B.V.V.S

Scheme and Syllabus

B.E. in
Electrical and Electronics Engineering

For 2024-25 Admitted Batch

Dept. of Electrical and Electronics Engg.

Basaveshwar Engineering College
Bagalkote-587102

B.V.V.S

Vision of the Institute

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

Mission of the Institute

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

B.V.V.S

Vision of the Department of E&EE

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

Mission of the Department of E&EE

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

B.V.V.S

PEOs of the Department of E&EE

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

PSOs of the Department of E&EE

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

B.V.V.S

Program Outcomes

Engineering Graduates will be able to:

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

B.V.V.S

Program Outcomes (As per NBA 2025 onwards)

Engineering Graduates will be able to:

Program Outcomes (POs)

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

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

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

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

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

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

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

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

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

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

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

B.V.V.S

Knowledge and Attitude Profile (WK)

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

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

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

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

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

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

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

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

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

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

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

2024-25 (admitted batch), 2025-26 (sem 3&4), 2026-27 (sem 5&6), 2027-28 (sem 7&8).

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

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

Sl.	Category	VTU	AICTE	BEC Present	BEC Revised
1.	HSMC: HSS (English:2, Kannada:1, UHV:1, Constitution:1, EV:1), HRM:3 (Offered by Dept) = 9 AEC (Scientific foundations of Health: 1, Innovation and design Thinking: 1, SS:2, IKS: 1, MOOCS: 3)= 8	14+8=22	15	9+10=19	9+8=17
2.	BSC: Basic Science Courses (Physics, Chemistry and Mathematics)	22	23	22	22
3.	ESC/ETC: Engineering Science Courses (Basic Elect/ Electronics/ Computer/ Mechanics/ Workshop/ Drawing etc.)	18	17	18	18
4.	PCC: Professional Core Courses	57	61	56	61
5.	PEC: Professional Elective Courses relevant to the branch with at least one course either fully or partially supported by industry	12	12	12	12
6.	OEC: Open Electives Courses/ Subjects from other technical/Arts/Commerce (3 MOOCS + 6)	9	12	09	09
7.	Mini (2) and Major projects (9)/Industrial Internships (10)	20	20	24	21
8.	Mandatory Course: PE, Yoga, NSS, Bridge course Maths 1 and 2 (lateral Entry)	00	00	00	00
	Total	160	160	160	160

Table-2: Semester wise Breakdown of Credits

Sem.	BSC	ESC ETC PLC	HSMC	AEC	PCC	PEC	OEC	Proj.	Int.	Total
I	8	9	2	1						20
II	8	9	2	1						20
III	3				17					20
IV	3		1		16					20
V			1	2	9	3	3	2		20
VI				1	13	3	3			20
VII			3		6	6		9		24
VIII				3			3		10	16
Tot.	22	18	9	8	61	12	9	11	10	160

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Department of Electrical and Electronics Engineering

Semester-I (C Group) CAY 2024-25 (160 Credits 2024-25 admitted batch)

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	BSC (IC)	BMAE101C	Mathematics-I for EEE Stream	4	3	0	2	50	50	100
2.	BSC (IC)	BCHE102C	Applied Chemistry for EEE Stream	4	3	0	2	50	50	100
3.	ESC	BMEB103C	Computer Aided Engineering Drawing	3	2	0	2	50	50	100
4.	ESC - I	BxxA104N	Engineering Science Course-I	3	3	0	0	50	50	100
5.	PLC - I	Bxxx105D	Programming Language Course-I	3	2	0	2	50	50	100
6.	AEC	BHSB106C	Professional Writing Skills in English	1	1	0	0	50	50	100
7.	HSMC	BHSB107C / BHSC107C	Samskrutika Kannada/ Balake Kannada	1	1	0	0	50	50	100
8.	HSMC	BHSB108C	Innovation and Design Thinking	1	1	0	0	50	50	100
			Total	20						

Semester-II (P Group) CAY 2024-25 (160 Credits 2024-25 admitted batch)

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	BSC (IC)	BMAE201C	Mathematics-II for EEE Stream	4	3	0	2	50	50	100
2.	BSC (IC)	BPHE202C	Applied Physics for EEE Stream	4	3	0	2	50	50	100
3.	ESC	BEEA203C	Elements of Electrical Engineering	3	3	0	0	50	50	100
4.	ESC - II	BxxA204N	Engineering Science Course-II	3	3	0	0	50	50	100
5.	ETC – II	Bxxx205B	Emerging Technology Course-II	3	3	0	0	50	50	100
6.	AEC	BHSA206C	Communicative English	1	1	0	0	50	50	100
7.	HSMC	BHSA207C	Indian Constitution	1	1	0	0	50	50	100
8.	HSMC	BHSA208C	Scientific Foundations of Health	1	1	0	0	50	50	100
			Total	20						

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Course Category	Course Code	Course Title (L:T:P)
Engineering Science Courses ESC-I/ESC-II	BCVA104N/ BCVA204N BCSA104N/ BCSA204N BEEA104N/ BEEA204N BECA104N/ BECA204N BMEA104N / BMEA204N	Introduction to Civil Engineering (3:0:0) Introduction to C Programming (2:0:2) Introduction to Electrical Engineering (3:0:0) Introduction to Electronics and Communication (3:0:0) Introduction to Mechanical Engineering (3:0:0)
Emerging Technology Courses ETC-I/ ETC-II	BAIA105B/ BAIA205B BCVA105B/ BCVA205B BCVB105B/ BCVB205B BECA105B/ BECA205B BECB105B/ BECB205B BEEA105B/ BEEA205B BISA105B/ BISA205B BMEA105B/ BMEA205B BMEB105B/ BMEB205B BUEA105B/ BUEA205B	Introduction to Cyber Security (3:0:0) Green Building (3:0:0) Waste Management (3:0:0) Introduction to Nano Technology (3:0:0) Introduction to Embedded System (3:0:0) Renewable Energy Sources (3:0:0) Introduction to Internet of Things (IOT) (3:0:0) Smart Materials and Systems (3:0:0) Introduction to Sustainable Engineering (3:0:0) Emerging Applications of Biosensors (3:0:0)
Programming Language Courses PLC-I/PLC-II	BCSA105D/ BCSA205D BCSB105D/ BCSB205D BCSC105D/ BCSC205D BCSD105D/ BCSD205D	Introduction to Web programming (2:0:2) Introduction to Python programming (2:0:2) Introduction to JAVA programming (2:0:2) Introduction to C++ programming (2:0:2)

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Department of Electrical and Electronics Engineering

Semester-III **CAY 2025-26 (160 Credits 2024-25 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	BSC	BMAE301C	Mathematics – III for Electrical Science Stream	3	3	0	0	50	50	100
2.	PCC	BEEA302C	Network Analysis	3	2	2	0	50	50	100
3.	PCC	BEEA303C	Power Systems – I	3	3	0	0	50	50	100
4.	PCC	BEEA304C	Electronic Circuits	3	3	0	0	50	50	100
5.	PCC	BEEA305C	Electrical Machines – I	3	3	0	0	50	50	100
6.	IPCC	BEEA306C	Electrical and Electronic Measurements	3	2	0	2	50	50	100
7.	PCC	BEEA307L	Electronic Circuits Laboratory	1	0	0	2	50	50	100
8.	PCC	BEEA308L	Electrical Machines – I Laboratory	1	0	0	2	50	50	100
9.	BSC	BMA	Bridge Course Mathematics-I	0	3	0	0	50	50	100
10.	MC	BHSA360M	Yoga-I	0	0	0	2	100	-	100
		BHSB360M	National Service Scheme-I	0	0	0	2	100	-	100
		BHSC360M	Physical Education-I	0	0	0	2	100	-	100
		BHSD360M	Music-I	0	0	0	2	100	-	100
			Total	20						

All students have to register for any one of the courses namely National Service Scheme, Physical Education (Sports and Athletics), Yoga and Music with the concerned coordinator of the course during the first week of III semester. The activities shall be carried out between III semesters to VI semester (for 4 semesters).

Semester-IV **CAY 2025-26 (160 Credits 2024-25 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	BEEA401C	Signals and Systems	3	3	0	0	50	50	100
2.	PCC	BEEA402C	Logic Design	3	3	0	0	50	50	100
3.	PCC	BEEA403C	Electrical Machines – II	3	3	0	0	50	50	100
4.	PCC	BEEA404C	Control Systems	4	4	0	0	50	50	100
5.	BSC	BBTA405C	Biology for Engineers	3	3	0	0	50	50	100
6.	PCC	BEEA406L	PCB Design Laboratory	1	0	0	2	50	50	100
7.	PCC	BEEA407L	Logic Design Laboratory	1	0	0	2	50	50	100
8.	PCC	BEEA408L	Electrical Machines – II Laboratory	1	0	0	2	50	50	100
9.	UHV	BHSA424C	Universal Human Values-II	1	1	0	0	50	50	100
10.	MC	BHSA460M	Yoga-II	0	0	0	2	100	-	100
		BHSB460M	National Service Scheme-II	0	0	0	2	100	-	100
		BHSC460M	Physical Education-II	0	0	0	2	100	-	100
		BHSD460M	Music-II	0	0	0	2	100	-	100
			Total	20						

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Semester-V **CAY 2026-27 (160 Credits 2024-25 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	BEEA5XXX	Power System – II	3	3	0	0	50	50	100
2.	PCC	BEEA5XXX	Power Electronics	3	3	0	0	50	50	100
3.	PEC	BEEA5XXX	Professional Elective Course – I	3	3	0	0	50	50	100
4.	OEC	BEEA5XXX	Open Elective Course – I	3	3	0	0	50	50	100
5.	PCC	BEEA5XXX	Power Electronics Laboratory	1	0	0	2	50	50	100
6.	PCC	BEEA5XXX	Power System – I Laboratory	1	0	0	2	50	50	100
7.	PCC	BEEA5XXX	Control System Laboratory	1	0	0	2	50	50	100
8.	Proj	BEEA5XXX	Mini Project	2	0	0	4	50	50	100
9.	HSMC	BEEA5XXX	Environmental Studies	1	1	0	0	50	50	100
10.	AEC	BEEA5XXX	Quantitative Aptitude and Professional Skills	2	2	0	0	50	50	100
11.	MC	BHSA460M	Yoga-III	0	0	0	2	100	-	100
		BHSB460M	National Service Scheme-III	0	0	0	2	100	-	100
		BHSC460M	Physical Education-III	0	0	0	2	100	-	100
		BHSD460M	Music-III	0	0	0	2	100	-	100
			Total	20						

Semester-VI **CAY 2026-27 (160 Credits 2024-25 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	BEEA6XXX	Power System – III	4	4	0	0	50	50	100
2.	PCC	BEEA6XXX	Microcontrollers	3	3	0	0	50	50	100
3.	PCC	BEEA6XXX	Digital Signal Processing	4	4	0	0	50	50	100
4.	PEC	BEEA6XXX	Professional Elective Course – II	3	3	0	0	50	50	100
5.	OEC	BEEA6XXX	Open Elective Course – II	3	3	0	0	50	50	100
6.	PCC	BEEA6XXX	Power System – II Laboratory	1	0	0	2	50	50	100
7.	PCC	BEEA6XXX	Microcontrollers Laboratory	1	0	0	2	50	50	100
8.	AEC	BEEA6XXX	Indian Knowledge Systems	1	1	0	0	50	50	100
9.	MC	BHSA460M	Yoga-IV	0	0	0	2	100	-	100
		BHSB460M	National Service Scheme-IV	0	0	0	2	100	-	100
		BHSC460M	Physical Education-IV	0	0	0	2	100	-	100
		BHSD460M	Music-IV	0	0	0	2	100	-	100
			Total	20						

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-VII/VIII **CAY 2027-28 (160 Credits 2024-25 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	PCC	BEEA701C/801C	Power System – IV	3	3	0	0	50	50	100
2.	PCC	BEEA702C/802C	High Voltage Engineering	3	3	0	0	50	50	100
3.	PEC	BEEX703C/803C	Professional Elective Course-III	3	3	0	0	50	50	100
4.	PEC	BEEX704C/804C	Professional Elective Course-IV	3	3	0	0	50	50	100
5.	HSMC	BEEA705C/805C	Research Methodology and IPR	3	3	0	0	50	50	100
6.	Proj	BEEA706P/806P	Project Work	9	0	0	--	50	50	100
			Total	24						

Semester-VIII/VII **CAY 2027-28 (160 Credits 2024-25 admitted batch)**

Sl.	Category	Subject Code	Subject Title	Cr	Hrs/Week			Exam. Marks		
					L	T	P	CIE	SEE	Total
1.	INT	BEEA801I/701I	Internship	10	0	0	--	50	50	100
2.	AEC	--	MOOCs*	3	--	--	--	--	--	--
3.	OEC	--	MOOCs*	3	--	--	--	--	--	--
			Total	16						

Semester 7 & 8 are flippable (swapped)

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

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

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

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-5

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

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

Semester-6

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

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

Semester-7

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

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

Syllabus for

B.E. I / II – Sem.

for academic year 2024 – 2025

(For students admitted to I year in 2024-25)

Syllabus for B.E. I Year (I/II – Semester) for Academic Year 2024 – 2025

(For students admitted to I year in 2024-25)

Elements of Electrical Engineering	
Course Code: BEEA103C/ BEEA203C	**Credits: 03 (3:0:0:0)**
Teaching Hours/Week: 3:0:0:0	**Total Hours: 40 hours Theory**
CIE Marks: 50	**SEE Marks: 50**

Module-1 (8 Hours)
DC circuits: Ohm's law and Kirchhoff's laws, analysis of series, parallel and series-parallel circuits. Power and energy. **Electromagnetism:** Fundamentals of Electromagnetism, Faraday's Laws of Electromagnetic Induction, Lenz's Law, Flemings rules, statically and dynamically induced EMF; concepts of self and mutual inductance, coils connected in series- adding and opposing, Coefficient of Coupling, Comparison of electric and magnetic circuits, Energy stored in magnetic field. Numerical.
Module-2 (8 Hours)
Single-phase AC circuits: Generation of sinusoidal voltage, frequency of generated voltage, average value, RMS value, form factor and peak factor of sinusoidal voltage and currents. Phasor representation of alternating quantities. Analysis of R, L, C, R-L, R-C and R-L-C circuits with phasor diagrams, Real power, reactive power, apparent power, and Power factor. Series, Parallel and Series-Parallel circuits. Numerical.
Module-3 (8 Hours)
Three-phase AC circuits: Necessity and advantage of 3-phase system. Generation of 3-phase power. Definition of phase sequence. Balanced supply and balanced load. Relationship between line and phase values of balanced star and delta connections. Power in balanced 3-phase circuits. Measurement of 3-phase power by 2-wattmeter method. Numerical.
Module-4 (8 Hours)
Measuring Instruments: Construction and working principle of whetstone's bridge, Kelvin's double bridge, Measurement of earth resistance-Fall of Potential method, Andersons bridge, Maxwel's bridge for inductance, Schering's bridge for capacitance, concepts of current transformer and potential transformer. (Only balance equations and Excluding Vector diagram approach), Numerical**.**
Module-5 (8 Hours)
Domestic Wiring: Requirements, Types of wiring: Surface and Concealed wiring, Two way and three way control of loads. Electricity Billing: Power rating of household appliances. Definition of "unit" used for consumption of electrical energy, calculation of electricity bill for domestic consumers. Equipment Safety measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Factors affecting the impact of electric shock on human body, Earthing and its types, Safety Precautions to avoid shock.

References:

Text 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

Reference Books:

3. D C Kulshreshth, "Basic Electrical Engineering", Tata McGraw Hill, 1st Edition 2019.
4. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill 4th edition, 2019.
5. V. K. Mehta, Rohit Mehta, "Principles of Electrical Engineering & Electronics", S. Chand and Company Publications, 2nd edition, 2015.
6. A K Sawhney, "Electrical and electronic measurements and instrumentation", A K Sawhney, Dhanapat Rai and Co. edition, January 2015.
7. Rajendra Prasad, "Fundamentals of Electrical Engineering", PHI Learning, 2nd Edition, 2009
8. V. N. Mittle & A. Mittal, "Basic Electrical Engineering", Tata McGraw-Hill Education, 2005
9. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", 2nd Edition, Pearson Publications, 2017.

Course Outcomes:

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

1. Apply the fundamental concepts of DC circuits and electromagnetism to assess the parameters of electric and magnetic circuits respectively
2. Apply electric circuit theorems to DC and AC (single phase and three phase) circuits to determine current, voltage, and power in various branches
3. Apply the principles of various electrical measurement techniques for determination of electrical parameters
4. Identify the safety aspects in different types of wiring mechanisms and evaluate the energy consumption in domestic loads

CO-PO & PSO Mapping Table

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

Syllabus for B.E. I Year (I/II – Semester) for Academic Year 2024 – 2025

(For students admitted to I year in 2024-25)

Introduction to Electrical Engineering	
Course Code: BEEA104N/BEEA204N	**Credits: 03 (3:0:0:0)**
Teaching Hours/Week: 3:0:0:0	**Total Hours: 40 hours Theory**
CIE Marks: 50	**SEE Marks: 50**

Module-1 (8 Hours)
Introduction: Conventional and non-conventional energy resources; General structure of electrical power systems using single line diagram approach. **Power Generation:** Thermal, Hydel, Nuclear (Block Diagram approach). **DC Circuits:** Ohm's Law and its limitations. KCL & KVL, series, parallel, series-parallel circuits. Numerical.
Module-2 (8 Hours)
A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor. Voltage and current relationship with phasor diagrams in R, L, and C circuits. Concept of Impedance. Analysis of R-L, R-C, R-L-C Series circuits. Active power, reactive power and apparent power. Concept of power factor. (Numerical). **Three Phase Circuits:** Generation of Three phase AC quantity, advantages and limitations; star and delta connection, relationship between line and phase quantities
Module-3 (8 Hours)
DC Machines: **DC Generator:** Principle of operation, constructional details, induced emf expression, types of generators. Relation between induced emf and terminal voltage. Numerical. **DC Motor:** Principle of operation, back emf and its significance, Types of motors, Applications of DC motors. Numerical.
Module-4 (8 Hours)
Transformers: Necessity of transformer, principle of operation, Types and construction of single- phase transformers, EMF equation, losses, variation of losses with respect to load. Efficiency and condition for maximum efficiency. Numerical. **Three-phase induction Motors:** Concept of rotating magnetic field, Principle of operation, constructional features of motor, types – squirrel cage and wound rotor. Slip and its significance. Torque equation and Torque slip characteristics. Numerical.
Module-5 (8 Hours)
Domestic Wiring: Requirements, Types of wiring: Surface and Concealed wiring, Two way and three way control of loads. **Electricity Billing:** Power rating of household appliances**.** Definition of "unit" used for consumption of electrical energy, calculation of electricity bill for domestic consumers. **Equipment Safety measures:** Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. **Personal safety measures:** Electric Shock, Factors affecting the impact of electric shock on human body, Earthing and its types, Safety Precautions to avoid shock.

References:

Text 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

Reference Books:

3. D C Kulshreshth, "Basic Electrical Engineering", Tata McGraw Hill, 1st Edition 2019.
4. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill 4th edition, 2019.
5. Rajendra Prasad, "Fundamentals of Electrical Engineering", PHI Learning, 2nd Edition, 2009
6. V. N. Mittle & A. Mittal, "Basic Electrical Engineering", Tata McGraw-Hill Education, 2005
7. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", 2nd Edition, Pearson Publications, 2017.
8. V. K. Mehta, "Principles of Power System", S. Chand Publishing, 2020

Course Outcomes:

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

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

CO-PO & PSO Mapping Table

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

Syllabus for B.E. I Year (I/II – Semester) for Academic Year 2024 – 2025

(For students admitted to I year in 2024-25)

Renewable Energy Sources	
Course Code: BEEA105B/ BEEA205B	**Credits: 03 (3:0:0:0)**
Teaching Hours/Week: 3:0:0:0	**Total Hours: 40 hours Theory**
CIE Marks: 50	**SEE Marks: 50**

Module-1 (8 Hours)
Introduction: Energy Consumption as a measure of prosperity, Classification of Energy Sources, Principles of renewable energy; energy and sustainable development, fundamentals and social implications. worldwide renewable energy availability, renewable energy availability in India, brief descriptions on solar energy, wind energy, tidal energy, wave energy, ocean thermal energy, biomass energy, geothermal energy, oilshale. Introduction to Internet of energy (IOE).
Module-2 (8 Hours)
Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Solar radiation Measurements- Pyrheliometers, Pyrometer, Sunshine Recorder. Solar Thermal systems: Flat plate collector; Solar distillation; Solar pond electric power plant. Numerical Solar electric power generation- Principle of Solar cell, Photovoltaic system for electric power generation, advantages, Disadvantages and applications of solar photovoltaic system. Numerical
Module-3 (8 Hours)
Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Basic components of wind energy conversion system (WECS); Classification of WECS- Horizontal axis- single, double and multi blade system. Vertical axis- Savonius and darrieus types. Numerical Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies-fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft). Numerical
Module-4 (8 Hours)
Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, advantages and limitations. Components of Tidal power plants, Estimation of Energy and power in simple single Basin tidal System. Numerical **Ocean Thermal Energy Conversion:** Principle of working, OTEC power stations in the world, problems associated with OTEC. Numerical
Module-5 (8 Hours)
Green Energy: Introduction, Fuel cells: Classification of fuel cells –H2; Operating principles, Zero energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy

References:

Text Books:

1. G. D. Rai, "Non-conventional Energy sources", Khanna Publication, 4th Edition, 2015.
2. S.Rao and Dr. B.B. Parulekar, "Energy Technology", Khanna Publication, 3rd Edition, 2024
3. Subhas P Sukhatme, "Solar energy", Tata McGrawHill, 2nd Edition, 1996.

Reference Books:

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

Course Outcomes:

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

1. Apply principles of renewable energy and sustainable development to analyze global and Indian energy scenarios, including social implications and basic renewable energy sources.
2. Analyze the working principles, components, and performance metrics of solar, wind, biomass, tidal, and ocean thermal energy systems using theoretical and numerical approaches.
3. Evaluate the feasibility, benefits, and limitations of renewable energy technologies, including solar PV, wind turbines, and hydrogen fuel cells, for power generation and storage applications.
4. Create systems, or conceptual frameworks for harnessing renewable energy, emphasizing Internet of Energy (IoE), zero-energy concepts, and hydrogen-based solutions.

CO-PO & PSO Mapping Table

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

Syllabus for

B.E. III – Semester

for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

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

(For students admitted to I year in 2024-25)

BMAE301C	Mathematics – III for Electrical Science Stream	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Curve fitting, Correlation and Regressions: Principles of least squares, Curve fitting by the method of least squares in the form y = a + bx, y= a+ bx + cx^2, y = ab^x. Correlation, Regression and rank correlation. **(RBT Levels: L1, L2 and L3)**	
UNIT – II	**10 Hours**
Fourier series and practical harmonic analysis: Periodic functions, Dirichlet's condition. Fourier series expansion of functions with period 2π and with arbitrary period: periodic rectangular wave, Half-wave rectifier, rectangular pulse, Saw tooth wave. Half-range Fourier series. Half range expansions, Practical harmonic analysis, and variation of periodic current. **(RBT Levels: L1, L2 and L3)**	
UNIT – III	**10 Hours**
Infinite Fourier Transforms: Infinite Fourier transforms, Fourier cosine and sine transforms, Inverse Fourier transforms, Inverse Fourier cosine and sine transforms, discrete Fourier transform (DFT). Z-transforms **(RBT Levels: L1, L2 and L3)**	
UNIT – IV	**10Hours**
Ordinary Differential Equations of Higher Order: Higher-order linear ODEs with constant coefficients - Inverse differential operator, problems. Linear differential equations with variable Coefficients-Cauchy's and Legendre's differential equations – Problems. Application of linear differential equations to L-C circuit and L-C-R circuit. **(RBT Levels: L1, L2 and L3)**	

References:

Textbooks:

1. **Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye** "Probability & Statistics for Engineers & Scientists", Pearson Education, 9th edition, 2017.
2. **Peter Bruce, Andrew Bruce & Peter Gedeck** "Practical Statistics for Data Scientists" O' Reilly Media, Inc., 2nd edition **2020**.

Reference Books :

1. **Erwin Kreyszig**, "Advanced Engineering Mathematics", John Wiley & Sons,9th Edition , 2006.
2. **B. S. Grewal** "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
3. **G Haribaskaran** " Probability, Queuing Theory & Reliability Engineering", Laxmi Publication , Latest Edition, 2006
4. **Irwin Miller & Marylees Miller,** John E. Freund's "Mathematical Statistics with Applications" Pearson. Dorling Kindersley Pvt. Ltd. India, 8th edition, 2014.
5. **S C Gupta and V K Kapoor** , "Fundamentals of Mathematical Statistics", S Chand and Company , Latest edition.
6. **Robert V. Hogg, Joseph W. McKean & Allen T. Craig**. "Introduction to Mathematical Statistics", Pearson Education 7thedition, 2013.
7. **Jim Pitman**. Probability, Springer-Verlag , 1993.
8. **Sheldon M. Ross,** "Introduction to Probability Models"11th edition. Elsevier, 2014.

9. **A.M. Yaglomand I. M. Yaglom**, "Probability and Information" D. Reidel Publishing Company. Distributed by Hindustan Publishing Corporation (India) Delhi,1983.
10. **P.G. Hoel , S.C. Portand C. J. Stone**, "Introduction to Probability Theory", Universal Book Stall, (Reprint), 2003.
11. **S. Ross**, "A First Course in Probability", Pearson Education India, 6th Ed.,2002.
12. **W. Feller**, "An Introduction to Probability Theory and its Applications", Vol. 1,Wiley, 3rdEd., 1968.
13. **N. P. Bali and Manish Goyal** , A Text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
14. **Veerarajan T**, Engineering Mathematics(for semester III),Tata McGraw-Hill, New Delhi

Course Outcomes:

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

BEEA302C	Network Analysis	03 - Credits (2 : 2 : 0)
Hours/Week : 04		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. AbhijitChakrabarti, "Circuit Theory-Analysis and Synthesis", 7thEdition, DhanpatRai Technical Publishers, 2016.

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

(For students admitted to I year in 2024-25)

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	PSO1	PSO2	PSO3
1	CO-1	3	3	1	1							1	3	1	1
2	CO-2	3	3	2	1							1	3	1	1
3	CO-3	3	3	2	1							1	3	1	1
4	CO-4	3	3	1	1							1	3	1	1

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

(For students admitted to I year in 2024-25)

BEEA303C	Power System - I	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours

AC Transmission Systems: Typical AC transmission system, Advantages of high voltage transmission. 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 Hours

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 Hours

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.

UNIT – IV	10 Hours

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.

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, Buchholz Relay.

Reference Books:

1. Mehta V K and Rohit Mehta, “Principals of Power Systems”, 4th Edition, S Chand and Company Ltd, Publishers, New Delhi, 2015.
2. Soni, Gupta and Bhatnagar, “Power System Engineering”, 5th Edition, DhanapatRai 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.

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

(For students admitted to I year in 2024-25)

Course Outcomes:

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

1. Describe AC transmission system components and assess the effects of corona, insulator performance, and sag in overhead lines.
2. Calculate transmission line parameters and evaluate the performance of short, medium, and long transmission lines.
3. Illustrate the structure and characteristics of underground cables and evaluate different types and layouts of electrical distribution systems.
4. Explain circuit breaker operation and classify protective relays based on their principles and applications.

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

BEEA304C	Electronic Circuits	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours

Diode Circuits:

Introduction to the PN Junction diodes, diode clipping and clamping circuits.

Transistor Biasing and Stabilization:

Introduction, operating point, DC load line, DC analysis and design of fixed bias circuit, emitter stabilized bias circuit, collector to base bias circuit, voltage divider bias circuit, modified DC bias with voltage feedback, derivation of stability factor, Bias compensation.

UNIT – II	10 Hours

Transistor at Low Frequencies:

Hybrid model, h-parameters for CE, CC and CB modes, mid-band analysis of single stage amplifier, simplified hybrid model, analysis for CE, CB and CC (emitter voltage follower circuit) modes, Millers Theorem and its dual, analysis for collector to base bias circuit and CE with un bypassed emitter resistance.

Transistor frequency response:

General frequency considerations, effect of various capacitors on frequency response, Miller effect capacitance, high frequency response, hybrid – pi model, CE short circuit current gain using hybrid pi model, multistage frequency effects.

UNIT – III	10 Hours

Multistage amplifiers:

Cascade connection, analysis for CE-CC mode, CE-CE mode, CASCODE stage-unbypassed and bypassed emitter resistance modes, Darlington connection using h-parameter model.

Feedback Amplifiers:

Classification of feedback amplifiers, concept of feedback, general characteristics of negative feedback amplifiers, Input and output resistance with feedback of various feedback amplifiers, analysis of different practical feedback amplifier circuits.

UNIT – IV	10 Hours

Power Amplifiers:

Classification of power amplifiers, Analysis of class A, Class B, Class C and Class AB amplifiers, Distortion in power amplifiers, second harmonic distortion, harmonic distortion in Class B amplifiers, cross over distortion and elimination of cross over distortion.

Oscillators:

Concept of positive feedback, frequency of oscillation for RC phase oscillator, Wein Bridge oscillator, Tuned oscillator circuits, Hartley oscillator, Colpitt's oscillator, crystal oscillator and its types.

FET: Construction, working and characteristics of JFET and biasing of JFET.

References:

1. Jacob Milliman, Christos C. Halkias, Chetan D. Parikh, Integrated Electronics-Analog and Digital Circuits and Systems, 2nd Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2015.
2. G. K. Mithall, Electronic Devices and Circuits, Khanna Publishers, New Delhi, 1998.
3. Electronic Devices and Circuit Theory, Robert L Boylestadand Louis Nashelsky, Pearson, 11th Edition, 2015

4. Electronic Devices and Circuits, Millman and Halkias, Mc Graw Hill, 4th Edition, 2015
5. Electronic Devices & Circuits, David A Bell, Oxford University Press, 5th Edition, 2008.

Course Outcomes:

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

1. Analyse diode circuits and design the stabilized transistor biasing circuits for various applications.
2. Apply transistor models and analyse frequency response techniques to solve circuit problems.
3. Evaluate the performance of multistage and feedback amplifier circuits for desired specifications.
4. Design power amplifiers and oscillator circuits and analyze the working and biasing of JFETs for amplification and oscillation applications.

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

BEEA305C	Electrical Machines-I	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours

Single Phase Transformer:
Principle of operation, Types and construction 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 Hours

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 Hours

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 Hours

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 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.

References:

Text Books:

1. I J Nagarath and DP Kothari, “Electrical machines”, 5th - Edition, TMH, New Delhi, 2020
2. Ashfaq Hussain, “Electrical Machines”, Dhanpat Rai & Co. Publications, 3rd Edition, 2017

3. P.S. Bhimbhra, "Electrical Machinery", Khanna publishers, 7th Edition 2018
4. G D Rai, Non-conventional Energy sources, Khanna Publishers, 2014.

Reference Books:

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

Course Outcomes:

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

1. Analyze the construction, operation, and performance characteristics of single-phase and three-phase transformers, including phasor diagrams, voltage regulation, losses, and efficiency.
2. Apply standard testing methods such as Open Circuit, Short Circuit, Sumpner's, and polarity tests to determine transformer parameters and evaluate equivalent circuits.
3. Examine the construction, principle of operation, torque characteristics, and performance evaluation of three-phase and single-phase induction motors.
4. Evaluate various starting and speed control methods of induction motors and identify suitable motor types and configurations for practical applications.

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

BEEA306C	Electrical & Electronic Measurement	03 - Credits (2 : 0 : 2)
Hours/Week : 2L + 2P		CIE Marks : 50
Total Hours(T+L) : 40		SEE Marks : 50

UNIT – I	7 Hours
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 Hours**
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	**7Hours**
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 Hours**
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 2025 – 2026

(For students admitted to I year in 2024-25)

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. Apply bridge circuits to measure electrical parameters and evaluate the influence of errors, sources, and detectors on measurement accuracy.
2. Demonstrate and interpret the operation of instruments used for electrical power and energy measurement.
3. Evaluate range extension methods and differentiate between CTs and PTs based on their operation and performance.
4. Classify transducers and justify the selection of suitable types for specific applications based on their working and characteristics.

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

BEEA307L	Electronic Circuits Laboratory	01 - Credits (0 : 0 : 2)
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. Calculation of hybrid parameters of CE transistor amplifier.
4. Frequency response of single stage BJT and FET RC coupled amplifier and determination of half power points, bandwidth, input and output impedances.
5. Design and testing of BJT – RC phase shift oscillator for given frequency of oscillation.
6. Design and testing of Wien bridge oscillator for given frequency of oscillation.
7. Design and testing of Hartley and Colpitt's oscillator for given frequency of oscillation.
8. Determination of gain, input and output impedance of BJT Darlington emitter follower with and without bootstrapping.
9. Design and testing of Class A and Class B power amplifier and to determine conversion efficiency.
10. Design and simulation of Fullwave centre tapped transformer type and Bridge type rectifier circuits with and without Capacitor filter using MATLAB. Determination of ripple factor, regulation and efficiency.

References:

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

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	PSO1	PSO2	PSO3
1	CO-1	3	2			2	1							3	1
2	CO-2	3	3	3	2	2	1							3	1
3	CO-3	3	3	2	3	2	1							3	1

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

(For students admitted to I year in 2024-25)

BEEA308L	Electrical Machines Laboratory - I	01 - Credits (0 : 0 : 2)
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", DhanpatRai& 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. Conduct open circuit, short circuit, Sumpner's test, and polarity test on single-phase transformers to evaluate efficiency, regulation, and equivalent circuit parameters.
2. Perform experiments on three-phase and single-phase induction motors to analyze performance characteristics and determine equivalent circuit parameters using tests like brake load, no-load, blocked rotor, and circle diagram method.
3. Demonstrate parallel operation of transformers, different types of three-phase transformer connections, and speed control methods for slip-ring induction motors, analyzing load sharing and performance under various configurations.

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

BMAB300M	Bridge Course Mathematics-I	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction to root finding problems, Newton-Raphson's 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 interpolation formulae (without proof). Simpson's 3/8th and 1/3rd rule(no derivation)-problems. Runge-Kutta 4 th order method, (no derivation)-problems. (RBT Levels: L1, L2 and L3)	
UNIT – II	**(10 Hours)**
Linear and Bernoulli's differential equations. Exact and reducible to exact differential equations Integrating factors , higher order linear differential equations with constant coefficients- Inverse differential operator(eax,sinax,coax,xn). (RBT Levels: L1, L2 and L3)	
UNIT – III	**(10 Hours)**
Introduction, Definition of Laplace Transform, Laplace Transform of standard functions, Properties: Shifting, differentiation, Integral and division by t. Periodic function, Heaviside's Unit step function. Inverse Laplace transform, Properties, Solutions of linear differential equations. (RBT Levels: L1, L2 and L3)	
UNIT – IV	**(10 Hours)**
Elementary transformations, Rank of a matrix, consistency of a system of linear equations, solution of homogeneous and non homogeneous equations, Gauss-elimination method, Gauss-seidel method, Eigen values and eigen vectors by Rayleigh's power method. (RBT Levels: L1, L2 and L3)	

Reference Books:

1. B. S. Grewal: "Higher Engineering Mathematics", Khanna Publishers, 44thEd., 2021.
2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10thEd., 2018.
3. V. Ramana: "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017
4. Srimanta Pal & Subodh C.Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
5. N.P Bali and Manish Goyal: "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
6. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics" McGraw – Hill Book Co., New York, 6th Ed., 2017.
7. Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education(India) Pvt. Ltd 2015.
8. H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.
9. David C Lay: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.
10. Gareth Williams: "Linear Algebra with Applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.

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

(For students admitted to I year in 2024-25)

Course Outcomes:

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

1. Solve engineering problems using Numerical techniques
2. Explain various physical models through first and higher order differential equations and solve such linear ordinary differential equations.
3. Apply the Laplace transform techniques to solve differential equations.
4. Solve linear equations using matrix methods

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for

B.E. IV – Semester

for academic year 2025 – 2026

(For students admitted to I year in 2024-25)

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

(For students admitted to I year in 2024-25)

BEEA401C	Signals and Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours

Introduction: Definition of signals and systems, classification of signals, elementary signals, basic operations on signals, interconnection of systems and operations, properties of systems. Usage of MATLAB command-line functions to verify the solution.

UNIT – II	10 Hours

Time domain representation of LTI systems: Convolution sum, convolution integral, impulse response representation. Properties of impulse response. Usage of MATLAB command-line functions to verify the solution.

UNIT – III	10 Hours

Fourier and inverse Fourier representation of signals: Introduction to complex sinusoidal signals and their use in Fourier representation of periodic signals (brief review of CTFS and DTFS). Continuous time Fourier transform, Discrete time Fourier Transform (DTFT), properties of DTFT and applications. Usage of MATLAB command-line functions to verify the solution.

UNIT – IV	10 Hours

Z -Transforms: Introduction, properties of ROC, properties of Z-transform and relation of Z -transform with Fourier transforms. Inverse Z-transform, transform analysis of LTI systems, transfers function, stability and causality, and solution of difference equations using Z-transfor Usage of MATLAB command-line functions to verify the solution.

Reference Books:

1. Simon Haykin and Barry Van Veen, Signals and Systems (2nd Edition), John Wiley &Sons
2. Michel J. Roberts, 2003 , Signals and Systems (2nd Edition), Tata McGraw Hill
3. Allan V. Oppenheam, Alan S. Willsky, and Hamid Nawab, 1997, Signals and Systems (2nd Edition), Pearson Education Asia.

Course Outcomes:

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

1. Analyze different types of signals and systems, and examine their interconnections and basic properties of the systems.
2. Evaluatelinear time-invariant (LTI) systems by determining output responses using convolution sum and integral, and asses the system properties using impulse responses.
3. Apply Fourier series and transforms (CTFS, DTFS, CTFT, DTFT) for the periodic and a-periodic signals and interpret their frequency-domain characteristics and properties.
4. Perform analysis of systems in the Z-domain, determine the properties on stability and causality, and resolve the difference equations using Z-transforms..

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

BEEA402C	Logic Design	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
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 Hours**
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 Hours**
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 Hours**
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. 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. 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. Apply number system conversions and binary coding techniques (BCD, Gray, ASCII, EBCDIC) to perform arithmetic and logical operations in digital systems. 2. Use Boolean algebra, standard forms (SOP/POS), and Karnaugh maps to simplify and implement digital logic circuits using basic and universal gates. 3. Analyze combinational and sequential circuits (e.g., adders, decoders, flip-flops, counters) for their logical behavior, timing, and design. 4. Analyze and interpret digital circuit behavior using programmable logic devices and Verilog, including memory decoding and simulation through test benches.	

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

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

BEEA403C	Electrical Machines-II	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours

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 Hours

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 Hours

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 Hours

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

Text Books:

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

Reference Books:

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

https://nptel.ac.in/courses/10810607

Course Outcomes:

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

1. Analyze the construction, working principle, EMF and torque equations, and performance characteristics of DC generators and motors, including armature reaction, commutation, and types of excitation.
2. Evaluate the need for starters, and apply suitable methods for starting, speed control, and braking of DC motors; and examine the testing procedures to determine losses and efficiency.
3. Analyze the construction, excitation systems, winding factors, and phasor diagrams of synchronous generators; and evaluate voltage regulation and salient pole machine behavior.
4. Examine the conditions for synchronization and parallel operation of alternators, and evaluate the performance of synchronous motors under varying excitation using V and inverted V curves.

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

BEEA404C	Control Systems	04 - Credits (4 : 0 : 0)
Hours/Week : 04		CIE Marks : 50
Total Hours :52		SEE Marks : 50

UNIT – I	(13 Hours)

Introduction: Objective of control system, Importance of control system, Examples of control system, Types of control systems, Open-loop and closed loop control systems, Feed-back and its effects on system performance characteristics.

Modeling of Physical Systems: Models of mechanical systems, Electrical systems and Electromechanical systems, Analogous systems: Force-voltage analogy, Force-current analogy. Usage of MATLAB command-line functions to verify the solution.

UNIT – II	(13 Hours)

Block Diagrams and Signal Flow Graphs: Transfer function; Block diagram reduction, Signal flow graphs, Mason's gain formula, and Application of Mason's gain formula to block diagrams.

Time Response of Feedback Control Systems: Standard test signals, Type and order of system, Steady state error and error constants, Unit-step response of standard second order systems, Time domain specifications. Usage of MATLAB command-line functions to verify the solution.

UNIT – III	(13 Hours)

Stability Analysis: The concept of stability, BIBO stability, Zero-input and asymptotic stability, Routh-Hurwitz(R-H) stability criterion, Application.

Root- Locus Analysis: The concept of root locus and Complementary root locus, Basic properties of root locus, Construction of root locus. Usage of MATLAB command – line functions to verify the solution.

UNIT – IV	(13 Hours)

Frequency Domain Analysis: The concept of frequency response, Bode plots, procedure for constructing Bode plots, Gain margin, Phase margin, Frequency domain specifications, Nyquist stability criterion and examples.

Control system analysis in state-space: State variable representation, conversion of state variable models to transfer functions and vice versa. Usage of MATLAB command-line functions to verify the solution.

Reference Books:

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

Course Outcomes:

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

1. Apply the concepts of open-loop and closed-loop control systems to model mechanical, electrical, and electromechanical systems using analogous methods and MATLAB tools.
2. Develop block diagrams and signal flow graphs, and apply Mason’s Gain Formula and MATLAB simulations to compute transfer functions of control systems.

3. Analyze time-domain response characteristics and system stability using Routh-Hurwitz criterion and root locus methods for first- and second-order systems.
4. Analyze system behavior in the frequency domain using Bode and Nyquist plots and evaluate gain/phase margins and system specifications using MATLAB tools.

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

BBTA405C	Biology for Engineers	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(13 Hours)

Introduction to Biology:

The cell: Structure, and functions of a cell. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, Proteins and Lipids. Importance of special biomolecules: Enzymes, vitamins and hormones -properties and functions.

Biomolecules and their Applications:

Carbohydrates in cellulose-based water filters production, PHA and PLA in bioplastics production, Nucleic acids in vaccines and diagnosis, Proteins in food production, Lipids in biodiesel, Enzymes in biosensor fabrication, food processing, detergent formulation and textile processing.

UNIT – II	(13 Hours)

Bio Inspiration Models Used In Engineering:

Bio inspiration - Introduction, Alliance between Engineering and Biology, Biomimicry - Science mimicking nature. Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Gecko Feet, Plant burrs (Velcro), Shark skin (Friction reducing swimsuits), Kingfisher beak (Bullet train), Fire fly LED.

Nature Bioinspired Materials And Mechanisms:

BioEcholocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf), Respiration (MFCs) Human Blood substitutes-hemoglobin based oxygen carriers (HBOCs) and perflourocarbons (PFCs).

UNIT – III	(13 Hours)

Human Organ Systems And Bio Designs

Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).

Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators).

Lungs as purification system gas exchange mechanisms, spirometry, Ventilators, Heart-lung machine).

Eye as a Camera system, bionic eye. **Kidney** as a filtration system - dialysis systems.

UNIT – IV	(13 Hours)

Trends In Bioengineering

Bioprinting techniques and materials, 3D printing of ear, bone and skin, electrical tongue and electrical nose in food science, Self-healing bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes), Biomining via microbial surface adsorption. Artificial Intelligence for disease diagnosis. Biochips & their applications. Biosensors & their applications.

Reference Books:

1. Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
2. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.

3. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
4. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
5. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
6. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
7. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
8. Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016

Web links and Video Lectures (e-Resources)

- https://nptel.ac.in/courses/121106008
- https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
- https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
- https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https://www.coursera.org/courses?query=biology
- https://onlinecourses.nptel.ac.in/noc19_ge31/preview
- https://www.classcentral.com/subject/biology
- https://www.futurelearn.com/courses/biology-basic-concepts

Course Outcomes:

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

1. Elucidate the basic biological concepts required for engineering applications.
2. Use nature inspired concepts for domain specific applications.
3. Analyze and apply the principles of bioengineering in developing biomedical devices.
4. Apply the innovative biobased solutions for eco-friendly and socially relevant problems.

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

BEEA406L	PCB Design Laboratory	01 - Credits (0 : 0 : 2)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1.Introduction to PCB Design Tools

- Use locally available tools like Proteus or KiCAD to create a basic schematic layout and familiarize with the interface.

2.Schematic Entry and Netlisting

- Design a simple electronic circuit (e.g., LED flasher) and generate a netlist using the PCB design tool.

3.Manual and Automatic Component Placement

- Place components for a simple analog circuit (e.g., amplifier) manually and compare with automatic placement results.

4.Track Routing and Design Rules

- Route tracks for a basic circuit (e.g., rectifier circuit) and apply design rules such as track width, angle, and clearance.

5.PCB Design of Basic Circuits using Copper Connection

- Design and simulate a simple logic circuit (e.g., OR gate, AND gate) and generate a PCB layout.

6.Design of Power Supply Circuit using Copper Connection

- Design and simulate a regulated power supply circuit (e.g., 5V DC supply) and generate Gerber files.

7.Printing and Etching of PCB

- Print a PCB layout on a copper-clad board and etch it using a locally available etching solution like ferric chloride.

8.Drilling and Soldering

- Drill holes for components using a handheld drill and solder basic components like resistors, capacitors, and ICs.

9.Soldering and Desoldering Practice

- Practice soldering and desoldering components on a PCB without damaging the board or components.

10.PCB Testing and Debugging

- Test the designed circuit for continuity and functionality using a multimeter or an oscilloscope.

Textbooks:

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

Textbooks:

1. Coombs, Clyde F., and Happy T. Holden. Printed Circuits Handbook. 7th ed., McGraw-Hill, 2016.
2. Sharma, Monika. Basics of PCB Design and Fabrication. IK International Publishing

House, 2019.
3. Williams, Timothy. EMC for Printed Circuit Boards: A Handbook of Design, Layout, and Troubleshooting. Newnes, 1996.
4. Buchanan, William D. PCB Design Using AutoCAD. Newnes, 1996.
1. Pandya, Ashish. Electronics Lab Manual Volume II. S. Chand & Company, 2020.

Course Outcomes:

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

BEEA407L	Logic Design Laboratory	01 - Credits (0 : 0 : 2)
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. Apply Boolean algebra and logic simplification techniques to design, implement, and verify combinational logic circuits using basic and universal gates.
2. Analyze and implement combinational and sequential digital circuits such as adders, subtractors, encoders, decoders, multiplexers, flip-flops, and counters using ICs and logic gates.
3. Design, set up, and troubleshoot digital systems including code converters, display systems, and sequence generators to meet specified functional requirements.

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

BEEA408L	**Electrical Machines –II Laboratory**	**01 - Credits (0 : 0 : 2)**
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", DhanpatRai& Co. Publications, 3rdEdition, 2017
3. P.S. Bhimra, "Electrical machinery", Khanna publishers, 7thEdition 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. Conduct experiments on DC generators and motors to determine OCC, load characteristics, torque-speed relations, losses, and efficiency using standard methods like Swinburne's and field tests.
2. Analyze speed control of DC motors using armature voltage, field control, and Ward Leonard method, and evaluate performance characteristics under various operating conditions.
3. Perform experiments on synchronous machines to determine voltage regulation using EMF and MMF methods, analyze synchronization with infinite bus, and plot V and inverted V curves to assess operational behavior.

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

BHSA424C	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.	
UNIT – IV	**(3 Hours)**
Harmony in the Nature/Existence Implications of the Holistic Understanding – a Look at Professional Ethics: Understanding Harmony in the Nature, Interconnectedness, self-regulation and MutualFulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels. The Holistic Perception of Harmony in Existence.Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-TypicalCase Studies, Strategies for Transition towards Value-based Life and Profession	

Reference Books:

1. Gaur R R, Asthana,R.G, Bagaria G P (2019).A Foundation Course in Human Values and Professional Ethics,2nd Revised Edition, Excel Books, New Delhi,
2. The Teacher‟s Manual for A Foundation Course in Human Values and Professiona Ethics, R R Gaur, R Asthana.
3. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak,1999.
4. Human Values, A.N.Tripathi, NewAge Intl.Publishers, New Delhi, 2004.
5. The Story of Stuff(Book).
6. The Story of My Experiments with Truth-by Mohandas Karamchand Gandhi
7. Small is Beautiful -E. F Schumacher.
8. Andrews Cecile, Slow is Beautiful
9. Kumarappa JC , Economy of Permanence
10. Pandit Sunderlal, Bharat Mein Angreji Raj
11. Dharampa l, Red is covering India
12. Gandhi Mohandas K ,Hind Swaraj or Indian Home Rule.
13. Maulana Abdul Kalam Azad :India Wins Freedom
14. Roma in Rolland (English) Vivekananda
15. Roma in Rolland(English), Gandhi
16. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986,

1991

17. Donella H.Meadows, Dennis L. Meadows, Jorgen Randers, William W. BehrensIII, 1972, Limits to Growth – Club of Rome'sreport, Universe Books.
18. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
19. P L Dhar, R R Gaur, 1990, Science and Humanism, Common wealth Publishers.
20. A N Tripathy, 2003, Human Values, NewAge International Publishers.
21. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
22. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
23. M Govindrajran, S Natrajan & V. S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, PrenticeHall of India Ltd.
24. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
25. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow, Reprinted 2008.

Suggested Web Links:

1. Value Education websites,
2. https://www.uhv.org.in/uhv-ii,
3. http://uhv.ac.in,
4. http://www.uptu.ac.in
5. Storyof Stuff,
6. http://www.storyofstuff.com
7. Al Gore, An Inconvenient Truth, Paramount Classics, USA
8. Charlie Chaplin, Modern Times, United Artists, USA
9. IIT Delhi, Modern Technology– the Untold Story
10. Gandhi A.,Right Here Right Now, Cycle wala Productions
11. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
12. https://fdp-si.aicte-india.org/8dayUHV_download.php
13. https://www.youtube.com/watch?v=8ovkLRYXIjE
14. https://www.youtube.com/watch?v=OgdNx0X923I
15. https://www.youtube.com/watch?v=nGRcbRpvGoU
16. https://www.youtube.com/watch?v=sDxGXOgYEKM

Course Outcomes:

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

1. Understand the need and role of value education for holistic development
2. Differentiate between self and body needs, and practice harmony within the human being.
3. Analyze relationship dynamics based on trust, respect, and justice within families and society.
4. Recognize harmony in nature and existence, and apply these ideas to sustainable living
5. Explore ethical practices and professional conduct within personal and professional contexts

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

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for

B.E. V – Semester

for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

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

(For students admitted to I year in 2024-25)

	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 RungeKutta 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", 1stEdition, 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", 4thEdition, Mc.Graw Hill Publishers, 2013.
4. HadiSaadat, "Power System Analysis", TMH, Publishers, 4th Edition 2015.
5. V Neelakantan, "Power System Analysis & Stability", Shiva Publishers, 2017.

Course Outcomes:

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

(For students admitted to I year in 2024-25)

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

	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	PSO1	PSO2	PSO3
1	CO-1	3	3	2	1	1				1	1	2	3	2	1
2	CO-2	3	2	3	3	1				1	1	2	2	2	1
3	CO-3	3	3	3	2	1				1	1	2	2	3	1
4	CO-4	3	2	2	3	1				1	1	2	3	1	2

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

(For students admitted to I year in 2024-25)

	Power Electronics Laboratory	**01 - Credits (0 : 0 : 2)**
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

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

Reference Books:

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

Course Outcomes:

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

	Power System – I Laboratory	**01 - Credits (0 : 0 : 2)**
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Operating characteristics of static Under/Over Voltage relay.
2. Operating characteristics of Microcontroller over voltage relay (DMT and IDMT)
3. Operating characteristics of Electro-Mechanical over current relay.
4. Operating characteristics of Electro-Mechanical Earth fault relay.
5. Operating characteristics of Microcontroller over current relay (DMT and IDMT).
6. Operating characteristics of static Over Current relay (DMT).
7. Break down strength of transformer oil.
8. Experiment on field plotting using electrodes.
9. Measurement of high AC and DC voltage using Sphere-gap.
10. 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, “Principals of Power Systems”, 4th Edition, S Chand and Company Ltd, Publishers, New Delhi, 2015.
2. Soni, Gupta and Bhatnagar, “Power System Engineering”, 5th Edition, DhanapatRai 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. Demonstrate and analyze the operating characteristics of various protective relays, including static, electro-mechanical, and microcontroller-based types for overcurrent, earth fault, and voltage protection.
2. Evaluate the dielectric strength of transformer oil and assess flashover characteristics under uniform and non-uniform field conditions in HVAC systems.
3. Measure high voltages using sphere gaps and interpret electric field distributions using field plotting techniques with electrode configurations

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

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

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

List of Experiments

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

Reference Books:

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

Course Outcomes:

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

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

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

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

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

Course Outcomes

After undergoing the internship, students will be able to:

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

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

	Environmental Studies	**01 - Credits (1 : 0 : 0)**
Hours/Week : 01		CIE Marks : 50
Total Hours : 15		SEE Marks : 50

UNIT – I	**(04 Hours)**
Natural Resources: Human activities and their impacts. Environmental Impact Assessment, **Renewable Energy**: Solar energy, Wind energy, Hydropower, Tidal energy, Ocean thermal energy, Geo thermal energy, Biomass energy, Biogas, Biodiesel, Bioethanol, Hydrogen as fuel. **Non renewable Energy**: Coal, Petroleum, Natural gas, Nuclear energy.	
UNIT – II	**(04 Hours)**
Environmental Pollution: Water pollution, water quality standards, water borne diseases, Fluoride problem, Air pollution, Noise pollution. Effect of electromagnetic waves. **Sustainable future**: Concept of sustainable development, threats to sustainability, strategies for sustainable development. Environment economics – concept of green building, Circular Economy.	
UNIT – III	**(03 Hours)**
Current Environmental Issues of concern: Greenhouse Effect- Greenhouse gases and Global Warming, Climate change, ozone layer depletion, Acid rain, Eutrophication Environmental policy legislation rules & regulations	
UNIT – IV	**(04 Hours)**
Fundamentals of Waste management: Solid waste management: Sources, classification, characteristics, collection & transportation, disposal, and processing methods. Hazardous waste management and handling. Concept of waste water treatment, Bioremediation. Industrial waste management (Case studies: Cement, plastic, chemical, E–waste, food & construction industry waste management).	
Reference Books: 1. Benny Joseph "Environmental Studies" Tata McGraw Hill, 2005 2. Dr. D. L. Manjunath, "Environmental Studies" Pearson Education, 2006 3. Koushik and Koushik "Environmental Science & Engineering" New Age International Publishers, New Delhi, 2006 4. Meenakshi "Environmental Science & Engineering" Pranticce Hall of India, 2006	
Course Outcomes: After completion of the course the students will be able to, 1. Identify natural resources and its uses. 2. Understand pollution and its effects on environment and to implement sustainable future in the work place. 3. Analyze current environmental issues. 4. Apply the waste management techniques in various fields.	

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

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

Professional Elective Course – I

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

(For students admitted to I year in 2024-25)

	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. Explain the fundamental principles and limitations of electrical machine design, and identify materials and insulators used in DC machines.
2. Design single-phase and three-phase transformers by formulating output equations, selecting specific loadings, and determining winding and core dimensions.
3. Apply design principles to three-phase induction motors including main dimensions, stator winding, air gap, and rotor slots.
4. Design salient and non-salient pole synchronous machines by determining main dimensions, armature slots, rotor configurations, and magnetic circuits.

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

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

	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. Apply the classification and structural characteristics of electrical and electronic materials, including spintronic and left-handed materials, for engineering applications.
2. Analyze the electrical, thermal, and mechanical properties of conducting materials using principles such as Seebeck effect, Wiedemann–Franz law, and Lorentz relation.
3. Evaluate the dielectric behavior and insulation performance of solid, liquid, and gaseous materials for various electrical engineering applications.
4. Examine the magnetic properties, hysteresis behavior, and performance of soft and hard magnetic materials under varying operating conditions.

Course Outcomes - Programme Outcomes Mapping Table

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

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(For students admitted to I year in 2024-25)

	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 Safety, Tools, and Regulatory Standards:-Electrical tools and instruments: Types, usage, and care – for installation, maintenance, and repair. Electrical accessories: Terminals, lugs, connectors, clamps, insulating materials, etc. Workmen's safety devices: Safety belts, gloves, helmets, earthing rods, shock protection. Electrical hazards and accident prevention: Causes and preventive measures. Artificial respiration methods (CPR basics).Safety codes and Indian Electricity Rules: Key regulations, permissions, and documentation. Earthing systems and safety audits in industrial premises.	
UNIT – II	**(10 Hours)**
Transformers – Installation, Testing, and Commissioning:-Site selection and foundation for transformers – outdoor/indoor setup, mode of transportation. Installation practices: Polarity, terminal plates, oil tanks, and winding drying methods. General and detailed inspection before commissioning. Commissioning tests as per IS/IEC standards: Voltage ratio test Earth resistance measurement Oil dielectric strength and insulation resistance Polarization Index and Impulse Tests Load and temperature rise tests Performance evaluation: Efficiency, voltage regulation, and mechanical stress under load, Preventive maintenance schedule and failure case studies.	
UNIT – III	**(10 Hours)**
Synchronous Machines: Installation: BIS specifications, alignment, cooling systems, control gear, excitation. Commissioning: Insulation tests, waveform analysis, telephone interference, line charging capacitance. Performance tests: Slip test, reluctance power, short-circuit test, sequence impedance, etc. Factory tests: Gap length, balancing, bearing performance, magnetic eccentricity. **Induction Motors:** Installation: Location, shaft alignment, pulley coupling, drying of windings. Commissioning: Air-gap symmetry, vibration and bearing testing, mechanical alignment. Performance tests: Temperature rise, stray load losses, re-winding needs, special duty performance. Maintenance techniques and troubleshooting common faults.	
UNIT – IV	**(10 Hours)**
Laying of Underground Cables: Inspection, handling, and storage of power and control cables. Cable laying: Depths, clearances, coordination with water/gas/telecom services. Trenching, backfilling, and protection measures for underground cables. Cable jointing and terminations – indoor, outdoor, and straight joints. Cable testing and commissioning: IR testing, continuity, and insulation resistance. Fault location techniques: Megger testing, loop tests, and TDR method overview. Troubleshooting issues: Loose neutral, flickering lights, service fuse failure impacts. Industry practices on service reliability and system integrity. **Switchgear and Protective Devices:** Standards, Types, Specification, Installation, Commissioning Tests, Maintenance Schedule, Type and Routine Tests.	

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.SharotriKatson Publishing House 1st Edition, 1980
4. Handbook of Switchgears BHEL McGraw Hill 1st Edition, 2005

Course Outcomes:

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

1. **Analyze** the selection, usage, and maintenance of electrical safety tools, accessories, and safety systems, in compliance with Indian safety regulations and standards for industrial installations.
2. **Evaluate** the procedures for installation, testing, and commissioning of transformers, synchronous machines, and induction motors, ensuring performance efficiency and compliance with IS/IEC standards.
3. **Formulate** and implement underground cable practices, including jointing and fault analysis, in alignment with technical and regulatory standards..
4. **Develop** maintenance schedules and trouble shooting strategies for switchgear, protective devices, and rotating machines based on performance diagnostics and case studies.

Course Outcomes - Programme Outcomes Mapping Table

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

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(For students admitted to I year in 2024-25)

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

UNIT – I	**(10 Hours)**
Introduction to Data Base Systems: Managing data, a historical perspective, File systems versus DBMS, Advantages of DBMS, Describing and Storing Data in DBMS, Queries in DBMS, Transaction management, Structure of DBMS, People who work with databases. **Entity – Relationship Model:** Using high-Level Conceptual Data Models for Database Design, An example of Database Application, Entity types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY database, ER Diagrams, Naming Conventions and Design Issues.	
UNIT – II	**(10 Hours)**
Relational Model and Relational Algebra: Relational model concepts, relational model constraints and relational database schemes, update operations and dealing with Constraint Violations, Unary relational Operations, SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations, JOIN and DIVISION, Additional Relational Operations, examples of Queries in Relational algebra, relational database design using ER – to-Relational mapping. **SQL-The Relational Database Standard:** SQL Data definition and data types, specifying basic constraints in SQL, Schemes, Change statements in SQL, basic Queries in SQL, more complex SQL queries, Insert, Delete and Update statements in SQL, additional features of SQL, specifying general constraints as assertion, views (virtual tables) in SQL,	
UNIT – III	**(10 Hours)**
Data Base Design: Informal Design Guidelines for Relation Schemes, Functional Dependencies, Normal Forms based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Properties of Relational Decompositions, Algorithms for Relational Database Scheme Design, Multivalued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Inclusion Dependencies, Other Dependencies and Normal Forms.	
UNIT – IV	**(10 Hours)**
Transaction Management: The ACID properties, Transactions and Schedules, Concurrent Execution of transactions, Lock-based Concurrency control, performance of locking, Transaction support In SQL, Introduction to crash recovery; 2PL, ss for 4rializability and recoverability, Introduction to lock management, Lock Conversions, Dealing with Deadlocks, Specialized locking Techniques, Concurrency control without locking, Introduction to ARIES	
Reference Books: 1. Silberschatz, Korth and Sudharahan, “Data Base System Concepts”, 5th Edition, Mc- Graw Hill, 2007 2. C.J. Date, A.Kannan, S.Swamynatham, “An Introduction to Database Systems”, 8th Edition, Pearson Education, 2006.	

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

Course Outcomes:

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

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(For students admitted to I year in 2024-25)

	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 and Big M method.	
UNIT – II	**(10 Hours)**
Duality: Formation of Dual Problems, Definition of dual problems, dual simplex method. **Transportation Model:** Definition of transportation model basic feasible solution by different methods, finding optimal solutions, stepping stone method, MODI method, the assignment model,traveling sales man problem.	
UNIT – III	**(10 Hours)**
GameTheory: Formulation of two–person, zero sum games, Games with and without saddle points, Max–Min, Min–Max principles, graphical solution procedure for 2×n or m×2 games, 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, PERTcalculation.	

Reference Books:

1. Hamdy A. Taha, "Operations Research: An Introduction", 10th Edition, Pearson Education, 2017.
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. J K Sharma, "Operations Research – Theory and Applications", 6th Edition, Macmillan Publishers, 2022.
5. S. S. Rao, "Optimization Techniques", 3rd edition New age International Publishers, 2010.
6. Kanti Swarup, P.K. Gupta and Man Mohan, "Operations Research", 19th Edition, Sultan Chand & Sons, New Delhi, 2022.

Course Outcomes:

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

1. Apply the basic concepts and formulate mathematical models of Linear Programming problems using appropriate methods.
2. Analyze and solve transportation and assignment problems including special cases using systematic procedures.
3. Develop strategic solutions for competitive situations using Game Theory models and graphical methods.
4. Evaluate project activities through PERT and CPM techniques to determine critical paths and project duration in uncertain environments.

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

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

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

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

UNIT – I	**(10 Hours)**
Coulomb's Law and Electric Field Intensity: Experimental law of Coulomb, electric field intensity, field due to continuous volume charge distribution, field of a line charge, field of a sheet charge. **Electric Flux Density, Gauss' Law and Divergence:** Electric Flux Density, Gauss' law, divergence. Maxwell's first equation (Electrostatics), vector operator V and the divergence theorem.	
UNIT – II	**(10 Hours)**
Energy and Potential: Energy expended in moving a point charge in an electric filed, the line integral, definition of potential difference and potential. The potential field of a point charge and system of charges, potential gradient, the dipole. Current and current density, Continuity of current.	
UNIT – III	**(10 Hours)**
The Steady Magnetic Field: Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density. **Magnetic Forces:** Force on a moving charge and differential current element, force between differential current elements.	
UNIT – IV	**(10 Hours)**
Materials and Inductance: The nature of magnetic materials, Magnetization and permeability. **Time Varying Fields and Maxwell's Equations:** Faraday's law, displacement current, Maxwell's equation in point and Integral form.	

Reference Books:

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

Course Outcomes:

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

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

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Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

Open Elective Course-I

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

(For students admitted to I year in 2024-25)

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

UNIT – I	**10 Hours**

Introduction to EV:
Historical Background, Benefits of Using Evs, Overview of types of Evs and its Challenges, EV Motor Drive Technologies, EV Energy Source Technologies, EV Battery Charging Technologies, EV Vehicle to Grid

EV Subsystem: EV Subsystems and Configurations, HEV Subsystems and Configurations. HEV Subsystems and Configurations, Motion and dynamic equations for vehicles

UNIT – II	**10 Hours**

Energy Storage:
Batteries-Overview of Batteries, Battery Parameters, Lead Acid Batteries, Lithium Batteries, Metal Air Batteries. Alternative and Novel Energy Sources-Solar Photovoltaics, Flywheels, Super Capacitors. Fuel Cells-Main issues in the fuel cell, Hydrogen Fuel Cells: Basic Principles, Fuel Cell Thermodynamics (Introduction)

UNIT – III	**10 Hours**

Architecture of EV and HEV:
Vehicle Power Plant and Transmission Characteristics- Introduction, Drive train Configuration, Vehicle power plant, Internal combustion engine, Electric Motor, The need for gearbox, Drive train tractive effort and vehicle speed, Vehicle performance. Basic Architecture of Hybrid Drive Trains and Analysis of Series Drive Train- The Hybrid Electric Vehicle (HEV), Energy Use in Conventional Vehicles, Energy Savings Potential ofHybrid Drivetrains, HEV Configurations, Series and parallel Hybrid System.

UNIT – IV	**10 Hours**

Power Flow in HEVs:
Introduction, Power Flow Control, Power Flow Control in Series Hybrid, Power Flow Control in Parallel Hybrid, Power Flow Control in series-Parallel Hybrid, Power Flow Control Complex HybridControl

Reference Books:

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

Course Outcomes:

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

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

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

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

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

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

Reference Books:

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

Course Outcomes:

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for

B.E. VI – Semester

for academic year 2026 – 2027

(For students admitted to I year in 2024-25)

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

(For students admitted to I year in 2024-25)

	Power System-III	**04 - Credits (4 : 0 : 0)**
Hours/Week : 04		CIE Marks : 50
Total Hours :52		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 Y_{bus} 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 including 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 hydro thermal plants. Problem formulation, solution procedure and algorithm.

UNIT – IV	**10 Hours**

Excitation Systems: Introduction, DC Excitation system, AC Excitation, static Excitation, Dynamic performance measures of Excitation system, control and protective functions: AC and DC regulators, excitation system stabilizing circuits, power system stabilizer, load compensation, under excitation limiter, over excitation limiter. Modeling of AVR, steady state and dynamic performance analysis of AVR.

References:

1. Stag. G. W, EI - Abaid, A. H., "Computer Methods in Power System Analysis", 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 Modeling Power Systems", 2nd Edition, I.K. International, 2014.
5. Singh L. P, "Advanced Power System Analysis and Dynamics", 6th Edition, NewAge International (P) Ltd, New Delhi, 2014.
6. Nagrath, I .J., and Kothari, D.P., "Modern Power System Analysis", 4th Edition, TMH, 2011.

Course Outcomes:

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

1. Apply suitable network topology, primitive network, types of power system buses

for load flow studies and economic scheduling algorithms and excitation systems for power system operation.

2. Investigate performance of the power systems using load flow analysis, optimum scheduling of thermal generators and excitation systems.
3. Calculate Y_{BUS} matrix, real power, reactive power and power flow for a given power systems using load flow studies and optimum cost of generation of thermal power plants using economic scheduling study and components of excitation systems.
4. Formulate the load flow models, economic scheduling of thermal generators.

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

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

UNIT – I	**10 Hours**
8051 Microcontroller Basics: Inside the Computer, Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins of 8051. Memory Address Decoding, 8031/51 Interfacing with External ROM And RAM.8051 Addressing Modes.	
UNIT – II	**10 Hours**
Assembly Programming and Instruction of 8051: Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives Arithmetic, logic instructions, Rotate and swap instructions, Programs, Jump, loop and call instructions, IO port programming.	
UNIT – III	**10 Hours**
8051 Programming in C: Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051 C. **8051Timer Programming in Assembly and C:** Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C. **8051 Interrupt Programming in Assembly and C:** 8051 interrupts, Programming timer, external hardware, serial communication interrupt, Interrupt priority in 8051/52, Interrupt programming in C.	
UNIT – IV	**10 Hours**
8051 Interfacing and Applications: Interfacing 8051 to LCD, parallel ADC0809, serial ADC MAX1112, DAC, Stepper motor **Introduction to the Raspberry Pi:** Basics of Raspberry Pi, Hardware layout, Operating Systems on Raspberry Pi, Configuring Raspberry Pi, Programming Raspberry Pi with Python.	
Reference Books: 1. The 8051 Microcontroller and Embedded Systems Using Assembly and C, Muhammad Ali Mazadi, Pearson, 2ndEdition, 2008. 2. The 8051 Microcontroller, Kenneth Ayala, Cengage, 3rd Edition,2005. 3. Microcontrollers: Architecture, Programming, Interfacing and System Design, RajKamal, Pearson, 1st Edition, 2012.	
Course Outcomes: At the end of the course, the student will be able to: 1. Apply the concepts of microcontroller architecture, memory organization, I/O ports, and addressing modes to design and interface simple embedded systems. 2. Develop and analyze assembly language programs using arithmetic, logic, branching, looping, and I/O instructions in 8051 microcontroller. 3. Develop timer, interrupt, and I/O-based applications using embedded C programming for 8051 microcontroller. 4. Design and implement embedded system applications by interfacing 8051 with peripherals and demonstrate basic Raspberry Pi programming using Python.	

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

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

	Digital Signal Processing	**04 - Credits (4 : 0 : 0)**
Hours/Week : 04		CIE Marks : 50
Total Hours :52		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.RameshBabu, "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. Apply Discrete Fourier Transform (DFT), Inverse DFT, and convolution methods (circular, overlap-add, overlap-save) to analyze discrete-time signals. 2. Implement Fast Fourier Transform (FFT) algorithms such as radix-2 DIT-FFT and IFFT to improve computational efficiency in spectral analysis. 3. Analyze and design digital FIR filters using windowing methods and digital IIR Filters using bilinear transformation, and analog prototypes like Butterworth and Chebyshev -I filters. 4. Analyze and realize digital systems using various structures such as direct form, cascade and parallel realizations for both FIR and IIR filters.	

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

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

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

List of Experiments

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

Reference Books:

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

Course Outcomes:

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

	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.

Part-B: Hardware interfacing using Raspberry Pi/Arduino

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 motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
5. To interface DISPLAY with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
6. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smart phone using Bluetooth
7. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to Thing speak cloud.
8. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from Thing speak cloud.

Reference Books:

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

Course Outcomes:

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

1. Develop and verify assembly language programes for the specified applications.
2. Analyze and execute the assembly language programes in keil software.
3. Interface and analyze the functioning of peripheral devices using Raspberry Pi/Arduino.

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

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

22UHS600C	**Indian Knowledge System**	**01 - Credits (1 : 0 : 0)**
Hours/Week : 01		CIE Marks : 50
Total Hours :15		SEE Marks : 50

UNIT – I	**10 Hours**
Indian Knowledge Systems (IKS) Overview, Vedic Corpus, Philosophy in Indian Knowledge system	
UNIT – II	**10 Hours**
Traditional Knowledge in Mathematics Introduction to Indian Mathematics, Unique aspects of Indian Mathematics, Indian Mathematicians and their Contribution. Number Systems and Units of Measurement.	
UNIT – III	**10 Hours**
Traditional Knowledge in Science Measurements for time, distance and weight, Astronomy, Indian contributions in astronomy, Astrology, The celestial coordinate system, Elements of the Indian calendar, Notion of years and month, Panchanga – The Indian calendar system.	
UNIT – IV	**10 Hours**
Traditional Knowledge in Professional domain Town Planning and Architecture, Agriculture, Governance and Public Administration.	

Reference Books:

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. "Introduction to Indian Knowledge System: Concepts and Applications", PHI Learning Private Ltd. Delhi (2022**).** Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati, New Delhi.
2. Sampad and Vijay "The Wonder that is Sanskrit", Sri Aurobindo Society, Puducherry. (2011).
3. Acarya, P.K. Indian Architecture, Munshiram Manoharlal Publishers, New Delhi. (1996).
4. Kapoor Kapil, Singh Avadhesh "Indian Knowledge Systems Vol – I & II", Indian Institute of Advanced Study, Shimla, H.P. (2021).
5. Dasgupta,S. A History of Indian Philosophy- Volume 1, Motilal Banarsidass, New Delhi. (1975).
6. P Lofker, K. (1963). Mathematics in India, Princeton University Press, New Jeresy, USA"

Suggested Web Links:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/
3. http://www.iitkgp.ac.in/department/KS;jsessionid=C5042785F727F6EB46CBF432D7683B63 (Centre of Excellence for Indian Knowledge System, IIT Kharagpur)
4. https://www.wipo.int/pressroom/en/briefs/tk_ip.html
5. https://unctad.org/system/files/official-document/ditcted10_en.pdf
6. http://nbaindia.org/uploaded/docs/traditionalknowledge_190707.pdf

Course Outcomes:

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

1. Provide an overview of the concept of the Indian Knowledge System and its importance
2. Appreciate the need and importance of protecting traditional knowledge.

3. Recognize the relevance of Traditional knowledge in different domains.
4. Establish the significance of Indian Knowledge systems in the contemporary world.

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

Professional Elective Course – II

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

(For students admitted to I year in 2024-25)

	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 the performance of the system when distributed generation is integrated

to the system.

3. Analyze effects of the integration of DG in terms of increased risk of overload, losses, over voltages and power quality disturbances
4. Assess the impact the integration of DG on power system stability and operation

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

	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 NewAge publishers, 1995.
3. William B Ribbens, “Understanding Automotive Electronics”, 7th Edition, Butterworth-Heinemann –Elsevier, 2012.
4. Bernhard Mencher, et. al., “Bosch Professional Automotive Information”, 5th Edition, Springer Vieweg, 2014.

Course Outcomes:

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

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

locking mechanisms.

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

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

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

Reference Books:

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

Course Outcomes:

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

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

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

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

	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, 3rdEdition, 2018.
3. Mead C and Conway, “Introduction to VLSI Systems”, Addison Wesley publications, 2ndEdition, 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, 3rdEdition, 2017.

Course Outcomes:

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

1. Apply VLSI design flow, hierarchy, and layout rules to illustrate MOSFET fabrication and design methodologies.
2. Analyze MOS transistor characteristics, scaling effects, and evaluate static performance of CMOS inverters.
3. Compute delay parameters, interconnect parasitics, and power dissipation to

assess switching behavior of CMOS inverters.

4. Design and evaluate combinational, sequential, and dynamic MOS logic circuits using CMOS and transmission gate techniques.

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

	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. VedamSubrahmanyam, “Electric Drives”, Tata McGraw Hill, 2nd Edition, 2011.
4. R. Krishnan, “Electric Motor Drives- Modelling, Analysis and Control”, Prentice Hall Inc., 2008.
5. Bimal K. Bose, “Modern Power Electronics & AC drives”, Prentice Hall Inc., 2001
6. Austin Hughes, “Electric Motor & Drives” Newnes-Elsevier, 3rd Edition, 2006.

7. S.K. Pillai, “A first course on Electrical Drives”, New Age International Publication, 2nd Edition, 1982.

Course Outcomes:

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

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

UNIT – I	**(10 Hours)**
State Variable Analysis and Design:-Introduction, concept of state, state variables and state model, state modeling of linear systems, linearization of state equations. State space representation using physical variables, phase variables & canonical variables. Usage of MATLAB command-line functions to verify the solution.	
UNIT – II	**(10 Hours)**
Derivation of transfer function from state model:-Derivation of transfer function from state model, diagolization, Eigen values, Eigen vectors, generalized Eigen vectors. **Solution of state equation:-** Solution of state equation, state transition matrix and its properties, computation using Laplace transformation, power series method, Cayley-Hamilton method, concept of controllability & observability, methods of determining the same. Usage of MATLAB command-line functions to verify the solution.	
UNIT – III	**(10 Hours)**
Control system design in state-space: State variable feedback structure, pole-placement design using feedback, state feedback with integral control, critique of pole-placement state feedback control, observer-based state feedback control. **Pole Placement Techniques and Controllers:-** Stability improvements by state feedback, necessary & sufficient conditions for arbitrary pole placement, state regulator design, and design of state observer, Controllers- P,PI, PID. Usage of MATLAB command-line functions to verify the solution.	
UNIT – IV	**(10 Hours)**
Nonlinear system analysis: Introduction, behavior of non-linear system, common physical non linearity-saturation, friction, backlash, dead zone, relay, multi variable non-linearity. **Phase plane method:-**Phase plane method, singular points, stability of nonlinear system, limit cycles **Liapunov stability criteria:-**Liapunov stability criteria, Liapunov functions, direct method of Liapunov& the linear system, construction of Liapunov functions for nonlinear system by Krasvskii's method.	
Reference Books: 1. M. Gopal, "Control Systems Principles and Design", 3rd Edition, Tata McGraw Hill, 2011. 2. Katsuhiko Ogata, "Modern Control Engineering", 4th Edition, Pearson Education, 2002. 3. A Nagoor Kani, "Advanced Control Theory", CBS Publishers, 3rd Edition, 2020	
Course Outcomes: After completion of the course the students will be able to, 1. Apply state-space representation techniques to model linear and nonlinear control systems. 2. Analyze system properties such as controllability, observability, and stability using mathematical tools and system matrices. 3. Design state feedback controllers and observers for modern control systems based on pole placement and canonical forms. 4. Evaluate nonlinear control system behavior using phase-plane methods and	

Liapunov's stability criteria for system performance analysis.

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

Open Elective Course – II

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

(For students admitted to I year in 2024-25)

	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,2ndEdition, 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, 4thEdition, 2008. 4. The Electricity Act, 2003, https://cercind.gov.in/Act-with-amendment.pdf	
Course Outcomes:	

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

(For students admitted to I year in 2024-25)

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

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

(For students admitted to I year in 2024-25)

	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 electro statically 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 electro chemical 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. Behavior of Lithium-Ion Batteries in Electric Vehicles: Battery Health, Performance, Safety, and Cost. Springer International Publishing AG, 2018. 4. Robert A. Huggins, Energy storage, Springer Science & Business Media (2010) 5. Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications, John Wiley & Sons, 3rd Edition, 2021.	

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

Course Outcomes:

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for

B.E. VII & VIII – Sem.

for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEA701C	Power System - IV	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

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

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

UNIT – II	(10 Hours)

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

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

UNIT – III	(10 Hours)

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

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

UNIT – IV	(10 Hours)

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

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

Reference Books:

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

press Taylor and Francis groups, 2015.

5. Nagrath,I.J., Kothari,D.P, "Modern Power SystemAnalysis", 4th Edition, TMH, 2014.
6. PrabhaKundur, "Power System Stability and Control", 9th reprint, TMH, 2009.

Course Outcomes:

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEA702C	High Voltage Engineering	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours

Conduction and Breakdown in Gases: Gases as InsulatingMedia, Collision Process, Ionization Processes, Townsend's Current Growth Equation, Current Growth in the Presence of Secondary Processes, Townsend's Criterion for Breakdown, Experimental Determination of Coefficients α and γ, Breakdown in Electronegative Gases, Time Lags for Breakdown, Streamer Theory of Breakdown in Gases, Paschen's Law, Breakdown in Non-Uniform Fields and Corona Discharges.

Conduction and Breakdown in Liquid Dielectrics: Liquids as Insulators, Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids.

Breakdown in Solid Dielectrics: Introduction, Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown.

UNIT – II	10 Hours

Generation of HV AC and DC Voltage:L-06 Hours

Classification of high voltages, HVAC-transformer, Need for cascade connection, working of transformer units connected in cascade, Series resonant circuit – principle of operation and advantages, Tesla coil.HV – DC voltage doublers circuit, Cock croft – Walton type high voltage DC set. Calculation of high voltage regulation, ripple and optimum number of stages for minimum voltage drop, Important applications of high voltages.

UNIT – III	10 Hours

Generation of Impulse Voltage and Current:L-04 Hours

Introduction to standard lightning and switching impulse voltages. Analysis of single -stage impulse generator, expression for output impulse voltage. Multistage impulse generator, working of Mark impulse generator, Rating of impulse generator, Components of multistage impulse generator.

Measurement of High Voltages:L-05 Hours

Electrostatic voltmeter – principle, construction and limitation. Chubb and Fortessue method for HVDC measurements. Series resistance micro ammeter, Standard Sphere gap measurements for HVAC, HVDC and factors affecting the measurements.

UNIT – IV	10 Hours

Non-Destructive Testing of Materials and Electrical Apparatus: Introduction, Measurement of Dielectric Constant and Loss Factor, Partial Discharge Measurements.

High Voltage Testing of Electrical Apparatus: Testing of Insulators and Bushings, Testing of Isolators and Circuit Breakers, Testing of Cables, Testing of Transformers, Testing of Surge Arrestors, Radio Interference Measurements, Testing of HVDC Valves and Equipment.

Reference Books:

1. Kuffel E., Zaengl W.S. and KuffelJ.,'High Voltage Engineering Fundamentals', Butterworth-Heineman press, Oxford, 2000.
2. M S Naidu & V Kamaraju, High Voltage Engineering, Tata McGraw Hill, 2004.
3. C. L. Wadhwa, “High Voltage Engineering”, New Age Intl. Publishers, 2015
4. A.vonHippel and A. S. Labounsky, “Dielectric Materials and Applications”, ArtechHouse, Boston, 1995.

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

Course Outcomes:

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

1. Explain the mechanisms of conduction and breakdown in gases, liquids, and solid dielectrics.
2. Analyze the methods and principles used in the generation of high AC, DC, and impulse voltages.
3. Demonstrate various techniques for measuring high voltages and currents used in high voltage engineering.
4. Evaluate the testing methods for high voltage equipment and materials through non-destructive and standard testing procedures.

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

Professional Elective Course – III

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEA703E	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: Computational Intelligence, Power System Enhancement, General View of the Smart Grid Market Drivers, Stakeholder Roles and Function, Working Definition of the Smart Grid Based on Performance Measures, Representative Architecture, Functions of Smart Grid Components. **Smart Grid Communications and Measurement Technology:** Communication and Measurement, Monitoring, PMU, Smart Meters, and Measurements Technologies, GIS and Google Mapping Tools, Multiagent Systems (MAS) Technology, Microgrid and Smart Grid Comparison. **Performance Analysis Tools for Smart Grid Design:** Introduction to Load Flow Studies, Challenges to Load Flow in Smart Grid and Weaknesses of the Present Load Flow Methods, Load, Flow State of the Art: Classical, Extended Formulations, and Algorithms, Congestion Management, Effect, Load Flow for Smart Grid Design.	
UNIT – II	**(10 Hours)**
Stability Analysis: Introduction to Stability, Strengths and Weaknesses of Existing Voltage Stability Analysis Tools, Voltage Stability Assessment, Voltage Stability Assessment Techniques, Voltage Stability Indexing, Analysis Techniques for Steady-State Voltage Stability Studies, Optimizing Stability Constraint through Preventive Control of Voltage Stability, Angle Stability Assessment. **Computation Tools for Smart Grid:** Introduction to Computational Tools, Decision Support Tools, Optimization Techniques, Classical Optimization Method, Heuristic Optimization, Evolutionary Computational Techniques.	
UNIT – III	**(10 Hours)**
Pathway for Designing Smart Grid: : Introduction to Smart Grid Pathway Design, Barriers and Solutions to Smart Grid Development, Solution Pathways for Designing Smart Grid Using Advanced Optimization and Control Techniques for Selection Functions, General Level Automation, Bulk Power Systems Automation of the Smart Grid at Transmission Level, Distribution System Automation Requirement of the Power Grid, End User/Appliance Level of the Smart Grid, Applications for Adaptive Control and Optimization. **Renewable Energy and Storage:** Renewable Energy Resources, Sustainable Energy Options for the Smart Grid, Penetration and Variability Issues Associated with Sustainable Energy Technology, Demand Response Issues, Electric Vehicles and Plug-in Hybrids, PHEV Technology, Environmental Implications, Storage Technologies, Tax Credits.	
UNIT – IV	**(10 Hours)**
Interoperability, Standards, and Cyber Security: Introduction, Interoperability, Standards, Smart Grid Cyber Security, Cyber Security and Possible Operation for Improving Methodology for Other Users. **Research, Education, and Training for the Smart Grid:** Introduction, Research Areas for Smart Grid Development, Research Activities in the Smart Grid, Multidisciplinary Research Activities, Smart Grid Education, Training and Professional Development.	

Case Studies and Test beds for the Smart Grid:

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

Reference Books:

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

Course Outcomes:

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEB703E	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. MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2004.
3. James Larminie, John Lowry, “Electric Vehicle Technology Explained”, Wiley publications, 2003.

Course Outcomes:

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

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEC703E	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 andforpowerplants.

Reference Books:

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

Course Outcomes:

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

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEED703E	**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. PrabhaKundur, “Power System Stability and Control”, TMH 9th reprint, 2007.

Course Outcomes:

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEE703E	Power System Planning	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

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

Reference Books:

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

Course Outcomes:

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

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEF703E	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. PrabhaKundur, “Power System Stability and Control”, TMH, 5th reprint 2008.
2. EW Kimbark, “Direct current Transmission”,Vol.No1, John Wiley, New York, 1971
3. K R Padiyar, “HVDC Power Transmission Systems Technology and System Interation”, (3rd Edition), New Age International Publishers, Reprint 2017.

Course Outcomes:

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

1. Explain the principles of HVDC transmission and analyze converter characteristics.
2. Evaluate control strategies for HVDC systems and their impact on system performance
3. Analyze filtering, harmonic effects, line protection, and system stability in HVDC

systems
4. Examine MTDC system configurations and perform power flow analysis in AC/DC systems

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

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Professional Elective Course – IV

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEA704E	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. PrabhaKundur, 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 2027 – 2028

(For students admitted to I year in 2024-25)

Course Outcomes:

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEB704E	Battery Management Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

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

models.

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

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEC704E	Energy Conservation, Audit and DSM	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

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

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

UNIT – II	(10 Hours)

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

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

UNIT – III	(10 Hours)

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

UNIT – IV	(10 Hours)

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

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

Reference Books:

1. Suresh Kumar Soni and Manoj Nair, "Energy Conservation and Audit", Satya Prakashan, New Delhi, 2010.
2. Rajiv Shankar, "Energy Auditing in Electrical Utilities", Viva Books, New Delhi, 2010.
3. Larry C. White, Philip S. Schmidt, David R. Brown, "Industrial Energy Management Systems", Hemisphere Publishing Corp, New York.
4. Albert Thumann, "Fundamentals of Energy Engineering", Prentice Hall Inc, Englewood Cliffs, New Jersey.
5. Gupta, B. R., "Generation of Electrical Energy", Eurasia Publishing House Pvt. Ltd., New Delhi, 6th, 2006

Course Outcomes:

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEED704E	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. Ali Emadi, "Energy Efficient Electric Motors: Selection and Application", CRC Press, 2018 (3rd Ed.).
2. Witte. L.C., P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation”, Hemisphere Publishers, Washington, 1988.
3. Callaghn, P.W. “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.
4. Dryden. I.G.C., “The Efficient Use of Energy”, Butterworths, London, 1982
5. Turner. W.C., “Energy Management Hand book”, Wiley, New York, 1982.
6. Murphy. W.R. and G. Mc KAY, “Energy Management”, Butterworths, London 1987.

Course Outcomes:

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

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEE704E	Wind Energy Conversion Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

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

Reference Books:

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

Course Outcomes:

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

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

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEF704E	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: 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. AbhisekUkil, “Intelligent Systems and Signal Processing in Power Engineering, Springer Berlin Heidelberg”, New York, 2002.
4. Kevin Warwick, Arthur Ekwue and Raj Aggarwal, “Artificial Intelligence Techniques in Power Systems”, IEEE Power Engineering Series, UK, 1997.
5. Rajashekran, S. and VijaylaksmiPai, G.A., “Neural Networks, Fuzzy Logic and Genetic Algorithm Synthesis and Applications”, Prentice–Hall of India Private Limited, 2004.

Course Outcomes:

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

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

optimization using AI-based tools and techniques.

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

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEA705C/805C	Research Methodology & IPR	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

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

Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.

Geographical Indications: Acts, Laws and Rules Pertaining to GI. Ownership of GI. Rights Granted to the Holders. Registered GI in India. Identification of Registered GI. Classes of GI. Non-Registerable GI. Protection of GI. Collective or Certification Marks. Enforcement of GI Rights. Procedure for GI Registration Documents Required for GI Registration. GI Ecosystem in India.

Case Studies on Patents. Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, Case study of Basmati patent. IP Organizations In India. Schemes and Programmes.

Reference Books:

1. Dr.Nejakar SantoshM,Dr.Bendigeri Harish (2023-24) "Research Methodology and Intellectual Property Rights",ISBN978-93-5987-928-4,
2. Thiel DavidV."Research Methods for Engineers" Cambridge University Press,
3. Acharya N.K Intellectual Property Rights. 6th Edition, Asia Law House.
4. P. Naryan, (2007). "Intellectual Property Law", 3rd Ed, Eastern Law House,
5. Dr. Myneni S.R.,(2019) "Law of Intellectual Property", 9th edition, Asia law House,.
6. Dr. Reddy G.B, (2020) "Intellectual Property Rights and Law", Reprint edition, Gogia Law Agency. Hydrabad,.
7. N.R. Subbaram. S. Viswanathan, (2008). "Hand book Indian Patent Law and, Practice" Printers and publishers Pvt,Ltd,
8. Cornish, "Intellectual Property Rights", Universal publications.
9. Dr.B.L.Wadehra,"Law Relating to Intellectual Property" 5thedition,Universal Law publishing Co, Dehli.
10. SWAYAM / NPTL/ MOOCS/ We blinks/ Internet sources/ YouTube videos and other materials / notes
11.

Course Outcomes:

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

1. Integrate research methodology in engineering sciences in relevant trades.
2. Exhibit reflective thinking in problem solving exercises.
3. Identify criteria to fit one's own intellectual work in particular form of IPRs and able to apply statutory provisions and procedure to protect different forms of IPRs at national and international level.
4. Develop skill of making search using modern tools and techniques and also student is able to become patent agent by cracking patent agent exam.

Course Outcomes - Programme Outcomes Mapping Table

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

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEA706P	Project Work	9 - Credits (0 : 0 : 18)
Hours/Week : 18Hrs/Week		CIE Marks : 50
Total Hours : 160		SEE Marks : 50

	(0L-0T-P 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	PSO1	PSO2	PSO3
1	CO-1	3	3	2	2	1	1	1		2	2	2	3	2	1
2	CO-2	3	3	3	3	3				2	2	2	3	3	1
3	CO-3	2	2	2	2	2	2	1		2	3	2	2	3	1
4	CO-4								3	2	2	2	2	2	1

Syllabus for B.E VII - Semester for academic year 2027 – 2028

(For students admitted to I year in 2024-25)

BEEA701I/801I	Internship	10 - Credits (0 : 0 : 30)
Hours/Week : 30		CIE Marks : 50
Total Hours : --		SEE Marks : 50

All the students have to undergo mandatory Research/Industrial internship in any one of the reputed industry/ research institute. The internship program has to be taken up during the entire semester. The duration of the training program should be for entire semester for 15 weeks. A report on the internship is to be submitted. The supervisor/ guide from industry shall allot 100 marks of the CIE and the other 100 by the internal evaluation committee. SEE evaluation will be made by a committee comprising of HoD as Chairman/his nominee, internship coordinator and a senior faculty. The SEE will be a Technical Seminar on the industrial training.

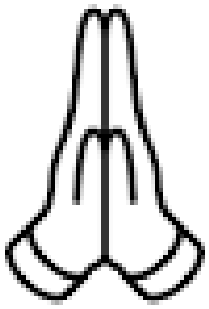
Course Outcomes

After undergoing the internship, students shall be able to:

1. Test the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period.
2. Operate the systems/ devices independently and tabulate the experimental results in consultation with supervisor.
3. Apply various soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship organization.
4. Analyze the real time functioning of internship organization.

Course Outcomes - Programme Outcomes Mapping Table

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



Thank You

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