



Basaveshwar Engineering College

[Autonomous College, Recognised by AICTE, Permanently Affiliated to VTU Belagavi, NAAC Accredited]

Bagalkote-587102, Karnataka state, India.

Department of Electrical and Electronics Engineering

[Government Aided, NBA Accredited, Research Center of VTU Belagavi]



Syllabus: 2024-25 Batch



B.V.V.S

Scheme and Syllabus

Bachelor of Engineering (B.E.) in Electrical and Electronics Engineering

For 2024-25 Admitted Batch

**Dept. of Electrical and Electronics Engg.
Basaveshwar Engineering College
Bagalkote-587102
Karnataka, India**



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

- 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)



B.V.V.S

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

Sl.	Category	BEC
1.	HSMC: English: 2, Kannada: 1, UHV: 1, Constitution: 1, EV: 1, HRM: 3 (Offered by Dept.)	9
2.	AEC: Scientific foundations of Health: 1, Innovation and design Thinking: 1, SS: 2, IKS: 1, 3 MOOCS	8
3.	BSC: Basic Science Courses (Physics, Chemistry and Mathematics)	22
4.	ESC/ETC/PLC: Engineering Science Courses	18
5.	PCC: Professional Core Courses	61
6.	PEC: Professional Elective Courses relevant to the branch	12
7.	OEC: Open Electives Courses/ Subjects from other technical disciplines (3 Credits MOOCS)	09
8.	Projects: Mini Project (2) and Major project (9)	11
9.	Internship	10
10.	Mandatory Course: Bridge course Mathematics (lateral Entry), PE, Yoga, NSS, Music	00
Total		160

Table-2: Semester wise Breakdown of Credits

Sem.	HSMC	AEC	BSC	ESC	PCC	PEC	OEC	Projects	Internship	Total
I.	2	1	8	9						20
II.	2	1	8	9						20
III.			3		17					20
IV.	1		3		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
Total	9	8	22	18	61	12	9	11	10	160

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-I (C Group)

CAY 2024-25 (160 Credits 2024-25 admitted batch)

Sl. No.	Course Category	Course Code	Course Title	Teaching-Learning Scheme Hrs/Week (Hrs/Sem.)				Examination Duration (Hrs/Sem.)		Total Hours	Examination Scheme and Evaluation			Credits = Total Hours/30
				L	T	P	TW+SL	CIE	SEE		CIE Marks	SEE Marks	Total Marks	
1.	BSC (IC)	BMAE101C	Mathematics-I for EEE Stream	3(42)	0	2(26)	44	5	3	120	50	50	100	4
2.	BSC (IC)	BCHE102C	Applied Chemistry for EEE Stream	3(42)	0	2(26)	44	5	3	120	50	50	100	4
3.	ESC	BMEB103C	Computer Aided Engineering Drawing	2(28)	0	2(26)	28	5	3	90	50	50	100	3
4.	ESC - I	BxxA104N	Engineering Science Course-I	3(42)	0	0	42	3	3	90	50	50	100	3
5.	PLC - I	Bxxx105D	Programming Language Course-I	2(28)	0	2(26)	28	5	3	90	50	50	100	3
6.	HSMC	BHSB106C	Professional Writing Skills in English	1(14)	0	0	13	2	1	30	50	50	100	1
7.	HSMC	BHSB107C / BHSC107C	Sanskritika Kannada/ Balake Kannada	1(14)	0	0	13	2	1	30	50	50	100	1
8.	AEC	BHSB108C	Innovation and Design Thinking	1(14)	0	0	13	2	1	30	50	50	100	1
										600				20

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-II (P Group)

CAY 2024-25 (160 Credits 2024-25 admitted batch)

Sl. No.	Course Category	Course Code	Course Title	Teaching-Learning Scheme Hrs/Week (Hrs/Sem.)				Examination Duration (Hrs/Sem.)		Total Hours	Examination Scheme and Evaluation			Credits = Total Hours/30
				L	T	P	TW+SL	CIE	SEE		CIE Marks	SEE Marks	Total Marks	
1.	BSC (IC)	BMAE201C	Mathematics-II for EEE Stream	3(42)	0	2(26)	44	5	3	120	50	50	100	4
2.	BSC (IC)	BPHE202C	Applied Physics for EEE Stream	3(42)	0	2(26)	44	5	3	120	50	50	100	4
3.	ESC	BEEA203C	Elements of Electrical Engineering	3(42)	0	0	42	3	3	90	50	50	100	3
4.	ESC - II	BxxA204N	Engineering Science Course-II	3(42)	0	0	42	3	3	90	50	50	100	3
5.	ETC – II	Bxxx205B	Emerging Technology Course-II	3(42)	0	0	42	3	3	90	50	50	100	3
6.	HSMC	BHSA206C	Communicative English	1(14)	0	0	13	2	1	30	50	50	100	1
7.	HSMC	BHSA207C	Indian Constitution	1(14)	0	0	13	2	1	30	50	50	100	1
8.	AEC	BHSA208C	Scientific Foundations of Health	1(14)	0	0	13	2	1	30	50	50	100	1
										600				20

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Department of Electrical and Electronics Engineering

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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Semester-III

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

Sl. No.	Course Category	Course Code	Course Title	Teaching-Learning Scheme Hrs/Week (Hrs/Sem.)				Examination Duration (Hrs/Sem.)		Total Hours	Examination Scheme and Evaluation			Credits = Total Hours/30
				L	T	P	TW+SL	CIE	SEE		CIE Marks	SEE Marks	Total Marks	
1.	BSC	BMAE301C	Mathematics – III for Electrical Science Stream	3(42)	0	0	42	3	3	90	50	50	100	3
2.	PCC	BEEA302C	Network Analysis	3(42)	0	0	42	3	3	90	50	50	100	3
3.	PCC	BEEA303C	Power Systems – I	3(42)	0	0	42	3	3	90	50	50	100	3
4.	PCC	BEEA304C	Electronic Circuits	3(42)	0	0	42	3	3	90	50	50	100	3
5.	PCC	BEEA305C	Electrical Machines – I	3(42)	0	0	42	3	3	90	50	50	100	3
6.	PCC (IC)	BEEA306C	Electrical and Electronic Measurements	2(28)	0	2(26)	28	5	3	90	50	50	100	3
7.	PCC	BEEA307L	Electronic Circuits Laboratory	0	0	26	--	2	2	30	50	50	100	1
8.	PCC	BEEA308L	Electrical Machines – I Laboratory	0	0	26	--	2	2	30	50	50	100	1
9.	BSC	BMAB300M	Bridge Course Mathematics-I	3(42)	0	0	45	3	0	90	100	-	100	0
10.	MC	BHSA360M	Yoga-I	1(14)	0	0	14	2	0	30	100	-	100	0
		BHSB360M	National Service Scheme-I	1(14)	0	0	14	2	0	30	100	-	100	0
		BHSC360M	Physical Education-I	1(14)	0	0	14	2	0	30	100	-	100	0
		BHSD360M	Music-I	1(14)	0	0	14	2	0	30	100	-	100	0
										810				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).

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Semester-IV

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

Sl. No.	Course Category	Course Code	Course Title	Teaching-Learning Scheme Hrs/Week (Hrs/Sem.)				Examination Duration (Hrs/Sem.)		Total Hours	Examination Scheme and Evaluation			Credits = Total Hours/30
				L	T	P	TW+SL	CIE	SEE		CIE Marks	SEE Marks	Total Marks	
1.	BSC	BBTA402C	Biology for Engineers	3(42)	0	0	42	3	3	90	50	50	100	3
2.	PCC	BEEA403C	Electrical Machines – II	3(42)	0	0	42	3	3	90	50	50	100	3
3.	PCC	BEEA404C	Control Systems	4(56)	0	0	58	3	3	120	50	50	100	4
4.	PCC	BEEA405C	Signals and Systems	3(42)	0	0	42	3	3	90	50	50	100	3
5.	PCC	BEEA406C	Logic Design	3(42)	0	0	42	3	3	90	50	50	100	3
6.	PCC	BEEA407L	PCB Design Laboratory	0	0	26	--	2	2	30	50	50	100	1
7.	PCC	BEEA408L	Logic Design Laboratory	0	0	26	--	2	2	30	50	50	100	1
8.	PCC	BEEA409L	Electrical Machines – II Laboratory	0	0	26	--	2	2	30	50	50	100	1
9.	HSMC	BHSA424C	Universal Human Values-II	1(14)	0	0	13	2	1	30	50	50	100	1
10.	MC	BHSA460M	Yoga-II	1(14)	0	0	14	2	0	30	100	-	100	0
		BHSB460M	National Service Scheme-II	1(14)	0	0	14	2	0	30	100	-	100	0
		BHSC460M	Physical Education-II	1(14)	0	0	14	2	0	30	100	-	100	0
		BHSD460M	Music-II	1(14)	0	0	14	2	0	30	100	-	100	0
										720				20

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Semester-V

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

Sl. No.	Course Category	Course Code	Course Title	Teaching-Learning Scheme Hrs/Week (Hrs/Sem.)				Examination Duration (Hrs/Sem.)		Total Hours	Examination Scheme and Evaluation			Credits = Total Hours/30
				L	T	P	TW+SL	CIE	SEE		CIE Marks	SEE Marks	Total Marks	
1.	PCC	BEEA501C	Power System – II	3(42)	0	0	42	3	3	90	50	50	100	3
2.	PCC	BEEA502C	Power Electronics	3(42)	0	0	42	3	3	90	50	50	100	3
3.	PEC	BEEEX503E	Professional Elective Course – I	3(42)	0	0	42	3	3	90	50	50	100	3
4.	PCC	BEEA504L	Power Electronics Laboratory	0	0	26	--	2	2	30	50	50	100	1
5.	PCC	BEEA505L	Power System – I Laboratory	0	0	26	--	2	2	30	50	50	100	1
6.	PCC	BEEA506L	Control System Laboratory	0	0	26	--	2	2	30	50	50	100	1
7.	Project	BEEA507P	Mini Project	Two contact hours/week for interaction (28)			28	2	2	60	50	50	100	2
8.	OEC	BEEEX508N	Open Elective Course – I	3(42)	0	0	42	3	3	90	50	50	100	3
9.	HSMC	BBTA523C	Environmental Studies	1(14)	0	0	13	2	1	30	50	50	100	1
10.	AEC		Quantitative Aptitude and Professional Skills	2(28)	0	0	28	2	2	60	50	50	100	2
11.	MC	BHSA560M	Yoga-III	1(14)	0	0	14	2	0	30	100	-	100	0
		BHSB560M	National Service Scheme-III	1(14)	0	0	14	2	0	30	100	-	100	0
		BHSC560M	Physical Education-III	1(14)	0	0	14	2	0	30	100	-	100	0
		BHSD560M	Music-III	1(14)	0	0	14	2	0	30	100	-	100	0
										720				20

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Semester-VI

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

Sl. No.	Course Category	Course Code	Course Title	Teaching-Learning Scheme Hrs/Week (Hrs/Sem.)				Examination Duration (Hrs/Sem.)		Total Hours	Examination Scheme and Evaluation			Credits = Total Hours/30
				L	T	P	TW+SL	CIE	SEE		CIE Marks	SEE Marks	Total Marks	
1.	PCC	BEEA601C	Power System – III	4(56)	0	0	58	3	3	120	50	50	100	4
2.	PCC	BEEA602C	Microcontrollers	3(42)	0	0	42	3	3	90	50	50	100	3
3.	PCC	BEEA603C	Digital Signal Processing	4(56)	0	0	58	3	3	120	50	50	100	4
4.	PEC	BEEEX604E	Professional Elective Course – II	3(42)	0	0	42	3	3	90	50	50	100	3
5.	PCC	BEEA605L	Power System – II Laboratory	0	0	26	--	2	2	30	50	50	100	1
6.	PCC	BEEA606L	Microcontrollers Laboratory	0	0	26	--	2	2	30	50	50	100	1
7.	AEC	BHSA600C	Indian Knowledge Systems	1(14)	0	0	13	2	1	30	50	50	100	1
8.	OEC	BEEEX608N	Open Elective Course – II	3(42)	0	0	42	3	3	90	50	50	100	3
9.	MC	BHSA660M	Yoga-IV	1(14)	0	0	14	2	0	30	100	-	100	0
		BHBS660M	National Service Scheme-IV	1(14)	0	0	14	2	0	30	100	-	100	0
		BHSC660M	Physical Education-IV	1(14)	0	0	14	2	0	30	100	-	100	0
		BHSD660M	Music-IV	1(14)	0	0	14	2	0	30	100	-	100	0
										720				20

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

Semester-VII

CAY 2027-28 (160 Credits 2024-25 admitted batch)

Sl. No.	Course Category	Course Code	Course Title	Teaching-Learning Scheme Hrs/Week (Hrs/Sem.)				Examination Duration (Hrs/Sem.)		Total Hours	Examination Scheme and Evaluation			Credits = Total Hours/30
				L	T	P	TW+SL	CIE	SEE		CIE Marks	SEE Marks	Total Marks	
1.	PCC	BEEA701C/801C	Power System – IV	3(42)	0	0	42	3	3	90	50	50	100	3
2.	PCC	BEEA702C/802C	High Voltage Engineering	3(42)	0	0	42	3	3	90	50	50	100	3
3.	PEC	BEEEX703C/803E	Professional Elective Course-III	3(42)	0	0	42	3	3	90	50	50	100	3
4.	PEC	BEEEX704C/804E	Professional Elective Course-IV	3(42)	0	0	42	3	3	90	50	50	100	3
5.	HSMC	BHSA705C/805C	Research Methodology and IPR	3(42)	0	0	42	3	3	90	50	50	100	3
6.	Project	BEEA706P/806P	Project Work	Two contact hours/week for interaction (28)			238	2	2	270	50	50	100	9
										720				24

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Department of Electrical and Electronics Engineering

Semester-VIII

CAY 2027-28 (160 Credits 2024-25 admitted batch)

Sl. No.	Course Category	Course Code	Course Title	Teaching-Learning Scheme Hrs/Week (Hrs/Sem.)				Examination Duration (Hrs/Sem.)		Total Hours	Examination Scheme and Evaluation			Credits = Total Hours/30
				L	T	P	TW+SL	CIE	SEE		CIE Marks	SEE Marks	Total Marks	
1.	Internship	BEEA8011/7011	Internship	-				2	2	300	50	50	100	10
2.	AEC	--	MOOCs*	-	-	-	90	-	-	90	-	-	100	3
3.	OEC	--	MOOCs*				90	-	-	90	-	-	100	3
										480				16

Basaveshwar Engineering College, Bagalkote

Department of Electrical and Electronics Engineering

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.

Semester-5

List of subjects for Professional Elective Course – I (Sem-V)

1.	BEEA503E	Electrical Machine Design
2.	BEEB503E	Electrical Engineering Materials
3.	BEEC503E	Testing and Commissioning of Electrical Equipment
4.	BEED503E	Data Base management Systems
5.	BEEE503E	Operation Research
6.	BEEF503E	Field Theory

List of subjects for Open Elective Course I

1.	BEEA508N	Electric Vehicle
2.	BEEB508N	Fundamentals of Wind Energy Conversion System

Semester-6

List of subjects for Professional Elective Course – II (Sem-VI)

1.	BEEA604E	Integration of Distributed Generation
2.	BEEB604E	Automotive Electronics
3.	BEEC604E	Intelligent Instrumentation
4.	BEED604E	VLSI Design
5.	BEEE604E	Electric Machine Drives
6.	BEEF604E	Modern Control Theory

List of subjects for Open Elective Course II

1.	BEEA608N	Electrical Safety for Engineers
2.	BEEB608N	Energy Storage Systems

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Semester-7th / 8th

List of subjects for Professional Elective Course – III (Sem-VII)

1.	BEEA703C/803E	Smart Grids
2.	BEEB703C/803E	Electric Vehicles
3.	BEEC703C/803E	Solar Photovoltaic System Design
4.	BEED703C/803E	Reactive Power Management
5.	BEEE703C/803E	Power System Planning
6.	BEEF703C/803E	HVDC Transmission

List of subjects for Professional Elective Course – IV (Sem-VII)

1.	BEEA704C/804E	Flexible AC Transmission Systems
2.	BEEB704C/804E	Battery Management Systems
3.	BEEC704C/804E	Energy Conservation, Audit and DSM
4.	BEED704C/804E	Energy Efficient Motors
5.	BEEE704C/804E	Wind Energy Conversion Systems
6.	BEEF704C/804E	AI Applications to Power Systems

Syllabus for B.E. I/II - Semester

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

Syllabus for B.E. I/II - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEAI03C/203C	Elements of Electrical Engineering	Semester	: I / II
L:T:P	: 3:0:0		Course Type	: ESC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Demonstrate the ability to apply the fundamental principles of electrical engineering—including DC and AC circuit analysis, electromagnetism, electrical measurements, domestic wiring, and electrical safety—to analyze, evaluate, and solve practical electrical engineering problems.

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

Module - I (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, Maxwell'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.

Syllabus for B.E. I/II - Semester
(For Students Admitted to I Year in AY 2024-25)

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.

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:

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

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1 WK2 WK3)	2 (WK1 WK2 WK3)										3		
CO2	3 (WK2 WK3 WK4)	3 (WK2 WK3 WK4)										3	1	
CO3	2 (WK2 WK3 WK4)	3 (WK2 WK3 WK4)		1 (WK8)								3	1	
CO4	2 (WK3 WK4)	2 (WK3 WK4)	1 (WK5)		2 (WK2 WK6)	2 (WK1 WK5 WK7)	1 (WK9)				1 (WK8)	2	1	

Syllabus for B.E. I/II - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEAI04N/204N	Introduction to Electrical Engineering	Semester	: I / II
L:T:P	: 3:0:0		Course Type	: ESC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Demonstrate the ability to apply fundamental electrical engineering principles, including electric power systems, DC and AC circuit analysis, electrical machines, transformers, domestic wiring, and electrical safety, to analyze system performance, identify suitable applications of electrical equipment, and solve practical engineering problems.

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

Module - I (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 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.

Syllabus for B.E. I/II - Semester
(For Students Admitted to I Year in AY 2024-25)

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.

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:

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

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1 WK2 WK3 WK4)	2 (WK1 WK2 WK3 WK4)										3		
CO2	3 (WK1 WK2 WK3 WK4)	3 (WK1 WK2 WK3 WK4)										3	1	
CO3	3 (WK1 WK2 WK3 WK4)	2 (WK1 WK2 WK3 WK4)	1 (WK5)									3	2	
CO4	2 (WK1 WK2 WK3 WK4)	2 (WK1 WK2 WK3 WK4)	1 (WK5)			2 (WK1 WK5 WK7)	1 (WK9)				1 (WK8)	2	1	

Syllabus for B.E. I/II - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEAI05B/205B	Renewable Energy Sources	Semester	: I / II
L:T:P	: 3:0:0		Course Type	: ETC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.	: 90 Hrs	Credits	: 03

Professional Competency:

Demonstrate the ability to apply the principles of renewable energy technologies, sustainable development, and green energy systems to analyze, evaluate, and select appropriate renewable energy solutions for sustainable power generation and energy applications.

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.

Module - I (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.

Syllabus for B.E. I/II - Semester
(For Students Admitted to I Year in AY 2024-25)

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

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:

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

Syllabus for B.E. I/II - Semester
(For Students Admitted to I Year in AY 2024-25)

Matrix to describe the mapping of COs with POs (considering Wks) and PSOs

Course Outcomes - COs	Program Outcomes and Wks											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1 WK2 WK3 WK4)	2 (WK1 WK2 WK3 WK4)				2 (WK1 WK5 WK7)					1 (WK8)	2		1
CO2	3 (WK1 WK2 WK3 WK4)	3 (WK1 WK2 WK3 WK4)		1 (WK8)								3	1	1
CO3	2 (WK1 WK2 WK3 WK4)	3 (WK1 WK2 WK3 WK4)	1 (WK5)	1 (WK8)		2 (WK1 WK5 WK7)					1 (WK8)	3	1	2
CO4	2 (WK1 WK2 WK3 WK4)	2 (WK1 WK2 WK3 WK4)	2 (WK5)	1 (WK8)		2 (WK1 WK5 WK7)					2 (WK8)	3	2	2

Syllabus for B.E. III - Semester

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

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BMAE301C	Mathematics-III for Electrical Science Stream	Semester	: III
L:T:P	: 3:0:0		Course Type	: BSC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Applying statistical analysis, calculus, and transform methods to solve engineering problems.

Course Outcomes:

After the completion of the course student will be able to

1. Apply correlation and regression analysis to fit a suitable mathematical model for Statistical data.
2. Apply the concepts of probability distributions and Joint probability distribution for engineering problems.
3. Apply Fourier series to study the behavior of periodic functions and their applications.
4. Apply Fourier transforms and Z-Transform to solve engineering problems.

UNIT-I (10 Hrs.)

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.

UNIT-II (11 Hrs.)

Probability Distributions: Random variables-discrete and continuous Probability distribution function, cumulative distribution function, Mathematical Expectation, mean and variance, Binomial Poisson's and Normal distribution (without proofs for mean and SD) – Problems.

Joint Probability Distribution: Joint probability distributions for discrete and continuous random variable expectation, covariance and correlation.

UNIT-III (11 Hrs.)

Fourier series and practical harmonic analysis: Periodic functions, Dirichlet's condition. Fourier series expansion of functions with period 2π and with arbitrary period $2l$. Half-range Fourier series. Practical harmonic analysis

UNIT-IV (10 Hrs.)

Fourier and Z Transforms: Infinite Fourier transforms, Fourier cosine and sine transforms, Inverse Fourier transforms, Inverse Fourier cosine and sine transforms. Z-transforms.

Text Books

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.

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

6. Robert V. Hogg, Joseph W. McKean & Allen T. Craig. "Introduction to Mathematical Statistics", Pearson Education 7th edition, 2013.
7. Jim Pitman. Probability, Springer-Verlag, 1993.
8. Sheldon M. Ross, "Introduction to Probability Models" 11th edition. Elsevier, 2014.
9. A.M. Yaglom and 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. N. P. Bali and Manish Goyal, A Text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010

Web Links and Video Lectures:

<https://drive.google.com/file/d/1KtCtZmnjOvVIS68wXS9FZPXUFvRktBQ/view?usp=sharing>

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)						1			1 (WK8)	3	1	1
CO2	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)						1			1 (WK8)	3	1	1
CO3	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)						1			1 (WK8)	3	1	1
CO4	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)						1			1 (WK8)	3	1	1

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEA302C	Network Analysis	Semester	: III
L:T:P	: 3:0:0		Course Type	: PCC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

The course enables students to analyse and solve complex electrical networks using circuit theorems, network topology, and mathematical techniques. Students develop competency in transient analysis of RL, RC, and RLC circuits using Laplace transforms and switching concepts. The course also provides skills in analysing resonant circuits and evaluating two-port network parameters for practical electrical and communication systems. These competencies prepare students for advanced studies and applications in electrical, electronics, communication, and power engineering systems.

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.

Unit-I (11 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-2 (10 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-3 (11 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-4 (10 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.

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

Text 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.

Reference Books:

1. Roy Chowdhary, "Network and Systems", 2nd Edition, New age International Publications, 2010.
2. Charles K. Alexander, Matthew N. O. Sadiku "Fundamentals of Electric Circuits", 5th Edition, Tata McGraw Higher Education, 2013.
3. Abhijit Chakrabarti, "Circuit Theory-Analysis and Synthesis", 7th Edition, Dhanpat Rai Technical Publishers, 2016.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)									I (WK8)	3	I	I
CO2	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)									I (WK8)	3	I	I
CO3	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	I (WK5)	I (WK8)							I (WK8)	3	I	I
CO4	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	I (WK5)	2 (WK8)							I (WK8)	3	I	I

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEA303C	Power System - I	Semester	: III
L:T:P	: 3:0:0		Course Type	: PCC
Hours/Sem.	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Develop the ability to apply fundamental concepts of power systems—such as transmission line parameters, line performance, underground cable characteristics, distribution networks, and protective devices—to analyse and assess the operation and reliability of electrical power transmission and distribution systems.

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.

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-2 (11 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-3 (11 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-4 (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,

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

Induction type Non-directional over current relay, Directional relay. Differential relay- Principle of operation, Distance relays: Impedance Relay, Buchholz Relay.

Text Books:

1. Mehta V K and Rohit Mehta, "Principals of Power Systems", 4th Edition, S Chand and Company Ltd, Publishers, New Delhi, 2015.
2. Uday A. Bakshi, Dr. Mayuresh V. Bakshi, "Transmission and Distribution", 1st Edition, Technical Publications, Pune, 2020.

Reference Books:

1. Soni, Gupta and Bhatnagar, "Power System Engineering", 5th Edition, Dhanapat Rai and Co.(P) Ltd. Publishers, New Delhi, 2016.
2. Sunil Rao, "Switchgear and Protection and Power Systems", 13th Edition, Khanna Publishers, 2008.
3. J.B.Gupta, "Switchgear and Protection", (2nd Edition), Katson Publisher, 2013.
4. Ravindarnath B, "Power System Protection and Switchgear", 2nd Edition, New age International, 2008.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2)									1 (WK8)	3		1
CO2	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3)									1 (WK8)	3		1
CO3	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3)									1 (WK8)	3	1	1
CO4	2 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3)				1 (WK5)		1	1		1 (WK8)	3		1

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEA304C	Electronic Circuits	Semester	: III
L:T:P	: 3:0:0		Course Type	: PCC
Hours/Sem.	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Analyse, design and evaluate electronic circuits by applying semiconductor device concepts, transistor models, frequency response techniques and amplifier principles to develop stable biasing, amplification, oscillation and feedback systems for practical applications.

Course Outcomes:

After completion of the course, the students 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.

Unit-1 (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-2 (11 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-3 (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-4 (11 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.

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

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.

Text Books:

1. Robert L Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson, 11th Edition, 2015.
2. David A Bell, "Electronic Devices & Circuits", Oxford University Press, 5th Edition, 2008.

Reference Books:

1. Jacob Millman, 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. Millman and Halkias, "Electronic Devices and Circuits", Mc Graw Hill, 4th Edition, 2015.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	1 (WK1) (WK2) (WK3) (WK4)	2 (WK5)								1 (WK8)		3	1
CO2	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)	2 (WK5)								1 (WK8)		3	1
CO3	2 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	2 (WK8)							1 (WK8)		3	1
CO4	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)	2 (WK5)								1 (WK8)		3	1

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEA305C	Electrical Machines-I	Semester	: III
L:T:P	: 3:0:0		Course Type	: PCC
Hours/Sem.	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Demonstrate the ability to apply fundamental principles of electrical machines to analyze, evaluate, and solve engineering problems related to transformers and induction motors, including their construction, operation, performance characteristics, testing methods, and control techniques for practical applications.

Course Outcomes:

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

1. Analyze the construction, operating characteristics, equivalent circuit, testing, voltage regulation, losses, and efficiency of single-phase transformers.
2. Evaluate three-phase transformer connections, parallel operation, harmonic suppression, and autotransformer performance for electrical power applications.
3. Examine the operating principles, torque characteristics, equivalent circuit, and performance of three-phase induction motors.
4. Evaluate starting and speed control techniques of induction motors and select appropriate three-phase and single-phase induction motors for industrial applications.

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, Losses & efficiency, all day efficiency, voltage regulation, polarity test and Sumpner's test.

Unit-2 (11 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-3 (11 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-4 (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.

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024-25)

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.

Text Books:

1. IJ 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.

Reference Books:

1. Mulukuntla S. Sarma, "Electric Machines", Cengage, 1st Edition, 2009.
2. Theodore Wildi, "Electrical Machines, Drives and Power systems", Pearson, 6th Edition, 2014.
3. P.S. Bhimbhra, "Generalized Theory of Electrical Machines", Khanna publishers, 2014.
4. V.K Mehta, Rohit Mehta, "Principles of Electrical Machines", S Chand, 2nd Edition, 2009.

Web Links and Video Lectures (e-Resources):

1. <https://nptel.ac.in/courses/108102146>
2. <https://nptel.ac.in/courses/108105131>
3. <https://nptel.ac.in/courses/108105155>
4. <https://nptel.ac.in/courses/10810607>

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	2 (WK2) (WK3)										3		
CO2	3 (WK1) (WK2) (WK3) (WK4)	2 (WK2) (WK3)										3		
CO3	3 (WK1) (WK2) (WK3) (WK4)	2 (WK2) (WK3)										3		
CO4	3 (WK1) (WK2) (WK3) (WK4)	2 (WK2) (WK3)										3		

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEA306C	Electrical and Electronic Measurements	Semester	: III
L:T:P	: 2:0:2		Course Type	: PCC
Hours/Sem.	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Apply electrical and electronic measurement techniques, measuring instruments, bridge circuits, instrument transformers, and transducers to measure, analyze, and interpret electrical parameters for engineering applications.

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.

Unit-I (07 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-2 (07 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-3 (07 Hours)

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-4 (07 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 I-Φ Energy meter.

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

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.

Text Books:

1. A.K. Sawhney, "A Course in Electrical & Electronic Measurements and Instrumentation", Dhanpat Rai and Co., New Delhi, 19th Edition, 2015.
2. J. B. Gupta, "A Course in Electronic and Electrical Measurements", S. K. Kataria & Sons, Delhi, 12th Edition, 2009.

Reference Books:

1. David Bell, "Electronic Instrumentation and Measurements", Oxford University Press, 1st Edition, 2013.
2. A.J. Bouwens, "Digital Instrumentation", Tata McGraw Hill Publications, 16th Reprint Edition, 2008.
3. H.S. Kalsi, "Electronic Instrumentation", Tata McGraw Hill Education, 4th Edition, 2019.
4. C.S. Rangan, G.R. Sharma and V. S. V. Mani, "Instrumentation Devices and Systems", Tata McGraw Hill Book Co., New Delhi, 1st Edition, 2004.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK3) (WK4)	2 (WK2)		1 (WK8)	3 (WK2) (WK6)							3	2	
CO2	2 (WK3) (WK4)	1 (WK2)		1 (WK8)	3 (WK6)				1			3	2	
CO3	2 (WK2) (WK3)	1 (WK2)			3 (WK6)					1		3	2	
CO4	2 (WK1) (WK3)	1 (WK2)	1 (WK5)	1 (WK8)	2 (WK6)	1 (WK7)					1 (WK8)	2	3	

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEA307L	Electronic Circuits Laboratory	Semester	: III
L:T:P	: 0:0:2		Course Type	: PCC
Hours/Sem.	Practical		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE + SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 01

Professional Competency:

Design, implement and analyse electronic experiments by selecting appropriate components, constructing circuits, conducting experiments and interpreting results to draw conclusions and prepare comprehensive reports.

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.

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 Full wave – centre tapped transformer type and Bridge type rectifier circuits with and without Capacitor filter using MATLAB. Determination of ripple factor, regulation and efficiency.

Text Books:

1. Electronic Devices and Circuit Theory, "Robert L Boylestad and Louis Nashelsky", Pearson, 11th Edition, 2015.
2. David A Bell, "Electronic Devices & Circuits", Oxford University Press, 5th Edition, 2008.

Reference Books:

1. Jacob Millman, 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. Millman and Halkias, "Electronic Devices and Circuits", Mc Graw Hill, 4th Edition, 2015.

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	1 (WK1) (WK2) (WK3) (WK4)	2 (WK5)					3			1 (WK8)		3	1
CO2	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	3 (WK8)	2 (WK2) (WK6)			3			1 (WK8)		3	1
CO3	2 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	3 (WK8)	2 (WK2) (WK6)			3	-	3	1 (WK8)		3	1

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEA308L	Electrical Machines – I Laboratory	Semester	: III
L:T:P	: 0:0:2		Course Type	: PCC
Hours/Sem	Practical		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 01

Professional Competency:

Demonstrate the ability to apply fundamental principles of electrical machines to analyze, evaluate, and solve engineering problems related to transformers and induction motors, including their construction, operation, performance characteristics, testing methods, and control techniques for practical applications.

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.

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.)

Text Books:

1. IJ 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.

Reference Books:

1. Mulukuntla S. Sarma, "Electric Machines", Cengage, 1st Edition, 2009.
2. Theodore Wildi, "Electrical Machines, Drives and Power systems", Pearson, 6th Edition, 2014.
3. P.S. Bhimbhra, "Generalized Theory of Electrical Machines", Khanna publishers, 2014.

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

4. V.K Mehta, Rohit Mehta, "Principles of Electrical Machines", S Chand, 2nd Edition, 2009.

Web Links and Video Lectures (e-Resources):

1. <https://nptel.ac.in/courses/108102146>
2. <https://nptel.ac.in/courses/108105131>
3. <https://nptel.ac.in/courses/108105155>
4. <https://nptel.ac.in/courses/10810607>

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	2 (WK2) (WK3) (WK4)	3 (WK5)									3		
CO2	3 (WK1) (WK2) (WK3) (WK4)	3 (WK2) (WK3) (WK4)	3 (WK5)									3		
CO3	3 (WK1) (WK2) (WK3) (WK4)	3 (WK2) (WK3) (WK4)										3		

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code :		BMAB300M	Bridge Course Mathematics-I	Semester :	III
L:T:P :		3 : 0 : 0		Course Type :	MC
Hours/Sem.	Teaching :	42 Hrs		CIE Marks :	100
	Learning :	45 Hrs		SEE Marks :	00
	CIE Exam :	3 Hrs		Total Marks :	100
	SEE Exam :	----			
	Total Hrs. :	90 Hrs		Credits :	00

Professional Competency:

Apply calculus, linear algebra, Laplace transform, and numerical techniques to solve engineering and mathematical problems efficiently.

Course Outcomes

After completion of the course student will be able to

1. Apply the concepts of calculus
2. Apply the principles of linear algebra to solve system of linear equations.
3. Apply the Laplace transform techniques to solve differential equations.
4. Apply the Numerical techniques to solve engineering problems.

Unit - I (11 Hrs.)

Partial Derivatives and Ordinary Differential equations

Partial differentiation, total derivative –differentiation of composite functions, Jacobian. Linear and Bernoulli's differential equations. Exact and reducible to exact differential equations.
Integrating factors on $(1/N) (\partial M / \partial y - \partial N / \partial x)$ and $(1/M) (\partial N / \partial x - \partial M / \partial y)$.

Unit - II (10Hrs.)

Linear Algebra

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.

Unit - III (11Hrs.)

Laplace Transform

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 (Shifting, Partial fractions, and Logarithmic functions). Solutions of linear differential equations.

Unit - IV (10 Hrs.)

Numerical Methods

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 $1/3^{\text{rd}}$ and $3/8^{\text{th}}$ rule(no derivation)-problems. Runge-Kutta 4^{th} order method -problems.

Text Books

1. B. S. Grewal: "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2021.
2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.

Reference Books

1. V. Ramana: "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017
2. Srimanta Pal & Subodh C.Bhunia: "Engineering Mathematics" Oxford University

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

Press, 3rd Ed., 2016.

3. N.P Bali and Manish Goyal: "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics" McGraw – Hill Book Co., New York, 6th Ed., 2017.
5. Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education (India) Pvt. Ltd 2015.
6. David C Lay: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.
7. Gareth Williams: "Linear Algebra with Applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BHSA360M	Yoga - I	Semester	: III
L:T:P	: 0:0:2		Course Type	: MC
Hours/Sem.	Practical		CIE Marks	: 100
	Learning (TW+SL)		SEE Marks	: 00
	Exam (CIE)		Total Marks	: 100
	Total Hrs.		Credits	: 00

Professional Competency:

Yoga enables an individual to understand, perform, demonstrate, and learn Yoga effectively and safely, contributing to holistic health, mental peace, and quality of life.

Course Outcomes:

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

1. Explain the meaning, aims, and objectives of Yoga and explain its relevance in daily life.
2. Perform and teach Surya namaskar, demonstrating its correct sequence, technique, and explaining its physical and mental benefits.
3. Demonstrate various Asanas by name, including their significance, correct methods of practice, and associated benefits for overall well-being.
4. Demonstrate different types of Pranayama, detailing their names, procedures, safety precautions, and therapeutic uses.

Unit-I (7 Hrs.)

Yoga, its meaning, definitions, origin, history and development, Different schools of yoga, aims and objectives of yoga, importance of prayer, Yogic practices for common man to promote positive health, Rules to be followed during yogic practices by practitioner Yoga, its misconceptions.

Unit-II (7 Hrs.)

Difference between yogic and non-yogic practices, Suryanamaskar - prayer, meaning, need, importance and benefits of Suryanamaskar, Practice of 12 count - 2 rounds.

Unit-III (7 Hrs.)

Asana its meaning by name, different types of asana technique, precautionary measures and benefits of each asana Sitting: 1. Padmasana 2. Vajrasana - Meaning, Importance, Rules. Standing: 1. Vrikshana 2. Trikonasana - Meaning, Importance, Rules.

Unit-IV (7 Hrs.)

Prone line: 1. Bhujangasana 2. Shalabhasana - Meaning, Importance, Rules.
Supine line: 1. Utthitadvipadasana 2. Ardhalasana- Its meaning, Importance, Rules & Practices session

Reference Books:

1. S. K. Kuppasta, "Samagra yoga darshaini Publication", Vivekananda Yoga Vignana Kendra, Bagalkot, 2021.
2. Ajitkumar, A., "Yogapravesha in Kannada", Karnataka Yoga Publications, 1st Edition, 2012.
3. Iyengar, B. K. S., "Light on Yoga", George Allen & Unwin Ltd., Revised Edition, 1966.
4. Gharote, M. L. and Ganguly, S. K., "Teaching Methods for Yogic Practices", Kaivalyadhama M.Y.M. Samiti, 1st Edition, 1980.
5. SVYASA University, "Yoga Instructor Course Handbook", SVYASA University, 2nd Edition, 2018.
6. Muthanna, Y., "Yoga for Children – Step by Step", Prasara Publications, 1st Edition, 2015.

Web Links and Video Lectures:

<https://youtu.be/KB-TYIgdIwE>
<https://youtu.be/aa-TG0WgILs>

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BHSB360M	National Service Scheme - I	Semester	: III
L:T:P	: 0:0:2		Course Type	: MC
Hours/Sem.	Practical		CIE Marks	: 100
	Learning (TW+SL)		SEE Marks	: 00
	Exam		Total Marks	: 100
	Total Hrs.		Credits	: 00

Professional Competency:

After completing the course, students will be able to responsibly analyze societal and environmental challenges, design and implement sustainable and innovative solutions, contribute to community welfare, respond effectively to emergencies, and promote national integration and social harmony.

Course Outcomes:

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

1. Recognize and understand their roles and responsibilities towards society for its betterment.
2. Analyze environmental and societal issues and design effective and sustainable solutions.
3. Assess existing systems critically and propose practical, innovative solutions to promote sustainable development.
4. Plan and implement government-led or self-initiated projects efficiently for community and societal welfare.
5. Develop the ability to respond to emergencies and natural disasters, while fostering national integration, social harmony, and unity.

General Instructions - Pedagogy:

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for NSS activities and its present relevance in the society and provide real-life examples.
3. Support and guide the students for self-planned activities.
4. Course instructor will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

Topics/Activities to be Covered

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management–Public, Private and Govt. organization, 5R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.

Plan of Action Execution of Activities For Each Semester

1. Practice Session Description
2. Lecture session by NSS Officer
3. Students Presentation on Topics
4. Presentation – Selection of topic: PHASE-I
5. Commencement of activity and its progress: PHASE- 2
6. Execution of Activity
7. Execution of Activity
8. Execution of Activity

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

9. Execution of Activity
10. Case study based Assessment, Individual performance
11. Sector wise study and its consolidation
12. Video based seminar for 10minutes by each student At the end of semester with Report.
 - In every semester from 3rd semester to 6th semester, each student should carry out activities according to the scheme and syllabus.
 - At the end of every semester, student performance has to be evaluated by the NSS coordinator for the assigned activity progress and its completion.
 - Finally, in the 6th semester, a consolidated report of all activities from 3rd to 6th semester, compiled as per the instructions.

Reference Books:

1. NSS Cell, VTU Belagavi. (n.d.). NSS course manual (Edition unknown). Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS Cell. (n.d.). Activity reports and manual, Government of Karnataka.
3. Government of India, NSS Cell. (n.d.). Activity reports and manual, Government of India.

Pedagogy–Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl	Topic	Group size	Location	Activity execution	Reporting	Evaluation of Topic
1.	Organic farming, Indian Agriculture Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside /community area/ College campus etc.	Site selection/ proper consultation/ Continuous monitoring/ Information board	Report should be submitted by the individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
2.	Waste management – Public, Private and Govt org.	May be individual or team	Villages/City Areas/Grama panchayat/public associations/Government Schemes officers/ campus etc.	Site selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to evaluation authority.	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
3.	Setting of information imparting club for women leading to contribution in social, economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams /College campus etc.....	Group selection/proper consultation/Continuous monitoring/ Information board		Evaluation as per the rubrics Of scheme and syllabus by NSS officer

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BHSC360M	Physical Education - I	Semester	: III
L:T:P	: 0:0:2		Course Type	: MC
Hours/Sem.	Practical		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam		Total Marks	: 100
	Total Hrs.		Credits	: 00

Professional Competency:

After completing the course, students will be able to demonstrate physical fitness and sporting proficiency by correcting postural deformities, managing stress, performing aerobic exercises, and applying proper skills and techniques in games and athletic events while participating confidently in competitive sports.

Course Outcomes:

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

1. Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth and development
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional/state / national / international levels.
5. Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.
6. Understand and practice of Traditional Games.

Unit-I (7 Hrs.)

1. Lifestyle
2. Health & Wellness
3. Pre-Fitness test.

Unit-II (7 Hrs.)

General Fitness & Components of Fitness

1. Warming up (Free Hand exercises)
2. Strength–Push-up/ Pull-ups
3. Speed–30Mtr Dash

Unit-III (7 Hrs.)

Specific games (Any one to be selected by the student)

Kabaddi–Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.

Unit -IV (7 Hrs.)

Kho-Kho–Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.

Reference Books:

1. Bandopadhyay, K. (n.d.), Sarir Siksha Parichay, Classic Publishers.
2. Dharma, P. N. (n.d.), Fundamentals of Track and Field, Khel Sahitya Kendra.
3. Dubey, H. C. (n.d.), Basketball, Discovery Publishing House.
4. Jain, N. (n.d.), Play and Learn Basketball, Khel Sahitya Kendra.
5. Jain, R. (n.d.), Play and Learn Cricket, Khel Sahitya Kendra.
6. Kus, S. (n.d.), Coaching Volleyball Successfully, Human Kinetics.
7. Petipus, et al, (n.d.), Athlete's Guide to Career Planning, Human Kinetics.
8. Saha, A. K. (n.d.), Sarir Siksher Ritiniti, Rana Publishing House.
9. Thani, V. (n.d.), Coaching Cricket, Khel Sahitya Kendra.
10. Rachana, J. (n.d.), Teach Yourself Basketball, Sports Publication

Scheme and Assessment for the course

Sl.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes–2,each of 15marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks	50
Total		100

Syllabus for B.E. (E&EE) III - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	:	BHSD360M		Semester	:	III
L:T:P	:	0:0:2		Course Type	:	MC
Hours/Sem.	Practical	:	28 Hrs	CIE Marks	:	100
	Learning (TW+SL)	:	00 Hrs	SEE Marks	:	0
	Exam	:	02 Hrs	Total Marks	:	100
	Total Hrs.	:	30 Hrs	Credits	:	00

Music - I

Professional Competency:

Demonstrate foundational professional competency in Indian music by applying knowledge of its historical evolution and core musical concepts such as Shruthi, Nada, Swara, Laya, Raga, Tala, and Mela in analysis, performance, and musical interpretation

Course Outcomes:

1. To understand the origin and evolution of the Indian music system and trace its historical development and cultural significance.
2. To develop a foundational understanding of the core concepts of Indian music, including Shruthi, Nada, Swara, Laya, Raga, Tala, and Mela, and their role in musical practice and performance.

Content (28 Hrs.)

Introduction:

Origin of the Indian Music: Evolution of the Indian music system, Understanding of Shruthi, Nada, Swara, Laya, Raga Tala, Mela.

Textbooks

1. Vidushi Vasantha Madhavi, "Theory of Music", Prism Publication, 2007.
2. T Sachidevi and T Sharadha (Thirumalai Sisters), Karnataka Sangeetha Dharpana- Vol. I (English), Shreenivaas Prakaashana, 2018.

Reference Books:

1. Lakshminarayana Subramaniam, Viji Subramaniam, "Classical Music of India: A Practical Guide", Tranqueber 2018.
2. R. Rangaramanuja Ayyangar, "History of South Indian (Carnatic) Music", Vipanci Charitable Trust; Third edition, 2019.
3. Ethel Rosenthal, "The Story of Indian Music and Its Instruments: A Study of the Present and Record of the Past", Pilgrims Publishing, 2007.
4. Carnatic Music, "National Institute of Open Schooling", 178 EC Proceedings dated 17.07.2024.

Syllabus for B.E. IV - Semester

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

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BBT402C	Biology for Engineers	Semester	: IV
L:T:P	: 3:0:0		Course Type	: BSC
Hours/Sem.	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Understanding fundamentals of biological processes and apply to solve engineering problems, bridging the technical engineering with living systems.

Course Outcomes:

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

1. Explain the structure and functions of cells and biomolecules, properties and applications of special biomolecules in engineering and industrial contexts.
2. Interpret bio-inspired models and natural mechanisms and correlate them with engineering designs and technological innovations.
3. Analyze the functional architecture of human organ systems as models to design and evaluate engineering solutions.
4. Apply the concept of bioprinting, artificial intelligence, and microbial processes in the design and development of innovative solutions for healthcare, food science, and sustainable infrastructure.

UNIT-I (10 Hrs.)

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 bioplastics production, Proteins in food production, Lipids in biodiesel.

UNIT-II (10 Hrs.)

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 Mechanisms:

BioEcholocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf), Respiration (MFCs)

UNIT-III (12 Hrs.)

Human Organ Systems and Bio Designs:

Brain as a CPU system -architecture, CNS and Peripheral Nervous System, signal transmission, EEG. 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.

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

UNIT-IV (10 Hrs.)

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

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

adsorption. Artificial Intelligence for disease diagnosis. Biochips & their applications. Biosensors & their applications.

Reference Books

1. Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao, "Biology for Engineers" N Publishing, Bengaluru, 2023.
2. S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Biology for Engineers, Tata McGraw-Hill, New Delhi, 2012.
3. Arthur T. Johnson, Biology for Engineers, 2nd Edition, CRC Press, Taylor & Francis Group, Boca Raton, FL, 2019.
4. Sohini Singh and Tanu Allen, Biology for Engineers, Vayu Education of India, New Delhi, 2014.
5. Yoseph Bar-Cohen, Biomimetics: Nature-Based Innovation, 1st edition, CRC Press., 2012
6. Ibrahim Ozbolat, 3D Bioprinting: Fundamentals, Principles and Applications, Academic Press (Elsevier), 2016.
7. Rodríguez Méndez, M. L. (Ed.), Electronic Noses and Tongues in Food Science, 1st Edition, Academic Press (Elsevier), Cambridge, MA, USA, 2016.

Web links and Video Lectures (e-Resources)

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

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1, WK2, WK3, WK4)	3 (WK1, WK2, WK3, WK4)	3 (WK5)	2 (WK8)	2 (WK2, WK6)	2 (WK1, WK5, WK7)	2 (WK9)	2			3 (WK8)			
CO2	3 (WK1, WK2, WK3, WK4)	3 (WK1, WK2, WK3, WK4)	3 (WK5)	2 (WK8)	3 (WK2, WK6)	3 (WK1, WK5, WK7)	2 (WK9)	2			3 (WK8)			
CO3	3 (WK1, WK2, WK3, WK4)	3 (WK1, WK2, WK3, WK4)	3 (WK5)	2 (WK8)	3 (WK2, WK6)	3 (WK1, WK5, WK7)	3 (WK9)	2			3 (WK8)			
CO4	3 (WK1, WK2, WK3, WK4)	3 (WK1, WK2, WK3, WK4)	3 (WK5)	2 (WK8)	3 (WK2, WK6)	3 (WK1, WK5, WK7)	3 (WK9)	2			3 (WK8)			

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA403C	Electrical Machines-II	Semester	: IV
L:T:P	: 3:0:0		Course Type	: PCC
Hours/Sem.	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Demonstrate the ability to apply the principles of electrical machines to analyze, evaluate, and control the performance of DC machines and synchronous machines, including their construction, operation, characteristics, testing methods, and practical applications in power systems.

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 excitations.
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.

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-2 (11 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-3 (11 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-4 (10 Hours)

Parallel operations of alternators: Synchronization, parallel operation, operation on infinite bus, operating characteristics, power flow equations of Alternators.

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

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. IJ 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.

Reference Books:

1. Mulukuntla S. Sarma, "Electric Machines", Cengage, 1st Edition, 2009.
2. Theodore Wildi, "Electrical Machines, Drives and Power systems", Pearson, 6th Edition, 2014.
3. P.S. Bhimbhra, "Generalized Theory of Electrical Machines", Khanna publishers, 2014.
4. V.K Mehta, Rohit Mehta, "Principles of Electrical Machines", S Chand, 2nd Edition, 2009.

Web Links and Video Lectures (e-Resources):

1. <https://nptel.ac.in/courses/108102146>
2. <https://nptel.ac.in/courses/108105131>
3. <https://nptel.ac.in/courses/108105155>
4. <https://nptel.ac.in/courses/10810607>

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	2 (WK2) (WK3) (WK4)									1 (WK8)	3		
CO2	3 (WK1) (WK2) (WK3) (WK4)	2 (WK2) (WK3) (WK4)									1 (WK8)	3		
CO3	3 (WK1) (WK2) (WK3) (WK4)	2 (WK2) (WK3) (WK4)									1 (WK8)	3		
CO4	3 (WK1) (WK2) (WK3) (WK4)	2 (WK2) (WK3) (WK4)									2 (WK8)	3		

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA404C	Control Systems	Semester	: IV
L:T:P	: 4:0:0		Course Type	: PCC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 04

Professional Competency:

The learner demonstrates comprehensive expertise in modeling, analyzing, and designing linear feedback control systems. They apply mathematical principles and software automation tools to predict, evaluate, and optimize system behavior in both time and frequency domains.

Course Outcomes:

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

1. Classify control systems based on a number of ways and select them for particular applications.
2. Develop mathematical modeling of LTI control systems via differential equation formation, transfer function, and state space analysis.
3. Employ time domain analysis to predict and diagnose transient performance parameters of LTI control systems for standard input function step.
4. Formulate different types of analysis in frequency domain to obtain the stability of the LTI control systems.

Unit-I (14 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-2 (14Hours)

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

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

Unit-3 (14 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-4 (14 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

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Text Books:

1. Modern Control Engineering (5th Ed, 2010) by K. Ogata,
2. M.Gopal, "Control Systems Principles and Design", 3rd Edition, Tata McGraw Hill, 2011.

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, AddisonWesley, 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

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2)	2 (WK5)	2 (WK8)	2 (WK6)						1 (WK8)	3	2	2
CO2	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK3) (WK4)	2 (WK5)	2 (WK8)	2 (WK6)						2 (WK8)	3	3	2
CO3	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK4)	3 (WK5)	3 (WK8)	2 (WK6)						2 (WK8)	3	3	2
CO4	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK3) (WK4)	2 (WK5)	3 (WK8)	2 (WK6)	1 (WK5)		1	1		3 (WK8)	3	2	2

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA405C	Signals and Systems	Semester	: IV
L:T:P	: 3:0:0		Course Type	: PCC
Hours/Sem.	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE + SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Analyze and evaluate signals and systems by applying time-domain, frequency-domain, and Z-domain techniques, compute and interpret responses of Linear Time-Invariant (LTI) systems using convolution and impulse response methods, apply Fourier series and transforms to examine spectral characteristics of signals. Z-transform to determine stability, causality and validation using MATLAB tools.

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. Evaluate linear time-invariant (LTI) systems by determining output responses using convolution sum and integral, and assess the system properties using impulse responses.
3. Apply Fourier series and transforms (CTFS, DTFS, CTFT, DTFT) for the periodic and aperiodic 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.

Unit-1 (11 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-2 (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-3 (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-4 (11 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, transfer function, stability and causality, and solution of difference equations using Z transform Usage of MATLAB command-line functions to verify the solution.

Text Books:

1. Simon Haykin and Barry Van Veen, Signals and Systems John Wiley & Sons (2nd Edition).
2. A.V. Oppenheim, A.S. Willsky, and S.H. Nawab Signals and Systems (4th edition, published by Pearson) (2016).

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Reference Books:

1. A. Anand Kumar Signals and Systems (3rd Edition) published by PHI Learning) (2019/2020,.
2. B.P. Lathi Signals and Systems (BS Publications) 2003.
3. Benoit Boulet 'Fundamentals of Signals and Systems') Strong emphasis on practical applications (2005)
4. C.L. Phillips, J.M. Parr, and E.A. Riskin Signals & Systems, & Transforms (5th Edition) (2014)
5. E.W. Kamen and B.S. Heck Fundamentals of Signals and Systems Using the Web and MATLAB (3rd Edition) by (2006).

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK3)	1 (WK5)		1 (WK6)						1 (WK8)		2	1
CO2	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK3) (WK4)	1 (WK5)		1 (WK6)						1 (WK8)		2	1
CO3	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK3)	1 (WK5)		1 (WK6)						1 (WK8)		2	1
CO4	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK3) (WK4)	1 (WK5)	1 (WK8)	1 (WK6)	1 (WK5)		1	1		1 (WK8)		2	1

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code		: BEEA406C	Logic Design	Semester	: IV
L:T:P		: 3:0:0		Course Type	: PCC
Hours/Sem	Teaching	: 42 Hrs		CIE Marks	: 50
	Learning (TW+SL)	: 42 Hrs		SEE Marks	: 50
	Exam (CIE+SEE)	: 06 Hrs		Total Marks	: 100
	Total Hrs.	: 90 Hrs		Credits	: 03

Professional Competency:

Analyze, design, and implement digital logic circuits using Boolean algebra, combinational and sequential logic principles, programmable logic devices, and hardware description language for digital system applications.

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.

Unit-1 (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-2 (11 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-3 (11 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-4 (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 Behavioural Design, Verilog Time Dimension and Test Benches.

Text 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. KandellLangholz, Digital Logic Design, Prentice Hall, 1988.

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Reference Books:

1. Rafiquzzaman & Chandra, "Modern Computer Architecture", West Pub. Comp., 1988.
2. Zvi. Kohavi, "Switching and Finite Automata Theory", Tata McGraw Hill, India, 2004.
3. C. V. S. Rao, "Switching and Logic Design", 3rd Edition, Pearson Education, India, 2009.
4. Donald D. Givone, "Digital Principles and Design", Tata McGraw Hill, India, 2002.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3)	1 WK2)			1 (WK2) (WK6)							2	1	
CO2	3 (WK2) (WK3) (WK4)	2 WK2)	2 (WK5)		2 (WK6)							3	2	
CO3	3 (WK2) (WK3) (WK4)	2 (WK2)	3 (WK5)	1 (WK8)	2 (WK6)						1 (WK8)	3	2	1
CO4	2 (WK2) WK4)	1 (WK2)	2 (WK5)	2 (WK8)	3 (WK6)						2 (WK8)	2	3	1

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA407L	PCB Design Laboratory	Semester	: IV
L:T:P	: 0:0:1		Course Type	: PCC
Hours/Sem.	Practical		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 01

Professional Competency:

Apply PCB design principles, electronic circuit simulation techniques, layout development methods, and fabrication practices to design, develop, test, and validate analog and digital electronic circuits using modern PCB design and manufacturing tools.

Course Outcomes:

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

1. Apply and analyze PCB design tools and simulation software to develop schematic diagrams, generate netlists, and perform circuit simulation for analog and digital electronic circuits.
2. Design PCB layouts for power supply and logic circuits by incorporating appropriate component selection, routing techniques, grounding practices, and Gerber file generation.
3. Fabricate, test, and evaluate PCB boards using generated Gerber files and verify circuit performance through debugging, inspection, and functional validation of implemented systems.

List of Experiments

1. Introduction to PCB Design Tools and simulation software
2. Design a simple electronic circuit (LED flasher) and generate a netlist using the PCB design tool.
3. Design and construct a regulated power supply that delivers a constant DC output voltage
4. Design an automatic light switching circuit using a LDR sensor
5. Design and simulate a simple logic circuit
6. Fabricate and test the LED circuit using gerber files
7. Fabricate and test the regulated power supply circuit using gerber files
8. Fabricate and test the automatic light switching circuit using gerber files
9. Fabricate and test the simple logic circuit using gerber files
10. Fabricate and test the clipper circuit using gerber files.

Reference Books:

1. Khandpur, R. S. Printed Circuit Boards: Design, Fabrication, Assembly and Testing. Tata McGraw-Hill, 2005.
2. Floyd, Thomas L. Electronic Devices and Circuit Theory. 11th ed., Pearson Education, 2015.
3. Rashid, Muhammad H. Introduction to PSpice Using OrCAD for Circuits and Electronics. 3rd ed., Pearson Education, 2017.
4. Coombs, Clyde F., and Happy T. Holden. Printed Circuits Handbook. 7th ed., McGraw-Hill, 2016.
5. Sharma, Monika. Basics of PCB Design and Fabrication. IK International Publishing House, 2019.
6. Williams, Timothy. EMC for Printed Circuit Boards: A Handbook of Design, Layout, and Troubleshooting. Newnes, 1996.
7. Buchanan, William D. PCB Design Using AutoCAD. Newnes, 1996.
8. Pandya, Ashish. Electronics Lab Manual Volume II. S. Chand & Company, 2020.

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	1 (WK8)	3 (WK2)							2		2
CO2	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	3 (WK5)	2 (WK8)	3 (WK2)	1 (WK5) (WK7)	1 (WK9)						3	
CO3	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	3 (WK5)	3 (WK8)	2 (WK2)	1 (WK5) (WK7)	1 (WK9)	1			2 (WK8)			3

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA408L	Logic Design Laboratory	Semester	: IV
L:T:P	: 0:0:2		Course Type	: PCC
Hours/Sem	Practical		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 01

Professional Competency:

Apply principles of digital logic to design, implement, and experimentally validate combinational and sequential circuits using standard digital ICs.

Course Outcomes:

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

1. Simplify Boolean expressions and implement combinational logic circuits using basic gates.
2. Design and implement combinational and sequential circuits using standard ICs such as adders, subtractors, comparators, multiplexers and flip-flops.
3. Construct and test digital systems such as shift registers, counters and display circuits to verify their operation.

List of Experiments

1. Simplify the given expression and to realize it using Basic gates.
2. Realization of : (i) Half Adder and Full Adder (ii) Half Subtractor and Full Subtractor by using Basic gates.
3. Realization of Binary to Gray code converter and vice versa
4. Design and implementation of: (i) Full Adder and Full Subtractor using IC 74153 (MUX) (ii) Full Adder and Full Subtractor Using IC 74139 (DEMUX).
5. Realization and study of comparators using IC 7485 magnitude comparator.
6. Set up and testing of a 7-Segment Static Display System.
7. Verification of truth tables of JK, T and D Flip-Flops.
8. Realization and study of SISO, SIPO, PISO and PIPO shift registers.
9. Realization and study of Ring and Johnson counters.
10. Design and Implementation of an Up/Down counter using IC 74193

Text Books:

1. Morris Mano, Charles R. Kime, "Logic and Computer Design Fundamentals", Pearson Prentice Hall, 2004.
2. Basavaraj, B., "Digital Fundamentals", Vikas Publishing House, New Delhi, 1999.

Reference Books:

1. Kandellangholz, "Digital Logic Design", Prentice Hall, 1988.
2. C. V. S. Rao, "Switching and Logic Design", Pearson Education, India, 3rd Edition, , 2009.
3. Donald D. Givone, "Digital Principles and Design", Tata McGraw Hill, India, 2002.

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2 (WK1) (WK3) (WK4)	1 (WK2)	2 (WK5)	1 (WK8)	2 (WK2) (WK6)				1			2	2	1
CO2	2 (WK1) (WK3) (WK4)	2 (WK1) (WK3) (WK4)	3 (WK5)	2 (WK8)	3 (WK2) (WK6)				2	1		3	3	1
CO3	2 (WK3) (WK4)	1 (WK2)	2 (WK5)	2 (WK8)	3 (WK2) (WK6)				2	1	1 (WK8)	3	2	1

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA409L	Electrical Machines – II Laboratory	Semester	: IV
L:T:P	: 0:0:2		Course Type	: PCC
Hours/Sem:	Practical		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.	: 30 Hrs	Credits	: 01

Professional Competency:

Demonstrate the ability to apply the principles of electrical machines to analyze, evaluate, and control the performance of DC machines and synchronous machines, including their construction, operation, characteristics, testing methods, and practical applications in power systems.

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.

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

Text Books:

1. IJ 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.

Reference Books:

1. Mulukuntla S. Sarma, "Electric Machines", Cengage, 1st Edition, 2009.
2. Theodore Wildi, "Electrical Machines, Drives and Power systems", Pearson, 6th Edition, 2014.
3. P.S. Bhimbhra, "Generalized Theory of Electrical Machines", Khanna publishers, 2014.
4. V.K Mehta, Rohit Mehta, "Principles of Electrical Machines", S Chand, 2nd Edition, 2009.

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Web Links and Video Lectures (e-Resources):

1. <https://nptel.ac.in/courses/108102146>
2. <https://nptel.ac.in/courses/108105131>
3. <https://nptel.ac.in/courses/108105155>
4. <https://nptel.ac.in/courses/10810607>

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) WK4)	2 (WK2) (WK3) WK4)	1 (WK5)		1 (WK2)							3		
CO2	3 (WK1) (WK2) WK3) (WK4)	3 (WK1) (WK2) WK3) (WK4)	1 (WK5)		1 (WK2)							3		
CO3	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) WK3) (WK4)	1 (WK5)		1 (WK2)							3		

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BHSA424C	Universal Human Values-II	Semester	: IV
L:T:P	: 1:0:0		Course Type	: HSMC
Hours/Sem:	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam		Total Marks	: 100
	Total Hrs.		Credits	: 01

Professional Competency:

After completing the course, students will be able to understand and apply value-based principles to achieve personal harmony, nurture ethical relationships, and promote sustainable and responsible living in personal, social, and professional life.

Course Outcomes:

After 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.

Unit-I (3 Hrs)

Introduction to Value Education

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations

Unit-II (4 Hrs)

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 (3 Hrs)

Harmony in the Family and Society

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to- Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

Unit-IV (4 Hrs)

Harmony in the Nature/Existence Implications of the Holistic Understanding – a Look at Professional Ethics

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical
Case Studies, Strategies for Transition towards Value-based Life and Profession.

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

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 Professional Ethics, R R Gaur, R Asthana, G
3. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
4. Human Values, A.N. Tripathi, New Age 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 J C, Economy of Permanence
10. Pandit Sunderlal, Bharat Mein Angreji Raj
11. Dharampa I, Rediscovering India
12. Gandhi Mohandas K, Hind Swaraj or Indian Home Rule.
13. Maulana Abdul Kalam Azad : India Wins Freedom -
14. Romain Rolland (English) Vivekananda
15. Romain 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. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
18. A Nagaraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
19. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
20. A N Tripathy, 2003, Human Values, New Age 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, Prentice Hall 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.

Web Links and Video Lectures:

Suggested Web Links:

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

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BHSA460M	Yoga-II	Semester	: IV
L:T:P	: 0:0:2		Course Type	: MC
Hours/Sem.	Practical		CIE Marks	: 100
	Learning (TW+SL)		SEE Marks	: 00
	Exam		Total Marks	: 100
	Total Hrs.		Credits	: 00

Professional Competency:

Yoga enables an individual to understand, perform, demonstrate, and learn Yoga effectively and safely, contributing to holistic health, mental peace, and quality of life.

Course Outcomes:

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

1. Explain the meaning, aims, and objectives of Yoga and explain its relevance in daily life.
2. Perform and Teach Surya namaskar, demonstrating its correct sequence, technique, and explaining its physical and mental benefits.
3. Identify, Demonstrate, and Teach Various Asanas by name, including their significance, correct methods of practice, and associated benefits for overall well-being
4. Instruct and Explain Kapalabhati, including its purpose, technique, precautions, and health benefits, teach different types of Pranayama, detailing their names, procedures, safety precautions, and therapeutic uses.

Unit-I (7 Hrs.)

Patanjali's Ashtanga Yoga, its need and importance, Yama : Ahimsa, Satya, Asteya, Brahm Acarya, Aparigraha, Niyama: Shoucha, Santosh, Tapa, Svaadhyaya, Eshvarapranidhan

Unit -II (7 Hrs.)

Suryanamaskar | 2 counts- 4 rounds of practice Asana, benefits, Importance of Asana, Asana its meaning by name, types, technique, precautionary measures and benefits of each asana
 Sitting : 1. Sukhasana 2. Paschimottanasana - Meaning, Importances, Rules.

Unit -III (7 Hrs.)

Asana its meaning by name, technique, precautionary measures and benefits of each asana
 Standing Asana: 1. Ardhakati Chakrasana 2. Parshva Chakrasana - meaning, Importance, Rules. Prone line: Dhanurasana- It's meaning, Importances, Rules. Supine line: 1. Halasana 2. Karna Peedasana - Meaning, Importance, Rules.

Unit -IV (7 Hrs.)

Meaning, importance and benefits of Kapala Bhati, 40 strokes/min 3 rounds, Pranayama
 Meaning, Need, importance of Pranayama, different types, technique, precautionary measures and benefits of each pranayama Types of Pranayama: 1. Suryanuloma-Viloma 2. Chandranuloma-Viloma 3. Suryabhedana 4. Chandra Bhedana 5. Nadishodhana

Reference Books:

1. S. K. Kuppasta, "Samagra yoga darshaini Publication", Vivekananda Yoga Vignana Kendra, Bagalkot, 2021.
2. Ajitkumar, A., "Yogapravesha in Kannada", Karnataka Yoga Publications, 1st Edition, 2012.
3. Iyengar, B. K. S., "Light on Yoga", George Allen & Unwin Ltd., Revised Edition, 1966.
4. Gharote, M. L. and Ganguly, S. K., "Teaching Methods for Yogic Practices", Kaivalyadhama M.Y.M. Samiti, 1st Edition, 1980.
5. SVYASA University, "Yoga Instructor Course Handbook", SVYASA University, 2nd Edition, 2018.
6. Muthanna, Y., "Yoga for Children – Step by Step", Prasaranga Publications, 1st Ed, 2015.

Web Links and Video Lectures:

<https://youtu.be/KB-TYIgdIwE>
<https://youtu.be/aa-TG0WgILs>

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BHSB460M	National Service Scheme - II	Semester	: IV
L:T:P	: 0:0:2		Course Type	: MC
Hours/Sem.	Practical		CIE Marks	: 100
	Learning (TW+SL)		SEE Marks	: 00
	Exam (CIE)		Total Marks	: 100
	Total Hrs.		Credits	: 00

Professional Competency:

After completing the course, students will be able to responsibly analyse societal and environmental challenges, design and implement sustainable and innovative solutions, contribute to community welfare, respond effectively to emergencies, and promote national integration and social harmony.

Course Outcomes:

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

1. Recognize and understand their roles and responsibilities towards society for its betterment.
2. Analyze environmental and societal issues and design effective and sustainable solutions.
3. Assess existing systems critically and propose practical, innovative solutions to promote sustainable development.
4. Plan and implement government-led or self-initiated projects efficiently for community and societal welfare.
5. Develop the ability to respond to emergencies and natural disasters, while fostering national integration, social harmony, and unity.

Topics/Activities to be Covered

1. Water conservation techniques – Role of different stakeholders – Implementation.
2. Preparing an actionable business proposal for enhancing village income and its approach for implementation.
3. Helping local schools to achieve good results and enhance their enrolment in higher, technical, and vocational education.

Pedagogy–Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl.	Topic	Group size	Location	Activity execution	Reporting	Evaluation of the Topic
1.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/City Areas/ Grama Panchayat /Public Associations/ Govt. Offices/ Campus etc.	Group selection/proper consultation/Continuous monitoring/Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2.	Preparing an actionable	May be individual	Villages/City Areas/Grama	Group selection/proper	Report should	Evaluation as per

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

	business proposal for enhancing the village income and approach for implementation.	ual or team	panchayat/public associations/Govt. offices/campus etc.....	consultation/Continuous monitoring/Information board	be submitted by individual to the concerned evaluation authority	the rubrics of scheme and syllabus by NSS officer
3.	Helping local schools to achieve good results and enhance their enrolment in Higher/technical/vocational education.	May be individual or team	Local government/private/ aided schools/Government Schemes officers etc.....	School selection/proper consultation/Continuous monitoring/Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

Plan of Action Execution of Activities For Each Semester

1. Practice Session Description
2. Lecture session by NSS Officer
3. Students Presentation on Topics
4. Presentation – Selection of topic: PHASE-I
5. Commencement of activity and its progress: PHASE- 2
6. Execution of Activity
7. Execution of Activity
8. Execution of Activity
9. Execution of Activity
10. Case study based Assessment, Individual performance
11. Sector wise study and its consolidation
12. Video based seminar for 10minutes by each student At the end of semester with Report.
 - In every semester from 3rd semester to 6th semester, each student should carry out activities according to the scheme and syllabus.
 - At the end of every semester, student performance has to be evaluated by the NSS coordinator for the assigned activity progress and its completion.
 - Finally, in the 6th semester, a consolidated report of all activities from 3rd to 6th semester, compiled as per the instructions.

Reference Books:

1. NSS Cell, VTU Belagavi. (n.d.). NSS course manual (Edition unknown). Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS Cell. (n.d.). Activity reports and manual, Government of Karnataka.
3. Government of India, NSS Cell. (n.d.). Activity reports and manual, Government of India.

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	:	BHSC460M		Semester	:	IV
L:T:P	:	0:0:2		Course Type	:	MC
Hours/Sem.	Practical	:	28 Hrs	CIE Marks	:	100
	Learning (TW+SL)	:	00 Hrs	SEE Marks	:	00
	Exam	:	02 Hrs	Total Marks	:	100
	Total Hrs.	:	30 Hrs	Credits	:	00

Physical Education-II

Professional Competency:

After completing the course, students will be able to demonstrate physical fitness and sporting proficiency by correcting postural deformities, managing stress, performing aerobic exercises, and applying proper skills and techniques in games and athletic events while participating confidently in competitive sports.

Course Outcomes:

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

1. Understand the ethics and moral values in sports and athletics.
2. Perform in the selected sports or athletics of student's choice.
3. Understand the roles and responsibilities of organisation and administration of sports and games.

Unit-I (7 Hrs.)

Ethics in Sports, Moral Values in Sports and Games.

Unit-II (7 Hrs.)

Volley ball–Attack, Block, Service, Upper Hand Pass and Lower hand Pass.

Unit-III (7 Hrs.)

Athletics (Track Events) –Any event as per availability of Ground.

Unit-IV (7 Hrs.)

Role of Organisation and administration

Reference Books:

1. Bandopadhyay, K. (n.d.), Sarir Siksha Parichay, Classic Publishers.
2. Dharma, P. N. (n.d.), Fundamentals of Track and Field, Khel Sahitya Kendra.
3. Dubey, H. C. (n.d.), Basketball, Discovery Publishing House.
4. Jain, N. (n.d.), Play and Learn Basketball, Khel Sahitya Kendra.
5. Jain, R. (n.d.), Play and Learn Cricket, Khel Sahitya Kendra.
6. Kus, S. (n.d.), Coaching Volleyball Successfully, Human Kinetics.
7. Petipus, et al, (n.d.), Athlete's Guide to Career Planning, Human Kinetics.
8. Saha, A. K. (n.d.), Sarir Siksher Ritiniti, Rana Publishing House.
9. Thani, V. (n.d.), Coaching Cricket, Khel Sahitya Kendra.

Scheme and Assessment for the course

Sl.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes–2,each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
Total		100

Syllabus for B.E. (E&EE) IV - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BHSD460M	Music - II	Semester	: IV
L:T:P	: 0:0:2		Course Type	: MC
Hours/Sem.	Practical		CIE Marks	: 100
	Learning (TW+SL)		SEE Marks	: 0
	Exam		Total Marks	: 100
	Total Hrs.		Credits	: 00

Professional Competency:

Demonstrate competency in understanding, analysing, and interpreting Carnatic music compositions, notation systems, and the contributions of eminent composers to appreciate and apply the fundamentals of Carnatic music.

Course Outcomes:

1. Explain the characteristics and structural features of major Carnatic music compositions such as Geethe, Jathi, Swara, Swarajathi, Varna, Krithi, and Thillana.
2. Interpret and apply the Carnatic music notation system for reading and understanding musical compositions.
3. Differentiate among various forms of Carnatic compositions based on their musical structure, purpose, and performance practice.
4. Describe the life, contributions, and musical legacy of Purandara Dasa, Tyagaraja, and Mysore Vasudev Acharya.

Content (28 Hrs.)

Compositions: Introduction to the types of composition in Carnatic Music - Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, Notation System.

Composers: Biography and contributions of Purandaradasa, Thyagaraja, Mysore Vasudevacharya.

Textbooks

1. Vidushi Vasantha Madhavi, "Theory of Music", Prism Publication, 2007.
2. T Sachidevi and T Sharadha (Thirumalai Sisters), Karnataka Sangeetha Dharpana- Vol. I (English), Shreenivaas Prakaashana, 2018.

Reference Books:

1. Lakshminarayana Subramaniam, Viji Subramaniam, "Classical Music of India: A Practical Guide", Tranqueber 2018.
2. R. Rangaramanuja Ayyangar, "History of South Indian (Carnatic) Music", Vipanci Charitable Trust; Third edition, 2019.
3. Ethel Rosenthal, "The Story of Indian Music and Its Instruments: A Study of the Present and a Record of the Past", Pilgrims Publishing, 2007.
4. Carnatic Music, "National Institute of Open Schooling", 17 EC Proceedings dated 17.07.2024.

Syllabus for B.E. V - Semester

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

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA501C	Power System – II	Semester	: V
L:T:P	: 3:0:0		Course Type	: PCC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Demonstrate the ability to apply the principles of power system analysis, fault analysis, symmetrical components, and power system stability to model, analyze, and evaluate the performance of electrical power systems under normal and abnormal operating conditions.

Course Outcomes:

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

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

Unit-1 (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. Numerical.

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. Numerical.

Unit-2 (11 Hours)

Symmetrical Components: Definition of sequence components for 3-Phase unbalanced power systems, Operator “a” and its properties, Expressions for sequence components, Star and delta connected networks. Numerical.

Sequence Networks: 3- Phase 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. Numerical.

Unit-3 (11 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. Numerical.

Unsymmetrical Faults on Power Systems: L-G, L-L, L-L-G faults on unloaded power systems, Open Conductor faults in power system. Numerical.

Unit-4 (10 Hours)

Transient Stability Analysis: Classification of Power System Stability, Steady Rotor dynamics, Swing equation, Solution of swing equation by numerical techniques, Power angle equation for salient and non-salient pole synchronous machines. Numerical.

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

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Text Books:

1. V Neelakantan, "Power System Analysis & Stability", Shiva Publishers, 2017.
2. K. Uma Rao, "Computer Techniques and Models in Power Systems", 1st Edition, I. K. International publishing house, 2014.

Reference Books:

1. Nagarath and Kothari, "Modern Power System Analysis", 3rd Edition, TMH, 2009.
2. W.D. Stevenson, "Elements of Power Systems Analysis", 4th Edition, Mc.Graw Hill Publishers, 2013.
3. Hadi Saadat, "Power System Analysis", TMH, Publishers, 4th Edition 2015.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	I (WK3)	2 (WK2) (WK3) (WK4)									I (WK8)	3		I
CO2	I (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)		I (WK8)							I (WK8)	3		I
CO3	I (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)		I (WK8)		I (WK7)					I (WK8)	3		I
CO4	I (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)		I (WK8)		I (WK7)					I (WK8)	3		I

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA502C	Power Electronics	Semester	: V
L:T:P	: 3:0:0		Course Type	: PCC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Ability to develop the competence of selecting appropriate power switches for industrial converter designs and evaluate their performance by analysing power losses and power quality indices

Course Outcomes:

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

1. Analyse the static and switching characteristics of power transistors such as Power BJT and MOSFET, including switching limits, protection circuits, and thermal management techniques.
2. Compute average output voltage, current, power factor, ripple content, and performance parameters of controlled rectifier circuits
3. Analyse and apply thyristor commutation techniques, DC–DC converters, chopper circuits, and fly-back converters with appropriate control strategies for efficient power conversion and industrial applications.
4. Apply the operating principles, control techniques, performance characteristics, and design aspects of single-phase and three-phase inverters and AC voltage controllers with resistive and inductive loads for power electronic applications.

Unit-1 (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-2 (11 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-3 (11 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-4 (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°- and 180°-degree modes. Voltage control of single-phase inverters – single pulse width modulation, multiple pulse width modulation and sinusoidal pulse width modulation.

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

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.

Text Books:

1. M.H. Rashid, "Power Electronics", 3rd-Edition, P.H.I./Pearson, New Delhi, 2002.
2. M. D. Singh and Khanchandani K. B., "Power Electronics", 2nd Edition, Khanna Publisher, 2007.

Reference Books:

1. Mohan, Undeland, Robbins, "Power Electronics" Wiley Edition 2003
2. P.S. Bimbra, "Power Electronics", 4th edition Khanna Publishers, 2009.
3. G. K. Dubey, S. R. Dorodla, A. Joshi and R. M. K. Sinha, "Thyristorised Power Controllers", New Age International Publishers, 2005.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK4)	3 (WK1) (WK2) (WK3)	2 (WK5)	2 (WK8)	2 (WK6)	1 (WK5)	1 (WK9)		1	-	2 (WK8)	2	1	2
CO2	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	2 (WK8)	2 (WK6)	1 (WK5)			1		2 (WK8)		2	
CO3	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	3 (WK5)	2 (WK8)	2 (WK6)	2 (WK5)	1 (WK9)	1	1	1	2 (WK8)		3	
CO4	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	3 (WK5)	2 (WK8)	2 (WK6)	2 (WK5)	1 (WK9)	1	1	1	2 (WK8)	2	2	2

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA504L	Power Electronics Laboratory	Semester	: V
L:T:P	: 0:0:2		Course Type	: PCC
Hours/Sem.	Practical		CIE Marks	: 50
	Learning(TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 01

Professional Competency:

Ability to analyze, interpret, and validate experimental results to assess the performance characteristics of switching devices and power electronic converter circuits for engineering applications.

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.

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.

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3)	1 (WK5)	1 (WK8)	1 (WK2)	1 (WK5) (WK7)	1 (WK9)	1	1	1	1 (WK8)	3	2	1
CO2	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3)	1 (WK5)	1 (WK8)	1 (WK6)	1 (WK5) (WK7)	1 (WK9)	2	2	1	1 (WK8)	2	2	2
CO3	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3)	1 (WK5)	1 (WK8)	1 (WK6)	1 (WK5) (WK7)	1 (WK9)	1	1	2	1 (WK8)	2	2	1

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA505L	Power System – I Laboratory	Semester	: V
L:T:P	: 0:0:2		Course Type	: PCC
Hours/Sem	Practical		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 01

Professional Competency:

Operate, test, and analyze protective relays and high-voltage measurement systems to evaluate protection characteristics, insulation strength, and electric field behavior in power system applications.

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

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)

Text 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. Badri Ram, D N Vishwakarma, "Power System Protection and Switchgear", 2nd Edition, Tata McGraw Hill, New Delhi, 2019.

Reference Books:

1. Sunil Rao, "Switchgear and Protection and Power Systems", 13th Edition, Khanna Publishers, 2008.
2. J.B.Gupta, "Switchgear and Protection", (2nd Edition), Katson Publisher, 2013.
3. Ravindarnath B, "Power System Protection and Switchgear", 2nd Edition, New age International, 2008.

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2 (WK3) (WK4)	2 (WK2)		2 (WK8)			1 (WK7)		1			3	2	
CO2	2 (WK1) (WK4)	2 (WK2)	1 (WK5)	2 (WK8)		1 (WK7)				1	1 (WK8)	3	3	1
CO3	2 (WK2) (WK4)	2 (WK2)		2 (WK8)					1	1	1 (WK8)	3	2	

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA506L	Control System Laboratory	Semester	: V
L:T:P	: 0:0:2		Course Type	: PCC
Hours/Sem:	Practical		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 01

Professional Competency:

This laboratory course enables students to practically analyze lead and lag compensator networks and evaluate the performance characteristics of control system components like AC servomotors and synchros. Furthermore, it equips learners with professional proficiency in assessing system stability through Root Locus, Bode, and Nyquist plots using MATLAB.

Course Outcomes:

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

1. To realize and analyze frequency, time response of 2nd order system with lead and lag compensator networks.
2. To examine characteristics of control system components such as AC servomotor and synchro-phasors.
3. To analyze stability of the system through Root Locus, Bode plot and Nyquist plot using MATLAB.

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.

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Matrix to describe the mapping of COs with POs (considering Wks) and PSOs

Course Outcomes COs	Program Outcomes and Wks											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	1 (WK2) (WK3)	2 (WK2) (WK3) (WK4)	1 (WK5)				1 (WK9)					1	1	2
CO2	2 (WK2) (WK3) (WK4)	1 (WK3) (WK4)		1 (WK8)	3 (WK6)						1 (WK8)	1	1	3
CO3	2 (WK2) (WK3) (WK4)	2 (WK2) (WK3) (WK4)	1 (WK5)	1 (WK8)	3 (WK2) (WK6)						1 (WK8)	1	1	2

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code		: BEEA507P	Mini Project	Semester	: V
L:T:P		: 2:0:0		Course Type	: PROJ
Hours/Sem.	Teaching	: 26 Hrs		CIE Marks	: 50
	Learning (TW+SL)	: 28 Hrs		SEE Marks	: 50
	Exam (CIE+SEE)	: 06 Hrs		Total Marks	: 100
	Total Hrs.	: 60 Hrs		Credits	: 02

Professional Competency

Develop the ability to identify and analyze engineering problems in electrical and electronics engineering and interdisciplinary domains, apply appropriate contemporary tools and techniques to validate engineering solutions, communicate technical concepts effectively to diverse audiences, and prepare comprehensive technical reports with systematic analysis and professional documentation.

Course Outcomes:

At the end of this course, 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.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 WK1 WK2 WK3 WK4	3 WK1 WK2 WK3 WK4	2 WK5	2 WK8	2 WK2 WK6	1 WK1 WK5 WK7	1 WK9		2	2	1 WK8	3	2	1
CO2	3 WK WK WK WK	3 WK1 WK2 WK3 WK4	2 WK5	2 WK8	2 WK2 WK6			2	2	2	1 WK8	3	3	1
CO3	3 WK1 WK2 WK3 WK4	3 WK1 WK2 WK3 WK4	2 WK5	2 WK8	2 WK2 WK6	2 WK1 WK5 WK7	2 WK9	2	2	2	1 WK8	2	3	1
CO4						1 (WK1) (WK5) (WK7)	1 (WK9)	1	1	2	1 (WK8)	2	2	1

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	:	BBTA523C	Environmental Studies	Semester	:	V
L:T:P	:	1:0:0		Course Type	:	HSMC
Hours/Sem	Teaching	:		CIE Marks	:	50
	Learning (TW+SL)	:		SEE Marks	:	50
	Exam	:		Total Marks	:	100
	Total Hrs.	:		Credits	:	01

Professional Competency:

Develop the ability to analyze environmental issues and implement sustainable solutions by applying environmental science principles, pollution control measures, and environmental legislation.

Course Outcomes:

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

CO1: Identify natural resources and its uses.

CO2: Understand pollution and its effects on environment and to implement sustainable future in the work place.

CO3: Analyze current environmental issues.

CO4: Apply the waste management techniques in various fields.

UNIT – 1 (03 Hrs.)

Natural Resources: Human activities and their impacts. Environmental Impact Assessment, Renewable Energy: Solar, Wind, Hydropower, Tidal, Ocean thermal, Geo thermal, Biomass energy, Biogas, Biodiesel, Bioethanol, Hydrogen as fuel.

Non-renewable Energy: Coal, Petroleum, Natural gas, Nuclear energy.

UNIT – 2 (04 Hrs.)

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, Sustainable development goals (SDGs). Environment economics – concept of green building, Circular Economy.

UNIT – 3 (03 Hrs.)

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 – 4 (04 Hrs.)

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).

Text books

1. Benny Joseph, Environmental Studies, 3rd Edition, McGraw Hill Education (India) Pvt. Ltd., 2017.
2. Manjunath, D. L., Environmental Studies, 1st Edition, Pearson Education, New Delhi, 2007.
3. Anubha Kaushik and C. P. Kaushik, Perspectives in Environmental Studies, 8th Edition, New Age International (P) Ltd., New Delhi, 2025.
4. P. Meenakshi, Elements of Environmental Science and Engineering, 2nd Edition, PHI Learning Pvt. Ltd., New Delhi, 2012.

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Matrix to describe the mapping of COs with POs (considering Wks) and PSOs

Course Outcomes - COs	Program Outcomes and Wks											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2 (WK1 WK2 WK3 WK4)		2 (WK5)			3 (WK1 WK5 WK7)					3 (WK8)	3		3
CO2	2 (WK1 WK2 WK3 WK4)		2 (WK5)			3 (WK1 WK5 WK7)					3 (WK8)	3		3
CO3	2 (WK1 WK2 WK3 WK4)		2 (WK5)			3 (WK1 WK5 WK7)					3 (WK8)	3		3
CO4	2 (WK1 WK2 WK3 WK4)		2 (WK5)			3 (WK1 WK5 WK7)					3 (WK8)	3		3

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	:		Quantitative Aptitude and Professional Skills	Semester	:	V
L:T:P	:	2:0:0		Course Type	:	AEC
Hours/Sem.	Teaching	: 28 Hrs		CIE Marks	:	50
	Learning (TW+SL)	: 28 Hrs		SEE Marks	:	50
	Exam (CIE+SEE)	: 04 Hrs		Total Marks	:	100
	Total Hrs.	: 60 Hrs		Credits	:	02

Professional Competency:

Demonstrate competency in enhancing vocabulary, improving verbal ability, analysing problems systematically and solving quantitative problems using appropriate language and numerical techniques.

Course Outcomes:

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

1. Enhance vocabulary and apply techniques to further improve word usage and language proficiency.
2. Apply techniques to improve verbal ability in communication and comprehension tasks.
3. Analyze problems step-by-step and develop appropriate methods for solving them effectively.
4. Solve quantitative problems by applying appropriate concepts and techniques to improve numerical ability.

Unit-I (7 Hrs.)

Vocabulary Development: Vocabulary Building Techniques, Root Words, Antonyms & Synonyms, Sentence Completion, Error Detection & Correction, Reading Comprehension.

Unit-II (7 Hrs.)

Numbers, Proportion & Finance: Number System, Factors & Multiples, the God of Math – Linear Equations, Ratio-Proportion-Variation, Percentages, Profit & Loss, Interest, Averages & Allegations.

Unit-III (7 Hrs.)

Time & Probability: Time & Work, Time Speed, & Distance, Permutations & Combinations, Probability.

Unit-IV (7 Hrs.)

Verbal, Analytical and Visual Reasoning: Human Relations, Direction Tests, Coding Decoding, Clocks and Calendars, Visual Reasoning, Analytical Puzzles, Mathematical, Arrangement & Classification Puzzles.

Reference Books:

1. R. S. Aggarwal, "A Modern Approach to Verbal and Non-Verbal Reasoning", Sultan Chand and Sons, New Delhi, 2018.
2. R. S. Aggarwal, "Quantitative Aptitude", Sultan Chand and Sons, New Delhi, 2018
3. Chopra, "Verbal and Non-Verbal Reasoning", MacMillan India.
4. MTyra, "Magical Book on Quicker Maths", BSC Publications, 2018.
5. George J Summers, "The Great Book of Puzzles & Teasers", Jaico Publishing House, 1989.
6. Shakuntala Devi, "Puzzles to Puzzle You", Orient Paper Backs, New Delhi, 1976.
7. R. S. Aggarwal, "A Modern Approach to Logical Reasoning", Sultan Chand and Sons, New Delhi, 2018.

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1		3 (WK1) (WK2) (WK3) (WK4)								2				
CO2		3 (WK1) (WK2) (WK3) (WK4)						2	2	2				
CO3			3 (WK2)		2									
CO4			3 (WK2)		2									

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BHSA560M	Yoga – III	Semester	: V
L:T:P	: 0:0:2		Course Type	: MC
Hours/Sem.	Practical		CIE Marks	: 100
	Learning (TW+SL)		SEE Marks	: 00
	Exam (CIE)		Total Marks	: 100
	Total Hrs.		Credits	: 00

Professional Competency:

Demonstrate proficiency in practicing and teaching Yoga techniques, including Surya namaskar, Asanas, Kapalabhati and Pranayama, to promote physical, mental and holistic well-being.

Course Outcomes:

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

1. Understand the meaning, aims, objectives, and importance of Yoga and explain its relevance in daily life.
2. Perform and Teach Surya namaskar, demonstrating the correct sequence, technique, and explaining its physical and mental benefits.
3. Identify, Demonstrate and Teach Various Asanas, including their significance, correct methods of practice, precautions and benefits for overall well-being.
4. Demonstrate and Teach Kapala Bhati and Different Types of Pranayama, explaining their purpose, techniques, safety precautions, therapeutic uses, and health benefits.

Unit-I (7 Hrs.)

Patanjali's Ashtanga Yoga, its need and importance, types of Ashtanga Yoga Asana, Pranayama, Pratyahara, Asana its meaning by name, technique, precautionary measures and benefits of each asana.

Unit -II (7 Hrs.)

Sitting Asanas : Ardha Ushtrasana, Vakrasana, Yogamudra in Padmasana
 Standing Asanas: UrdhvaHastothanasana, Hastapadasa, ParivrittaTrikonasana, Utkatasana

Unit -III (7 Hrs.)

Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana/ Rajakapotasana - Its meaning and Importance, rules.
 Supine line: Sarvangasana, Chakraasan, Navasana/Noukasana, Pavanamuktasana - It's meaning and importance, rules.

Unit -IV (7 Hrs.)

Kapalabati Revisi on of practice 60 strokes/min 3 rounds, Meaning by name, technique, precautionary measures and benefits of each Pranayama – Ujjayi, Sheetal, Sheektari

Reference Books:

1. Ajitkumar, Yogapravesha (in Kannada), 2017.
2. Iyengar, B. K. S, Light on Yoga, London: Unwin Paperbacks. (1966).
3. Gharote, M. L., & Ganguly, S. K., Teaching methods for yogic practices, Lonavla: Kaivalyadhama S.M.Y.M. Samiti. (1988).
4. SVYASA University, Yoga Instructor Course handbook, Bengaluru: Swami Vivekananda Yoga Anusandhana Samsthana. 2018
5. Muthanna. Y., Yoga for children: Step by step, Mumbai: Vakils, Feffer and Simons Ltd. (2012).

Web Links and Video Lectures:

<https://youtu.be/KB-TYlgdIwE>
<https://youtu.be/aa-TG0WgILs>

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BHSB560M	National Service Scheme – III	Semester	: V
L:T:P	: 0:0:2		Course Type	: MC
Hours/Sem:	Practical		CIE Marks	: 100
	Learning (TW+SL)		SEE Marks	: 00
	Exam (CIE)		Total Marks	: 100
	Total Hrs.		Credits	: 00

Professional Competency:

Demonstrate social responsibility, environmental awareness, leadership, and problem-solving skills to contribute effectively to sustainable community development and societal well-being.

Course Outcomes:

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

1. Recognize and understand individual roles and responsibilities towards society and contribute positively to its welfare and development.
2. Analyze environmental and societal issues and design practical, innovative, and sustainable solutions for community development.
3. Critically assess existing systems and effectively plan and implement government-led or self-initiated projects for social and sustainable development.
4. Develop the ability to respond to emergencies and natural disasters while fostering national integration, social harmony, unity, and community resilience.

Topics/Activities to be Covered

1. Developing sustainable water management systems for rural areas and approaches for effective implementation.
2. Contributing to national-level initiatives of the Government of India (e.g., Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharat, Make in India, MUDRA Scheme, Skill Development Programs, etc.).
3. Spreading public awareness under rural outreach programs (minimum of 5 programs).
4. Social connect and responsibilities.

Pedagogy–Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Plan of Action Execution of Activities for Each Semester

1. Practice Session Description
2. Lecture session by NSS Officer
3. Students Presentation on Topics
4. Presentation – Selection of topic: PHASE-I
5. Commencement of activity and its progress: PHASE- 2
6. Execution of Activity
7. Execution of Activity
8. Execution of Activity
9. Execution of Activity
10. Case study based Assessment, Individual performance
11. Sector wise study and its consolidation
12. Video based seminar for 10minutes by each student At the end of semester with Report.
 - In every semester from 3rd semester to 6th semester, each student should carry out activities according to the scheme and syllabus.
 - At the end of every semester, student performance has to be evaluated by the NSS coordinator for the assigned activity progress and its completion.
 - Finally, in the 6th semester, a consolidated report of all activities from 3rd to 6th semester, compiled as per the instructions.

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Reference Books:

1. NSS Cell, VTU Belagavi. (n.d.). NSS course manual (Edition unknown). Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS Cell. (n.d.). Activity reports and manual, Government of Karnataka.
3. Government of India, NSS Cell. (n.d.). Activity reports and manual, Government of India.

Sl.	Topic	Group size	Location	Activity execution	Reporting	Evaluation of the Topic
1.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/City Areas/Grama panchayat/public associations/Government offices/campus etc	Site selection/proper consultation/Continuous monitoring/Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
2.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atma nirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	May be individual or team	Villages/City Areas/Grama panchayat/public associations/Government offices/campus etc	Group selection/proper consultation/Continuous monitoring /Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
3.	Spreading public awareness under rural outreach programs. (minimum 5 programs)/ Social connect and responsibilities.	May be individual or team	Villages/City Areas/Grama panchayat/public associations/Government offices/campus etc	Group selection/proper consultation/Continuous monitoring /Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BHSC560M	Physical Education-III	Semester	: V
L:T:P	: 0:0:2		Course Type	: MC
Hours/Sem.	Practical		CIE Marks	: 100
	Learning (TW+SL)		SEE Marks	: 0
	Exam (CIE)		Total Marks	: 100
	Total Hrs.		Credits	: 00

Professional Competency:

Demonstrate competence in physical education, health, fitness, sports, and athletic activities to promote holistic development and achieve excellence in competitive and professional sports.

Course Outcomes:

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

1. Understand the fundamental concepts and skills of Physical Education, Health, Food, Nutrition and general fitness
2. Familiarization of health-related Exercises, Sports for overall growth and development
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional/state / national / international levels.

Unit-I (7 Hrs.)

Fitness, Food and Nutrition.

Unit-II (7 Hrs.)

Agility–Shuttle Run, Flexibility–Sit and Reach, Cardiovascular Endurance–Harvard step Test

Unit-III (7 Hrs.)

Badminton (Fore hand low/high service, back hand service, smash, drop) and Basketball (Dribbling, passing, shooting etc.)

Unit -IV (7 Hrs.)

Athletics (Field events–Throws)

Reference Books:

1. Bandopadhyay, K. (n.d.), Sarir Siksha Parichay, Classic Publishers.
2. Dharma, P. N. (n.d.), Fundamentals of Track and Field, Khel Sahitya Kendra.
3. Dubey, H. C. (n.d.), Basketball, Discovery Publishing House.
4. Jain, N. (n.d.), Play and Learn Basketball, Khel Sahitya Kendra.
5. Jain, R. (n.d.), Play and Learn Cricket, Khel Sahitya Kendra.
6. Kus, S. (n.d.), Coaching Volleyball Successfully, Human Kinetics.
7. Petipus, et al, (n.d.), Athlete's Guide to Career Planning, Human Kinetics.
8. Saha, A. K. (n.d.), Sarir Siksher Ritiniti, Rana Publishing House.
9. Thani, V. (n.d.), Coaching Cricket, Khel Sahitya Kendra.

Scheme and Assessment for the course

Sl.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes–2,each of 15marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
Total		100

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BHSD560M	Music - III	Semester	: V
L:T:P	: 0:0:2		Course Type	: MC
Hours/Sem.	Practical		CIE Marks	: 100
	Learning (TW+SL)		SEE Marks	: 0
	Exam (CIE)		Total Marks	: 100
	Total Hrs.		Credits	: 00

Professional Competency:

Demonstrate competency in classifying, analysing, and understanding the construction, functioning, and acoustic properties of Indian musical instruments across string, wind, percussion, and idiophone categories.

Course Outcomes:

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

1. Classify Indian musical instruments into string, wind, percussion, and idiophone (Ghana Vaadya) categories based on their sound production methods.
2. Explain the basic construction and working principles of different types of musical instruments used in Indian music.
3. Identify and differentiate the structural and functional features of string, wind, percussion, and idiophone instruments through examples.
4. Demonstrate an understanding of the acoustic and musical properties of various instrument families and their role in performance practice.

Content (28 Hrs.)

Music Instruments: Classification and construction of string instruments, wind instruments, percussion instruments, Idiophones (Ghana Vaadya), Examples of each class of Instruments

Textbooks

1. Vidushi Vasantha Madhavi, "Theory of Music", Prism Publication, 2007.
2. T Sachidevi and T Sharadha (Thirumalai Sisters), Karnataka Sangeetha Dharpana- Vol. I (English), Shreenivaas Prakaashana, 2018.

Reference Books:

1. Lakshminarayana Subramaniam, Viji Subramaniam, "Classical Music of India: A Practical Guide", Tranqueber 2018.
2. R. Rangaramanuja Ayyangar, "History of South Indian (Carnatic) Music", Vipanci Charitable Trust; Third edition, 2019.
3. Ethel Rosenthal, "The Story of Indian Music and Its Instruments: A Study of the Present and Record of the Past", Pilgrims Publishing, 2007.
4. Carnatic Music, "National Institute of Open Schooling", 17 EC Proceedings dated 17.07.2024.

Syllabus for B.E. (E&EE) V - Semester
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Professional Elective Course – I

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA503E	Electrical Machine Design	Semester	: V
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

This course develops professional competency in the design and analysis of electrical machines by applying electrical, magnetic, thermal, and mechanical design principles. Students gain the ability to design DC machines, transformers, induction motors, and synchronous machines by estimating machine dimensions, winding details, slot configurations, and performance parameters. The course also enables learners to select suitable materials, insulation systems, and cooling methods for efficient machine operation. Further, students develop analytical and practical engineering skills required for industrial applications in electrical machine design, manufacturing, testing, and maintenance.

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.

Unit-1 (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-2 (11 Hours)

Design of Transformers (Single phase and three phase): Output equation for single phase and three phase transformer, choice of specific loadings, expression for 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-3 (11 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-4 (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.

Textbooks

1. A.K. Sawhney, A Course in Electrical Machine Design, Dhanpat Rai & Co. (P) Limited (2017), ISBN-10: 8177001019, ISBN-13: 978-8177001013.
2. V.N. Mittle, Arvind Mittal, Design of Electrical Machines, Standard Publishers

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(For Students Admitted to I Year in AY 2024-25)

Distributors (2009), ISBN-10: 8180141268, ISBN-13: 978-8180141263.
3. V. Rajini, V.S. Nagarajan, Electrical Machine Design, Pearson Education (2018), ISBN-10: 9332585571, ISBN-13: 978-9332585577.
Reference Books:
1. K.G. Upadhyay, Design of Electrical Machines, New Age International Publishers (2010), ISBN-10: 8122422829, ISBN-13: 978-8122422825.
2. M.G. Say, Electrical Machine Design, CBS Publishers & Distributors (Latest Edition).
3. A.E. Fitzgerald, Charles Kingsley Jr., Stephen D. Umans, Electric Machinery, McGraw-Hill Education, 7th Edition (2013), ISBN-10: 0073380466, ISBN-13: 978-0073380469.
4. P.C. Sen, Principles of Electric Machines and Power Electronics, John Wiley & Sons, 3rd Edition (2013), ISBN-10: 1118074817, ISBN-13: 978-1118074817.
5. A. Shanmugasundaram, G. Gangadharan, R. Palani, <i>Electrical Machine Design Data Book</i> , New Age International Publishers, 2nd Edition (2015), ISBN-10: 8122437680, ISBN-13: 978-8122437683.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes – PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)	1 (WK5)									3	2	1
CO2	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	2 (WK8)								2	3	2
CO3	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)	2 (WK5)									2	3	3
CO4	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	2 (WK8)								3	3	3

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEB503E	Electrical Engineering Materials	Semester	: V
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem:	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Develop the ability to select, analyze, evaluate, and apply electrical, electronic, dielectric, conducting, insulating, and magnetic materials based on their physical, electrical, thermal, and magnetic properties for reliable, efficient, and sustainable electrical engineering applications and devices.

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.

Unit-1 (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-2 (11 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-3 (11 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-4 (10 Hours)

Magnetic Materials: Origin of permanent magnetic dipole, Magnetic terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

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.

Text 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.

Reference Books:

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

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3)										3		
CO2	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3)	1 (WK5)									3		
CO3	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3)	2 (WK5)									3		
CO4	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3)	2 (WK5)									3		

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEC503E	Testing and Commissioning of Electrical Equipment's	Semester	: V
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE + SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Develop the capability to safely install, commission, test, and evaluate electrical equipment and systems—including transformers, synchronous machines, induction motors, and underground cables—by applying relevant standards, tools, and engineering practices. The learner will be able to analyze performance, diagnose faults, and ensure reliable operation under normal and abnormal conditions while adhering to safety regulations and industry codes.

Course Outcomes:

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

1. Apply appropriate electrical tools, safety practices, and Indian Electricity Rules to install, test, and evaluate transformer systems, including performing standard commissioning tests and assessing their performance under normal and abnormal operating conditions.
2. Apply BIS-standard specifications to install, test, a synchronous machine by performing commissioning, performance, and factory tests, and their operational characteristics under various loading and fault conditions.
3. Demonstrate the ability to install, align, commission, and critically evaluate induction motors by applying standard specifications and conducting mechanical, electrical, and performance tests to assess efficiency, losses, thermal behavior, and suitability for normal and industrial applications.
4. Plan, execute, and evaluate underground cable systems by applying standard practices for inspection, handling, laying, jointing, and termination; perform testing and fault localization using appropriate instruments; and analyze system issues such as neutral faults, improper protection, and voltage fluctuations to ensure safe, reliable operation.

Unit-I (10 Hours)

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

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

Unit-2 (11 Hours)

Synchronous Machines: Specifications as per BIS Standards. Installation - Physical Inspection, Foundation Details, Alignments, Excitation Systems, Cooling and Control Gear, Drying Out. Commissioning Tests - Insulation, Resistance Measurement of Armature and Field Windings, Wave Form and Telephone Interference Tests, Line Charging Capacitance. Performance Tests -Various Tests to Estimate the Performance of Generator Operations, Slip Test, Maximum Lagging Current, Maximum Reluctance Power Tests, Sudden Short

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Circuit Tests, Transient Sub Transient Parameters, Measurement of Sequence Impedances, Capacitive Reactance, and Separation Of Losses, Temperature Rise Test, and Retardation Tests. Factory Tests -Gap Length, Magnetic Eccentricity, Balancing Vibrations, Bearing Performance
Unit-3 (11 Hours)
Induction Motor: Specifications. Installation- Location of Motors and its Control Apparatus, Shaft Alignment for Various Coupling, Fitting of Pulleys and Coupling, Drying of Windings. Commissioning Tests -Mechanical Tests For Alignment, Air Gap Symmetry, Tests for Bearings, Vibrations and Balancing. Specific Tests -Performance and Temperature Raise Tests, Stray Load Losses, Shaft Alignment, Re-Writing and Special Duty Capability, Site Tests
Unit-4 (10 Hours)
Laying of Underground Cables: Inspection, Storage, Transportation and Handling of Cables, Cable Handling Equipment, Cable Laying Depths and Clearances from other Services such as Water Sewerage, Gas, Heating and other Mains, Series of Power and Telecommunication Cables and Coordination with these Services, Excavation of Trenches, Cable Jointing and Terminations Testing and Commissioning. Location of Faults using Megger, Effect of Open or Loose Neutral Connections, Provision of Proper Fuses on Service Lines and Their Effect on System, Causes and Dim, and Flickering Lights
Text Books:
1. S. Rao Testing, Commissioning, Operation and Maintenance of Electrical Equipment Khanna Publishers 6th Edition, 19th Reprint, 2015 2. R.L.Chakrasali Testing and Commissioning of Electrical Equipment Prism Books Pvt Ltd 1st Edition, 2014
Reference Books:
1. S.K.Sharotri Preventive Maintenance of Electrical Apparatus Katson Publishing House 1st Edition, 1980 2. Handbook of Switchgears BHEL McGraw Hill 1st Edition, 2005 3. Transformers BHEL McGraw Hill 1st Edition, 2003 4. Martin J. Heathcote Newnes The J&P Transformer Book, 12th Edition, 1998

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Matrix to describe the mapping of COs with POs (considering Wks) and PSOs

Course Outcomes - COs	Program Outcomes and Wks											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	1 (WK1) (WK2)	1 (WK5)	1 (WK8)							1 (WK8)	3	2	2
CO2	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK3) (WK4)	1 (WK5)	1 (WK8)							1 (WK8)	3	3	2
CO3	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK4)	1 (WK5)	1 (WK8)	1 (WK6)						1 (WK8)	3	3	2
CO4	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK3) (WK4)	1 (WK5)	1 (WK8)	1 (WK6)	1 (WK9)		1	1		1 (WK8)	3	2	2

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEED503E	Database Management System	Semester	: V
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem:	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Develop the ability to design, manipulate and manage databases by constructing ER and relational models, performing relational algebra and SQL operations, applying normalization techniques and implementing transaction management and crash recovery mechanisms for various applications.

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 queries from database using SQL.
3. Describe different normal forms and properties of relational decomposition.
4. Perform operations about Transaction Management and Crash recovery.

Unit-1 (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-2 (11 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-3 (11 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.

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Unit-4 (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

Text 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.

Reference Books:

3. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw Hill, 2004.
4. Elmasri and Navathe, "Fundamentals of Database Systems", 4th Edition, Pearson Publication.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes – PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)				3 (WK2) (WK6)						1 (WK8)			2
CO2	3 (WK1) (WK2) (WK3) (WK4)		2 (WK5)	2 (WK8)	3 (WK2) (WK6)						1 (WK8)			2
CO3	2 (WK1) (WK2) (WK3) (WK4)			2 (WK8)	3 (WK2) (WK6)						1 (WK8)			2
CO4	2 (WK1) (WK2) (WK3) (WK4)			2 (WK8)	3 (WK2) (WK6)						1 (WK8)			2

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEE503E	Operations Research	Semester	: V
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE + SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Apply operations research techniques, mathematical models, and optimization methods to analyze, design, and solve engineering and managerial decision-making problems related to resource allocation, scheduling, transportation, inventory, and project management.

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. Analyse 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.

Unit-1 (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-2 (11 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-3 (10 Hours)

Game Theory:

Formulation of two-person, zero sum games, Games with and without saddle points, Max–Min, Min–Max principles, graphical solution procedure for $2 \times n$ or $m \times 2$ games, solving by linear programming.

Unit-4 (11 Hours)

PERT and CPM Techniques: Network representation, critical path computation, construction of the time schedule, variation under probabilistic models, crossing of simple networks, PERT calculation.

Text Books:

1. Hamdy A. Taha, "Operations Research: An Introduction", 10th Edition, Pearson Education, 2017.
2. Fredrick S. Hillier and Lieberman, "Operation Research Concept and Cases", 8th edition, TMH, 2009.
3. S.D. Sharma, "Operation Research", 16th revised edition, KNRN Publisher, New Delhi, 2009.

Reference Books:

1. J K Sharma, "Operations Research – Theory and Applications", 6th Edition, Macmillan Publishers, 2022.
2. S. S. Rao, "Optimization Techniques", 3rd edition New age International Publishers,

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

2010.

3. Kanti Swarup, P.K. Gupta and Man Mohan, "Operations Research", 19th Edition, Sultan Chand & Sons, New Delhi, 2022.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	2 (WK5)	2 (WK8)						1	2 (WK8)	2		1
CO2	3 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	2 (WK5)	3 (WK8)					1	1	2 (WK8)	2		1
CO3	2 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	3 (WK5)	2 (WK8)		1 (WK5 WK7)			1	1	2 (WK8)	1		2
CO4	3 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	2 (WK5)	3 (WK8)		1 (WK7)	1 (WK9)		1	2	2 (WK8)	2	1	2

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEF503E	Field Theory	Semester	: V
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem.	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE + SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Apply the principles of electrostatics, magnetostatics, and electromagnetic fields to analyze electric and magnetic field distributions, evaluate field interactions, and solve engineering problems related to electrical and electronic systems using Maxwell's equations and vector analysis techniques.

Course Outcomes:

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

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

Unit-1 (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 ∇ and the divergence theorem.

Unit-2 (11 Hours)

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

Unit-3 (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-4 (11 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.

Text Books:

1. William H. Hayt Jr. and John A Buck, "Engineering Electromagnetics", 17th - Edition, Tata McGraw Hill, 2012.
2. Dr. D. Ganesh Rao, "Field Theory" Sanguine Technical Publishers, 1st Edition, 2014.

Reference Books:

1. John Karuss, Daniel A Fleisch, "Electromagnetics with Applications", 5th Edition

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

McGraw-Hill, 1999.

2. Edward C. Jordan and Keith G Balmain, "Electromagnetic Waves and Radiating Systems," II- Edition, Prentice Hall of India / Pearson Education, 1968. Reprint 2002.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	2 (WK5)	2 (WK8)							1 (WK8)	3	2	
CO2	3 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	2 (WK5)	3 (WK8)							1 (WK8)		2	
CO3	2 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	3 (WK5)	2 (WK8)		2 (WK1) (WK5)					1 (WK8)		2	2
CO4	3 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	2 (WK5)	3 (WK8)		3 (WK1) (WK5) (WK7)					2 (WK8)	3		2

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Open Elective Course – I

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	:	BEEA508N		Semester	:	V
L:T:P	:	3:0:0		Course Type	:	OEC
Hours/Sem	Teaching	:	42 Hrs	CIE Marks	:	50
	Learning (TW+SL)	:	42 Hrs	SEE Marks	:	50
	Exam (CIE+SEE)	:	06 Hrs	Total Marks	:	100
	Total Hrs.	:	90 Hrs	Credits	:	03

Electric Vehicles

Professional Competency:

Develop the ability to understand the evolution, classification, components, energy storage systems, alternative energy sources, drive-train architectures, vehicle dynamics, and power flow control strategies of electric and hybrid vehicles for effective analysis and application.

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.

Unit-1 (11 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-2 (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-3 (11 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-4 (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 in Complex Hybrid.

Text Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.

Reference Books:

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

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Matrix to describe the mapping of COs with POs (considering Wks) and PSOs

Course Outcomes - COs	Program Outcomes and Wks											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2 (WK1) (WK2) (WK3) (WK4)					2 (WK1) (WK5) (WK7)					1 (WK8)		1	2
CO2	2 (WK1) (WK2) (WK3) (WK4)		3 (WK5)	1 (WK8)							1 (WK8)		1	2
CO3	2 (WK1) (WK2) (WK3) (WK4)			2 (WK8)		2 (WK1) (WK5) (WK7)					1 (WK8)		1	2
CO4	2 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)		2 (WK8)							1 (WK8)		1	2

Syllabus for B.E. (E&EE) V - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEB508N	Fundamentals of Wind Energy Conversion Systems	Semester	: V
L:T:P	: 3:0:0		Course Type	: OEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Ability to analyze wind energy systems by applying key principles to real-world energy generation scenarios. Develops proficiency in evaluating system performance and key parameters to ensure efficient energy conversion. Further, it enables the design and assessment of reliable and high-performance wind energy systems.

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.

Unit-1 (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-2 (11 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-3 (11 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-4 (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

Text 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.

Reference Books:

1. Introduction to Wind Energy Systems: Basics, Technology and Operation Authors: Hermann-Josef
2. Wagner, Jyotirmay Mathur Second Edition (2012) Publisher: Springer Berlin/Heidelberg
3. Aerodynamics of Wind Turbines Author: Martin O. L. Hansen Third Edition (2015) Publisher: Routledge, Taylor & Francis

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4. Wind Energy Engineering: A Handbook for Onshore and Offshore Wind Turbines Trevor Letcher Second Edition (2023) Publisher: Academic Press, Elsevier
5. Wind Power Technology: An Introduction Joshua Earnest & Sthuthi Rachel Third Edition (2019/2023) Publisher: PHI Learning
6. Wind Energy Handbook Tony Burton, Nick Jenkins, Ervin Bossanyi Third Edition (2021) Publisher: John Wiley & Sons, Inc.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	1 (WK1) (WK2) (WK3) (WK4)									1 (WK8)	3		1
CO2	3 (WK1) (WK2) (WK3) (WK4)	1 (WK1) (WK2) (WK3) (WK4)									1 (WK8)	3		1
CO3	3 (WK1) (WK2) (WK3) (WK4)	1 (WK1) (WK2) (WK3) (WK4)									1 (WK8)	3	1	1
CO4	2 (WK1) (WK2) (WK3) (WK4)	1 (WK1) (WK2) (WK3) (WK4)				1 (WK5)		1	1		1 (WK8)	3		1

Syllabus for B.E. VI - Semester

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

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA601C	Power System-III	Semester	: VI
L:T:P	: 4:0:0		Course Type	: PCC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 04

Professional Competency:

Competent in modelling and evaluating power system performance by performing load flow computations, optimizing thermal generation dispatch, and analyzing excitation system stability

Course Outcomes:

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

1. Apply concepts of graph theory, network topology, trees, cut-sets, loops, and incidence matrices for representation and analysis of power system networks.
2. Compute bus voltages, real and reactive power flows, transmission losses, and transformer effects in practical power system networks using various load flow methods
3. Analyze the effect of transmission losses and penalty factors on economic dispatch and determine optimal power generation allocation for thermal and hydrothermal power plants.
4. Explain and analyze the operation, control, protection, and dynamic performance of DC, AC, and static excitation systems used in power systems

Unit-1 (14 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 using Step by Step method, formation of Ybus by inspection method and singular transformation method.

Unit-2 (14 Hours)

Load Flow Studies: Introduction, Power Flow Equation, Classification of Buses

Gauss-Seidel Method: Algorithm for GS method, Modification of algorithm to include PV buses, Q- limit violations, Acceleration of convergence and examples. Representation of Transformer during load flow studies: Fixed Tap Setting and Tap changing under load Transformer.

Newton-Raphson Method: Introduction, Algorithm for NR method in polar coordinates and rectangular coordinates. Fast Decoupled Load Flow and examples.

Unit-3 (14 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, Lambda Iterative technique, Economic Dispatch Including Transmission Losses: Approximation penalty factor, Derivation of transmission loss formula. Introduction to optimal scheduling for hydrothermal plants. Problem formulation, solution procedure and algorithm

Unit-4 (14 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. Derivation of State Space

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model from transfer function model of TYPE-1, TYPE-2, TYPE-3 and TYPE-4 of excitation system. Modeling of AVR, steady state and dynamic performance analysis of AVR.

Text Books:

1. Stag. G. W, El-Abaid, A. H., "Computer Methods in Power System Analysis", MED TECH, A Division of Scientific International 2019
2. Pai M.A., "Computer Techniques in Power System Analysis", 2nd Edition, TMH, 2006
3. Nagrath, I. J., and Kothari, D.P., "Modern Power System Analysis", 4th Edition, TMH, 2011

Reference Books:

1. Olle I. Elgerd, "Electric Energy Systems Theory-An Introduction", 2nd Edition McGraw-Hill Book Company.
2. Pai M.A., "Computer Techniques in Power System Analysis", 2nd Edition, TMH, 2006.
3. K. Uma Rao, "Computer Techniques and Model in Power Systems", 2nd Edition, I.K. International, 2014.
4. Singh L. P., "Advanced Power System Analysis and Dynamics", 6th Edition, New Age International (P) Ltd, New Delhi, 2014.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3)	2 (WK5)	2 (WK8)	2 (WK2)						1 (WK8)	2	1	
CO2	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	3 (WK5)	3 (WK8)	2 (WK2)	1 (WK5)			1	1	1 (WK8)	1	2	1
CO3	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	2 (WK8)	3 (WK6)	2 (WK5)				3	1 (WK8)	3	1	1
CO4	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	3 (WK5)	2 (WK8)	2 (WK2) (WK6)	1 (WK5)	1		1	1	2 (WK8)	3	1	

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA602C	Microcontrollers	Semester	: VI
L:T:P	: 3:0:0		Course Type	: PCC
Hours/Sem.	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Apply microcontroller architecture concepts and develop embedded system applications using 8051 assembly/embedded C programming with timers, interrupts, I/O interfacing, peripherals and basic Raspberry Pi programming.

Course Outcomes:

After completion of the course, the students 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 analyse assembly language programs using arithmetic, logic, branching, looping and I/O instructions in 8051 microcontrollers.
3. Develop timer, interrupt, and I/O-based applications using embedded C programming for 8051 microcontrollers.
4. Design and implement embedded system applications by interfacing 8051 with peripherals and demonstrate basic Raspberry Pi programming using Python.

Unit-1 (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-2 (11 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-3 (10 Hours)

8051 Programming in C:

Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051 C.

8051 Timer 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-4 (11 Hours)

8051 Interfacing and Applications:

Interfacing 8051 to LCD, parallel ADC0809, serial ADC MAX1112, DAC, Stepper motor

Introduction to the RaspberryPi:

Basics of RaspberryPi, Hardware layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python.

Text Books:

1. Muhammad Ali Mazadi, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", Pearson, 2nd Edition, 2008.

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2. Kenneth Ayala, "The 8051 Microcontroller", 3rd Edition, West Publishing Company, 2005.

Reference Books:

1. Raj Kamal, "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson, 1st Edition, 2012.
2. Manish K Patel, "The 8051 Microcontroller Based Embedded Systems", McGraw Hill, 2014, ISBN: 978-93-329-0125-4.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2 (WK1) (WK2) (WK3) (WK4)	1 (WK1) (WK2) (WK3) (WK4)	3 (WK5)		3 (WK2) (WK6)						1 (WK8)		3	1
CO2	2 (WK1) (WK2) (WK3) (WK4)	1 (WK1) (WK2) (WK3) (WK4)	3 (WK5)		3 (WK2) (WK6)						1 (WK8)		3	1
CO3	2 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)	3 (WK5)		3 (WK2) (WK6)						1 (WK8)		3	1
CO4	2 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)	3 (WK5)		3 (WK2) (WK6)						1 (WK8)		3	1

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA603C	Digital Signal Processing	Semester	: VI
L:T:P	: 4:0:0		Course Type	: PCC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 04

Professional Competency:

The course enables students to analyse, design, and implement digital signal processing systems used in modern communication and embedded applications. Students gain competency in spectral analysis using DFT and FFT techniques, and in designing FIR and IIR digital filters for signal conditioning. The course also develops skills in efficient realization of digital systems using various structures and computational methods. These competencies prepare students for applications in communication systems, audio and image processing, biomedical engineering, and real-time digital system design.

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.

Unit-1 (14 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-2 (14 Hours)

Fast Fourier Transform Algorithms:

Introduction, radix-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-3 (14 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-4 (14 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.

Text Books:

1. Proakis and Manolakis, "Digital Signal Processing Principle, algorithms and applications",

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5th Edition, Pearson Education, 2021.

2. Sanjith K. Mithra, "Digital Signal Processing", 4th Edition, 2013.

Reference Books:

1. Proakis and Manolakis, "Digital Signal Processing Principle, algorithms and applications", 5th Edition, Pearson Education, 2021.

2. Sanjith K. Mitra, "Digital Signal Processing", 4th Edition, McGraw-Hill, 2010.

3. P. Ramesh Babu, "Digital Signal Processing", 7th Edition, Scitech, 2018.

4. S. Salivahanan, "Digital Signal Processing", 4th Edition, McGraw-Hill, 2019.

5. Emmanuel Ifeachor, "Digital Signal Processing", 2nd Edition Pearson, 2001.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK2) (WK3) (WK4)	2 (WK2) (WK3)		1 (WK8)	2 (WK2) (WK6)						1 (WK8)	1	1	
CO2	3 (WK2) (WK3) (WK4)	2 (WK2) (WK3)		1 (WK8)	2 (WK2) (WK6)						1 (WK8)		1	
CO3	3 (WK2) (WK3) (WK4)	3 (WK2) (WK3) (WK4)	1 (WK5)	1 (WK8)	2 (WK2) (WK6)	2 (WK5) (WK7)					1 (WK8)		1	
CO4	3 (WK2) (WK3) (WK4)	2 (WK2) (WK3)	1 (WK5)	2 (WK8)	2 (WK2) (WK6)	1 (WK5)					1 (WK8)		1	

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA605L	Power System – II Laboratory	Semester	: VI
L:T:P	: 0:0:2		Course Type	: PCC
Hours/Sem	Practical		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam		Total Marks	: 100
	Total Hrs.		Credits	: 01

Professional Competency:

Demonstrate the ability to model, simulate, and analyze power system components and networks using MATLAB and MiPower software, and interpret the results of fault analysis, load flow studies, stability analysis, transmission line performance, and optimal generation scheduling to evaluate the efficiency, stability, and reliability of electrical power systems.

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 software tools.
3. Interpret experimental results, analyze system performance, and formulate conclusions to evaluate and improve the efficiency, stability, and reliability of power systems.

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 3-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

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Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1		1 (WK2) (WK3)		3 (WK8)	3 (WK2) (WK6)						1 (WK8)	3		2
CO2	1 (WK2) (WK3)	2 (WK2) (WK3) (WK4)		3 (WK8)	3 (WK2) (WK6)						1 (WK8)	3		2
CO3	1 (WK2) (WK3)	2 (WK2) (WK3) (WK4)		3 (WK8)	3 (WK2) (WK6)						1 (WK8)	3		2

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA606L	Microcontrollers Laboratory	Semester	: VI
L:T:P	: 0:0:2		Course Type	: PCC
Hours/Sem	Practical		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 01

Professional Competency:

Develop, implement and validate assembly language programs using Keil software and analyse the interfacing and operation of peripheral devices with Raspberry Pi/Arduino platforms.

Course Outcomes:

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

1. Develop and verify assembly language programmes for the specified applications using Keil software.
2. Develop, execute, and analyse 8051 embedded C programs for interfacing and controlling peripheral devices using Keil software.
3. Interface and analyze the functioning of peripheral devices using Raspberry Pi/Arduino.

Part-A: Assembly Language Programming

8051 Microcontroller Basics:

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 Thingspeak cloud.
8. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from Thingspeak cloud.

Text Books:

1. Muhammad Ali Mazadi, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", Pearson, 2nd Edition, 2008.
2. Kenneth Ayala, "The 8051 Microcontroller", West Publishing Company, 3rd Edition, 2005.

Syllabus for B.E. (E&EE) VI - Semester
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Reference Books:

1. Raj Kamal, "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson, 1st Edition, 2012.
2. Manish K Patel, "The 8051 Microcontroller Based Embedded Systems", McGraw Hill, 2014.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	I	2	3
CO1	2 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)	3 (WK5)	3 (WK8)	3 (WK2) (WK6)			3			I (WK8)		3	I
CO2	2 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)	3 (WK5)	3 (WK8)	3 (WK2) (WK6)			3			I (WK8)		3	I
CO3	2 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)	3 (WK5)	3 (WK8)	3 (WK2) (WK6)			3			I (WK8)		3	I

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BHSA600C	Indian Knowledge System	Semester	: VI
L:T:P	: 1:0:0		Course Type	: AEC
Hours/Sem	Practical		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam		Total Marks	: 100
	Total Hrs.		Credits	: 01

Professional Competency:

Apply the principles of the Indian Knowledge System to appreciate, preserve and utilize traditional knowledge for addressing contemporary societal and professional challenges.

Course Outcomes:

After 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.

Unit-I (3 Hrs.)

Introduction to Indian Knowledge Systems (IKS):

Overview, Vedic Corpus, Philosophy in Indian Knowledge system.

Unit-II (4 Hrs.)

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 (4 Hrs.)

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 (4 Hrs.)

Traditional Knowledge in Professional domain

Town Planning and Architecture, Agriculture, Governance and Public Administration.

Text 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

Reference Books:

1. Sampad, Vijay "The Wonder that is Sanskrit", Sri Aurobindo Society, Puducherry. (2011).
2. Acarya. P.K. Indian Architecture, Munshiram Manoharlal Publishers, New Delhi. (1996).
3. Kapoor Kapil, Singh Avadhesh "Indian Knowledge Systems Vol – I & II", Indian Institute of Advanced Study, Shimla, H.P. (2021).
4. Dasgupta S.A History of Indian Philosophy, Vol. I, Motilal Banarsidass, New Delhi. (1975).
5. PLofer. K. (1963). Mathematics in India, Princeton University Press, New Jersey, USA.

Web Links and Video Lectures:

1. <https://www.youtube.com/watch?v=LZPIStpYEPm>
2. <http://nptel.ac.in/courses/121106003/>
3. https://www.wipo.int/pressroom/en/briefs/tk_ip.html
4. https://unctad.org/system/files/official-document/ditcted10_en.pdf
5. http://nbaindia.org/uploaded/docs/traditionalknowledge_190707.pdf
6. <https://unfoundation.org/what-we-do/issues/sustainable>

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BHSA660M	Yoga – IV	Semester	: VI
L:T:P	: 0:0:2		Course Type	: MC
Hours/Sem.	Practical		CIE Marks	: 100
	Learning (TW+SL)		SEE Marks	: 00
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 00

Professional Competency:

Demonstrate proficiency in practicing and teaching Yoga techniques, including Surya namaskar, Asanas, Kapalabhati and Pranayama, to promote physical, mental and holistic well-being.

Course Outcomes:

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

1. Understand the meaning, aims, objectives, and importance of Yoga and explain its relevance in daily life.
2. Perform and Teach Surya namaskar, demonstrating the correct sequence, technique, and explaining its physical and mental benefits.
3. Identify, Demonstrate and Teach Various Asanas, including their significance, correct methods of practice, precautions and benefits for overall well-being.
4. Demonstrate and Teach Kapala Bhati and Different Types of Pranayama, explaining their purpose, techniques, safety precautions, therapeutic uses, and health benefits.

Unit-I (7 Hrs.)

Ashtanga Yoga 1. Dharana 2. Dhyana (Meditation) 3. Samadhi
 Asana by name, technique, precautionary measures and benefits of each asana
 Different types of Asanas:
 Sitting Asanas - Bakasana, Hanumanasana, Ekapada Rajakapotasana, Yogamudra in Vajrasana - Meaning, Importance Rules.
 Standing Asanas - Vatayanasana, Garudasana - It's meaning, Importance, Rules.

Unit -II (7 Hrs.)

Balancing: Veerabhadrasana, Sheershasana, It's meaning, Importance, Rules.
 Supine line: Setubandha, Sarvangasana, Shavasana (Relaxation posture), Its meaning, Importance, Rules.
 Revision of Kapala Bhati practice 80 strokes/min - 3 rounds

Unit -III (7 Hrs.)

Different types, Meaning by name, Technique, Precautionary measures and Benefits of each, Pranayama 1. Bhastrika 2. Bhramari - Meaning, Importance Rules.

Unit -IV (7 Hrs.)

Meaning, Need, importance of Shatkriya, Different types, Meaning by name, technique, precautionary measures and benefits of each Kriya
 1. Jalaneti & sutraneti
 2. Nauli (only for men)
 3. Sheetkarma Kapalabhati

Reference Books:

1. S. K. Kuppasta, "Samagra yoga darshaini Publication", Vivekananda Yoga Vignana Kendra, Bagalkot, 2021.
2. Ajitkumar, A., "Yogapravesha in Kannada", Karnataka Yoga Publications, 1st Edition, 2012.
3. Iyengar, B. K. S., "Light on Yoga", George Allen & Unwin Ltd., Revised Edition, 1966.
4. Gharote, M. L. and Ganguly, S. K., "Teaching Methods for Yogic Practices", Kaivalyadhama M.Y.M. Samiti, 1st Edition, 1980.
5. SVYASA University, "Yoga Instructor Course Handbook", SVYASA University, 2nd

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(For Students Admitted to I Year in AY 2024-25)

Edition, 2018.

6. Muthanna, Y., “Yoga for Children – Step by Step”, Prasaranga Publications, 1st Edition, 2015.

Web Links and Video Lectures:

<https://youtu.be/KB-TYlgdIwE>

<https://youtu.be/aa-TG0WgILs>

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BHSB660M	National Service Scheme - IV	Semester	: VI
L:T:P	: 0:0:2		Course Type	: MC
Hours/Sem.	Practical		CIE Marks	: 100
	Learning (TW+SL)		SEE Marks	: 00
	Exam		Total Marks	: 100
	Total Hrs.		Credits	: 00

Professional Competency:

Demonstrate social responsibility, environmental awareness, leadership, and problem-solving skills to contribute effectively to sustainable community development and societal well-being.

Course Outcomes:

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

1. Recognize and understand individual roles and responsibilities towards society and contribute positively to its welfare and development.
2. Analyze environmental and societal issues and design practical, innovative, and sustainable solutions for community development.
3. Critically assess existing systems and effectively plan and implement government-led or self-initiated projects for social and sustainable development.
4. Develop the ability to respond to emergencies and natural disasters while fostering national integration, social harmony, unity and community resilience.

Topics/Activities to be Covered

1. Plantation and adoption of plants. Know your plants.
2. Organize National integration and social harmony events/workshops/seminars. (Minimum 02 programs).
3. Govt. school Rejuvenation and helping them to achieve good infrastructure.

Pedagogy–Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Plan of Action Execution of Activities for Each Semester

1. Practice Session Description
2. Lecture session by NSS Officer
3. Students Presentation on Topics
4. Presentation – Selection of topic: PHASE-I
5. Commencement of activity and its progress: PHASE- 2
6. Execution of Activity
7. Case study based Assessment, Individual performance
8. Sector wise study and its consolidation
9. Video based seminar for 10minutes by each student At the end of semester with Report.
 - In every semester from 3rd semester to 6th semester, each student should carry out activities according to the scheme and syllabus.
 - At the end of every semester, student performance has to be evaluated by the NSS coordinator for the assigned activity progress and its completion.
 - Finally, in the 6th semester, a consolidated report of all activities from 3rd to 6th semester, compiled as per the instructions.

Reference Books:

1. NSS Cell, VTU Belagavi. (n.d.). NSS course manual (Edition unknown). Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS Cell. (n.d.). Activity reports and manual, Government of Karnataka.
3. Government of India, NSS Cell. (n.d.). Activity reports and manual, Government of India.

Syllabus for B.E. (E&EE) VI - Semester
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Sl.	Topic	Group size	Location	Activity execution	Reporting	Evaluation of the Topic
1.	Plantation and adoption of plants. Know your plants.	May be individual or team activity	Villages/City Areas/Grama panchayat/public associations/Govt. offices/campus etc.	Place selection/proper consultation/Continuous monitoring /Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
2.	Organize National integration and social harmony events /workshops /seminars (Minimum 02 programs).	May be individual or team	Villages/City Areas/Grama panchayat/public associations/Govt. offices/campus etc.	Place selection/proper consultation/Continuous monitoring /Information board	Report should be submitted by the individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
3.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/City Areas/Grama panchayat/public associations/Govt. offices/campus etc.	Place selection/proper consultation/Continuous monitoring /Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BHSC660M	Physical Education - IV	Semester	: VI
L:T:P	: 0:0:2		Course Type	: MC
Hours/Sem.	Practical		CIE Marks	: 100
	Learning (TW+SL)		SEE Marks	: 0
	Exam		Total Marks	: 100
	Total Hrs.	: 30 Hrs	Credits	: 00

Professional Competency:

Demonstrate competence in physical education, health, fitness, sports, and athletic activities to promote holistic development and achieve excellence in competitive and professional sports.

Course Outcomes:

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

1. Understand the Postural deformities and Stress management in sports and athletics.
2. Participate in the competition at regional/state / national / international levels.
3. Understand and practice of specific games and athletic Jumping events.
4. Understand and practice of Aerobics.

Unit-I (7 Hrs.)

Postural deformities and Stress management

Unit-II (7 Hrs.)

Throw ball and Table Tennis

Unit-III (7 Hrs.)

Athletics (Field Events-Jumps) – Any event as per availability of Ground.

Unit -IV (7 Hrs.)

Aerobics

Reference Books:

1. Bandopadhyay, K. (n.d.), Sarir Siksha Parichay, Classic Publishers.
2. Dharma, P. N. (n.d.), Fundamentals of Track and Field, Khel Sahitya Kendra.
3. Dubey, H. C. (n.d.), Basketball, Discovery Publishing House.
4. Jain, N. (n.d.), Play and Learn Basketball, Khel Sahitya Kendra.
5. Jain, R. (n.d.), Play and Learn Cricket, Khel Sahitya Kendra.
6. Kus, S. (n.d.), Coaching Volleyball Successfully, Human Kinetics.
7. Petipus, et al, (n.d.), Athlete's Guide to Career Planning, Human Kinetics.
8. Saha, A. K. (n.d.), Sarir Siksher Ritiniti, Rana Publishing House.
9. Thani, V. (n.d.), Coaching Cricket, Khel Sahitya Kendra.

Scheme and Assessment for the course

Sl.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes–2, each of 15marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
Total		100

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code		: BHSD660M	Music - IV	Semester	: VI
L:T:P		: 0:0:2		Course Type	: MC
Hours/Sem.	Practical	: 28 Hrs		CIE Marks	: 100
	Learning (TW+SL)	: 00 Hrs		SEE Marks	: 0
	Exam	: 02 Hrs		Total Marks	: 100
	Total Hrs.	: 30 Hrs		Credits	: 00

Professional Competency:

Demonstrate competency in performing basic Carnatic Swara exercises, applying notation skills, and rendering Geethe, Jathi Swara, and Krithi with correct pitch, rhythm, and adherence to raga and tala structures.

Course Outcomes:

1. Perform basic swara exercises (Sarale Varase) accurately in Mayamalavagowla Raga with proper pitch and rhythm.
2. Apply notation writing skills for Sarale Varase and Suladi Saptha Tala to accurately represent rhythmic and melodic structures.
3. Sing prescribed Geethe in Malahari Raga with correct swara alignment and tala adherence.
4. Perform Jathi Swara and one Krithi in a Mela raga with proper expression, laya, and adherence to composition structure.

Content (28 Hrs.)

Abhyasa Gana: Singing the swara exercises (Sarale Varase Only), Notation writing for Sarale Varase and Suladi Saptha Tala (Only in Mayamalavagowla Raga), Singing 4 Geethe in Mallahari and one jathi Swara, One Krithi in a Mela raga

Textbooks

1. Vidushi Vasantha Madhavi, "Theory of Music", Prism Publication, 2007.
2. T Sachidevi and T Sharadha (Thirumalai Sisters), Karnataka Sangeetha Dharpana- Vol. I (English), Shreenivaas Prakaashana, 2018.

Reference Books:

1. Lakshminarayana Subramaniam, Viji Subramaniam, "Classical Music of India: A Practical Guige", Tranqueber 2018.
2. R. Rangaramanuja Ayyangar, "History of South Indian (Carnatic) Music", Vipanci Charitable Trust; Third edition, 2019.
3. Ethel Rosenthal, "The Story of Indian Music and Its Instruments: A Study of the Present and a Record of the Past", Pilgrims Publishing, 2007.
4. Carnatic Music, "National Institute of Open Schooling", 17 EC Proceedings dated 17.07.2024.

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Professional Elective Course – II

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA604E	Integration of Distributed Generation	Semester	: VI
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.	: 90 Hrs	Credits	: 03

Professional Competency:

Develop the ability to analyze, evaluate, and integrate distributed generation systems into modern power networks while ensuring reliable operation, enhanced power quality, improved hosting capacity, sustainable energy utilization, and stable power system performance.

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.

Unit-1 (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. Interface with the Grid.

Unit-2 (11 Hours)

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-3 (11 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-4 (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.

Text 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.

Syllabus for B.E. (E&EE) VI - Semester
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Reference Books:

1. Chetan Singh Solanki, "Solar Photo Voltaics", PHI learning Pvt. Ltd., New Delhi, 2009
2. J.F. Manwell, J.G "Wind Energy Explained, Theory Design and Applications," McGowan Wiley publication, 2nd Edition, 2009.
3. John Twidell and Tony Weir, "Renewable Energy Resources", Taylor and Francis Publications, Second Edition, 2006.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK3) (WK4)	2 (WK2) (WK3) (WK4)	1 (WK5)									3		
CO2	3 (WK1) (WK2) (WK3) (WK4)	2 (WK2) (WK3) (WK4)	1 (WK5)									2		
CO3	3 (WK1) (WK3) (WK4)	2 (WK2) (WK3)	1 (WK5)									2		
CO4	3 (WK1) (WK3) (WK4)	2 (WK2) (WK3) (WK4)	1 (WK5)									2		

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEB604E	Automotive Electronics	Semester	: VI
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Develop a comprehensive understanding of automotive electronic systems, including electronic components, engine control, ignition and fuel systems, chassis control, and advanced comfort, safety, and security features used in modern automobiles.

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.

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-2 (11 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-3 (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-4 (11 Hours)

Electronics For Comfort, Safety And Security: Electric Seats, Mirrors And Sun-Roof Operation, Central Locking 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.

Text Books:

1. Tom Denton, "Automotive electrical and electronic systems", 3rd Edition, SAE International, 2015.
2. Eric Chowanietz, "Automotive Electronics", 1st Edition NewAge publishers, 1995.

Syllabus for B.E. (E&EE) VI - Semester
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Reference Books:

1. William B Ribbens, "Understanding Automotive Electronics", 7th Edition, Butterworth-Heinemann –Elsevier, 2012.
2. Bernhard Mencher, et. al., "Bosch Professional Automotive Information", 5th Edition, Springer Vieweg, 2014.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)									I (WK8)		3	I
CO2	2 (WK1) (WK2) (WK3) (WK4)	1 (WK1) (WK2) (WK3) (WK4)		2 (WK8)							I (WK8)		3	I
CO3	2 (WK1) (WK2) (WK3) (WK4)			3 (WK8)							I (WK8)		3	I
CO4	2 (WK1) (WK2) (WK3) (WK4)			3 (WK8)		3 (WK1) (WK5) (WK7)					I (WK8)		3	I

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEC604E	Intelligent Instrumentation	Semester	: VI
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem.	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Analyse, select and apply intelligent instrumentation techniques, smart sensor technologies, calibration methods, AI-based sensing approaches, and communication protocols for advanced measurement and automation applications.

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.

Unit-1 (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-2 (11 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-3 (11 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-4 (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.

Text Books:

1. Manabendra Bhuyan, "Intelligent Instrumentation: Principles and Applications," CRC Press, Taylor and Francis Group, 2011.
2. Rishab Anand, "Intelligent Instrumentation for Engineers", Khanna Book Publishing Company, First edition, 2013.

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Reference Books:

1. J.B Dixit, Amit Yadav, "Intelligent Instrumentation for Engineers," Laxmi Publications Ltd., 2011

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2 (WK1) (WK3) (WK4)	1 (WK2)			2 (WK6)						1 (WK8)	2	3	
CO2	2 (WK2) (WK3)	2 (WK2)	1 (WK5)	1 (WK8)	3 (WK6)						1 (WK8)	2	3	
CO3	2 (WK3) (WK4)	2 (WK2)	1 (WK5)	2 (WK8)	2 (WK6)						2 (WK8)	2	3	1
CO4	1 (WK4)	1 (WK2)	1 (WK5)		3 (WK6)	1 (WK7)					1 (WK8)	1	3	1

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEED604E	VLSI Design	Semester	: VI
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Demonstrate the ability to apply VLSI design principles, MOSFET device characteristics, CMOS circuit analysis, and digital logic design techniques to model, analyze, and design combinational, sequential, and dynamic integrated circuits for modern VLSI applications.

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.

Unit-1 (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-2 (11 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-3 (11 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-4 (10 Hours)

Combinational MOS Logic Circuits: Introduction, MOS logic circuits with Depletion nMOS Loads, CMOS logic circuits, Complex logic circuits, CMOS Transmission Gates (TGs)
Sequential MOS Logic Circuits: Introduction, Behavior of Bistable elements, The SR latch circuit, Clocked latch and Flip-flop circuit, CMOS D-latch and Edge-triggered flip-flop
Dynamic Logic Circuits: Introduction, Basic Principles of pass transistor circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, CMOS Dynamic Circuit Techniques, High-performance Dynamic CMOS circuits.

Reference Books:

1. Sung – Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated circuits – Analysis and Design", TATA McGraw-Hill Pub. Company Ltd.
2. Pucknell, Eshraghian, "Basic VLSI Design", PHI publications, 3rd Edition, 2018.

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3. Mead C and Conway, "Introduction to VLSI Systems", Addison Wesley publications, 2nd Edition, 1990.
4. John P. Uyemura, "Introduction to VLSI Circuits & Systems", Wiley Publications, 2006.
5. Brown and Vranesic, "Fundamentals of Digital Logic Design with VHDL", McGraw Hill Education, 3rd Edition, 2017.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK3 WK4)	2 (WK3)	1 (WK5)									2	3	
CO2	3 (WK1 WK3 WK4)	3 (WK3 WK4)		2 (WK8)								2	3	
CO3	3 (WK2 WK3 WK4)	3 (WK3 WK4)		2 (WK8)								2	3	
CO4	3 (WK3 WK4)	3 (WK3 WK4)	3 (WK5)	2 (WK8)								3	3	

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	:	BEEA604E	Electric Machine Drives	Semester	:	VI
L:T:P	:	3:0:0		Course Type	:	PEC
Hours/Sem	Teaching	:		CIE Marks	:	50
	Learning (TW+SL)	:		SEE Marks	:	50
	Exam (CIE+SEE)	:		Total Marks	:	100
	Total Hrs.	:		Credits	:	03

Professional Competency:

Develop the ability to identify, analyse, design, model and evaluate converter-controlled electrical drive systems and motor performance for various industrial applications using DC, induction and synchronous motor drives.

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.

Unit-1 (10 Hours)

Fundamentals of Electric Drives

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

Unit-2 (11 Hours)

Converter Controlled DC Motor Drives: Modelling of DC motors, State space modelling, 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-3 (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-4 (11 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.

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Text 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. Veda M. Subrahmanyam, "Electric Drives", Tata McGraw Hill, 2nd Edition, 2011.

Reference Books:

1. R. Krishnan, "Electric Motor Drives - Modelling, Analysis and Control", Prentice Hall Inc., 2008.
2. Bimal K. Bose, "Modern Power Electronics & AC drives", Prentice Hall Inc., 2001.
3. Austin Hughes, "Electric Motor & Drives", Newnes-Elsevier, 3rd Edition, 2006.
4. S.K. Pillai, "A first course on Electrical Drives", New Age International Publication, 2nd Edition, 1982.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2 (WK1) (WK2) (WK3) (WK4)	1 (WK1) (WK2) (WK3) (WK4)		3 (WK8)							1 (WK8)		3	
CO2	2 (WK1) (WK2) (WK3) (WK4)	1 (WK1) (WK2) (WK3) (WK4)		3 (WK8)							1 (WK8)		3	
CO3	2 (WK1) (WK2) (WK3) (WK4)	1 (WK1) (WK2) (WK3) (WK4)	3 (WK5)	2 (WK8)							1 (WK8)		3	
CO4	2 (WK1) (WK2) (WK3) (WK4)	1 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	3 (WK8)							1 (WK8)		3	

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEF604E	Modern Control Theory	Semester	: VI
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE + SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Model and analyze control systems using state-space techniques, including the evaluation of key system properties such as controllability, observability, and stability. Design state feedback controllers and observers using appropriate methodologies, and analyze nonlinear system behaviour using phase-plane methods and Lyapunov stability criteria.

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. Develop the ability to design and analyze control systems using state-space techniques, including state feedback, pole placement, and observer-based control. The learner will be capable of ensuring system stability, designing regulators and controllers (P, PI, PID), and validating solutions using computational tools like MATLAB.
4. Evaluate nonlinear control system behavior using phase-plane methods and Liapunov's stability criteria for system performance analysis.

Unit-1 (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-2 (11 Hours)

Derivation of transfer function from state Model: -Derivation of transfer function from state model, diagonalization, 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-3 (11 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-4 (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: Introduction, singular points, stability of nonlinear system

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.

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Text Books:

1. K. Ogata, Modern Control Engineering, 5th Ed, 2010.
2. M.Gopal, "Control Systems Principles and Design", 3rd Edition, Tata McGraw Hill, 2011.

Reference Books:

1. W.L. Brogan, Modern Control Theory 3rd Ed, 1991 2011.
2. R.C. Dorf and R.H. Bishop, Modern Control Systems, 13th Ed, 2016.
3. A Nagoor Kani, "Advanced Control Theory", CBS Publishers, 3rd Edition, 2020.
4. B.C. Kuo and F. Golnaraghi, Automatic Control Systems, 10th Edition, 2014.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2)	1 (WK5)	1 (WK8)	1 (WK6)						1 (WK8)	3	2	2
CO2	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK3) (WK4)	1 (WK5)	1 (WK8)	1 (WK6)						1 (WK8)	3	3	2
CO3	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK4)	1 (WK5)	1 WK8	1 (WK6)						1 (WK8)	3	3	2
CO4	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK3) (WK4)	1 (WK5)	1 (WK8)	1 (WK6)	1 (WK9)		1	1		1 (WK8)	3	2	2

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Open Elective Course – II

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA608N	Electrical Safety for Engineers	Semester	: VI
L:T:P	: 3:0:0		Course Type	: OEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Demonstrate the ability to identify electrical hazards, analyze safety requirements, and apply electrical safety, grounding, protection, and accident management practices to ensure safe and reliable operation of electrical systems.

Course Outcomes:

After completion of the course the students 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.

Unit-1 (11 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-2 (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-3 (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-4 (11 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 & Lines, protection against over voltages

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Text Books:

1. S. Rao., R. K. Jain., H.L. Saluja., "Electrical safety, fire safety Engineering and safety management", Khanna Publishers New Delhi, 2nd Edition, 2021

Reference Books:

1. Pradeep Chaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997.
2. V. K.Mehta, Rohit Mehta, "Principles of Power Systems", S Chand Publications, 4th Edition, 2008.
3. The Electricity Act, 2003, <https://cercind.gov.in/Act-with-amendment.pdf>

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2 (WK1) (WK3) (WK4)			1 (WK8)		1 (WK7)					1 (WK8)			
CO2	2 (WK1) (WK3) (WK4)	1 (WK1) (WK3)		2 (WK8)		1 (WK7)	1 (WK9)				1 (WK8)			
CO3	2 (WK1) (WK3) (WK4)	1 (WK1) (WK3)		2 (WK8)		1 (WK7)	1 (WK9)				1 (WK8)			
CO4	2 (WK1) (WK3) (WK4)	1 (WK1) (WK3)		2 (WK8)		1 (WK7)					1 (WK8)			

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEB608N	Energy Storage Systems	Semester	: VI
L:T:P	: 3:0:0		Course Type	: OEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Demonstrate the ability to apply the principles of thermal, chemical, electromagnetic, and electrochemical energy storage systems to analyze, compare, design, and evaluate energy storage technologies for electric vehicles, renewable energy integration, and sustainable power applications.

Course Outcomes:

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

1. Analyze the need, scope, applications, and current trends of energy storage systems, and compare thermal energy storage technologies for engineering applications.
2. Analyze the operating principles, characteristics, advantages, limitations, and applications of chemical and electromagnetic energy storage systems.
3. Compare the operating principles, performance characteristics, and applications of electrochemical energy storage systems, including batteries, supercapacitors, and fuel cells.
4. Design battery storage systems for electric vehicle applications by considering battery packaging, charging methods, thermal management, state-of-charge/state-of-health estimation, and battery recycling.

Unit-1 (11 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-2 (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-3 (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.

Syllabus for B.E. (E&EE) VI - Semester
(For Students Admitted to I Year in AY 2024-25)

Unit-4 (11 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.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2 (WK2 WK3 WK4)	2 (WK2 WK3)												
CO2	2 (WK2 WK3 WK4)	3 (WK1 WK2 WK3 WK4)		1 (WK8)			1 (WK9)							
CO3	2 (WK2 WK3 WK4)	3 (WK1 WK2 WK3 WK4)		2 (WK8)			1 (WK9)							
CO4	2 (WK3 WK4)	2 (WK2 WK3 WK4)	3 (WK5)	2 (WK8)										

Syllabus for B.E. VII/VIII-Semester

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

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEA701C	Power System - IV	Semester	: VII
L:T:P	: 3:0:0		Course Type	: PCC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

This course is the basic technical and analytical skill set for modern power system operation and control. Students will learn to be proficient in the management of grid stability, economic dispatch and security assessment through contingency analysis and state estimation. In addition, the curriculum provides a link between traditional power engineering and digital infrastructure, developing knowledge in SCADA architecture, IED integration, and real-time automation, equipping graduates to manage the challenges of secure and efficient delivery of electrical energy.

Course Outcomes:

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

1. Analyze 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 (HMI) for effective power system monitoring and control.

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-2 (11 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

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Unit-3 (11 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-4 (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, 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 System Analysis", 4th Edition, TMH, 2014.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes-PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	1 (WK8)							1 (WK8)	3		1
CO2	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	1 (WK8)							1 (WK8)	3		1
CO3	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	1 (WK8)							1 (WK8)	3		1
CO4	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	1 (WK5)	1 (WK8)							1 (WK8)	3		1

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEA702C	High Voltage Engineering	Semester	: VII
L:T:P	: 3:0:0		Course Type	: PCC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

This course cultivates advanced professional competency in High Voltage (HV) Engineering, equipping students with the theoretical and practical expertise necessary to design, test, and maintain robust insulation systems. Graduates will master the fundamental physics of dielectric breakdown in gaseous, liquid, and solid media, and gain proficiency in the generation and precise measurement of high-voltage AC, DC, and impulse signals. By integrating rigorous non-destructive diagnostic techniques and standardized testing protocols for critical power apparatus—such as transformers, insulators, and circuit breakers—students develop the technical acumen required to ensure the reliability, safety, and operational integrity of high-voltage electrical infrastructure.

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.

Unit-1 (11 Hours)

Conduction and Breakdown in Gases: Gases as Insulating Media, 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-2 (10 Hours)

Generation of HV AC and DC Voltage: 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, Cockcroft – 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-3 (11 Hours)

Generation of Impulse Voltage and Current: 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.

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Measurement of High Voltages: 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-4 (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 Kuffell., 'High Voltage Engineering Fundamentals', Butterworth-Heinemann 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.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)										3		
CO2	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	3 (WK5)									3	2	2
CO3	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	3 (WK5)	2 (WK8)								2	3	2
CO4	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)	3 (WK5)	3 (WK8)								2	2	3

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEA705C	Research Methodology and IPR	Semester	: VII
L:T:P	: 3:0:0		Course Type	: HSMC
Hours/Sem.	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Apply research methodology, literature analysis techniques, and intellectual property rights principles to identify research problems, conduct ethical engineering research, and protect innovative outcomes through appropriate IPR mechanisms.

Course Outcomes:

After completion of the course the students will 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.

Unit-I (10 Hours)

Introduction to Engineering Research :

Research: Basic, applied, and translational research; identifying and solving worthwhile problems.

Fundamentals of Research: Meaning, objectives, and motivation in engineering research. Types of Engineering problems.

Research Ethics: Ethics in engineering research and practice, types of research misconduct, and ethical issues in authorship.

Unit-2 (11 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-3 (11 Hours)

Fundamentals of Intellectual Property Rights and Patents:

Introduction to Intellectual Property Rights (IPR): Concept, nature, and significance of Intellectual Property.

Types of Intellectual Property: Patents, Copyrights, Trademarks, Industrial Designs, Geographical Applicability and Prohibited by law.

Patent search: Importance and databases (In PASS, PATENTSCOPE, Google Patents).

Patent filing procedure in India: Provisional and Complete Specifications. Patent examination, publication, opposition, grant, renewal, and infringement Indications, Trade Secrets, and Plant Varieties.

Role of IPR in innovation: research, entrepreneurship, and economic development.

International IPR Framework: Overview of WIPO, WTO, TRIPS Agreement, Paris

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Convention, and Berne Convention.

Patents: Meaning, objectives, and characteristics of patents. Criteria for patentability: Novelty, Inventive Step, Industrial applications and not prohibited by the law.

Unit-4 (10 Hours)

Copyrights, Trademarks, Industrial Designs and IPR Management:

Copyrights: Meaning, subject matter, ownership, duration, and infringement, Copyright issues in the digital environment and academic research.

Trademarks and Industrial Designs: Concept and importance of trademarks. Registration process, infringement, and remedies. Industrial Designs: Registration, protection, and significance.

Geographical Indications and Trade Secrets: Concept, registration, and protection of Geographical Indications. Trade secrets and confidential information.

IPR Management and Commercialization: Technology Transfer and Licensing. Patent valuation and commercialization. Intellectual Property in Start-ups and Academic Institutions.

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.

Text Books:

1. Dr. Nejakar Santosh M, Dr. Bendigeri Harish (2023-24) "Research Methodology and Intellectual Property Rights", ISBN978-93-5987-928-4.

Reference Books:

1. David V. Thiel, "Research Methods for Engineers", Cambridge University Press, 978-1-107-03488-4
2. N. K. Acharya, "Intellectual Property Rights", Asia Law House, 6th Edition. ISBN: 978-93-81849-30-9
3. N.R. Subbaram. S. Viswanathan, "Hand book Indian Patent Law and, Practice" Printers and publishers Pvt. Ltd., 2008.
4. Dr. B. L. Wadehra, "Law Relating to Intellectual Property" 5th edition, Universal Law publishing Co., Delhi.

Web Links and Video Lectures:

1. https://mooc.utm.my/courses/researchmethodologyforen?utm_source=chatgpt.com
2. https://arxiv.org/abs/physics/0601009?utm_source=chatgpt.com
3. https://scholar.google.com/?utm_source=chatgpt.com
4. https://www.webofscience.com/?utm_source=chatgpt.com
5. https://www.wipo.int/en/web/wipo-academy/programs/ip-elearning?utm_source=chatgpt.com
6. https://ipindia.gov.in/?utm_source=chatgpt.com
7. https://patentscope.wipo.int/?utm_source=chatgpt.com
8. https://patents.google.com/?utm_source=chatgpt.com
9. https://nptel.ac.in/courses/109106148?utm_source=chatgpt.com

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2 (WK1) (WK3)	2 (WK2)		2 (WK8)			1 (WK9)		1		1 (WK8)			
CO2	1 (WK1)	3 (WK1) (WK2)	1 (WK5)	2 (WK8)					1		1 (WK8)			
CO3	1 (WK4)	2 (WK2)	1 (WK5)			1 (WK7)	3 (WK9)				1 (WK8)			
CO4	1 (WK2)	2 (WK2)		1 (WK8)			1 (WK9)		1		1 (WK8)			

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	:	BEEA706P	Project Work	Semester	:	VII
L:T:P	:			Course Type	:	PROJ
Hours/Sem	Teaching	:		CIE Marks	:	50
	Learning (TW+SL)	:		SEE Marks	:	50
	Exam (CIE + SEE)	:		Total Marks	:	100
	Total Hrs.	:		Credits	:	09

Professional Competency:

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.

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.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	1 (WK5)	1 (WK8)							1 (WK8)	3	2	1
CO2	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	1 (WK5)	1 (WK8)	2 (WK2) (WK6)						1 (WK8)	3	3	1
CO3	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)		1 (WK8)	2 (WK2) (WK6)	1 (WK7)		2	2	2	1 (WK8)	2	3	1
CO4						1 (WK7)	2 (WK9)	2	2		1 (WK8)	2	2	1

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Professional Elective Course – III

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code		:	BEEA703E	Smart Grids	Semester	:	VII
L:T:P		:	3:0:0		Course Type	:	PEC
Hours/Sem	Teaching	:	42 Hrs		CIE Marks	:	50
	Learning (TW+SL)	:	42 Hrs		SEE Marks	:	50
	Exam (CIE+SEE)	:	06 Hrs		Total Marks	:	100
	Total Hrs.	:	90 Hrs		Credits	:	03

Professional Competency:

Apply smart grid technologies, computational tools, communication systems, renewable energy integration techniques, and optimization methods to analyze, evaluate, and develop intelligent, secure, and sustainable power system networks for modern electrical energy management applications.

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 component in grid.
2. Apply the suitable load flow analysis technique for existing 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 smart grid using standards as for the case studies.

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-2 (11 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-3 (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

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

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-4 (11 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.

Text Books:

1. James Momoh., "Smart Grid, Fundamentals of Design and Analysis", 1st Edition, Wiley, 2012.

Reference Books:

1. Clark W Gellings, "The Smart Grid, Enabling Energy Efficiency and Demand Side Response"- CRC Press, 2009.
2. Yokoyama, Nick Jenkins, "Smart Grid: Technology and Applications"- Wiley, 2012.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1 WK2 WK3 WK4)	2 (WK2 WK3 WK4)	1 (WK5)	1 (WK8)		1 (WK7)						3	2	1
CO2	3 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	2 (WK5)	2 (WK8)	3 (WK2 WK6)	1 (WK7)				1		3	2	1
CO3	3 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	3 (WK5)	2 (WK8)	3 (WK2 WK6)	2 (WK7)			1	1			2	2
CO4	3 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	3 (WK5)	3 (WK8)		2 (WK7)			1	2			3	

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEB703E	Electric Vehicles	Semester	: VII
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Develop the ability to understand the evolution, classification, components, energy storage systems, alternative energy sources, drive-train architectures, vehicle dynamics, and power flow control strategies of electric and hybrid vehicles for effective analysis and application.

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.

Unit-1 (11 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-2 (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-3 (11 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-4 (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 in Complex Hybrid.

Text Books:

1. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2003.

Reference Books:

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

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2 (WK1) (WK2) (WK3) (WK4)					2 (WK1) (WK5) (WK7)					1 (WK8)		1	2
CO2	2 (WK1) (WK2) (WK3) (WK4)		3 (WK5)	1 (WK8)							1 (WK8)		1	2
CO3	2 (WK1) (WK2) (WK3) (WK4)			2 (WK8)		2 (WK1) (WK5) (WK7)					1 (WK8)		1	2
CO4	2 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)		2 (WK8)							1 (WK8)		1	2

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEC703E	Solar Photovoltaic System Design	Semester	: VII
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE + SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Apply solar photovoltaic system design principles, performance analysis techniques, testing procedures, and integration methodologies to analyze, evaluate, and design standalone and grid-connected SPV systems for sustainable electrical energy applications.

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.

Unit-1 (10 Hours)

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

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

Unit-2 (11 Hours)

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.

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

Unit-3 (10 Hours)

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

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-4 (11 Hours)

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

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

Text Books:

1. Chetan Singh Solanki, “Solar Photovoltaic Technology and Systems – A Manual for Technicians, Trainers and Engineers”, PHI Learning Private Limited, New Delhi, 2014

Reference Books:

1. Chetan Singh Solanki, “Solar Photovoltaics – Fundamentals, Technologies and Applications”, PHI Learning Private Limited, New Delhi, 3rd Edition, 2015.

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2. Tiwari, G. N and Ghosal, M. K., “Fundamentals of Renewable Energy Sources”, Alpha Science International Ltd, New Delhi, 2007.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1 WK2 WK3 WK4)	2 (WK2 WK3 WK4)	1 (WK5)	2 (WK8)		1 (WK1)	2 (WK9)				1 (WK8)	3	1	2
CO2	3 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	2 (WK5)	1 (WK8)		1 (WK1)	2 (WK9)				1 (WK8)	3	2	2
CO3	2 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	2 (WK5)	3 (WK8)		2 (WK7)	2 (WK9)				1 (WK8)		2	
CO4	3 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	3 (WK5)	3 (WK8)		2 (WK7)	3 (WK9)				1 (WK8)		2	

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEED703C	Reactive Power Management	Semester	: VII
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Apply reactive power compensation techniques, transmission line performance analysis, harmonic mitigation methods, and reactive power coordination strategies to analyze, control, and improve power quality, voltage stability, and operational efficiency of electrical power systems.

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 load ability characteristics.
3. Identify type of harmonics in transmission line by calculating magnitude of harmonics.
4. Develop reactive power management scheme for utilities.

Unit-1 (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-2 (11 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-3 (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-4 (11 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.

Text Books:

1. T. J. E. Miller, "Reactive Power Control in Electric Power Systems", John Wiley & Sons NY, 1st Edition 2009.

Reference Books:

1. D. Tagare, "Reactive Power Management", TMH, 1st Edition, 2004.
2. Prabha Kundur, "Power System Stability and Control", TMH 9th reprint, 2007.

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Matrix to describe the mapping of COs with POs (considering Wks) and PSOs

Course Outcomes - COs	Program Outcomes and Wks											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1 WK2 WK3 WK4)	2 (WK2 WK3 WK4)	1 (WK5)	1 (WK8)		1 (WK7)						3	1	1
CO2	3 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	2 (WK5)	2 (WK8)		1 (WK7)							1	
CO3	2 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	2 (WK5)	2 (WK8)		2 (WK7)								2
CO4	3 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	3 (WK5)	3 (WK8)		2 (WK7)						3	2	

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEE703E	Power System Planning	Semester	: VII
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE + SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Plan, Analyze, and optimize power systems by integrating structural, economic, reliability, and operational aspects using modern tools and technique

Course Outcomes:

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

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

Unit-I (11 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-2 (11 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-3 (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-4 (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..

Text 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.

Reference Books:

1. R. L. Sullivan *Power System Planning*, 1st Edition, McGraw-Hill, 1977.
2. Xifan Wang, James McDonald, 1st Edition, McGraw-Hill, 1994.

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3. Jürgen Schlabbach, Power System Engineering: Planning, Design and Operation of Power Systems and Equipment, 1st Edition, VCH (Wiley), 2008.
4. M. A. Laughton, D. F. Warne, Power System Planning, 16th Edition, 2002.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	1 (WK5)		1 (WK6)						1 (WK8)	2	3	1
CO2	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	1 (WK5)		1 (WK6)						1 (WK8)	2	3	2
CO3	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	1 (WK5)	1 (WK8)	1 (WK6)						1 (WK8)	2	3	1
CO4	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	1 (WK5)	1 (WK8)	1 (WK6)						1 (WK8)	2	3	2

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEF703E	HVDC Transmission	Semester	: VII
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Upon completion of this course, students will gain professional competency in understanding and analyzing HVDC transmission systems, including converter operation and control strategies. They will be able to evaluate system performance, harmonics, filtering, protection, and stability issues, as well as examine MTDC configurations and perform AC/DC power flow analysis. This equips them with the skills to apply HVDC concepts effectively in real-world power system engineering problems.

Course Outcomes:

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.

Unit-1 (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-2 (11 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.

Unit-3 (11 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-4 (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

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terminal DC system.

Reference Books:

1. Prabha Kundur, "Power System Stability and Control", TMH, 5th reprint 2008.
2. EW Kimbark, "Direct current Transmission", Vol. No I, John Wiley, New York, 1971
3. K R Padiyar, "HVDC Power Transmission Systems Technology and System Interaction", (3rd Edition), New Age International Publishers, Reprint 2017.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	2 (WK8)			2 (WK9)					3	2	
CO2	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	2 (WK8)								2	3	2
CO3	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	2 (WK8)								2	3	3
CO4	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	2 (WK8)								3	3	3

Professional Elective Course – IV

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEA704E	Flexible AC Transmission Systems	Semester	: VII
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Competence in modelling, analysis, selection, and implementation of FACTS devices such as SVC, STATCOM, GCSC, TSSC, and TCSC for efficient, stable, and reliable operation of power transmission systems

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.

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-2 (11 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-3 (11 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-4 (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.

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Text 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.

Reference Books:

1. Prabha Kundur, Power System Stability and Control Tata McGraw Hill Publishers, New Delhi, 2006.
2. 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.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3)	2 (WK5)	2 (WK8)		1 (WK5)					1 (WK8)	3	2	2
CO2	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	3 (WK5)	2 (WK8)		1 (WK5)					1 (WK8)	2	2	1
CO3	3 (WK1) (WK2) (WK3) (WK4)	2 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	2 (WK8)		1 (WK5)					1 (WK8)	3	2	1
CO4	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)	2 (WK5)	2 (WK8)							1 (WK8)	3	1	

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEB704E	Battery Management Systems	Semester	: VII
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Demonstrate the ability to apply battery management system principles, state estimation techniques, battery health assessment methods, and cell balancing strategies to model, analyze, and optimize the performance, safety, and reliability of lithium-ion battery packs in electric and energy storage applications.

Course Outcomes:

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

1. Analyze 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

Unit-1 (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-2 (11 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-3 (11 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 x_i and y_i .

Unit-4 (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

Syllabus for B.E. (E&EE) VII - Semester
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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 I: Battery Modeling , Artech House September 2015

Matrix to describe the mapping of COs with POs (considering Wks) and PSOs

Course Outcomes - COs	Program Outcomes and Wks											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK3 WK4)	2 (WK3 WK4)		1 (WK8)								3	2	1
CO2	3 (WK2 WK3 WK4)	3 (WK3 WK4)		2 (WK8)								3	3	1
CO3	3 (WK2 WK3 WK4)	3 (WK3 WK4)		2 (WK8)								3	3	1
CO4	3 (WK2 WK3 WK4)	3 (WK3 WK4)	3 (WK5)	2 (WK8)								3	3	1

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEC704E	Energy Conservation, Audit and DSM	Semester	: VII
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.	: 90 Hrs	Credits	: 03

Professional Competency:

Develop the ability to analyze, evaluate, design, and implement energy conservation, energy auditing, demand side management, and energy management techniques for efficient utilization of energy resources in industrial, commercial, agricultural, transportation, and domestic sectors while promoting sustainable development.

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.

Unit-1 (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-2 (11 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-3 (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-4 (11 Hours)

Energy Conservation: Introduction, Results of energy conservation, Principles of energy

Syllabus for B.E. (E&EE) VII - Semester
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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.

Text 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.

Reference Books:

1. Albert Thumann, “Fundamentals of Energy Engineering”, Prentice Hall Inc, Englewood Cliffs, New Jersey.
2. Gupta, B. R., “Generation of Electrical Energy”, Eurasia Publishing House Pvt. Ltd., New Delhi, 6th, 2006

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK3) (WK4)	2 (WK2)	1 (WK2)			1 (WK5) (WK7)						2		
CO2	3 (WK1) (WK2) (WK3) (WK4)	2 (WK2)	1 (WK2)			1 (WK5) (WK7)						3		
CO3	3 (WK1) (WK3) (WK4)	2 (WK2) (WK3)	1 (WK2)			1 (WK5) (WK7)						3		
CO4	3 (WK1) (WK3) (WK4)	2 (WK2)	1 (WK2)			1 (WK5) (WK7)						2		

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEED704E	Energy Efficient Motors	Semester	: VII
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Develop the ability to analyze, evaluate, and implement energy-efficient motor systems, power factor improvement techniques, and adjustable speed drive applications for achieving energy conservation, improved industrial performance, and sustainable electrical engineering practices.

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.

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-2 (11 Hours)

Power Factor: The power factor in sinusoidal systems, power factor improvement, power factor with nonlinear loads, Harmonics and the power factor.

Unit-3 (11 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-4 (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.

Text 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 Utilization", Hemisphere Publishers, Washington, 1988.
3. Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford, 1981.

Reference Books:

1. Dryden. I.G.C., "The Efficient Use of Energy", Butterworths, London, 1982
2. Turner. W.C., "Energy Management Hand book", Wiley, New York, 1982.
3. Murphy. W.R. and G. Mc KAY, "Energy Management", Butterworths, London 1987.

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Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	I	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)		I (WK8)								3		
CO2	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)		I (WK8)								3		
CO3	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)		I (WK8)								3		
CO4	3 (WK1) (WK2) (WK3) (WK4)	3 (WK1) (WK2) (WK3) (WK4)		I (WK8)								3		

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEE704E	Wind Energy Conversion Systems	Semester	: VII
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Apply wind energy conversion principles, aerodynamic analysis, electrical generation techniques, and system design methodologies to analyze, evaluate, and develop standalone and grid-connected wind energy systems for sustainable power generation applications.

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.

Unit-1 (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-2 (11 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-3 (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-4 (11 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.

Text Books:

1. Bhadra, S. N., Kashta, D., and Bannerjee, S., Wind Electrical Systems, Oxford University

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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
Reference Books:
1. D. Mukhaerjee and S. Chakrabarti, Fundamentals of Renewable Energy Systems, New Age International Publishers New Delhi, 2007.
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.

Matrix to describe the mapping of COs with POs (considering Wks) and PSOs

Course Outcomes - COs	Program Outcomes and Wks											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1 WK2 WK3 WK4)	2 (WK2 WK3 WK4)	1 (WK5)			1 (WK7)						3		1
CO2	3 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	1 (WK5)	2 (WK8)		1 (WK7)						2		2
CO3	2 (WK1 WK2 WK3 WK4)	3 (WK1 WK2 WK3 WK4)	2 (WK5)	2 (WK8)		1 (WK7)							1	2
CO4	3 (WK1 WK2 WK3 WK4)	3 (WK1 WK2 WK3 WK4)	3 (WK5)	2 (WK8)		1 (WK7)						3	1	

Syllabus for B.E. (E&EE) VII - Semester
(For Students Admitted to I Year in AY 2024–25)

Course Code	: BEEF704E	AI Applications to Power System	Semester	: VII
L:T:P	: 3:0:0		Course Type	: PEC
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE + SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 03

Professional Competency:

Apply artificial intelligence techniques such as neural networks, fuzzy logic, genetic algorithms, and intelligent systems to analyze, optimize, and solve complex problems in electrical power systems including voltage control, security assessment, maintenance scheduling, and load forecasting.

Course Outcomes:

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

1. To understand the fundamentals of Artificial Intelligence, including its history, applications, and significance in power systems.
2. To apply AI techniques such as Artificial Neural Networks, Fuzzy Logic, and Genetic Algorithms for solving power system challenges like voltage control, security assessment, and demand forecasting.
3. To optimize power system operations using AI-based approaches for maintenance scheduling, fault detection, and energy management.
4. To analyse AI-driven models and compare their effectiveness with conventional power system solutions.

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 (11 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 (11 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.

Text Books:

1. N. P. Padhy, "Artificial Intelligence and Intelligent Systems", OXFORD University Press, New Delhi, 1st Ed, 2005.

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2. Stamations V. Kartalopoulos, “Understanding Neural Networks and Fuzzy Logic: Basic concepts and Applications”, Prentice Hall India Private Limited, New Delhi, 1st Ed, 2002.

Reference Books:

1. Abhisek Ukil, “Intelligent Systems and Signal Processing in Power Engineering, Springer Berlin Heidelberg”, New York, 1st Ed, 2002.
2. Kevin Warwick, Arthur Ekwue and Raj Aggarwal, “Artificial Intelligence Techniques in Power Systems”, IEEE Power Engineering Series, UK, 1st Ed, 1997.
3. Rajashekran, S. and VijaylaksmiPai, G.A., “Neural Networks, Fuzzy Logic and Genetic Algorithm Synthesis and Applications”, Prentice–Hall of India Private Limited, 1st Ed, 2004.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1 WK2 WK3 WK4)	2 (WK2 WK3 WK4)	1 (WK5)									2	3	1
CO2	3 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	1 (WK5)	2 (WK8)								2		2
CO3	2 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	2 (WK5)	2 (WK8)		1 (WK7)							3	2
CO4	3 (WK1 WK2 WK3 WK4)	3 (WK2 WK3 WK4)	3 (WK5)	3 (WK8)		1 (WK7)	1 (WK9)						1	3

Syllabus for B.E. (E&EE) VIII - Semester
(For Students Admitted to I Year in AY 2024-25)

Course Code	: BEEA8011	Internship	Semester	: VIII
L:T:P	:		Course Type	: Internship
Hours/Sem	Teaching		CIE Marks	: 50
	Learning (TW+SL)		SEE Marks	: 50
	Exam (CIE+SEE)		Total Marks	: 100
	Total Hrs.		Credits	: 10

Professional Competency:

Demonstrate the ability to apply engineering knowledge, technical skills, professional ethics, communication, teamwork, and problem-solving abilities in an industrial environment by executing assigned tasks, documenting learning experiences, and integrating theoretical concepts with engineering practice.

Course Outcomes:

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

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

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.

Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes - COs	Program Outcomes and WKs											Program Specific Outcomes - PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 WK3 WK4	–	–	–	–	–	–	–	–	–	–	2	2	3
CO2	2 WK4	–	–	3 WK8	3 WK6	–	–	–	2	–	–	2	1	3
CO3	–	–	–	–	–	–	2 WK9	3	3	2	–	2	1	3
CO4	–	2 WK3 WK4	–	–	–	2 WK7	–	–	–	–	2 WK8	1	1	3

Assessment Methods and Rubrics

Assessment Methods and Rubrics

Theory Courses

Non-Integrated Course

a. Continuous Internal Evaluation (CIE) and Assignment

CIE carries 50% of the total marks for any course. The mechanism designed to ensure a rigorous evaluation of CIE for theory is outlined below. Additionally, assignments are assessed before each CIE, covering all COs of corresponding units.

i. Assessment Process of CIE

- A CIE question paper and scheme of solution of course will be prepared by respective faculty members.
- A scrutiny committee will scrutinize the CIE question paper and scheme of solution to adhere the questions covering entire syllabus, Marks distribution, Blooms Levels and aligned with COs and POs/PSOs.
- After the examination, faculty members evaluate the answer papers and discusses the scheme of solution with students for better understanding the distribution of marks.

ii. Assessment of Assignment

- A set of question bank will be prepared by faculty covering the syllabus, in align with COs and POs/PSOs and unit-wise assignment questions will be shared with students before one week of CIE. Assignments are assessed before every CIE with questions covering all COs of corresponding units. Assignment shall be either or both questions or field works or quizzes covering entire syllabus. Assignments are assessed to ensure consistency and alignment with COs and POs/PSOs. The evaluation process typically includes the following process:
 - Question and answer
 - Quizzes
 - Course Project
 - Field Experiment

iii. Marks allotment

- CIE first test - 40 marks reduced 20
- CIE second test – 40 marks reduced to 20
- Assignment/Seminar/Course project/Case study/Quiz etc.: 10 Marks
- Total marks of CIE and Assignments is 50, minimum eligibility marks for SEE is 20.

b. Semester End Examination (SEE)

SEE assessment carries 100 marks.

SEE comprises of 1 test of 3 hours for 100 marks, which is scaled down to 50 marks. The format of SEE has 8 questions of 20 marks each taking two questions from each unit of syllabus. A student is expected to answer any 5 questions taking at least one question from each unit.

Assessment Methods and Rubrics

Integrated Course

a. Continuous Internal Evaluation (CIE) and Assignment

CIE carries 50% of the total marks for any course. The mechanism designed to ensure a rigorous evaluation of CIE for theory is outlined below. Additionally, assignments are assessed before each CIE, covering all COs of corresponding units.

i. Assessment Process of CIE

- A CIE question paper and scheme of solution of course will be prepared by respective faculty members.
- A scrutiny committee will scrutinize the CIE question paper and scheme of solution to adhere the questions covering entire syllabus, Marks distribution, Blooms Levels and aligned with COs and POs/PSOs.
- After the examination, faculty members evaluate the answer papers and discusses the scheme of solution with students for better understanding the distribution of marks.

ii. Assessment of Assignment

- A set of question bank will be prepared by faculty covering the syllabus, in align with COs and POs/PSOs and unit-wise assignment questions will be shared with students before one week of CIE. Assignments are assessed before every CIE with questions covering all COs of corresponding units. Assignment shall be either or both questions or field works or quizzes covering entire syllabus. Assignments are assessed to ensure consistency and alignment with COs and POs/PSOs. The evaluation process typically includes the following process:
 - Question and answer
 - Quizzes
 - Course Project
 - Field Experiment

iii. Marks allotment

Theory Component:

- Two CIE tests and each test for 40 marks (1½ hours), later scale down to 20 Marks.
- Assignment/Seminar/Course project/Case study/Quiz etc.: 10 Marks
- Total marks for CIE theory component : 50
- Minimum marks required for eligibility to SEE : 20
- Total marks for CIE theory component is 50 and later scale down to 25

Practical Component

- On completion of every experiment in the laboratory, the students shall be evaluated & marks shall be awarded on the same day.
- 30 marks for regular conduction and journal write-up/report: Each experiment shall be evaluated for 10 marks. (If 10 experiments, then 100 marks), Scaled down to 30 Marks and Minimum marks to be scored is 12.
- 20 marks for lab CIE test (duration 02 hours) 5 marks for write-up, 10 marks for conduction, calculation, result etc. and 5 marks for viva-voce

Assessment Methods and Rubrics

- The laboratory test shall be conducted at the end of the semester
- Laboratory test shall be conducted with two internal faculty members.
- Minimum marks to be scored is 8.
- Total marks for CIE practical component: 50
- Minimum marks required for eligible to SEE: 20
- Total marks for CIE lab component is 50 and later scale down to 25

Semester End Examination (SEE)

SEE assessment carries 100 marks.

- SEE comprises of 1 test of 3 hours for 100 marks, which is scaled down to 50 marks. The format of SEE has 8 questions of 20 marks each taking two questions from each unit of syllabus. A student is expected to answer any 5 questions taking at least one question from each unit.
- The theory portion of the Integrated Course shall be for both CIE and SEE, whereas the practical portion will have CIE component only.

Assessment Methods and Rubrics

Laboratory Courses

The laboratory courses are designed to develop practical skills, experimental competency, analytical ability, and professional ethics through continuous assessment. The Continuous Internal Evaluation (CIE) emphasizes regular laboratory performance, timely completion of experiments, maintenance of observation books and journals, and demonstration of conceptual understanding through viva-voce and laboratory tests. The assessment methodology ensures constructive alignment with the Course Outcomes (COs), Program Outcomes (POs), and Program Specific Outcomes (PSOs), thereby promoting experiential learning and continuous improvement. The detailed assessment scheme for laboratory courses is as follows:

Regular Conduction (Total 30 Marks)

- On completion of every experiment/program in the laboratory, the students shall be evaluated & marks shall be awarded on the same day.
- 30 marks for regular conduction and journal write-up/report: Each experiment shall be evaluated for 10 marks. 10 experiments, 100 marks. Scaled down to 30 Marks and Minimum marks to be scored is 12.
- 20 marks for lab CIE test (duration 02 hours) 5 marks for write-up, 10 marks for conduction, calculation, result etc. and 5 marks for viva-voce
- The laboratory test shall be conducted at the end of the semester
- Laboratory test shall be conducted by internal faculty member.
- Minimum marks to be scored are 8.
- Total marks for CIE practical component: 50 (later scale down to 25)
- Minimum marks required for eligible to SEE: 20

CIE- Conduction + Journals - (Total 30 Marks)

Sl.	Assessment Component	Marks Allocated	Evaluation Criteria
1.	Write-up in Observation book (each experiment)	2 marks	Aim of the experiment, procedure and background theory
2.	Experiment conduction, calculations, graph, results, viva	6 marks	Accuracy in setup, observations, analysis, result interpretation, oral questioning
3.	Journal/Record writing	2 marks	Completeness, neatness, timely submission
Total (Conduction + Journals)		10 Marks	
Total if 10 experiments, then 100 marks - scaled down to 30			

CIE-Test (Total 20 Marks)

Sl.	Assessment Component	Marks Allocated	Evaluation Criteria
1.	Write-up during CIE test	5 Marks	Written understanding of experiment and procedure
2.	Experiment conduction, calculations, graph and result	10 marks	Correct procedure, experimental accuracy, result matching theory
3.	Viva-voce (oral)	5 Marks	Conceptual questions on procedure, safety, interpretation
Total Lab CIE		20 marks	

Thus, the total CIE = 30 (Regular Lab) + 20 (Lab Test) = 50 Marks.

Assessment Methods and Rubrics

A minimum of 20 marks out of 50 is required to pass the laboratory component. This method ensures continuous engagement, encourages regular work, and reinforces both practical skills and theoretical understanding, while being constructively aligned to Course Outcomes (COs) and Program Outcomes (POs/PSOs). Further, SEE is assessed for 50 marks which is distributed as follows:

SEE (Total Marks=50)

Sl.	Assessment Component	Marks Allocated	Evaluation Criteria
1.	Write-up	13 Marks	Statement of aim, apparatus, procedure, neat diagrams
2.	Experiment conduction, calculations, graph and results	25 marks	Setup execution, observations, analytical skills, final output
3.	Viva voce (oral)	12 Marks	Oral examination on theoretical background, experimental logic

Assessment Methods and Rubrics

Assessment of Projects (Mini Project & Major Project)

Projects form a vital component of the academic curriculum, providing students with the opportunity to integrate, apply, and demonstrate the knowledge and skills acquired throughout the programme. Project work fosters independent thinking, problem-solving ability, innovation, teamwork, effective communication, and professional practices, thereby contributing significantly to the attainment of Program Outcomes (POs) and Program Specific Outcomes (PSOs). The evaluation of project work is carried out through a systematic assessment process based on well-defined rubrics aligned with the targeted POs and PSOs. Continuous Internal Evaluation (CIE) monitors the progress through regular reviews, interim reports, presentations, and viva-voce, while the Semester End Examination (SEE) assesses the overall quality of the project based on the final report, implementation, demonstration, presentation, and viva-voce.

The following project evaluation process is followed

- Batch formation of students is done based on the previous semester grade point in such a way that each batch includes student members having different grades: A, B, C, D (each batch with minimum 2 and maximum 4 members).
- Based on the expertise of the faculty, guide/mentors will be allotted to each batch.
- Students in consultation with the allotted guide/mentors will identify the project ideas through:
 - real time engineering challenges/issues faced in the society
 - referring to SCOPUS/SCI/ Q1-Q4 journals, conference proceedings
 - problems faced in industries referred through MoU partners
 - upgrading of previously done project with added features
- Students take up literature survey, formulate the problem of the project, define the project objectives and prepare implementation schedule.
- Project work, is implemented and demonstrated.
- The project work is carried out in the department and can also be collaborated with a reputed industry/ research organization.

Major Project (IV Year)

The Major Project represents the culmination of the undergraduate engineering programme, providing students with an opportunity to integrate and apply the knowledge, technical skills, and professional competencies acquired throughout the curriculum to address complex engineering problems. It emphasizes problem identification, system design and development, experimentation, validation, analysis, innovation, project management, teamwork, and effective technical communication. Students are expected to demonstrate engineering judgement, ethical responsibility, and the ability to develop sustainable and practical engineering solutions. The project is evaluated through a systematic assessment process based on well-defined rubrics aligned with the targeted Course Outcomes (COs), Program Outcomes (POs), and Program Specific Outcomes (PSOs). Continuous Internal Evaluation (CIE) monitors the progress through periodic reviews, while the Semester End Examination (SEE) assesses the overall quality of the project through implementation, demonstration, technical presentation, project report, and viva-voce.

For all project courses, a student shall secure a minimum of 50% of the total CIE marks to

Assessment Methods and Rubrics

become eligible for the Semester End Examination (SEE). In addition, the student shall secure a minimum of 50% of the marks in the Semester End Examination (SEE) to be declared as having successfully passed the project course.

Rubrics for	Phase	Period (Duration)	Rubrics #	Marks	Evaluation by
CIE	Evaluation - 1 (CIE-1)	Within first six weeks of semester	R1	15	Committee consisting of HOD/ Nominee + Project Coordinator/ Nominee of Project Coordinator + Guide(s)
	Evaluation - 2 (CIE-2)	Two weeks before the last working day of the semester.	R2	15	
	Evaluation – 3 (Report Submission)	In the last week of the semester	R3	20	Guide(s)
SEE	Semester End Examination	During Semester End Examination	R4	50	Committee consisting of HOD/ Nominee + External Examiner + Project Coordinator

Rubrics for Projects (Major Projects- IV Year)

R1. Synopsis presentation (Before the end of the first one and half months of the semester): Total Marks of 15

Evaluation Criteria	Score/Marks			Total Marks	Evaluation by
	Poor (Needs Improvement) (1)	Average (Acceptable) (2)	Very good (Proficient) (3)		
Motivation And Rationale behind the project	• Demonstrates limited motivation and lacks consistent drive to complete tasks or achieve project goals. • The project's need statement and alignment with solving real-world problems in a meaningful or challenging domain is inadequately addressed.	• Moderately motivated and has some interest to achieve a goal, accomplish a task, or work • Need for the process /product that offers viable solutions to accomplish work towards expectations in a challenging and interesting area is okay and acceptable	• Highly motivated and desirous to achieve a goal, accomplish a task, or work • Need for the process /product that offers viable solutions to accomplish work towards expectations in a challenging and interesting area is good	15	Committee consisting of HOD/ Nominee + Project Coordinator + Guide(s). Each will be evaluated for 15 marks and the average of all three is the marks awarded.
Literature review	• Fewer than three technical references have been reviewed, and the literature surveyed lacks strong relevance to the topic.	• Three to five technical papers are reviewed and moderately relevant	• More than 5 technical papers from reputed journals are made and reviews are quite relevant to the project work		

Assessment Methods and Rubrics

Objectives, Project plan	Only a few objectives of the project are clearly articulated, and the project plan lacks clarity and structure.	Incomplete justification to the objectives proposed and moderately defined project plan	Good justification to the objectives and well-defined project plan		
Proposed methodology	Division of project work into modules but improper selection of design approaches and design methodology and not properly justified	Division of project work into modules with proper selection of design approaches and design methodology but not properly justified.	Division of project work into modules and good selection of design approaches, appropriate design methodology with proper justification		
Presentation	- Contents of presentations are not appropriate and not well arranged. - Exhibits minimal eye contact during presentation and communicates with insufficient clarity or audibility	- Contents of presentations are appropriate but not well arranged - Exhibits minimal eye contact during presentation and communicates with insufficient clarity or audibility	- Contents of presentations are appropriate and well arranged. - Satisfactory demonstration, clear voice with good spoken language and good non-verbal communication		

R2. Project Complete presentation (Before 15 days of the end of the Last month in the semester):Total Marks of 15

Evaluation Criteria	Score/Marks			Total Marks	Evaluation By
	Poor (Needs Improvement) (1)	Average (Acceptable) (2)	Very good (Proficient) (3)		
Involvement in the work and ability to work in a team	Less involved in the work	Would have involved still more	Sincerely involved in the work and very hard working and has good interest	15	Committee consisting of HOD/ Nominee + Project Coordinator + Guide(s). Each will be evaluated for 15 marks and the average of all three is the marks awarded.
Incorporation of Suggestions made in the previous review	Some changes are made as per modifications suggested during previous evaluation	All major changes are made as per modifications suggested during previous evaluation	Changes are made as per modifications suggested during previous evaluation and good justification		
Results and Discussion	Results are not presented properly, Project work is not	Results presented are not much satisfactory, Project work summary and	Results are presented in good manner, Project work summary and		

Assessment Methods and Rubrics

	summarized and concluded Future extensions in the project are not specified	conclusion not very appropriate. Future extensions in the project are not specified	conclusion not very appropriate. Future extensions in the project are specified		
Demonstration/ Conclusion	Modules are not in proper working form that further leads to failure of integrated system, Contents of presentations are not appropriate and not well delivered	Modules are working well in isolation and properly demonstrated, Modules of project are not properly integrated, Contents of presentations are appropriate but not well delivered	Each module working well and properly demonstrated, Integration of all modules done and system working is very satisfactory		
Presentation	Contents of presentations are not appropriate and not well arranged. Very less eye contact and unclear voice	Contents of presentations are appropriate but not well arranged. Eye contact with few people and unclear voice	Contents of presentations are appropriate and well arranged. Satisfactory demonstration, clear voice with good spoken language and good eye contact		

R3: Evaluation by the guide (In the last week of the semester): Evaluate by Guide and Total Marks of 20

Evaluation Criteria	Score/Marks				Total Marks	Evaluation By
	Needs improvement (Poor) (2)	Acceptable (Average) (3)	Satisfactory (Good) (4)	Proficient (Excellent) (5)		
Technical Knowledge gained through project work	Poor knowledge and no awareness related to project.	Lacks sufficient knowledge and Awareness.	Fair knowledge and awareness related to the project.	Extensive knowledge and awareness related to the project.	20	Guide(s)
Regularity and Attendance	Irregular and inconsistent in work	Reports to the guide but lacks Consistency	Reports to the guide very often but not very consistent	Reports to the guide regularly and consistent in work		
Incorporation of Suggestions made periodically	Major changes are not made as per modifications suggested	Few changes are made as per modifications suggested	Changes are made as per demonstrated suggested	Changes are made as per demonstrated suggested and innovations are added		
Organization and structure of Project Report	Project report not prepared according to the specified format, References and	Project report is according to the specified format but some	Project report is according to the specified format, References	Project report is according to the specified format, References and citations are		

Assessment Methods and Rubrics

	citations are not appropriate	mistakes, Insufficient references and citations	and citations are appropriate but not mentioned well	appropriate and well mentioned		
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R4: SEE Evaluation for Project Phase (During SEE):Total Marks of 50

Evaluation Criteria	Score				Total Marks	Evaluation By
	Needs improvement (Poor) (4)	Acceptable (Average) (6)	Satisfactory (Good) (8)	Proficient (Excellent) (10)		
Presentation	Contents of presentations are not appropriate and not well delivered, Poor eye contact with audience and unclear voice	Contents of presentations are appropriate but not well delivered, Eye contact with only few people and unclear voice	Contents of presentations are demonstrate and well delivered, Clear voice with good spoken language but less eye contact with audience	Contents of presentations are appropriate and well delivered, Proper eye contact with audience and clear voice with good spoken language	50	Committee consisting of HOD/ Nominee + External Examiner + Project Coordinator
Designs and implementation	Proper design methodology is not followed resulting into poor design , No modern tools are used to implement, Work contributes very less to the world	Proper design methodology is followed, Design lacks, very less modern tools are used to implement, the work contributes to the world in little way	Proper design methodology is followed, Design is done but not perfect, few modern tools are used to implement, the work 180emonstrat to the world in some way	Proper design methodology is followed, Design is perfect, Modern tools are used to implement, the work contributes to the world in greater way		
Results and Demonstration	Some of the defined objectives are achieved. Modules are not in proper working form that further leads to failure of integrated system	All defined objectives are achieved. Modules are working well in isolation and properly demonstrated Modules of project are not properly integrated	All defined objectives are achieved and working well and demonstrated.	All defined objectives are achieved and evident from the results.		
Project report	Project report not prepared according to the specified format. References and citations are not appropriate	Project report is according to the specified format with mistakes.In-sufficient references and citations	Project report is according to the specified format.	Project report is according to the specified format.		
Viva – Voce	Answered 25% of questions related to design, implementation and	Answered 50% of questions related to design, implementation and	Answered 75% of the questions related to design, implementation	Answered more than 90% of questions related to design,		

Assessment Methods and Rubrics

	applications of project work	applications of project work.	and applications of project work	implementation & applications		
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Mini Project (III Year)

The Mini Project is intended to provide students with an opportunity to apply the engineering knowledge acquired during the initial stages of the programme to solve real-world problems through a systematic engineering design process. It encourages students to identify practical problems, carry out literature surveys, generate and evaluate alternative solutions, develop models or prototypes, and demonstrate engineering creativity, teamwork, and communication skills. The Mini Project serves as a preparatory stage for the Major Project by fostering innovation, independent learning, analytical thinking, and problem-solving abilities. The assessment is carried out through structured rubrics aligned with the targeted Course Outcomes (COs), Program Outcomes (POs), and Program Specific Outcomes (PSOs) to ensure constructive alignment and continuous improvement.

For all project courses, a student shall secure a minimum of 50% of the total CIE marks to become eligible for the Semester End Examination (SEE). In addition, the student shall secure a minimum of 50% of the marks in the Semester End Examination (SEE) to be declared as having successfully passed the project course.

Rubrics for	Phase	Period (Duration)	Rubrics #	Marks	Evaluation by
CIE	Evaluation - 1 (CIE-1)	Within first six weeks of semester	R1	15	Committee consisting of HOD/ Nominee + Project Coordinator/ Nominee of Project Coordinator + Guide(s)
	Evaluation - 2 (CIE-2)	Two weeks before the last working day of the semester.	R2	15	
	Evaluation – 3 (Report Submission)	In the last week of the semester	R3	20	Guide(s)
SEE	Semester End Examination	During Semester End Examination	R4	50	Committee consisting of HOD/ Nominee + External Examiner + Project Coordinator

Rubrics for Mini Projects (III Year)

R1: Rubrics to evaluate mini-project in the beginning of semester: Within first six weeks from the start of semester

Evaluation Criteria	Needs improvements (Poor) (2)	Acceptable (Average) (3)	Satisfactory (Good) (4)	Proficient (Very good) (5)	Total marks	Evaluated by
Articulate problem statements and identify objectives	Problem statement and objectives are not clear	Problem statement is clear and objectives are not in line with problem statement	Problem statement is clear and objectives are not completely defined.	Problem statement is clear and objectives are completely defined	15	Committee consisting of HOD/ Nominee + Project Coordinator + Guide(s).
Identify existing	Not able to identify	Not able to identify	Able to identify	Able to identify		

Assessment Methods and Rubrics

processes/ solution methods for solving the problem, including forming justified approximations and assumptions	existing solution for solving the problem. The assumptions, approximations and justifications are identified but not clear	existing solution for solving the problem. But assumptions and approximations are aligned to the objectives.	existing solution for solving the problem. Assumptions, and approximations are clear	existing solution for solving the problem. and assumptions, approximations and justifications are clear		Each will be evaluated for 15 marks and the average of all three is the marks awarded.
Compare and contrast alternative solution processes to select the best process	Not able to compare alternative solution processes	Able to compare alternative solution processes but could not contrast clearly	Able to compare alternative solution processes and contrast clearly but not able to select best process	Able to compare alternative solution processes, contrast it and also able to select best process		

R2: Rubrics to review mini-project: Before 15 days from the end of semester

Evaluation Criteria	Needs improvements (Poor) (2)	Acceptable (Average) (3)	Satisfactory (Good) (4)	Proficient (Very good) (5)	Total marks	Evaluated by
Apply formal idea generation tools to develop multiple engineering design solutions and Identify suitable criteria for evaluation of alternate design solutions	Able to identify but not able to use it effectively. Able to identify criteria but not able to use them	Able to use the tool but not able to generate engineering designs. Able to use criteria but not able to compare alternatives	Able to generate engineering designs but not able to justify. Not able to justify the comparison with criteria	Able to generate engineering designs with justification. Able to justify the comparison with criteria	15	Committee consisting of HOD/ Nominee + Project Coordinator + Guide(s). Each will be evaluated for 15 marks and the average of all three is the marks awarded.
Apply formal decision-making tools to select optimal engineering design solutions for further development	Able to identify but not able to choose optimum one	Able to identify optimum one but not able to use it	Able to use optimum one but not able to justify	Able to use optimum one with justification		
Build models/ prototypes to develop diverse set of design solutions and develop drawings	Able to choose the tool but not able to use it effectively	Able to use the tool but not able to generate alternatives	Able to generate alternatives but not able to justify the best solution	Able to generate and justify the best solution		

R3: Rubrics for evaluation by the guide(s): Before one week from the end of semester

Evaluation Criteria	Score/Marks				Total Marks	Guides
	Needs improvement (Poor) (2)	Acceptable (Average) (3)	Satisfactory (Good) (4)	Proficient (Excellent) (5)		
Identify engineering systems, variables, and parameters	Engineering systems are identified but not clear. Variables, and	Engineering systems are clear. Variables, and	Engineering systems are identified. Variables, and	Engineering systems are identified. Variables, & parameters	20	Guide(s)

Assessment Methods and Rubrics

to solve the problems	parameters to solve the problems are not defined	parameters to solve the problems are not defined	parameters to solve the problems are partially defined	to solve the problems are completely defined		
Technical Knowledge and Awareness related to the Project	Poor knowledge and no awareness related to project	Lacks sufficient knowledge and Awareness	Fair knowledge and awareness related to the project	Extensive knowledge and awareness related to the project		
Regularity and Attendance	Irregular and inconsistent in work	Reports to the guide but lacks consistency	Reports to the guide very often but not very consistent	Reports to the guide regularly and consistent in work		
Read, understand and interpret technical and non-technical information	Able to identify non-technical information	Able to read technical and non-technical information, but could not understand and interpret	Able to read, understand technical and non-technical information, but could not interpret	Able to read, understand and interpret technical and non-technical information		

R4: Rubrics for SEE evaluation

Evaluation Criteria	Very poor (2)	Poor (4)	Average (6)	Good (8)	Very good (10)	Total marks	Evaluated by
Generate information through appropriate tests to improve or revise design	Not able to identify suitable tests to be done	Able to identify but not able to follow testing procedure	Able to follow testing procedures but not able to collect information	Able to collect information but not able to apply it for improvement	Able to apply information for the improvement	50	Committee consisting of HOD/ Nominee + External Examiner + Project Coordinator
Use appropriate procedures, tools and techniques to conduct experiments and collect data	Not able to identify tools, techniques and procedures	Able to identify but not able to conduct experiments	Able to conduct experiments but not able to follow procedure	Able to follow procedure but not able to collect data	Able to collect data as per the standards		
Analyze data for trends and correlations, stating possible errors and limitations	Not able to understand data	Able to understand but not able to analyze data	Able to analyze data but not able to correlate them	Able to correlate but not able to identify errors and limitations	Able to identify errors and limitations		
Deliver effective oral presentations to technical and non-technical audiences	Could not deliver effective presentations.	Could not deliver presentation, but presentation was prepared	Able to deliver fair presentation but not able to answer to the audiences	Deliver effective presentations but able to answer partially to	Deliver effective presentation and able to answer all queries of the audience.		

Assessment Methods and Rubrics

		and attempted.		the audience queries.			
Present results as a team, with smooth integration of contributions from all individual efforts	No Contribution from an individual to a team	Contributions from an individual to a team is minimal	Contributions from an individual to a team is moderate	A contribution from an individual to a team is good but not well groomed in team.	Contribution from an individual to a team is good and results in an integrated team presentation.		

Assessment Methods and Rubrics

Internship

The Industry Internship forms an integral component of the undergraduate engineering curriculum, providing students with an opportunity to bridge the gap between theoretical knowledge acquired in the classroom and its practical application in industrial and professional environments. The internship enables students to gain exposure to real-world engineering practices, industrial processes, organizational culture, professional ethics, and emerging technologies. It fosters experiential learning by enhancing technical competence, problem-solving ability, communication skills, teamwork, adaptability, and lifelong learning, while developing an understanding of workplace responsibilities and professional conduct. The internship also provides valuable exposure to industry expectations and contemporary engineering challenges, thereby improving students' employability and preparedness for professional practice. The performance of students during the internship is assessed through a comprehensive evaluation process comprising continuous assessment by the industry mentor and the institute, along with the Semester End Evaluation (SEE), based on well-defined rubrics aligned with the Course Outcomes (COs), Program Outcomes (POs), and Program Specific Outcomes (PSOs).

Student's Diary/ Daily Log

Student's Diary and Internship Report shall be submitted by the students along with attendance record and an evaluation sheet duly signed by the internal guide, immediately after the completion of the internship. It will be evaluated based on the following criteria (Sample diary copy is enclosed):

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Drawings, sketches and data recorded.
- Thought process and recording techniques used.
- Organization of the information.

Internship Report

The Internship report will be evaluated based on following criteria:

- Originality: Ensures the report reflects the student's own learning, observations, and reflections.
- Adequacy and Purposeful Write-up: Measures the completeness and clarity with which the student explains their training experience.
- Organization, Format, Drawings, Sketches, Style, and Language etc.: Evaluates the report structure, use of visuals, formatting, and professional communication skills.
- Variety and Relevance of Learning Experience: Assesses the diversity of tasks undertaken and their connection to electrical/electronic engineering domains.
- Practical Applications, Relationships with Basic Theory and Concepts: Examines how effectively the student connects industry practices with theoretical knowledge gained in the program.

Evaluation through Seminar Presentation/Viva-Voce at the Institute

The student will give a seminar based on his/her training/internship report, before an evaluation committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Quality of content presented.
- Proper planning for presentation.

Assessment Methods and Rubrics

- Effectiveness of presentation.
- Depth of knowledge and skills.
- Attendance record, daily diary, departmental reports shall also be analyzed along with the Report.

Scheme of Evaluation for Industry Internship

Students undertaking internship will maintain a diary of daily activities and submit monthly progress reports to their guides. Regular updates and communication with the guide are essential to ensure alignment with internship objectives. The final report shall reflect the student's original work, include authorized supporting materials with proper citations, and be professionally presented without undue criticism. A copy of the report will be submitted to both the guide and the internship provider.

The industry guide will issue a recommendation letter to state whether the intern,

- Exceeded the expectations of the internship.
- Met the expectations of the internship.
- Did not meet the expectations of the internship.
- Did work to a satisfactory level.
- Did an unsatisfactory internship.
- And same will be attached in the report.

Evaluation is carried out based on industry representative and departmental evaluation committee/faculty. Further, marks are assigned based on Annex. I and Annex 2.

Industry Representative	
Evaluation Criteria	Marks
Regularity in maintenance of the diary	10
Quality of Work	10
Adequacy & quality of information recorded	10
Ability to Learn	10
Initiative and Creativity	10
Thought process and recording techniques used	10
Drawings, sketches and data recorded.	10
Dependability	10
Organizational Fit	10
Response to Mentor	10
	100
Department Evaluation Committee/Faculty	
Diary	25
Report	50
Presentation skill & Viva Voce	25
	100

For the Internship course, a student shall secure a minimum of 50% of the total CIE marks to become eligible for the Semester End Examination (SEE). In addition, the student shall secure a minimum of 50% of the marks in the Semester End Examination (SEE) to be declared as having successfully completed the Internship course.

Assessment Methods and Rubrics

Assessment of Continuous Internal Evaluation (CIE)

Assessment of CIE for 100 marks shall be awarded by supervisor in the internship organization. Participation of internal guide/s (faculty members), is desirable. The CIE marks awarded for the interns shall be based on the rubrics (Annex I).

Annex. I: Evaluation of Internship (CIE) – Grading Rubric

Evaluation Dimensions	Performance Rating			Max Score
	Needs Improvement	Meets Expectations	Excellent	
	0-4	5-7	8-10	
Internship Evaluation Dimensions–Grading Criteria				
Regularity in maintenance of the diary	The daily/weekly attendance has not been maintained or reported to the guide.	The daily/weekly attendance is inconsistently maintained and reported to the guide.	Reporting the daily/weekly attendance is well maintained and reported to the guide regularly	10
Quality of Work	The work was completed carelessly, resulting in inconsistent quality. Assignments were often submitted late and needed revisions, with frequent mistakes.	The work requirements were generally met, with only a few minor exceptions. Most assignments were submitted on time, although there were occasional mistakes.	Thoroughly and accurately performed all work requirements. Submitted all work assignments on time	10
Adequacy & quality of information recorded	The daily/weekly records have not been maintained or submitted to the guide.	The daily/weekly records are not consistently maintained or submitted to the guide.	Reporting / submitting the daily/weekly records is well maintained and reported to the guide regularly	10
Ability to Learn	Questions and seldom sought additional information. Struggled or took longer to grasp new concepts, ideas, and work assignments. Reluctant or unwilling to acknowledge mistakes and was not open to making necessary changes or improvements.	Asked pertinent questions and actively sought additional information from relevant sources. Demonstrated a satisfactory understanding of new concepts, ideas, and work assignments. Showed willingness to take responsibility for mistakes and make necessary changes and improvements.	Consistently asked relevant questions and sought out additional information from appropriate sources; Quickly understood new concepts, ideas, and work assignments; Always willing to take responsibility for mistakes and to make needed changes and improvements	10
Initiative and Creativity	Demonstrated a minimal effort and limited relevance to the internship objectives.	Demonstrated that worked with minimal supervision, occasionally showed initiative, and made moderate efforts to exceed expectations with some creativity.	A self-starter; Consistently sought new challenges and asked for additional work assignments; Regularly approached and solved problems independently; Frequently proposed innovative & creative ideas, solutions, Options	10
Thought process and recording techniques use	Lacked a clear or strong thought process when recording learnings.	Inconsistent or limited thought process when recording learnings.	Good to Excellent thought process in the process of recording the learnings	10
Drawings, sketches and data recorded.	Demonstrated a minimal effort and limited relevance to the internship objectives.	Showed an optimistic attitude all the time, with a few tiny exceptions. displayed integrity & honesty on a regular basis at work.	Exhibited exceptional positivity, integrity, and professionalism with strong ethical and diversity awareness throughout.	10

Assessment Methods and Rubrics

Dependability	Exhibited inconsistent task completion reliability with inadequate adherence to instructions, requiring frequent verification and constant supervision to ensure work quality standards were met	Generally dependable in completing tasks. Typically followed instructions and procedures. Usually attentive to detail, though work occasionally required review. Operated with minimal supervision.	Demonstrated exceptional reliability in task completion with meticulous adherence to instructions and procedures, exhibiting outstanding attention to detail while requiring minimal supervisory guidance.	10
Organizational Fit	Demonstrated insufficient comprehension of and alignment with organizational mission, vision, and goals, with notable difficulty adapting to established norms and protocols while frequently circumventing proper authority channels.	Exhibited adequate comprehension of and support for organizational mission, vision, and goals, with satisfactory adaptation to institutional norms and appropriate utilization of established authority channels.	Demonstrated comprehensive understanding of and exemplary commitment to organizational mission, vision, and goals, with seamless integration into institutional culture.	10
Response to Mentor	Demonstrated insufficient initiative in seeking necessary guidance, exhibited resistance to constructive feedback, and showed minimal implementation of supervisory recommendations	Appropriately solicited guidance when required, demonstrated receptiveness to constructive feedback, consistently implemented supervisory recommendations, and actively pursued professional development opportunities.	Actively sought supervision when necessary; Always receptive to constructive criticism and advice; Successfully implemented supervisor suggestions when offered; Always willing to explore personal strengths and areas for improvement	10

Assessment of Semester End Evaluation (SEE)

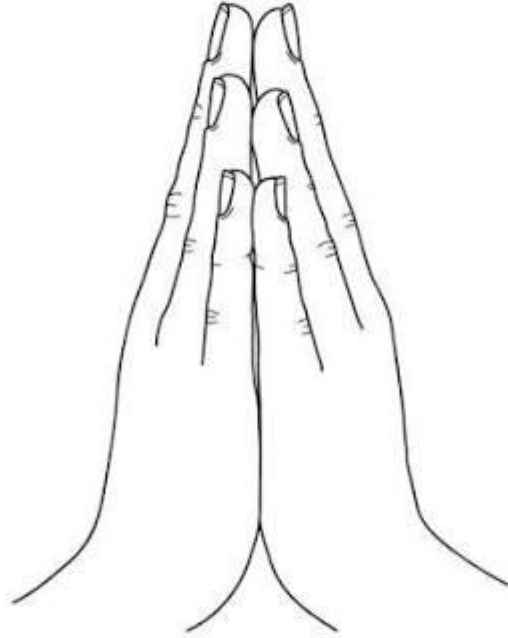
Assessment of SEE for 100 marks shall be awarded as per the rubrics (Annex 2) by a committee consisting of the Head of the department and two faculty members of the department. Contribution to the internship and the performance of each member will be assessed in semester end examination (SEE) conducted at the department. Marks will be awarded based on the evaluation of the diary, report, presentation skill and viva-voce in the ratio 25:50:25.

Annex. 2: Evaluation of Internship (SEE)–Grading Rubric

Evaluation Dimensions	Performance Rating			Max. Score
	Needs Improvement	Meets Expectations	Excellent	
	Up to 30%	30%-75%	75%-100%	
	Internship Evaluation Dimensions – Grading Criteria			
Diary	Poorly maintained with insufficient information.	Poorly maintained with moderate information.	Well maintained with all information.	25
Report	The report lacks clarity and coherence, contains several language errors, and provides minimal evidence of practical application or alignment with internship competencies, reflecting	The report is generally well-structured with minor errors; however, conceptual clarity, completeness, and concise articulation of activities and	The report is well-edited, clearly structured, and effectively presents comprehensive insights, practical applications, and well-aligned internship experiences with the program	50

Assessment Methods and Rubrics

	limited effort and engagement.	practical applications require further improvement to effectively reflect internship learning outcomes.	outcomes and key concepts.	
Presentation skill & Viva Voce	The presented information is vague or lacking, which makes it hard to grasp the purpose of the evidence and internship experiences.	The information is presented clearly, but it still lacks practical experience.	The information is presented comprehensively, with ideas conveyed in a way that allows the audience to clearly understand the evidence and internship experiences.	25



Thank You

End of the Document

Best Practices Initiated by Department

- The department has established an Alumni Mentorship Programme to guide Electrical Engineering students in career planning, higher studies, and professional development.
- The department has adopted the IEEE PES Student Chapter as a platform for organizing various technical activities and fostering professional engagement among students.
- Under the IEEE PES Student Chapter, the department has initiated Alumni Webinar Series enabling students to interact with experts and gain insights into emerging technologies and industry practices.
- An Assignment Question Bank has been developed for major courses, incorporating questions from competitive examinations such as GATE, IES, etc. to strengthen students' preparedness for higher studies and competitive exams.
- The department actively encourages students to undertake survey and data collection activities through the AICTE Activity Points Programme, which are further analyzed to draw meaningful inferences for academic and societal applications.

