B.V.V.S

Scheme and Syllabus

B.E in Electrical and Electronics Engineering

For 2021-22 Admitted Batch

Department of Electrical and Electronics Engineering
Basaveshwar Engineering College
Bagalkote-587102

B.V.V.S

Vision and Mission of the College

Vision

To be recognized as a premier technical institute committed to developing exemplary professionals, offering research based innovative solutions and inspiring inventions for holistic socio-economic development

Mission

- **To pursue excellence through student centric dynamic teaching-learning processes, encouraging freedom of inquiry and openness to change.**
- **To carry out innovative cutting edge research and transfer technology for industrial and societal needs.**
- **To imbibe moral and ethical values and develop compassionate, humane professionals.**

B.V.V.S

Vision and Mission of the Department

Vision

To be in the global forefront of Academic Excellence, Research, and Innovation in Electrical and Electronics Engineering to influence and meet the energy, environment, industrial and societal needs.

Mission

- **To practice dynamic teaching-learning processes adapting to ongoing global technological developments in the field of Electrical and Electronics Engineering.**
- **To involve ourselves in national/international (industry/institute) collaborations for higher studies, research, development and innovation.**
- **To carryout inter-disciplinary projects, skill development activities and field visits to imbibe real life experiences in students.**
- **To render empathetical services to resolve energy, ecology and environmental issues.**

B.V.V.S

Programme Educational Objectives (PEOs)

After successful completion of the program:

PEO1: **The graduates will be able to pursue professional career**

PEO2: **The graduates will be able to take up higher studies and research**

PEO3: **The graduates will be able to engage in multi-disciplinary innovation and entrepreneurship activities**

PEO4: **The graduates will be able to adopt emerging technologies to provide solutions to the societal and environmental issues**

B.V.V.S

Programme Specific Outcomes (PSOs)

After successful completion of the program:

PSO1: **Specify, formulate and analyze concepts used in power systems and electrical machines as per requirements of power & energy sector**

PSO2: **Identify, analyze, design and test technologies used in power electronics, electronic & signal processing circuits and control systems**

PSO3: **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**

Program Outcomes as defined by NBA (POs)

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.

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

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

2021-22 (admitted batch), 2022-23 (sem 3&4), 2023-24 (sem 5&6), 2024-25 (sem 7&8).

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

Table-1: Breakdown of Credits (NEP 2020) suggested by the VTU Belagavi/AICTE New Delhi

Sl.	Course Category	Proposed by		
		AICTE	VTU	BEC (A)
1.	BSC: Basic Science Courses (Physics, Chemistry and Mathematics)	25	23	23
2.	ESC: Engineering Science Courses (Basic Elect/ electronics/ computer/ mechanics /workshop /drawing / etc.)	24	20	19
3.	HSMC: HSS, Management courses, Kannada, English, Const., EV (VTU and BEC: 4 English, 1 Kannada, 1 Const., 1 EV, 3 HRM left to dept)	12	10	10
4.	PCC: Professional Core Courses (Fundamental subjects of individual disciplines)	48	43	49
5.	PEC: Professional Elective Courses relevant to the branch with at least one course either fully or partially supported by industry.	18	14	12
6.	OEC: Open Electives Courses/Subjects from other technical/arts/commerce & AEC: (1 Scientific foundations of Health, 2 Innovation and design 2 SS, 2 Biology or RM, 3 MOOCS, 3 Dept. specific)	18	14	9+11 = 20
7.	Mini (2) and Major projects (8)/ seminar (1)/ summer internships (2+3) and Research/Industrial Internships (10)	15	32	26
8.	Mandatory Credit course: UHV :1, Non-credit courses: Yoga, NSS, Bridge course maths 1 and 2 (lateral Entry)	No Credits	04	01
Total		160	160	160

Table-2: Semester wise Breakdown of Credits

Sem	BSC	ESC	HSMC	AEC	OEC	PCC	PEC	Proj.	INT	Seminar	UHV	Total
I	7	10	2	1 (common)								20
II	7	9	2	2 (common)								20
III	3		1	1 (dept.)		14					1	20
IV	3		1			15			2			21
V	3		1	2(SS)	3	11			3			23
VI					6	9	3	2				20
VII			3				9	8				20
VIII				3 (MOOCS) + 2 (RM-dept.)					10	1		16
Tot.	23	19	10	11	09	49	12	10	15	01	01	160*

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Semester-I Physics Group **AY 2021-22 (Common to branches EE, CS, IS & AI)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	BSC	21UMA101C	Engineering Mathematics – I	3	3	0	0	50	50	100
2.	BSC	21UPH102C	Engineering Physics	3	3	0	0	50	50	100
3.	ESC	21UCS103C	Principles of Programming with C	3	3	0	0	50	50	100
4.	ESC	21UEC104C	Basic Electronics Engineering	3	2	2	0	50	50	100
5.	ESC	21UEE105C	Basic Electrical Engineering	3	3	0	0	50	50	100
6.	HSMC	21UHS106C	Communicative English	2	2	0	0	50	50	100
7.	AEC	21UHS107C	Scientific Foundation of Health	1	2	0	0	50	50	100
8.	BSC	21UPH108L	Engineering Physics Laboratory	1	0	0	3	50	50	100
9.	ESC	21UCS109L	Programming practice using C Laboratory	1	0	0	2	50	50	100
			Total	20	18	2	5	450	450	900

Semester-II Chemistry Group **AY 2021-22 (Common to branches EE, CS, IS & AI)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1	BSC	21UMA201C	Engineering Mathematics – II	3	3	0	0	50	50	100
2	BSC	21UCH210C	Engineering Chemistry	3	3	0	0	50	50	100
3	ESC	21UCV211C	Engineering Mechanics	3	3	0	0	50	50	100
4	ESC	21UME212C	Elements of Mechanical Engineering	3	2	2	0	50	50	100
5	ESC	21UME213L	Computer Aided Engineering Drawing	3	2	0	2	50	50	100
6	BSC	21UCH214L	Engineering Chemistry Laboratory	1	0	0	2	50	50	100
7	HSMC	21UHS206C	Professional writing skills in English	2	2	0	0	50	50	100
8	AEC	21UHS215C	Innovation and Design Thinking	2	1	0	2	50	50	100
			Total	20	16	2	6	400	400	800

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Semester-3 **CAY 2022-23 (160 Credits 2021-22 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	BSC	21UMA303C	Computation Techniques for Electrical Systems -I	3	3	0	0	50	50	100
2.	PCC	21UEE305C	Network Analysis	3	2	2	0	50	50	100
3.	PCC	21UEE306C	Electronic Circuits	3	3	0	0	50	50	100
4.	PCC	21UEE307C	Electrical Machines – I	3	3	0	0	50	50	100
5.	PCC	21UEE308C	Electrical & Electronic Measurement	3	2	0	2	50	50	100
6.	PCC	21UEE310L	Electronic Circuits Laboratory	1	0	0	2	50	50	100
7.	PCC	21UEE311L	Electrical Machines – I Laboratory	1	0	0	2	50	50	100
8.	AEC	21UEE315C	Agri-Tech	1	1	0	0	50	50	100
9.	HSMC	21UHS321C	Constitution of India	1	1	0	0	50	50	100
10.	UHV	21UHS324C	Universal Human Values – II	1	1	0	0	50	50	100
11.	BSC	21UMA300C	Bridge Course Mathematics-I**	0	3	0	0	50	50	100
12.	NCMC	21UHS001M	Yoga	0	--	--	--	--	--	--
		21UHS002M	National Service Scheme	0						
		21UHS003M	Physical Education (Sports and Athletics)	0						
			Total	20	16	2	6	500	500	1000

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 VIII semester (for 5 semesters). The accumulated marks are considered for CIE. SEE will be conducted in final semester. Successful completion of the registered course is mandatory for the award of the degree.

Semester-4 **CAY 2022-23 (160 Credits 2021-22 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	BSC	21UMA403C	Computation Techniques for Electrical Systems -II	3	3	0	0	50	50	100
2.	PCC	21UEE405C	Power Systems – I	3	3	0	0	50	50	100
3.	PCC	21UEE406C	Logic Design	3	3	0	0	50	50	100
4.	PCC	21UEE407C	Electrical Machines – II	3	3	0	0	50	50	100
5.	PCC	21UEE408C	Control Systems	3	3	0	0	50	50	100
6.	PCC	21UEE410L	Power System – I Laboratory	1	0	0	2	50	50	100
7.	PCC	21UEE411L	Logic Design Laboratory	1	0	0	2	50	50	100
8.	PCC	21UEE412L	Electrical Machines – II Laboratory	1	0	0	2	50	50	100
9	INT	21UEE415I	Summer Internship – I	2	0	0	4	100	--	100
10.	HSMC	21UHS422C	Saamskrutika Kannada **	1	1	0	0	50	50	100
			OR							
10.	HSMC	21UHS423C	Balake Kannada **	1	1	0	0	50	50	100
11.	BSC	21UMA400C	Bridge Course Mathematics-II***	0	3	0	0	50	50	100
			Total	21	16	0	10	550	450	1000

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Semester-5 **CAY 2023-24 (160 Credits 2021-22 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	BSC	21UMA503C	Computation Techniques for Electro-Magnetic Fields	3	2	2	0	50	50	100
2.	PCC	21UEE505C	Power System – II	3	3	0	0	50	50	100
3.	PCC	21UEE506C	Power Electronics	3	3	0	0	50	50	100
4.	PCC	21UEE507C	Digital Signal Processing	3	3	0	0	50	50	100
5.	PCC	21UEE510L	Power Electronics Laboratory	1	0	0	2	50	50	100
6.	PCC	21UEE511L	Auto CAD Electrical Laboratory	1	0	0	2	50	50	100
7.	INT	21UEE515I	Summer Internship – II	3	0	0	6	70	30	100
8.	OEC	21UEE516N	Open Elective Course – I	3	3	0	0	50	50	100
9.	AEC	21UHS521C	Quantitative Aptitude and Professional Skills	2	2	0	0	50	50	100
10.	HSMC	21UBT523C	Environmental Studies	1	1	0	0	50	50	100
			Total	23	17	2	10	520	480	1000

Semester-6 **CAY 2023-24 (160 Credits 2021-22 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	21UEE605C	Power System – III	3	3	0	0	50	50	100
2.	PCC	21UEE606C	Microcontrollers	3	3	0	0	50	50	100
3.	PCC	21UEE610L	Power System – II Laboratory	1	0	0	2	50	50	100
4.	PCC	21UEE611L	Microcontrollers Laboratory	1	0	0	2	50	50	100
5.	PCC	21UEE612L	Advanced Programming Laboratory	1	0	0	2	50	50	100
6.	PEC	21UEE6xxE	Professional Elective Course – I	3	3	0	0	50	50	100
7,	OEC	21UEE616N	Open Elective Course – II	3	3	0	0	50	50	100
8.	OEC	21UEE617N	Open Elective Course – III	3	3	0	0	50	50	100
9.	Proj	21UEE618P	Mini Project	2	0	0	4	50	50	100
			Total	20	15	0	10	450	450	900

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Semester-7[#] **CAY 2024-25 (160 Credits 2021-22 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PEC	21UEE7xxE	Professional Elective Course-II	3	3	0	0	50	50	100
2.	PEC	21UEE7xxE	Professional Elective Course-III	3	3	0	0	50	50	100
3.	PEC	21UEE7xxE	Professional Elective Course-IV	3	3	0	0	50	50	100
4.	Proj	21UEE718P	Project Work	8	0	0	16	50	50	100
5.	HSMC	21UHS721C	Intellectual Property Rights	3	3	0	0	50	50	100
			Total	20	12	0	16	250	250	500

Semester-8[#] **CAY 2024-25 (160 Credits 2021-22 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	INT	21UEE815C	Research/Industrial Internship	10	0	0	20	70	30	100
2.	Seminar	21UEE816C	Technical Seminar	1	0	0	2	100	--	100
4.	AEC	21UEE817C	Research Methodology (online)	2	2	0	0	50	50	100
3.	AEC	21UEE8xxC	MOOCs*	3	0	0	0	--	--	--
5.	NCMC	21UHS001M	Yoga	0	--	--	--	50	50	100
		21UHS002M	National Service Scheme							
		21UHS003M	Physical Education (Sports and Athletics)							
			Total	16	2	0	22	220	80	300

[#] 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 Open Elective Course I - 21UEE516N		
1.		Electric Vehicle
2.		Fundamentals of Wind Energy Conversion Systems

Semester-6

List of subjects for Professional Elective Course – I (Sem-VI)		
1.	21UEE611E	Electrical Machine Design
2.	21UEE612E	Electrical Engineering Materials
3.	21UEE613E	Testing and Commissioning of Electrical Equipment
4.	21UEE614E	Data Base management Systems
5.	21UEE615E	Operation Research
6.	21UEE616E	Field Theory

List of subjects for Open Elective Course II - 21UEE616N		
1.		Electrical Safety for Engineers
2.		Energy Storage Systems

List of subjects for Open Elective Course III - 21UEE617N		
1.		Renewable Energy Resources
2.		MATLAB for Engineers

Semester-7

List of subjects for Professional Elective Course – II (Sem-VII)		
1.	21UEE721E	Integration of Distributed Generation
2.	21UEE722E	Automotive Electronics
3.	21UEE723E	Intelligent Instrumentation
4.	21UEE724E	VLSI Design
5.	21UEE725E	Electric Machine Drives
6.	21UEE726E	Modern Control Theory
7.	21UEE727E	Power System Operation and Control

List of subjects for Professional Elective Course – III (Sem-VII)		
1.	21UEE731E	Smart Grids
2.	21UEE732E	Electric Vehicles
3.	21UEE733E	Solar Photovoltaic System Design
4.	21UEE734E	Reactive Power Management
5.	21UEE735E	Power System Planning
6.	21UEE736E	HVDC Transmission

List of subjects for Professional Elective Course – IV (Sem-VII)		
1.	21UEE741E	Flexible AC Transmission Systems
2.	21UEE742E	Battery Management Systems
3.	21UEE743E	Energy Conservation, Audit and DSM
4.	21UEE744E	Energy Efficient Motors
5.	21UEE745E	Wind Energy Conversion Systems
6.	21UEE746E	AI Applications to Power Systems

Syllabus for

B.E. I/II - Semester

for academic year 2021 – 2022

(For students admitted to I year in 2021-22)

Syllabus for B.E I/II - Semester for academic year 2021 – 2022

(For students admitted to I year in 2021-22)

Syllabus as per NEP applicable to Students admitted to

BE I - Semester during the academic year 2021 – 2022

21UEE105C/21UEE205C	**Basic Electrical Engineering**	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs.**
Electrical Power Generation: Power Generation: Hydel plants, Thermal plant, Nuclear plant- Working principle, Site selection parameters, Pros & Cons. Renewable energy sources: Solar power plant and Wind turbine generators **Electromagnetism:** Comparison between magnetic and electric circuits, Faradays laws, Lenz's law, Fleming's rules, Statically and dynamically induced emf, Self and mutual inductance, Coefficient of coupling, Energy stored in a magnetic field.	
UNIT – II	**10 Hrs.**
Single Phase AC Circuits: Generation of sinusoidal voltages, Phase & phase difference of sinusoidal waveform, J-operator, Voltage and current relationships, Instantaneous and average power in R, L, C, R-L, R-C & R-L-C series circuits, R-L-C Parallel circuits. **Three Phase AC Circuits:** Generation of three phase AC voltage, Phase sequence, Voltage and current relationship for star and delta connections, Advantages of three phase supply over single phase. Measurement of power using two wattmeters (for balanced load), Expression for power factor in terms of wattmeter readings, Effect of power factor on wattmeter readings.	
UNIT – III	**10 Hrs.**
Transformer: Types, Construction and principle of operation, EMF equation, No load and On load operation, Losses and efficiency. **DC Machines:** Construction, Principle of operation as generator and motor, emf equation, back emf, Torque equation, Classification and applications, Necessity of starters.	
UNIT – IV	**10 Hrs.**
AC Machines: Alternator: Types, Construction, Principle of operation, emf equation excluding Kp & Kd. Induction Motor: Types, Construction and principle of operation, Rotating magnetic field, Frequency of rotor current, Slip, Torque equation, Applications, Star-Delta starter. **Electrical Wiring and Safety:** Elementary details: safety devices- Fuses, MCB's, Necessity of earthing and types of earthing. Electrical wiring- Conduit and Concealed wiring, Two way and three way control of lamps, Calculation of energy consumption and billing	

Syllabus for B.E I/II - Semester for academic year 2021 – 2022

(For students admitted to I year in 2021-22)

Reference Books:

1. Edward Hughes, "Electrical and Electronic Technology", Pearson Publications, 10th Edition, 2010
2. B. L Theraja, "Fundamentals of Electrical Engineering and Electronics", S. Chand Publications, 27th Edition, 2008
3. Rajendra Prasad, "Fundamentals of Electrical Engineering", PHI Learning, 2nd Edition, 2009
4. V. N. Mittle & A. Mittal, "Basic Electrical Engineering", Tata McGraw-Hill Education, 2005
5. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", 2nd Edition, Pearson Publications, 2017

Course Outcomes:

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

1. Recall definitions and fundamental concepts of magnetic circuits, electromagnetism, AC circuits and electrical earthing **(BLL 1)**
2. Illustrate - the laws of magnetic circuits, electric circuits; concepts of AC circuits; operation of electrical equipment viz. transformer, AC machines, DC machines; domestic wiring practices; principles of electricity generation **(BLL 2)**
3. Derive the expressions for electromotive force (emf), inductances, power in AC circuits, torque in electric machines **(BLL 3)**
4. Analyze and provide solutions to problems associated with magnetic circuits, AC circuits, transformers, electric machines, energy billing **(BLL 4)**

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Students shall be able to Recall definitions and fundamental concepts of magnetic circuits, electromagnetism, AC circuits and electrical earthing	**3**					**1**	**1**					**1**
2	Students shall be able to Illustrate - the laws of magnetic circuits, electric circuits; concepts of AC circuits; operation of electrical equipment viz. transformer, AC machines, DC machines; domestic wiring practices; principles of electricity generation	**3**	**2**				**1**	**1**					**1**
3	Students shall be able to Derive the expressions for electromotive force (emf), inductances, power in AC circuits, torque in electric machines	**3**	**2**	**1**									
4	Students shall be able to Analyze and provide solutions to problems associated with magnetic circuits, AC circuits, transformers, electric machines, energy billing	**3**	**3**	**1**	**1**								

Syllabus for

B.E. III - Semester

for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UMA303C	Computation Techniques for Electrical Systems - I	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs.
Introduction: Definitions of signals and systems, Classification of signals, Elementary signals, Basic operations on signals, Properties of systems.	
UNIT – II	**10 Hrs.**
Time-domain representation for LTI systems: Convolution, Impulse response representation, Properties of impulse response representation, Block diagram representations	
UNIT – III	**10 Hrs.**
Z-Transforms: Introduction, Z transform, Properties of ROC, Properties of the Z - transform, Inverse Z - transform, Partial fraction expansion method, Transfer function, Causality and Stability	
UNIT – IV	**10 Hrs.**
Fourier Analysis of Continuous Time Periodic and Aperiodic signals: Introduction, Properties of continuous-time Fourier series (Excluding derivation of defining equations for CTFS), Linearity, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parseval's theorem and problems on properties of Fourier series and Fourier transform.	

References:

1. Simon Haykin and BaryVam Veen, "Signals and Systems," John Wiely and Sons, 2nd Edition, 2014.
2. H P HSU, "Signals and Systems," Schaums Outline, TMH, 2nd Edition, 2011.
3. Michael Roberts, "Fundamentals of Signals & Systems", 2nd Edition, Tata McGraw-Hill, 2010
4. Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, "Signals and Systems" Pearson Education Asia / PHI, 2nd Edition, 2013.
5. Ganesh Rao, Satish Tunga, "Signals and Systems", Sanguine Technical Publishers, 2nd Edition, 2020.

Course Outcomes:

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

1. Represent signals and perform the basic operations on signals and to identify systems properties on causality, stability, memory, linearity and time invariance
2. Illustrate- Continuous time systems and discrete time system by performing Convolution in LTI system with properties of impulse response
3. Analyze and Derive the Z transforms and properties of Z transform by using the concept of ROC
4. Determine Fourier series and properties of Fourier series in CTFS and CTFT signals

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

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	21UMA303C.1	2	3										1	1	2	1
2	21UMA303C.2	3	1	2	1								1	2	3	1
3	21UMA303C.3	3	3	1	1	1			1				1	1	2	1
4	21UMA303C.4	3	3	2	2	1			1				1		1	1

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE305C	Network Analysis	03 - Credits (2 : 1 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 52		SEE Marks : 50

UNIT – I	(7L-8T Hours)

Mesh and Node Analysis: Practical source transformation, network reduction using star delta transformation, Loop and node analysis with linearly dependent and independent source for DC and AC networks. Concept of super node and super mesh- Numerical Problems

Network Topology: Graph of network, concept of tree and co-tree, incidence matrix, Tie-set & cut-set schedules, Formulation of equilibrium equations in matrix form, solution of resistive network, Principles of duality- Numerical Problems

UNIT – II	(6L-6T Hours)

Network Theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Compensation theorem, Tellegan's theorem - Numerical Problems

UNIT – III	(7L-6T Hours)

Transient Behavior and Initial Conditions: Behavior of circuit element under switching condition and their representation, evaluation of initial and final conditions in RL, RC, and RLC circuits for AC and DC excitation- Numerical Problems

Laplace Transformations and Applications:

Step, Ramp and Impulse functions and their Laplace transformation, Waveform synthesis and Laplace transformation, Initial value theorem and final value theorem, transformed network and their solution- Numerical Problems

UNIT – IV	(6L-6T Hours)

Resonant Circuits: Series and parallel resonance, frequency-response of series and parallel circuits, Q-factor, Bandwidth-Numerical Problems

Two Port Network Parameters: Short Circuit admittance parameters, open circuit impedance parameters, transmission parameters, hybrid parameters, relationship between parameters sets- Numerical Problems

Reference Books:

1. William H, Jack E Kemmerly and Steve Durbin, "Engineering Circuit Analysis", 8th Edition, Tata McGraw Higher Education, 2014.
2. M. E. Van Valkenburg, "Network analysis", 3rd Edition, PHI Learning, 2014.
3. Roy Chowdhary, "Network and Systems", 2nd Edition, New age International Publications, 2010.
4. Charles K. Alexander, Matthew N. O. Sadiku "Fundamentals of Electric Circuits", 5th Edition, Tata McGraw Higher Education, 2013.
5. Abhijit Chakrabarti, "Circuit Theory-Analysis and Synthesis", 7th Edition, Dhanpat Rai Technical Publishers, 2016.

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

Course Outcomes:

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

1. Calculate current, voltage and power dissipated in various branches of the complex electric circuit having three or more meshes/nodes by applying electric circuit theorems
2. Solve and analyze the electrical circuits under transient conditions with the given initial conditions using Laplace transforms
3. Analyze series and parallel resonance circuits to determine the circuit parameters (L&C) for which the circuit will resonate at given frequency
4. Evaluate Admittance, Impedance, Hybrid and Transmission parameters for a given two port network by deriving the relation between different set of parameters.

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	21UEE305C.1	3							1		1		1	3	1	1
2	21UEE305C.2	3	1						1		1		1	2	3	1
3	21UEE305C.3	3	3	2	2	1			1		1		1	1	1	1
4	21UEE305C.4	3	3	3	3	1			1	1	1		2	1	1	1

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE306C	Electronic Circuits	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs.
Diode Circuits: Introduction, clipping circuits, Clipping at two independent levels, Clamping Circuits, Comparators, Full wave rectifier with C filter. **Transistor Biasing:** Introduction, Operating point, DC load line, Bias stability, voltage divider bias, Derivation of stability factors, Bias compensation.	
UNIT – II	**10 Hrs.**
BJT Low Frequency Analysis: Introduction, two port devices. Hybrid model, transistor hybrid model. h - Parameters, Analysis of transistor amplifier circuit using h- parameters (CE amplifier only). **Multistage Amplifiers & Power Amplifier:** Introduction, Classification of Amplifiers, , Frequency response of R-C coupled amplifier, Class A large signals amplifier, Transformer coupled power amplifier, Class B (Push pull) amplifiers. **Field Effect Transistor:** Transfer characteristics of JFET, Important relationships, Depletion & Enhancement type MOSFETs.	
UNIT – III	**10 Hrs.**
Basics of Op-Amps: Block diagram and characteristics of 741 Op-amp, Op-amp as an inverting and non- inverting amplifier, voltage follower, adder, subtractor, integrator and differentiator. **Signal Processing circuits:** Precision half wave & full wave rectifiers, limiting circuits, clamping circuits, peak detectors, sample and hold circuits, Voltage regulators basics, voltage follower regulator, adjustable output regulator.	
UNIT – IV	**10 Hrs.**
Applications of Op-Amps: Zero crossing detectors, inverting Schmitt trigger circuit, non-inverting Schmitt circuit. Astable multivibrator and mono-stable multivibrator using 555 timer, Phase shift oscillator, oscillator amplitude stabilization and Wein bridge oscillator. **Active filters:** First and second order high pass and low pass filters, band stop and band pass filters.	

Reference 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. David A. Bell, "Operational Amplifier and Linear ICS", 3rdEdition, Oxford, 2012.
4. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuits Theory, 9thEdition, Pearson/Prentice Hall, India, 2006.
5. Ramakanth A. Gayakwad, "Operational Amplifier and Linear ICS", 4thEdition, PHI, 2016.
6. Jacob Millman, Arvin Grabel, Microelectronics, 2ndEdition, Tata McGraw Hill, New Delhi, 2003

Course Outcomes:

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

1. Design and analyze diode clipping, limiting and clamping circuits

2. Examine various transistor biasing circuits
3. Analyse BJT, MOSFETs, and multistage amplifiers
4. Design and analyse op-amp based feedback circuits and various applications of op amps

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	21UEE306C.1	3	2	2									2	3	3	3
2	21UEE306C.2	3	2										2	2	3	3
3	21UEE306C.3	3		3		1			1		1		1	2	2	1
4	21UEE306C.4	3	3	3		1			1		1		2	2	2	1

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE307C	Electrical Machines-I	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs.

Single Phase Transformer:
Constructional details and EMF equation, Phasor diagrams, Calculation of equivalent circuit parameters by OC and SC tests, Transformer ratings and per unit (p.u.) scaling, Losses & efficiency, all day efficiency, voltage regulation, polarity test and Sumpner's test.

UNIT – II	10 Hrs.

Three Phase Transformers
Construction of three phase transformer and types, bank of single phase transformers for three phase operations and their connections: star-star, star-delta, delta-star, delta-delta, open delta, Labeling of terminals and vector groups, Single unit three phase transformer, Choice of connections:, Harmonics in transformer, Suppression of harmonics by tertiary winding, Scott connection and Phase conversion.
(Note: No analysis of Scott connection)
Parallel operation of Transformer
Need for parallel operation, conditions to be satisfied for parallel operation and load sharing.
Auto Transformer: Construction, working principle, saving of copper and applications.

UNIT – III	10 Hrs.

Three Phase Induction Motor:
Construction and types of motors, Principle of operation, production of rotating magnetic field, slip, rotor induced emf and its frequency, power losses in an induction motor, equivalent circuit, torque equation, torque-slip characteristics-motoring, generating and braking modes, starting torque, maximum torque, effect of rotor resistances on torque slip - characteristics, power output, no load and blocked rotor test- evaluation of equivalent circuit parameters, Cogging and crawling, Introduction of circle diagram.
(Note: Drawing of circle diagram would be done from NL and BR test in the laboratory. No problems on circle diagram in theory papers)

UNIT – IV	10 Hrs.

Starting and Speed Control of Three Phase Induction Motors:
Need for starter, DOL, star delta, autotransformer and rotor resistance starters, Calculation of starting torque, double cage and deep bar motors, speed control by rotor resistance, voltage control, V/f control, NEMA classifications.
Introduction of Induction generator, Linear induction motor
Single Phase Induction Motors: Construction, double field revolving theory, equivalent circuit, starting of single phase motors: Resistance split phase, capacitor start and capacitor run motors, shaded pole motors.

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

Reference Books:

1. I J Nagarath and DP Kothari, "Electrical machines", 4th - Edition, TMH, New Delhi, 2020
2. Ashfaq Hussain, "Electrical Machines", Dhanpat Rai & Co. Publications, 3rd Edition, 2017
3. P.S. Bhimra, "Electrical Machinery", Khanna publishers, 7th Edition 2018
4. P.S. Bhimra, "Generalized Theory of Electrical Machines", Khanna publishers, 2014
5. M. G. Say, "Alternating Current Machines", ELBS publishers, 1986
6. Alexander Langsdorf, "Theory of alternating current machines", TMH, 1999

Course Outcomes:

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

1. Test the given transformers and induction motors by various methods and predetermine their performance such as losses, efficiency, and regulation.
2. Connect the given transformers in different configurations for different operations, like autotransformer, parallel operation and 3-phase connections.
3. Control the starting current and speed of 3-phase induction motors by suitable methods.
4. Select suitable induction motors for different industrial or domestic applications.

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	21UEE307C.1	3	2	2									2	3		3
2	21UEE307C.2	3	2										2	3		3
3	21UEE307C.3	3		3		1			1		1		1	3		2
4	21UEE307C.4	3	3	3		1			1		1		2	3	1	3

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE308C	**Electrical & Electronic Measurements**	**03 - Credits (2 : 0 : 2)**
Hours/Week : 2L + 2P		CIE Marks : 50
Total Hours :		SEE Marks : 50

UNIT – I	**7 Hrs.**
Measurement of Resistance Inductance and Capacitance: Measurement of medium resistance: Wheatstone bridge, Limitations; Measurement of low resistance: Kelvin's Double bridge; AC Bridges: General equilibrium equations of AC bridges; Measurement of Self Inductance – Types of bridges for measurement of self inductance, Maxwell's Inductance Capacitance Bridge, Measurement of Capacitance: Types of bridges for measurement of capacitance, De Sauty's bridge. Sources of errors in bridge circuits. Sources and Detectors	
UNIT – II	**6 Hrs.**
Measurement of Power and Related Parameters: Dynamometer Type Wattmeter; Induction Type Single Phase Energy meter – Construction, Theory; Dynamometer Type Single Phase Power Factor meter – Construction and Operation; Weston Frequency meter.	
UNIT – III	**7Hrs.**
Extension of Instrument ranges: Introduction; Shunts and Multipliers; Instrument Transformers: Advantages of Instrument Transformers, Ratios of Instrument Transformers, ratio Correction Factor, Burden on Instrument Transformer; Current Transformer(CT) – Theory of CT; Potential Transformer(PT) – Differences between CT and PT, Theory of PT.	
UNIT – IV	**6 Hrs.**
Sensors and transducers: Definition and meaning of sensors and transducers, Difference between sensors and transducers, Classification (Types) of transducers: Mechanical/Electrical, Active/Passive, Analog/Digital, Modulating/Self balancing. Advantages and Disadvantages of Electrical transducers. Principle, construction, working and application of: Resistive transducers - Resistance Temperature Detector (RTD), Light Dependent Resistor (LDR); Capacitive transducers; Inductive transducers: Linear variable differential transformer (LVDT). LM 35 sensor.	

List of Experiments

1. Measurement of low resistance using Kelvin's double bridge.
2. Measurements of inductance using Maxwell's L-C bridge.
3. Measurements of capacitance using De-sauty's bridge
4. Adjustment and calibration of l-Φ Energy meter.
5. Measurement of power in a balanced 3-phase circuit using two wattmeters for star and delta connected loads.
6. Evaluation of transfer characteristics of Resistance Temperature Detector (RTD) using RTD
   Module.
7. Evaluation of transfer characteristics of Light Dependent Resistor (LDR) using LDR module.
8. Evaluation of transfer characteristics of Semiconductor Temperature Sensor using LM35 sensor module/unit.

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

Reference Books:

1. A. K. Sawhney, "Electrical & Electronic Measurements and Instrumentation", 19th Edition, Dhanpat Rai & Son's, New Delhi, 2011.
2. Golding & Widdies, Pitman, "Electrical Measurements and Measuring Instruments", 5th Edition, D.R & Son's, New Delhi.
3. Ramon P. Areny, John G. Webster, "Sensors and Signal Conditioning", 2nd Edition, Wiley India Private Ltd.
4. Ian R. Sinclair, "Sensors and Transducers", 3rd Edition, Newgen Publication.

Course Outcomes:

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

1. Measure resistance, inductance and capacitance of a given specimen using DC and AC Bridges and validate the results analytically
2. Measure electrical power and related parameters using different types of measuring devices and validate the results analytically
3. Select Shunts & Multipliers, CT's & PT's to extend the range of ammeters & voltmeters
4. Select sensors & transducers for different electrical based applications

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	21UEE308C.1	3	2	2									2	3		3
2	21UEE308C.2	3	2										2	3		3
3	21UEE308C.3	3		3		1			1		1		1	3		2
4	21UEE308C.4	3	3	3		1			1		1		2	3	1	3

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE310L	Electronic Circuits Laboratory	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Design and testing of diode clipping and clamping circuits.
2. Design of fixed bias and voltage divider bias circuits for BJT.
3. Design of RC coupled single stage BJT amplifier and determination of the gain, frequency response, input and output impedances.
4. Calculation of hybrid parameters of a CE transistor amplifier
5. Study of Op-Amp as
   - Inverting and non-inverting amplifier
   - Voltage follower
   - Adder and substractor
6. Study of Op-Amp as zero crossing detector
7. Study of Op-Amp as Schmitt trigger
8. Design and testing of Op-Amp based RC phase shift oscillator.
9. Study of rectifiers using Op-Amp.
10. Design and testing of first and second order filters using Op-Amp.
11. Study of astable multi vibrator using 555 timer

Reference 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. David A. Bell, "Operational Amplifier and Linear ICS", 3rd Edition, Oxford, 2012.
4. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuits Theory, 9th Edition, Pearson/Prentice Hall, India, 2006.

Course Outcomes:

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

1. Draw the circuit, write the procedure and select the required electronic components for a given experiment.
2. Rig up the circuit and conduct experiments using the electronic components to achieve desired results.
3. Analyze 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	PO12	PSO1	PSO2	PSO3
1	21UEE310L.1	3				1	1					1	1	2	3	3
2	21UEE310L.2	3	1		1	2						1	2	3	3	3
3	21UEE310L.3	3	2	2	1	2	2					1	2	2	3	2

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE311L	Electrical Machines Laboratory - I	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Open circuit and short circuit test on single phase transformer and pre-determination of efficiency, regulation for different loads at power factors. Calculations of equivalent circuit parameters of a given transformer.
2. Polarity test
3. Sumpner's test to calculate no load loss and full load loss and predetermine efficiency.
4. Parallel operation of two single phase transformers and determine their load sharing
5. Connection of three single phase transformers: star-star, star-delta, delta-delta and delta-star.
6. Brake load test on three phase induction motor and performance evaluation, (torque-speed, BHP-efficiency, slip BHP, etc).
7. No-load and blocked rotor test on three phase induction motor to calculate parameters of equivalent circuit diagram and performance evaluation.
8. No-load and blocked rotor test on three phase induction motor to draw the circle diagram and hence the performance evaluation of given motor.
9. Speed control of three phase slip ring induction motor by rotor resistance.
10. Brake load test on single phase induction motor and performance evaluation (torque-speed, BHP- efficiency, slip -BHP, etc.)

Reference Books:

1. I J Nagarath and DP Kothari, "Electrical machines", 4th Edition, TMH, New Delhi
2. Ashfaq Hussain, "Electrical Machines", Dhanpat Rai & Co. Publications, 3rd Edition, 2017
3. P.S. Bhimra, "Electrical machinery", Khanna publishers, 7th Edition 2018
4. Mohinder Singh Sejwal "Laboratory manual for Electro mechanics", Curriculum Development Cell, Dept. of EE IIT Delhi, Wiley Eastern Ltd, ISBN 0852261438

Course Outcomes:

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

1. Test the given transformers and induction motors by various methods and predetermine their performance such as losses, efficiency and regulation.
2. Connect the given transformers in different configurations for different operations, like autotransformer, parallel operation and 3-phase connections.
3. Control the speed of 3-phase induction motors by stator voltage and rotor resistance method.

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	21UEE311L.1	3	1	1		1	1					1	1	2	3	3
2	21UEE311L.2	3	1	1	1							1	1	3	3	3
3	21UEE311L.3	3	1	1	1							1	1	2	3	2

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE315C	Agri Tech	01 - Credits (1 : 0 : 0)
Hours/Week : 01		CIE Marks : 50
Total Hours : 15		SEE Marks : 50

UNIT – I	(4 Hours)
Irrigation: Need for Irrigation, History of Irrigation in India, Ill effects of irrigation, Type of Irrigation methods (Surface, Drip, Sprinkler) pros and cons of each method, Types of pumps employed in agriculture-pros and cons.	
UNIT – II	**(4 Hours)**
Crop water assessment: Concept of Evapotranspiration, Growth stages of crops, Different methods for assessment of evapotranspiration, Crop factors. Assessment of hydraulic head and HP rating of Pumps, Assessment of energy conservation and saving potential.	
UNIT – III	**(4 Hours)**
Different types of SPV irrigation systems and components, Advantages of SPV pumps, Issues in sizing the SPV based pumps, Govt. schemes for SPV irrigation systems.	
UNIT – IV	**(3 Hours)**
Design of Drip Irrigation Systems: Components used, Layout of drip irrigation, Selection of lateral pipelines, Sizing of pumping unit, Cost and Energy Analysis.	

Reference Books:

1. A.M.Michael, “Irrigation Theory and Practice”, Vikas Publishers, Second Enlarged Edition, 2011.
2. B.F.Ronad, S H Jangamshetti, “Optimum Sizing of SPV Irrigation Systems based on Field Conditions”, LAP LAMBERT Academic Publishing, August 2018.
3. M.Kay, N.Hatcho, “Small-Scale Pumped Irrigation: Energy and Cost”, Irrigation Water Management Training Manual, Food and Agriculture Organization of United States, Rome, 1992.

Course Outcomes:

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

1. Identify the challenges faced by farmers and will be able to suggest probable solution
2. Calculate the exact water requirement of the crops for the specific location for the local climatic conditions and suggest the suitable size of the irrigation pumps
3. Analyze the working of various irrigation schemes powered by AC Grid/SPV powered systems
4. Suggest the type of micro irrigation scheme for specified agriculture land for proposed crops

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	21UEE315C.1	2	2										1	2		2
2	21UEE315C.2	2	1	1			1						1	1		2
3	21UEE315C.3	2	1	1			1	1	1				1	1		2
4	21UEE315C.4	2	2	1	1		1	1	1				1	1		1

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UHS321C	Constitution of India	01 - Credits (1 : 0 : 0)
Hours/Week : 01		CIE Marks : 50
Total Hours :15		SEE Marks : 50

UNIT – I	(4 Hours)
Introduction Indian constitution: The Salient Features of the Indian Constitution. Preamble to the Constitution of India. Fundamental Rights, Directive Principles of State policy and Fundamental Duties**.**	
UNIT – II	**(4 Hours)**
The Union and State Governments: The Union Executive, The Union Legislature and The Union Judiciary - The Supreme Court of India	
UNIT – III	**(4 Hours)**
The Indian State Government: The State Executive, The State legislature and The State Judiciary **The Local Government:** Local Government-Panchayat raj system with special reference to 73rd and Urban Local Self Govt. with special reference to74th Amendment.	
UNIT – IV	**(3 Hours)**
Election provisions, Emergency provisions, Amendment of the constitution:	

Reference Books:

1. An introduction to the constitution of India and Profession Ethics, Venkatesh B. R. and Merunandan K. B., Idea International Publication, Bangalore.
2. M. V. Pylee, “Introduction to the Constitution of India”, 4th Edition, Vikas publication, 2005.
3. The Constitution of India and Profession of Ethics, K. R. Phaneesh, Sudha Publication, Bangalore.
4. Durga Das Basu (D. D. Basu), “Introduction to the constitution of India”, (Student Edition), 19th Edition, Prentice-Hall EEE, 2008.
5. Engineering Ethics: Charles Harries J. R. and Michard and Michael J. Rabins

Course Outcomes:

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

1. Understand and explain the significance of Indian Constitution as the fundamental law of the land.
2. Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building.
3. Analyse the Indian political system, the powers and functions of the Union, State and Local Governments in detail.
4. Elaborate Electoral Process, Emergency provisions and Amendment procedure.

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	**21UHS321C.1**						**1**	**1**					**1**			
2	**21UHS321C.2**						**3**	**1**					**2**			
3	**21UHS321C.3**						**1**	**1**					**1**			
4	**21UHS321C.4**												**1**			

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UHS324C	**Universal Human Values-II**	**01 - Credits (1 : 0 : 0)**
Hours/Week : 01		CIE Marks : 50
Total Hours :15		SEE Marks : 50

UNIT – I	**(4 Hours)**
Introduction to Value Education: Right Understanding; Relationship and Physical Facility; Understanding Value Education; Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity -the Basic Human Aspiration-Current Scenario and Method to Fulfill the Basic Human Aspirations.	
UNIT – II	**(4 Hours)**
Harmony in the Human Being: 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.	
UNIT – III	**(4 Hours)**
Harmony in the Family and Society and Nature: 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; Understanding Harmony in the Nature; Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature..	
UNIT – IV	**(3 Hours)**
Implications of the Holistic Understanding – a Look at Professional Ethics 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; Strategies for Transition towards Value-based Life and Profession	
Reference Books: 1. 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. Teachers' Manual for 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- 53-2 3. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999. 4. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.	
Course Outcomes: Upon successful completion of the course, students will be able to: 1. Explore holistic vision of life - themselves and their surroundings. 2. Develop competence and capabilities for maintaining Health and Hygiene. 3. Analyze various problems in life, family, Society and in handling problems with Sustainable Solutions. 4. Apply values to their own self in different day-to-day settings in real life and in handling problems with sustainable solutions. 5. Adopt the value of appreciation and aspiration for excellence and gratitude for all.	

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

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	**21UHS324C.1**							**3**	**2**	**3**			**1**			
2	**21UHS324C.2**						**3**	**3**	**1**	**1**			**1**			
3	**21UHS324C.3**						**3**	**3**	**2**	**1**			**1**			
4	**21UHS324C.4**						**2**	**2**	**3**	**2**			**1**			
5	**21UHS324C.5**								**3**				**1**			

Syllabus for

B.E. IV - Semester

for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

Syllabus for B.E IV - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UMA403C	Computation Techniques for Electrical Systems -II	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs.
Fourier analysis of Discrete Time Periodic and Aperiodic signals: Introduction, Properties of Discrete - time Fourier series , Linearity, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parseval's theorem and problems on Fourier series and Fourier transforms.	
UNIT – II	**10 Hrs.**
Numerical Analysis – I: Introduction to root finding problems, Newton-Raphson method. Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae. (Without proof), Lagrange's Method (without proof). Numerical differentiation using Newton's forward and backward formulae-problems. Numerical Integration: Trapezoidal rule, Simpson's one third rule.	
UNIT – III	**10 Hrs.**
Numerical Analysis - II: Numerical methods for solution of differential equations: Euler's and Modified Euler's method, Runge-Kutta 4^{th} order method. Step by step method(point by point method) **Statistics:** Curve fitting by the method of least squares: $y = a + bx$, $y = a + bx + cx^2$, $y = ab^x$.	
UNIT – IV	**10 Hrs.**
Basic Probability Theory: Probability concepts, Random variables probability distributions. Binomial distributions, Poisson distributions and Normal distributions. Concept of joint probability, Joint probability distributions.	

References:

1. Numerical Methods for Engineers by Steven C Chapra & Raymond P Canale.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. Advanced Engineering Mathematics By H. K. Das, S. Chand & company Ltd. Ram Nagar, New Delhi
4. "Signals and Systems", Ganesh Rao, Satish Tunga, Sanguine Technical Publishers, 2^{nd} Edition , 2020.
5. Signals and Systems, Uday Kumar S.PRISM book publisher, 6^{th} Edition , 2013
6. H P HSU, "Signals and Systems," Schaums Outline, TMH, 2^{nd} Edition , 2011.
7. Probability and stochastic processes by Roy D. Yates and David J. Goodman, wiley India pvt. ltd 2^{nd} Edition 2012.
8. Theory and problems of probability by Seymour Lipschutz (Schaum's Series).

Course Outcomes:

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

1. Apply the concepts of Fourier series and Fourier transforms to analyse Discrete Time Periodic and aperiodic signals.
2. Solve engineering problems using numerical techniques.
3. Obtain the numerical solution of ordinary differential equations.
4. Apply the concepts of Statistics and probability to solve problems in Engineering.

Syllabus for B.E IV - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

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	21UMA403C.1	2	3										1	1	2	1
2	21UMA403C.2	3	1	2	1								1	2	3	1
3	21UMA403C.3	3	3	1	1								1	1	2	1
4	21UMA403C.4	3	3	2	2	1	1						1		1	1

Syllabus for B.E IV - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE405C	Power System I	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs.

AC Transmission Systems: Typical AC transmission system, Advantages of high voltage transmission. Comparison of conductor material in overhead lines: 3 phase 3 wire system, 3 phase 4 wire system. Components of overhead transmission line: Conductors, Line supports, Insulators – Types, Potential distribution over suspension insulator string, String efficiency, Methods of improving string efficiency. Corona – Factors affecting corona, Imp terms, Methods of reducing corona. Sag in overhead lines- Calculation of sag for equal and unequal supports, Effect of wind and ice loading on sag.

UNIT – II	10 Hrs.

Electrical Parameters of Overhead Transmission Lines: Constants of Transmission line. Inductance of single phase two wire line, Capacitance of single phase two wire line.

Performance of Transmission Lines: Classification of overhead Transmission line. Short Transmission line, Medium Transmission line – End condenser method, Nominal T method, Nominal π method, Long Transmission line. Generalized circuit constants (ABCD) of a transmission line.

UNIT – III	10 Hrs.

Underground Cables: Construction of underground cables, Insulating materials for underground cables, Laying of underground cables. Insulation resistance of single core cable, Capacitance of single core cable, Dielectric stress in a single core cable.

Distribution Systems: Classification of distribution systems. Overhead Vs Underground distribution system. Connection schemes of distribution system. Requirements of a distribution system. Types of DC distributors, DC distributor fed at one end- Concentrated loading, Uniform loading. DC distributor fed at both ends - Concentrated loading.

Circuit Breakers: Operating Principle of circuit breaking, Arc Phenomenon, Principle of Arc extinction, Methods of Arc extinction, Types of circuit breakers: Air blast circuit breaker, SF6 circuit breaker.

UNIT – IV	10 Hrs.

Protective Relaying and Protective Schemes: Relay definition, Required qualities of Protective Relaying, Primary and Back up protection, Classification of protective Relaying, Induction type Non-directional over current relay, Directional relay. Differential relay-Principle of operation, Distance relays: Impedance Relay, Reactance Relay, Mho Relay; and Buchholz Relay.

Static Relays: Introduction, Basic construction and classification. Definite time lag static over current relay, Inverse time static over current relay, Static over voltage and under voltage relay, Microprocessor based over current relay-block diagram approach.

Reference Books:

1. Mehta V K and Rohit Mehta, “Principles of Power Systems”, 4th Edition, S Chand and Company Ltd, Publishers, New Delhi, 2015.
2. Soni, Gupta and Bhatnagar, “Power System Engineering”, 5th Edition, Dhanapat Rai and Co.(P) Ltd. Publishers, New Delhi, 2016.
3. Sunil Rao, “Switchgear and Protection and Power Systems”, 13th Edition, Khanna Publishers, 2008.

4. J.B.Gupta, "Switchgear and Protection", 2nd Edition, Katson Publisher, 2013.
5. Ravindarnath B, "Power System Protection and Switchgear", 2nd Edition, New age International, 2008.

Course Outcomes:

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

1. Select various mechanical components for overhead transmission line based on the required electrical properties, mechanical properties and available budget
2. Estimate sag for equal, unequal supports with and without considering wind/ice loading
3. Assess performance of short, medium and long transmission lines in terms of efficiency and regulation
4. Select relevant method to implement protective schemes against different faults in electrical 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	21UEE405C.1	3											1	1	2	3
2	21UEE405C.2	3	1										1	1	1	2
3	21UEE405C.3	3	3	2	2	1	1						1	2	2	2
4	21UEE405C.4	3	3	3	3	1	1		1		1		2	1	1	1

Syllabus for B.E IV - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE406C	Logic Design	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs.
Introduction: Introduction to Digital logic Design; Binary Systems and Codes: Binary Numbers, Octal and Hexadecimal Numbers; Number Base Conversions; Arithmetic Operation with different Bases; Complements. Signed Binary Numbers; Binary Codes and conversions: BCD, Gray, ASCII and EBCDIC. Binary Logic and Logic Gates: AND, OR and NOT.	
UNIT – II	**10 Hrs.**
Boolean Algebra and Logic Gates: Basic Definition. Basic Theorems. Boolean Functions; Standard Forms: Minterm and Maxterm. Simplification of Boolean Functions using SOP and POS; Logic Operations: NAND, NOR, Exclusive-OR and Equivalence. Integrated Circuits **Gate-Level Minimization:** The Map Method. Two- and Three-Variable Map. Four-Variable Map. Product of Sums Simplification. Don't-Care Conditions, logic gates implementation, determination and selection of Prime Implicants, Essential and Nonessential prime Implicants.	
UNIT – III	**10 Hrs.**
Analysis and Synthesis of Combinational Circuits: Combinational Circuits. Analysis and Design Procedure; Binary Adders-Subtractor; Decoders and Multiplexers, Sequential Circuits, Latches. **Flip-Flops:** RS, D, JK and T; Analysis of Clocked Sequential Circuits. Design Procedure, Registers and Counters: Registers. Shift Registers; Synchronous Counters. Ripple Counters.	
UNIT – IV	**10 Hrs.**
Sequential Circuits with Programmable Logic Devices: Introduction, Random-Access Memory, Memory Decoding, Read-Only Memory. Programmable Logic Array. **Verilog:** Introduction to Verilog, Verilog Structural and Behavioral Design, Verilog Time Dimension and Test Benches.	
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. Kandel Langholz, Digital Logic Design, Prentice Hall, 1988. 4. Rafiq uzzaman& Chandra, Modern Computer Architecture, West Pub. Comp., 1988. 5. Zvi. Kohavi, Switching and Finite Automata Theory, Tata McGraw Hill, India, 2004. 6. C. V. S. Rao, Switching and Logic Design, 3rd Edition , Pearson Education, India, 2009. 7. Donald D. Givone, Digital Principles and Design, Tata McGraw Hill, India, 2002.	
Course Outcomes: After completion of the course the students will be able to, 1. Simplify Boolean functions using various reduction algorithms 2. Design and implement variety of logical circuits using combinational logic 3. Design and implement variety of logical circuits using sequential logic 4. Model various Verilog descriptions to test and verify digital systems	

Syllabus for B.E IV - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

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	21UEE406C.1	3	2	2									2	1	3	1
2	21UEE406C.2	3	2	3									3	1	3	1
3	21UEE406C.3	3		3	1	1					1		3	1	3	1
4	21UEE406C.4	3	3	3	1	1			1		1		2	1	3	1

Syllabus for B.E IV - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE407C	Electrical Machines-II	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs.
DC Generator: Construction of DC machines, introduction of armature windings, emf equation, types of excitations, no load and load characteristics (only separately excited and shunt field generator, no compound generator) Armature reaction and its effects, demagnetizing and cross magnetizing AT/pole, compensating winding, interpole, commutation **DC Motors:** Principle of Operation & concept of back EMF, torque equation, characteristics of D.C. motors (without compound motors), and applications, universal motor.	
UNIT – II	**10 Hrs.**
Starting, Speed control and Braking of DC Motors: Necessity of starters, resistance starters (excluding three point and four point starter), Speed control of shunt field, separately excited and series motors, Ward Leonard method of speed control, Braking of DC motors **Testing of D.C Motors:** Losses in DC Machine, Efficiency, direct load test, Swinburne's test, Field's test on DC series motors.	
UNIT – III	**10 Hrs.**
Synchronous Machines: Construction and types, types of field excitation, emf equation for generator, effect of distribution winding and chorded coils, effects of harmonics on emf generated, phasor diagram of a Synchronous generator with cylindrical rotor, voltage regulation, calculation of synchronous reactance by emf method **Salient pole synchronous machines:** Two-reaction model, slip test.	
UNIT – IV	**10 Hrs.**
Parallel operations of alternators: Synchronization, parallel operation, operation on infinite bus, operating characteristics, power flow equations of Alternators **Synchronous Motors:** Principle of operation, methods of starting, phasor diagram, effect of changing excitation, V and inverted V curves of synchronous machines, hunting in synchronous machines, effect of damper windings	

Reference Books:

1. I J Nagarath and DP Kothari, "Electrical machines", 4th - Edition , TMH, New Delhi,2020
2. Ashfaq Hussain, "Electrical Machines", Dhanpat Rai & Co. Publications, 3rd Edition , 2017
3. P.S. Bhimra, "Electrical machinery", Khanna publishers, 7th Edition 2018
4. P.S. Bhimra, "Generalized theory of Electrical machines", Khanna publishers, 2014
5. M. G. Say, "Alternating Current Machines" ELBS publishers, 1986
6. Alexander Langsdorf, "Theory of alternating current machines", TMH, 1999

Course Outcomes:

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

1. Test the dc/ac generator and motor for losses and efficiency using various methods.
2. Analyse the effect of harmonics on ac generator and motor in emf generation.
3. Estimate the emf, number of poles/slots, losses, efficiency and power flow equations of dc/ac generator and motor
4. Select the suitable generator and motor for various engineering applications.

Syllabus for B.E IV - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

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	21UEE407C.1	3				1	1						1	1	3	2
2	21UEE407C.2	3	1										1	1	2	1
3	21UEE407C.3	3	3	2	2								1		2	1
4	21UEE407C.4	3	3	3	3	1		1					2	1	2	1

Syllabus for B.E IV - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE408C	Control Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction and Transfer Function of Systems: Classification of control systems, open loop and closed loop systems, effects of feedback, Mathematical models of physical systems; definition of transfer function, Mechanical systems, Rotational systems, Electrical systems, Analogous systems. Usage of MATLAB command-line functions to verify the solution.	
UNIT – II	**(10 Hours)**
Block Diagrams and Signal Flow Graphs: Block diagrams (BD), Reduction of BD, Signal Flow graphs (SFG), Drawing block diagram and SFG of simple networks Mason's gain formula, Converting BD into SFG. Usage of MATLAB command-line functions to verify the solution.	
UNIT – III	**(10 Hours)**
Time Response of Feed Back Control Systems: Standard test signals, Unit step response of First and second order systems, time response specifications, and Time response specifications of second order systems, steady state errors and error constants. **Stability Analysis:** Concepts of stability, Necessary conditions for Stability, Routh's stability criterion. **Root–Locus Techniques:** Root locus concepts, Construction of root loci. Usage of MATLAB command-line functions to verify the solution.	
UNIT – IV	**(10 Hours)**
Frequency Domain Analysis: Introduction, frequency domain specifications, correlation between time and frequency response. Method to draw bode plot, phase margin, gain margin, Nyquist stability criterion. **Introduction to State Variable Analysis**: Concepts of state, state variables and state model, state models for linear continuous time systems, conversion of state model to transfer function and transfer function to state model. Usage of MATLAB command-line functions to verify the solution.	
Reference Books: 1. Norman S Nise "Control System Engineering", McGraw Hill, 2010. 2. Benjamin C Kuo, "Automatic Control System", VII- Edition , PHI, 2010. 3. Richard C. Dorf Robert H Bishop "Modern Control Systems", VII- Edition , Addison Wesle 4. Ogata, K., Modern Control Engineering, Prentice–Hall of India Private Limited, 2001	
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.	

Syllabus for B.E IV - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

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	21UEE408C.1	3	3	2	2	1							1	1	2	
2	21UEE408C.2	3	3	3	2	2							1	1	3	2
3	21UEE408C.3	3	3	2	2	2			1		1		1	1	3	2
4	21UEE408C.4	3	3	2	2	2			1		1		1	1	3	1

Syllabus for B.E IV - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE410L	Power System – I Laboratory	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. ABCD parameters for short and medium network of transmission lines.
    a) Verification of Symmetry and Reciprocity of the network.
    b) Determination of regulation and efficiency.
2. Operating characteristics of static Under/Over Voltage relay.
3. Operating characteristics of Microcontroller over voltage relay (DMT and IDMT)
4. Operating characteristics of Electro-Mechanical over current relay.
5. Operating characteristics of Electro-Mechanical Earth fault relay.
6. Operating characteristics of Microcontroller over current relay (DMT and IDMT).
7. Operating characteristics of static Over Current relay (DMT).
8. Break down strength of transformer oil.
9. Experiment on field plotting using electrodes.
10. Measurement of high AC and DC voltage using Sphere-gap.
11. Flash-over characteristics of uniform and non-uniform Gaps for HVAC
    a) Plane-Plane Electrodes (Uniform field)
    b) Point-Plane Electrodes (Non-uniform field)

Reference Books:

1. Mehta V K and Rohit Mehta, “Principles of Power Systems”, 4th Edition, S Chand and Company Ltd, Publishers, New Delhi, 2015.
2. Soni, Gupta and Bhatnagar, “Power System Engineering”, 5th Edition, Dhanapat Rai and Co.(P) Ltd. Publishers, New Delhi, 2016.
3. Sunil Rao, “Switchgear and Protection and Power Systems”, 13th Edition, Khanna Publishers, 2008.
4. J.B.Gupta, “Switchgear and Protection”, 2nd Edition, Katson Publisher, 2013.
5. Ravindarnath B, “Power System Protection and Switchgear”, 2nd Edition, New age International, 2008.

Course Outcomes:

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

1. Determine the electrical network parameters using electrical topology
2. Perform test to evaluate the breakdown strength of transformer oil.
3. Measure high AC and DC voltage using Sphere-gap test

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	21UEE410L.1	2	3										1	1	2	1
2	21UEE410L.2	3	1	2	1								1	2	3	1
3	21UEE410L.3	3	3	1	1	1			1				1	1	2	1

Syllabus for B.E IV - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE411L	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	PO12	PSO1	PSO2	PSO3
1	21UEE411L.1	2	3										1	1	2	1
2	21UEE411L.2	3	1	2	1								1	1	3	1
3	21UEE411L.3	3	3	1	1	1			1				1	1	2	1

Syllabus for B.E IV - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE412L	Electrical Machines Laboratory-II	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. OCC characteristics of D.C. Shunt generator and determine critical resistance and critical speed.
2. Load characteristics of a D.C. generator.
3. Load test on a DC motor- determination of speed-torque and BHP-efficiency characteristics
4. Speed control of DC motor by armature voltage control and flux control.
5. Swinburne's test to determine losses of a dc shunt motor and efficiency.
6. Ward Leonard method of speed control of D.C. motor.
7. Fields test on dc series motors to determine losses and efficiency.
8. Voltage regulation of alternator by EMF and MMF method.
9. Synchronization of Alternator with infinite bus.
10. V and Inverted V curves of a synchronous motor

Reference Books:

1. I J Nagarath and DP Kothari, "Electrical machines", 4th - Edition , TMH, New Delhi
2. Ashfaq Hussain, "Electrical Machines", Dhanpat Rai & Co. Publications, 3rd Edition , 2017
3. P.S. Bhimra, "Electrical machinery", Khanna publishers, 7th Edition 2018
4. P.S. Bhimra, "Generalized theory of Electrical machines", Khanna publishers, 2014
5. M. G. Say, Performance and design of AC machines, CBS publishers.
6. Alexander Langsdorf, "Theory of alternating current machines", TMH, 1999

Course Outcomes:

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

1. Test the parameters of synchronous machine and DC machines by various methods and predetermine their performance such as losses, efficiency and regulation
2. Analyse the performance of DC and synchronous machines and tabulate the readings by their characteristics.
3. Select the suitable ac/dc generator and motor for various engineering applications

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	21UEE412L.1	3	1	1		1	1					1	1	2	3	3
2	21UEE412L.2	3	1	1	1							1	1	3	3	3
3	21UEE412L.3	3	1	1	1							1	1	2	3	2

Syllabus for B.E IV - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE415I	Summer Internship – I	02 - Credits (0 : 0 : 2)
Hours/Week :		CIE Marks : 50
Total Hours :		SEE Marks : 50

List of Activities

1. Monitor and Study Solar Radiation and SPV Panels
2. Monitor and Study wind measurement – using anemometer
3. Monitor and study DC irrigation pump powered by solar photovoltaic
4. Monitor and Study Solar thermal devices –
   a. Solar still
   b. Solar drier
   c. Solar boxcooker
   d. Solar concentrating dish cooker
   e. Solar water heaters
5. Monitoring and study of energy conservation in lighting systems
6. Energy Conservation study in domestic and institutional campus
7. Visit to 255 kW solar roof top power plant

Course Outcomes:

After undergoing the internship, students will be able to

1. Demonstrate the technical skills acquired during the internship
2. Operate the systems/ devices independently and tabulate the experimental results
3. Build the professional technical document with relevant conclusions drawn
4. Develop communication, interpersonal and other critical skills in the real time work environment

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	21UEE415I.1	1	1			2						2		2	1	2
2	21UEE415I.2	1	1			2	1		1		2	2		3	1	2
3	21UEE415I.3	1				1	1					2		2		1
4	21UEE415I.4	1							1	3	3	2		2		1

Syllabus for

B.E. V - Semester

for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UMA503C	**Computation Techniques for Electro-Magnetic Fields**	**03 - Credits (2 : 2: 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 52		SEE Marks : 50

UNIT – I	**(7L-6T Hours)**
Review of Vector Analysis: Introduction to scalars and vectors **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	**(6L-7T 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. **Conductors, Dielectrics and Capacitance:** Current and current density, Continuity of current, metallic conductors, Conductor properties and Boundary conditions, capacitance.	
UNIT – III	**(7L-6T 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, Force and torque on a closed circuit.	
UNIT – IV	**(6L-7T Hours)**
Materials and Inductance: The nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuit, Potential energy and forces on magnetic materials. **Time Varying Fields and Maxwell's Equations:** Faraday's law, displacement current, Maxwell's equation in point and Integral form.	
References: 1. William H. Hayt Jr. And John A Buck, "Engineering Electromagnetics**",** 17th Edition, Tata McGraw Hill, 2012. 2. John Karuss and Daniel A Fleisch, "Electromagnetics with Applications", 5th Edition McGraw-Hill, 1999. 3. Edward C. Jordan and Keith G Balmain, **"**Electromagnetic Waves and Radiating Systems," 2nd Edition, Prentice Hall of India / Pearson Education, 1968. Reprint 2002. 4. Dr. D. Ganesh Rao, "Field Theory", Sanguine Technical Publishers, 1st Edition, 2014.	

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

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. Analyse the time varying and static electric and magnetic fields for various charges
4. Select the suitable time varying Maxwell's equation for real-time application of electromagnetism.

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	21UMA503C.1	3	1	1	1	3	1		1		1		1	1	2	1
2	21UMA503C.2	3	2	1	1				1		1		1	2	3	1
3	21UMA503C.3	3	2	2	2	1		1	1		1		1	1	2	1
4	21UMA503C.4	3	3	3	2	1			1	1	1	1	2		1	1

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE505C	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 2023 – 2024

(For students admitted to I year in 2021-22)

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	PO12	PSO1	PSO2	PSO3
1	21UEE505C.1	3	1	1	1		1				1		1	2		1
2	21UEE505C.2	3	2	1	1						1		1	2		2
3	21UEE505C.3	3	2	2	2	1		1	1		1		1	2		2
4	21UEE505C.4	3	3	3	2	1			1	1	1	1	2	1	1	2

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE506C	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 Converter** 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	PO12	PSO1	PSO2	PSO3
1	21UEE506C.1	3							1		1		1	2	1	2
2	21UEE506C.2	3	3						1		1		1		2	
3	21UEE506C.3	3	3	2	1	1			1		1		1		3	
4	21UEE506C.4	3	3	2	2	1			1		1		2	2	2	2

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE507C	Digital Signal Processing	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Discrete Fourier Transform: Introduction, Definition, and derivation of DFT and IDFT, Properties-linearity, shift, Symmetry etc., circular convolution, use of tabular arrays, circular arrays, Stock Ham's methods (via DFT-IDFT), Linear convolution of long duration sequences: Overlap-save and overlap-add methods.	
UNIT – II	**10 Hours**
Fast Fourier Transform Algorithms: Introduction, redix-2, decimation in time algorithm (DIT-FFT, DIT-IFFT), First decomposition, Continuation of decomposition, number of computations, number of multiplications, Computational efficiency **Design of FIR Digital filters:** Introduction, Windowing, rectangular, Hamming window	
UNIT – III	**10 Hours**
Design of IIR Digital Filters: Introduction, all pole analog filters- Butterworth and Chebyshev-I, Design of analog filters, Bilinear Transformation, Design of digital Butterworth and Chebyshev-I filters, Frequency transformations	
UNIT – IV	**10 Hours**
Realization of Digital Systems: Introduction, block diagrams and SFG's, Realization of IIR systems- direct form, cascade form, Parallel form, Realization of FIR systems- direct form, cascade form, Linear phase realizations	
Reference Books: 1. Proakis and Manolakis, "Digital Signal Processing Principle, algorithms and applications", 5th Edition, Pearson Education, 2021. 2. Sanjith K. Mithra, "Digital Signal Processing", 4th Edition, 2013. 3. P.Ramesh Babu, "Digital Signal Processing", 7th Edition, Scitech, 2018. 4. Salivahanam, "Digital Signal Processing", 4th Edition, TMH 2019. 5. Emmanuel, "Digital Signal Processing", 2nd Edition Pearson, 2001.	
Course Outcomes: After completion of the course the students will be able to, 1. Derive DFT properties and determine output of systems using convolution approach and DFT properties. 2. Assess the output of systems by deriving and developing fast Fourier algorithms. 3. Evaluate transfer function, frequency response, and output of a system by designing FIR/ IIR filters for required filter specifications. 4. Realize the discrete LTI system in direct form I & II, cascade and parallel forms. FIR/ IIR filters for required filter specifications.	

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

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	21UEE507C.1	3				1	1						1	1	3	2
2	21UEE507C.2	3	1										1	1	2	1
3	21UEE507C.3	3	3	2	2								1		2	1
4	21UEE507C.4	3	3	3	3	1		1					2	1	2	1

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE510L	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. Explain the basic operation of various power semiconductor devices and passive components
2. Apply power electronic circuits for different loads
3. Demonstrate the ability to apply what they have learned theoretically in the field of Power electronics

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	21UEE510L.1	3							1		1		1	2	1	2
2	21UEE510L.2	3	3						1		1		1		2	
3	21UEE510L.3	3	3	2	1	1			1		1		1	3	3	3

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE511LC	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	PO12	PSO1	PSO2	PSO3
1	21UEE511L.1	3	1	1		3	1					1	1	2	1	3
2	21UEE511L.2	3	2	2	1	3	1					1	2	2	1	3
3	21UEE511L.3	3	2	2	1	3	2					1	2	2		3

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE515I	Summer Internship – II	02 - Credits (0 : 0 : 2)
Hours/Week :		CIE Marks : 50
Total Hours :		SEE Marks : 50

Activities under Internship-II

This internship is referred to as Innovation/Societal/ Entrepreneurship based Internship and to be taken-up during the intervening vacation of IV and V semesters for all students.

During the intervening period of IV and V semesters, students shall be ready for industrial experience. Therefore, they shall choose to undergo an Internship involving Innovation / Entrepreneurship related activities. Students may choose to work on innovation or entrepreneurial activities or both resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry. In case students want to undergo an internship at his/her family business, he /she shall be permitted provided, a declaration by a parent is submitted directly to the Principal of the institution.

With the consent of the internship guide and Principal of the institution, students shall be allowed to carry out the internship at their hometown (within and outside the state), provided favorable facilities are available.

Course Outcomes:

After undergoing the internship, students will 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 and engage themselves in 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	PO12	PSO1	PSO2	PSO3
1	21UEE515I.1	1	1			2						2	3	2	1	2
2	21UEE515I.2	1	1			2	1		1		2	2	3	3	1	2
3	21UEE515I.3	1				1	1					2	3	2		1
4	21UEE515I.4	1							1	3	3	2	3	2		1

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

Open Elective Course-I

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

	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. HEVSubsystems 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 2023 – 2024

(For students admitted to I year in 2021-22)

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		3	1	1	1		1				1		1			
2		3	2	1	1						1		1			
3		3	3					1	1		1		1			
4		3	3	3	2	1			1	1	1	1	2			

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

	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. List and define various parameters and features of wind energy conversion systems.
2. Explain 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	PO12	PSO1	PSO2	PSO3
1		3	1	1				1	1		1		1			
2		3	1	1				2	1		1		1			
3		3	2	1				2	1	1	1		1			
4		3	3	3				2	1		1		2			

Syllabus for

B.E. VI - Semester

for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE605C	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 and EI-Abaid, A. H., "Computer Methods in Power System Analysis", 2019 MEDTECH, 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 2023 – 2024

(For students admitted to I year in 2021-22)

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 YBUS 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	PO12	PSO1	PSO2	PSO3
1	21UEE605C.1	3							1		1		1	2	1	
2	21UEE605C.2	3	1						1		1		1	1	2	1
3	21UEE605C.3	3	3	2	2	1			1		1		1	3	1	1
4	21UEE605C.4	3	3	3	3	1			1	1	1		2	3	1	

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE606C	Microcontrollers	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Microprocessors and Microcontrollers: Introduction of Microprocessors and Microcontrollers 8051, Features, Block diagram, pin diagram, program model, Architecture, PSW, PC, SP, Memory Organization **8051 Assembly Language Programming:** Introduction to assembly language programming, assembling and running a program, The program counter and ROM space, data types and directives. **Addressing Modes:** Introduction, Addressing modes, External Data Moves, Code Memory Read Only Data Moves, Indexed Addressing Mode, Programs, PUSH and POP Opcodes, programs, Data exchanges-Programs	
UNIT – II	**10 Hours**
Logical and Arithmetic Operations: Introduction, Arithmetic instructions, incrementing and decrementing, Addition, subtraction, multiplication and division, decimal arithmetic-Programs, Byte level Logical instructions, Bit level logical instructions, Rotate and swap instructions, Programs **Jump and Call Instructions:** The jump and call program range, jump and call instructions, machine cycle and time delays generation-Programs	
UNIT – III	**10 Hours**
8051 I/O and Timer Programming: Introduction, I/O programming, I/O Bit Manipulation Programming. Timers, programming timers 0 and 1 in 8051 assembly. Counter programming **8051 Serial Port Programming:** Basics of serial communication, 8051 connections to RS-232, Serial port programming in 8051 assembly.	
UNIT – IV	**10 Hours**
8051 Interfacing and Applications: Interfacing 8051 to LCD, parallel ADC0809, serial ADC MAX1112, DAC, Stepper motor **Programming in C for 8051:** Introduction, Programming in C for 8051: data types, Programs on time delays, I/O programming.	
Reference Books: 1. Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications" 3rd Edition, Cengage, 2007. 2. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; "The 8051 Microcontroller and Embedded Systems using assembly and C", 2nd Edition, Pearson, 2013. 3. Ajay V. Deshmukh; "Microcontrollers-Theory and Applications", TMH, 2017. 4. Dr.Ramani Kalpathi and Ganesh Raja; "Microcontroller and its applications", 1st revised Edition Sanguine Technical publishers, Bangalore-2007.	

5. Subrata Ghoshal ," 8051 Microcontrollers, 2/e: Internals, Instructions, Programming &Interfacing", 2nd Edition, Pearson, 2014.
6. K Uma Rao, "The 8051 Microcontroller", Pearson, 2010.

Course Outcomes:

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

1. Comprehend architecture of 8051 microcontrollers, instruction set, directives, addressing modes
2. Illustrate arithmetic, logical, jump and call instructions, formulate and develop assembly language programs.
3. Illustrate serial communication, assess program execution time by calculating number of machine cycles and develop programs for timers and serial port.
4. Interface peripheral devices and develop programms for given application using assembly language and 8051C.

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	21UEE606C.1	3							1		1		1	3	1	1
2	21UEE606C.2	3	1						1		1		1	2	3	1
3	21UEE606C.3	3	3	2	2	1			1		1		1	1	1	1
4	21UEE606C.4	3	3	3	3	1			1	1	1		2	1	1	1

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE610L	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. To determine fault currents and voltages in a single line systems with star- delta transformers at a specified location for SLGF, DLGF, LL and check boundary conditions.
2. YBus formation of power systems with and without mutual coupling by singular transformation and inspection method.
3. Determination of power angle diagrams for salient and non-salient pole synchronous m/cs, reluctance power, excitation emf and regulation.
4. Determine stability of power system using Swing equation. To determine critical clearing time for SMIB system by varying inertia constant, line parameters/fault location.
5. Write a program to perform load flow study using Gauss-Seidel method (only pq Bus not exceeding 4-buses).
6. Formation of Jacobian matrix for a given power system not exceeding 4 buses in polar Coordinates (no PV buses).
7. Write a program to perform load flow study using Fast-Decouple Load Flow Method
8. 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. Identify and formulate the electrical network parameters for load flow analysis using electrical topology
2. Model and simulate the steady state analysis of power system network
3. Evaluate generator scheduling and economic load dispatch in power plant

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	21UEE610L.1	3	1	1		1	1					1	1	3		2
2	21UEE610L.2	3	1	1	1							1	1	3		2
3	21UEE610L.3	3	1	1	1							1	1	2		2

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE611L	Microcontrollers Laboratory	01 - Credits (0 : 0 : 2)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

Part A - Assembly Language Programming

1. Addition of two 8 bit numbers, 16 bit numbers, array of 8 bit numbers, average of an array
2. Subtraction of two 8 bit numbers, 16 bit numbers
3. BCD Addition- two digit numbers, 4 digit numbers
4. Multiplication, Division
5. Arranging an array of number in ascending/descending order
6. To find maximum/minimum number of an array
7. Block of data transfer- Internal RAM, Internal RAM to external RAM
8. To find number of positive and negative numbers in an array
9. Code Conversion-BCD to Hex, Hex to BCD
10. Counters-Binary, BCD

Part B-IOT Programming

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/Buzzer with Arduino Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds
3. 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.
4. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
6. To interface DISPLAY with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smart phone using Bluetooth
8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when I'/'O' is received from smartphone using Bluetooth.
9. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to Thingspeak cloud
10. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from Thingspeak cloud
11. To install MySQL database on Raspberry Pi and perform basic SQL queries.
12. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker
13. Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.
14. Write a program to create TCP server on Arduino Raspberry Pi and respond with humidity data to TCP client when requested.
15. Write a program to create UDP server on Arduino Raspberry Pi and respond with humidity data to UDP client when requested.

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

Reference Books:

1. Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications" 3rd Edition, Cengage, 2007.
2. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; "The 8051 Microcontroller and Embedded Systems using assembly and C", 2nd Edition, Pearson, 2012.
3. David Calcutt Fred Cowan, Hasan Parchizadeh Elsecier, "8051 Microcontrollers an application based introduction", 2004.

Course Outcomes:

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

1. Develop and verify Assembly Language Programes for the specified applications
2. Analyze and execute the Assembly Language Programes in Microcontroller kit
3. Interface and analyze the functioning of peripheral devices with microcontroller

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	21UEE611L.1	3	1	1		1	1					1	1		1	1
2	21UEE611L.2	3	1	1	1	2						1	1		2	2
3	21UEE611L.3	3	1	1	1	2						1	1		2	2

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE612L	Advanced Programming Laboratory	01 - Credits (0 : 0 : 2)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Study on basic instructions of Python programming language, scripts, commands
2. Write a programme to find slicing of numbers and characters
3. Write a programme to store the pair of elements using dictionary
4. Write a programme to find the exponentiation of a number
5. Write a programme to find the maximum from a list of numbers
6. Write a programme to perform Linear Search of given sequence
7. Write a program to count the numbers of characters in the string and store them in a dictionary data structure
8. Write a program to find the sum of all the primes below two million
9. Write a program to find multiplication of matrices and command line arguments using function
10. Write a programme to plot average hourly data of solar radiation and wind velocity
11. Write a programme to load the data from file.
12. Write a programme to concatenate the given numbers
13. Write a program to call methods of a class with object
14. Write a program to perform the given tasks using list comprehension

Reference Books:

1. Svein Linge and Hans Petter Langtangen, "Introduction to Python for Computational Science and Engineering (A beginner's guide)", Springer Open, 1st Edition 31 May 2018.
2. Allen Downey, Jeffrey Elkner, "Learning with Python: How to Think Like a Computer Scientist Paperback", 2015.
3. Y. Daniel Liang, "Introduction to programming using Python", 1st Edition, Pearson Publications, 2017.
4. Sheetal Taneja, Python Programming A Modular Approach, 1st Edition Pearson Publications, 2017.

Course Outcomes:

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

1. Examine Python syntax and semantics and be fluent in the use of Python flow control and functions Student should be able to develop algorithmic solutions to simple computational problems.
2. Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions to interpret the concepts of Object-Oriented Programming as used in Python.
3. Implement exemplary applications related to Electrical Engineering in Python

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	21UEE612L.1	3	1	1		1	1					1	1		1	1
2	21UEE612L.2	3	1	1	1	2						1	1		2	2
3	21UEE612L.3	3	1	1	1	2						1	1		2	2

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

Professional Elective Course – I

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE611E	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. UpadhyayDesign 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 VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

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	21UEE611E.1	3	2	2					1		1		1	3	1	1
2	21UEE611E.2	3	2	2					1		1		1	2	1	1
3	21UEE611E.3	3	3	3	3				1	2	1		1	1	1	1
4	21UEE611E.4	3	3	3	2				1		1		2	1	1	1

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE612E	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	PO12	PSO1	PSO2	PSO3
1	21UEE612E.1	3							1		1		1		1	1
2	21UEE612E.2	3	1						1		1		1	2		1
3	21UEE612E.3	3		2		1			1	1	1		1	1	1	1
4	21UEE612E.4	3	3	2	2	1			1		1		2	1	1	1

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE613E	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	PO12	PSO1	PSO2	PSO3
1	21UEE613E.1	3							1		1		1		1	1
2	21UEE613E.2	3	1						1		1		1	2		1
3	21UEE613E.3	3		2		1			1	1	1		1	1	1	1
4	21UEE613E.4	3	3	2	2	1			1		1		2	1	1	1

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE614E	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	PO12	PSO1	PSO2	PSO3
1	21UEE614E.1	1							1		1		1	1	1	1
2	21UEE614E.2	1	1						1		1		1	1	1	1
3	21UEE614E.3	1		2		1			1	1	1		1	1	1	1
4	21UEE614E.4	1	1	2	2	1			1		1		2	1	1	1

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE615E	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 VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

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	21UEE615E.1	3							1		1		1	3	1	1
2	21UEE615E.2	3	1						1		1		1	2	3	1
3	21UEE615E.3	3	3	2	2	1			1		1		1	1	1	1
4	21UEE615E.4	3	3	3	3	1			1	1	1		2	1	1	1

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE616E	Field Theory	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Review of Vector Analysis:
Introduction to scalars and vectors

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.

Conductors, Dielectrics and Capacitance: Current and current density, Continuity of current, metallic conductors, Conductor properties and Boundary conditions, capacitance.

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, Force and torque on a closed circuit.

UNIT – IV	(10 Hours)

Materials and Inductance:
The nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuit, Potential energy and forces on magnetic materials.

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 and Daniel A Fleisch, "Electromagnetics with Applications", 5th Edition McGraw-Hill,1999.
3. Edward C. Jordan and Keith G Balmain, "Electromagnetic Waves and Radiating Systems", 2nd 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.

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	21UEE616E.1	3	1	1	1	3	1		1		1		1	1	2	1
2	21UEE616E.2	3	2	1	1				1		1		1	2	3	1
3	21UEE616E.3	3	2	2	2	1		1	1		1		1	1	2	1
4	21UEE616E.4	3	3	3	2	1			1	1	1	1	2		1	1

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

Open Elective Course – II

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

	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 2023 – 2024

(For students admitted to I year in 2021-22)

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	PO12	PSO1	PSO2	PSO3
1		2	1		1		1		1		1		1			
2		2	2	1	1				1		1		1			
3		2	2	2	2				1		1		1			
4		2	2	2	2				1	1	1	1	2			

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

	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	PO12	PSO1	PSO2	PSO3
1		2	2										1	2	1	
2		2	1	1	1								1	2	1	
3		3	2	3	2	2	1	1	1	1		1	2	3	1	1
4		3	2	3	2	2	1	1		1		1	2	3	1	1

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

Open Elective Course – III

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

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

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 (only theory); Measurement of Solar Radiation Data – Pyranometer and Pyrheliometer. **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.	
UNIT – II	**10 Hours**
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. **Wind Energy:** Wind and its Properties, History of Wind Energy. Basic principles of Wind Energy Conversion Systems (WECS), Classification of WECS, Parts of a WECS, Derivation for Power in the wind, Advantages and Disadvantages of WECS	
UNIT – III	**10 Hours**
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. **Geothermal Energy:** Introduction, Geothermal resources (brief description); Advantages and disadvantages; Applications of Geothermal Energy.	
UNIT – IV	**10 Hours**
Energy from Ocean: Tidal Energy – Principle of Tidal Power, Components of Tidal Power Plant (TPP), Classification of Tidal Power Plants, Advantages and Limitation of TPP. **Ocean Thermal Energy Conversion (OTEC):** Principle of OTEC system, Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle) and Hybrid cycle (block diagram description of OTEC); Advantages and Limitation of OTEC. **Emerging Technologies:** Fuel Cell, Wave Energy. (Principle of Energy generation using block diagrams, advantages and limitations).	
Reference Books: 1. A Khan, B. H., Non-Conventional Energy Resources, TMH, New Delhi, 2006. 2. Rai, G. D., Non-Conventional Sources of Energy, IV- Edition, Khanna Publishers, New Delhi, 2007 3. Mukherjee, D., and Chakrabarti, S., Fundamentals of Renewable Energy Systems, New Age International Publishers, 2005. 4. Tiwari,G.N., and Ghosal,M.K., Renewable Energy Sources: Basic Principles and	

Applications, Alpha Science International, Ltd., New Delhi, 2006.

Course Outcomes:

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

1. List and define various parameters and features of solar, wind, biomass, geothermal and ocean energy conversion systems.
2. Explain various concepts and theory related to solar, wind, biomass, geothermal and ocean energy conversion systems.
3. Evaluate/calculate various parameters related to solar and wind energy conversion systems.
4. Relate/articulate the concepts and theories related to 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		3	1	1				1	1		1		1			
2		3	1	1				2	1		1		1			
3		3	2	1				2	1	1	1		1			
4		3	3	3				2	1		1		2			

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

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

UNIT – I	**10 Hours**
Fundamental Engineering Computing • Engineering Problem Solving, MATLAB Environment, MATLAB Functions and Linear Algebra and Matrices	
UNIT – II	**10 Hours**
Numerical Techniques • Solution in System of Linear Equation • Interpolation and Curve Fitting • Numerical Integration and Differentiation • Ordinary Differential Equation	
UNIT – III	**10 Hours**
Special Topics • Symbolic Mathematics • Signal Processing • Control System	
UNIT – IV	**10 Hours**
Simulink Programming • Introduction • Usage of Simulink function blocks • Handling of input and output data • Development of Simulink model for solving of Engineering problems	
Reference Books: 1. Holly Moore, "MATLAB for Engineers", 4th Edition Pearson publisher 2015 2. David Alferdo, "MATLAB Handbook with the Applications to Mathematics, Engineering, Science and Finance" CRC Press Taylor and Francis group 2015	
Course Outcomes: After completion of the course the students will be able to, 1. Write Matlab program to solve system of linear Equation, Interpolation and Curve Fitting, Numerical Integration and Differentiation, Ordinary Differential Equation 2. Analyze the solution of engineering problems obtained from Matlab/ Simulink programs 3. Develop Matlab/Simulink model related signal processing and control system engineering. 4. Formulate and create new model to solve complex engineering problems	

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		1	1	1		3							1			
2		1	1	1	1	3							1			
3		1	1	1	2	3	1	1	1	1	1	1	2			
4		1	1	1	2	3	1	1	1	1	1	1	2			

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE618P	**Mini Project**	**02- Credits (0 : 0 : 4)**
Hours/Week : 0L+4P		CIE Marks : 50
Total Hours : 48		SEE Marks : 50

Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary. Mini- project can be assigned to an individual student or to a group having not more than 4 students.

Mini Project helps students to explore and strengthen the understanding of fundamentals through practical application of theoretical concepts. Mini Project will boost student's skills and widen their horizon of thinking. It acts like a beginners guide to do larger projects later in their career.

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	PO12	PSO1	PSO2	PSO3
1	**21UEE618P.1**	**3**			**3**					**3**			**3**	**2**	**3**	**1**
2	**21UEE618P.2**		**3**	**3**		**3**	**3**						**3**	**1**	**1**	**2**
3	**21UEE618P.3**	**3**	**3**	**3**	**2**	**2**	**1**				**3**		**3**	**2**	**2**	**3**
4	**21UEE618P.4**	**2**	**1**								**3**		**3**	**2**	**1**	**2**

Syllabus for

B.E. VII - Semester

for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

Professional Elective Course – II

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE721E	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	PO12	PSO1	PSO2	PSO3
1	21UEE721E.1	3	2	2					1		1		1	3	1	1
2	21UEE721E.2	3	2	2					1		1		1	2	1	1
3	21UEE721E.3	3	3	3	3				1	2	1		1	1	1	1
4	21UEE721E.4	3	3	3	2	1	1		1		1		2	1	1	1

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE722E	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. Justify the need of Autotronic systems and explain the construction of various electronically controlled chassis /vehicle safety systems
2. Analyze the working of electronic control systems used in modern automobiles
3. Apply the knowledge of working of various sensors in the control of vehicular systems
4. Compare the working of programmed control systems with conventional vehicular control systems to evaluate the performance of vehicle embedded with engine management systems

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

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	21UEE722E.1	3	2	2					1		1		1	3	1	1
2	21UEE722E.2	3	2	2					1		1		1	2	1	1
3	21UEE722E.3	3	3	3	3				1	2	1		1	1	1	1
4	21UEE722E.4	3	3	3	2	1	1		1		1		2	1	1	1

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE723E	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. Conceptualize intelligent sensor devices, their performance characteristics and signals and systems dynamics 2. Address the issues in dealing signal conditioning operations such as calibration, linearization and compensation 3. Develop the design methodologies for measurement and instrumentation of real world problems. 4. Use artificial intelligence in sensor signal processing to solve real world problems.	

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

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	21UEE723E.1	1									1		1	1	1	1
2	21UEE723E.2	1	1								1		1	1	1	1
3	21UEE723E.3	1	1	2	1	1			1		1		1	1	1	1
4	21UEE723E.4	2	1	3	1	1			1	1	1		2	1	1	1

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE724E	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. Analyze, design, and simulate various static CMOS circuits 2. Analyze and simulate various dynamic CMOS circuits 3. Prepare layout of MOSFET based circuits 4. Understand CMOS latch-up, clocking strategy, and testing principles	

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

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	21UEE724E.1	1	1	1					1		1		1	3	3	1
2	21UEE724E.2	1	1	1					1		1		1	2	3	1
3	21UEE724E.3	3	1	1	3				1	2	1		1	1	3	1
4	21UEE724E.4	3	3	3	2	1	1		1		1		2	1	2	1

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE725E	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	PO12	PSO1	PSO2	PSO3
1	21UEE725E.1	3	2	2									1	2	1	1
2	21UEE725E.2	2	1	1									1	1	2	3
3	21UEE725E.3	1	1	1	3				1	1	1		1	1	2	3
4	21UEE725E.4	1	3	3	2	1	1		1	1	1		2	1	2	3

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE726E	Modern Control Theory	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Design of feedback control systems: Concepts of design and compensation: cascade compensation networks, phase-lead and phase-lag control design approaches using both root locus plots and Bode diagrams. Introduction of P, PI, PD and PID Controllers. Usage of MATLAB command-line functions to verify the solution.	
UNIT – II	**(10 Hours)**
Control system analysis in state-space: State variable representation, Solution of state equations, state transition matrix and its properties, computation using Laplace transformation, power series, Cayley-Hamilton method, concepts of controllability and observability. 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. Usage of MATLAB command-line functions to verify the solution.	
UNIT – IV	**(10 Hours)**
Nonlinear system analysis: Some common nonlinear system behaviors, common nonlinearities in control systems, describing function fundamentals, describing function of common nonlinearities, stability analysis by describing function method. Usage of MATLAB command-line functions to verify the solution.	

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. Conceptualize on controller, state space, controllability, observability, nonlinearity and describing function and able to examine a system for its controllability and observability.
2. Propose, design, and realize appropriate compensator for the given specifications.
3. Design state feedback controller and observer via pole-placement.
4. Test linear control systems for complete controllability and observability.

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	21UEE726E.1	3	1	1	1	3	1		1		1		1	1	2	1
2	21UEE726E.2	3	2	1	1				1		1		1	2	3	1
3	21UEE726E.3	3	2	2	2	1		1	1		1		1	1	2	1
4	21UEE726E.4	3	3	3	2	1			1	1	1	1	2	1	1	1

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE727E	Power System Operation and Control	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. Apply suitable compensating device, method of unit commitment, SACDA system and economy interchange of power for power system operation.
2. Investigate performance of the power systems using ALFC model, reliability and cost of generators, power trading, power system security and state estimation.
3. calculate cost of generation using unit commitment, degree of compensation for transmission lines, various parameters of ALFC and state estimators of power systems
4. Formulate/develop SCADA system for power system, scheduling for thermal generator using unit commitment concept based on load profile.

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	21UEE727E.1	3	1	1	1	3	1		1		1		1	1	2	1
2	21UEE727E.2	3	2	1	1				1		1		1	2	3	1
3	21UEE727E.3	3	2	2	2	1		1	1		1		1	1	2	1
4	21UEE727E.4	3	3	3	2	1			1	1	1	1	2	1	1	1

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

Professional Elective Course – III

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE731E	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.	

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

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	PO12	PSO1	PSO2	PSO3
1	21UEE731E.1	3	1		1		1		1		2		1	3	1	1
2	21UEE731E.2	3	2	1	1				1		1		1	2	1	1
3	21UEE731E.3	3	3	2	2	1			1		1		1	1	1	1
4	21UEE731E.4	3	2	3	2	1			1	1	1	1	2	1	1	1

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE732E	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. 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 Subsystems
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 VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

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	21UEE732E.1	1	1	1	1								1	3	1	1
2	21UEE732E.2	1	2	1	1								1	2	1	2
3	21UEE732E.3	1	1	2	2			1	1		1		1	1	2	2
4	21UEE732E.4	2	3	3	2				1	1	1	1	2	1	2	2

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE733E	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. Compute performance of SPV systems for different loads and applications based on numerical problems 2. Analyze different SPV systems for specific applications based on performance 3. Operate and test working of SPV systems and their components 4. Design a solar PV system – stand alone or grid connected – based on typical loads.	

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

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	21UEE733E.1	3							1		1		1	3	1	2
2	21UEE733E.2	3	1								1		2	2	3	1
3	21UEE733E.3	3	2	2	3	1			1				1	1	2	1
4	21UEE733E.4	3	2	2	2	1			1	1	1		2	1	1	1

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE734E	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	PO12	PSO1	PSO2	PSO3
1	21UEE734E.1	3							1		1		1	3	1	2
2	21UEE734E.2	1	1								1		2	2	3	1
3	21UEE734E.3	2	2	2	3				1				1	1	2	1
4	21UEE734E.4	1	1	2	2				1	1	1		2	1	1	1

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE735E	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. Conduct the load forecast of primary and secondary distribution systems
2. Analyze the co-generation captive power, power polling and power trading.
3. Compare and contrast system operations planning using different parameters
4. Evaluate Admittance, Impedance, Hybrid and Transmission parameters for a given combine and revise operations planning by different techniques

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	21UEE735E.1	3							1		1		1	3	1	1
2	21UEE735E.2	3	1						1		1		1	2	3	1
3	21UEE735E.3	3	3	2	2	1			1		1		1	1	1	1
4	21UEE735E.4	3	3	3	3	1			1	1	1		2	1	1	1

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE736E	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”, (edition), 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.

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

Course Outcomes:

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

1. Compare the general aspects of HVDC transmission and different types of transmission topology employed in EHVDC and AC system.
2. Analyze six pulses converter and twelve pulse converters with overlap and without overlap angle ability to analysis the converter with different control strategy.
3. Develop the harmonics filter and protect the circuit for various fault occurred in HVDC system.
4. Design earth electrode, power converter, smoothing reactor for HVDC station.

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	21UEE736E.1	1	2		1		1						1	1	2	1
2	21UEE736E.2	1	1		1								1	2	3	1
3	21UEE736E.3	1	2	2	2				1				1	1	2	1
4	21UEE736E.4	2	1	2	2				1	1	1	1	2	1	1	1

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

Professional Elective Course – IV

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE741E	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 2024 – 2025

(For students admitted to I year in 2021-22)

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	PO12	PSO1	PSO2	PSO3
1	21UEE741E.1	1												3	1	2
2	21UEE741E.2	2	1	1										3	1	1
3	21UEE741E.3	3	1	1	2			1	1				1	2	1	1
4	21UEE741E.4	3	1	1	2			1					1	1	1	1

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE742E	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. Conduct tests to find the SOC, SOC and internal impedances of a given battery 2. Solve complex problems on aspects of a rechargeable battery, performance parameters & specifications, battery cell voltage equalization. 3. Compare the types of battery state of charge & health estimation methods and control methods for providing optimal performance of a given battery	

4. Implement machine learning techniques for a given battery management system for energy conservation

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	21UEE742E.1	1	2											1	1	2
2	21UEE742E.2	2	2	1										1	1	1
3	21UEE742E.3	1	2	1	1			1	1				1	1	1	1
4	21UEE742E.4	1	2	1	1			1					1	1	1	1

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE743E	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.	

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

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	PO12	PSO1	PSO2	PSO3
1	21UEE743E.1	3							1		1		2	3	1	1
2	21UEE743E.2	3	2						2		1		1	3	2	1
3	21UEE743E.3	3	3	2	3	2			1		1		1	2	1	1
4	21UEE743E.4	3	2	2	3	1				1	1		2	1	1	1

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE744E	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. Formulate strategies for Energy Management in utilization of electric motors
2. Suggest alternative substitutes for the convectional motors with efficient motors
3. Assess the amount of energy conservation by different policies associated with energy efficient motors
4. Illustrate the factors to increase the efficiency of electrical equipment

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	21UEE744E.1	1	2											2	1	2
2	21UEE744E.2	2	2	2										2	1	1
3	21UEE744E.3	1	2	2	1			1	1				1	2	1	1
4	21UEE744E.4	1	2	2	1			1					1	2	1	1

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE745E	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.

Course Outcomes:

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

1. List and define various parameters and features of wind energy conversion systems.

2. Analyze the wind data using different distribution functions.
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	PO12	PSO1	PSO2	PSO3
1	21UEE745E.1	3	1	1				1	1		1		1	2	1	1
2	21UEE745E.2	3	1	1				2	1		1		1	3	1	1
3	21UEE745E.3	3	2	1				2	1	1	1		1	2	1	1
4	21UEE745E.4	3	3	3				2	1		1		2	3	1	1

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE746E	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. Illustrate the problem solving methods in different sectors tools that are needed to solve real-time problems. 2. Implement fuzzy controllers by modelling the human intelligence into mathematical	

model.
3. Obtain the optimum solution of well formulated optimization problem using evolutionary approach.
4. Analyze the different feasible languages to interpret in power 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	21UEE746E.1	3	3	2	1	2	2		1		1		1	1	1	1
2	21UEE746E.2	3	1	2	1	2							1	1	1	1
3	21UEE746E.3	3	3	1	1	1			1		2		1	2	1	1
4	21UEE746E.4	3	3	2	2	1			1		2		1	2	1	1

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(For students admitted to I year in 2021-22)

21UEE718P	Project Work	08 - Credits (0 : 0 : 16)
Hours/Week :		CIE Marks : 50
Total Hours :		SEE Marks : 50

	(0L-0T-26P Hours)
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	PO12	PSO1	PSO2	PSO3
1	21UEE718P.1	3	3						3	3	3	1	3	3	3	3
2	21UEE718P.2	3	3		2		2		3	3	3	2	2	3	3	3
3	21UEE718P.3	3	3	3	3	3	3	1	3	3	3	3	3	3	3	3
4	21UEE718P.4	1	1	2					3	3	3	1	2	3	3	3

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UHS721C	Intellectual Property Rights	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction to IPRS: Importance of human creativity and its recognition and protection. Concepts of Property and Rights. Different forms of IPRs. Role of IPRs in R&D. **Patents**: Meaning of Patent, Objectives and Value of Patent. Criteria for Patentability. Software and Business Methods Patents. Govt. use of inventions, infringement of Patent and remedies for infringement. Compulsory license.	
UNIT – II	**(10 Hours)**
Prior art Searching: Prior art- Tangible versus Intangible prior art. Search strategy: key words, structures, sequences, use of operators, database for searching- free and paid, disclosed versus claimed matters. **Patent Drafting:** Types of specification, descriptions, drawing, claim drafting. **Filing Requirement of patent**: Work flow chart in obtaining Patents, Forms to be submitted, filing mechanism through Individual patent office and PCT route. Request for re - examination and revocation. Term of Patent and Patent renewal.	
UNIT – III	**(10 Hours)**
Trade-Marks: Meaning and functions of Trade Marks. Concept of Distinctiveness and Trade Marks registration. Trade Marks- Challenges in Non- Conventional Marks. Infringement of Trade Marks and remedies for infringement. Domain names and Trade Names. **Industrial Design**: Definition of a design. Inclusive and Exclusive Designs; Industrial Design registration in India. Infringement of Design and remedies for infringement.	
UNIT – IV	**(10 Hours)**
Copyright: Nature of Copyright, Subject-matter, Requirements to protect Copyright under the Law, Neighboring/Related Rights. Authorship rights. Copyright in the Digital Context. Transfer of Copyright and Infringement and remedies. Fair dealing and online streaming. **Confidential Information and Trade Secrets**: Introduction, Conditions of protection. Essentials for an action for breach of confidence.	

Reference Books:

1. P. Naryan, "Intellectual Property Law", 3rd Ed, Eastern Law House, 2007.
2. Dr. S. R. Myneni, "Law of Intellectual Property", 9th edition, Asia law House, 2019.
3. Dr. G. B Reddy, "Intellectual Property Rights and Law", Gogia Law Agency. Hydrabad, Reprint edition 2020.
4. N.R. Subbaram., S.Viswanathan, "Hand book Indian Patent Law and, Practice" Printers and publishers Pvt., Ltd, 2008.
5. Cornish, "Intellectual Property Rights", Universal publications.
6. Dr. B. L. Wadehra, "Law Relating to Intellectual Property" 5th edition, Universal Law publishing Co, Dehli.
7. SWAYAM / NPTL/ MOOCS/ We blinks/ Internet sources/ YouTube videos and other materials / notes

Syllabus for B.E VII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

Course Outcomes:

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

1. Identify criteria to fit one's own intellectual work in particular form of IPRs.
2. Apply statutory provisions and procedure to protect different forms of IPRs at national and international level.
3. Analyze rights and responsibilities of holder of Patent, Copyright, Trademark, Industrial design etc.
4. Develop skill of making search using modern tools and techniques.

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	21UHS721C.1						3									
2	21UHS721C.2			2		1	2	2	2		2		2			
3	21UHS721C.3						3	2	2		2		1			
4	21UHS721C.4					2				1	1		2			

Syllabus for

B.E. VIII - Semester

for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

Syllabus for B.E VIII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE815C	Research/Industrial Internship	10 - Credits (0 : 0 : 2)
Hours/Week :		CIE Marks : 70
Total Hours :		SEE Marks : 30

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. A report on the internship is to be submitted. The supervisor/ guide from industry shall allot 70 marks of the CIE and the other 30 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	PO12	PSO1	PSO2	PSO3
1	21UEE815C.1	1	1			2		1	1	1		2	2	2	1	2
2	21UEE815C.2	1	1			2	1	1	1	1	2	2	2	3	1	2
3	21UEE815C.3	1				1	1	1	2	1	1	2	2	2	2	1
4	21UEE815C.4	1						1	1	3	3	2	2	2	2	1

Syllabus for B.E VIII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE816C	Technical Seminar	01 - Credits (0 : 0 : 2)
Hours/Week : 08		CIE Marks : 50
Total Hours :		SEE Marks : 50

Technical seminar is an important integral part of BE (E&EE) program. Seminar is outcome of 4 years of engineering program and is expected to test the learning skills of a student. It reflects quality of teaching-learning process in the department. Seminar work will remain as an epitome of your entire professional career.

Seminar should be based on thrust areas in state of art technologies. Students should identify the topic of seminar and finalize in consultation with coordinator. Students should understand the topic and compile the report in standard format and present in front of Panel of Examiners respective Programme.

Course Outcomes

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

1. Enhance the knowledge on engineering problems associated with electrical & electronics engineering and interdisciplinary research.
2. Data analysis and interpretation of contemporary tools & resources to analyze / validate the solutions of engineering problems
3. Communicate effectively to meet the technical seminar requirements and present the work to technical audience.
4. Prepare quality technical report with detailed analysis and representation of selected topic.

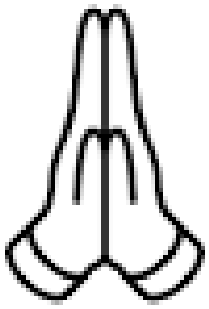
Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE816C.1	3	3						3	3	3	1	3	1	1	1
2	21UEE816C.2	3	3		2		2		3	3	3	2	2	1	1	2
3	21UEE816C.3	3	3	3	3	3	3	1	3	3	3	3	3	2	1	1
4	21UEE816C.4	1	1	2					3	3	3	1	2	2	2	3

Syllabus for B.E VIII - Semester for academic year 2024 – 2025

(For students admitted to I year in 2021-22)

21UEE817C	**Research Methodology**	**02 - Credits (2 : 0 : 0)**
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50



Thank You

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