops.
Module-5 (8 Hours)
Sequential Circuit Design: Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams, counter design. Memories: Read only and Read/Write Memories, Programmable ROM, EPROM, Flash memory.
References: **Text Books:** 1. John M Yarbrough, “Digital logic applications and design”, Thomson Learning, 2001. 2. Donald D Givone, “Digital Principles and design”, MC Graw Hill, 2002 3. Charles H Roth Jr, Larry L Kinney, “Fundamentals of logic design”, Cengage Learning, 7th Edition, 2020. **Reference Books:** 4. D.P.Kothari, J S Dhillon, “Digital circuits and design”, Pearson, 2016. 5. Morris Mano, “Digital Design”, PHI, 3rd Edition, 2019. 6. K.A. Navas, “Electronics Lab Manual”, Vol.1, PHI 5th Edition, 2015.
Course Outcomes: After completion of the course the students will be able to, 1. Minimize Boolean functions using different techniques. 2. Analyze and design combinational circuits 3. Analyze and design sequential logic circuits. 4. Model the behavior of sequential logic circuits and systems using Mealy and Moore machines.

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	2	3	2									2	2	2
2	CO-2	3	2	3	2									2	1	2
3	CO-3	3	2	2	2									2	2	1
4	CO-4	3	2	3	2									2	2	1

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Electrical Measurements and Instrumentation	
Course Code: 22UEE332C	**Credits: 03 (3:0:0:0)**
Teaching Hours/Week: 3:0:0:0	**Total Hours: 40 Hours Theory**
CIE Marks: 50	**SEE Marks: 50**

Module-1 (8 Hours)
Measurements and Measurement systems: Introduction, significance and methods of Measurements, Instruments and measurement systems, Mechanical, electrical and electronic instruments. Classification of instruments. Functions and applications of Measurement systems. Types of Instrumentation systems, information and signal processing. Elements of generalised measurement system. Input-output configurations of measuring instruments and measurement systems. Methods of correction for interfering and modifying inputs, errors in measurements, Accuracy and precision.
Module-2 (8 Hours)
Measurement of Resistance: Wheatstone's bridge, sensitivity, limitations. Kelvin's double bridge. Earth resistance measurement by fall of potential method and by using Megger. **Measurement of Inductance and Capacitance:** Sources and detectors, Maxwell's inductance and capacitance bridge, Hay's bridge, Anderson's bridge, Desauty's bridge, Schering bridge. Shielding of bridges. (Derivations and Numerical as applicable).
Module-3 (8 Hours)
Instrument Transformers: Introduction, Use of Instrument transformers. Burden on Instrument transformer. **Current transformer (CT):** Relationships in CT, Errors in CT, characteristics of CT, Causes and reduction of errors in CT, Construction and theory of CT. **Potential transformer (PT):** Difference between CT and PT, Relationships in PT, Errors in PT, characteristics of PT, reduction of errors in PT. **Magnetic measurements:** Introduction, measurement of flux/ flux density, magnetising force and leakage factor.
Module-4 (8 Hours)
Electronic and Digital Instruments: Introduction. Essentials of electronic instruments, Advantages of electronic instruments. True RMS reading voltmeter. Electronic multi-meters. Digital voltmeters (DVM) - Ramp type DVM, Integrating type DVM and Successive - approximation DVM. Q meter. Principle of working of electronic energy meter (with block diagram), extra features offered by present day meters and their significance in billing.
Module-5 (8 Hours)
Display Devices: Introduction, character formats, segment displays, Dot matrix displays, Bar graph displays. Cathode ray tubes, Light emitting diodes, Liquid crystal displays, Nixes, Incandescent, Fluorescent, Liquid vapour and Visual displays. **Recording Devices:** Introduction, Strip chart recorders, Galvanometer recorders, Null balance recorders, Potentiometer type recorders, Bridge type recorders, LVDT type recorders, Circular chart and xy recorders. Digital tape recording, Ultraviolet recorders. Electro Cardio Graph (ECG).

Text Books:

1. A.K. Sawhney, "Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai & Co, 19th Edition, 2020.
2. J. B. Gupta, "A Course in Electronics and Electrical Measurements and Instrumentation", S.K. Kataria & Sons, 14th edition, 2014.

Reference Books:

1. R.K. Rajput, S Chand, "Electrical and Electronic Measurements and Instrumentation", 5th Edition, 2012.
2. S.C. Bhargava, "Electrical Measuring Instruments and Measurements", BS Publications, 2013.
3. Cooper D and A.D. Heifrick, "Modern Electronic Instrumentation and Measuring Techniques", Pearson, First Edition, 2015.
4. David A Bell, "Electronic Instrumentation and Measurements", Oxford University, 3rd Edition, 2013.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify and categorize different types of measurement systems (e.g., analog, digital, mechanical, electrical) and describe their components (sensors, transducers, displays, etc.).
2. Demonstrate a solid understanding of the working principles and applications of Wheatstone bridge**,** Maxwell's bridge**,** Hay's bridge, Schering bridge, and other common bridge circuits used for measuring resistance, inductance, and capacitance.
3. Evaluate the characteristics and performance of the secondary circuit in CTs and VTs, including burden impedance, voltage drop, and how these factors influence measurement accuracy and protection performance.
4. Describe the different types of display devices, such as analog, digital, LED**,** LCD**,** Nixes, Incandescent, Fluorescent, Liquid vapour and Visual displays and explain their features, advantages, and limitations in the context of electrical measurements and instrumentation.

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	2	2								2	3	3	2	
2	CO-2	3	2	2	2							2	3	3	2	
3	CO-3	3	3	3	3		2					3	3	3	2	
4	CO-4	3	2	2	2							2	3	3	2	

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Electromagnetic Field Theory	
Course Code: 22UEE333C	**Credits: 03 (3:0:0:0)**
Teaching Hours/Week: 3:0:0:0	**Total Hours: 40 Hours Theory**
CIE Marks: 50	**SEE Marks: 50**

Module-1 (8 Hours)
Vector Analysis: Scalars and Vectors, Vector algebra, Cartesian co-ordinate system, Vector Components and unit vectors. Scalar field and Vector field. Dot product and Cross product, Gradient of a scalar field. Divergence and Curl of a vector field. Co – ordinate systems: cylindrical and spherical, relation between different coordinate systems. Expression for gradient, divergence and curl in rectangular, cylindrical and spherical co-ordinate systems. Numerical. **Electrostatics:** Coulomb's law, Electric field intensity and its evaluation for (i) point charge (ii) line charge (iii) surface charge (iv) volume charge distributions. Electric flux density, Gauss law and its applications. Maxwell's first equation (Electrostatics). Divergence theorem. Numerical.
Module-2 (8 Hours)
Energy and Potential: Energy expended in moving a point charge in an electric field. The line integral. Definition of potential difference and potential. The potential field of a point charge and of a system of charges. Potential gradient. The dipole. Energy density in the electrostatic field. Numerical. **Conductor and Dielectrics:** Current and current density. Continuity of current. Metallic conductors, conductor's properties and boundary conditions. Perfect dielectric materials, capacitance calculations. Parallel plate capacitor with two dielectrics with dielectric interface parallel to the conducting plates. Numerical.
Module-3 (8 Hours)
Poisson's and Laplace Equations: Derivations and problems, Uniqueness theorem. **Steady magnetic fields:** Biot - Savart's law, Ampere's circuital law. The Curl. Stokes theorem. Magnetic flux and flux density. Scalar and vector magnetic potentials. Numerical.
Module-4 (8 Hours)
Magnetic forces: Force on a moving charge and differential current element. Force between differential current elements. Force and torque on a closed circuit. Numerical. **Magnetic Materials and Magnetism:** Nature of magnetic materials, magnetisation and permeability. Magnetic boundary conditions. Magnetic circuit, inductance and mutual inductance. Numerical.
Module-5 (8 Hours)
Time Varying Fields and Maxwell's Equations: Faraday's law, Displacement current. Maxwell's equations in point form and integral form. Numerical. Uniform plane wave: **Electromagnetic radiation:** Near field—non-radiative and radiative, far field. Wave propagation in free space and in dielectrics. Pointing vector and power considerations. Propagation in good conductors, skin effect. Numerical.

References:

Text Books:

1. William H Hayt, Engineering Electromagnetics, McGraw Hill 8th Edition, 2014
2. Matthew N. O. Sadiku, Principles of Electromagnetics, Oxford 6th Edition, 2015

Reference Books:

3. David K. Cheng, Fundamentals of Engineering Electromagnetics Pearson 2014.
4. Ashutosh Pramanik, Electromagnetism -Theory (Volume -1) - Applications (Volume-2), PHI Learning 2014.
5. Bhag Guru, Electromagnetic Field Theory Fundamentals, Cambridge 2005.
6. Rohit Khurana Vikas, Electromagnetic Field Theory Publishing 1st Edition, 2014.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply vector calculus and coordinate transformation techniques to solve problems in vector fields, electrostatics, and magnetic fields, including numerical calculations.
2. Analyze energy, potential, and field interactions in systems involving conductors, dielectrics, magnetic materials, and electromagnetic waves to determine their properties and behaviour.
3. Evaluate the performance and correctness of field solutions, boundary conditions, and electromagnetic models using Maxwell's equations, theorems, and practical boundary conditions.
4. Create models, simulations, and solutions to demonstrate the behaviour of electrostatic, magnetic, and electromagnetic fields in real-world scenarios.

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	3		2	3							2	3	1	
2	CO-2	3	3	2	2		2	2					2	2	1	
3	CO-3	3	3		3	3	2	2					2		3	
4	CO-4	3	3	2	2	1	2	1	2	1	2	1	2			2

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Physics for Electronic Devices	
Course Code: 22UEE334C	**Credits: 03 (3:0:0:0)**
Teaching Hours/Week: 3:0:0:0	**Total Hours: 40 Hours Theory**
CIE Marks: 50	**SEE Marks: 50**

Module-1 (8 Hours)
Semiconductors: Bonding forces in solids, energy bands, metals, semiconductors and insulators, direct and indirect semiconductors, electrons and holes, intrinsic and extrinsic materials, conductivity and mobility, drift and resistance, effects of temperature and doping on mobility, Hall effect
Module-2 (8 Hours)
P-N JUNCTIONS: Forward and reverse bias junctions, Qualitative description of current flow at a junction, reverse bias and reverse bias breakdown, Zener breakdown, avalanche breakdown, Thermal runaway. **Optoelectronic Devices:** Photo diodes, current and voltage in illuminated junction, solar cells, photo detectors, light emitting diode, light emitting materials
Module-3 (8 Hours)
Bipolar Junction Transistor: Fundamentals of BJT operation, amplification with BJTs, BJT fabrication, the Coupled diode model (Ebers –Moll Model), switching operation of transistor, cutoff, saturation, switching cycle, specifications, drift in the base region, base narrowing, avalanche breakdown.
Module-4 (8 Hours)
Field Effect Transistors: Basic PN JFET operation, equivalent circuit and frequency limitation, MOSFET two terminal MOS structure, energy band diagram, ideal capacitance voltage characteristics and frequency effects, basic MOSFET operation, MOSFET structure, current-voltage characteristics.
Module-5 (8 Hours)
Fabrication of PN junction: Thermal oxidation, diffusion, rapid thermal processing, Ion implantation, chemical vapour deposition, photolithography, etching, metallization. **Integrated Circuits:** Background, evolution of ICs, CMOS process integration, integration of other circuit elements.
References: **Text Books:** 1. Ben. G. Streetman, Sanjay Kumar Banerjee, “Solid State Electronic Devices”, 7th Edition, Pearson Education 2016, ISBN 978-93-325-5508-2 2. Donald A Neamen, Dhrubes Biswas, “Semiconductor physics and Devices”, 4th Edition, MC Graw Hill Education 2012, ISBN 978-0-07-107010-2 **Reference Books:** 3. S.M. Sze, Kwok K Ng, “Physics of semiconductor devices”, 3rd edition, Wiley 2018. 4. Adir Bar-Lev, “Semiconductor and electronic devices”, 3rd Edition , PHI, 1993.
Course Outcomes: After completion of the course the students will be able to, 1. Apply the principle of PN junction in evaluating the characteristics of different types of semiconductor devices.

2. Compare the principle of operation of BJT and FET.
3. Analyze and interpret the fabrication process of BJT and FET.
4. Utilize the mathematical models of MOS transistors for circuits and systems.

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO.1	3	2	2	2								1		3	1
2	CO.2	3	2	2	3								1		3	
3	CO.3	3	2	3	2							1	1		2	
4	CO.4	3	2	3	2	1			1				1		3	1

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Social Connect and Responsibility	
Course Code: 22UHS317L	**Credits: 01 (0:0:0:1)**
Teaching Hours/Week: 0:0:0:4	**Total Hours: 50 Hours (Discussions and Activities)**
CIE Marks: 100	**SEE Marks: (No SEE – Only CIE)**

Module-1 (8 Hours)
Part I: Plantation and adoption of a tree: Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes**.**
Module-2 (8 Hours)
Part II: Heritage walk and crafts corner: Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - Objectives, Visit, Case Study, Report, Outcomes.
Module-3 (8 Hours)
Part III: Organic farming and waste management: Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – Objectives, Visit, case study, report, outcomes.
Module-4 (8 Hours)
Part IV: Water conservation: Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.
Module-5 (8 Hours)
Part V: Food walk: City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.
Course Outcomes: After completion of the course the students will be able to, 1. Apply sustainable practices in tree plantation, organic farming, and waste management to promote environmental conservation and campus sustainability. 2. Analyze the historical, cultural, and ecological significance of heritage sites, crafts, and water conservation practices to understand their impact on the community. 3. Evaluate the effectiveness of social and environmental initiatives like water conservation, organic farming, and culinary heritage in addressing local and global challenges. 4. Create innovative documentation such as photo blogs and documentaries that showcase environmental, cultural, and culinary practices, fostering awareness and responsibility.

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	2	2	2		3	3	2	2			2	2	3	
2	CO-2	2	3				3	3	3	2	2		3	1	3	
3	CO-3	3	2	2	2	1	3	3	3	2	2	2	3	2		1
4	CO-4	2	2	3	2	3	3	3	2	3	3	3	3	2	3	

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

SCI Lab/MATLAB for Transformers and Generators	
Course Code: 22UEE341L	**Credits: 01 (1:0:0:0)**
Teaching Hours/Week: 0:0:2:0	**Total Hours: 10 Lab Sessions**
CIE Marks: 50	**SEE Marks: 50**

List of Experiments

1. Open Circuit and Short circuit tests on single phase step up or step-down transformer and predetermination of (i) Efficiency and regulation (ii) Calculation of parameters of equivalent circuit.
2. Sumpner's test on similar transformers and determination of combined and individual transformer efficiency.
3. Parallel operation of two dissimilar single-phase transformers of different kVA and determination of load sharing and analytical verification given the Short circuit test data.
4. Separation of hysteresis and eddy current losses in single phase transformer.
5. Voltage regulation of an alternator by EMF and MMF methods.
6. Voltage regulation of an alternator by ZPF method.
7. Power angle curve of synchronous generator.
8. Slip test – Measurement of direct and quadrature axis reactance and predetermination of regulation of salient pole synchronous machines.

References:

Text Books:

1. D. P. Kothari, B. S. Umre, "Laboratory Manual for Electrical Machines", 2nd edition, Wiley Publishers.
2. I J Nagarath and DP Kothari, "Electrical machines", 5th - Edition, TMH, New Delhi, 2020.
3. Ashfaq Hussain, "Electrical Machines", Dhanpat Rai & Co. Publications, 3rd Edition, 2017
4. P.S. Bhimra, "Electrical Machinery", Khanna publishers, 7th Edition 2018
5. P.S. Bhimra, "Generalized Theory of Electrical Machines", Khanna publishers, 2014

Reference Books:

6. Mulukuntla S. Sarma, "Electric Machines", Cengage, 1st Edition, 2009.
7. Theodore Wildi, "Electrical Machines, Drives and Power systems", Pearson, 6th Edition, 2014.
8. V.K Mehta, Rohit Mehta, "Principals of Electrical Machines", S Chand, 2nd Edition, 2009.

Course Outcome

After completion of the course the students will be able to,

1. Select the suitable commands of Scilab / MATLAB to implement the experiments on transformers and generators
2. Analyze the performance of the transform and machine based on the results obtained
3. Create the alternate model for better performance of the machines and to conduct the comparative analysis.

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	2	1	3	2				1	1	1	2	2	1	2
2	CO-2	3	1	3	2	2				2	2	1	2	2	1	2
3	CO-3	3	1	1	2	1				1	1	1	1	2	1	2

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Circuit Laboratory using P Spice	
Course Code: 22UEE342L	**Credits: 01 (1:0:0:0)**
Teaching Hours/Week: 0:0:2:0	**Total Hours: 10 Lab Sessions**
CIE Marks: 50	**SEE Marks: 50**

List of Experiments

1. Simulate Series RL&RC circuit and observe phase difference between waveforms of voltage and current.
2. Simulation and verification of Kirchhoff's Current Law& Kirchhoff's Voltage Law.
3. Simulation of Mesh analysis for a given circuit.
4. Simulation of Nodal analysis for a given circuit.
5. Determination of Z&Y parameters of a given two-port network.
6. Simulation and verification of Superposition theorem.
7. Simulation and verification of Reciprocity theorem.
8. Simulation and verification of Thevenin's and Norton'stheorem.
9. Simulation and verification of Maximum Power Transfer theorem.
10. Simulation of Series and Parallel Resonance circuit

Course Outcome

After completion of the course the students will be able to,

1. Simulate various electric circuits using PSPICE software.
2. Analyze electric circuits in an intelligent manner.
3. Design electric circuits in an efficient way.

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	3	2	2	3								2	2	1
2	CO-2	3	3	2	2	3								2	2	1
3	CO-3	3	3	2	2	3								2	2	1

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

555 IC Laboratory	
Course Code: 22UEE343L	**Credits: 01 (1:0:0:0)**
Teaching Hours/Week: 0:0:2:0	**Total Hours: 10 Lab Sessions**
CIE Marks: 50	**SEE Marks: 50**

List of Experiments

1. Construct Astable Multivibrator circuit using IC-555 Timer.
2. Construct Mono-stable Multivibrator circuit using IC-555 Timer.
3. Construct and test Sequential timer using IC-555.
4. Generate Pulse Width Modulator (PWM) signal using IC-555 Timer.
5. Construct Burglar Alarm circuit using IC-555 Timer.
6. Construct and generate Frequency Shift Keying (FSK) signal using IC-555 Timer.
7. Construct and test Running LED circuit using IC-555 Timer.
8. Construct water level indicator using IC-555 Timer.
9. Construct continuity tester using IC-555 Timer.

References:

Text Books :

1. Cabe Satalic Atwel Essential 555 IC Design, l Publisher Pragmatic Bookshelf Latest update in 2021 (eBook and paperback formats available)
2. Paul Scherz and Simon Monk “Practical Electronics for Inventors" McGraw-Hill Education, 4th Edition (2023)
3. Walter G. Jung “IC Timer Cookbook" Publisher Newnes (Elsevier) Edition 2022

Reference Books

4. Forrest M. Mims “Timer Op Amp, and Optoelectronic Circuits & Projects” Master Publishing, Inc. Year: 2004
5. Charles Platt "Make: Electronics: Learning Through Discovery" Publisher Maker Media, Inc. Year: 2015 (2nd Edition)
6. Coughlin and Driscoll "Integrated Circuits: Theory and Applications" Publisher Prentice Hall Year: 2001
7. Dave Cutcher "Electronic Circuits for the Evil Genius" Publisher McGraw-Hill Education Year: 2005.

Course Outcome

After completion of the course the students will be able to,

1. Demonstrate an understanding of the internal architecture and operational modes of the 555 timer IC, including monostable, astable, and bistable configurations.
2. Design and implement basic circuits using the 555 timer IC for applications such as oscillators, pulse generators, and timers.
3. Develop skills to test, analyze, and troubleshoot 555 timer-based circuits using laboratory equipment such as oscilloscopes, function generators, and multimeters.

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	2	1	3					1	1	1	2	2	1	2
2	CO-2	3	1	3	2					2	2	1	2	2	1	2
3	CO-3	3	1	1	2					1	1	1	1	2	1	2

Syllabus for B.E. III - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Electric Hardware Laboratory	
Course Code: 22UEE344L	**Credits: 01 (1:0:0:0)**
Teaching Hours/Week: 0:0:2:0	**Total Hours: 10 Lab Sessions**
CIE Marks: 50	**SEE Marks: 50**

List of Experiments

1. Verification of KCL and KVL for DC Circuits.
2. Verification of KCL and KVL for AC Circuits.
3. Measurement of Current, Power and Power Factor of Incandescent Lamp, Fluorescent Lamp and LED Lamp.
4. Evaluate the loading effect of Voltmeter of electric circuits.
5. Measurement of Resistance using V-I method.
6. Measurement of Resistance and Inductance of a Choke coil using three voltmeter method.
7. Determination of Phase and Line quantities in three-phase star and delta connected loads.
8. Two-Way and Three-Way Control of Lamp and Formation of Truth Table.
9. Measurement of Earth Resistance using fall of potential method.
10. Determination of fuse characteristics.

References:

Text Books:

1. B.L Theraja, “Fundamentals of Electrical Engineering and Electronics”, S. Chand Publications, 27th Edition, 2014
2. D C Kulshreshtha, “Basic Electrical Engineering”, Tata McGraw Hill, 10th Edition, 2019
3. Edward Hughes, “Electrical and Electronic Technology”, Pearson Publications, 10th Edition, 2010
4. Rajendra Prasad, “Fundamentals of Electrical Engineering”, 2nd Edition, PHI Learning, 2009
5. V.N.Mittle & A.Mittal, “Basic Electrical Engineering”, Tata McGraw-Hill Education, 2005.

Course Outcomes:

After completion of the course the students will be able to,

1. Conduct and understand circuit rig up and verification of theoretical results with practical results.
2. Measure AC/ DC quantities of electrical appliance with loads.
3. Determine the characteristics of electrical protection devices

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	2							3			1	3		1
2	CO-2	3	2							3			1	3		1
3	CO-3	3	2							3			1	3		1

Syllabus for

B.E. IV – Semester

for academic year 2024 – 2025

(For students admitted to I year in 2023-24)

Syllabus for B.E. IV - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Electric Motors	
Course Code: 22UEE425C	**Credits: 03 (3:0:0:0)**
Teaching Hours/Week: 3:0:0:0	**Total Hours: 40 hours Theory**
CIE Marks: 50	**SEE Marks: 50**

Module – 1	**08 Hours**
DC Motors: Construction and working principle. Back E.M.F and its significance, Torque equation, Classification, Characteristics of shunt, series & compound motors, Speed control of shunt motor, Application of motors. **Losses and Efficiency**- Losses in DC motors, power flow diagram, efficiency, condition for maximum efficiency. **Testing of DC Motors**: Direct & indirect methods of testing of DC motors- Swinburne's test, Field's test, merits and demerits of tests. (numerical as applicable)	
Module – 2	**08 Hours**
Three Phase Induction Motors: Concept and generation of rotating magnetic field, Principle of operation, construction, types; squirrel-cage, slip-ring. Slip and its significance, Torque equation, torque-slip characteristic covering motoring, generating and braking regions of operation, Maximum torque, (numerical as applicable)	
Module – 3	**08 Hours**
Performance of Three-Phase Induction Motor: Phasor diagram of induction motor on no-load and on load, losses, efficiency, No-load and blocked rotor tests, equivalent circuit. Performance of the motor from the equivalent circuit. Cogging and crawling. High torque rotors-double cage and deep rotor bars. Induction motor working as induction generator, construction and working of doubly fed induction generator. (numerical as applicable)	
Module – 4	**08 Hours**
Starting and Speed Control of Three-Phase Induction Motors: Necessity of starter. Direct on line, Star-Delta, and autotransformer starting. Rotor resistance starting. Speed control by frequency. **Single-Phase Induction Motor:** Double revolving field theory and principle of operation. Construction and operation of split-phase, capacitor start and capacitor run and shaded pole motors. Comparison of single phase motors and applications. (numerical as applicable)	
Module – 5	**08 Hours**
Synchronous Motor: Principle of operation, phasor diagrams, torque and torque angle, effect of change in load, effect of change in excitation. V and inverted V curves. Synchronous condenser **Other Motors:** Construction and operation of Universal motor, AC servomotor, Linear induction motor, PMSM, SRM and BLDC.	
References:	

1. I J Nagarath and DP Kothari, “Electrical machines”, 5th - Edition, TMH, New Delhi, 2020
2. Ashfaq Hussain, “Electrical Machines”, Dhanpat Rai & Co. Publications, 3rd Edition, 2017
3. P.S. Bhimbhra, “Electrical Machinery”, Khanna publishers, 7th Edition 2018
4. P.S. Bhimbhra, “Generalized Theory of Electrical Machines”, Khanna publishers, 2014
5. B. L. Theraja, A. K. Theraja “Textbook of Electrical Technology: AC and DC Machines”,

S. Chand & Company, 2019.

6. Web links and Video Lectures (e-Resources):
   i. https://nptel.ac.in/courses/108102146
   ii. https://nptel.ac.in/courses/108105131
   iii. https://nptel.ac.in/courses/108105155
   iv. https://nptel.ac.in/courses/10810607

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze the construction and operation, classification and characteristics of DC Motors, Induction motors, Synchronous motors.
2. Test and evaluate to find efficiency, losses for DC motors, three phase induction motors and single phase IM.
3. Examine starting, running performances and different speed control methods and applications of three phase and single phase Induction motors.
4. Evaluate basic operation and performance of motors for different application and can select motors for different purposes.

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	1	2	3								1	3		1
2	CO-2	3	1	2	3								1	3		1
3	CO-3	3	1	2	3		1	1					1	3		1
4	CO-4	3	1	2	3		1	1					2	3		3

Syllabus for B.E. IV - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Transmission and Distribution	
Course Code: 22UEE426C	**Credits: 04 (4:0:0:0)**
Teaching Hours/Week: 4:0:0:0	**Total Hours: 50 hours Theory**
CIE Marks: 50	**SEE Marks: 50**

Module – 1	**10 Hours**
Introduction to Power System: Structure of electric power system: generation, transmission and distribution. Advantages of higher voltage transmission: HVAC, EHVAC, UHVAC and HVDC. Interconnection. Feeders, distributors and service mains. **Overhead Transmission Lines:** A brief introduction to types of supporting structures and line conductors - Conventional conductors; Aluminium Conductor steel reinforced (ACSR), All – aluminium alloy conductor (AAAC) and All – aluminium conductor (AAC). High temperature conductors; Thermal resistant aluminium alloy (ATI),Super thermal resistant aluminium alloy (ZTAI), Importance of sag, Sag calculation – supports at same and different levels, effect of wind and ice. **Overhead Line Insulators:** A brief introduction to types of insulators, material used-porcelain, toughened glass and polymer (composite). Potential distribution over a string of suspension insulators. String efficiency, Methods of increasing string efficiency. Arcing horns.	
Module – 2	**10 Hours**
Line Parameters: Introduction to line parameters- resistance, inductance and capacitance. Calculation of inductance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing. Calculation of capacitance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing.	
Module – 3	**10 Hours**
Performance of Transmission Lines: Classification of lines – short, medium and long. Current and voltage relations, line regulation in short length lines, medium length lines considering Nominal T and nominal circuits, and long lines considering hyperbolic form equations. Generalized circuit constants (ABCD) of a transmission line.	
Module – 4	**10 Hours**
Corona: Phenomena, disruptive and visual critical voltages, corona loss. Advantages and disadvantages of corona. Methods of reducing corona. **Underground Cable:** Types of cables, constructional features, insulation resistance, thermal rating, charging current, grading of cables – capacitance and inter-sheath. Dielectric loss. Comparison between ac and DC cables. Limitations of cables.	
Module – 5	**10 Hours**
Distribution: Primary AC distribution systems – Radial feeders, parallel feeders, loop feeders and interconnected network system. Secondary AC distribution systems – Three phase 4 wire system and single phase 2 wire distribution, AC distributors with concentrated loads. **Reliability and Quality of Distribution System:** Introduction, definition of reliability, failure, probability concepts, limitation of distribution systems, power quality, Reliability aids.	

Text Books:

1. Mehta V K and Rohit Mehta, " Principals of Power Systems", 4th edition, S Chand and Company Ltd, Publishers, New Delhi, 2019.
2. Soni, Gupta and Bhatnagar, "Power System Engineering", 5th edition, Dhanapat Rai and Co.(P) Ltd. Publishers, New Delhi, 2018.

Reference Books:

1. Sunil Rao, "Switchgear and Protection and Power Systems", 13th edition, Khanna Publishers, 2019.
2. J.B.Gupta, "Switchgear and Protection", (4nd edition), Katson Publisher, 2017.
3. Ravindarnath B, "Power System Protection and Switchgear", 2nd edition, New age International, Reprint 2016.

Course outcome:

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

1. Demonstrate a fundamental understanding of the mechanical components used in overhead and underground transmission lines, including conductors, towers, insulators, cables, supports, and junctions.
2. Estimate sag for equal and unequal supports with and without considering wind and ice loading.
3. Analyze and calculate the performance of short, medium and long transmission lines using simplified models for impedance and voltage regulation, and understand the primary effect of series impedance on power loss and voltage drop.
4. Demonstrate a thorough understanding of the basic concepts of electrical power distribution, including the components, structure, and operation of electrical distribution systems.

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	2	2			1	1				2	3	3	2	
2	CO-2	3	2	2	2			1				2	2	3	2	
3	CO-3	3	2	2	2		1	1				3	2	3	2	
4	CO-4	3	2	2	2		1	1				2	3	3	2	

Syllabus for B.E. IV - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Microcontrollers	
Course Code: 22UEE427C	**Credits: 04 (3:0:1:0)**
Teaching Hours/Week: 3:0:2:0	**Total Hours: 40 Hours Theory + 10 Lab Slots**
CIE Marks: 50	**SEE Marks: 50**

Module – 1	**8 Hours**
8051 Microcontroller Basics: Inside the Computer, Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins of 8051. Memory Address Decoding, 8031/51 Interfacing with External ROM And RAM.8051 Addressing Modes.	
Module – 2	**8 Hours**
Assembly Programming and Instruction of 8051: Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming.	
Module – 3	**8 Hours**
8051 Programming in C: Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051 C, Data conversion program in 8051 C, accessing code ROM space in 8051C, Data serialization using 8051C. **8051 Timer Programming in Assembly and C:** Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C.	
Module – 4	**8 Hours**
8051 Interrupt Programming in Assembly and C: 8051 interrupts, Programming timer, external hardware, serial communication interrupt, Interrupt priority in 8051/52, Interrupt programming in C. **Interfacing:** LCD interfacing, Keyboard interfacing. **ADC, DAC and Sensor Interfacing:** ADC 0808 interfacing to 8051, Serial ADC Max1112 ADC interfacing to 8051, DAC interfacing, Sensor interfacing and signal conditioning.	
Module – 5	**8 Hours**
Motor Control: Relay, PWM, DC and Stepper Motor: Relays and opt isolators, stepper motorinterfacing, DC motor interfacing and PWM. **Introduction to the RaspberryPi:** Basics of RaspberryPi, Hardware layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python.	

Practical Component of IPCC	
Sl No.	**Experiments**
Note: For the experiments 1 to 6, 8051 assembly programming is to be used.	
1	Arithmetic instructions: Addition, subtraction, multiplication and division. Square using MATLAB/simulink.
2	Data transfer – Program for block data movement, sorting, exchanging, finding

	largest element in an array.
3	Up/Down BCD/ Binary Counters
4	Boolean and logical instructions (bit manipulation).
5	Code conversion programs – BCD to ASCII, ASCII to BCD, ASCII to decimal, Decimal to ASCII, Hexa.
6	Programs to generate delay, Programs using serial port and on-chip timer/counters.
Note: Single chip solution for interfacing 8051 and RaspberryPi is to be with C and Python Programs for the following experiments.	
7	Simulate and test a PWM controlled DC motor using Simscape.
8	Stepper motor interface for direction and speed control.
9	Alphanumerical LCD panel interface.
10	Generate different waveforms: Sine, Square, Triangular, Ramp using DAC interface.

Suggested Learning Resources:

Books

1. Muhammad Ali Mazadi, The 8051 Microcontroller and Embedded Systems Using Assembly and C, Pearson, 2nd Edition, 2008.
2. Kenneth Ayala, Cengage, The 8051 Microcontroller, 3rd Edition, 2005.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, Pearson, 1st Edition, 2012.

Web links and Video Lectures (e-Resources):

- NPTEL course on 8051 microcontrollers: **https://nptel.ac.in/courses/108105102**
- You tube videos on 8051 microcontrollers
- 8051 programming online course: Complete 8051 Microcontroller Programming Course in Udemy

Course Outcomes:

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

1. Discuss the architecture of 8051 microcontroller and discuss the instruction set.
2. Formulate and analyze the assembly and C language programs in data movement, arithmetic, logical, branching operation and other operations.
3. Design and apply the knowledge of on-chip peripherals and also interface external hardware to microcontroller.
4. Understand the basics of RaspberryPi and its programming using Python.

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	1	2	1	1				1			2		2	
2	CO-2	3	2	1	1	3				1			1		3	
3	CO-3	3	3	2	2	3				1			1		2	
4	CO-4	3	3	2	2	3				1			2		3	1

Syllabus for B.E. IV - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Electric Motors Lab	
Course Code: 22UEE428L	**Credits: 01 (0:0:1:0)**
Teaching Hours/Week: 0:0:2:0	**Total Hours: 10 Lab Slots**
CIE Marks: 50	**SEE Marks: 50**

List of Experiments

1. Load test on DC shunt motor to draw speed-torque and horse power-efficiency characteristics.
2. Speed control of DC shunt motor by armature and field control.
3. Swin burne's Test on DC motor.
4. Regenerative test on DC shunt machines.
5. Load test on three phase induction motor.
6. No-load and Blocked rotor test on three phase induction motor to draw (i) equivalent circuit and (ii) circle diagram. Determination of performance parameters at different load conditions.
7. Load test on induction generator.
8. Load test on single phase induction motor to draw output versus torque, current, power and efficiency characteristics.
9. Conduct suitable tests to draw thee equivalent circuit of single phase induction motor and determine performance parameters.
10. Conduct an experiment to draw V and Inverted V curves of synchronous motor at no load and load conditions.
11. Analyze current and load torque of DC Shunt Motor using Simscape
12. Model 3-phase induction motor using MATLAB and Simulink

References:

1. D. P. Kothari, B. S. Umre, “Laboratory Manual for Electrical Machines”, 2nd edition, Wiley Publishers.
2. I J Nagarath and DP Kothari, “Electrical machines”, 5th - Edition, TMH, New Delhi, 2020
3. Ashfaq Hussain, “Electrical Machines”, Dhanpat Rai & Co. Publications, 3rd Edition, 2017
4. P.S. Bhimbhra, “Electrical Machinery”, Khanna publishers, 7th Edition 2018
5. Web links and Video Lectures (e-Resources):
   i. https://nptel.ac.in/courses/108102146
   ii. https://nptel.ac.in/courses/108105131
   iii. https://nptel.ac.in/courses/108105155
   iv. https://nptel.ac.in/courses/10810607

Course Outcomes:

After completion of the course the students will be able to,

1. Conduct and understand tests on machines to evaluate the performance characteristics of the DC motor, Induction motor, Synchronous motor.
2. Conduct and Understand Load test and speed control of an induction generator and DC motor using different methods.
3. Simulate and analyze the load current and torque of a DC shunt motor and Model 3-phase induction motor using MATLAB/Simscape.

Syllabus for B.E. IV - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	2		2					3			1	3		2
2	CO-2	3	2		2					3			1	3		2
3	CO-3	3	2		2	3				3			1	3		2

Syllabus for B.E. IV - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Electrical Power Generation and Economics	
Course Code: 22UEE431C	**Credits: 03 (3:0:0:0)**
Teaching Hours/Week: 3:0:0:0	**Total Hours: 40 Hours Theory**
CIE Marks: 50	**SEE Marks: 50**

Module – 1	**08 Hours**
Hydroelectric Power Plants: Hydrology, run off and stream flow, hydrograph, flow duration curve, Mass curve, reservoir capacity, dam storage. Hydrological cycle, merits and demerits of hydroelectric power plants, Selection of site. General arrangement of hydel plant, elements of the plant, Classification of the hydroelectric plants. Water turbines – Pelton wheel, Francis, Kaplan and propeller turbines. Characteristic of water turbines, Governing of turbines, selection of water turbines.	
Module – 2	**08 Hours**
Steam Power Plants: Introduction, Efficiency of steam plants, Merits and demerits of plants, selection of site. Working of steam plant, Power plant equipment and layout, Steam turbines, Fuels and fuel handling, Fuel combustion and combustion equipment, Coal burners, Fluidized bed combustion, Combustion control, Ash handling, Dust collection, Draught systems, Feed water, Steam power plant controls, plant auxiliaries. Diesel Power Plant: Introduction, Merits and demerits, selection of site, elements of diesel power plant, applications.	
Module – 3	**08 Hours**
Gas Turbine Power Plant: Introduction Merits and demerits, selection of site, Fuels for gas turbines, Elements of simple gas turbine power plant, Methods of improving thermal efficiency of a simple gas power plant, Closed cycle gas turbine power plants. Comparison of gas power plant with steam and diesel power plants. Nuclear Power Plants: Introduction, Economics of nuclear plants, Merits and demerits, selection of site, Nuclear reaction, Nuclear fission process, Nuclear chain reaction, Nuclear energy, Nuclear fuels, Nuclear plant and layout, Nuclear reactor and its control, Classification of reactors, power reactors in use, Effects of nuclear plants, Disposal of nuclear waste and effluent, shielding.	
Module – 4	**08 Hours**
Variable Load on Power Stations: Introduction, Structure of Electric Power System, Variable load on power station, Load Curves, Important Terms and Factors, Units Generated per Annum, Load Duration Curve, Types of Loads, Typical Demand and Diversity Factors, Load Curves and Selection of Generating Units, Important Points in the Selection of Units, Base Load and Peak Load on Power Station, Method of Meeting the Load, Interconnected Grid System.	
Module – 5	**08 Hours**
Economics of Power Generation, Cost of Electrical Energy, Expressions for Cost of Electrical Energy, Tariff, Desirable Characteristics of a Tariff, and Types of Tariff. Power factor, disadvantages of low power factor, causes, methods of improving power factor, Advantages of improved power factor, economics of power factor improvement and comparison of methods of improving the power factor.	

Text Books:

1. Mehta V K and Rohit Mehta, " Principals of Power Systems", 4th edition, S Chand and Company Ltd, Publishers, New Delhi, 2019.
2. Soni, Gupta and Bhatnagar, "Power System Engineering", 5th edition, Dhanapat Rai and Co.(P) Ltd. Publishers, New Delhi, 2018.

Reference Books:

4. S. N. Singh , "Electric Power Generation: Transmission And Distribution", 2nd Edition, PHI Learning Pvt. Ltd., 2015.
5. A. Chakrabarti, M L Soni, P V Gupta & U S Bhatnagar,"A Text Book on Power System Engineering", 2nd Edition, Dhanpat Rai & Co., Delhi , 2010

Course outcome:

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

1. Explain the working principles of hydroelectric and steam power generation systems, including turbines, generators, and auxiliary systems.
2. Identify and explain the functions of key reactor components, including the reactor core, control rods, coolant systems, pressure vessels, steam generators, and containment structures.
3. Interpret load curves and identify different types of loads. Understand how load variability affects the operation of power plants.
4. Discuss the components of a tariff structure, such as fixed charges**,** energy charges, and demand charges, and how they are designed to recover the cost of generation, transmission, and distribution.

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	2	2			1	1				2	3	3	2	
2	CO-2	3	2	2	2			1				2	3	3	2	
3	CO-3	3	3	3	3		1	1				3	3	3	2	
4	CO-4	3	2	2	2		1	1				2	3	3	2	

Syllabus for B.E. IV - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Op-Amps and LIC	
Course Code: 22UEE432C	**Credits: 03 (3:0:0:0)**
Teaching Hours/Week: 3:0:0:0	**Total Hours: 40 Hours Theory**
CIE Marks: 50	**SEE Marks: 50**

Module – 1	**08 Hours**
Operational amplifiers: Introduction, Block diagram representation of a typical Op-amp, schematic symbol, characteristics of an Op-amp, ideal op-amp, equivalent circuit, ideal voltage transfer curve, open loop configuration, differential amplifier, inverting & non-inverting amplifier, Op-amp with negative feedback; voltage series feedback amplifier-gain, input resistance, output resistance, voltage shunt feedback amplifier- gain, input resistance, output resistance. General Linear Applications: D.C. & A.C amplifiers, peaking amplifier, summing, scaling & averaging amplifier, inverting and non-inverting configuration, differential configuration, instrumentation amplifier	
Module – 2	**08 Hours**
Active Filters: First & Second order high pass & low pass Butterworth filters, higher order filters, Band pass filters, Band reject filters & all pass filters. DC Voltage Regulators: voltage regulator basics, voltage follower regulator, adjustable output regulator, LM317 & LM337 Integrated circuits regulators.	
Module – 3	**08 Hours**
Signal generators: Working and derivation of frequency of oscillation for Phase shift oscillator, Wien bridge oscillator, square wave generator, sawtooth wave generator, triangular wave generator, rectangular wave generator. Comparators & Converters: Basic comparator, zero crossing detector, inverting & non-inverting Schmitt trigger circuit, voltage to current converter with grounded load, current to voltage converter and basics of voltage to frequency and frequency to voltage converters.	
Module – 4	**08 Hours**
Signal processing circuits: Precision half wave & full wave rectifiers limiting circuits, clamping circuits, peak detectors, sample & hold circuits. A/D & D/A Converters: Basics, R-2R D/A Converter, Integrated circuit 8-bit D/A, successive approximation ADC, linear ramp ADC, dual slope ADC, digital ramp ADC	
Module – 5	**08 Hours**
Phase Locked Loop (PLL): Basic PLL, components, performance factors, applications of PLL IC 565. Timer: Internal architecture of 555 timer, Mono stable, Astable-multivibrators applications	

References:

Text Books:

1. Ramakant A Gayakwad, “Op-Amps and Linear Integrated Circuits” Pearson, 4th Edition, 2015
2. David A. Bell “Operational Amplifiers and Linear ICs” Oxford, 3rd Edition 2011
3. James M. Fiore “Operational Amplifiers and Linear Integrated Circuits, Theory and Application” Independently published (2016); eBook (Creative Commons Edition,

2020)

4. Roy Choudhury and Shail Jain “Linear Integrated Circuits", New Age International Publishers 5th Edition 2018

Reference Books:

5. S. Salivahanan , Linear Integrated Circuits, Wiley India, 2013
6. James M Fiore, Cengage, Op-Amps and Linear Integrated Circuits, Concept and Application, 2009
7. Op Amp Applications Handbook Walt Jung Publisher
   Robert F. Coughlin and Frederick F. Driscoll “Operational Amplifiers and Linear ICs" Publisher Pearson Education Edition, 6th Edition Year, 2020

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze the working principles of operational amplifiers and linear integrated circuits, including internal structure, characteristics, and key performance parameters.
2. Design and develop analog circuits such as amplifiers, oscillators, filters, and voltage regulators using Op-Amps and other linear ICs for real-world applications.
3. Apply Op-Amps and LICs in advanced applications, such as signal processing, data conversion, and communication systems, demonstrating innovation and problem-solving skills.
4. Create LIC-based systems such as oscillators, voltage regulators, and phase-locked loops (PLLs) for use in advanced analog and mixed-signal applications.

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	3	2	2		1	1					1	2		1
2	CO-2	3	2	2	2		1	1					1	2		2
3	CO-3	3	2	2	2		1	1					1	3	1	
4	CO-4	3	2	2	1		2	2					1	3	2	

Syllabus for B.E. IV - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Engineering Materials	
Course Code: 22UEE433C	**Credits: 03 (3:0:0:0)**
Teaching Hours/Week: 3:0:0:0	**Total Hours: 40 Hours Theory**
CIE Marks: 50	**SEE Marks: 50**

Module – 1	**08 Hours**
THEORY OF METALS Elementary Quantum mechanical ideas: Wave Particle Duality, Wave function, schrodinger's equation, operator notation, expected value, Infinite Potential Well: A confined electron. Finite Potential Barrier: Tunnelling Phenomenon. Free electron theory of metals: Electron in a linear solid, Fermi energy, Degenerate states, Number of States, Density of States, Population Density. Fermi-Dirac Distribution Function. Thermionic Emission: Richardson's Equation, Schottky Effect. Contact Potential: Fermi level at Equilibrium.	
Module – 2	**08 Hours**
FREE ELECTRON THEORY OF CONDUCTION IN METAL Crystalline structure: Simple cubic structure, Body centered cubic, Face centered cubic. Band Theory of Solids. Effective mass of Electron. Thermal Velocity of Electron at equilibrium. Electron mobility, conductivity and resistivity.	
Module – 3	**08 Hours**
DIELECTRICS and INSULATING MATERIALS DIELECTRICS: Dielectric, polarization under static fields- electronic ionic and dipolar polarizations, behavior of dielectrics in alternating fields, Factors influencing dielectric strength and capacitor materials. Insulating materials, complex dielectric constant, dipolar relaxation and dielectric loss.	
Module – 4	**08 Hours**
INSULATING MATERIALS: Inorganic materials (mica, glass, porcelain, asbestos), organic materials (paper, rubber, cotton silk fiber, wood, plastics and bakelite), resins and varnishes, liquid insulators (transformer oil) gaseous insulators (air, SF6 and nitrogen) and ageing of insulators.	
Module – 5	**08 Hours**
SEMICONDUCTORS Mechanism of conduction in semiconductors, density of carriers in intrinsic semiconductors, the energy gap, types of semiconductors. Hall effect, compound semiconductors, basic ideas of amorphous and organic semiconductors.	

References:

1. Bhadra Prasad Pokharel and Nava Raj Karki,"Electrical Engineering Materials", Sigma offset Press, Kamaladi, Kathmandu, Nepal, 2004.
2. R.C. Jaeger, "Introduction to Microelectronic Fabrication- Volume IV", Addison Wesley publishing Company, Inc., 1988.
3. Introduction to Electrical Engineering Materials 4th Edn. 2004 Edition by Indulkar C, S. Chand & Company Ltd-New Delhi.
4. Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi.

Syllabus for B.E. IV - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Course Outcomes:

After completion of the course the students will be able to,

1. Understand and explain wave particle duality, tunnelling phenomenon, electron theory of metals.
2. Analyze the free electron theory of conduction in metals.
3. Evaluate the polarization under static fields, behavior of dielectrics in alternating fields, Inorganic materials, organic materials), resins and varnishes, liquid insulators.
4. Understand and explain the mechanism of conduction in semiconductors.

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	3	2	2		1	1					1	2		1
2	CO-2	3	1	2	2		1	1					1	2		2
3	CO-3	3	1		2								1	1	1	
4	CO-4	2	1	2	1								1	1	2	

Syllabus for B.E. IV - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Object Oriented Programming	
Course Code: 22UEE434C	**Credits: 03 (3:0:0:0)**
Teaching Hours/Week: 3:0:0:0	**Total Hours: 40 Hours Theory**
CIE Marks: 50	**SEE Marks: 50**

Module – 1	**08 Hours**
Overview: Why Object-Oriented Programming in C++ - Native Types and Statements – Functions and Pointers Implementing ADTs in the Base Language.	
Module – 2	**08 Hours**
Basic Characteristics of OOP: Data Hiding and Member Functions- Object Creation and Destruction- Polymorphism data abstraction: Iterators and Containers.	
Module – 3	**08 Hours**
Advanced Programming: Templates, Generic Programming, and STL-Inheritance-Exceptions-OOP Using C++.	
Module – 4	**08 Hours**
Overview of Java: Data types, variables and arrays, operators, control statements, classes, objects, methods – Inheritance	
Module – 5	**08 Hours**
Exception Handling: Packages and Interfaces, Exception handling, Multithreaded programming, Strings, Input/Output	

References:

Text Books

1. Ira Pohl, “Object-Oriented Programming Using C++”, Pearson Education Asia, 2003
2. H.M.Deitel, P.J.Deitel, "Java : how to program", Fifth edition, Prentice Hall of India private limited, 2003.

Reference Books

1. Herbert Schildt, "The Java 2: Complete Reference", Fourth edition, TMH, 2002
2. Bjarne Stroustrup, “The C++ Programming Language”, Pearson Education, 2004.
3. Stanley B. Lippman and Josee Lajoie , “C++ Primer”, Pearson Education, 2003.
4. K.R.Venugopal, Rajkumar Buyya, T.Ravishankar, "Mastering C++", TMH, 2003.

Course Outcomes:

After completion of the course the students will be able to,

1. Formulate and apply the Object-Oriented concepts to solve basic engineering problems
2. Create user defined data type using constructor and destructor
3. Apply the concept of polymorphism and inheritance to map and solve real world problems
4. Develop applications using Object Oriented Programming Concepts.

Syllabus for B.E. IV - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	3	3	2	1							1	2		1
2	CO-2	3	2	1	2	1							1	2		2
3	CO-3	3	2	2	1	2							1	3	1	
4	CO-4	3	2	2	1	2							1	3	2	

Syllabus for B.E. IV - Semester for Academic Year 2024 – 2025

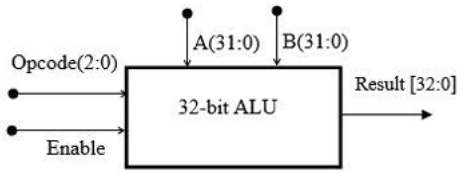
(For students admitted to I year in 2023-24)

Basics of-VHDL Lab	
Course Code: 22UEE441L	**Credits: 01 (0:0:1:0)**
Teaching Hours/Week: 0:0:2:0	**Total Hours: 10 Lab Slots**
CIE Marks: 50	**SEE Marks: 50**

List of Experiments

Note: Programming can be done using any compiler. Download the programs on a FPGA/CPLD board and performance testing may be done using 32 channel pattern generator and logic analyser, apart from verification by simulation with tools such as Altera/Modelsim or equivalent

1. Write Verilog program for the following combinational design along with test bench to verify the design:
   a. 2 to 4 decoder realization using NAND gates only (structural model)
   b. 8 to 3 encoder with priority encoder and without priority encoder (behavioral model)
   c. 8 to 1 Multiplexer using case statement and if statement
   d. 4 bit binary to gray code converter using 1 bit gray to binary converter 1 bit adder and subtractor.
2. Model in Verilog for a full adder and add functionality to perform logical operations of XOR, XNOR, AND and OR gates. Write test bench with appropriate input patterns to verify the modelled behavior.
3. Verilog 32 bit ALU shown in figure below and verify the functionality of ALU by selecting appropriate test patterns. The functionality of the ALU is shown in Table-1
   a. Write test bench to verify the functionality of the ALU considering all possible input patterns
   b. The enable signal will set the output to required functions if enabled, if disabled all the outputs are set to tri-state.
   c. The acknowledge signal is set high after every operation is complete.



ALU Top Level Diagram

Table:-1 ALU Functions

Opcode (2:0)	ALU Operation	Remarks	
000	A+B	Addition of two numbers	Both A and B are in two's complement format
001	A-B	Subtraction of two numbers	
010	A+1	Increment Accumulator by1	A is two's complement format
011	A-1	Decrement Accumulator by1	
100	A	True	Inputs cab in any format
101	A complement	Complement	

110	A OR B	Logical OR	
111	A AND B	Logical AND	

4. Write Verilog code for SR, D and JK and verify the flip flop
5. Write Verilog code for 4 bit BCD synchronous counter
6. Write Verilog code for counter with given input clock and check whether it works as clock divider performing division of clock by 2, 4, 8 and 16. Verify the functionality of the code.

PART B

Demonstration Experiments (For CIE)

7. Write a Verilog code to design a clock divider circuit that generates ½, 1/3rd, 1/4th, clock from given input clock. Port the design to FPGA and validate the functionality through CRO.
8. Interface a DC motor to FPGA and write Verilog code to change its speed and direction
9. Interface a stepper motor to FPGA and write Verilog code to control the stepper motor rotation which in turn may control a Robatic arm. External switches to be used for different controls like rotate the stepper motor:
    a. + N steps if the switch number 1 of a DIP switch is closed.
    b. +N/2 steps if switch number 2 of a DIP switch is closed.
    c. -N steps if switch number 3 of a DIP switch is closed etc.
10. Interface a DAC to FPGA and write Verilog code to generate a sine wave of frequency f KHz, ex f = 100 KHz, or 200 KHz etc,. Modify the code to down sample the frequency to f/2 KHz. Display the original and down sampled signals by connecting them to CRO.
11. Write Verilog code using FSM to simulate elevator operation.
12. Write Verilog code to convert an analog input signal of a sensor to digital form and to display the same on a suitable display like simple set of LEDs, 7 segment display digits or LCD display

Course Outcome

After completion of the course the students will be able to,

1. Write the VHDL/Verilog programs to simulate combinational circuits in data flow, behavioral, gate level abstractions.
2. Describe sequential circuits like flip-flops, counters, in behavioral descriptions and obtain simulated waveforms.
3. Synthesize combinational and sequential circuits on programmable ICs and test the hardware, Use FPGA/CPLD kits for downloading Verilog codes and check output.

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	2	1	3	2				1	1	1	2	2	1	2
2	CO-2	3	1	3	2	2				2	2	1	2	2	1	2
3	CO-3	3	1	1	2	1				1	1	1	1	2	1	2

Syllabus for B.E. IV - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

PCB Design Laboratory	
Course Code: 22UEE442L	**Credits: 1 (0:0:1:0)**
Teaching Hours/Week: 0:0:2:0	**Total Hours: 10 Lab Slots**
CIE Marks: 50	**SEE Marks: 50**

List of Experiments
1. Introduction Need for PCB, Types of PCBs: Single and Multilayer, Technology: Plated Through Hole, Surface Mount, PCB Material, Electronic Component packaging, PCB Designing, Fabrication, Electronic Design Automation Tools: proteus, Orcad or any other tool. 2. Introduction to proteus, Orcad or any other tool., Schematic entry / drawing, netlisting. layering, component foot print library selection & designing, design rules, component placing: Manual & automatic, track routing: automatic & manual, rules: track length, angle, joint & size, Autorouter setup. Design Rules. 3. PCB Designing Practice: PCB Designing of Basic and Analog Electronic Circuits, PCB Designing of Power Supplies. 4. Post Designing & PCB Fabrication Process: Printing the Design, Etching, Drilling, Interconnecting and Packaging electronic Circuits, Gerber Generation, Soldering and De- soldering, Component Mounting, PCB and Hardware Testing.
1. Introduction to PCB Design Tools-Use locally available tools like Proteus or KiCAD to create a basic schematic layout and familiarize with the interface. 2. Schematic Entry and Netlisting-Design a simple electronic circuit (e.g., LED flasher) and generate a netlist using the PCB design tool. 3. Manual and Automatic Component Placement-Place components for a simple analog circuit (e.g., amplifier) manually and compare with automatic placement results. 4. Track Routing and Design Rules-Route tracks for a basic circuit (e.g., rectifier circuit) and apply design rules such as track width, angle, and clearance. 5. Layering and Footprint Creation-Design a two-layer PCB and create custom footprints for components (e.g., a unique IC). 6. PCB Design of Basic Circuits-Design and simulate a simple logic circuit (e.g., OR gate, AND gate) and generate a PCB layout. 7. Design of Power Supply Circuit-Design and simulate a regulated power supply circuit (e.g., 5V DC supply) and generate Gerber files. 8. Printing and Etching of PCB-Print a PCB layout on a copper-clad board and etch it using a locally available etching solution like ferric chloride. 9. Drilling and Soldering-Drill holes for components using a handheld drill and solder basic components like resistors, capacitors, and ICs. 10. Soldering and Desoldering Practice-Practice soldering and desoldering components on a PCB without damaging the board or components. 11. Component Mounting and Packaging-Mount components on the etched PCB, package it, and prepare it for testing. 12. PCB Testing and Debugging-Test the designed circuit for continuity and functionality using a multimeter or an oscilloscope.

Text books:

1. Khandpur, R. S. Printed Circuit Boards: Design, Fabrication, Assembly and Testing. Tata McGraw-Hill, 2005.
2. Floyd, Thomas L. Electronic Devices and Circuit Theory. 11th ed., Pearson Education, 2015.
3. Rashid, Muhammad H. Introduction to PSpice Using OrCAD for Circuits and Electronics. 3rd ed., Pearson Education, 2017.

Reference books:

1. Coombs, Clyde F., and Happy T. Holden. Printed Circuits Handbook. 7th ed., McGraw-Hill, 2016.
2. Sharma, Monika. Basics of PCB Design and Fabrication. IK International Publishing House, 2019.
3. Williams, Timothy. EMC for Printed Circuit Boards: A Handbook of Design, Layout, and Troubleshooting. Newnes, 1996.
4. Buchanan, William D. PCB Design Using AutoCAD. Newnes, 1996.
   Pandya, Ashish. Electronics Lab Manual Volume II. S. Chand & Company, 2020.

Course Outcome

After completion of the course the students will be able to,

1. Apply knowledge of PCB technology and electronic design automation tools to design and develop PCBs for basic analog and power electronic circuits.
2. Analyse design rules, track routing techniques, and fabrication processes to ensure optimal PCB performance and compliance with industry standards.
3. Create and fabricate PCBs using advanced tools, including Gerber generation, component mounting, and hardware testing, to deliver functional prototypes.

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	3	2		3		2					2	3	2	
2	CO-2	3	3	2	3	3	2						2	3	1	
3	CO-3	3	3	3	3	3	2	2	1	1	1	2	3	2	1	1

Syllabus for B.E. IV - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Scilab / MATLAB for Electrical and Electronic Measurements	
Course Code: 22UEE443L	**Credits: 01 (0:0:1:0)**
Teaching Hours/Week: 0:0:2:0	**Total Hours: 10 Lab Slots**
CIE Marks: 50	**SEE Marks: 50**

List of Experiments

1. Design and Analysis of measurement of Resistance using Wheatstone and Kelvins double bridge.
2. Design and Analysis of measurement of Inductance using Schering and De-Sauty's Bridges.
3. Design and Analysis of measurement of Inductance using Maxwells and Anderson Bridges.
4. Design and Analysis of measurement of Frequency in Single and Three Phase Circuits.
5. Design and Analysis of measurement of Real Power, Reactive and Power Factor in Three Phase Circuits.
6. Design and Analysis of measurement of Energy in Three Phase Circuits.
7. Design and Analysis of measurement of Flux and Flux density.
8. Testing and Analysis of Current Transformer using Silsbees Deflection Method.
9. Testing and Analysis of Voltage Transformer using Silsbees Deflection Method.
10. Design and Analysis of True RMS Reading Volt Meters.
11. Design and Analysis of Integrating and Successive approximation type Digital Volt Meters.
12. Design and Analysis of Q Meter.

Course Outcome

After completion of the course the students will be able to,

1. Select the suitable commands of Scilab / MATLAB to implement the experiments on Electrical and Electronic Measurements
2. Analyze the performance of the measuring devices based on the results obtained
3. Design the measuring devices for better performance

CO-PO & PSO Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	2	1	3	2				1	1	1	2	2	1	2
2	CO-2	3	1	3	2	2				2	2	1	2	2	1	2
3	CO-3	3	1	1	2	1				1	1	1	1	2	1	2

Syllabus for B.E. IV - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Arduino and Raspberry Pi	
Course Code: 22UEE444L	**Credits: 01 (0:0:1:0)**
Teaching Hours/Week: 0:0:2:0	**Total Hours: 10 Lab Slots**
CIE Marks: 50	**SEE Marks: 50**

List of Experiments

1. (i). To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to 'turn ON' LED for 1 sec after every 2 seconds.
   (ii). To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to 'turn ON' LED when push button is pressed or at sensor detection.
2. (i). To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
   (ii). To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
3. To interface motor using relay with Arduino/Raspberry Pi and write a program to 'turn ON' motor when push button is pressed.
4. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to Smartphone using Bluetooth.
5. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from Smartphone using Bluetooth.
6. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thing speak cloud.
7. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thing speak cloud.
8. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thing speak cloud.
9. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.
10. Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.
11. Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.
12. Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.

Suggested Learning Resources:

1. https://www.arduino.cc
2. https://www.raspberrypi.org/
3. Course in Internet of Things (IOT) Using Arduino - NIELIT Delhi Centre
4. Vijay Madisetti, Arshdeep Bahga, Internet of Things. "A Hands on Approach", University Press
5. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs
6. Pethuru Raj and Anupama C Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
7. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi

8. Adrian McEwen, "Designing the Internet of Things", Wiley
9. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill

Course Outcome

After completion of the course the students will be able to,

1. Discuss the concepts of Internet of Things and its hardware and software components
2. Interface I/O devices, sensors & communication modules, Remotely monitor data and control devices
3. Develop real life IoT based projects.

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1	3	2	1		3				3	1	1	2		3	2
2	CO-2	3	1	3		3				3	2	1	2		3	2
3	CO-3	3	1	1		3				3	1	1	1		3	2

Syllabus for B.E. IV - Semester for Academic Year 2024 – 2025

(For students admitted to I year in 2023-24)

Universal Human Values (UHV)	
Course Code: 22UHS424C	**Credits: 01 (1:0:0:0)**
Teaching Hours/Week: 1:0:0:0	**Total hrs: 15 hrs Theory Session + 15 hrs Self study**
CIE Marks: 50	**SEE Marks: 50**

Module – 1	**03 Hours**
Introduction to Value Education Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity–Current Scenario, Method to Fulfill the Basic Human Aspirations	
Module – 2	**03 Hours**
Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health	
Module – 3	**03 Hours**
Harmony in the Family and Society: Harmony in the Family–the Basic Unit of Human Interaction, 'Trust'–the Foundational Value in Relationship, 'Respect'–as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order	
Module – 4	**03 Hours**
Harmony in the Nature /Existence: Understanding Harmony in the Nature,- Inter connectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.	
Module – 5	**03 Hours**
Implications of the Holistic Understanding– a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession	

References:

Text Book and Teachers Manual

1. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur,R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. The Teacher‟s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan VidyaPrakashan,Amarkantak,1999.
2. Human Values, A.N.Tripathi, New Age Intl. Publishers, New Delhi, 2004.

3. The Story of My Experiments with Truth-by Mohandas Karamchand Gandhi
4. Small is Beautiful -E. F.Schumacher
5. Slow is Beautiful –Cecile Andrews
6. Economy of Permanence –J C Kumarappa
7. Bharat Mein Angreji Raj–Pandit Sunderlal
8. Re discovering India – by Dharampal
9. Hind Swaraj or Indian HomeRule-by Mohandas K. Gandhi
10. India Wins Freedom-Maulana Abdul Kalam Azad
11. Vivekananda-Romain Rolland(English)
12. Gandhi-Romain Rolland(English)
13. Sussan George,1976, How the Other Half Dies ,Penguin Press. Reprinted 1986,1991
14. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. BehrensIII, 1972, Limits to Growth – Club of Rome's report, Universe Books.
15. A Nagraj, 1998,JeevanVidya EkParichay, Divya Path Sansthan, Amarkantak.
16. P LDhar, RRGaur, 1990, Science and Humanism, Common wealth Publishers.
17. ANTripathy,2003, Hum an Values, New Age International Publishers.
18. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.

Course Outcomes:

After completion of the course the students will be able to,

1. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
2. They would have better critical ability.
3. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
4. It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO-1							3	2	3			1			
2	CO-2						3	3	1	1			1			
3	CO-3						3	3	2	1			1			
4	CO-4						2	2	3	2			1			

Syllabus for

B.E. V - Semester

for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE525C	Power System - II	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Power System Representation:

Standard symbols of power system components, Single line diagram, Per unit system, Per unit impedance of 3 phase components, Change of base, Per unit impedance diagram, Advantages of per unit system calculations.

Symmetrical Three Phase Faults:

3 - phase short circuit at the terminals of unloaded generator, Sub transient, Transient and Steady state reactance, Transients on a transmission line, Short circuit currents and Reactance of synchronous machines on load and no load, Short circuit MVA.

UNIT – II	(10 Hours)

Symmetrical Components:

Definition of sequence components for 3-Phase unbalanced power systems, Operator “a” and its properties, Expressions for sequence components, Phase shift of symmetrical components in star delta transformer bank.

Sequence Networks:

3- Ph power in terms of sequence components, voltage drop due to sequence currents, sequence impedance and sequence networks of power system elements (Alternator, Transformer and Transmission line), positive, negative and zero sequence networks of power system elements.

UNIT – III	(10 Hours)

Unsymmetrical Fault at the Terminals Unloaded Generator:

L-G, L-L, L-L-G fault with and without fault impedance at the terminals of unloaded generator- derivation for connection of sequence network and fault currents.

Unsymmetrical Faults on Power Systems:

L-G, L-L, L-L-G faults on unloaded power systems, Open conductor faults in power system.

UNIT – IV	(10 Hours)

Transient Stability Analysis:

Classification of Power System Stability, Steady Rotor dynamics, Swing equation, Solution of swing equation by numerical techniques (Point by point method and Runge Kutta Method), Power angle equation for salient and non-salient pole synchronous machines.

Equal Area Criterion:

Equal area criterion – Stability analysis for sudden change in mechanical input power, 3- ph fault on Generator terminals and on transmission line, Expression for critical clearing angle, Methods to improve stability of power system.

Reference Books:

1. K. Uma Rao, “Computer Techniques and Models in Power Systems”, 1st Edition, I. K. International publishing house, 2014.
2. Nagarath and Kothari, “Modern Power System Analysis”, 3rd Edition, TMH, 2009.
3. W.D. Stevenson, “Elements of Power Systems Analysis”, 4th Edition, Mc.Graw Hill Publishers, 2013.
4. Hadi Saadat, “Power System Analysis”, TMH, Publishers, 4th Edition 2015.
5. V Neelakantan, "Power System Analysis & Stability”, Shiva Publishers, 2017.

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes:

After completion of the course the students will be able to,

1. Represent power system networks as per unit reactance diagrams on the base of given MVA and KV values
2. Assess phase & line components of voltage/current and to draw the positive, negative & sequence networks using symmetrical components
3. Carry out analysis of unsymmetrical faults (LG,LL,LLG) to determine fault currents when fault occurs at generator terminals/in power systems networks
4. Assess stability of power system under different types of disturbances by applying equal area criterion/solving the swing equation

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE525C.1	1	2	1	1							1	3		1
2	22UEE525C.2	1	3	2	1							1	3		1
3	22UEE525C.3	1	3	2	2							1	3		1
4	22UEE525C.4	1	3	2	2							1	3		1

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE526C	Power Electronics	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Introduction: Introduction to power electronics, block diagram of power electronic converter system, applications of power electronics. Types of power electronic circuits and their peripheral effects. **Power Transistors:** Introduction to Power BJT's and MOSFETs static characteristics, switching characteristics, switching limits, di**/**dt and dv**/**dt protection, cooling, heat sinks and snubber circuits. **Thyristors:** Introduction, static characteristics, two transistor model. Switching characteristics, di/dt and dv/dt protection.	
UNIT – II	**10 Hours**
Controlled Rectifiers: Introduction. Classification of rectifiers, principle of phase-controlled converter operation. Single- phase half wave, semi-converters and full converters and problems. Three-phase half-wave, semi-converters and full converters with R, R-L and RLE load. Performance evaluation of Rectifier.	
UNIT – III	**10 Hours**
Commutation Techniques: Introduction. Natural commutation, forced commutation: self-commutation, impulse commutation, resonant pulse commutation and complementary commutation. **DC–DC Converters:** Introduction. Principle Operation of dc-dc converter, Control Strategies: constant frequency, Variable Frequency, Four quadrant operation of dc-dc converter. Detailed analysis of Class-A chopper with numerical, Principle operations of Class-B, Class-C, Class-D and Class-E chopper. Flyback converters-Boost, Buck and Buck-Boost converters	
UNIT – IV	**10 Hours**
Inverters: Introduction. Types of inverters, performance parameters, principle of operation of half bridge and full bridge inverters with R and R-L load. Three phase inverter configurations to operate with 120^0- and 180^0-degree modes. Voltage control of single-phase inverters – single pulse width modulation, multiple pulse width modulation and sinusoidal pulse width modulation. **AC Voltage Controllers:** Introduction. Principle of ON-OFF control and phase control. Single-phase half wave and full-wave AC voltage controllers with resistive and inductive loads.	

Reference Books:

1. M. H. Rashid, "Power Electronics", 3rd Edition, P.H.I./Pearson, New Delhi, 2002.
2. Mohan, Undel and, Robbins, "Power Electronics" Wiley Edition, 2003
3. P. S. Bimbra, "Power Electronics", 4th Edition Khanna Publishers, 2009.
4. G. K. Dubey, S.R.Dorodla, A.Joshiand, R.M.K.Sinha, "Thyristorised Power Controllers",

New Age International Publishers, 2005.

5. M. D. Singh and Khanchandani K. B., "Power Electronics", 2nd Edition, Khanna Publisher, 2007

Course Outcomes:

After completion of the course the students will be able to,

1. Select suitable power switches, heat sinks and power converters for industrial applications.
2. Investigate performance of the power switches-based on switching characteristics, power converters based on performance indices
3. Compute power loss in power switches and power converters, average and rms voltage, average and rms currents, ripple factors and harmonic components of power converters
4. Design various components of power converters employed in industrial application

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE526C.1	3	3	2	1	1				1	1	2	3	2	1
2	22UEE526C.2	3	2	3	3	1				1	1	2	2	2	1
3	22UEE526C.3	3	3	3	2	1				1	1	2	2	3	1
4	22UEE526C.4	3	2	2	3	1				1	1	2	3	1	2

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE520L	Power Electronics Laboratory	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Static characteristic of SCR
2. Static and switching characteristic of IGBT and MOSFET
3. Static characteristic of TRIAC
4. Study of SCR firing circuit (R, RC, UJT)
5. Single phase half wave controlled rectifier with R and RL load
6. Single phase half controlled bridge rectifier with R and RL load
7. Single phase fully controlled bridge rectifier with R and RL load
8. Speed control of a separately excited D.C. motor using an IGBT an MOSFET chopper
9. Study of SCR commutation circuit
10. Half wave and Full wave bridge Inverter for R and RL load

Reference Books:

1. M. H. Rashid, “Power Electronics”, 3rd Edition, P.H.I./Pearson, New Delhi, 2002.
2. Mohan, Undel and, Robbins, “Power Electronics” Wiley Edition, 2003
3. P. S. Bimbra, “Power Electronics”, 4th Edition Khanna Publishers, 2009.
4. G. K. Dubey, S.R.Dorodla, A.Joshiand, R.M.K.Sinha, “Thyristorised Power Controllers”, New Age International Publishers, 2005.

Course Outcomes:

After completion of the course the students will be able to:

1. Select appropriate power equipment and instruments for realization of static and switching characteristics of MoSFET, SCR, IGBT and various power converter circuits
2. Conduct the experiments to evaluate performance characteristics of power devices and power electronics converter circuits
3. Interpret experiment results to investigate performance of various switching device and power converter

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE520L.1	3	1	2	2	1				2	2	2	3	2	1
2	22UEE520L.2	3	2	3	2	1				1	1	2	2	2	2
3	22UEE520L.3	3	1	2	2	1				1	2	2	2	2	1

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE521L	Auto CAD Electrical Laboratory	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Installation and Basic Commands of Auto CAD package
2. Drawing the basic diagrams for familiarization with Auto CAD
3. Drawing the cross sectional elevation of XLPE cable
4. Drawing the line diagram of DOL and Star – Delta starter
5. Drawing the half sectional elevation of pin insulator
6. Drawing the single line diagrams of a substations for the specified incoming and outgoing components
7. Drawing the layout of residential and workshop plans
8. Development and drawing of Simplex, Single layer Progressive Lap winding for DC machine with specified details
9. Development and drawing of Simplex, Single layer retrogressive Lap winding for DC machine with specified details
10. Development and drawing of Simplex, Double layer progressive Lap winding for DC machine with specified details
11. Development and drawing of Duplex, Single layer progressive Lap winding for DC machine with specified details
12. Development and drawing of Simplex, Single layer Progressive Wave winding for DC machine with specified details
13. Development and drawing of Simplex, Single layer retrogressive Wave winding for DC machine with specified details

Reference Books:

1. Devalapur, S F, "Textbook of Electrical Drafting", 7th Edition, Eastern Book Promoters, Belgaum, 2006
2. A.K. Sawhney, A Course in Electrical Machine Design, Dhanpat Rai & Co. (P) Limited (2017), ISBN-10: 8177001019, ISBN-13: 978-8177001013.
3. Mittle V.N., Arvind Mittal, Design of Electrical Machines, Standard Publishers Distributors (2009), ISBN-13: 978-81-8014-126-3, ISBN: 81-8014-126-8.

Course Outcomes:

After completion of the course the students will be able to:

1. Identify the tools and commands in the AutoCAD software
2. Draw and develop the engineering diagrams of the specified electrical components as per the proposed scale
3. Analyze the constructional details of electrical devices and components

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE521L.1	3	1	1		3	1				1	1	2	1	3
2	22UEE521L.2	3	2	2	1	3	1				1	2	2	1	3
3	22UEE521L.3	3	2	2	1	3	2				1	2	2		3

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE522L	Logic Design Laboratory	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Study and verify the truth table of logic gates
2. Simplify the given expression and to realize it using Basic gates and Universal gates Design and testing of diode clipping and clamping circuits.
3. Realization of
   i. Half Adder and Full Adder
   ii. Half Subtractor and Full Subtractor by using Basic gates and NAND gates
4. Design and set up the following circuit using IC 7483.
   i. A 4-bit binary parallel adder.
   ii. A 4-bit binary parallel subtractor
5. Design and realize the following using IC 7483.
   i. BCD to Excess- 3 Code
   ii. Excess-3 to BCD Code.
6. Realization of Binary to Gray code converter and vice versa
7. Design and set up the MUX & DEMUX circuits for following cases
   i. 4:1 Multiplexer (MUX) using only NAND gates.
   ii. 1:4 Demultiplexer(DE-MUX) using only NAND gates.
   iii. Verify the various functions of IC 74153(MUX) and IC 74139(DEMUX).
   iv. Half/Full Adder and Half/Full Subtractor using IC 74153.
8. Realization of One & Two Bit Comparator and study of 7485 magnitude comparator
9. Realization of decoder circuits using basic gates and to verify with IC 74LS139
10. Set up and test a 7-segment static display system to display numbers
11. Design Encoder circuits for following cases
    i. Decimal-to-BCD Encoder using IC 74147.
    ii. Hexadecimal-to-Binary Encoder using IC
    iii. 74148 Encoders and IC 74157 Multiplexer
12. Truth Table verification of following Flip-Flops
    i. RS Flip Flop
    ii. T type Flip Flop.
    iii. D type Flip Flop.
    iv. JK Flip Flop.
    v. JK Master Slave Flip Flop.
13. Realization and study of following types of Shift Registers.
    i. SISO (Serial in Serial out)
    ii. SIPO (Serial in Parallel out)
    iii. PIPO (Parallel in Parallel out)
    iv. PISO (Parallel in Serial out)
14. Design and set up of Sequence Generator using IC 7495
15. Realization and study of Ring and Johnson counters
16. Design and test 3-bit binary synchronous & asynchronous counters using flip-flop IC 7476 for the given sequence.

17. Design IC 74193 as a up/down counter
18. Design IC 7490 as a decade counter with BCD count sequence

Reference Books:

1. Morris Mano, Charles R. Kime, Logic and computer design fundamentals, Pearson Prentice Hall, 2004
2. Basavaraj,B., Digital fundamentals, New Delhi: Vikas Publishing House, 1999.
3. KandelLangholz, Digital Logic Design, Prentice Hall, 1988.
4. Rafiquzzaman& Chandra, Modern Computer Architecture, West Pub. Comp., 1988.
5. Zvi. Kohavi, Switching and Finite Automata Theory, Tata McGraw Hill, India, 2004.

Course Outcomes:

After completion of the course the students will be able to:

1. Draw the circuit, write the procedure and select the required components for a given experiment
2. Rig up the circuit, simplify the expressions using K-map and conduct experiments using the selected components to achieve desired results
3. Verify the results to write the inference and prepare a detailed report.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE522L.1	2	3									1	1	2	1
2	22UEE522L.2	3	1	2	1							1	1	3	1
3	22UEE522L.3	3	3	1	1	1			1			1	1	2	1

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Professional Elective Course – I

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE511E	Electrical Machine Design	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Principles of Electrical Machine Design: Introduction to design of electrical machines, limitations. Different types of materials and insulators used in electrical machines. **Design of DC Machines:** Output equation, choice of specific loadings and number of poles, design of main dimensions, armature slot dimensions and estimation of ampere turns.	
UNIT – II	**(10 Hours)**
Design of Transformers (Single phase and three phase): Output equation for single phase and three phase transformer, choice of specific loadings, expression tor volts/turn, determination of main dimensions of the core, types of windings and estimation of number of turns and cross sectional area of Primary and secondary coils and Design of tank and cooling tubes.	
UNIT – III	**(10 Hours)**
Design of Induction Motors: Output equation, choice of specific loadings, main dimensions of three phase induction motor, stator winding design, choice of length of the air gap, estimation of number of slots for the squirrel cage rotor, end ring current.	
UNIT – IV	**(10 Hours)**
Design of Synchronous Machines: Output equation, choice of specific loadings, short circuit ratio, design of main dimensions, armature slots and windings, slot details for the stator of salient and non salient pole synchronous machine. Design of rotor of salient pole synchronous machines, magnetic circuits and rotor of non salient pole machine.	

Reference Books:

1. A.K. Sawhney, A Course in Electrical Machine Design, Dhanpat Rai & Co. (P) Limited (2017), ISBN-10: 8177001019, ISBN-13: 978-8177001013.
2. Mittle V.N., Arvind Mittal, Design of Electrical Machines, Standard Publishers Distributors (2009), ISBN-13: 978-81-8014-126-3, ISBN: 81-8014-126-8.
3. V. Rajini, V. S. Nagarajan Electrical Machine Design Pearson Education (May 2018) ISBN-10: 9332585571, ISBN-13: 978-9332585577
4. K. G. Upadhyay Design of Electrical Machines (2010) Publisher: New Age International ISBN: 9788122422825, 8122422829.

Course Outcomes:

After completion of the course the students will be able to,

1. List and define different types of materials, parts, insulators, and the terms associated to electrical machines and its design terms.
2. Explain the specific loadings, design factors for electrical machines.
3. Calculate the design parameters of an electrical machine for a given set of specifications and necessary assumptions as per the Indian standards.
4. Derive the equations with respect to specific loadings, dimensions and other design aspects for electrical machines.

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE511E.1	3	2	2				1		1		1	3	1	1
2	22UEE511E.2	3	2	2				1		1		1	2	1	1
3	22UEE511E.3	3	3	3	3			1	2	1		1	1	1	1
4	22UEE511E.4	3	3	3	2			1		1		2	1	1	1

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE512E	Electrical Engineering Materials	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction to Electrical and Electronic Materials: Importance of materials, Classification of electrical and electronic materials, Scope of electrical and electronic materials, Requirement of Engineering materials, Operational requirements of electrical and electronic materials, Classification of solids on the basis of energy gap, Products – working principle and materials, Types of engineering materials, Levels of material structure. Spintronics and Spintronic materials, Ferromagnetic semiconductors, Left handed materials.	
UNIT – II	**(10 Hours)**
Conductors: Conductor materials, Factors affecting conductivity, Thermal conductivity, Heating effect of current, Thermoelectric effect, Seebeck effect, Thomson effect, Wiedemann – Franz law and Lorentz relation, Problems. **Conductive Materials and Applications:** Mechanically processed forms of electrical materials, Types of conducting materials, Low resistivity materials, High resistivity materials, Contact materials, Fusible materials, Filament materials, Carbon as filamentary and brush material, Material for conductors, cables, wires, solder, sheathing and sealing.	
UNIT – III	**(10 Hours)**
Dielectrics: Introduction to dielectric materials, classification of dielectric materials, Dielectric constant, Dielectric strength and Dielectric loss. Polarization, Mechanisms of polarization, Comparison of different polarization process, Factors affecting polarization, Spontaneous polarization, Behavior of polarization under impulse and frequency switching, Decay and build-up of polarization under ac field, Complex dielectric constant. **Insulating Materials:** Insulating materials and applications – Ceramic, Mica, Porcelain, Glass, Micanite and Glass bonded mica. Polymeric materials – Bakelite, Polyethylene. Natural and synthetic rubber. Paper. Choice of solid insulating material for different applications, Liquid insulating materials – Requirements, Transformer oil, Bubble theory, Aging of mineral insulating oils. Gaseous insulating Materials – Air, Nitrogen, Vacuum.	
UNIT – IV	**(10 Hours)**
Magnetic Materials: Origin of permanent magnetic dipole, Magnetic terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetism, Ferromagnetism, Antiferromagnetic and the corresponding materials. Ferrimagnetism and ferrites – properties and applications, Soft and hard ferrites. Curie temperature, Laws of magnetic materials. Magnetization curve, Initial, and maximum permeability. Hysteresis loop and loss, Eddy current loss. Types of magnetic materials, Soft and hard magnetic materials, High energy magnetic materials, Commercial grade soft and hard magnetic materials.	
Reference Books: 1. K.M. Gupta, Nishu Gupta, “Advanced Electrical and Electronics Materials; Processes and Applications”, 1st Edition, Scrivener Publishing, 2015 2. R.K. Shukla, Archana Singh, “Electronic Engineering Materials”, Tata McGraw Hill Education PVT Ltd, 2012.	

3. L Solymar, D. Walsh, R. R. A. Syms, “Electrical Properties of Materials”, 10th Edition, Oxford Publishing, 2018.
4. A.J. Dekker, “Electrical Engineering Materials”, 1st Edition, Pearson, 2015.

Course Outcomes:

After completion of the course the students will be able to,

1. Classify solids on the basis of energy gap, Products – working principle and materials,
2. Select Material for conductors, cables, wires, solder, sheathing and sealing.
3. Choose solid and liquid insulating materials for different applications.
4. Select magnetic materials: Soft and hard magnetic materials, High energy magnetic materials, Commercial grade soft and hard magnetic materials.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE512E.1	3						1		1		1		1	1
2	22UEE512E.2	3	1					1		1		1	2		1
3	22UEE512E.3	3		2		1		1	1	1		1	1	1	1
4	22UEE512E.4	3	3	2	2	1		1		1		2	1	1	1

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE513E	Testing and Commissioning of Electrical Equipment	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Electrical Tools, accessories: Tools, Accessories and Instruments required for Installation, Maintenance and Repair Work, India Electricity Rules, Safely Codes Causes and Prevention of Accidents, Artificial Respiration, Workmen's Safety Devices.

Transformers: Installation, Location Site Selection, Foundation Details, Code of Practice for Terminal Plates, Polarity and Phase Sequence, Oil Tanks, Drying of Winding sand General Inspection. Commissioning Tests As Per National and International Standards - Volts Ratio Earth Resistance, Oil Strength, Insulation Tests, Impulse Tests Polarizing Index, Load Temperature Rise Tests. Specific Tests for Determination of Performance Curves like Efficiencies, Regulation Etc., Determination Mechanical Stress Under Normal and Abnormal Conditions.

UNIT – II	(10 Hours)

Synchronous Machines: Specifications as per BIS Standards. Installation - Physical Inspection, Foundation Details, Alignments, Excitation Systems, Cooling and Control Gear, Drying Out. Commissioning Tests - Insulation, Resistance Measurement of Armature and Field Windings, Wave Form and Telephone Interference Tests, Line Charging Capacitance. Performance Tests -Various Tests to Estimate the Performance of Generator Operations, Slip Test, Maximum Lagging Current, Maximum Reluctance Power Tests, Sudden Short Circuit Tests, Transient Sub Transient Parameters, Measurement of Sequence Impedances, Capacitive Reactance, and Separation Of Losses, Temperature Rise Test, and Retardation Tests. Factory Tests -Gap Length, Magnetic Eccentricity, Balancing Vibrations, Bearing Performance

UNIT – III	(10 Hours)

Induction Motor: Specifications. Installation- Location of Motors and its Control Apparatus, Shaft Alignment for Various Coupling, Fitting of Pulleys and Coupling, Drying of Windings. Commissioning Tests -Mechanical Tests For Alignment, Air Gap Symmetry, Tests for Bearings, Vibrations and Balancing. Specific Tests -Performance and Temperature Raise Tests, Stray Load Losses, Shaft Alignment, Re-Writing and Special Duty Capability, Site Tes

UNIT – IV	(10 Hours)

Laying of Underground Cables: Inspection, Storage, Transportation and Handling of Cables, Cable Handing Equipment, Cable Laying Depths and Clearances from other Services such as Water Sewerage, Gas, Heating and other Mains, Series of Power and Telecommunication Cables and Coordination with these Services, Excavation of Trenches, Cable Jointing and Terminations Testing and Commissioning. Location of Faults using Megger, Effect of Open or Loose Neutral Connections, Provision of Proper Fuses on Service Lines and Their Effect on System, Causes and Dim, and Flickering Lights

Reference Books:

1. Testing, Commissioning, Operation and Maintenance of Electrical Equipment S. Rao Khanna Publishers 6th Edition, 19th Reprint, 2015
2. Testing and Commissioning of Electrical Equipment R.L.Chakrasali Prism Books Pvt Ltd 1st Edition,2014

3. Preventive Maintenance of Electrical Apparatus S.K.Sharotri Katson Publishing House 1st Edition, 1980
4. Handbook of Switchgears BHEL McGraw Hill 1st Edition, 2005
5. Transformers BHEL McGraw Hill 1st Edition, 2003
6. The J&P Transformer Book Martin J. Heathcote Newnes, 12th Edition, 1998

Course Outcomes:

After completion of the course the students will be able to,

1. Describe the process to plan, control and implement commissioning of electrical equipment's.
2. Differentiate the performance specifications of transformer and induction motor Synchronous machines and switchgear.
3. Demonstrate the routine tests for synchronous machine, induction motor, transformer & switchgears.
4. Describe corrective and preventive maintenance of electrical equipment's. Such as isolators, circuit breakers, induction motor and synchronous machines.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE513E.1	3						1		1		1		1	1
2	22UEE513E.2	3	1					1		1		1	2		1
3	22UEE513E.3	3		2		1		1	1	1		1	1	1	1
4	22UEE513E.4	3	3	2	2	1		1		1		2	1	1	1

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE514E	Data Base Management Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Introduction to Data Base Systems:

Managing data, a historical perspective, File systems versus DBMS, Advantages of DBMS, Describing and Storing Data in DBMS, Queries in DBMS, Transaction management, Structure of DBMS, People who work with databases.

Entity – Relationship Model:

Using high-Level Conceptual Data Models for Database Design, An example of Database Application, Entity types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY database, ER Diagrams, Naming Conventions and Design Issues.

UNIT – II	(10 Hours)

Relational Model and Relational Algebra:

Relational model concepts, relational model constraints and relational database schemes, update operations and dealing with Constraint Violations, Unary relational Operations, SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations, JOIN and DIVISION, Additional Relational Operations, examples of Queries in Relational algebra, relational database design using ER – to-Relational mapping.

SQL-The Relational Database Standard:

SQL Data definition and data types, specifying basic constraints in SQL, Schemes, Change statements in SQL, basic Queries in SQL, more complex SQL queries, Insert, Delete and Update statements in SQL, additional features of SQL, specifying general constraints as assertion, views (virtual tables) in SQL,

UNIT – III	(10 Hours)

Data Base Design:

Informal Design Guidelines for Relation Schemes, Functional Dependencies, Normal Forms based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Properties of Relational Decompositions, Algorithms for Relational Database Scheme Design, Multivalued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Inclusion Dependencies, Other Dependencies and Normal Forms.

UNIT – IV	(10 Hours)

Transaction Management:

The ACID properties, Transactions and Schedules, Concurrent Execution of transactions, Lock-based Concurrency control, performance of locking, Transaction support In SQL, Introduction to crash recovery; 2PL, ss for 4rializability and recoverability, Introduction to lock management, Lock Conversions, Dealing with Deadlocks, Specialized locking Techniques, Concurrency control without locking, Introduction to ARIES

Reference Books:

1. Silberschatz, Korth and Sudharahan, “Data Base System Concepts”, 5th Edition, Mc- Graw Hill, 2007
2. C.J. Date, A.Kannan, S.Swamynatham, “An Introduction to Database Systems”, 8th

Edition, Pearson Education, 2006.
3. Raghu Ramakrishnan and JohannesGehrke, “Database Management Systems”, 3rd Edition, McGraw Hill, 2004.
4. Elmasri and Navathe, “Fundamentals of Database Systems”, 4th Edition, Pearson Publication.

Course Outcomes:

After completion of the course the students will be able to,

1. Construct, manipulate and share data base, for various applications and Draw ER diagram.
2. Construct relational database schemes, perform relational algebra operations and ER- to Relational Mapping and queues from database using SQL.
3. Describe different normal forms and properties of relational decomposition.
4. Perform operations about Transaction Management and Crash recovery.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE514E.1	1						1		1		1	1	1	1
2	22UEE514E.2	1	1					1		1		1	1	1	1
3	22UEE514E.3	1		2		1		1	1	1		1	1	1	1
4	22UEE514E.4	1	1	2	2	1		1		1		2	1	1	1

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE515E	Operation Research	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction: Definition, OR models characteristics and phase of OR. Modeling with linear Programming: Two variable LP model, Graphical LP solution, model in equation from graphical to algebraic solution. **Simplex Method:** Special cases in Simplex method Big M method.	
UNIT – II	**(10 Hours)**
Duality: Definition of the dual problem primal to dual relationships, economic interpretation of duality, additional simplex algorithms. **Transportation Model:** Definition of transportation model basic feasible solution by different methods, finding optimal solutions, stepping stone method, MODI method, the assignment model, traveling salesman problem.	
UNIT – III	**(10 Hours)**
Advanced Linear Programming: Revised simplex method, dual simplex method, Bounded variable algorithm, parametric linear programming. **Game Theory:** Formulation of two – person, zero sum games, solving simple games, Max–Min, Min–Max principles, graphical solution procedure, solving by linear programming.	
UNIT – IV	**(10 Hours)**
Pert and CPM Techniques: Network representation, critical path computation, construction of the time schedule, variation under probabilistic models, crossing of simple networks, PERT calculation.	

Reference Books:

1. Hamdy A Thoha, "Operation Research an Introduction", 8th Edition, Pearson Education, 2008.
2. Fredrick S.Hillier and Lieverman "Operation Research Concept and Cases", 8th Edition, TMH, 2009.
3. S.D. Sharma, "Operation Research" 16th revised Edition, KNRN New Delhi 2009.
4. S. S. Rao, "Optimization Techniques", 3rd Edition, New age International Publishers, 2010.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify and develop operational research models from the algebraic linear equations for the real world problems.
2. Illustrate the mathematical tools that are needed to solve different optimization problems.
3. Find the feasible solution for real time algebraic equations.
4. Design the PERT network and obtain solution by CPM methods.

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE515E.1	3						1		1		1	3	1	1
2	22UEE515E.2	3	1					1		1		1	2	3	1
3	22UEE515E.3	3	3	2	2	1		1		1		1	1	1	1
4	22UEE515E.4	3	3	3	3	1		1	1	1		2	1	1	1

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE516E	Field Theory	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Coulomb's Law and Electric Field Intensity:
Experimental law of Coulomb, electric field intensity, field due to continuous volume charge distribution, field of a line charge, field of a sheet charge.
Electric Flux Density, Gauss' Law and Divergence:
Electric Flux Density, Gauss' law, divergence. Maxwell's first equation (Electrostatics), vector operator V and the divergence theorem.

UNIT – II	(10 Hours)

Energy and Potential: Energy expended in moving a point charge in an electric filed, the line integral, definition of potential difference and potential. The potential field of a point charge and system of charges, potential gradient, the dipole. Current and current density, Continuity of current.

UNIT – III	(10 Hours)

The Steady Magnetic Field: Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density.
Magnetic Forces:
Force on a moving charge and differential current element, force between differential current elements.

UNIT – IV	(10 Hours)

Materials and Inductance:
The nature of magnetic materials, Magnetization and permeability.
Time Varying Fields and Maxwell's Equations:
Faraday's law, displacement current, Maxwell's equation in point and Integral form.

Reference Books:

1. William H. Hayt Jr. and John A Buck, "Engineering Electromagnetics", 17th - Edition, Tata McGraw Hill, 2012.
2. John Karuss, Daniel A Fleisch, "Electromagnetics with Applications", 5th Edition McGraw-Hill,1999.
3. Edward C. Jordan and Keith G Balmain, "Electromagnetic Waves and Radiating Systems," II- Edition, Prentice Hall of India / Pearson Education, 1968. Reprint 2002.
4. Dr. D. Ganesh Rao, "Field Theory" Sanguine Technical Publishers, 1st Edition, 2014.

Course Outcomes:
After completion of the course the students will be able to,

1. Identify differential coordinate elements for the various electric and magnetic field applications
2. Estimate the flux density, field intensity of electric and magnetic fields for various charges
3. Analyze the time varying and static electric and magnetic fields for various charges
4. Select the suitable time varying maxwells equation for real-time application of electromagnetism.

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE516E.1	3	3	2	2	1							3		
2	22UEE516E.2	3	3	3	2	2							3		
3	22UEE516E.3	3	3	3	3	2							3		
4	22UEE516E.4	3	3	3	2	2							3	2	

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Open Elective Course-I

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

	Electric Vehicles	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hours**
Introduction to EV: Historical Background, Benefits of Using Evs, Overview of types of Evs and its Challenges, EV Motor Drive Technologies, EV Energy Source Technologies, EV Battery Charging Technologies, EV Vehicle to Grid **EV Subsystem**: EV Subsystems and Configurations, HEV Subsystems and Configurations. HEV Subsystems and Configurations, Motion and dynamic equations for vehicles	
UNIT – II	**10 Hours**
Energy Storage: Batteries-Overview of Batteries, Battery Parameters, Lead Acid Batteries, Lithium Batteries, Metal Air Batteries. Alternative and Novel Energy Sources-Solar Photovoltaics, Flywheels, Super Capacitors. Fuel Cells-Main issues in the fuel cell, Hydrogen Fuel Cells: Basic Principles, Fuel Cell Thermodynamics (Introduction)	
UNIT – III	**10 Hours**
Architecture of EV and HEV: Vehicle Power Plant and Transmission Characteristics- Introduction, Drive train Configuration, Vehicle power plant, Internal combustion engine, Electric Motor, The need for gearbox, Drive train tractive effort and vehicle speed, Vehicle performance. Basic Architecture of Hybrid Drive Trains and Analysis of Series Drive Train- The Hybrid Electric Vehicle (HEV), Energy Use in Conventional Vehicles, Energy Savings Potential ofHybrid Drivetrains, HEV Configurations, Series and parallel Hybrid System.	
UNIT – IV	**10 Hours**
Power Flow in HEVs: Introduction, Power Flow Control, Power Flow Control in Series Hybrid, Power Flow Control in Parallel Hybrid, Power Flow Control in series-Parallel Hybrid, Power Flow Control Complex HybridControl	

Reference Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

Course Outcomes:

After completion of the course the students will be able to,

1. list and define all the terms associated with electric and hybrid electric vehicles
2. Explain the types of EVs, power flow topologies, Motors, EV & HEV Sub systems
3. solve simple numerical problems on battery cell voltage fuel cells and flywheels
4. Compare and contrast the types of EVs based on applications, battery requirements and HEV configurations.

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE516N.1	3	1	1	1					1		1			
2	22UEE516N.2	3	2	1	1					1		1			
3	22UEE516N.3	3	3				1	1		1		1			
4	22UEE516N.4	3	3	3	2	1		1	1	1	1	2			

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

	Fundamentals of Wind Energy Conversion Systems	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hours**
Introduction: Historical Development (BC – 20th Century); Historical Development (20th Century – 1980s); Recent Developments (1980s – present); The Nature of the Wind, origin of wind; Wind Energy Potential; Offshore Wind Energy; Modern Wind Turbines; Wind Vs Conventional power generation.	
UNIT – II	**10 Hours**
Wind Resource Assessment: Introduction – Spatial variation, Time variation; Characteristics of steady wind; Weibull wind speed distribution function; Vertical profiles of steady wind; Wind rose; Energy content of wind; Resource assessment.	
UNIT – III	**10 Hours**
Aerodynamics: Introduction; Aerofoil – Two dimensional theory, Relative wind velocity, Stall control; Wind flow models – Wind flow pattern; Axial momentum theory; Momentum theory for rotating wake; Blade element theory, Strip theory; Tip losses and correction; Wind Machine Characteristics.	
UNIT – IV	**10 Hours**
Wind Turbines: Introduction; Classification of Wind Turbines; Wind Turbine Components; Basic principles of wind energy extraction; Extraction of wind turbine power (Numerical problems) - Weibull distribution-Wind power generation curve-Betz's Law-Modes of wind power generation.	

Reference Books:

1. Siraj Ahmed, "Wind Energy- Theory and Practice", Prentice Hall of India, New Delhi, 2010.
2. D. P. Kothari, S. Umashankar, Wind Energy Systems and Applications, Narosa publishers, 2017.
3. Khan B. H., Non-Conventional Energy Resources, Tata McGraw Hill, 2009.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply various parameters and features of wind energy conversion systems.
2. Analyse various concepts and theory related to wind energy conversion systems.
3. Evaluate/calculate various parameters related to wind energy conversion systems.
4. Relate/articulate the concepts and theories related to wind energy conversion systems.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE517N.1	3	2	2	2	1					1				
2	22UEE517N.2	3	3	3	2	2									
3	22UEE517N.3	3	2	3	3	2					1	1			
4	22UEE517N.4	3	3	3	2	2					1	1			

Syllabus for B.E V - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE528P	**Mini Project**	**02- Credits (0 : 0 : 4)**
Hours/Week : 0L+4P		CIE Marks : 50
Total Hours : 48		SEE Marks : 50

The Mini Project is a laboratory-oriented course designed to provide students with a platform to enhance their practical knowledge and technical skills through the development of small-scale systems or applications. It serves as a foundation for larger project work in the final year and beyond, encouraging creativity, collaboration, and hands-on learning.

Students will undertake a mini project either individually or in teams of up to four members, based on their abilities and the recommendations of the faculty mentor. Projects may be single-disciplinary or multidisciplinary, depending on the nature of the problem and the interests of the students.

The evaluation of the Mini Project will be carried out in two stages: Continuous Internal Evaluation (CIE) and Semester End Evaluation (SEE), each carrying 50 marks. The CIE will be conducted by a committee comprising the Head of the Department (HOD) or nominee, the Mini Project Coordinator, and the assigned faculty guide. Students will be assessed based on predefined rubrics that consider the relevance and clarity of the problem identified, technical depth, innovation, quality of implementation, teamwork, and effectiveness of presentation and communication. For the SEE, students are required to present their completed mini project to the Mini Project Evaluation Committee (MPEC), which includes the Mini Project Coordinator, HOD or nominee, and an External Examiner. The committee will evaluate the students based on the demonstration of the project, technical content, report quality, and overall presentation. This dual-stage evaluation ensures a comprehensive assessment of both the process and the outcome of the mini project work.

Course Outcomes

After undergoing the internship, students will be able to:

1. Identify engineering problems associated with electrical & electronics engineering and interdisciplinary research.
2. Analyze Data and interpret contemporary tools & resources to analyze / validate the solutions for engineering problems.
3. Communicate effectively and present the work to technical audience.
4. Prepare quality technical report with detailed analysis and representation of the executed work.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	**22UEE528P.1**	3	3	2	1	2	1	1	2	2	2	1	2	2	3
2	**22UEE528P.2**	2	3	3	2	3	1	1	1	1	1	1	2	2	3
3	**22UEE528P.3**							1	1	3	1	1	2	2	3
4	**22UEE528P.4**				1	2	1	1	1	2	1	1	2	2	3

Syllabus for

B.E. VI – Semester

for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE625C	Power System-III	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Network Topology: Introduction, Elementary Graph Theory, connected graph, sub graph Loop, Cut-set, Tree, Co- tree, Basic loops, Basic cut-set. Incidence Matrices: Element-node incidence matrix A (Bus-incidence matrix), Branch path incidence matrix K, Basic (Fundamental) cut-set incidence matrix B, Augmented cut-set matrix, Basic loop incidence matrix C, Augmented loop incidence matrix. Algorithm for formation of Bus Impedance Matrix, formation of Ybus by inspection method and singular transformation method.	
UNIT – II	**10 Hours**
Load Flow Studies: Introduction, Power Flow Equation, Classification of Buses **Gauss-Seidel Method:** Algorithm for GS method, Modification of algorithm to include PV buses, Q- limit violations, Acceleration of convergence and examples. **Newton-Raphson Method:** Introduction, Algorithm for NR method in polar coordinates and rectangular coordinates. Fast Decoupled Load Flow and examples.	
UNIT – III	**10 Hours**
Economic Operations of Power System: Introduction, Performance curves, Economic generation scheduling neglecting losses and generator limits, Economic generation including generator limits and neglecting losses, Iterative technique, Economic Dispatch Including Transmission Losses: Approximation penalty factor, Derivation of transmission loss formula. Introduction to optimal scheduling for hydrothermal plants. Problem formulation, solution procedure and algorithm	
UNIT – IV	**10 Hours**
Excitation Systems: Introduction, DC Excitation system, AC Excitation, static Excitation, Dynamic performance measures of Excitation system, control and protective functions: AC and DC regulators, excitation system stabilizing circuits, power system stabilizer, load compensation, under excitation limiter, over excitation limiter. Modeling of AVR, steady state and dynamic performance analysis of AVR.	

References:

1. Stag. G. W, EI-Abaid, A. H., “Computer Methods in Power System Analysis”, MED TECH, A Division of Scientific International 2019.
2. Olle I. Elgerd, “Electric Energy Systems Theory-An Introduction”, 2nd Edition McGraw-Hill Book Company.
3. Pai M.A., “Computer Techniques in Power System Analysis”, 2nd Edition, TMH, 2006.
4. K. Uma Rao, “Computer Techniques and Model in Power Systems”, 2nd Edition, I.K. International, 2014.
5. Singh L. P., “Advanced Power System Analysis and Dynamics”, 6th Edition, New Age International(P) Ltd, New Delhi, 2014.
6. Nagrath, I .J., and Kothari, D.P., “Modern Power System Analysis”, 4th Edition, TMH, 2011

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes:

After completion of the course the students will be able to,

1. Apply suitable network topology, primitive network, types of power system buses for load flow studies and economic scheduling algorithms and excitation systems for power system operation.
2. Investigate performance of the power systems using load flow analysis, optimum scheduling of thermal generators and excitation systems.
3. Calculate Y_{BUS} matrix, real power, reactive power and power flow for a given power systems using load flow studies and optimum cost of generation of thermal power plants using economic scheduling study and components of excitation systems.
4. Formulate the load flow models, economic scheduling of thermal generators.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE625C.1	3						1		1		1	2	1	
2	22UEE625C.2	3	1					1		1		1	1	2	1
3	22UEE625C.3	3	3	2	2	1		1		1		1	3	1	1
4	22UEE625C.4	3	3	3	3	1		1	1	1		2	3	1	

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE626C	Control Systems	04 - Credits (4 : 0 : 0)
Hours/Week : 04		CIE Marks : 50
Total Hours : 52		SEE Marks : 50

UNIT – I	(13 Hours)
Introduction: Objective of control system, Importance of control system, Examples of control system, Types of control systems, Open-loop and closed loop control systems, Feed-back and its effects on system performance characteristics. **Modeling of Physical Systems:** Models of mechanical systems, Electrical systems, and Electromechanical systems, Analogous systems: Force-voltage analogy, Force- current analogy. Usage of MATLAB command-line functions to verify the solution.	
UNIT – II	**(13 Hours)**
Block Diagrams and Signal Flow Graphs: Transfer function; Block diagram reduction, Signal flow graphs, Mason's gain formula, and Application of Mason's gain formula to block diagrams. **Time Response of Feedback Control Systems:** Standard test signals, Type and order of system, Steady state error and error constants, Unit-step response of first and second order systems, Time domain specifications. Usage of MATLAB command-line functions to verify the solution.	
UNIT – III	**(13 Hours)**
Stability Analysis: The concept of stability, BIBO stability, Zero-input and asymptotic stability, Routh- Hurwitz (R-H) stability criterion, Application. **Root-Locus Analysis:** The concept of root locus and Complementary root locus, Basic properties of root locus, Construction of root locus. Usage of MATLAB command-line functions to verify the solution.	
UNIT – IV	**(13 Hours)**
Frequency Domain Analysis: The concept of frequency response, Bode plots, procedure for constructing Bode plots, Gain margin, Phase margin, Frequency domain specifications, Nyquist stability criterion and examples. **Control system analysis in state-space:** State variable representation, conversion of state variable models to transfer functions and vice versa. Usage of MATLABcommand-line functions to verify the solution.	

Reference Books:

1. Benjamin C. Kuo, “Automatic Control System”, 7th Edition, PHI, 2010.
2. Richard C. Dorf Robert H. Bishop “Modern Control Systems”, 8th Edition, Addison-Wesley,1999
3. I.J. Nagarath and M Gopal, “Control Systems Engineering”, New Age International (P) Ltd.,1999
4. Norman S. Nise “Control System Engineering”, McGraw Hill, 2010.
5. R. S. Allurkar, “Control Systems”, EBPB, 2004

Course Outcomes:

After completion of the course the students will be able to,

1. Classify control systems based on a number of ways and select them for particular applications.
2. Develop mathematical modeling of LTI control systems via differential equation

formation, transfer function, and state space analysis.

3. Employ time domain analysis to predict and diagnose transient performance parameters of LTI control systems for standard input function step.
4. Formulate different types of analysis in frequency domain to obtain the stability of the LTI control systems.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE626C.1	3	3	2	2	2							2	1	2	1
2	22UEE626C.2	3	3	3	2	3							2	1	3	1
3	22UEE626C.3	3	3	3	3	3							2	1	3	1
4	22UEE626C.4	3	3	3	3	3							2	1	2	1

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE627C	Digital Signal Processing	04 - Credits (4 : 0 : 0)
Hours/Week : 04		CIE Marks : 50
Total Hours : 52		SEE Marks : 50

UNIT – I	13 Hours
Introduction: Definition of signal and system, classification of signals, elementary signals, basic operations on signals, sampling and aliasing, sampling theorem, basic system properties: stability, memory, causality, time invariance and linearity. **Time-domain Analysis of Discrete-Time LTI Systems:** The convolution sum, convolution sum evaluation procedure, convolution properties. **Time domain Analysis of Continuous-Time LTI Systems:** The convolution integral, convolution integral evaluation procedure.	
UNIT – II	**13 Hours**
Fourier Series Representations: Continuous-time periodic signals: Fourier Series (FS), properties of FS, Discrete-Time Fourier Series (DTFS). **Fourier Transforms Representations:** Continuous-time aperiodic signals: Fourier Transform (FT), properties of FT.	
UNIT – III	**13 Hours**
The Discrete Fourier Transform (DFT): DFT, IDFT, DFT as a linear transformation, properties of DFT, circular convolution. Efficient Computation of the DFT: Radix-2 FFT algorithm, Radix-2 inverse FFT, decimation-in-time FFT algorithm, decimation-in-frequency FFT algorithm.	
UNIT – IV	**13 Hours**
Design of FIR filters: Design of FIR filters using windows(Rectangular, Hamming). **Design of IIR filter:** Design of IIR filter from analog Butterworth filter, Impulse -invariance and bilinear transformation method. **Realization of IIR systems:** Structure for IIR systems: Direct-form, cascade form and parallel form.	

Text Books:

1. Simon Haykin, Barry van Veen, “Signals and Systems,” John Wiley &Sons (Asia) Pvt. Ltd, 2nd Edition, 2004.
2. B. P. Lathi, “Principles of Linear Systems and Signals,” Oxford University Press, 2nd Edition,
3. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", 4th Edition, Pearson Education, 2007.

Reference Books:

4. A.V. Oppenheim, A.S. Willsky, S.H. Nawab, “Signals and Systems,” 2nd Edition, 2006.
5. R.E. Ziemer, W.H. Tranter, D.R. Fannin, “Signals and Systems,” Pearson Education, 2nd Edition, 2002.
6. S.K. Mitra, “Digital Signal Processing: A Computer - Based Approach”, McGraw Hill Higher Education, 4th Edition, 2013.

Course Outcomes:

After completion of the course the students will be able to,

1. Classify signals and systems.
2. Determine the response of LTI systems..
3. Represent the signals in the frequency domain.
4. Design and realize filters.

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	CO 1	3	2	2	1	1					3	2		3	1
2	CO 2	3	3	3	2	2					3	2		3	1
3	CO 3	3	2	3	2	3					2	2		3	1
4	CO 4	3	2	3	2	3					2	2		3	1

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE620L	Power System-II Laboratory	01 - Credits (0 : 0 : 2)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Determination of regulation, efficiency, symmetry and reciprocity of transmission lines by assessment of ABCD parameters
2. Determination of fault currents and voltages in a power systems at a specified location for LG, LL & LLG faults and to check boundary conditions
3. Formation of Y_{Bus} of power systems by singular transformation and inspection method.
4. Determination of power angle diagrams for salient and non-salient pole synchronous machines.
5. Determination of power system stability using swing equation
6. Determination of critical clearing time for SMIB system by varying inertia constant, line parameters/fault location.
7. Load flow study of power systems using Gauss-Seidel method (only pq Bus not exceeding 4-buses).
8. Load flow study of power systems using Jacobian matrix for a given power system not exceeding 4 buses in polar Coordinates (no PV buses).
9. Load flow study of power systems using fast-decoupled method.
10. Optimal generator scheduling for thermal power plants connected to load dispatch center.

Reference Books:

1. K. Uma Rao, "Computer Techniques and Model in Power Systems", 2nd Edition, I.K. International, 2014.
2. Singh L. P., "Advanced Power System Analysis and Dynamics", 6th Edition, New Age International(P) Ltd, New Delhi, 2014.
3. Nagrath, I .J., and Kothari, D.P., "Modern Power System Analysis", 4th Edition, TMH, 2011

Course Outcomes:

After completion of the course the students will be able to:

1. Apply MATLAB and Mi Power software tools to model, simulate, and analyze various power system components and networks.
2. Conduct experiments related to transmission line parameters, fault analysis, stability studies, load flow methods, and optimal scheduling in power systems using laboratory setups and software tools.
3. Interpret experimental results, analyze system performance, and formulate conclusions to evaluate and improve the efficiency, stability, and reliability of power systems.

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE620L.1		1	1	3	3						1	3		2
2	22UEE620L.2	1	2	2	3	3						1	3		2
3	22UEE620L.3	1	2	3	3	3						1	3		2

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE621L	Control Systems Laboratory	01 - Credits (0 : 0 : 2)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. To determine the characteristics of synchro-transmitter and receiver system and to study its application as remote position indicator.
2. To determine the time domain response of a second order system using RLC circuit for a step input.
3. To determine the frequency response of a second -order system.
4. To determine the frequency response of RC lag compensating network.
5. To determine the frequency response RC lead compensating network.
6. To draw the speed – torque characteristic of A.C. servomotor.
7. To sketch the root loci for the given control system for $K \geq 0$. Find the value of K at the breakaway point. Also write a MATLAB program to verify the same.
8. To sketch the Bode plot of the given open-loop transfer function and determine the gain cross-over frequency and phase cross-over frequency, GM, PM. Also write a MATLAB program to verify the same.
9. To sketch the Nyquist plot of the given feedback control system and examine the stability of the closed loop system using Nyquist criterion. Also write a MATLAB program to verify the same.
10. To Incorporate MATLAB program into a Simulation Model.

Reference Books:

1. Benjamin C. Kuo, “Automatic Control System”, 7th Edition, PHI, 2010.
2. Richard C. Dorf Robert H. Bishop “Modern Control Systems”, 8th Edition, Addison-Wesley,1999
3. I.J. Nagarath and M Gopal, “Control Systems Engineering”, New Age International (P) Ltd.,1999
4. Norman S. Nise “Control System Engineering”, McGraw Hill, 2010.
5. R. S. Allurkar, “Control Systems”, EBPB, 2004

Course Outcomes:

1. To realize and analyze lead and lag compensator networks.
2. Examine characteristics of control system components such as AC servomotor, and synchros.
3. To analyze stability of the system through Root Locus, Bode plot and Nyquist plot using MATLAB

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE621L.1	2	3										1	1	2
2	22UEE621L.2	3	1	2	1								1	1	3
3	22UEE621L.3	3	3	1	1	1			1				1	1	2

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Professional Elective Course – II

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE621E	Integration of Distributed Generation	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Distributed Generation: Introduction, Sources of Energy - Wind Power, Solar Power, Combined Heat-and-Power, Hydropower, Tidal Power, Wave Power, Geothermal Power, Thermal Power Plants	
UNIT – II	**(10 Hours)**
Distributed Generation (continued): Interface with the Grid. Power System Performance: Impact of Distributed Generation on the Power System, Aims of the Power System, Hosting Capacity Approach, Power Quality, Voltage Quality and Design of Distributed Generation, Hosting Capacity Approach for Events, Increasing the Hosting Capacity.	
UNIT – III	**(10 Hours)**
Overloading and Losses: Impact of Distributed Generation, Overloading: Radial Distribution Networks, Overloading: Redundancy and Meshed Operation, Losses Overloading and Losses (continued): Increasing the Hosting Capacity. Voltage Magnitude Variations: Impact of Distributed Generation, Voltage Margin and Hosting Capacity, Design of Distribution Feeders, A Numerical Approach to Voltage Variations, Tap Changers with Line-Drop Compensation, Probabilistic Methods for Design of Distribution Feeders	
UNIT – IV	**(10 Hours)**
Voltage Magnitude Variations (continued): Statistical Approach to Hosting Capacity, Increasing the Hosting Capacity. Power Quality Disturbances: Impact of Distributed Generation, Fast Voltage Fluctuations, Voltage Unbalance.	

Reference Books:

1. Math Bollen, “Integration of Distributed Generation in the Power System”, Wiley publications, 2011.
2. Amirnaser Yezdani, and Reza Iravani, “Voltage Source Converters in Power Systems: Modeling, Control and Applications”, IEEE John Wiley Publications, 2009.
3. Dorin Neacsu, “Power Switching Converters: Medium and High Power”, CRC Press, Taylor & Francis, 2006.
4. Chetan Singh Solanki, “Solar Photo Voltaics”, PHI learning Pvt. Ltd., New Delhi, 2009
5. J.F. Manwell, J.G “Wind Energy Explained, Theory Design and Applications,” McGowan Wiley publication, 2nd Edition, 2009.
6. John Twidell and Tony Weir, “Renewable Energy Resources”, Taylor and Francis Publications, Second Edition, 2006.

Course Outcomes:

After completion of the course the students will be able to,

1. Determine the variation in production capacity at different timescales, the size of individual units, and the flexibility in choosing locations with respect to of wind and solar systems.

2. Evaluate performance of the power system with distributed generation is integrated to the system.
3. Analyze effects of the integration of DG in terms of increased risk of overload, losses, over voltages and power quality disturbances
4. Assess the impact the integration of DG on power system stability and operation

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE621E.1	3					1	1					2	1	1
2	22UEE621E.2	3	3	2	1		1						2	1	1
3	22UEE621E.3	3	3	2	1	1	1						2	1	1
4	22UEE621E.4	3	3	2	1	1	1				1		2	1	1

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE622E	Automotive Electronics	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction: Need For Electronics In Automotive Control Systems, Structure Of Vehicle Electronics Systems, Common Features Of Vehicle Systems, Measurement System, Sensors And Actuators. Introduction To Electronics: Electronic Components, Diodes, Transistors, Electronic Circuits, Analog Circuits, Digital Circuits, Integrated Circuits, Microprocessor Systems, Systems Approach To Control And Instrumentation.	
UNIT – II	**(10 Hours)**
Electronic Ignition Systems: Types Of Ignition Systems, Conventional Ignition System, Cdi, Programmed Ignition System, Distributor-Less Ignition System, Direct Ignition. Electronic Fuel Control: Electronic Control Of Carburetion, Petrol Injection System, Single And Multi-Point Injection System, Components, Flow Diagram, Diesel Fuel Injection.	
UNIT – III	**(10 Hours)**
Engine Management System: Combined Ignition And Fuel Management System, Exhaust Emission Control, Digital Control Techniques, Complete Vehicle Control Systems, Artificial Intelligence And Engine Management Chassis Electrical Systems: Anti-Lock Brakes, Active Suspension, Traction Control, Electronic Control Of Automatic Transmission.	
UNIT – IV	**(10 Hours)**
Electronics For Comfort, Safety And Security: Electric Seats, Mirrors And Sun-Roof Operation, Central Looking And Electric Windows, Cruise Control, In Car Entertainment (Ice) And Communications, Adaptive Noise Control, Airbags And Seatbelt Tensioners, Obstacle Avoidance Radar, Security Systems - Engine Immobilizer, Icat.	

Reference Books:

1. Tom Denton, “Automotive electrical and electronic systems”, 3rd Edition, SAE International, 2015.
2. Eric Chowanietz, “Automotive Electronics”, 1st Edition Newnes publishers, 1995.
3. William B Ribbens, “Understanding Automotive Electronics”, 7th Edition, Butterworth-Heinemann –Elsevier, 2012.
4. Bernhard Mencher, et. al., “Bosch Professional Automotive Information”, 5th Edition, Springer Vieweg, 2014.

Course Outcomes:

After completion of the course the students will be able to,

1. Explain the need for electronics in modern automobiles and describe the structure and function of key electronic components, sensors, actuators, and control systems used in vehicles.
2. Analyze various electronic ignition and fuel control systems including CDI, programmed ignition, and petrol/diesel injection systems.
3. Examine the role of electronics in engine management systems and advanced chassis control systems such as ABS, traction control, and electronic suspension.
4. Evaluate comfort, safety, and security features in automobiles enabled by

electronics such as airbags, cruise control, infotainment systems, and electronic locking mechanisms.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE622E.1	3	2			1							2	2	1
2	22UEE622E.2	2	3			2								3	2
3	22UEE622E.3	3	2	2		3								3	3
4	22UEE622E.4	2	3		2	2								3	3

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE623E	Intelligent Instrumentation	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction: Intelligent instrumentation, Definition, Historical Perspective, Current status, software based instruments. **Intelligent Sensors**: Classification, Smart sensors, Monolithic Integrated Smart Sensors, Hybrid Integrated Smart Sensors, Cogent Sensors, Soft or Virtual sensors, Self-adaptive, Self- validating sensors, Soft Sensor Secondary Variable Selection, Rough Set Theory, Model Structures. Self-Adaptive Sensors, Self-Validating Sensors, VLSI Sensors, Temperature Compensating Intelligent Sensors, Pressure Sensor.	
UNIT – II	**(10 Hours)**
Sensor Characterization and Linearization: Analog Linearization of Positive and Negative Coefficient Resistive Sensors. Higher-Order Linearization, Quadratic Linearization, Third-Order Linearization Circuit, Nonlinear ADC- and Amplifier-Based Linearization, Interpolation, Piecewise Linearization, Microcontroller-Based Linearization, Lookup Table Method, Artificial Neural Network– Based Linearization, Nonlinear Adaptive Filter–Based Linearization.	
UNIT – III	**(10 Hours)**
Sensor Calibration and Compensation: Sensor Calibration, Conventional Calibration Circuits, Offset Compensation, Error and Drift Compensation, Lead Wire Compensation. **Sensors with Artificial Intelligence:** Artificial Intelligence, Sensors with Artificial Intelligence, Multidimensional Intelligent Sensors, AI for Prognostic Instrumentation, ANN-Based Intelligent Sensors, Fuzzy Logic–Based Intelligent Sensors.	
UNIT – IV	**(10 Hours)**
Intelligent Sensor Standards and Protocols: IEEE 1451 Standard: STIM, TEDS, NCAP. Network Technologies, LonTalk, CEBUS, J1850 Bus: Signal Logic and Format, MI Bus, Plug-n-Play Smart Sensor Protocol.	

Reference Books:

1. Manabendra Bhuyan, “Intelligent Instrumentation: Principles and Applications,” CRC Press, Taylor and Francis Group, 2011.
2. G. C. Barney, “Intelligent Instrumentation,” Prentice Hall, 1995.
3. J.B Dixit, Amit Yadav, “Intelligent Instrumentation for Engineers,” Laxmi Publications Ltd., 2011

Course Outcomes:

After completion of the course the students will be able to,

1. Explain intelligent instrumentation and analyze the structure and types of smart and self-adaptive sensors.
2. Apply and compare analog and digital linearization techniques for accurate sensor characterization.
3. Apply sensor calibration and compensation techniques and analyze the role of AI in intelligent sensors.
4. Describe IEEE 1451 standards and evaluate protocols used for smart sensor communication and integration.

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE623E.1	3	2	1		2						1	3	2	
2	22UEE623E.2	3	3	2		3							3	3	
3	22UEE623E.3	3	3	2		3						1	3	3	
4	22UEE623E.4	3	2	2		3						2	3	3	

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE624E	VLSI Design	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction: Overview of VLSI design methodology, VLSI design flow, Design hierarchy, Concept of regularity, Modularity, and Locality, VLSI design style, Design quality, package technology, introduction to FPGA and CPLD, computer aided design technology. Fabrication of MOSFET: Introduction, Fabrication Process flow: Basic steps, C-MOS nWellProcess, Layout Design rules, full custom mask layout design.	
UNIT – II	**(10 Hours)**
MOS Transistor: The Metal Oxide Semiconductor (MOS) structure, The MOS System under external bias, Structure and Operation of MOS transistor, MOSFET Current-Voltage characteristics, MOSFET scaling and small-geometry effects, MOSFET capacitances MOS Inverters - Static Characteristics: Introduction, Resistive load Inverter, Inverter with n-type MOSFET load(Enhancement and Depletion type MOSFET load), CMOS Inverter	
UNIT – III	**(10 Hours)**
MOS Inverters Switching characteristics and Interconnect Effects: Introduction, Delay-time definitions, Calculation of Delay times, Inverter design with delay constraints, Estimation of Interconnect Parasitic, Calculation of interconnect delay, Switching Power Dissipation of CMOS Inverters	
UNIT – IV	**(10 Hours)**
Combinational MOS Logic Circuits: Introduction, MOS logic circuits with Depletion nMOS Loads, CMOS logic circuits, Complex logic circuits, CMOS Transmission Gates (TGs) Sequential MOS Logic Circuits: Introduction, Behavior of Bistable elements, The SR latch circuit, Clocked latch and Flip-flop circuit, CMOS D-latch and Edge-triggered flip-flop Dynamic Logic Circuits: Introduction, Basic Principles of pass transistor circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, CMOS Dynamic Circuit Techniques, High-performance Dynamic CMOS circuits	
Reference Books: 1. Sung – Mo Kang, Yusuf Leblebici, “CMOS Digital Integrated circuits – Analysis and Design”, TATA McGraw-Hill Pub. Company Ltd. 2. Pucknell, Eshraghian, “Basic VLSI Design”, PHI publications, 3rd Edition, 2018. 3. Mead C and Conway, “Introduction to VLSI Systems”, Addison Wesley publications, 2nd Edition, 1990. 4. John P. Uyemura, “Introduction to VLSI Circuits & Systems”, Wiley Publications, 2006. 5. Brown and Vranesic, “Fundamentals of Digital Logic Design with VHDL”, McGraw Hill Education, 3rd Edition, 2017.	
Course Outcomes: After completion of the course the students will be able to, 1. Apply VLSI design flow, hierarchy, and layout rules to illustrate MOSFET fabrication and design methodologies. 2. Analyze MOS transistor characteristics, scaling effects, and evaluate static performance of CMOS inverters.	

3. Compute delay parameters, interconnect parasitics, and power dissipation to assess switching behavior of CMOS inverters.
4. Design and evaluate combinational, sequential, and dynamic MOS logic circuits using CMOS and transmission gate techniques.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE624E.1	3	2	2	2	1					1		3	2	
2	22UEE624E.2	3	3	2	2	2					1		3	2	
3	22UEE624E.3	3	3	3	2	2					2		3	2	1
4	22UEE624E.4	3	3	3	2	3					2		3	3	2

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE625E	Electric Machine Drives	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Fundamentals of Electric Drives

Electric drive – Concept, classification, parts and advantages of electrical dives, Types of Loads, Components of load toques Fundamental torque equation – Load torque components – Nature and classification of load torques – Steady state stability – Transient stability -Load equalization– Four quadrant operation of drive (hoist control) – Braking methods: Dynamic – Plugging – Regenerative methods

UNIT – II	(10 Hours)

Converter Controlled DC Motor Drives

Modeling of DC motors, State space modeling, block diagram & Transfer function, Single phase, three phases fully controlled and half controlled DC drives. Dual converter control of DC drives. Power factor, supply harmonics and ripple in motor current

DC–DC Converters Controlled DC Motor Drives

Single quadrant – Two quadrant and four quadrant DC-DC converter fed separately excited and self-excited DC motors – Continuous current operation – Output voltage and current waveforms – Speed–torque expressions – Speed–torque characteristics – Four quadrant operation – Closed loop operation (qualitative treatment only).

UNIT – III	(10 Hours)

Induction motor Drive

Stator voltage variation by three phase controllers, Speed control using chopper resistance in the rotor circuit, slip power recovery scheme. Pulse width modulated inverter fed and current source inverter fed induction motor drive. Volts/Hertz Control, Vector or Field oriented control

UNIT – IV	(10 Hours)

Synchronous motor drives

Variable frequency control, Self-Control, Voltage source inverter fed synchronous motor drive, Vector control

Solar and Battery Powered Drive

Introduction, Stepper motor, Switched Reluctance motor drive

Industrial application

Drive consideration for Textile mills, Steel rolling mills, Cement mills, Paper mills, Machine tools. Cranes & hoist drives

Reference Books:

1. G K Dubey, “Fundamentals of Electric Drives”, Narosa Publications, 2nd Edition, 2011.
2. S.B. Dewan, G.R. Slemon, A. Straughen, “Power Semiconductor Drives”, Wiley-India Publications, 2nd Edition, 2009.
3. Vedam Subrahmanyam, “Electric Drives”, Tata McGraw Hill, 2nd Edition, 2011.
4. R. Krishnan, “Electric Motor Drives- Modelling, Analysis and Control”, Prentice Hall Inc., 2008.
5. Bimal K. Bose, “Modern Power Electronics & AC drives”, Prentice Hall Inc., 2001

6. Austin Hughes, “Electric Motor & Drives” Newnes-Elsevier, 3rd Edition, 2006.
7. S.K. Pillai, “A first course on Electrical Drives”, New Age International Publication, 2nd Edition, 1982.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify and classify suitable drive system for industrial application
2. Analyze the operation of three phase converter and DC-DC converter fed dc motors for four quadrant operation
3. Design suitable drives system based on the performance of motor for various industrial application
4. Model and analyze the DC motor, induction motor and synchronous motor for converter-controlled drive system

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE625E.1	3	2	2	2	1				1	2	1	3	1	3
2	22UEE625E.2	3	3	3	2	3				1	2	1	3	2	2
3	22UEE625E.3	3	2	3	3	3				1	2	1	3	2	1
4	22UEE625E.4	3	2	2	2	3				1	2	1	3	3	2

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE626E	Modern Control Theory	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

State Variable Analysis and Design:-Introduction, concept of state, state variables and state model, state modeling of linear systems, linearization of state equations. State space representation using physical variables, phase variables & canonical variables. Usage of MATLAB command-line functions to verify the solution.

UNIT – II	(10 Hours)

Derivation of transfer function from state model:-Derivation of transfer function from state model, diagolization, Eigen values, Eigen vectors, generalized Eigen vectors.

Solution of state equation:- Solution of state equation, state transition matrix and its properties, computation using Laplace transformation, power series method, Cayley-Hamilton method, concept of controllability & observability, methods of determining the same. Usage of MATLAB command-line functions to verify the solution.

UNIT – III	(10 Hours)

Control system design in state-space: State variable feedback structure, pole-placement design using feedback, state feedback with integral control, critique of pole-placement state feedback control, observer-based state feedback control.

Pole Placement Techniques and Controllers:- Stability improvements by state feedback, necessary & sufficient conditions for arbitrary pole placement, state regulator design, and design of state observer, Controllers- P,PI, PID. Usage of MATLAB command-line functions to verify the solution.

UNIT – IV	(10 Hours)

Nonlinear system analysis: Introduction, behavior of non-linear system, common physical non linearity-saturation, friction, backlash, dead zone, relay, multi variable non-linearity.

Phase plane method:-Phase plane method, singular points, stability of nonlinear system, limit cycles

Liapunov stability criteria:-Liapunov stability criteria, Liapunov functions, direct method of Liapunov& the linear system, construction of Liapunov functions for nonlinear system by Krasvskii's method.

Reference Books:

1. M.Gopal, "Control Systems Principles and Design", 3rd Edition, Tata McGraw Hill, 2011.
2. Katsuhiko Ogata, "Modern Control Engineering", 4th Edition, Pearson Education, 2002.
3. A Nagoor Kani, "Advanced Control Theory", CBS Publishers, 3rd Edition, 2020

Course Outcomes:

After completion of the course the students will be able to,

1. Apply state-space representation techniques to model linear and nonlinear control systems.
2. Analyze system properties such as controllability, observability, and stability using mathematical tools and system matrices.
3. Design state feedback controllers and observers for modern control systems based on pole placement and canonical forms.

4. Evaluate nonlinear control system behavior using phase-plane methods and Liapunov's stability criteria for system performance analysis.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE626E.1	3	2	2	2	2						1	3	2	2
2	22UEE626E.2	3	3	2	2	2						2	3	3	2
3	22UEE626E.3	3	2	3	3	2						2	3	3	2
4	22UEE626E.4	3	3	2	3	2						3	3	2	2

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Open Elective Course – II

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

	Electrical Safety for Engineers	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hours**
Introduction to Electrical Safety, Electric Shocks and their Prevention: OSHA standards on electrical safety, objectives of safety and security measures, hazards associated with electric current and voltage, principles of electrical safety, approaches to prevent accidents, review of IE rules & acts. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns	
UNIT – II	**10 Hours**
First Aid in Case of Electric Shock: First principles of actions after electric shock, first aid-artificial respiration methods, Cardiac Pulmonary Resuscitation, accident management and safety management. **Equipment Earthing and System Neutral Earthing:** Earthing, need for earthing, types of earthing, distinction between system grounding and equipment grounding, functional requirement of earthing system, technical consideration of station earthing system, step and touch potential, neutral grounding and its advantages	
UNIT – III	**10 Hours**
Safety in Residential, Commercial and Agricultural Installations: Domestic wiring methods and installations, safety requirements, shocks from domestic equipment-water taps- wet walls-agricultural pumps, types of cables and specifications, underground cables, best practices with use of electricity. **Accident Investigation:** Why and how to investigate, investigation report writing. Case studies of accidents in HESCOM/GESCOM region	
UNIT – IV	**10 Hours**
Electrical System Safety: Safety devices and their characteristics, safety clearances and creepage distances in electrical plants, line supports, insulators Circuit Breakers: Arc phenomenon, principles of arc extinction, oil & air blast breakers Protective Relays: Fundamental requirements of relaying, classification of relays Protection of Alternators, Transformers, Bus bars and Lines, protection against over voltages	
Reference Books: 1. S. Rao., R. K. Jain., H.L. Saluja., "Electrical safety, fire safety Engineering and safety management", Khanna Publishers New Delhi, 2nd Edition, 2021 2. Pradeep Chaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997. 3. V. K.Mehta, Rohit Mehta, "Principles of Power Systems", S Chand Publications, 4th Edition, 2008. 4. The Electricity Act, 2003, https://cercind.gov.in/Act-with-amendment.pdf	

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

Course Outcomes:

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

1. Identify the type of the electric shock and suggest probable electric safety & security measures in the given electric system
2. Analyze the safety & grounding requirements in Residential, Commercial, Agricultural installations and suggest best practices with use of electricity
3. Carry out detailed fault investigation and suggest the methods to rescue & first aid approaches in case of electrical accidents
4. Analyze the need for safety devices and requirements in the electric systems

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1			1	1	1				1						
2		1	2	1	2		1					1			
3		1	2	1	2		1		1			1			
4		1	2	1	2		1					1			

Syllabus for B.E VI - Semester for academic year 2025 – 2026

(For students admitted to I year in 2023-24)

22UEE617N	Energy Storage Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Energy storage systems overview - Scope of energy storage, needs and opportunities in energy storage, Technology overview and key disciplines, comparison of time scale of storages and applications, Energy storage in the power and transportation sectors. Importance of energy storage systems in electric vehicles, Current electric vehicle market. **Thermal storage system**-heat pumps, hot water storage tank, solar thermal collector, application of phase change materials for heat storage-organic and inorganic materials, efficiencies, and economic evaluation of thermal energy storage systems.	
UNIT – II	**10 Hours**
Chemical storage system- hydrogen, methane etc., concept of chemical storage of solar energy, application of chemical energy storage system, advantages and limitations of chemical energy storage, challenges, and future prospects of chemical storage systems **Electromagnetic storage systems** - double layer capacitors with electrostatically charge storage, superconducting magnetic energy storage (SMES), concepts, advantages and limitations of electromagnetic energy storage systems, and future prospects of electrochemical storage systems.	
UNIT – III	**10 Hours**
Electrochemical storage system **Batteries-**Working principle of battery, primary and secondary (flow) batteries, battery performance evaluation methods, major battery chemistries and their voltages- Li-ion battery& Metal hydride battery vs lead-acid battery. **Super capacitors-** Working principle of super capacitor, types of super capacitors, cycling and performance characteristics, difference between battery and super capacitors, Introduction to Hybrid electrochemical super capacitors **Fuel cell:** Operational principle of a fuel cell, types of fuel cells, hybrid fuel cell-battery systems, hybrid fuel cell-super capacitor systems.	
UNIT – IV	**10 Hours**
Battery design:- Battery design for transportation, Mechanical Design and Packaging of Battery Packs for Electric Vehicles, Advanced Battery-Assisted Quick Charger for Electric Vehicles, Charging Optimization Methods for Lithium-Ion Batteries, Thermal run-away for battery systems, Thermal management of battery systems, State of Charge and State of Health Estimation Over the Battery Lifespan, Recycling of Batteries from Electric Vehicles	
Reference Books: 1. Frank S. Barnes and Jonah G. Levine, Large Energy Storage Systems Handbook (Mechanical and Aerospace Engineering Series), CRC press (2011) 2. Ralph Zito, Energy storage: A new approach, Wiley (2010) 3. Pistoia, Gianfranco, and Boryann Liaw. Behaviour of Lithium-Ion Batteries in Electric Vehicles: Battery Health, Performance, Safety, and Cost. Springer International Publishing AG, 2018. 4. Robert A. Huggins, Energy storage, Springer Science & Business Media (2010) 5. Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and	

Applications, John Wiley & Sons, 3rd Edition, 2021.

6. Ru-shi Liu, Lei Zhang and Xueliang sun, electrochemical technologies for energy storage and conversion, Wiley publications, 2nd Volume set, 2012.
7. James Larminie and Andrew Dicks, Fuel cell systems Explained, Wiley publications, 3rd Edition, 2018.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify the requirement, current status and future prospectus of energy storage.
2. Describe and compare various thermal, chemical energy storage technologies on the basis of technical characteristics.
3. Verify various types of energy losses and the associated energy efficient technologies for the routinely used thermal, chemical and electrical energy systems.
4. Design and Model the battery storage system and its applications

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1		1	1	1	1										
2		1	1	2	2										
3		1	1	2	2										
4		1	1	1	1										

Syllabus for

B.E. VII & VIII – Sem.

for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE725C	Power System - IV	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Automatic Load Frequency Control: Introduction, Control loops of power systems modeling of Automatic Load Frequency Control (ALFC) of single area systems, performance of ALFC. ALFC of two area systems, expression for tie-line flow and frequency deviation, parallel operation. Generation Control: Supplementary Control Action, Tie line Control, Generation Allocation.

Control of Voltage and Reactive Power: Introduction, generation and absorption of reactive power, methods of voltage control: Shunt reactor, shunt capacitor, series capacitor, tap changing transformer and booster transformer Compensating Devices-Characteristics of SVC, TCR, TSC and STATCOM. voltage stability, PV and QV curves, voltage collapse, prevention of voltage collapse**.**

UNIT – II	(10 Hours)

Unit Commitment: Statement of the problem, need and importance of unit, constraints in unit commitment, spinning reserve, Thermal Unit Constraints, Other constraints, Hydro constraints, Must Run, Fuel constraints, Unit commitment Solution methods: Priority-List methods, Dynamic Programming solution. Reliability Considerations, Patton's Security Function, Security constrained Optimal Unit Commitment

Interchange of Power and Energy: Introduction, Economy Interchange between Interconnected Utilities, Infertility Economy Energy Evaluation, Multiple-Utility Interchange Transaction, Power pools, Transmissions Effects and Issues

UNIT – III	(10 Hours)

Power System Security: Introduction, factors affecting power system security, power system contingency analysis, detection of network problems, network sensitivity methods, calculation of network sensitivity factor, contingency ranking

Power System State Estimation: Introduction, power system state estimation, maximum likeli-hood weighted least-square estimation, maximum likeli- hood concept with example, matrix formulations, Detection and Identification of bad measurements

UNIT – IV	(10 Hours)

Power System SCADA: Introduction, building blocks of SCADA, Remote Terminal Unit (RTU)-Evolution and Components of RTU, Communication Subsystem, Logic subsystem, Termination subsystem, HMI subsystem, Advanced RTU functionalities.

Intelligent Electronic Device (IED)-IED functional block diagram, hardware and software architecture of IED, IED communication systems. Data concentrator and merging units, SCADA communication system, Master station, Human Machine Interface (HMI), Building SCADA system, Classification of SCADA,SCADA implementation and Case studies in SCADA

Reference Books:

1. Allaen J Wood Bruce F. Wollenberg, “Power Generation, Operation and Control”, 2nd Edition, John Wiley and Sons, Reprint 2014.
2. G.L. Kusic, “Computer Aided Power System Analysis”, 2nd Edition, PHI, 1992.
3. T.J.E Miler, “Reactive Power Control in Electric Power Systems”, John Wiely and Sons NY, 1982.

4. Mini S Thomas, Jhon D. McDonald. "Power System SCADA and Smart Grid", CRC press Taylor and Francis groups, 2015.
5. Nagrath,I.J., Kothari,D.P, "Modern Power SystemAnalysis", 4th Edition, TMH, 2014.
6. Prabha Kundur, "Power System Stability and Control", 9th reprint, TMH, 2009.

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze and design automatic load frequency control (ALFC) and voltage control strategies in power systems, including modeling of single and two-area systems, reactive power management, and the application of compensating devices to enhance system stability and prevent voltage collapse.
2. Evaluate and apply unit commitment strategies and economic interchange methods in interconnected power systems, considering system constraints, reliability, and transmission effects to ensure optimal and secure operation.
3. Assess and improve power system security through contingency analysis, sensitivity methods, and state estimation techniques, using tools like maximum likelihood estimation and matrix formulations to detect network issues and ensure system reliability.
4. Describe the concepts behind the design and operation of SCADA systems, including the roles of Remote Terminal Units (RTUs), Intelligent Electronic Devices (IEDs), communication subsystems, and Human-Machine Interfaces (HMIs) for effective power system monitoring and control.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE725C.1	1	3	2	1							1	3		1
2	22UEE725C.2	1	3	2	1							1	3		1
3	22UEE725C.3	1	3	2	1							1	3		1
4	22UEE725C.4	1	1	1	1							1	3		1

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

Professional Elective Course – III

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE731E	Smart Grids	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Smart Grid Architectural Designs: Introduction, Today's Grid versus the Smart Grid, Energy Independence and Security Act of 2007: Rationale for the Smart Grid, Computational Intelligence, Power System Enhancement, Communication and Standards, Environment and Economics, General View of the Smart Grid Market Drivers, Stakeholder Roles and Function, Working Definition of the Smart Grid Based on Performance Measures, Representative Architecture, Functions of Smart Grid Components. **Smart Grid Communications and Measurement Technology:** Communication and Measurement, Monitoring, PMU, Smart Meters, and Measurements Technologies, GIS and Google Mapping Tools, Multiagent Systems (MAS) Technology, Microgrid and Smart Grid Comparison. **Performance Analysis Tools for Smart Grid Design:** Introduction to Load Flow Studies, Challenges to Load Flow in Smart Grid and Weaknesses of the Present Load Flow Methods, Load, Flow State of the Art: Classical, Extended Formulations, and Algorithms, Congestion Management, Effect, Load Flow for Smart Grid Design.	
UNIT – II	**(10 Hours)**
Stability Analysis: Introduction to Stability, Strengths and Weaknesses of Existing Voltage Stability Analysis Tools, Voltage Stability Assessment, Voltage Stability Assessment Techniques, Voltage Stability Indexing, Analysis Techniques for Steady-State Voltage Stability Studies, Optimizing Stability Constraint through Preventive Control of Voltage Stability, Angle Stability Assessment. **Computation Tools for Smart Grid:** Introduction to Computational Tools, Decision Support Tools, Optimization Techniques, Classical Optimization Method, Heuristic Optimization, Evolutionary Computational Techniques.	
UNIT – III	**(10 Hours)**
Pathway for Designing Smart Grid: : Introduction to Smart Grid Pathway Design, Barriers and Solutions to Smart Grid Development, Solution Pathways for Designing Smart Grid Using Advanced Optimization and Control Techniques for Selection Functions, General Level Automation, Bulk Power Systems Automation of the Smart Grid at Transmission Level, Distribution System Automation Requirement of the Power Grid, End User/Appliance Level of the Smart Grid, Applications for Adaptive Control and Optimization. **Renewable Energy and Storage:** Renewable Energy Resources, Sustainable Energy Options for the Smart Grid, Penetration and Variability Issues Associated with Sustainable Energy Technology, Demand Response Issues, Electric Vehicles and Plug-in Hybrids, PHEV Technology, Environmental Implications, Storage Technologies, Tax Credits.	
UNIT – IV	**(10 Hours)**
Interoperability, Standards, and Cyber Security: Introduction, Interoperability, Standards, Smart Grid Cyber Security, Cyber Security and Possible Operation for Improving Methodology for Other Users. **Research, Education, and Training for the Smart Grid:** Introduction, Research Areas for Smart Grid Development, Research Activities in the Smart Grid, Multidisciplinary Research	

Activities, Smart Grid Education, Training and Professional Development.

Case Studies and Test beds for the Smart Grid:

Introduction, Demonstration Projects, Advanced Metering, Microgrid with Renewable Energy, Power System Unit Commitment (UC) Problem, ADP for Optimal Network Reconfiguration in Distribution Automation, Case Study of RER Integration, Testbeds and Benchmark Systems, Challenges of Smart Transmission, Benefits of Smart Transmission.

Reference Books:

1. James Momoh., "Smart Grid, Fundamentals of Design and Analysis", 1st Edition, Wiley, 2012.
2. Clark W Gellings, "The Smart Grid, Enabling Energy Efficiency and Demand Side Response"- CRC Press, 2009.
3. Yokoyama, Nick Jenkins, "Smart Grid: Technology and Applications"- Wiley, 2012.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify the smart measuring instruments for two way communication of each components in grid.
2. Apply the suitable load flow analysis technique for exiting distribution system.
3. Evaluate the optimal value for distribution system including renewable energy and storage systems.
4. Formulate the existing distribution for the conversion to smartgrid using standards as for the case studies.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE731E.1	3	2	2	2	3					1		3	2	2
2	22UEE731E.2	3	3	2	3	2					1		3	3	2
3	22UEE731E.3	3	3	3	3	3		2		1	2	2	3	3	3
4	22UEE731E.4	3	3	3	3	2	2	2	2	2	3	2	3	3	3

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE732E	Electric Vehicles	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Introduction to EV: Historical Background, Benefits of Using Evs, Overview of types of Evs and its Challenges, EV Motor Drive Technologies, EV Energy Source Technologies, EV Battery Charging Technologies, EV Vehicle to Grid **EV Subsystem**: EV Subsystems and Configurations, HEV Subsystems and Configurations. HEV Subsystems and Configurations, Motion and dynamic equations for vehicles	
UNIT – II	**10 Hours**
Energy Storage: Batteries-Overview of Batteries, Battery Parameters, Lead Acid Batteries, Lithium Batteries, Metal Air Batteries. Alternative and Novel Energy Sources-Solar Photovoltaics, Flywheels, Super Capacitors. Fuel Cells-Main issues in the fuel cell, Hydrogen Fuel Cells: Basic Principles, Fuel Cell Thermodynamics (Introduction)	
UNIT – III	**10 Hours**
Architecture of EV and HEV: Vehicle Power Plant and Transmission Characteristics- Introduction, Drive train Configuration, Vehicle power plant, Internal combustion engine, Electric Motor, The need for gearbox, Drive train tractive effort and vehicle speed, Vehicle performance. Basic Architecture of Hybrid Drive Trains and Analysis of Series Drive Train- The Hybrid Electric Vehicle (HEV), Energy Use in Conventional Vehicles, Energy Savings Potential of Hybrid Drivetrains, HEV Configurations, Series and parallel Hybrid System.	
UNIT – IV	**10 Hours**
Power Flow in HEVs: Introduction, Power Flow Control, Power Flow Control in Series Hybrid, Power Flow Control in Parallel Hybrid, Power Flow Control in series-Parallel Hybrid, Power Flow Control Complex Hybrid Control	

Reference Books:

1. Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2004.
3. James Larminie, John Lowry, “Electric Vehicle Technology Explained”, Wiley publications, 2003.

Course Outcomes:

After completion of the course the students will be able to,

1. Illustrate the evolution, classification, and components of electric and hybrid vehicles.
2. Analyze different energy storage and alternative energy sources used in EV applications.
3. Interpret the drive-train architecture and vehicle dynamics of electric and hybrid vehicles.
4. Evaluate the power flow control strategies in various hybrid electric vehicle configurations.

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE732E.1	3	2					2					3		
2	22UEE732E.2	3	3	2									2	3	
3	22UEE732E.3	3	2	3	2								3	3	2
4	22UEE732E.4	2	2	3	3	2							2	3	3

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE733E	Solar Photovoltaic Systems Design	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Chapter-01: Solar Energy – Introduction and its scenario of India and global; Solar Radiation – solar radiation spectrum, diffuse & beam radiation and solar radiation measurement.

Chapter-02: Solar Cells – I-V & P-V characteristics; Technologies; Parameters; Factors affecting electricity generated; series, parallel and series & parallel connections; Numerical problems.

UNIT – II	(10 Hours)

Chapter-03: SPV module – Ratings, standard parameters; factors affecting electricity generated; I-V & P-V Characteristics; connection of modules in series, parallel and series & parallel; Mismatch in series and parallel connections, Introduction to arrays.

Chapter-04: Balance of System (BoS) - Batteries; Charge Controllers; MPPT; Inverters. (BoS to cover functions, working, types, features, typical specifications and cost). Numerical problems.

UNIT – III	(10 Hours)

Chapter-05: Wires – Introduction, basics of current conduction, types of wires, measurement of wire dimensions, wire sizing; junction box;

Chapter-06: Installation, troubleshooting of stand-alone and grid connected solar PV power systems; Safety of SPV power plants; Solar PV plant installation check list – Electrical testing of PV array, inverter; islanding protection; commissioning and system functioning. Field visits within campus to study installations.

UNIT – IV	(10 Hours)

Chapter-07: SPV system design and integration – Types of SPV systems; Design Methodology for Stand-alone SPV systems.

Chapter-08: Grid connected Solar PV Power Systems (GCSPVPS) – Introduction, Configurations & Components of GCSPVPS, GCSPVPS Design for small applications and for power plants.

Reference Books:

1. Chetan Singh Solanki, "Solar Photovoltaics – Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 3rd Edition, 2015.
2. Chetan Singh Solanki, "Solar Photovoltaic Technology and Systems – A Manual for Technicians, Trainers and Engineers", PHI Learning Private Limited, New Delhi, 2014
3. Tiwari, G. N and Ghosal, M. K., "Fundamentals of Renewable Energy Sources", Alpha Science International Ltd, New Delhi, 2007.

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze the performance of solar photovoltaic systems under varying load and environmental conditions using numerical and analytical methods.
2. Apply knowledge of solar PV system components and configurations to select appropriate systems for specific applications.
3. Evaluate the operation, testing, and troubleshooting of solar PV systems and their

components ensuring safe and effective performance.

4. Design stand-alone and grid-connected solar photovoltaic systems based on specific load requirements and integration methodologies.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE733E.1	3	3	2	2	2		2			2		3	2	2
2	22UEE733E.2	3	2	2	2	3		2			2		3	3	2
3	22UEE733E.3	3	3	3	3	3	2	2			2	2	3	3	3
4	22UEE733E.4	3	3	3	3	3	2	2		2	3	2	3	3	3

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE734E	Reactive Power Management	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction Importance of reactive power control in electrical power system, objectives of load compensation, ideal compensator, load compensation specific of a compensator, power factor correction and voltage regulation in single phase system, reactive power bias.	
UNIT – II	**(10 Hours)**
Basic requirement in AC power transmission Factor affecting stability and voltage, uncompensated Transmission line: performance equations and performance requirement of lines, voltage profile, voltage-power characteristics, load ability characteristics. Transmission line compensation: types passive/active compensators, series/shunt compensation and compensation by sectioning.	
UNIT – III	**(10 Hours)**
Harmonics Characteristics and un characteristics harmonics, sources, troubles caused by harmonics on electrical equipment, means of reducing harmonics, types of harmonic filters, DC filters IEEE 519-1992 guidelines telephone interferences.	
UNIT – IV	**(10 Hours)**
Reactive power co-ordination Reactive power management and planning, utility objectives, practices, transmission benefits, reactive power dispatch & equipment impact, reactive power forecasting, reactive power control by DSM, power pooling.	

Reference Books:

1. T. J. E. Miller, “Reactive Power Control in Electric Power Systems”, John Wiley & Sons NY 2009
2. D. Tagare, “Reactive Power Management”, TMH, 1st Edition, 2004.
3. Prabha Kundur, “Power System Stability and Control”, TMH 9th reprint, 2007.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply suitable compensation scheme for load and power factor correction
2. Investigate performance of the transmission lines through voltage-power and loadability characteristics
3. Identify type of harmonics in transmission line by calculating magnitude of harmonics
4. Develop reactive power management scheme for utilities

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE734E.1	3	2	1	3	2				1	2	2	3	2	2
2	22UEE734E.2	3	3	3	1	3				1	1	2	3	2	1
3	22UEE734E.3	3	2	2	2	2				1	1	2	3	3	2
4	22UEE734E.4	3	2	3	2	3				1	2	2	3	3	2

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE735E	Power System Planning	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction of Power Planning: National and regional planning, structure of power system, planning tools, electricity regulation, Load forecasting, forecasting techniques, modeling. **Generation Planning:** Integrated power generation, co-generation / captive power, power pooling and power trading, transmission and distribution planning.	
UNIT – II	**(10 Hours)**
Power System Economics: Power system economics, power sector finance, financial planning, private participation, rural electrification investment, concept of rational tariffs. **Computer Aided Planning:** Wheeling, environmental effects, greenhouse effect, technological impacts, insulation co-ordination, reactive compensation.	
UNIT – III	**(10 Hours)**
Power System Reliability: Reliability definition, system reliability, system adequacy and security, reliability planning, reliability evaluation, functional zones, generation, transmission, reliability target, quality of supply.	
UNIT – IV	**(10 Hours)**
System Operation Planning: Operations, Maintenance, Load management, Load prediction, Reactive power balance, Power grid, Online power flow studies, State estimation, Computerized management, Power system simulator.	

Reference Books:

1. A.S.Pabla, Macmillan “Electrical Power System Planning”, (1st Edition), India Ltd, 2016.
2. M. E. Van Valkenburg, "Network analysis", 3rd Edition, PHI Learning, 2014.
3. Charles E Ebeling by “Reliability and Maintainability Engineering”, 1st Edition, Tata McGraw Hill, 2004.

Course Outcomes:

After completion of the course the students will be able to,

1. **Analyze** the structure of national and regional power systems, and apply forecasting techniques and planning tools for effective generation, transmission, and distribution planning.
2. **Evaluate** the economic aspects of power system planning, including tariff structuring, investment strategies, financial modeling, and the role of private participation in the power sector.
3. **Assess** the reliability of power systems by evaluating generation, transmission, and distribution adequacy using system reliability models and performance indicators.
4. **Develop** strategies for power system operation through load management, state estimation, reactive power balancing, and the application of simulation and computerized planning tools.

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE735E.1	3	2	2		2						1	2	3	1
2	22UEE735E.2	2	3	2		2	1					1	2	3	2
3	22UEE735E.3	3	3	2	2	2						1	2	3	1
4	22UEE735E.4	3	2	3	2	3						1	2	3	2

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE736E	HVDC Transmission	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
General Aspects of DC Transmission: Historical sketch, constitution of EHVAC and DC links, Limitations and Advantages of AC and DC Transmission and comparison of DC with AC transmission **Analysis of the Bridge Converter:** Analysis with grid control but no overlap, Analysis with grid control and with overlap less than 60 deg, Analysis with overlap greater than 60 deg, complete characteristics of rectifier, Inversion.	
UNIT – II	**(10 Hours)**
Control of HVDC Converters and Systems: Grid control, basic means of control, power reversal, limitations of manual control, constant current versus constant voltage, desired feature of control, actual control characteristics, constant -minimum -Ignition –angle control, constant –current control, constant –extinction –angle control, stability of control. Grid control, basic means of control, power reversal, limitations of manual control, constant current versus constant voltage, desired feature of control, actual control characteristics, constant -minimum -Ignition –angle control, constant –current control, constant –extinction –angle control, stability of control.	
UNIT – III	**(10 Hours)**
Smoothing Reactor and DC Line: Smoothing reactor, voltage oscillations and valve dampers, current oscillations and anode dampers, DC line oscillations and line dampers, clear line faults and reenergizing the line, DC Breakers, Effects of proximity of AC and DC Transmission Lines **Harmonics, Filters and Torsional Interaction:** Generation of Harmonics, design of AC filters, DC filters, harmonic interactions and torsional interaction. Torsional interactions with HVDC systems, counter measures to torsional interaction with DC systems	
UNIT – IV	**(10 Hours)**
Multiterminal DC Systems: Potential Applications of MTDC Systems, Types of MTDC Systems, Control and protection of MTDC systems, study of MTDC systems **Power Flow Analysis in AC/DC Systems:** Modeling of DC Links, solution of DC load flow, per unit system for DC quantities, solution of SC-AC power flow. An example: Five terminal DC system.	
Reference Books: 1. Prabha Kundur, “Power System Stability and Control”, TMH, 5th reprint 2008. 2. EW Kimbark, “Direct current Transmission”,Vol.No1, John Wiley, New York, 1971 3. K R Padiyar, “HVDC Power Transmission Systems Technology and System Interation”, (3rd Edition), New Age International Publishers, Reprint 2017.	
Course Outcomes: After completion of the course the students will be able to, 1. Explain the principles of HVDC transmission and analyze converter characteristics. 2. Evaluate control strategies for HVDC systems and their impact on system performance	

3. Analyze filtering, harmonic effects, line protection, and system stability in HVDC systems
4. Examine MTDC system configurations and perform power flow analysis in AC/DC systems

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE736E.1	3	3	2	2			2					3	2	
2	22UEE736E.2	3	3	3	3	2							2	3	2
3	22UEE736E.3	3	2	3	2	2							2	3	3
4	22UEE736E.4	3	3	3	3	3							3	3	3

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

Professional Elective Course – IV

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE741E	Flexible AC Transmission Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Review of AC transmission lines: Electrical characteristics, performance equations, natural or surge impedance loading, equivalent circuit of a transmission line, performance requirements of power transmission lines, voltage and current profile under no load.

Power transfer and stability considerations, Principles of transmission system compensation - series and shunt, Compensation by line sectioning, Concept of flexible AC transmission, FACTS-Benefits, Types and Brief descriptions.

UNIT – II	(10 Hours)

Static Shunt Compensators: Objective of shunt compensation, Methods of controllable VAR Generation. SVC and STATCOM: Operating principle, Regulation slope, Transfer function and Dynamic performance, Transient stability enhanced and power oscillation damping, VAR Reserve Control.

Comparison between STATCOM and SVC: V-I and V-Q Characteristics, Transient Stability, Response Time, Capability to Exchange real power, operating with unbalanced AC system, Physical size and Installation, Merit of hybrid compensator, Static Var Systems.

UNIT – III	(10 Hours)

Static Series Compensators GCSC, TSSC, TCSC: Objectives of series compensation, Voltage stability, Improvement of transient stability, power oscillation damping, sub synchronous oscillation damping, approaches to controlled series compensation.

Variable Impedance Type series compensators: GTO Thyristor- controlled series capacitor (GCSC), Thyristor-Switched Series Capacitor (TSSC), Thyristor Controlled Series Capacitor (TCSC), Thyristor- Controlled Voltage and Phase Angle Regulators (TCVRs and TCPARs).

UNIT – IV	(10 Hours)

Unified Power Flow Controller (UPFC): Basic operating principle, control capabilities, implementation, comparison to series compensators and Phase Angle Regulators, Control structure, Dynamic performance. Interline Power Flow Controller (IPFC): operating Principle, control structure and Applications.

Dynamic Voltage Restorer (DVR) – Introduction to DVR, overview of voltage sag and swells.

Reference Books:

1. Narain G. Hingorani and Lazlo Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE Press and John Wiley & Sons, Inc, 2000.
2. Prabha Kundur, Power System Stability and Control Tata McGraw Hill Publishers, New Delhi, 2006.
3. R. Mohan Mathur, Static Controllers for Electrical Transmission Systems, IEEE Press and John Wiley & Sons, Inc. 2008.
4. R. Mohan Mathur, Rajiv K Varma, Thyristor-Based FACTS Controllers for Electrical Transmission Systems, IEEE Press and John Wiley & Sons, Inc. 2008.

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

Course Outcomes:

After completion of the course the students will be able to,

1. Analyze the operations of different FACTS devices on a given transmission line and assess the impact of FACTS controller
2. Choose proper controller for the specific application based on system requirements
3. Interpret the control circuits of Shunt Controllers SVC & STATCOM for various functions viz. Transient stability Enhancement, voltage instability prevention and power oscillation damping
4. Detect the Power and control circuits of Series Controllers GCSC, TSSC and TCSC

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE741E.1	3	2	1	3	2				1	2	2	3	2	2
2	22UEE741E.2	3	2	2	1	3				1	2	2	2	2	1
3	22UEE741E.3	3	2	2	2	2				1	1	2	2	3	2
4	22UEE741E.4	3	2	3	2	3				1	2	2	3	3	2

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE742E	Battery Management Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Battery-Management-System Requirements: Introduction and BMS functionality. Requirements: Sensing, High-voltage contactor control, Isolation sensing and thermal control, Protection and interface, State-of-charge estimation and Energy & power estimation.	
UNIT – II	**(10 Hours)**
Battery State Estimation: Preliminary definitions, approaches to estimate state of charge, Review of probability, Overview of vector random (stochastic) processes, Sequential-probabilistic-inference solution, The six-step process, Deriving the linear Kalman filter, Visualizing the Kalman filter, MATLAB code for the Kalman filter steps, Practical considerations, The extended Kalman filter (EKF)	
UNIT – III	**(10 Hours)**
Battery Health Estimation: Introduction, Lithium-ion aging: Negative electrode, Lithium-ion aging: Positive electrode, Sensitivity of voltage to ESR and total capacity, A Kalman filter framework for estimating parameters, EKF for parameter estimation, Simultaneous state and parameter estimation, Robustness and speed, The problem with least-squares capacity estimates, Derivation of weighted ordinary least squares, Derivation of weighted total least squares, Goodness of the model fit and confidence intervals, Simplified method with proportional confidence on xi and yi.	
UNIT – IV	**(10 Hours)**
Cell Balancing: Causes (and not causes) of imbalance, Design choices when implementing balancing, Circuits for balancing (1): Passive, Circuits for balancing (2): Active, capacitive, Circuits for balancing (3): Active, inductive and dc-dc, How quickly must I balance a pack? And results of balancing simulations. Voltage-Based Power-Limit Estimation: Problem definition, Voltage-based rate limits, using simple cell model, Voltage-based rate limits, using comprehensive cell model, Bisection search and Power-limits estimation example.	
Reference Books: 1. A.R. JHA, Next-Generation Batteries and Fuel Cells for Commercial, Military, and Space Applications, CRC Press, 2012. 2. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric, Springer, 2013. 3. Gregory L. Plett, Battery Management Systems, Volume 1: Battery Modeling , Artech House September 2015	
Course Outcomes: After completion of the course the students will be able to, 1. Explain the functional requirements and critical roles of a Battery Management System (BMS) in electric energy systems. 2. Apply probabilistic and filtering techniques for battery state estimation using Kalman and Extended Kalman Filters. 3. Evaluate battery health and degradation mechanisms using statistical and estimation	

models.

4. Analyze balancing circuits and estimate voltage-based power limits for optimal battery pack performance

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE742E.1	3	2	2									3	2	
2	22UEE742E.2	3	3	3	3	3							2	3	3
3	22UEE742E.3	3	3	3	3	2							2	3	3
4	22UEE742E.4	2	3	3	2	2							2	3	3

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE743E	Energy Conservation, Audit and DSM	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Energy Scenario: Introduction to Energy; Units and Conversions; GDP, GNP and Per Capita Energy Consumption; Renewable Energy Act, International Energy Agency, OECD and Kyoto Protocol (only overview)

Economic Analysis of Energy: Economic analysis of investment, Cash Flows and CF diagrams, Economic analysis technique – Simple payback period method, Discounted cash flow method or Time adjustment technique, Net present value method, Present value index method or Profitability index method, Internal rate of return method, Accounting on average rate of return method; Interest Factors – Single Payment Compound Amount (SPCA), Single Payment Present Worth (SPPW), Uniform Series Compound Amount (USCA), Sinking Fund Payment (SFP), Uniform Series Present Worth (USPW), Capital Recovery (CR). (Simple Numerical problems).

UNIT – II	(10 Hours)

Motors: Introduction, Motor Efficiency, Motor Selection; Determination of energy saving, Energy saving options in oversized motors, Effect of variation of voltage on performance of motor, Effect on efficiency due to variation in load; Energy Efficient Motors, Choice of energy efficient motor, Factors Affecting Energy Efficiency, Rewinding Effects on Energy Efficiency, Standards and Star Labeling of Energy Efficient Induction Motors.

Lighting: Introduction, Terms and definitions – Lumen, Lux, Load efficacy, Lamp circuit efficacy, Colour rendering index (CRI); Characteristic of different types of lamps, Aspects of lighting system designing, Installed load efficacy ratio, Various means of energy savings – Use of natural day light, Reduction in light fixture, High efficiency lamps and luminaries, Effect of reduction in supply voltage on energy consumption, Timers and occupancy sensors.

UNIT – III	(10 Hours)

Energy Management and Audit: Energy management; Developing energy use profiles; Sankey Diagram; Process flow diagrams; Material and energy balance; Energy auditing instruments. Energy audit – Need for energy audit, Scope of energy audit, Types of energy audit – Preliminary energy audit, Detailed energy audit.

UNIT – IV	(10 Hours)

Energy Conservation: Introduction, Results of energy conservation, Principles of energy conservation, Energy conservation planning, Energy conservation Act,; Energy conservation in residential and commercial sectors, Energy conservation in transportation, considerations for Energy conservation in industry, Energy conservation in electricity generation, transmission and distribution, Energy conservation in agricultural sector.

Demand Side Management: Introduction to DSM – Definition, Evolution, Benefits and Scope; Role of Energy Companies, Load Management, Application of Load Control, DSM Implementation Issues, Strategies to implement and Promote DSM, Customer acceptance of DSM, Environment & DSM, International experience with DSM, DSM in India.

Reference Books:

1. Suresh Kumar Soni and Manoj Nair, “Energy Conservation and Audit”, Satya Prakashan, New Delhi, 2010.

2. Rajiv Shankar, “Energy Auditing in Electrical Utilities”, Viva Books, New Delhi, 2010.
3. Larry C. White, Philip S. Schmidt, David R. Brown, “Industrial Energy Management Systems”, Hemisphere Publishing Corp, New York.
4. Albert Thumann, “Fundamentals of Energy Engineering”, Prentice Hall Inc, Englewood Cliffs, New Jersey.
5. Gupta, B. R., “Generation of Electrical Energy”, Eurasia Publishing House Pvt. Ltd., New Delhi, 6th, 2006

Course Outcomes:

After completion of the course the students will be able to,

1. Solve issues & interpret outcomes related to energy economics and energy efficient motors
2. Compare & contrast on selection of energy economic techniques, lighting criterion, energy efficient motors and energy alternative from DSM techniques
3. Evaluate various methods of energy conservation and DSM in different sectors like agriculture, commercial, transpiration and domestic
4. Design and develop methods/techniques for energy conservation, audit & management

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE743E.1	1	2	2	3								3		1
2	22UEE743E.2	1	2	3	3			1		1	1		3		1
3	22UEE743E.3	1	2	3	3			1		1	1		3		1
4	22UEE743E.4	1	2	3	3						1		3		1

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE744E	Energy Efficient Motors	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction: Need for energy efficient machines, energy cost and two part tariff, energy conservation in industries and farms -a necessity, introduction to energy management and energy audit system. Review of induction motor characteristics.	
UNIT – II	**(10 Hours)**
Power Factor: The power factor in sinusoidal systems, power factor improvement, power factor with nonlinear loads, Harmonics and the power factor.	
UNIT – III	**(10 Hours)**
Energy Efficient Motors: Standard motor efficiency, why more efficient motors? An energy efficient motor, efficiency determination methods, Direct Measurement method, Loss segregation method, Comparison, motor efficiency labelling, energy efficient motor standards. Motor life cycle.	
UNIT – IV	**(10 Hours)**
Induction Motors and Adjustable Drive Systems: Energy Conservation, adjustable speed systems, Application of adjustable speed systems to fans, pumps and constant torque loads.	

Reference Books:

1. Witte. L.C., P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation”, Hemisphere Publishers, Washington, 1988.
2. Callaghn, P.W. “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.
3. Dryden. I.G.C., “The Efficient Use of Energy”, Butterworths, London, 1982
4. Turner. W.C., “Energy Management Hand book”, Wiley, New York, 1982.
5. Murphy. W.R. and G. Mc KAY, “Energy Management”, Butterworths, London 1987.

Course Outcomes:

After completion of the course the students will be able to,

1. Examine the need for energy efficiency in machines and industries, and analyze the role of energy audits and management systems in reducing energy costs.
2. Analyze the concept of power factor under linear and nonlinear loads and evaluate its significance in energy conservation.
3. Evaluate the performance of energy efficient motors using efficiency determination methods and compare with conventional motors.
4. Apply energy conservation techniques in induction motor drive systems and analyze the suitability of adjustable speed drives for various industrial loads.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE744E.1	3	2		2		1	2					2		1
2	22UEE744E.2	3	3		2	2		2					3	2	
3	22UEE744E.3	3	2	3	2								3	3	
4	22UEE744E.4	3	2	3	2	2							3	2	2

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE745E	Wind Energy Conversion Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction: Introduction: Nature of wind, historical uses of wind, history of wind electric generation, working principle of wind turbines (lift and drag mechanism), components of horizontal and vertical axis wind turbines, classification, applications, advantages and disadvantages.	
UNIT – II	**(10 Hours)**
Wind Resource Assessment: Wind Data Analysis: Wind velocity – measurement and representation, wind speed statistics, probability distribution functions – Weibull and Raleigh. **Performance of Wind Turbine Generators:** Basics of fluid mechanics (simple terms & definitions), elementary fluid flow concepts,	
UNIT – III	**(10 Hours)**
Power in the wind: maximum power output of wind turbine (Betz limit), axial force and thrust on blades, torque developed by turbine, dynamic matching for maximum power extraction - tip speed ratio & blade pitch angle, power vs wind speed characteristics, electrical power output from wind energy conversion system, capacity factor, energy production.	
UNIT – IV	**(10 Hours)**
Electric Generators for WECS: Classification, basic working principle, advantages and disadvantages. **Grid-connected and Self-excited Induction Generator Operation:** Constant-voltage, constant-frequency generation, reactive power compensation, variable-voltage, variable-frequency generation, effect of wind generator on the network. **Wind Energy Conversion Systems (WECS):** Stand-alone and grid connected wind farms, simulation model of WECS. Site matching of wind turbine generators. Economics of wind systems: Reliability consideration, estimation of O&M costs, capital costs, cost of energy, estimation of payback period	

Reference Books:

1. Bhadra, S. N., Kashta, D., and Bannerjee, S., Wind Electrical Systems, Oxford University Press, New Delhi, 2009.
2. Gary L. Johnson, Wind Energy Systems, Prentice hall Publication, 1985.
3. G. D. Rai, Non-Conventional Energy Sources, Khanna Publishers New Delhi, 2007.
4. B. H. Khan, Non-Conventional Energy Resources, 2nd Edition, Tata McGraw Hill Publishing Ltd. New Delhi, 2009
5. D. Mukhaerjee and S. Chakrabarti, Fundamentals of Renewable Energy Systems, New Age International Publishers New Delhi, 2007.
6. D. P. Kothari, S. Umashankar, “Wind Energy Systems and Applications”, Narosa publishers, 2017.
7. Khan B. H., Non-Conventional Energy Resources, Tata McGraw Hill, 2009.

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

Course Outcomes:

After completion of the course the students will be able to,

1. Apply the principles of wind energy conversion and turbine operation in analyzing different types of wind turbines and their components.
2. Analyze wind resource data, turbine characteristics, and fluid flow behavior for performance assessment of wind energy systems.
3. Calculate the power output, capacity factor, and economic parameters of wind energy systems using appropriate performance equations and site data.
4. Design wind energy systems for standalone and grid-connected applications considering technical constraints, environmental impact, and economic viability.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE745E.1	3	2	2			2	3					2	1	1
2	22UEE745E.2	3	2	2	2			2					3	1	1
3	22UEE745E.3	3	3	3	3	3		2			2		2	1	1
4	22UEE745E.4	3	3	3	3	3	2	2		2	2		3	1	1

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE746E	AI Applications to Power Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Artificial Intelligence: History and Applications Introduction, Intelligence, Communication, Learning, Artificial Intelligence, History, Early Works, Importance, Definitions, Programming Methods, Techniques, Progress of Artificial Intelligence, Growth of AI, AI and Industry, AI and the world, Current Trends in Applied AI, Modeling, Simulation and AI, Intelligent Systems, Role of IS, Comparisons with conventional programs.

UNIT – II	(10 Hours)

Artificial Neural Network: difference between human machine and intelligence, biological neural network, artificial neuron model, Concept of Perceptron, ADALINE, Feedback in Neural Network, Neural Network Architectures: Neural Learning, Application of Neural Network in Power System

Fuzzy Logic: Introduction, Foundation of Fuzzy Systems, Representing Fuzzy Elements, Basic Terms and Operations, Properties of Fuzzy Sets, Fuzzification, Arithmetic Operations of Fuzzy Numbers.

UNIT – III	(10 Hours)

Genetic Algorithms and Evolutionary Programming: Introduction, Genetic Algorithms, Procedure of Genetic Algorithms, Genetic Representations, Initialization and Selection, Genetic Operators, Mutation, The Working of Genetic Algorithms, Evolutionary Programming, The Working of Evolutionary Programming.

UNIT – IV	(10 Hours)

Application of AI in Power Systems: Application of Neural Network and Expert Systems in Voltage Control, Application of ANN for security assessment, Schedule Maintenance of Electrical Power Transmission Networks using Genetic Algorithm, Intelligent Systems for Demand Forecasting.

Reference Books:

1. N. P. Padhy, “Artificial Intelligence and Intelligent Systems”, OXFORD University Press, New Delhi, 2005.
2. Stamations V. Kartalopoulos, “Understanding Neural Networks and Fuzzy Logic: Basic concepts and Applications”, Prentice Hall India Private Limited, New Delhi, 2002.
3. Abhisek Ukil, “Intelligent Systems and Signal Processing in Power Engineering, Springer Berlin Heidelberg”, New York, 2002.
4. Kevin Warwick, Arthur Ekwue and Raj Aggarwal, “Artificial Intelligence Techniques in Power Systems”, IEEE Power Engineering Series, UK, 1997.
5. Rajashekran, S. and VijaylaksmiPai, G.A., “Neural Networks, Fuzzy Logic and Genetic Algorithm Synthesis and Applications”, Prentice–Hall of India Private Limited, 2004.

Course Outcomes:

After completion of the course the students will be able to,

1. Apply the fundamentals of Artificial Intelligence, neural networks, fuzzy logic, and evolutionary algorithms for power system applications.
2. Analyze the behavior of neural networks, fuzzy systems, and genetic algorithms for solving engineering problems.
3. Solve practical problems related to power system operation, control, and

optimization using AI-based tools and techniques.

4. Evaluate the suitability of various AI methods for specific power system applications like voltage control, demand forecasting, and preventive maintenance.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE746E.1	3	2	2	2	2							3	2	2
2	22UEE746E.2	3	3	3	3	2							3	3	2
3	22UEE746E.3	2	3	3	3	3				2	2	2	3	3	2
4	22UEE746E.4	2	3	3	3	3		2		2	2	2	3	3	3

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE728P	**Project Work**	**12 - Credits (0 : 0 : 24)**
Hours/Week : 24		CIE Marks : 50
Total Hours :		SEE Marks : 50

Students have to take up literature survey, formulate the problem of the project, define the project objectives and prepare the project implementation schedule. Project work, based on the problem defined, should be completed and implemented. The implementation of the project work can be done either in a reputed industry/ research organization/ parent institute. A certified report with project demonstration and a seminar is to be presented by the students. The seminar should highlight – Broad project area of their project work carried out.

CIE of 50 marks will be conducted by the Committee consisting of HOD/Nominee + Project Coordinator + Guides as per the rubrics. For SEE, student has to make a presentation of the work carried out to Project Evaluation Committee (PEC- Project coordinator, Hod/Nominee, External Examiner). PEC will allot SEE marks for 50.

Course Outcomes

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

1. Identify, formulate & analyze the engineering problems associated with electrical & electronics engineering and interdisciplinary research.
2. Design & implement proposed solutions for complex engineering problems to meet specified objectives by analyzing / validating the design / solutions of engineering problems using contemporary tools & resources.
3. Prepare engineering documents and make effective presentation to communicate effectively and collaboratively with detailed analysis and interpretation of results to yield valid conclusions.
4. Demonstrate social, ethical cultural & engineering professional responsibilities.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE728P.1	3	3	2	2	1	1	1		2	2	2	3	2	1
2	22UEE728P.2	3	3	3	3	3				2	2	2	3	3	1
3	22UEE728P.3	2	2	2	2	2	2	1		2	3	2	2	3	1
4	22UEE728P.4								3	2	2	2	2	2	1

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UHS721C/22UHS821C	Research Methodology and IPR	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction to Engineering Research **Fundamentals of Research**: Meaning, objectives, and motivation in engineering research. **Types of Engineering Research:** Basic, applied, and translational research; identifying and solving Worthwhile problems. **Research Ethics:** Ethics in engineering research and practice, types of research misconduct, and ethical issues in authorship.	
UNIT – II	**(10 Hours)**
Literature Review and Citations **Technical Reading & Analysis:** Methods for reviewing literature, analyzing prior art, and synthesizing new and existing knowledge. **Bibliographic Databases:** Web of Science, Google, Google Scholar, effective search strategies. **Conceptualizing Research:** Critical and creative reading, taking notes, reading mathematical models, algorithms, and datasheets. **Citations & Acknowledgments:** Attribution, citation styles, impact of keywords, citing datasets, and knowledge dissemination	
UNIT – III	**(10 Hours)**
Intellectual Property Rights (IPR) & Patents: **Introduction to Intellectual Property:** Concepts of property and rights, forms of IPR, role in research and economic development, IP governance, and global innovation indicators. **Patents:** Definition, objectives, criteria for patentability, software/business method patents, infringement, compulsory licensing, and government use of inventions. **Patent Process:** Prior art search strategies, patent databases (free and paid), drafting specifications and claims, filing requirements, jurisdiction, opposition procedures, and renewal. **Filing Requirement of patent:** Patent Application Forms. Work flow chart in obtaining Patents, Jurisdiction of Filing Patent Application. Pre-grant & Post-grant Opposition. Forms to be submitted, filing mechanism through Individual patent office and PCT route. Need for a Patent Attorney/Agent Revocation. Term of Patent, Patent renewal and Fee Structure National Bodies Dealing with Patent Affairs. Utility Models.	
UNIT – IV	**(10 Hours)**
Copyrights and Related Rights: Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement and remedies in case of infringement. Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights and the Word 'Indian Work'. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC). International Copyright	

Agreements, Conventions and Treaties. Interesting Copyrights Cases.

Trademarks: Eligibility Criteria. Who Can Apply for a Trademark. Acts and Laws. Classification of Trademarks. Registration of a Trademark. Process for Trademarks Registration. Prior Art Search. Validity of Trademark. Trademark Registry. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd.

Industrial Designs: Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term. Procedure for Registration of Industrial Designs. Prior Art Search. Application for Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.

Reference Books:

1. Dr. Santosh M Nejakar, Dr. Harish Bendigeri "Research Methodology and Intellectual Property Rights", ISBN 978-93-5987-928-4, Edition: 2023-24.
2. David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1- 107-03488-4
3. Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-30-9
4. P. Naryan, "Intellectual Property Law", 3rd Ed, Eastern Law House, 2007.
5. Dr. S.R. Myneni, "Law of Intellectual Property", 9th edition, Asia law House, 2019.
6. Dr. G.B Reddy, "Intellectual Property Rights and Law", Gogia Law Agency, Hydrabad, Reprint edition 2020.
7. N.R. Subbaram. S. Viswanathan, "Hand book Indian Patent Law and, Practice" Printers and publishers Pvt. Ltd, 2008.
8. Cornish, "Intellectual Property Rights", Universal publications.
9. Dr. B. L. Wadehra, "Law Relating to Intellectual Property" 5th edition, Universal Law publishing Co, Dehli.

Course Outcomes:

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

1. Integrate research methodology in engineering sciences in relevant trades.
2. Exhibit reflective thinking in problem solving exercises.
3. Identify criteria to fit one's own intellectual work in particular form of IPRs and able to apply statutory provisions and procedure to protect different forms of IPRs at national and international level.
4. Develop skill of making search using modern tools and techniques and also student is able to become patent agent by cracking patent agent exam.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UHS721C.1		2	2	3	2	1	2	3		1	2			
2	22UHS721C.2		3	2	3		2	2	2			2			
3	22UHS721C.3					2	3	2	3		1	3			
4	22UHS721C.4				2	3	2		1		1				

Syllabus for B.E VII - Semester for academic year 2026 – 2027

(For students admitted to I year in 2023-24)

22UEE725I/825I	Internship	10 - Credits (0 : 0 : 30)
Hours/Week : 30		CIE Marks : 50
Total Hours : --		SEE Marks : 50

All the students have to undergo mandatory Research/Industrial internship in any one of the reputed industry/ research institute. The internship program has to be taken up during the entire semester. The duration of the training program should be for entire semester for 15 weeks. A report on the internship is to be submitted. The supervisor/ guide from industry shall allot 100 marks of the CIE and the other 100 by the internal evaluation committee. SEE evaluation will be made by a committee comprising of HoD as Chairman/his nominee, internship coordinator and a senior faculty. The SEE will be a Technical Seminar on the industrial training.

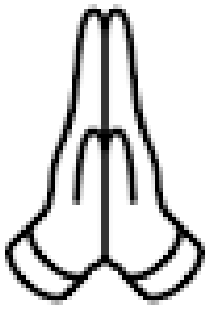
Course Outcomes

After undergoing the internship, students shall be able to:

1. Test the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period.
2. Operate the systems/ devices independently and tabulate the experimental results in consultation with supervisor.
3. Apply various soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship organization.
4. Analyze the real time functioning of internship organization.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	22UEE815I.1	2	2	2	3	1			1	1		2	1	1	3
2	22UEE815I.2	2	2	1	3	3			1	1		2	1	1	3
3	22UEE815I.3						1	1	3	3	3	2			3
4	22UEE815I.4	2	2	3	3	3	1	1	1	2	2	1	2	2	2



Thank You

End of the Document