Department of Electrical and Electronics Engineering

B.Tech. Electrical and Electronics Engineering
Curriculum and Syllabus

(Applicable to the students admitted from AY: 2023 onwards)

School of Engineering and Sciences
SRM University *AP*, Andhra Pradesh

Department Vision

To produce professionally competent graduates in the domain of power and energy by addressing the technical challenges. through unique learning experiences to serve society.

Department Mission

1. Impart standard and equitable education through academic rigor to produce real-world electrical and electronics engineers.
2. Bring on board academia and industry for collaborative research, product development, and building entrepreneurship proficiency among students and faculty.
3. To incorporate multi-disciplinary activities and ethical practices at different stages of learning.

Program Educational Objectives (PEO)

1. Develop the ability to apply concepts from the diverse areas of electrical and electronics engineering to understand and arrive at solutions.
2. Utilise interdisciplinary ideas for societal development.
3. Use domain knowledge to develop novel products, technologies, and services.
4. Effectively work as an individual/team, involved in research, development of green technologies, and creating future entrepreneurs.

Mission of the Department to Program Educational Objectives (PEO) Mapping

	PEO 1	PEO 2	PEO 3	PEO 4
Mission Statement 1				
Mission Statement 2				
Mission Statement 3				

Program Specific Outcomes (PSO)

1. Demonstrate competence in the analysis, design and development of Electrical and Electronic systems, including advanced power systems, renewable energy systems and related control strategies.
2. Use technologies, platforms, and tools to implement and enhance understanding of electrical and electronic-based systems.
3. Implement socially relevant, sustainable, and green technical solutions to complex engineering problems in multi-disciplinary environments.

Mapping Program Educational Objectives (PEO) to Program Learning Outcomes (PLO)

Program Learning Outcomes (PLO)															
PEOs	POs												PSOs		
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
PEO 1															
PEO 2															
PEO 3															

Category Wise Credit Distribution			
Course Sub-Category	**Sub-Category Credits**	**Category Credits**	**Learning Hours**
Ability Enhancement Courses (AEC)		8	240
University AEC	8		
School AEC	0		
Value Added Courses (VAC)		8	240
University VAC	8		
School VAC	0		
Skill Enhancement Courses (SEC)		16	480
School SEC	5		
Department SEC	5		
SEC Elective	6		
Foundation/ Interdisciplinary courses (FIC)		18	540
School FIC	18		
Department FIC	0		
Core + Core Elective including Specialization (CC)		82	2460
Core	67		
Core Elective (Inc Specialization)	15		
Minor (MC) + Open Elective (OE)	15	15	450
Research / Design / Internship/ Project (RDIP)		16	480
Internship / Design Project / Startup / NGO	4		
Internship / Research / Thesis	12		
Total		**163**	**4890**

Semester wise Course Credit Distribution Under Various Categories										
Category	**Semester**									
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Total**	**%**
Ability Enhancement Courses - AEC	2	2	2	2	0	0	0	0	8	**5**
Value Added Courses - VAC	2	2	0	0	0	4	0	0	8	**5**
Skill Enhancement Courses - SEC	3	2	3	2	3	3	0	0	16	**10**
Foundation / Interdisciplinary Courses - FIC	12	6	0	0	0	0	0	0	18	**11**
CC / SE / CE / TE / DE / HSS	0	7	15	16	17	18	9	0	82	**50**
Minor / Open Elective - OE	0	0	3	3	3	3	3	0	15	**9**
(Research / Design / Industrial Practice / Project / Thesis / Internship) - RDIP	0	0	0	0	0	0	4	12	16	**10**
Grand Total	**19**	**19**	**23**	**23**	**23**	**28**	**16**	**12**	**163**	**100**

Note: L-T/D-P/Pr and the class allocation is as follows.

a) Learning Hours : 30 learning hours are equal to 1 credit.

b) Lecture/Tutorial : 15 contact hours (60 minutes each) per semester are equal to 1 credit.

c) Discussion : 30 contact hours (60 minutes each) per semester are equal to 1 credit.

d) Practical : 30 contact hours (60 minutes each) per semester are equal to 1 credit.

e) Project : 30 project hours (60 minutes each) per semester are equal to 1 credit.

SEMESTER - I								
S. No	**Category**	**Sub-Category**	**Course Code**	**Course Title**	**L**	**T/D**	**P/Pr**	**C**
1	AEC	U AEC	AEC 101	Art of Listening, Speaking and Reading Skills	1	0	1	2
2	VAC	U VAC	VAC 101	Environmental Science	2	0	0	2
3	SEC	S SEC	SEC 101	Analytical Reasoning and Aptitude Skills	1	1	1	3
4	FIC	S FIC	FIC 101	Emerging Technologies	2	0	0	2
5	FIC	S FIC	FIC 102	Engineering Physics	2	0	1	3
6	FIC	S FIC	FIC 103	Calculus For Engineers	3	0	0	3
7	FIC	S FIC	FIC 104	Fundamentals of Computing and Programming in C	3	0	1	4
				Semester Total	**14**	**1**	**4**	**19**

SEMESTER - II								
S. No	**Category**	**Sub-Category**	**Course Code**	**Course Title**	**L**	**T/D**	**P/Pr**	**C**
1	AEC	U AEC	AEC 107	Effective Writing and Presentation Skills	1	0	1	2
2	VAC	U VAC	VAC 102	Universal Human Values and Ethics	2	0	0	2
3	SEC	S SEC	SEC 103	Entrepreneurial Mindset	2	0	0	2
4	FIC	S FIC	FIC 106	Fundamentals of Chemistry for Engineers	2	0	1	3
5	FIC	S FIC	FIC 117	Linear Algebra and Differential Equations	3	0	0	3
6	CC	Core	EEE 101	Basic Electrical and Electronics Engineering	2	0	1	3
7	CC	Core	EEE 102	Measurements and Instrumentation	3	0	1	4
				Semester Total	**15**	**0**	**4**	**19**

SEMESTER - III								
S. No	**Category**	**Sub-Category**	**Course Code**	**Course Title**	**L**	**T/D**	**P/Pr**	**C**
1	AEC	S AEC	AEC 108	Problem Solving Skills	1	0	1	2
2	VAC	S VAC	VAC 103	Co-Curricular Activities	0	0	2	2*
3	VAC	S VAC	VAC 104	Community Service and Social Responsibility	0	0	2	2*
4	SEC	D SEC	SEC 115	Data Structures	2	0	1	3
5	CC	Core	EEE 201	Circuit Theory	3	0	1	4
6	CC	Core	EEE 202	Electrical Machines-1	3	0	1	4
7	CC	Core	EEE 203	Principles of Signal Processing	3	0	0	3
8	CC	Core	EEE 204	Digital Electronics	3	0	1	4
9	Elective	OE		Open Elective / Minor	3	0	0	3
				Semester Total	**18**	**0**	**5**	**23**

SEMESTER - IV								
S. No	**Category**	**Sub-Category**	**Course Code**	**Course Title**	**L**	**T/D**	**P/Pr**	**C**
1	AEC	U AEC	AEC 104	Creativity and Critical thinking Skills	1	0	1	2
2	VAC	U VAC	VAC 103	Co-Curricular Activities	0	0	2	2*
3	VAC	U VAC	VAC 104	Community Service and Social Responsibility	0	0	2	2*
4	SEC	D SEC	SEC 117	Solid State Devices	2	0	0	2
5	CC	Core	EEE 205	Power Generation, Transmission and Distribution	3	0	1	4
6	CC	Core	EEE 206	Electrical Machines-II	3	0	1	4
7	CC	Core	EEE 207	Analog Circuits	3	0	1	4
8	CC	Core	EEE 208	Linear Systems and Control Design	3	0	1	4
9	Elective	OE		Open Elective / Minor	3	0	0	3
				Semester Total	**18**	**0**	**5**	**23**

SEMESTER - V								
S. No	**Category**	**Sub-Category**	**Course Code**	**Course Title**	**L**	**T/D**	**P/Pr**	**C**
1	VAC	U VAC	VAC 103	Co-Curricular Activities	0	0	2	2*
2	VAC	U VAC	VAC 104	Community Service and Social Responsibility	0	0	2	2*
3	SEC	E SEC	SEC	Career Skills - I	3	0	0	3
4	CC	Core	EEE 301	Electromagnetic Field Theory	3	0	0	3
5	CC	Core	EEE 302	Power System Analysis	3	0	1	4
6	CC	Core	EEE 303	Nonlinear Systems and Control	2	0	1	3
7	CC	Core	EEE 304	Power Electronics	3	0	1	4
8	CC	Core	EEE 305	Microcontrollers and Applications	2	0	1	3
9	Elective	OE		Open Elective / Minor	3	0	0	3
				Semester Total	**19**	**0**	**4**	**23**

SEMESTER - VI								
S. No	**Category**	**Sub-Category**	**Course Code**	**Course Title**	**L**	**T/D**	**P/Pr**	**C**
1	VAC	U VAC	VAC 103	Co-Curricular Activities	0	0	2	2
2	VAC	U VAC	VAC 104	Community Service and Social Responsibility	0	0	2	2
3	SEC	E SEC		Career Skills - II	3	0	0	3
4	CC	Core	EEE 306	High Voltage Engineering	3	0	1	4
5	CC	Core	EEE 307	Switchgear and Protection	3	0	1	4
6	CC	Core	EEE 308	Renewable Energy Sources	3	0	1	4
7	Elective	CE		Core Elective	2	0	1	3
8	Elective	CE		Core Elective	3	0	0	3
9	Elective	OE		Open Elective / Minor	3	0	0	3
				Semester Total	**20**	**0**	**8**	**28**

SEMESTER - VII								
S. No	**Category**	**Sub-Category**	**Course Code**	**Course Title**	**L**	**T/D**	**P/Pr**	**C**
1	Elective	CE		Core Elective	3	0	0	3
2	Elective	CE		Core Elective	3	0	0	3
3	Elective	CE		Core Elective	3	0	0	3
4	Elective	OE		Open Elective / Minor	3	0	0	3
5	RDIP	RDIP	EEE 401	Internship	0	0	4	4
				Semester Total	**12**	**0**	**4**	**16**

SEMESTER - VIII								
S. No	**Category**	**Sub-Category**	**Course Code**	**Course Title**	**L**	**T/D**	**P/Pr**	**C**
1	RDIP	RDIP	EEE 402	Major Project	0	0	12	12
				Semester Total	**0**	**0**	**12**	**12**

Core Electives								
S. No	**Category**	**Sub-Category**	**Course Code**	**Course Title**	**L**	**T/D**	**P/Pr**	**C**
1	Elective	CE	EEE 427	Numerical Methods for Electrical Engineering	3	0	0	3
2	Elective	CE	EEE 428	Indian Standards for Electrical Engineering Applications	3	0	0	3
3	Elective	CE	EEE 429	Power Semiconductor Drives	3	0	0	3
4	Elective	CE	EEE 430	Computer Aided Design of Electrical Machines	3	0	0	3
5	Elective	CE	EEE 431	Power System Operation and Control	3	0	0	3
6	Elective	CE	EEE 432	Switched Mode Power Converters	3	0	0	3
7	Elective	CE	EEE 433	Control of Switched Mode Power Converters	3	0	0	3
8	Elective	CE	EEE 434	Embedded Systems for Power Applications	3	0	0	3

Specialization : Renewable Energy								
S. No	**Category**	**Sub-Category**	**Course Code**	**Course Title**	**L**	**T/D**	**P/Pr**	**C**
1	Elective	CE		Design of Photovoltaic Systems	3	0	0	3
2	Elective	CE		Modelling and Control of Battery Energy Systems	3	0	0	3
3	Elective	CE		Power Quality Issues and Mitigation Techniques	3	0	0	3
4	Elective	CE		Renewable Energy Integration with the Grid	3	0	0	3
5	Elective	CE		Control of Power Converters	3	0	0	3
6	Elective	CE		Microgrids and Energy Management	3	0	0	3

Open Electives								
S. No	**Category**	**Sub-Category**	**Course Code**	**Course Title**	**L**	**T/D**	**P/Pr**	**C**
1	Elective	OE	EEE 244	Nuclear Power Generation	3	0	0	3
2	Elective	OE	EEE 243	Introduction to Green Energy Technologies	3	0	0	3
3	Elective	OE	EEE 255	Electric Vehicle Engineering	3	0	0	3
4	Elective	OE	EEE 256	Introduction to Electric Vehicles	3	0	0	3

Career Skill Courses								
S. No	**Category**	**Sub-Category**	**Course Code**	**Course Title**	**L**	**T/D**	**P/Pr**	**C**

1	Elective	E SEC	SEC	Design of Power Electronics Circuits	3	0	0	3
2	Elective	E SEC	SEC	Design of Industrial Drives	3	0	0	3

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Art of Listening, Speaking and Reading Skills

Course Code	AEC 101	**Course Category**	AEC		**L**	**T**	**P**	**C**
					1	0	1	2
Pre-Requisite Course(s)		**Co-Requisite Course(s)**		**Progressive Course(s)**				
Course Offering Department	Literature and Languages	**Professional / Licensing Standards**						

Course Objectives / Course Learning Rationales (CLRs)

1. To develop the students' ability to comprehend spoken language in various contexts
2. To help them build confidence and fluency in speaking through structured activities, discussions, and presentations.
3. To enhance their reading skills by engaging with a variety of texts, including literary works, informational articles, and academic writings.

Course Outcomes / Course Learning Outcomes (CLOs)

	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
Outcome 1	Demonstrate effective listening strategies by accurately summarizing and responding to spoken content in various contexts	2	70%	65%
Outcome 2	Students will be able to critically analyze spoken and written texts to identify underlying themes, arguments, and perspectives.	3, 4	75%	70%
Outcome 3	Students will construct and deliver coherent and engaging oral presentations and written responses that integrate information from multiple sources.	5, 6	70%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and CT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1		1				1			3	3	1	2			
Outcome 2		2				2			3	3	2	2			
Outcome 3		3				3			3	3	3	2			
Average		**2**				**2**			**3**	**3**	**2**	**2**			

Course Unitization Plan

Unit No.	Unit Name	Required Contact Hours	CLOs Addressed	References Used
Unit 1	**Augmenting Listening skills**	**9**		
	Course introduction and objectives: Importance of LSRW	1	1	1 a
	Listening - Barriers to active listening and steps to Overcome	2	1	1 b
	Listening Comprehension How to take/ make notes (different ways)	2	1	1b, 2a, 2c
	Listening practice: Identifying main ideas, supporting details, and inferences and summarizing key points	2	1	1b, 2a, 2c
	Practice sessions: memory games, Chinese whisper	2	1	NA
Unit 2	**Developing Speaking Skills**	**9**		
	Strategies for good speech, Basics of grammatically correct speech	1	2	1a, 2 a, b, c
	Basics of phonetics and intonation	2	2	1a
	Oral presentations: do's and don'ts	1	2	1a
	Speaking Practice: Just a minute/ Impromptu, Story-telling/ Story starters Group discussions,	5	2	NA
Unit 3	**Communication and Persuasion**	**9**		
	Verbal Communication and Nonverbal Communication	2	2, 3	1a
	The art of persuasive communication (Ethos, pathos, Logos)	2	2, 3	1a
	Practice sessions (Convince the other Role plays, Self-introduction, Pitching, extempore, public speaking)	5	2, 3	NA
Unit 4	**Reading**	**9**		
	Reading strategies (Skimming and scanning, extensive and intensive)	2	2	1c
	Reading and analyzing various texts, including articles, essays, and academic papers	3	2	1c
	Reading Comprehension Practice	4	2	1c, 2a
Unit 5	**Integrated Skills and Real-World Application**	**9**		
	Engaging in discussions and debates on current issues	2	3	NA
	Real-world application of language skills (e.g., job interviews, social interactions)	2	3	NA
	Pitching Presentation	5	3	NA
	Total contact hours	45		
	Notional hours	15		
	Total Leaning Hours	**60**		

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (60%)				End Semester Project (40%)
		CLA-1 20%	Mid-1	CLA-2 20%	CLA-3 20%	
Level 1	Remember	20%			40%	30%
	Understand					
Level 2	Apply	60%		40%	40%	30%
	Analyse					
Level 3	Evaluate	20%		60%	20%	40%
	Create					
Total		100%		100%	100%	100%

Recommended Resources

1a. Shoba, L. (2017). Communicative English: A Workbook. U.K: CambridgeUniversity Press.
1b. Leonardo, N. (2020) Active Listening Techniques: 30 Practical Tools to Hone Your Communication Skills. Rockridge Press
1c. Williams, A.J. (2014) Reading Comprehension: How To Drastically Improve Your Reading Comprehension and Speed Reading Fast! (Reading Skills, Speed Reading)

2a. https://learnenglishteens.britishcouncil.org/
2b. https://www.bbc.co.uk/learningenglish/
2c. https://www.ted.com/?geo=hi

Other Resources

1. -

Course Designers

1. -

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Environmental Science

Course Code	VAC 101	**Course Category**	VAC	**L**	**T**	**P**	**C**
				2	0	0	2
Pre-Requisite Course(s)		**Co-Requisite Course(s)**		**Progressive Course(s)**			
Course Offering Department	Environmental Science and Engineering	**Professional / Licensing Standards**					

Course Objectives / Course Learning Rationales (CLRs)

1. To describe the environmental concepts from ecology and earth science to address real-world problems.
2. To interpret the complex interactions within and between environmental systems and to evaluate evolving environmental problems.

Course Outcomes / Course Learning Outcomes (CLOs)

	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
Outcome 1	Comprehend the environmental challenges that need attention.	1	80%	70%
Outcome 2	Summarize the types of environmental pollutions and possible effects to society	2	80%	70%
Outcome 3	Classify the natural environmental resources, present state, rate of depletion and future perspectives	2	80%	70%
Outcome 4	Articulate a project-based learning on existing local to global environmental issues	2	80%	70%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and CT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Life Long Learning	PSO 1	PSO 2	PSO 3
Outcome 1	-	-	-	-	1	1	2	-	2	1	-	1	-	-	-
Outcome 2	-	1	-	1	1	1	2	-	2	1	-	1	-	-	-
Outcome 3	-	1	-	1	1	1	3	-	2	1	-	1	-	-	-
Outcome 4	1	1	1	2	1	2	3	2	2	2	2	2	-	-	-
Average	1	1	1	1.33	1	1.25	2.5	2	2	1.25	2	1.25	-	-	-

Course Unitization Plan

Unit No.	Unit Name	Required Contact Hours	CLOs Addressed	References Used
Unit 1	**Human, Environmental Issues, and Climate Change**	**6**	1	1,2,3
	The man-environment interaction	1	1	1,2,3
	Environmental issues and scales	1	1	1,2,3
	Land use and Land cover change	2	1	1,2,3
	Ozone layer depletion	1	1	1,2,3
	Understanding climate change and adaptation	1	1	1,2,3
Unit 2	**Environmental Pollution and Health**	**7**	2	1,2,3
	Understanding pollution; Definitions, sources, impacts on human health and ecosystem	2	2	1,2,3
	Air pollution	1	2	1,2,3
	Water pollution	1.5	2	1,2,3
	Soil pollution	1	2	1,2,3
	Solid waste	1.5	2	1,2,3
Unit 3	**Ecosystems, Biodiversity Conservation, and Sustainable Development**	**9**	3	1,2,3
	Ecosystems and ecosystem services	1	3	1,2,3
	Biodiversity and its distribution	1	3	1,2,3
	Threats to biodiversity and ecosystems	1	3	1,2,3
	Overview of natural resources	1	3	1,2,3
	Biotic resources	1	3	1,2,3
	Water resources; Soil and Energy resources	2	3	1,2,3
	Introduction to Sustainable Development Goals (SDGs)-targets and indicators	2	3	1,2,3
Unit 4	**Environmental Management, Treaties and Legislation**	**8**	4	1,2,3
	Introduction to environmental laws and regulation	2	4	1,2,3
	Environmental management system	2	4	1,2,3
	Pollution control and management	2	4	1,2,3
	Major International Environmental Agreements; Major Indian Environmental Legislations	2	4	1,2,3
Total Contact Hours		30		

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (70%)				End Semester Exam (30%)
		CLA-1 (15%)	Mid-1 (25%)	CLA-2 (15%)	CLA-3 (15%)	
Level 1	Remember	60%	60%	60%	60%	40%
	Understand					
Level 2	Apply	40%	40%	40%	40%	60%
	Analyse					
Level 3	Evaluate	-	-	-	-	-
	Create					
Total		**100%**	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. Rajagopalan, R. (2016) Environmental Studies (3rd edition), Oxford University Press.
2. Sharma, P. D. (2018) Ecology and environment. Rastogi Publications.
3. Anil K. Dey. (2016). Environmental Chemistry. New Age Publisher International Pvt Ltd. ISBN: 9789385923890, 9385923897

Other Resources

Course Designers

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Analytical Reasoning and Aptitude Skills

Course Code	SEC 101	**Course Category**	SEC		**L**	**T**	**P**	**C**
					3	0	0	3
Pre-Requisite Course(s)		**Co-Requisite Course(s)**		**Progressive Course(s)**				
Course Offering Department	Mathematics	**Professional / Licensing Standards**						

Course Objectives / Course Learning Rationales (CLRs)

1. To categorize, apply and use thought process to distinguish between concepts of quantitative methods.
2. To prepare and explain the fundamentals related to various possibilities.
3. To critically evaluate numerous possibilities related to puzzles.
4. Explore and apply key concepts in logical thinking to business problems.

Course Outcomes / Course Learning Outcomes (CLOs)

	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
Outcome 1	Use logical thinking and analytical abilities to solve quantitative aptitude questions from company specific and other competitive tests.	1	70%	60%
Outcome 2	Solve questions related to Time and Distance and Time and work from company specific and other competitive tests.	3	80%	70%
Outcome 3	Understand and solve puzzle questions from specific and other competitive tests	1	70%	60%
Outcome 4	Make sound arguments based on mathematical reasoning and careful analysis of data.	1	90%	80%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1					1			2		2		1			
Outcome 2		2			3			3	3						
Outcome 3		3							2			2			
Outcome 4								2	3			2			
Average								2	3			2			

Course Unitization Plan

Unit No.	Unit Name	Required Contact Hours	CLOs Addressed	References Used
Unit 1	**Quantitative Aptitude**	**14**		
	Time, speed and distance	5	1,4	1,4
	Time and work, Pipes and cisterns	9	1,4	1,4
Unit II	Numbers, LCM and HCF.	2	1,4	1,4
	P and C	4	1,4	1,4
	Probability, progressions	4	1,4	1,4
Unit III	Geometry, Mensuration	5	1,2	2,3
	Clocks and calendars	4	1,3	1,4
Unit IV	Linear equation and special equations	5	1,2	1,2
	Quadratic equations	2	1,2	1,2
	Inequalities	2	2,3	2,3
	Sets and Venn diagrams	3	1,2	2,4
Total Contact Hours		**45**		

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 20%		Mid-1 20%		CLA-2 20%		Mid -2 15%			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	40%		50%		40%		50%		50%	
	Understand										
Level 2	Apply	60%		50%		60%		50%		50%	
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**		**100%**		**100%**		**100%**		**100%**	

Recommended Resources

1. Arun Sharma – How to prepare for Quantitative Aptitude, Tata Mcgraw Hill.
2. R.S. Agarwal – Reasoning. Reasoning for competitive exams – Agarwal.
3. Objective Quantitative Aptitude – Oswaal books.
4. Test of reasoning and numerical ability, quantitative aptitude book – Sahitya bhavan.
5. Radian's Quantitative Aptitude.
6. Quantitative Aptitude and Reasoning – Shyam Saraf / Abhilasha Swarup.
7. Fast track objective Arithmetic – Rajesh Verma.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Emerging Technologies

Course Code	FIC 101	Course Category	FIC		L	T	P	C
					2	0	0	2
Pre-Requisite Course(s)	-	Co-Requisite Course(s)	-	Progressive Course(s)	-			
Course Offering Department	-	Professional / Licensing Standards	-					

Course Objectives / Course Learning Rationales (CLRs)

- Foster a comprehensive grasp of diverse emerging technologies and their transformative impacts on society and industries.
- Cultivate critical thinking skills to analyse challenges, opportunities, and applications within each technological domain.
- Develop practical skills through hands-on experiences and assignments, translating theoretical concepts into real-world applications.
- Raise awareness of ethical considerations, particularly in the context of Artificial Intelligence, encouraging responsible and informed decision-making.

Course Outcomes / Course Learning Outcomes (CLOs)

	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
Outcome 1	Exhibit a thorough understanding of quantum computing principles, including superposition, entanglement, and interference.	1	80	90
Outcome 2	Illustrate understanding by explaining the history, synthesis, and applications of nanomaterial and green hydrogen.	1	80	90
Outcome 3	Understand and classify 3D printing technologies.	2	75	85
Outcome 4	Demonstrate understanding of the evolution, classification, and applications of UAVs.	2	75	85
Outcome 5	Apply knowledge of Artificial Intelligence and Machine Learning to address classification, regression, clustering, and decision-making problems.	2	75	85

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and CT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Life Long Learning	PSO 1	PSO 2	PSO 3
Outcome 1	1	2	1	1	3	1	1	2	1	3	1	2	1	1	1
Outcome 2	1	2	1	2	1	1	2	2	2	1	1	2	1	1	1
Outcome 3	2	1	2	1	2	2	1	1	1	2	2	1	1	2	2
Outcome 4	3	3	3	2	1	3	2	3	2	1	3	3	2	2	1
Outcome 5	2	3	2	1	1	2	1	3	1	1	2	3	2	2	1
Average															

Course Unitization Plan

Unit No.	Unit Name	Required Contact Hours	CLOs Addressed	References Used
Unit 1	**Quantum Computing and Quantum Communications**	**7**		
1.1	Quantum Computer and early ideas, classical and quantum computing approaches, superposition, entanglement, and interference in quantum computing.	1	1	1
1.2	QUBITS and their types; representation of data in quantum mechanics.	1	1	1
1.3	Shor's Algorithm, Grover's search algorithm.	1	1	1
1.4	Quantum programming languages; Obstacles in building quantum computers.	1	1	1
1.5	Applications of quantum computers; Opportunities in the field of quantum computing.	1	1	1
1.6	Introduction of quantum communication pillers, quantum network, Heisenberg's uncertainty principle and QKD.	1	1	1
1.7	Challenges in QKD, National Quantum Mission, Future perspectives.	1	1	1
Unit 2	**Unit 2: Nanotechnology and Green Hydrogen**	**6**		
2.1	Introduction to the nanometer scale. history of nanomaterials	1	2	2
2.2	Synthesis of nanomaterials: Bottom-up and Top-down approach	1	2	2
2.3	tools & techniques to characterize nanomaterials. Applications of nanomaterials.	1	2	2
2.4	Green Technology: Definition, types of Green Technologies, Green Hydrogen production.	1	2	2
2.5	Challenges involved in the storage of Green Hydrogen produced from PEM based electrolysis.	1	2	2
2.6	Applications of Green Hydrogen.	1	2	2
Unit 3	**3D Printing and Applications**	**5**		
3.1	Introduction to 3D printing and additive manufacturing	1	3	3
3.2	Capabilities of 3D printing	1	3	3
3.3	Applications of 3D printing	1	3	3
3.4	Classification based on ASTM	1	3	3
3.5	Working principles of 3D printing technologies	1	3	3
Unit 4	**UAVs, Drones and Applications**	**6**		
4.1	Introduction to the evolution of drones	1	4	4
4.2	Classification of drones	1	4	4
4.3	Basic components of drones	1	4	4
4.4	Principles of flight	1	4	4
4.5	Applications of drones	1	4	4
4.6	Drones rules in India, Challenges and future scope.	1	4	4
Unit 5	**Introduction to Artificial Intelligence and Machine Learning**	**6**		
5.1	Introduction to Artificial Intelligence, Machine Learning and Deep learning	1	5	5
5.2	Supervised (Classification and regression) learning	1	5	5
5.3	Unsupervised (Clustering) learning	1	5	5
5.4	Reinforcement learning (Decision making)	1	5	5
5.5	Features and Applications of AI and ML	1	5	5
5.6	Threats of AI: Lack of Regulation.	1	5	5
Total Contact Hours		**30**		

Learning Assessment

Bloom's Level of Cognitive Task		CLA-1 (20%)	CLA-2 (20%)	CLA-3 (20%)	CLA-4 (20%)	CLA-5 (20%)
Level 1	Remember	100 %	100 %	100 %	100 %	100 %
	Understand					
Level 2	Apply	0 %	0 %	0 %	0 %	0 %
	Analyse					
Level 3	Evaluate	0 %	0 %	0 %	0 %	0 %
	Create					
Total		**100%**	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. Nielsen, M. A., & Chuang, I. L. (2001). Quantum computation and quantum information (Vol. 2). Cambridge: Cambridge university press.
2. Fiiipponi, L., & Sutherland, D. (Eds.). (2012). Nanotechnologies: principles, applications, implications and hands-on activities: A compendium for educators. European Union, Directorate General for Research and Innovation.
3. Paul, C. P. and Jinoop, A. N. (2021) Additive manufacturing: Principles, Technologies and applications. McGraw Hill
4. Kilby, T., & Kilby, B. (2015). Getting Started with Drones: Build and Customize Your Own Quadcopter. Maker Media, Inc.
5. Russell, S. J., & Norvig, P. (2016). Artificial intelligence: a modern approach. Pearson.

Course Designers

1. Dr. Sunil Chinnadurai, Assistant Professor, ECE Department.
2. Dr. Pardha Saradhi Maram, Associate Professor, Chemistry Department.
3. Dr. Sangjukta Devi, Assistant Professor, Mechanical Department.
4. Dr. Harish Puppala Assistant Professor, Civil Department.
5. Dr. Ravi Kumar, Assistant Professor, Physics Department.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Engineering Physics

Course Code	FIC 102	Course Category	FIC		L	T	P	C
					2	0	1	3
Pre-Requisite Course(s)	NA	Co-Requisite Course(s)	NA	Progressive Course(s)	-			
Course Offering Department	Physics	Professional / Licensing Standards	-					

Course Objectives / Course Learning Rationales (CLRs)

1. To understand the fundamental concepts of physics and their application in engineering.
2. To develop problem-solving skills through physics-based problems.
3. To enhance practical knowledge through laboratory experiments and real-world applications.
4. To foster analytical and critical thinking skills.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
1	Demonstrate understanding of core physics principles in mechanics, waves, modern physics, and electromagnetism	2	75%	70%
2	Apply physics principles to analyse and solve engineering physics problems	3	70%	65%
3	Demonstrate problem-solving skills using mathematical tools	3	70%	65%
4	Evaluate experimental data to interpret and explain the underlying physics concepts	3	75%	70%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CO's	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	2	2	1	1	1			1	2			2	1	1	1
Outcome 2	2	3	2	2	2			2	2			2	2	1	1
Outcome 3	2	3	2	2	2			2	2			2	2	1	1
Outcome 4	2	3	2	2	3			2	3			2	2	1	2
Course Average	**2.0**	**2.8**	**1.8**	**1.8**	**2.0**			**1.8**	**2.3**			**2.0**	**1.8**	**1.0**	**1.3**

Course Unitization Plan: Theory

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Introduction	1	1	1, 3
	Newton's laws of mechanics, Free body force diagram	1	1, 2, 3	1, 3
	Momentum and Impulse,Conservation of linear momentum	1	1, 2, 3	1, 3
	Work-Kinetic Energy Theorem and related problems	1	1, 2, 3	1, 3
	Conservation of mechanical energy: Worked outproblems	1	1, 2, 3	1, 3
	Elastic properties of solids, Stress-strain relationship, elastic constants, and their significance	1	1	1, 2
Unit No. 2	Concept of Electromagnetic waves & EMW Spectra	1	1	1, 2
	Geometrical & Wave Optics: Laws of reflection and refraction	1	1, 2, 3	1, 2
	Concept of Interference	1	1, 2, 3	1, 2
	Phase Difference and Path Difference	1	1	1, 2
	Double-Slit Interference	1	1	1, 2
	Diffraction: types and single slit	1	1, 2, 3	1, 2
Unit No. 3	Black Body Radiation; Wien's displacement law	1	1	1, 2
	Discussion on failure of classical laws to explain Black Body Radiation, and concept of Planck's Hypothesis	1	1, 2, 3	1, 2
	What is Light? Photon and Overview on Planck Constant	1	1	1, 2
	Photoelectric effect – Concept and Experimental Setup	1	1, 2, 3	1, 2
	Photoelectric effect – Intensity vs Current, Frequency vs Kinetic Energy, the drawback of Wave theory to explain Photoelectric effect	1	1	1, 2
	Wave properties of particle: De Broglie wave	1	1	1, 2
Unit No. 4	**Focus on Maxwell's Equation I**: Discuss lines of force and Electrostatic flux, Introduce Gauss's law (differential and integral form)	1	1	1, 4
	Application of Gauss Law: ES field due to infinite wire and sheet.	1	1	1, 4
	Electrostatic field due to conducting and insulating sphere.	1	1	1, 4
	Concept of Electrostatic Potential and Potential Energy. Inter-relation with electrostatic field.	1	1	1, 4
	Capacitor and Capacitance:	1	1, 2	1, 4
	Capacitance of a parallel plate capacitor.	1	1, 2, 3	1, 4
Unit No. 5	Introduce Biot-Savart Law as an alternative approach to calculate magnetic field.	1	1	1, 4
	Calculate Magnetic field due to finite current element using Biot-Savart Law.	1	1	1, 4
	Focus on Maxwell's Equation IV: Discuss Ampere's circuital law.	1	1	1, 4
	Calculate Magnetic field due to Infinite wire and Solenoid using Ampere's Law.	1	1, 2, 3	1, 4
	Focus on Maxwell's Equation III: Lenz's Law and Faraday's law: Induced EMF and Current	1	1, 2, 3	1, 4
	Describe Maxwell Equations as the foundation of electro-magnetism. Derive differential forms starting from Integral forms. Discuss Physical Significance.	1	1	1, 4

Course Unitization Plan: Laboratory

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Hooke's law and determination of spring constant for a given spring	2	1, 4	5
Unit No. 1	Michelson interferometer kit with diode laser	4	1, 4	5
Unit No. 2	He-Ne laser kit: Optical Interference and Diffraction	4	1, 4	5
Unit No. 2	Diffraction by Grating and Particle size measurement	4	1, 4	5
Unit No. 4	Dielectric constant of air using dielectric constant kit.	4	1, 4	5
Unit No. 4	Verification of Stefan's Law	4	1, 4	5
Unit No. 5	Biot-Savart law: To study the dependence of magnetic field on the current and magnetic field along the axis of a current carrying circular loop	4	1, 4	5
Unit No. 5	Faraday law & Induced E.M.F: Measurement of the induced voltage and calculation of the magnetic flux induced by a falling magnet	4	1, 4	5

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50 %)								End Semester Exam (50%)	
		CLA-1 (10%)		CLA-2 (10%)		CLA-3 (10%)		Mid Term (20%)			
		Th (5%)	Prac (5%)	Th (5%)	Prac (5%)	Th (5%)	Prac (5%)	Th (20%)	Prac (0%)	Th (30%)	Prac (20%)
Level 1	Remember	20%	20%	20%	20%	20%	20%	20%	-	20%	20%
	Understand	20%	20%	20%	20%	20%	20%	20%	-	20%	20%
Level 2	Apply	40%	30%	40%	30%	40%	30%	40%	-	40%	40%
	Analyse	20%	30%	20%	30%	20%	30%	20%	-	20%	20%
Level 3	Evaluate	-	-	-	-	-	-	-	-	-	-
	Create	-	-	-	-	-	-	-	-	-	-
Total		**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**		**100%**	**100%**

Recommended Resources

1. Serway, R. A., & Jewett, J. W. (2017). Physics for Scientists and Engineers with Modern Physics (9th ed.). Cengage India Private Limited.
2. Young, H. D., Freedman, R. A., & Ford, L. C. (2018). University Physics with Modern Physics with Mastering Physics (12th ed.). Pearson

Other Resources

1. Massachusetts Institute of Technology: OpenCourseWare. (2023). Physics I: Classical Mechanics. Retrieved from Massachusetts Institute of Technology: MIT OpenCourseWare https://ocw.mit.edu/courses/physics/8-01x-classical-mechanics-fall-2023/
2. Massachusetts Institute of Technology: OpenCourseWare. (2023). Physics II: Electricity and Magnetism. Retrieved from Massachusetts Institute of Technology: MIT OpenCourseWare https://ocw.mit.edu/courses/physics/8-02x-electricity-and-magnetism-fall-2023/
3. Department of Physics, SRM University AP. Engineering Physics lab manuals. Retrieved from Engineering Physics Lab (FIC102) https://srmap.edu.in/seas/physics-teaching-lab/

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Calculus For Engineers

Course Code	FIC 103	**Course Category**	FIC		**L**	**T**	**P**	**C**
					3	0	0	3
Pre-Requisite Course(s)	-	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	-			
Course Offering Department	Mathematics	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- Develop a comprehensive understanding of the fundamental concepts of calculus, including limits, derivatives, and integrals. Apply calculus techniques to solve a wide range of mathematical problems.
- Utilize calculus to find extreme values of functions and understand the Mean Value Theorem.
- Apply calculus to analyze monotonic functions, identify inflection points, and sketch curves.
- Apply Lagrange multipliers to solve optimization problems with single constraints. Calculate double and iterated integrals over various regions and in polar form.
- Develop concepts, similarities and differences in scalar and vector fields and theorems on vector calculus.
- Deliver an adequate grasp of complex variable theory to integrate contours to assess complex real integrals through residue calculus.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course, the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	Analyze functions and their graphs to identify key characteristics such as domain, range, and behavior.	1	75%	80%
2	Calculate derivatives of single-variable functions at specific points and apply various differentiation rules.	2	70%	75%
3	Determine definite and indefinite integrals of functions and their applications.	2	75%	80%
4	Apply calculus techniques to solve practical problems, including finding extreme values of functions. Utilize the Mean Value Theorem to understand the rate of change in real-world applications.	2	72%	75%
5	Calculate gradients and directional derivatives and understand their applications in various fields.	2	75%	80%
6	Compute double and triple integrals over various regions and apply calculus to real-world problems such as finding volumes, masses, and areas.	2	70%	75%
7	Understand the distribution of scalar and vector fields with the concerned governing equations	1	75%	80%
8	Analyze the functions with complex variables and extend their use in calculating improper integrals, bilinear transformation.	2	70%	75%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	2	3	2	2									2	2	2
Outcome 2	2	3	2	2									2	3	2
Outcome 3	2	3	2	2									2	2	2
Outcome 4	3	3	3	3									2	2	3
Outcome 5	2	3	3	2									2	2	2
Outcome 6	2	3	2	2									2	2	2
Outcome 7	3	3	2	3									2	3	3
Outcome 8	2	2	3	3									2	3	2
Course Average	2	3	2	2									2	2	2

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Single Variable Functions and Calculus: Functions and Graphs	1	1	1
	Trigonometric equations, identities and laws	2	1	1
	Limits and Continuity	1	1,2	1
	Derivatives and Chain Rule	1	1,2	1
	Linear and Quadratic Approximations	1	1,2	1
	Implementation with Maple	1	1,2	1
Unit No. 2	Calculus Applications: Local and global extremes, point of inflection, radius of curvature, arc-length	2	3,4	1
	The Mean Value Theorem, Rolle's theorem	1	3,4	1
	Concavity and curve sketching	2	3,4	1
	Newton-Raphson method for single variable polynomials	1	3,4	1
	Area between curves	1	3,4	1
	Implementation with Maple	1	3,4	1
Unit No. 3	Multivariable Calculus: Functions and Graphs	1	1	1
	Limits and Continuity	2	1	1
	Partial Derivatives	2	5	1
	Differentials, Chain rule	1	5	1
	Directional Derivatives and Gradients	2	5	1
	Extreme values and Saddle points	1	5	1
	Constrained Problems with Lagrange multipliers	2	5	1
	Implementation with Maple	1	5	1
Unit No. 4	Multiple Integrals and Vector Calculus: Double and Triple Integrals for Rectangular coordinates, Polar Coordinates and spherical coordinates	2	4	1
	Scalar and Fields, Divergence and Curl	2	7	1
	Line, Surface and Volume Integrals	1	6	1
	Green's Theorem, Gauss Divergence Theorem and Stoke's Theorem	4	7	1
	Implementation with Maple	4	6,7	1
Unit No. 5	Complex Variable Calculus: Homogeneous functions, Analytic functions and residues	1	8	1
	Cauchy-Reimann Equations	1	8	1
	Euler's Homogeneous function theorem	1	8	1
	Cauchy's integral formula and Theorem	2	8	1
	Implementation with Maple	2	8	1
Total Contact Hours		**45**		

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (60%)				End Semester Exam (40%)
		CLA-1 (15%)	Mid Term (25%)	CLA-2 (10%)	CLA-3 (10%)	
Level 1	Remember	30%	20%	25%	25%	20%
	Understand	20%	30%	30%	25%	30%
Level 2	Apply	25%	30%	25%	25%	25%
	Analyse	25%	20%	20%	25%	25%
Level 3	Evaluate	-	-	-	-	-
	Create	-	-	-	-	-
Total		**100%**	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. Thomas Calculus, 14th Edition, Joel R.Hass, Christopher E.Heil, Maurice D. Weir,2018.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Fundamentals of Computing and Programming in C

Course Code	FIC 104	**Course Category**	FIC		**L**	**T**	**P**	**C**
					3	0	1	4
Pre-Requisite Course(s)	NA	**Co-Requisite Course(s)**	NA	**Progressive Course(s)**	NA			
Course Offering Department	CSE	**Professional / Licensing Standards**	NA					

Course Objectives / Course Learning Rationales (CLRs)

- Gain basic knowledge in C programming language.
- Acquire knowledge on Decision making and functions in C.
- Learn arrays, strings and pointers concept in C.
- Understand the basics concepts of Structures, Union and File handling techniques using C Programming.

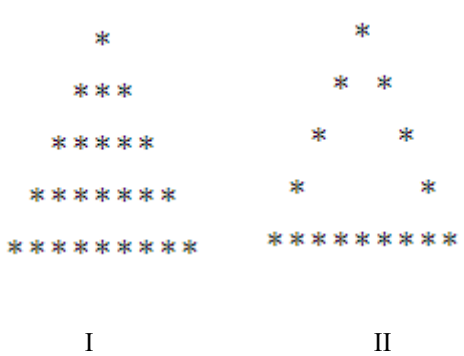
Course Outcomes / Course Learning Outcomes (CLOs)

CO's	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
1	Describe C structures, enumerators, keywords, header files and operators	2	75 %	70%
2	Illustrate Decision-Making statements and Functions.	3	70 %	65%
3	Interpret arrays, strings, and pointers programming in C	3	70 %	65%
4	Apply Structures, unions, File handling operations on different scenarios	3	70 %	65%
5	Solve given projects based on C concepts	4	70 %	65%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

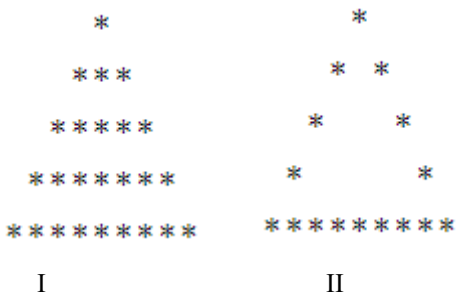
CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	3	2	1									2	2	3
Outcome 2	3	3	2	1									3	2	3
Outcome 3	3	3	2	2									3	2	3
Outcome 4	3	3	2	2									3	2	3
Outcome 5	3	3	2	2								2	3	2	2
Course Average	**3**	**3**	**2**	**2**								**2**	**3**	**2**	**3**

Course Unitization Plan

Unit No.	Unit Name	Required Contact Hours	CLOs Addressed	References Used
Unit 1	INTRODUCTION TO COMPUTER SCIENCE	**12**	1	1
	Fundamentals of Computing, Historical perspective, Early computers	2	1	1,2
	Computing machine. Basic organization of a computer: ALU, input-output units, memory, program counter - variables and addresses - instructions: store, arithmetic, input and output	2	1	1,2
	Problem solving: Algorithm / Pseudo code, flowchart, program development steps	1	1	1,2
	Computer languages: Machine, symbolic and high-level langua Level languages	1	1	1,2
	Creating and Running Programs: Writing, editing (any editor), compiling (gcc)	1	1	1,2
	linking, and executing in Linux environment	1	1	1,2
	Lab Experiment 1: GCC Compiler using Linux, various Linux commands used to edit, compile and executing	2	1	1,2
	Lab Experiment 2: a) Calculation of the area of the triangle. b) Swap two numbers without using a temporary variable. c) Find the roots of a quadratic equation	2	1	1,2
Unit 2	C PROGRAMMING BASICS	**12**		
	Structure of a C program, identifiers Basic data types and sizes. Constants, Variables	1	1	1,2
	Arithmetic, relational and logical operators, increment and decrement operator's	1	1	1,2
	Conditional operator, assignment operator, expressions Type conversi Type Conversions,	1	1	1,2
	Conditional Expressions Precedence and order of evaluation, Sample Programs.	1	1	1,2
	SELECTION & DECISION MAKING: if-else, null else, nested if, examples, multi-way selection: switch, else-if, examples.	1	1	1,2
	ITERATION: Loops - while, do-while and for, break, continue,	1	1	1,2
	initialization and updating, event and counter controlled loops and examples.	1	1,2	1,2
	Lab Experiment 3: a) Find the sum of individual digits of a positive integer and find the reverse of the given number. b) Generate the first n terms of Fibonacci sequence. c) Generate all the prime numbers between 1 and n, where n is a value supplied by the user.	1	1, 2	1,2
	Lab Experiment 4: a) Print the multiplication table of a given number n up to a given value, where n is entered by the user. b) Decimal number to binary conversion. c) Check whether a given number is the Armstrong number or not.	2	1, 2	1,2
	Lab Experiment 5: Triangle star patterns  I II	2	1, 2	1,2
Unit 3	FUNCTIONS AND ARRAYS	**12**		
	User defined functions, standard library functions	1	2,3	1,2
	Passing 1-D arrays, 2-D arrays to functions.	1	2,3	1,2
	Recursive functions - Recursive solutions for Fibonacci series, towers of Hanoi.	1	2,3	1,2
	C Pre-processor and header files	1	2,3	1,2
	Concepts, declaration, definition, storing and accessing elements	1	2,3	1,2
	one dimensional, two dimensional and multidimensional arrays	1	2,3	1,2
	array operations and examples, Character arrays and string manipulations	1	2,3	1,2

	Lab Experiment 6: a) (nCr) and (nPr) of the given numbers $1+x+x^2\backslash 2+x^3\backslash 3!+x^4\backslash 4!+\ldots\ldots\ldots..X^n\backslash n!$	1	2,3	1,2
	Lab Experiment 7: a) Interchange the largest and smallest numbers in the array. Searching an element in an array Sorting array elements.	1	2,3	1,2
	Lab Experiment 8: a. Transpose of a matrix. Addition and multiplication of 2 matrices.	1	2,3	1,2
	Lab Experiment 9: a. Function to find both the largest and smallest number of an array of integers. b. Liner search. Replace a character of string either from beginning or ending or at a specified location.	1	2,3	1,2
	Lab Experiment 10: Pre-processor directives a. If Def b. Undef Pragma	1	2,3	1,2
	FUNCTIONS AND ARRAYS	**12**		
Unit 4	POINTERS	**12**		
	Concepts, initialization of pointer variables	1	3,4	1,2
	pointers as function arguments, passing by address, dangling memory, address arithmetic	2	3,4	1,2
	character pointers and functions, pointers to pointers	1	3,4	1,2
	pointers and multi-dimensional arrays, dynamic memory management functions	1	3,4	1,2
	command line arguments	1	3,4	1,2
	Lab Experiment 10: a. Illustrate call by value and call by reference. b. Reverse a string using pointers Compare two arrays using pointers	2	3, 4	1,2,3
	Lab Experiment 11: a. Array of Int and Char Pointers. Array with Malloc(), calloc() and realloc().	2	3, 4	1,2,3
Unit 5	ENUMERATED, STRUCTURE AND UNION TYPES	**12**		
	Structures - Declaration, definition, and initialization of structures, accessing structures	1	5	2, 3, 4
	nested structures, arrays of structures, structures and functions, pointers to structures,	2	5	2, 3, 4
	self-referential structures. Unions, typedef, bit-fields, program applications	2	5	2, 3, 4
	Bit-wise operators: logical, shift, rotation, masks.	1	5	2, 3, 4
	FILE HANDLING: Concept of a file, text files and binary files, formatted I/O, file I/O operations and example programs.	2	5	2, 3, 4
	Lab Experiment 13: a. Reading a complex number b. Writing a complex number. c. Addition of two complex numbers Multiplication of two complex numbers	2	5	2, 3, 4
	Lab Experiment 14: a. File copy b. Word, line and character count in a file.	2	5	2, 3, 4
	Total Hours	**60**		

Course Utilization Plan- (Laboratory)

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	GCC Compiler using Linux, various Linux commands used to edit, compile and executing	2	1	1,2
Unit No. 2	a) Calculation of the area of the triangle. b) Swap two numbers without using a temporary variable. c) Find the roots of a quadratic equation	2	1	1,2
Unit No. 3	a) Find the sum of individual digits of a positive integer and find the reverse of the given number. b) Generate the first n terms of Fibonacci sequence. c) Generate all the prime numbers between 1 and n, where n is a value supplied by the user.	1	1, 2	1,2
Unit No. 3	a) Print the multiplication table of a given number n up to a given value, where n is entered by the user. b) Decimal number to binary conversion. c) Check whether a given number is the Armstrong number or not.	2	1, 2	1,2
Unit No. 3	Triangle star patterns  I II	2	1, 2	1,2
Unit No. 3	a) (nCr) and (nPr) of the given numbers $1+x+x^2/2+x^3/3!+x^4/4!+\ldots\ldots\ldots X^n/n!$	1	2,3	1,2
Unit No. 3	a) Interchange the largest and smallest numbers in the array. b) Searching an element in an array c) Sorting array elements.	1	2,3	1,2
Unit No. 3	a) Transpose of a matrix. b) Addition and multiplication of 2 matrices.	1	2,3	1,2
Unit No. 3	a) Function to find both the largest and smallest number of an array of integers. b) Liner search. c) Replace a character of string either from beginning or ending or at a specified location.	1	2,3	1,2
Unit No. 3	Pre-processor directives . If Def . Undef Pragma	1	2,3	1,2
Unit No. 3,4	a) Illustrate call by value and call by reference. b) Reverse a string using pointers c) Compare two arrays using pointers	2	3, 4	1,2,3
Unit No. 4	a) Array of Int and Char Pointers. b) Array with Malloc(), calloc() and realloc().	2	3, 4	1,2,3
Unit No. 4	a) To find the factorial of a given integer. b) To find the GCD (greatest common divisor) of two given integers. c) Towers of Hanoi	2	3, 4	1,2,3
Unit No. 4	a) Reading a complex number b) Writing a complex number. c) Addition of two complex numbers d) Multiplication of two complex numbers	2	5	2, 3, 4
Unit No. 5	a) File copy b) Word, line and character count in a file.	2	5	2, 3, 4
Total Contact Hours		**30**		

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)					End Semester Exam (50%)	
		Theory (40%)				Practical (10%)		
		CLA-1 (10%)	Mid-1 (10%)	CLA-2 (10%)	CLA-3(10%)		Th	Prac
Level 1	Remember	70%	60%	30%	30%	50%	50%	50%
	Understand							
Level 2	Apply	30%	40%	70%	70%	50%	50%	50%
	Analyse							
Level 3	Evaluate							
	Create							
Total		100%	100%	100%	100%	100%	100%	100%

Recommended Resources

1. 1.The C programming Language by Brian Kernighan and Dennis Richie.
2. 2.Programming in C, Pradip Dey and Manas Ghosh, Second Edition, OXFORD Higher Education, 2011.
3. 3.Problem Solving and Program Design in C, Hanly, Koffman, 7th edition, PEARSON 2013.
4. 4.Programming with C by R S Bichkar, Universities Press, 2012.

Other Resources

1. "Programming with C", Byron Gottfried, Mcgraw hill Education, Fourteenth reprint,2016

Course Designers

1. Dr. Ashok Kumar Pradhan, Associate Professor, Department of CSE, SRM University, AP.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Effective Writing and Presentation Skills

Course Code	AEC 107	**Course Category**	AEC	**L**	**T**	**P**	**C**
				1	0	1	2
Pre-Requisite Course(s)	AEC 101	**Co-Requisite Course(s)**		**Progressive Course(s)**			
Course Offering Department	Literature and Languages	**Professional / Licensing Standards**					

Course Objectives / Course Learning Rationales (CLRs)

1. To demonstrate proficiency in written communication, including the ability to compose clear, grammatically structured writing.
2. To critically analyse information from various sources, conduct research effectively, and use evidence to support their arguments in both written assignments and oral presentations.
3. To enhance students' ability to express ideas clearly, engage an audience, and deliver persuasive and impactful messages in both written and spoken formats.

Course Outcomes / Course Learning Outcomes (CLOs)

	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
Outcome 1	Develop coherent and well-structured written communication by generating clear and concise written content with logical organization, appropriate grammar, vocabulary, and sentence structure.	1, 2	70%	60%
Outcome 2	Recognize and analyze the expectations of specific target audiences by adjusting tone, language and style to suit the intended purpose of the message and tailoring written content to various formats such as reports, essays, emails, and professional correspondence.	3, 4	70%	60%
Outcome 3	Increased Confidence in Public Speaking with the ability to deliver structured, well-organized, and persuasive presentations by employing visual and interactive aids, storytelling techniques.	5, 6	70%	70%
Outcome 4	Develop strong critical thinking and research skills, enabling students to evaluate information critically, synthesize sources effectively, and provide well-reasoned arguments in their written work and presentations.	3, 4, 5, 6,	60%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	-	-	-	-	-	-	-	-	3	3	1	2	-	-	-
Outcome 2	-	2	-	-	-	1	-	-	3	3	2	2	-	-	-
Outcome 3	-	2	-	-	-	2	-	-	3	3	3	2	-	-	-
Outcome 4	-	2	-	-	-	3	-	-	-	-	-	-	-	-	-
Average	-	**2**	-	-	-	**2**	-	-	**3**	**3**	**2**	**2**	-	-	-

Course Unitization Plan

Unit No.	Unit Name	Required Contact Hours	CLOs Addressed	References Used
Unit 1	**Basics of Grammatically correct writing**	**9**	1	
	SVO	1	1	1a, 2a,b
	Punctuation	3	1	1a, 2a,b
	Articles and Preposition	2	1	1a, 2a, b
	Tense and Apostrophe	1	1	1a, 2a, b
	Subject-Verb-Agreement	2	1	1a, 2a, b
Unit 2	**Categories of Writing**	**9**		
	Emails – different types (Official mails : Requesting Leave/ Enquiring vacancy/ Resigning from job/ requesting internship etc.)	3	1, 2	1b, c
	Notice and Agenda,	2	1, 2	1b, c
	Minutes of Meeting	2	1, 2	1b, c
	Paragraph writing	2	1, 2	1b, c
Unit 3	**Advanced Writing**	**9**		
	Writing Cover Letters	3	1, 2	1e
	Resume writing	2	1, 2	1d
	SOP, Abstract	2	1, 2	1g
	Project Report Writing	2	1, 2	2, d
Unit 4	**Effective Presentation Techniques**	**9**		
	Understanding the elements of successful presentations – Non-verbal communication in presentaions	3	2,3, 4	1f, 2c
	Creating engaging PPTs	2	2,3, 4	1f, 2c
	Structuring presentations for clarity and impact - Logical flow of topics and connected writing in line with storyboard	2	2, 3, 4	1f, 2c
	Handling Questions and Answers	2	2, 3, 4	1f, 2c
Unit 5	**Project Based Learning**	**15**		
	Community Based Project	15	1, 2, 3, 4	NA
	Total Learning Hours	**60**		

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments 60%				End Semester Project 40%
		CLA-1 20%	Mid-1	CLA-2 20%	CLA-3 20%	
Level 1	Remember	20%		20%		50%
	Understand					
Level 2	Apply	40%		40%	50%	50%
	Analyse					
Level 3	Evaluate	40%		40%	50%	
	Create					
Total		100%		100%	100%	100%

Recommended Resources

1a) Swan, M. (2005). Practical English usage (Vol. 688). Oxford: Oxford university press.
1b) Fenning, C. (2023). Effective Emails: The secret to straightforward communication at work: 1 (Business CommunicationSkills): Sanage Publishing University Press.
1c) Talbot, F. (2009). How to Write Effective Business English: The Essential Toolkit for Composing Powerful Letters, Emails and More, for Today's Business Needs. Kogan Page Publishers
1d) Yate, M. (2016). Knock'em Dead Resumes: A Killer Resume Gets More Job Interviews! Simon and Schuster.
1e) Yate, M. J. (2018). Ultimate Cover Letters: Master the Art of Writing the Perfect Cover Letter to Boost Your Employability (Vol. 5). Kogan Page Publishers.
1f) Carnegie, D. (2013). The Art of Public Speaking. Wyatt North Publishing, LLC.
2a. https://learnenglishteens.britishcouncil.org/
2b. https://www.bbc.co.uk/learningenglish/
2c. https://www.ted.com/?geo=hi
2d .https://www.tifr.res.in/~cccf/data/InternDocs/How_to_write_a_structured_Project_Report.pdf

Other Resources

Course Designers

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Universal Human Values and Ethics

Course Code	VAC 102	**Course Category**	VAC		**L**	**T**	**P**	**C**
					2	0	0	2
Pre-Requisite Course(s)		**Co-Requisite Course(s)**		**Progressive Course(s)**				
Course Offering Department	Psychology Department	**Professional / Licensing Standards**						

Course Objectives / Course Learning Rationales (CLRs)

1. To cultivate deep understanding of human values by teaching students the core principles of universal human values and their significance.
2. To promote ethical decision-making skills by equipping the students with the ability to make ethical choices in life, work, and society.
3. To foster a diverse and inclusive ethical perspective by sensitizing the students to diversity, equity, inclusion, gender, and cultural differences.
4. To highlight the relevance of ethics in society and professions by showcasing the practical importance of ethics in personal, societal, and professional contexts.
5. To address common challenges by preparing the students to overcome obstacles to ethical behaviour, fostering a commitment to universal values.

Course Outcomes / Course Learning Outcomes (CLOs)

	At the end of the course the learner will be able to	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
Outcome 1	Evaluate the significance of value inputs in formal education and start applying them in their life and profession	3	70%	80%
Outcome 2	Students will foster diverse and inclusive perspectives, contributing to more equitable and harmonious communities and workplaces	2	70%	70%
Outcome 3	Students will be able to apply ethical principles effectively in their personal and professional lives, leading to improved relationships and ethical practices in society	3	60%	70%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	2	2	3				2	3	3	1	1	3			
Outcome 2		2	3				1	3	3	1		3			
Outcome 3	2	3	3					3	3	1	1	3			
Average	**2**	**2**	**3**				**1**	**3**	**3**	**1**	**1**	**3**			

Course Unitization Plan

Unit No.	Unit Name	Required Contact Hours	CLOs Addressed	References Used
Unit 1	**Fundamentals of Human Values and Ethics**	**7**	1	1, 2, 3, 4, 5
	Introduction to human values and ethics.	1		
	Theory of wellbeing	2		
	Purpose and relevance of human values	4		
Unit 2	**Culture and Ethical Principles**	**5**	**2**	
	Culture and ethics.	2		
	Ethics in the community and society	3		
Unit 3	**Ethics and Inclusivity**	**6**	**2**	
	Ethics and diversity & inclusion	3		
	Equity, equality, and addressing violence	3		
Unit 4	**Ethics in various life spheres**	**6**	**3**	
	Ethics in family, society, and workplace	4		
	Ethics in IPR and plagiarism	2		
Unit 5	**Overcoming ethical challenges**	**6**	**3**	
	Identifying common challenges	3		
	Strategies to overcome challenges	3		
Total Contact Hours		**30**		

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)		
		CLA-1 (10%)	CLA 2 (20%)	CLA-3 (20%)
		Theory	Theory	Theory
Level 1	Remember	50%	50%	50%
	Understand			
Level 2	Apply	50%	50%	50%
	Analyse			
Level 3	Evaluate			
	Create			
Total		**100%**	**100%**	**100%**

Recommended Resources

1. Landau, RS. Living Ethics. New York: Oxford University Press, 2019.
2. Nagarazan, R.S. Ethics and Human Values, New Delhi: New Age International
3. Limited.
4. Rachels, J. The Elements of Moral Philosophy. New York: McGraw Hill. 2003.
5. Singer, P. Applied Ethics. Oxford: Oxford University Press, 1986.
6. Ethics: Contemporary Readings. Edited by Harry Gensler, Earl Spurgin, James Swindle. New York, Routledge. 2004

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Entrepreneurial Mindset

Course Code	SEC 103	**Course Category**	SEC		**L**	**T**	**P**	**C**
					2	0	0	2
Pre-Requisite Course(s)	-	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	-			
Course Offering Department	Management	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

1. To develop a foundation in innovation and entrepreneurship among the students.
2. To enhance analytical skills of students for practical application of their ideas.
3. To make students proficient in designing solutions.
4. To introduce students to different phases of entrepreneurship.

Course Outcomes / Course Learning Outcomes (CLOs)

	At the end of the course the learner will be able to	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
Outcome 1	Describe and classify the basic concepts of Innovation and Entrepreneurship	2	90%	80%
Outcome 2	Discuss the concept of Design Thinking and prototyping	2	80%	70%
Outcome 3	Apply design thinking to generate innovative ideas and strategize implementation plan	3	65%	60%
Outcome 4	Prepare a business plan by assessing customer segment, market validation and product development	4	60%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**													
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	PSO 1	PSO 2	PSO 3
Outcome 1	3	1	1									2	3	2
Outcome 2	2	2	2		2		2					3	2	2
Outcome 3	1	3	3	2				3		3	3		3	2
Outcome 4	2	3	3	2				3	2	3	3	3		3
Average	**2**	**2**	**3**	**2**	**1**	**0**	**1**	**2**	**1**	**2**	**2**	**3**	**3**	**3**

Course Unitization Plan

Unit No.	Unit Name	Required Contact Hours	CLOs Addressed	References Used
Unit 1	**Entrepreneurship & Inventions**	**5**		
	Entrepreneurship and Types of Entrepreneurships	2	1	3,4
	Entrepreneurs and their Characteristics	1	1	3,4
	Innovation & its Types	2	1	1
Unit 2	**Exploration & Summarizing Facts**	**3**		
	Structured exploration and quantifying the data	2	3,4	3,4
	Analysing the data	1	3,4	3,4
Unit 3	**Reflection, Synthesizing and ideating**	**3**		
	Summarizing facts and designing a workable model	3	3,4	3,4
Unit 4	**Prototyping**	**8**		
	Definition and Basics of Prototyping	2	2,3,4	2
	Types and methods of Prototyping	4	2,3,4	2
	Innovations in prototyping	2	2,3,4	2
Unit 5	**Concept Ideation & Design Thinking**	**8**		
	Importance of Idea	1	3,4	1,2
	Idea Generation Techniques	1	3,4	1,2
	Validating the idea	1	3,4	1,2
	Definition and Basics of Design Thinking	2	2	5
	Stages of Design Thinking	3	2	5
Unit 6	**Market Validation**	**5**		
	Concept of Market Validation and its importance	2	3,4	3,4
	Customer survey	1	3,4	3,4,5
	Feedback and modifying the idea	2	3,4	3,4,5
Unit 7	**Segmentation of the potential users/ customers**	**3**		
	Customer segment and its types	2	4	3,4
	Understanding niche customer segment	1	4	3,4
	Reaching the real customers	1	4	3,4
Unit 8	**Industry Validation**	**2**		
	Industry validation and mentoring	2	3,4	3,4,5
Unit 9	**Solution Design**	**8**		
	Generate an Innovative Idea	3	3,4	1,2,5
	Develop a Business Plan	5	4	3,4
Total Contact Hours		**45**		

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)			End Semester Exam (50%)
		CLA-1 (10%)	CLA-2 (20%)	Mid-term (20%)	
Level 1	Remember	90%	50%	60%	40%
	Understand				
Level 2	Apply	10%	50%	40%	60%
	Analyse				
Level 3	Evaluate				
	Create				
Total		**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. Larry Keeley Brian Quinn Ryan Pikkel. Ten types of innovation -the discipline of building breakthroughs, John Wiley& Sons, Inc; 2013
2. Eric Ries. The lean startup how constant innovation creates radically successful businesses, Penguin Books
3. Bruce R. Barringer, R. Duane Ireland. Entrepreneurship Successfully Launching New Ventures, Pearson; 2020
4. Robert D. Hasrich, Dean A. Shepherd, Michael P. Peters, Entrepreneurship, McGraw Hill, 2020
5. Siva Prasad N. Design Thinking : Techniques And Approaches, Ane Books, New Delhi; 2023.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Fundamentals of Chemistry for Engineers

Course Code	FIC 106	**Course Category**	FIC		**L**	**T**	**P**	**C**
					2	0	1	3
Pre-Requisite Course(s)	NIL	**Co-Requisite Course(s)**	NIL	**Progressive Course(s)**	NA			
Course Offering Department	Department of Chemistry	**Professional / Licensing Standards**	NA					

Course Objectives / Course Learning Rationales (CLRs)

- To distinguish the types of bonding and can predict the structure, electronic and magnetic properties of small molecules and to learn the type of chemical reactions based on the reaction energetics and kinetics.
- To gain in-depth knowledge about crystalline materials and to understand the types of polymers and familiar with industrial applications.
- To learn the formation of proper electrochemical cell and their real-world applications.
- To choose the appropriate experimental method, apply learned theory to find out unknown concentrations of given solutions, analyse the data, and write the inference observed

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
1	Understand the theories of chemical bonding to predict molecular shapes and properties	2	80%	70%
2	Apply phase diagrams and thermochemical data for physical and chemical processes	3	75%	65%
3	Understand the crystallographic concepts to evaluate material properties	2	80%	70%
4	Apply the concepts of polymer science and electrochemistry	3	80%	75%
5	Understand the theory behind of various experiments and apply the same in acid/base, redox and complexometric titrations	3	85%	80%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	1	1	2	2	1	1	-	-	1	1	-	1	2	1	1
Outcome 2	1	2	2	2	1	1	-	-	1	1	-	1	2	2	1
Outcome 3	1	1	1	2	1	1	-	-	1	1	-	1	1	1	2
Outcome 4	1	1	3	2	1	1	-	-	1	1	-	1	1	1	1
Outcome 5	1	2	2	2	1	1	-	-	1	1	-	1	2	2	1
Course Average	**1**	**1**	**2**	**2**	**1**	**1**	**-**	**-**	**1**	**1**	**-**	**1**	**1**	**1**	**1**

Course Unitization Plan - Theory

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Ionic, covalent, and metallic bonds, Theories of bonding: Valence bond theory, nature of covalent bond, sigma (σ) bond, Pi (π) bond.	2	1	1,2
	Hydrogen bonding, Hybridization: Types of hybridization, sp, sp2, sp3, sp3d, d2sp3.	1	1	1,2
	Shapes of molecules (VSEPR Theory): BeCl2, CO2, BF3, H2O, NH3, CH4, PCl5, XeF2, SF6, XeF4.	2	1	1,2
	Molecular orbital theory: Linear combination of atomic orbitals (LCAO Method)	1	1	1,2
Unit No. 2	Phase rule, Definition of the terms used in phase rule with examples	2	2	1,2
	Application of phase rule to water system	1	2	1,2
	Basics of thermochemistry: Standard terms in thermochemistry and their significance.	2	2	1,2
	Kinetics: Order and molecularity of reactions, Zero order and first order reactions	1	2	1,2
Unit No. 3	Crystal structure: crystal systems, Properties of cubic crystals, Bragg's Law, Bravais lattices	1	3	1,2
	Miller indices	1	3	1,2
	Point defects	1	3	1,2
	Band theory: metals, insulators, and semiconductors.	3	3	1,2
Unit No. 4	Classification of polymers	2	4	1,2,3
	Properties of polymers: Tg, Tacticity, Molecular weight, weight average.	1	4	1,2,3
	Degradation of polymer, Common Polymers: Elastomer, Conducting polymer, biodegradable polymer.	2	4	1,2,3
	Demineralization of water and Zeolite process	1	4	1,2,3
Unit No. 5	Electrochemical cells	1	4	1,2
	Primary and secondary cells	2	4	1,2
	Lead-acid battery	1	4	1,2
	Li+ batteries and Fuel cells	2	4	1,2

Course Unitization Plan - Laboratory

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Volumetric titration of HCl vs NaOH	4	1	1,2
Unit No. 1	Standardization of potassium permanganate by Oxalic acid	4	2	1,2
Unit No. 1	Conductometric titration of HCl vs NaOH	4	1	1,2
Unit No. 4	Determination of hardness of water by EDTA method	4	2	1,2
Unit No. 4	Estimation of iron content of the given solution using potentiometer	4	3	1,2
Unit No. 4	Iodometric Determination of Ascorbic Acid (Vitamin C)	6	2	1,2
Unit No. 5	Determination of strength of given hydrochloric acid using pH meter	4	2	1,2

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (10%)		CLA-2 (10%)		CLA-3 (15%)		Mid Term (15%)			
		Th (5%)	Prac (5%)	Th (5%)	Prac (5%)	Th (10%)	Prac (5%)	Th (15%)	Prac (0%)	Th (30%)	Prac (20%)
Level 1	Remember	50%	50%	40%	50%	40%	50%	40%	-	40%	50%
	Understand								-		
Level 2	Apply	40%	50%	50%	50%	40%	50%	40%	-	40%	40%
	Analyse								-		
Level 3	Evaluate	10%	-	10%	-	20%	-	20%	-	20%	10%
	Create		-		-		-		-		
Total		**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	

Recommended Resources

1. A. Bahl, B.S. Bahl, G.D. Tuli, Essentials of Physical Chemistry, (2016), S Chand Publishing Company
2. T. Jain, Y. Jain, Engineering Chemistry, 16th Edition (2017), Dhanpat Rai Publication Company
3. V. R. Gowariker, N. V. Viswanathan, J. Sreedhar, Polymer Science, New Age International, 1986. ISBN: 0- 85226-307-4
4. G.H Jeffery, J Bassett, J Mendham, R.C Denny, Vogel's Textbook of Quantitative Chemical Analysis, Longmann Scientific and Technical, John Wiley, New York.
5. J.B Yadav, Advanced Practical Physical Chemistry, Goel Publishing House, 2001.

Other Resources

1. B. R. Puri, L. R. Sharma & M. S. Pathania, Principles of Physical Chemistry, 46th Edition (2013), Vishal Publication Company
2. F.W. Billmeyer, Text Book of Polymer Science, 3rd Ed., John Wiley & Sons, New York, 2003.
3. A.J.Bard and L.R. Faulkner, Electrochemical methods –Fundamentals and Applications,,2nd Ed., John Wiley and Sons, 2001.
4. D.M. Adams, Inorganic Solids, An introduction to concepts in solid state structural chemistry. J. Willey & Sons, 1974.Course Designers

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Linear Algebra and Differential Equations

Course Code	FIC 117	**Course Category**	FIC		**L**	**T**	**P**	**C**
					3	0	0	3
Pre-Requisite Course(s)	FIC103	**Co-Requisite Course(s)**	NA	**Progressive Course(s)**	**-**			
Course Offering Department	Mathematics	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

1. To make students understand the central ideas of linear algebra like solving linear equations performing matrix algebra, calculating determinants, finding eigenvalues and eigenvectors.
2. Equip the student with various solution techniques and modelling of linear and non-linear first and second-order differential equations, including systems of equations.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course, learners will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	Use the systems of linear equations for solving given problems in science and engineering.	2	80%	70%
2	Demonstrate the procedures of solving linear equations.	3	80%	70%
3	Performing matrix algebra, calculating determinants, and finding eigenvalues and eigenvectors.	3	80%	70%
4	Demonstrate the qualitative nature of the system of differential equations using matrix algebra.	3	70%	70%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CO's	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	2	3	2	2								2	2	1	1
Outcome 2	2	3	2	2								2	2	1	2
Outcome 3	2	3	2	2								2	2	1	2
Outcome 4	3	3	3	3								2	2	1	2
Course Average	**2**	**3**	**2**	**2**								**2**	**2**	**1**	**2**

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Matrices, Determinants and Linear Systems	8		
	Matrices: Addition, Scalar Multiplication, Rank	2	1	1
	Matrix Multiplication, Inverse and Transpose	2	1,2	1
	Gaussian Elimination	2	2	1
	Determinants, Cramer's Rule	1	1,2	1
	Implementation/Illustration with Maple	1	1	1
Unit No. 2	Vector spaces	12		
	Vector spaces and Subspaces	1	1,2	1
	Solutions of linear systems-existence and uniqueness. Application to DC level estimation in white noise with implementation.	2	1,2	1
	Linear Independence, Basis and Dimension	2	1,2	1
	The Four Fundamental Subspaces	1	1,2	1
	Linear Transformations, Geometric interpretation, Similarity Transformation. Demonstration of transformation for images using MATLAB.	2	2	1,3
	Orthogonal Vectors and Subspaces, Projections and Least Squares	3	3	1
	Implementation/Illustration with Maple	1	1	1
Unit No. 3	Eigenvalues and Eigenvectors	6		
	Eigen values and Eigenvectors	1	1	1,3
	Geometric multiplicity and Algebraic multiplicity of Eigen values			
	Diagonalization of matrices and Similarity transformations			
	Applications of Eigenvalue Problems	2	2	1,3
	Symmetric, Skew-Symmetric, and Orthogonal Matrices and their properties	3	2	1,3
Unit No. 4	First Order Differential Equations	7		
	Fundamental concepts, modeling	1	2	2
	Separable Differential Equations	1	2	2
	Exact Differential Equations, Integrating Factors	2	2	2
	Linear Differential Equations, Bernoulli Equation	2	2	2
	Implementation/Illustration with Maple	1	2	2
Unit No. 5	Higher Order Differential Equations	12		
	Homogeneous Linear Diff. Equations with Constant Coefficients	2	3	2
	Differential Operators	2	3	2
	Euler-Cauchy Equations	3	3,4	2
	Modeling of Second Order Electric Circuits with various excitation	2	3	2
	Solution by Variation of Parameters and method of Undetermined coefficients	2	2	2
	Implementation/Illustration with Maple	1	1	2
Total Contact Hours		**45**		

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (60%)				End Semester Assessments (40%)
		CLA-1 (10%)	Mid-1 (20%)	CLA-2 (10%)	CLA-3 (10%)	
Level 1	Remember	30%	25%	10%	20%	25%
	Understand	30%	30%	30%	30%	30%
Level 2	Apply	20%	25%	30%	30%	25%
	Analyse	20%	20%	30%	20%	20%
Level 3	Evaluate					
	Create					
Total		**100%**	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. Gilbert Strang, Linear Algebra and Its applications, Nelson Engineering, 4th Edn., 2007
2. Erwin Kreyszig, Advanced Engineering Mathematics, Willey India, 2006.
3. David Poole, Linear Algebra: A Modern Introduction, 4th Edn., Cengage, 2018.
4. Shepley L. Ross, Differential Equations, 2nd Edition, Wiley, 1974

Basics of Electrical and Electronics Engineering

Course Code	EEE 101	**Course Category**	Core Course (CC)		**L**	**T**	**P**	**C**
					2	0	1	3
Pre-Requisite Course(s)	-	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	-			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- To provide the basic idea of electrical and electronic circuits.
- To provide the basic idea of single-phase AC circuits and network theorems.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	Describe the laws and concepts of electrical circuits.	3	70%	70%
2	Discuss the network theorems under DC Excitation	3	70%	70%
3	Conduct Steady State Analysis of Pure R, L, C Circuits, RL, RC and RLC circuits under single-phase AC Excitation.	2	70%	70%
4	Describe the basic semiconductor devices and applications.	2	60%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Life Long	PSO 1	PSO 2	PSO 3
Outcome 1	3	3	2	2	2				1	1		2			
Outcome 2	3	3	2	2	2				1	1		2			
Outcome 3	3	3	2	2	2				1	1		2			
Outcome 4	3	3	2	1	2				1	1		2			
Course Average	3	3	2	2	2				1	1		2			

Course Unitization Plan - Theory

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Basic Concepts and DC Circuit Analysis: Nodes, Paths, Loops, Branches, Resistors in Series and Parallel, Ohm's law, Kirchhoff's Laws	2	1	1-3
	Voltage and Current Division, Ideal and Practical Voltage and Current Source, Dependent Voltage and Current Sources, Source Transformations	2	1	1-3
	Nodal Analysis - Presence of independent and dependent voltage and current sources	1	1	1-3
	The Super node - Presence of independent and dependent voltage and current sources	1	1	1-3
	Mesh Analysis - Presence of independent and dependent voltage and current sources	1	1	1-3
	The Super mesh - Presence of independent and dependent voltage and current sources	1	1	1-3
Unit No. 2	DC Network Theorems: Introduction to Network Theorems and Techniques, Superposition Theorem	1	2	1-3
	Thevenin's Theorem	2	2	1-3
	Norton's Theorem	1	2	1-3
	Maximum Power Transfer Theorem	2	2	1-3
	Reciprocity and Millman's Theorems	2	2	1-3
Unit No. 3	Single Phase AC Circuits: Basic Concepts Related to Generation of Sinusoidal AC Voltage. Definition and Numerical values of Average Value, Root Mean Square Value, Form Factor and Peak Factor for sinusoidal varying quantities	1	3	1-3
	Steady State Analysis of Pure R, L, C Circuits.	2	3	1-3
	Steady State Analysis of RL, RC and RLC Series Circuits with Phasor Diagrams	2	3	1-3
	Definitions of Real Power, Reactive Power, Apparent Power, and Power Factor. Concepts of Resonance	2	3	1-3
Unit No. 4	Basic Electronic Devices: PN junction diode structure	2	4	4
	Forward and reverse bias operation and characteristics of PN junction diode	1	4	4
	Half-wave, full wave, bridge rectifiers, clipping circuits using PN junction diode	2	4	4
	Bipolar junction transistors (BJTs) structure and operation	2	4	4

Course Unitization Plan – Laboratory

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Verification of Ohm's Law	2	1	1-3
Unit No. 1	Verification of Kirchoff's Current Law	2	1	1-3
Unit No. 1	Verification of Kirchoff's Voltage Law	2	1	1-3
Unit No. 2	Verification of Superposition theorem	2	2	1-3
Unit No. 2	Verification of Thevenin's theorem	2	2	1-3
Unit No. 2	Verification of Maximum Power Transfer Theorem	2	2	1-3
Unit No. 3	To study R-L-C steady characteristics using AC source.	2	3	1-3
Unit No. 4	To study the characteristics of P-N junction diode.	2	4	4
Unit No. 4	To study the performance of Half-wave rectifier	2	4	4
Unit No. 4	To study the performance of Full-wave rectifier	2	4	4

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (5%)		CLA-2 (5%)		CLA-3 (10%)		Mid Term (10% + 20% = 30%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	40%	-	30%	-	30%	-	40%	30%	30%	30%
	Understand										
Level 2	Apply	60%	-	70%	-	70%	-	60%	70%	70%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. William H Hayt, J E Kemmerly and Steven M Durbin (2024). *Engineering Circuit Analysis* (10th ed.). Mcgraw-Hill.
2. K. Alexander and Matthew N.O. Sadiku. (2016). *Fundamentals of Electric Circuits* (6th ed.). Mcgraw-Hill.
3. Abhijit Chakrabarti. (2017). *Circuit Theory Analysis and Synthesis* (7th ed.). Dhanpat Rai.
4. Robert L. Boylestad (2012). *Electronic Devices and Circuit Theory* (11th ed.). Prentice Hall.

Measurements and Instrumentation

Course Code	EEE 102	**Course Category**	Core Course (CC)		**L**	**T**	**P**	**C**
					3	0	1	4
Pre-Requisite Course(s)	FIC 103	**Co-Requisite Course(s)**	EEE 101	**Progressive Course(s)**	-			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- Study the principle of operation and working of different types of instruments. Measurement of voltage and current.
- Understand the working principle of operation of different types of instruments for measurement of power and energy.
- Learn the principle of operation and working of dc and ac potentiometers, instrumentation transformers.
- Apply AC and DC bridges for measurement of electrical parameters like resistance, inductance, and capacitance.
- Understand the basic concepts of digital metering and transducers.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
1	Identify the right type of instrument for measurement of voltage and current for ac and dc.	2	70%	65%
2	Identify the right type of instrument for measurement of power and energy.	2	70%	65%
3	Illustrate the calibration of various measuring meters with help of potentiometer.	3	70%	65%
4	Apply the solution for measurement of electrical parameters like resistance, inductance and capacitance.	3	70%	60%
5	Describe the basic operation of transducers, building blocks of digital systems, recording and display units.	2	70%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and	Self-Directed and Life Long	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	3	1	2							1	1		
Outcome 2	3	2	3	1	2							1	1		
Outcome 3	3	3	3	2	2							2	1		
Outcome 4	3	3	3	2	2							2	1		
Course Average	**3**	**2**	**3**	**2**	**2**							**2**	**1**		

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Measuring Instruments and classifications	1	1	1, 2 & 3
	Errors in Measurements	1	1	1, 2 & 3
	Classification of operating torques – deflecting, control and damping torques	1	1	1, 2 & 3
	Measurement of voltage & current- Permanent Magnet Moving Coil (PMMC) type	2	1	1, 2 & 3
	Measurement of voltage & current- Moving Iron type	2	1	1, 2 & 3
	Electrodynamometer-Type Instruments	1	1	1, 2 & 3
Unit No. 2	Power Measurement in DC and AC Circuits	1	2	1, 2 & 3
	Electrodynamometer and Induction-type Wattmeter	2	2	1, 2 & 3
	Measurement of active and reactive powers in balanced and unbalanced systems.	2	2	1, 2 & 3
	Single-Phase Induction-type Energy Meter	2	2	1, 2 & 3
	Errors in Induction-type Energy Meters and Their Compensation	2	2	1, 2 & 3
Unit No. 3	Principle and operation of D.C. Crompton's potentiometer – standardization	2	3	1, 2 & 3
	Measurement of unknown resistance, current, voltage	1	3, 4	1, 2 & 3
	AC Potentiometers – classifications, applications, advantages and disadvantages	2	3	1, 2 & 3
	Instrument transformers – Current and Potential transformers	2	3	1, 2 & 3
	Ratio and phase angle errors	2	3	1, 2 & 3
Unit No. 4	Method of measuring low, medium and high resistance, Wheat-stone's bridge – Carey Foster's bridge	2	4	1, 2 & 3
	Measurement of low resistance - Kelvin's double bridge	1		
	Measurement of high resistance – loss of charge method	1	4	1, 2 & 3
	Measurement of inductance-Maxwell's bridge, Hay bridge, Anderson's bridge	2	4	1, 2 & 3
	Measurement of capacitance and loss angle - De Sauty's bridge, Schering bridge	2	4	1, 2 & 3
	Frequency measurement and Wagner Earthing Device	1	4	1, 2 & 3

Course Unitization Plan - Laboratory

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Measurement of medium resistance by using the voltmeter and ammeter method.	2	1,4 1,4	1,3
	Conduct clamp-on meter for measurement of AC current.	2	1,4	1,3
	Measurement of resistance and inductance of a choke coil using a three-voltmeter method	2	1,4	1,3
	Measurement of resistance and inductance of a choke coil using a three-ammeter method	2	1,4	1,3
Unit No. 2	Calibration & testing of single-phase energy meter	2	1, 2, 3	2, 3
	Study the three-phase power and reactive power measurement by using two wattmeter method balanced load	2	2, 3, 4	2, 3
	Measurement of 3-phase reactive power with single wattmeter for balanced loading	2	2, 3	2, 3
	Measurement of 3-phase active power by using a single watt-meter method	2	2, 3	2, 3
Unit No. 3	CT error ratio	2		2, 3
Unit No. 4	Measurement of resistance by using Wheatstone's bridge	2	3, 4	2, 3

Learning Assessment

Bloom's Level of Cognitive Task		CLA-1 (5%)		CLA-2 (5%)		CLA-3 (10%)		Mid Term (10% + 20% = 30%)		End Semester Exam (50%)	
		Th	**Prac**	**Th**	**Prac**	**Th**	**Prac**	**Th**	**Prac**	**Th**	**Prac**
Level 1	Remember	70%	-	40%	-	40%	-	40%	30%	40%	30%
	Understand										
Level 2	Apply	30%	-	60%	-	60%	-	60%	70%	60%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	-	**100%**	-	**100%**	-	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. A.K. Sawhney. (2015), *A Course in Electrical and Electronic Measurements and Instrumentation* (19th ed.). Dhanpat Rai & Co (P).
2. E.W. Golding and F.C. Widdis. (2019), *Electrical Measurements and Measuring Instruments* (6th ed.). Medtech.
3. R.K. Rajput. (2020), *Electrical and Electronic Measurement and Instrumentation*, (4th ed.). S. Chand

SRM University *AP*, Andhra Pradesh

Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Problem Solving Skills

					L	T	P	C
Course Code	AEC 108	**Course Category**	AEC		1	0	1	2
Pre-Requisite Course(s)	SEC 101	**Co-Requisite Course(s)**		**Progressive Course(s)**				
Course Offering Department	Mathematics	**Professional / Licensing Standards**						

Course Objectives / Course Learning Rationales (CLRs)

- To categorize, apply and use thought process to distinguish between concepts of quantitative methods.
- To prepare and explain the fundamentals related to various possibilities.
- To critically evaluate numerous possibilities related to puzzles.
- Explore and apply key concepts in logical thinking to business problems.

Course Outcomes / Course Learning Outcomes (CLOs)

	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
Outcome 1	Use logical thinking and analytical abilities to solve quantitative aptitude questions from company specific and other competitive tests.	1	70%	60%
Outcome 2	Solve questions related to Time and Distance and Time and work from company specific and other competitive tests.	3	65%	70%
Outcome 3	Understand and solve puzzle questions from specific and other competitive tests	1	60%	60%
Outcome 4	Make sound arguments based on mathematical reasoning and careful analysis of data.	1	65%	70%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	-	2	2	2	1	-	-	-	1	-	-	-	2	2	2
Outcome 2	-	2	1	2	1	-	-	-		-	-	-	2	2	2
Outcome 3	-	3	2	2	-	-	-	-	1	-	-	-	2	2	2
Outcome 4	-	3	1	2	-	-	-	-		-	-	-	2	2	2
Average	-	**3**	**2**	**2**	**1**	-	-	-	**1**	-	-	-	**2**	**2**	**2**

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit 1	Clocks, Calendars	2	1,4	2,3
	Logical Reasoning Basics, Linear Arrangements, Circular Arrangements	3	1,4	2,3
	Logical Reasoning – Selections, Distributions, Selection decision table, Circular / Tabular arrangements	6	1,4	2,4
	Direction Sence, Blood Relations, Directions, Blood Relations, Problems based on dice and cubes	5	1,4	2,3
Unit 2	Data interpretation – Introduction, Line Graph	3	1,4	1,3
	Data interpretation – Bar Graph, Pie-Charts	3	1,4	1,3
	Data Interpretation – Tables, Case lets	3	1,4	1,3
Unit 3	Statistics: Basics, Concept Review Questions	2	1,2	4
	Mean, Median, Mode, QD, MD, SD, Advanced Problems.	3	1,2	4
	Functions Basics, Graphs Basics, Functions and Graphs-Advanced.	3	1,2	5
Unit 4	Geometry and Mensuration	3	1,2	1
	Venn diagram with two variables and three variables, logical deductions	3	1,2	2,3
Unit 5	Coding Maths – problems based on Number System Coding Maths - Pigeon Hole Principle	3	2,3	1,5
	Coding Maths - Discrete Math Graph Theory	3	1,2	5

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments 50%				End Semester Exam 50%
		CLA-1 10%	Mid-1 15%	CLA-2 10%	CLA-3 15%	
Level 1	Remember	40%	50%	40%	50%	50%
	Understand					
Level 2	Apply	60%	50%	60%	50%	50%
	Analyse					
Level 3	Evaluate					
	Create					
Total		**100%**	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. Arun Sharma – How to prepare for Quantitative Aptitude, Tata McGraw Hill.
2. R.S. Agarwal – Reasoning. Reasoning for competitive exams – Agarwal.
3. Logical Reasoning and Data Interpretation for CAT, By Nishit K. Sinha
4. Basic Statistics - B.L. Agarwal.
5. Graph Theory and Its Applications – Jonathan L. Gross

Other Resources

1. Geeks for Geeks
2. Indiabix.
3. M4maths.com

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Data Structures

Course Code	SEC 115	Course Category	-		L	T	P	C
					2	0	1	3
Pre-Requisite Course(s)	-	Co-Requisite Course(s)	-	Progressive Course(s)	-			
Course Offering Department	CSE	Professional / Licensing Standards	-					

Course Objectives / Course Learning Rationales (CLRs)

- To understand the basic concepts such as abstract data types, linear and non-linear data structures.
- To understand the behaviour of data structures such as arrays, linked lists, stacks, queues, trees, hash tables, search trees, graphs, and their representations.
- To provide an independent view of data structures, including its representation and operations performed on them, which are then linked to sorting, searching and indexing methods to increase the knowledge of usage of data structures in an algorithmic perspective.
- To choose an appropriate data structure for a specified application.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
1	Compare and contrast the algorithms for linked list, stack and queue operations.	4	77%	70%
2	Illustrate algorithms for Binary Search Trees and AVL Trees.	4	75%	70%
3	Analyse Graph traversal and minimum cost spanning tree algorithms.	4	72%	70%
4	Distinguish searching and sorting techniques.	2	78%	80%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	3	2	-	-	-	-	-	-	-	-	1	3	3	3
Outcome 2	3	3	2	1	-	-	-	-	-	-	-	1	3	3	3
Outcome 3	3	3	2	1	-	-	-	-	-	-	-	1	3	3	3
Outcome 4	3	3	1	-	-	-	-	-	-	-	-	1	3	3	3
Course Average	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**3**	**3**

Course Unitization Plan

Unit No.	Unit Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Introduction to Data Structures	9		
	Abstract Data Type (ADT), Time and space requirements of algorithms	1	1	1
	Array ADT, Representing polynomials	1	1	1,2
	Sparse matrix using arrays and its operations	1	1	1
	Stacks: representation and application, implementation of stack operations using C.	2	1	1
	Example applications on Stacks	2	1	
	Queues: representation and application, implementation of queue operations using C.	1	1	1,2
	Example applications on Queues	1	1	1,2
Unit No. 2	Linked lists	9		
	Linked lists: Single linked lists representation	1	1	1,2
	Implementation of linked list various operation using C	3	1	1
	Doubly linked list representation and Implementation of doubly linked list various operation using C	2	1	5
	Implementation of Circular linked list various operation using C	2	1	4,5
Unit No. 3	Trees	9		
	Tree terminology	1	2	1
	Binary tree, Representation of Binary Trees using Arrays and Linked lists	1	2	1
	Binary search tree	2	2	1
	Binary Search Trees- Basic Concepts, BST Operations: Insertion, Deletion	1	2	1
	Tree Traversals, Construction of tree using traversals	1	2	
	Applications, Expression tree	1	2	1
	General tree	1	2	1
	Heap Sort, Balanced Binary Trees, AVL Trees, Insertion, Deletion and Rotations.	1	2	1
Unit No. 4	Graphs	9		
	Graph terminology, Representation of graphs, path matrix	1	3	3
	BFS (breadth first search)	2	3	3
	DFS (depth first search)	1	3	3
	Topological sorting	1	3	3
	Priority Queues: Heap structures	1	3	5
	Binomial heaps, leftist heaps	1	3	2
	Shortest path algorithms.	1	3	2
	Implementation of shortest path algorithm using C	1	3	2
Unit No. 5	Sorting and Searching techniques	9		
	Bubble sort, selection sort and their algorithm analysis	1	4	2
	Insertion sort and its algorithm analysis	2	4	2
	Quick sort and its algorithm analysis	1	4	2,3
	Merge sort and its algorithm analysis	1	4	3
	Heap sort and its algorithm analysis	1	4	3
	Radix sort and its algorithm analysis	1	4	5
	Linear and binary search methods and its algorithm analysis.	1	4	5
	Hashing techniques and hash functions	1	4	5
Total Contact Hours		**45**		

Course Unitization Plan – Laboratory

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Conversion of infix expression to postfix expression Evaluation of expressions.	**2**	1	1,6
Unit No. 1	Tower of Hanoi is a mathematical puzzle where we have three rods and n disks. The objective of the puzzle is to move the entire stack to another rod, obeying the following simple rules: **.**Only one disk can be moved at a time. **.**Each move consists of taking the upper disk from one of the stacks and placing it on top of another stack i.e. a disk can only be moved if it is the uppermost disk on a stack. **.**No disk may be placed on top of a smaller disk .You can choose to use the function ***move (4, 1, 3, 2)****, w*here 4 represents the number of disks. 1 represents disks on source shaft, 3 represents the destination shaft which holds the disks after the move and finally 2 represents the intermediate support shaft – temporary storage. Write a C program to simulate the given problem and: Perform the algorithmic complexity analysis for the solution you propose.	2	1	1,6
Unit No. 1	Implementation the following operations: enqueue, dequeue and finding an element: **.**Linear Queue using arrays **.**Circular queue arrays **.**Priority queue singly linked list.	2	1	1,6
Unit No. 1	The "*4-Queens Problem*" consists of placing four queens on a 4 x 4 chessboard so that no two queens can capture each other. That is, no two queens are allowed to be placed on the same row, the same column or the same diagonal (both primary and secondary diagonals). Write a C program to simulate the given problem and perform the algorithmic complexity analysis for the solution you propose.	2	1	1,6
Unit No. 1	Create a singly linked list and perform the following operations: .Add an element at the end of the list .Delete an element from the beginning of the list .Find the middle element of the list .Search the given key form the list .Polynomial addition using linked list .Sparse matrix operations using linked list	**2**	1	1,6
Unit No. 1	Let us consider a small but busy airport with only one run-way (shown in figure). In each time unit, one plane can land or one plane can take off, but not both. Planes arrive ready to land or to take off at random times, so at any given unit of time, the runway may be idle or a plan may be landing or taking off, and there may be several planes waiting either to land or take off. We therefore need two queues, called *landing* and *take-off*, to hold these planes. It is better to keep a plane waiting on the ground than in the air, so a small airport allows a plane to take off only if there are no planes waiting to land. Hence, after receiving requests from new planes to land or take off, our simulation will first service the head of the queue of planes waiting to land, and only if the landing queue is empty will it allow a plane to take off. We shall wish to run the simulation through many units of time, and therefore, we embed the main action of the program in a loop that runs for cur-time (denoting current time) from 1 to a variable end-time. Simulate the given scenario using and write the output for different inputs.	2	1	1,6
Unit No. 2	Develop a code to test whether the given tree is binary tree or not. . Implementation of Binary tree traversals techniques – pre-order, in-order, and post-order. **.** Implementation of AVL tree and its operations	**2**	2	5
Unit No. 2	Given a mathematical expression, evaluate it using appropriate tree structure.	2	2	5
Unit No. 3	Write a C program for implementation of Graph traversals techniques (BFS and DFS).	2	3	1,6
Unit No. 3	The **Dijkstra's algorithm** is an algorithm that gives the shortest path between two given vertices of a graph. In this problem we are given a directed graph with each edge having a non-negative weight. Thus, a	**2**	3	1,6

	solution requires a path of many other that costs least. We can think of the problem as like this: think graph G as a map of the airline routes, each node of the graph as the cities and the weights on each edge as the cost of flying from one city to another city. The solution we have to find a routing from a city v to city w such that the total cost is minimum. Write a C program to simulate the given problem. That is find the shortest path between node A and node F in the given graph.			
Unit No. 4	Write a C program for Linear search and Binary search algorithms. What is the best case and worst-case time complexity of those searching algorithms?	2	4	2
Unit No. 4	Write a C program for bubble sort algorithm. What is the best case and worst-case time complexity of Bubble sort algorithm? Write a C program for Selection sort algorithm. What is the worst case or average case time complexity of selection sort algorithm?	2	4	2
Unit No. 4	Write a C program for Insertion sort algorithm. What is the worst case or average case time complexity of Insertion sort algorithm?	2	4	2
Unit No. 4	Write a C program for Quick sort algorithm. What is the worst case or average case time complexity of Quick sort algorithm?	2	4	3
Unit No. 4	Write a C program for Merge sort algorithm. What is the worst case or average case time complexity of Merge sort algorithm?	2	4	3
Total Hours		**30**		

Learning Assessment

Bloom's Level of Cognitive Task		**Continuous Learning Assessments (50%)**								**End Semester Exam (50%)**	
		CLA-1 (5%)		**CLA-2 (5%)**		**CLA-3 (5%)**		**Mid Term (15% +10%=25%)**			
		Th	**Prac**	**Th**	**Prac**	**Th**	**Prac**	**Th**	**Prac**	**Th**	**Prac**
Level 1	Remember	70%	-	30%	-	30%	-	60%	50%	40%	30%
	Understand										
Level 2	Apply	30%	-	70%	-	70%	-	40%	50%	60%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	-	**100%**	**-**	**100%**	**-**	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. Tenenbaum, A. M. (1990). Data structures using C. Pearson Education India.
2. Mark, A. W. (1992). Data structures and algorithm analysis in C.
3. Anderson-Freed, S., Horowitz, E., & Sahni, S. (2007). Fundamentals of Data Structures in C.
4. Lipschutz, (2002) "Data Structures", *Schaum's outline series*, *Tata McGraw Hill* Edition
5. Pai, G. V. (2008). Data Structures and Algorithms. Tata McGraw-Hill.
6. Kruse, R., & Tondo, C. L. (2007). Data structures and program design in C. Pearson Education India.

Other Resources

1. Gottfried, B. (2016) Programming with C Mcgraw hill Education, Fourteenth reprint
2. Dey, P. and Ghosh, M. (2012) Programming in C Second Edition, Oxford University Press.

Circuit Theory

Course Code	EEE 201	**Course Category**	Core Course (CC)		**L**	**T**	**P**	**C**
					3	0	1	4
Pre-Requisite Course(s)	EEE 101	**Co-Requisite Course(s)**	Electromagnetic Field Theory	**Progressive Course(s)**	Power Generation, Transmission and Distribution, Power Electronics			
Course Offering Department	EEE	**Professional / Licensing Standards**						

Course Objectives / Course Learning Rationales (CLRs)

- To provide the comprehensive idea of star delta networks, network theorems.
- To provide working application knowledge of two-port networks, and concepts of three phase AC circuits

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	Describe the star delta network and three phase electrical circuits.	3	70%	70%
2	Discuss the solution of complex DC circuits using network theorems.	3	70%	60%
3	Apply the solution methods of two-port networks	3	70%	60%
4	Illustrate the transient behaviour of RL, RC, and RLC circuits under DC and AC excitation.	3	60%	50%
5	Apply mathematical techniques to electrical circuits and understand concept of filters.	3	60%	50%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	3	2	3	2				2	1		2	3	1	1
Outcome 2	3	3	3	3	2				2	1		2	3	1	1
Outcome 3	3	3	3	3	2				2	1		2	3	1	1
Outcome 4	3	3	3	3	3				2	1		2	3	1	1
Outcome 5	3	3	3	3	3				2	1		2	3	1	1
Course Average	**3**	**3**	**3**	**3**	**2**				**2**	**1**		**2**	**3**	**1**	**1**

Course Unitization Plan - Theory

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Basic Circuit Analysis and Three Phase AC Circuits: Network Reduction Technique using Star–Delta Transformation	2	1	1, 2
	Analysis of electric circuits with voltage dependent voltage source and current source	2	1	1, 2
	Analysis of electric circuits with current dependent current source and voltage source	1	1	1, 2
	Necessity and advantages of three phase systems, generation of three phase power	2	1	1, 2
	Definition of Phase sequence, balanced supply, and balanced load	2	1	1, 2
	Relationship between line and phase values of balanced star and delta connections.	2	1	1, 2
Unit No. 2	Network Theorems: Superposition Theorem	1	1,2,3	1, 2 & 3
	Thevenin's Theorem	1	1,2,3	1, 2 & 3
	Norton's Theorem	2	1,2,3	1, 2 & 3
	Maximum Power Transfer Theorem	1	1,2,3	1, 2 & 3
	Reciprocity Theorem	1	1,2,3	1, 2 & 3
	Milliman's Theorems	1	1,2,3	1, 2 & 3
Unit No. 3	Two Port Network: Introduction to Two Port Networks	1	1,2,3	1, 2 & 3
	Impedance Parameters	2	1,2,3	1, 2 & 3
	Admittance Parameters	1	1,2,3	1, 2 & 3
	Hybrid Parameters	1	1,2,3	1, 2 & 3
	Transmission Parameters	2	1,2,3	1, 2 & 3
	Inter-relationship between parameters of a two-port network	2	1,2,3	1, 2 & 3
Unit No. 4	Transient Analysis of Circuits: Introduction to Transient analysis, Step Response of a Series RL circuit under DC Source Excitation	2	1,2,4	1,2,3,4&5
	Step Response of a Series RC circuit under DC Source Excitation	1	1,2,4	1,2,3,4&5
	Step Response of a Series RLC circuit under DC Source Excitation-Time Constant, Rise Time, Peak Time, Peak Overshoot/Undershoot and Settling Time	2	1,2,4	1,2,3,4&5
	Principle of Duality. Transient Response Analysis of Series RL, RC and RLC Circuits with AC Source Excitation.	4	1,2,4	1,2,3,4&5
Unit No. 5	Graph Theory and Filter Circuits: Graph theory- Concept of Tree, Branch, Tree link, Incidence matrix	2	1,5	1,2,3,4&5
	Tie-set matrix and loop currents, Cut set matrix and node pair potentials	2	1,5	1,2,3,4&5
	Principle of Duality,	1	1,5	1,2,3,4&5
	Passive filters-Concept-Ideal and practical, properties and uses and classification of filter	2	1,5	1,2,3,4&5
	Concept of low pass and high pass filter using reactive elements	2	1,5	1,2,3,4&5

Course Unitization Plan - Laboratory

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Study Of Balanced Three-Phase System for Star & Delta Connected Loads	3	1	2, 4, 5
Unit No. 1	To study Effect of Power Factor Using R And R, L Loads.	3	1	2, 4, 5
Unit No. 1	To study Power Factor Correction Using Static Capacitor	3	1	2, 4, 5
Unit No. 1	To study V-I Characteristics of Tungsten Filament Lamp	3	1	2, 4, 5
Unit No. 2	To verify Superposition 's theorem using AC source	3	2	2, 4, 5
Unit No. 2	To verify Thevenin 's theorem using AC source	3	2	2, 4, 5
Unit No. 3	To calculate Z-Parameters [Open Circuit Impedance Parameter] For a 2-Port Network.	3	3	2, 4, 5
Unit No. 3	To calculate Y-Parameters [Open Circuit Impedance Parameter] For a 2-Port Network.	3	3	2, 4, 5
Unit No. 4	To simulate and draw locus diagrams Of Series R-L Circuit Using MATLAB	3	4	2, 4, 5
Unit No. 4	To simulate and draw locus diagrams Of Series R-C Circuit Using MATLAB	3	4	2, 4, 5

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (5%)		CLA-2 (5%)		CLA-3 (5%)		Mid Term (15% +10%=25%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	40%	-	40%	-	40%	-	40%	30%	60%	30%
	Understand										
Level 2	Apply	60%	-	60%	-	60%	-	60%	70%	40%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. Electrical Engineering Fundamentals, Vincent Del Toro, Pearson, 2016.
2. Circuit Theory Analysis and Synthesis, Abhijit Chakrabarti, Dhanpat Rai & Co. 7th Edition, 2017.
3. Fundamentals of Electric Circuits, Charles K. Alexander and Matthew N.O. Sadiku, McGraw Hill Higher Education, Third Edition, 2005
4. Sudhakar, Shyammohan, S. Pillai, Network Theory, 2/e, Tata McGraw Hill Publications, 2012.
5. Introductory Circuit Analysis, Robert L. Boylestad, Twelfth edition, Pearson, 2012.

Electrical Machines – I

Course Code	EEE 202	**Course Category**	Core Course (CC)		**L**	**T**	**P**	**C**
					3	0	1	4
Pre-Requisite Course(s)	Foundation of Electrical and Electronics Engineering	**Co-Requisite Course(s)**	Circuit Theory	**Progressive Course(s)**	Electrical Machines-II			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- Study the construction and working principle of DC machines.
- Understand the armature reaction and commutation in DC machines.
- Learn the characteristics, performance, speed control and testing methods of DC motors.
- Study the operation and performance of single phase and three phase transformers.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	Explain the basic operating principle of DC machines.	2	70%	65%
2	Interpret the performance characteristics of different types of DC generators and motors for its application.	3	70%	65%
3	Analyse the speed control and testing methods of DC machines.	4	70%	65%
4	Explain the operation and performance of single phase and three phase transformers.	2	70%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	2	1	2							1	3	1	1
Outcome 2	3	3	3	3	3							2	3	1	1
Outcome 3	3	3	3	3	3							2	3	1	1
Outcome 4	3	3	2	2	3							2	3	1	1
Course Average	**3**	**3**	**3**	**3**	**3**							**2**	**3**	**1**	**1**

Course Unitization Plan - Theory

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Construction and Operation of DC Machines: D.C. Machines - Constructional details, Principle of operation	2	1	1, 2 & 3
	Action of commutator	1	1	1, 2 & 3
	E.M.F equation of DC generator - Problems	2	1	1, 2 & 3
	Methods of excitation of generators - Separately excited and self-excited; Causes of failure to self-excitation and remedial measures	2	1	1, 2 & 3
	Build-up of E.M.F under no load, Critical field resistance and critical speed	2	1	1, 2 & 3
Unit No. 2	DC Generators: Characteristics of DC generators - Internal and external characteristics of shunt, series, and compound generators	2	2	1, 2 & 3
	Armature reaction - Effect of armature reaction, Cross magnetizing, and demagnetizing AT/pole	3	2	1, 2 & 3
	Compensating winding, Interpoles	2	2	1, 2 & 3
	Commutation process, Methods to improve commutation	2	2	1, 2 & 3
Unit No. 3	DC Motors: Principle of operation DC Motor, Back E.M.F, Torque equation	2	2, 3	1, 2 & 3
	Types of DC motors and Characteristics of DC machines	2	2, 3	1, 2 & 3
	Speed control of D.C. Motors: Armature voltage and field flux control methods	2	2, 3	1, 2 & 3
	Starting of DC motors - Necessity and types of starters, 3 point and 4-point starters	2	2, 3	1, 2 & 3
Unit No. 4	Efficiency and Testing of DC Machines: Types of losses - Constant and Variable losses	1	3	1, 2 & 3
	Calculation of efficiency - Condition for maximum efficiency and example problems	1	3	1, 2 & 3
	Swinburne's test and example problems	2	3	1, 2 & 3
	Hopkinson's test and example problems	2	3	1, 2 & 3
	Field's test and example problems	2	3	1, 2 & 3
Unit No. 5	Transformers: Overview of Single-phase Transformer and emf equation	1	4	1, 2 & 3
	Phasor diagram on no-load and load – equivalent circuit	2	4	1, 2 & 3
	Losses and efficiency of transformer - regulation of transformer	2	4	1, 2 & 3
	Tests on single phase transformers – open circuit and short circuit tests – Sumpner's test – separation of losses	2	4	1, 2 & 3
	Auto-Transformer and Parallel operation of single-phase transformer	2	4	1, 2 & 3
	Speed control of D.C. Motors: Armature voltage and field flux control methods.	2	4	1, 2 & 3

Course Unitization Plan - Laboratory

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1, 2	Magnetization characteristics of DC shunt generator	3	1, 2	1, 2 & 3
Unit No. 2	Internal and External Characteristics of separately excited DC generator	3	2	1, 2 & 3
Unit No. 2	Study the characteristics of a dc shunt motor	3	2	1, 2 & 3
Unit No. 3	Speed Control of DC Motor: Field control, Armature control	3	3	1, 2 & 3
Unit No. 2, 3	Swinburne's test and separation of losses in DC Machine	3	2, 3	1, 2 & 3
Unit No. 2, 3	Brake test on DC shunt motor. Determination of performance curves	3	2, 3	1, 2 & 3
Unit No. 2, 3	Hopkinson's test on DC shunt machines	3	2, 3	1, 2 & 3
Unit No. 4	OC & SC test on single phase transformer	3	4	1, 2 & 3
Unit No. 4	Sumner's test on single phase transformer	3	4	1, 2 & 3
Unit No. 4	Load test on single-phase transformers	3	4	1, 2 & 3

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (5%)		CLA-2 (5%)		CLA-3 (5%)		Mid Term (15% + 20% = 35%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	70%	-	40%	-	40%	-	40%	30%	40%	30%
	Understand										
Level 2	Apply	30%	-	60%	-	60%	-	60%	70%	60%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. P. S. Bimbhra (2021). Electrical Machinery (Fully Revised ed.). Khanna Publishers.
2. D. P. Kothari, I. J. Nagrath (2022). Electric Machines (4th ed.). McGraw Hill Education.
3. A. E. Fitzgerald, C. Kingsley, and Stephen D Umans (2020). Electrical Machinery (7th ed.). McGraw Hill Education.

Principles of Signal Processing

Course Code	EEE 203	**Course Category**	Core Course (CC)		**L**	**T**	**P**	**C**
					3	0	0	3
Pre-Requisite Course(s)	FIC 103	**Co-Requisite Course(s)**	EEE 201	**Progressive Course(s)**	-			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- Outline and discuss the mathematical representation of continuous and discrete time signals and their further classification; develop input/output relationship for systems and their classification.
- Perform frequency-domain analysis of systems and periodic signals using Fourier series and aperiodic signals through Fourier transforms.
- Identify the limitations of Fourier transform and the necessity of Laplace and Z transform; their areas of application; striking a balance between theory and practice so that the theory discussed can be realized in simulations and easily compared with the analytically predicted results.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	Discuss fundamental principles of signals and systems which would allow them to analyze and apply to any physical system in time and frequency domain	3	70%	65%
2	Convert a signal/system from continuous time domain to a discrete-time domain and reconstruct it	2	70%	65%
3	Analyze the pros and cons of discretization of continuous time systems and apply the techniques as per the application requirement	3	70%	60%
4	To clearly apply the course knowledge to modern digital signal processing, control systems, signals and harmonic analysis in power electronics and power system analysis/stability.	2	70%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	2	1	2							1	3	2	3
Outcome 2	3	3	3	3	3							2	1	2	2
Outcome 3	3	3	3	3	3							2	2	2	1
Outcome 4	3	3	2	2	3							2	3	2	3
Course Average	**3**	**3**	**3**	**3**	**3**							**2**	**3**	**2**	**3**

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Classification of signals: continuous-time (CT)/discrete-time (DT), Even and odd, symmetry of signals	2	1,4	1, 2
	Periodic and aperiodic, energy and power signals, random, and deterministic signals	1	1,4	1, 2
	Standard signals: impulse, step, ramp, exponential, signum and sinusoids: definition and properties	1	1,4	1, 2
	Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration and their effects on energy and power signals.	2	1,4	1, 2
	Operations on signals: Time scaling, shifting, and folding and effect on energy/power signals	1	1,4	1, 2
	Analogy between vectors and signals, orthogonal signal space, signal approximation using orthogonal functions	2	1,4	1, 2
Unit No. 2	System: definition, Continuous-time/discrete-time LTI System	1	1,4	1, 2
	Classification of systems: linear and nonlinear, time-invariant/time-variant systems, static and dynamic, causal and non-causal, stable and unstable	2	1,4	1, 2
	Continuous-time/discrete-time LTI System properties: causality, memory, Stability (BIBO stability), and feedback system	2	1,4	1, 2
	Unit impulse response and convolution integral	1	1,4	1, 2
	Convolution: properties, response using convolution sum, and solution approach	3	1,4	1, 2
Unit No. 3	Definition and necessity of continuous and discrete-time Fourier series, Fourier series representation of periodic signals	1	1,3,4	1, 2, 3
	Properties and representation of Fourier series, Dirichlet's conditions for the existence of Fourier series	2	1,3,4	1, 2, 3
	Periodicity of DT signal, DT signal representation Fourier series	1	1,3,4	1, 2, 3
	Properties of DT Fourier series, Parseval power theorem	2	1,3,4	1, 2, 3
	Fourier Transform: Motivation, representation of an aperiodic signal	1	1,3,4	1, 2, 3
	Fourier Transforms of some useful signals	2	1,3,4	1, 2, 3
	Properties of Fourier transform and Parseval's theorem	2	1,3,4	1, 2, 3
	CTFT of periodic signals, amplitude and phase spectra, Discrete-time Fourier transform (DTFT) and its properties.	3	1,3,4	1, 2, 3
	Connection between Fourier transform with Laplace and Z-transform	1	1,3,4	1, 2, 3
Unit No. 4	Laplace Transform: Definition, derivation, necessity, existence conditions and region of convergence (ROC)	2	1,4	1, 2
	Properties of Laplace transform	1	1,4	1, 2
	Laplace transform of periodic signals, Use of Laplace Transforms to find response of an LTI system	2	1,4	1, 2
	Differential equation solution	1	1,4	1, 2
	Inverse Laplace transform	1	1,4	1, 2
	Initial and final value theorems; causality and stability from Laplace Transforms	2	1,4	1, 2
	Laplace Transform: Definition, derivation, necessity, existence conditions and region of convergence (ROC)	2	1,4	1, 2
Unit No. 5	Z-Transform: Definition, derivation, necessity, existence conditions and region of convergence (ROC)	2	2,3,4	1, 2
	Properties of Z-transform	1	2,3,4	1, 2
	Inverse Z-transform	1	2,3,4	1, 2
	Z-transform solution of linear difference equations	2	2,3,4	1, 2
	DT system realization	2	2,3,4	1, 2

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (10%)		CLA-2 (10%)		CLA-3 (10%)		Mid Term (20%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	40%	-	40%	-	20%	-	40%	-	40%	-
	Understand										
Level 2	Apply	60%	-	60%	-	80%	-	60%	-	60%	-
	Analyse										
Level 3	Evaluate	-	-	-	-	-	-	-	-	-	-
	Create	-	-	-	-	-	-	-	-	-	-
Total		**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**-**

Recommended Resources

1. Oppenheim, A.V., Willsky, A.S., and Nawab, S. *Signals and Systems* (2nd ed.). Prentice Hall.
2. Haykin, S., Veen, B.V., (2021). *Signals and Systems* (2nd ed.). Wiley.
3. Lathi, B.P. (2009). *Principles of Signal Processing and Linear Systems* (2nd ed.). Oxford.

Digital Electronics

Course Code	EEE 204	**Course Category**	Core Course (CC)		**L**	**T**	**P**	**C**
					3	0	1	4
Pre-Requisite Course(s)	**-**	**Co-Requisite Course(s)**	**-**	**Progressive Course(s)**	**-**			
Course Offering Department	EEE	**Professional / Licensing Standards**	**-**					

Course Objectives / Course Learning Rationales (CLRs)

- To acquire the basic knowledge of digital logic levels and application of the fundamentals to understand digital electronic circuits.
- To impart how to design Digital Circuits both theoretically and practically.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	Employ the codes and number systems converting circuits and compare types of logic families.	2	75%	65%
2	Apply mapping, mathematical methods and logical tools to design circuits.	3	75%	65%
3	Discuss combinational, asynchronous sequential, and synchronous sequential digital logic circuits.	2	75%	65%
4	Apply the concepts of memory devices in given problems.	3	75%	65%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and	Self-Directed and Life Long	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	3	3	2	-	-	-	-	-	3	3	2	1	1
Outcome 2	3	3	3	3	2	3	1	-	3	2	3	3	3	3	3
Outcome 3	3	2	1	1	1	-	-	-	1	-	2	3	1	1	1
Outcome 4	3	2	1	2	2	-	-	-	1	-	2	3	1	1	3
Course Average	**3**	**2**	**3**	**2**	**2**	3	1	-	3	2	3	**3**	**2**	**2**	**2**

Course Unitization Plan

	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	4 and 5 variable K-maps	2	1,2	1, 2
	1's and 2's complements	2	1	1
	Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes (Active Learning)	2	1,2	1
	Sum of products and product of sums, Minterms and Maxterms	1	1	1
	Quine-McCluskey method of minimization	2	1,2	1, 3
Unit No. 2	4 bit Adder and Subtractor	1	1	1, 2 & 3
	Binary Parallel Adder – Carry look ahead adder, BCD Adder	2	1, 2	2,3
	Multiplexer, Demultiplexer	2	1, 2	1
	Magnitude Comparator	1	1, 2	1, 3
	Decoder, Encoder, Priority Encoder (Active Learning)	2	1, 2	2,3
Unit No. 3	Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Triggering of FF	2	1,2	3,4
	Analysis and design of clocked sequential circuits – Design – Moore/Mealy models	2	1	4
	State minimization, State assignment	1	1	4
	Circuit implementation – Design of Counters – Ripple Counters, Ring Counters	2	1,2	4
	Shift Registers, Universal Shift Register	2	1,2	3,4
Unit No. 4	Stable and unstable states, output specifications	3	1,2.3	2,3
	Cycles and races, state reduction, race free assignments	2	3	1,3
	Hazards, Essential Hazards	2	2,3	1,3
	Pulse mode sequential circuits, Design of Hazard free circuits	2	1,2,3	1, 3
Unit No. 5	Classification of memories – ROM – ROM organization – PROM – EPROM – EEPROM –EAPROM	2	4	1,4
	RAM – RAM organization – Write operation – Read operation	1	4	2,4
	Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL)	2	4	4
	Field Programmable Gate Arrays (FPGA)	1	4	4
	Implementation of combinational logic circuits using ROM, PLA, PAL.	3	4	3,4

Course Unitization Plan - Laboratory

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Realization of Basic Logic Gates.	2	2	1,2
	Design of Code Converters (Binary to Gray) & (Gray to Binary).	2	2	1
Unit No. 2	Design of Half-Adder/Subtractor, Full- Adder/Subtractor, Multiplexers/De Multiplexers.	2	3	1,2
	Design of Decoder and Encoder/ BCD 7SSD.	2	3	2, 3
	Design of Magnitude Comparator (2-bit).	2	3	1,3
Unit No. 3	Design and Verification of Flip- Flops using IC.	2	3	3, 4
	Design of Asynchronous Counter (Any Mod, Up and Down, Jhonson and Ring).	2	3	4
	Design of Synchronous Counter (Any Mod, Decade counter 74ls90).	2	3	4
	Design of Universal Shift Register (Serial to Parallel, Parallel to Serial, Serial to Serial and Parallel to Parallel Converters).	2	3	3, 4
Unit No. 5	Design & Verification of Memory (SRAM).	2	4	2, 4

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (5%)		CLA-2 (5%)		CLA-3 (10%)		Mid Term (10% + 20% = 30%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	60%	-	40%	-	40%	-	40%	30%	40%	30%
	Understand										
Level 2	Apply	40%	-	60%	-	60%	-	60%	70%	60%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100**%	-	**100**%	-	**100**%	-	**100**%	**100**%	**100**%	**100**%

Recommended Resources

1. M. Morris Mano. (2018), Digital Design (5th ed.). Pearson Education.
2. John F.Wakerly (2005) ,Digital Design (4th ed.). Pearson/PHI.
3. John. M Yarbrough. (2006), Digital Logic Applications and Design (1st ed.). Thomson Learning.
4. Charles H. Roth. (2015), Fundamentals of Logic Design (7th ed.). Thomson Learning.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Creativity and Critical thinking Skills

Course Code	AEC 104	**Course Category**	Ability Enhancement Course (AEC)		**L**	**T**	**P**	**C**
					1	0	1	2
Pre-Requisite Course(s)	-	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	-			
Course Offering Department	Literature & Languages	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

1. Identify key concepts associated with creative problem-solving and critical analysis.
2. Interpret and summarize various models and frameworks used in fostering creative and critical thinking skills.
3. Apply divergent thinking methods to generate innovative solutions to multifaceted problems.
4. Assess and compare the strengths and weaknesses of various critical thinking approaches in decision-making.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	Define and describe fundamental concepts and theories related to creativity and critical thinking.	1	80%	80%
2	Explain the significance of creativity and critical thinking in problem-solving and decision-making processes.	2	80%	60%
3	Implement critical thinking strategies to analyse and evaluate information and arguments effectively.	3	80%	70%
4	Analyse and assess the effectiveness of specific creative thinking methods in addressing real-world problems.	4	80%	70%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**													
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	3	3	3	3			3		3		3	2	2	2
Outcome 2	3	3	3	3	3			3		3		3	2	2	2
Outcome 3	3	3	3	3	3			3		3		3	2	2	2
Outcome 4	3	3	3	3	3			3		3		3	2	2	2
Course Average	**3**	**3**	**3**	**3**	**3**			**3**		**3**		**3**	**2**	**2**	**2**

Course Unitization Plan

Unit No.	Syllabus Topic	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Introduction to Creativity and Critical Thinking	12		
	Introduction to key concepts		1,3	1
	Importance in personal and professional contexts		1,3	1,2
	Understanding the differences		2,3	1,4
	Real-world applications		1,3	1,3
Unit No. 2	Overcoming Mental Blocks	3		
	Identifying and addressing barriers		1	14
	Exercises for mental flexibility		4	1,2
Unit No. 3	Critical Thinking Skills	12		
	Recognizing common pitfalls		1,3	1,2
	Examples and group discussion		2,3	1,2
	Techniques for assessing information credibility		1,3	1
	Case studies and research exercises		1,3	3
Unit No. 4	Application of Creative Solutions	8		
	Practical problem-solving exercises		1,3	1,4
	Group projects and case studies		2,3	2,3
	Integrating ethics into creative and critical thinking		1,3	1
	Discussions on ethical dilemmas and decision-making		1,3	3
Unit No. 5	Application of Creative Solutions	6		
	Quizzes on concepts and techniques		1,3	1,2
	Individual and group assignments		2,3	1,2
	Applying creativity and critical thinking to a real-world scenario		1,3	1
	Presentation and peer evaluation		1,3	3
Total Contact Hours		**60**		

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (75%)			
		CLA-1 (20%)	CLA-2 (20%)	CLA-3 (20%)	Project Work (45%)
Level 1	Remember	30%		10%	
	Understand				
Level 2	Apply	70%	100%	90%	100
	Analyse				
Level 3	Evaluate				
	Create				
Total		**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. *Creative Confidence: Unleashing the Creative Potential Within Us All* by Tom Kelley and David Kelley
2. *Critical Thinking: An Introduction* by Alec Fisher
3. *Think Like a Freak: The Authors of Freakonomics Offer to Retrain Your Brain* by Steven D. Levitt and Stephen J. Dubner
4. *Creative Intelligence: Harnessing the Power to Create, Connect, and Inspire* by Bruce Nussbaum

Solid State Devices

Course Code	SEC 117	**Course Category**	SEC		**L**	**T**	**P**	**C**
					2	0	0	2
Pre-Requisite Course(s)	Engineering Physics, Single Variable Calculus, Linear Algebra	**Co-Requisite Course(s)**	Differential Equations	**Progressive Course(s)**	Power Electronics			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- Understanding the fundamental principles of semiconductor physics (e.g. energy bands, charge carriers, doping, conductivity, and mobility).
- Applying the semiconductor physics knowledge to understand the operational principles of essential semiconductor devices (e.g. p-n junction diode, transistor).
- Utilizing the knowledge of semiconductor devices for the purpose of choosing appropriate switches in the development of power electronic converters (e.g. inverters, rectifiers, and converters).

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	Summarize the concept of quantum theory and describe the behaviour of a semiconductor material at equilibrium.	2	70%	65%
2	Interpret the behaviour of the charges in a semiconductor and predict the change in carrier concentration at non-equilibrium condition.	3	70%	65%
3	Illustrate the behaviour of a semiconductor pn junction with different biasing and infer the working of a diode at with forward biasing.	2	70%	65%
4	Discover the concepts of BJT, MOScap, MOSFET, and HEMT working and interpret their potential applications.	3	70%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	2		2						1		2	2	1	
Outcome 2	3	2		2						1		2	2	1	
Outcome 3	3	3	1	2			1			1		3	3	1	2
Outcome 4	3	3	1	2			1			1		3	3	2	2
Course Average	**3**	**3**	**1**	**2**			**1**			**1**		**3**	**3**	**1**	**1**

Course Unitization Plan - Theory

Unit No.	Syllabus Topics		Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Introduction to Quantum Theory and Semiconductors: Introduction to Quantum (wave) Mechanics		1	1	1-2
	Allowed and Forbidden Energy Bands		1	1	1-2
	Density of States Function		1	1	1-2
	Equilibrium Distribution of Electrons and Holes, n0 and p0 Equations		1	1	1-2
	Intrinsic Carrier Concentration and Intrinsic Fermi-level Position		1	1	1-2
	Equilibrium Distribution of Electrons and Holes in Extrinsic Semiconductors, n0 and p0 Product in Extrinsic Semiconductors		1	1	1-2
	Fermi–Dirac Integral		1	1	1-2
	Degenerate and Nondegenerate Semiconductors and Charge Neutrality		1	1	1-2
Unit No. 2	Carrier Transport Phenomena and Nonequilibrium Excess Carriers in Semiconductors: Drift Current Density		1	2	1-2
	Mobility Effects		1	2	1-2
	Conductivity Velocity Saturation		1	2	1-2
	Diffusion Current Density		1	2	1-2
	Total Current Density		1	2	1-2
	Excess Carrier Generation and Recombination		1	2	1-2
	Continuity Equations and Ambipolar Transport		1	2	1-2
Unit No. 3	The pn Junction and Diode: Basic Structure of the pn Junction		1	3	1-2
	Zero Applied Bias	Built-in Potential Barrier, Electric Field	1	1-2	1-2
		Space Charge Width	1	1-2	1-2
	Reverse Applied Bias	Space Charge Width and Electric Field	1	1-2	1-2
		Junction Capacitance	1	1-2	1-2
	Junction Breakdown		1	3	1-2
	Poynting theorem	Boundary Conditions, Minority Carrier Distribution	1	1-2	1-2
		Ideal pn Junction Current, Generation Current, Recombination Current	1	1-2	1-2
Unit No. 4	Semiconductor Switch Fundamentals: Bipolar Junction Transistor (BJT) Principles		1	4	1-2
	Overview of Amplification and Switching in BJT and Current Gain		1	4	1-2
	Metal-Oxide Semiconductor Capacitor (MOScaps)		1	4	1-2
	Metal-Oxide-Semiconductor Field Effect Transistor (MOSFET) and Deviations from the Ideal MOSFET Case		1	4	1-2
	Heterojunctions		1	4	1
	High Electron Mobility Transistors (HEMTs)		2	4	1,3

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (10%)		CLA-2 (10%)		CLA-3 (10%)		Mid Term (20%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	60%	-	40%	-	60%	-	40%	-	40%	-
	Understand										
Level 2	Apply	40%	-	60%	-	40%	-	60%	-	60%	-
	Analyse										
Level 3	Evaluate	-	-	-	-	-	-	-	-	-	-
	Create	-	-	-	-	-	-	-	-	-	-
Total		**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**-**

Recommended Resources

1. Neamen, D.A. (2021). *Semiconductor Physics and Devices* (4th ed.). McGraw-Hill.
2. Streetman, B.G., Banerjee, S.K. (2016). *Solid State Electronic Devices* (7th ed.). Pearson.
3. Tripathi, S.L., Alvi, P.A., Subramaniam, U., (2021). *Electrical and Electronic Devices, Circuits, and Materials: Technological Challenges and Solutions* (1st ed.). Wiley.

Other Resources

1. Nath, Digbijoy N. (2021). *Fundamentals of semiconductor devices.* NPTEL Course IISc Bangalore. URL: https://onlinecourses.nptel.ac.in/noc20_bt17/preview

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Power Generation, Transmission and Distribution

Course Code	EEE 205	**Course Category**	Core Course (CC)		**L**	**T**	**P**	**C**
					3	0	1	4
Pre-Requisite Course(s)	Circuit Theory, Electromagnetic Field Theory	**Co-Requisite Course(s)**	Electrical Machine-II	**Progressive Course(s)**	Power System Analysis			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- To study the principle of operation and working of different electrical power generational sources.
- To recognize the constructional features of different types of overhead lines and insulators.
- To comprehend the constructional features of different types of underground cables.
- To realize the computation of transmission line resistance, inductance, and capacitance.
- To learn about the DC and AC distribution systems.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
1	Explain the operation of conventional generating stations and renewable sources of electrical power.	2	70%	70%
2	Explain the constructional features of different types of overhead lines and insulators	2	70%	60%
3	Illustrate the constructional features of different types of underground cables	3	70%	60%
4	Compute transmission line resistance, inductance, and capacitance	3	60%	50%
5	Discuss about the DC and AC distribution systems	2	60%	50%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	3	2	3	2				2	1		2	2	1	1
Outcome 2	3	3	3	3	2				2	1		2	2	2	2
Outcome 3	3	3	3	3	2				2	1		2	2	2	2
Outcome 4	3	3	3	3	3				2	1		2	2	2	2
Outcome 5	3	3	3	3	3				2	1		2	2	2	2
Course Average	**3**	**3**	**3**	**3**	**2**				**2**	**1**		**2**	**2**	**2**	**2**

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Generation of Electric Power: Typical layout of power system network, present power scenario in India	1	1	3
	General layout, working of thermal power plant with a brief description of components, site selection	2	1	3
	General layout, working of hydro power plant with a brief description of components, site selection.	2	1	3
	Nuclear power plant, Gas turbine power plant: general layout, working of nuclear and gas power plant with a brief description of components, site selection.	2	1	3
	Renewable energy sources (block diagram and brief description only): Solar energy, wind energy, tidal energy, and Fuel cells	2	1	3
Unit No. 2	Mechanical Design of Overhead Lines: Main components of overhead lines, Conductor materials, Line supports	2	2	2,3&4
	Insulators, Types of insulators, Potential distribution over suspension insulators	2	2	2,3&4
	String efficiency, Methods of improving string efficiency, Sag in overhead lines, Calculation of sag	2	2	2,3&4
	Corona, Factors affecting corona, Advantages and disadvantages of corona	2	2	2,3&4
	Methods of reducing corona effect	1	2	2,3&4
Unit No. 3	Underground cables: Underground cables, Construction of cables, Insulating materials for cables, Classification of cables	2	3	3&4
	Cables for three-phase service, Laying of underground cables, Insulation resistance of a single-core cable	2	3	3&4
	Capacitance of a single-core cable, Dielectric stresses in a single-core cable	2	3	3&4
	Most economical conductor size in a cable, Grading of cables, Capacitance grading, Intersheath grading	2	3	3&4
	Capacitance of 3-core cables, Measurements of core-to-core capacitance (Cc) and core to earth capacitance (Ce)	1	3	3&4
Unit No. 4	Computation of Line parameters: Different types of line conductors, Computation of line resistance, Effect of temperature and skin effect on the line resistance	1	4	1,2,3&4
	Inductance due to internal flux linkage, Inductance due to external flux linkage, Computation of inductance of single-phase lines, Flux linkages of one conductor in a group	2	4	1,2,3&4
	Inductance of composite conductor lines, Computation of inductance of three-phase lines with symmetrical and asymmetrical spacings	1	4	1,2,3&4
	Inductance of transposed lines, Computation of inductance for bundled conductors, Inductance of three-phase double circuit lines	1	4	1,2,3&4
	Electric field of a long straight conductor, Potential difference between two points due to a charge	1	4	1,2,3&4
	Computation of line capacitance of single-phase lines, Potential difference in a multi-conductor configuration	1	4	1,2,3&4
	Capacitance of three-phase lines with symmetrical and asymmetrical spacings	1	4	1,2,3&4
	Effect of earth on the capacitance, Computation of capacitance for bundled conductors	1	4	1,2,3&4
Unit No. 5	Distribution Systems- DC and AC distribution: Distribution system, Classification of distribution systems, AC distribution, DC distribution, Connection schemes of distribution system	2	5	3&4
	Types of DC distributors, DC distribution calculations, DC distributor fed at one end-concentrated loading, Uniformly loaded distributor fed at one end	2	5	3&4
	Distributor fed at both ends- concentrated loading, Uniformly loaded distributor fed at both ends, Distributor with both concentrated and uniform loading, Ring distributor, Ring main distributors with interconnector	2	5	3&4
	AC distribution calculations, Methods of solving AC distribution problems	2	5	3&4
	3-phase unbalanced loads, Four-wire star-connected unbalanced loads, Ground detectors	1	5	3&4

Learning Assessment

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Solar power generation by using MATLAB.	3	1	1, 2 ,3&4
Unit No. 1	AC Voltage Generation by wind turbine using MATLAB	3	1	1, 2 ,3&4
Unit No. 1	AC -DC Voltage Converter for wind turbine using MATLAB	3	1	1, 2 ,3&4
Unit No. 2	String efficiency calculations for string insulator	3	2	1, 2 ,3&4
Unit No. 3&4	ABCD parameters of short Transmission line	3	3&4	1, 2 ,3&4
Unit No. 3&4	ABCD parameters of medium Transmission line	3	3&4	1, 2 ,3&4
Unit No. 3&4	ABCD parameters of long Transmission line	3	3&4	1, 2 ,3&4
Unit No. 5	DC Distribution system fed from one end.	3	5	1, 2 ,3&4
Unit No. 5	DC Distribution system fed from both ends.	3	5	1, 2 ,3&4
Unit No. 5	DC Distribution system fed by Ring main.	3	5	1, 2 ,3&4

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (5%)		CLA-2 (5%)		CLA-3 (5%)		Mid Term (15% +10%=25%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	70%	-	40%	-	40%	-	40%	30%	40%	30%
	Understand										
Level 2	Apply	30%	-	60%	-	60%	-	60%	70%	60%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. Power Systems Analysis: John J. Grainger and W. D. Stevenson, Jr., McGraw-Hill, Inc., 1994.
2. Electrical Power systems: C. L. Wadhwa, 6th Edition, New Age International Publishers.
3. Principles of Power System: V.K. Mehta and Rohit Mehta, 4th Revised Edition, S. Chand.
4. Power System Engineering: D.P. Kothari and I.J. Nagrath, Second Edition, McGraw-Hill.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Electrical Machines - II

Course Code	EEE 206	**Course Category**	Core Course (CC)		**L**	**T**	**P**	**C**
					3	0	1	4
Pre-Requisite Course(s)	Electrical Machine - I	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	Power System Analysis			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- To introduce the concepts of three-phase induction motors and their testing.
- To deal with the detailed analysis of poly-phase induction motors and alternators.
- To understand the operation, construction and types of single-phase motors and their applications in household appliances and control systems.
- To learn and analyse the concept of parallel operation of alternators.
- To study the essential concepts of synchronous motors.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	Understand the concepts of rotating magnetic fields.	2	70%	70%
2	Analyse the three-phase induction motor.	3	70%	60%
3	Examine the operation of AC machines.	3	70%	60%
4	Analyse performance characteristics of AC machines.	3	60%	50%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	3	2	3	2				2	1		2	1	1	
Outcome 2	3	3	3	3	2				2	1		2	2	2	1
Outcome 3	3	3	3	3	2				2	1		2	1	1	
Outcome 4	3	3	3	3	3				2	1		2	2	2	1
Outcome 5	3	3	3	3	3				2	1		2	2	2	
Course Average	**3**	**3**	**3**	**3**	**2**				**2**	**1**		**2**	**2**	**2**	**1**

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Constructional details, Types of rotors, Principle of operation	1	1,2	1 & 2
	Slip, cogging and crawling, Equivalent circuit	2	1,2	1 & 2
	Torque - Slip characteristics, Condition for maximum torque	3	1,2	1 & 2
	Losses and efficiency, Load test, No load, blocked rotor tests, Circle diagram, Separation of losses	3	1,2	1 & 2
Unit No. 2	Need for starting, Types of starters, DOL, Rotor resistance, Autotransformer and Star - delta starters	2	2,3	1 & 2
	Speed control, Voltage control, Frequency control and pole-changing	2	2,3	1 & 2
	Cascaded connection, V/f control, Slip power recovery scheme	2	2,3	1 & 2
	Braking of three-phase induction motor: Plugging, dynamic braking and regenerative braking.	2	2,3	1 & 2
Unit No. 3	Constructional features, double-revolving field theory	2	3	1 & 2
	Equivalent circuit, determination of parameters	2	3	1 & 2
	Split-phase starting methods and applications	4	3	1 & 2
Unit No. 4	Types of rotors, winding factors, EMF equation, Synchronous reactance	2	4,5	1 & 2
	Armature reaction, phasor diagrams of non-salient, pole synchronous generator connected to infinite bus	2	4,5	1 & 2
	Synchronizing and parallel operation, synchronizing torque, Change of excitation and mechanical input	2	4,5	1 & 2
	Voltage regulation – EMF, MMF, ZPF and A.S.A methods	5	4,5	1 & 2
	steady state power, angle characteristics, two reaction theory, slip test, short circuit transients, Capability Curves	1	4,5	1 & 2
Unit No. 5	Principle of operation, torque equation, operation on infinite bus bars	1	4,5	1 & 2
	V and Inverted V curves, power input and power developed equations	2	4,5	1 & 2
	Starting methods, current loci for constant power input, constant excitation and constant power developed	2	4,5	1 & 2
	Hunting, natural frequency of oscillations, damper windings, synchronous condenser	1	4,5	1 & 2
	Special machines: SRM, BLDC, PMSM	2	4,5	1 & 2

Course Unitization Plan - Laboratory

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	No load and blocked rotor test on a 3- ϕ induction motor	3	1,2,3	1 & 2
Unit No. 1	Brake test on 3- ϕ squirrel cage induction motor	3	1,2,3	1 & 2
Unit No. 2	VFD drive based speed control of 3 phase ac motor	3	1,2,3	1 & 2
	3 phase ac induction generator	3	1,2,3	1 & 2
Unit No. 3	Load test on 1-phase induction motor	3	1,2,3	1 & 2
	Equivalent circuit of a sigle phase induction motor	3	1,2,3	1 & 2
Unit No. 4	Regulation of alternator using synchronous impedance method and mmf method	3	4,5	1 & 2
	Parallel operation of 3 phase alternator	3	4,5	1 & 2
Unit No. 5	Determination of x_d and x_q of salient pole synchronous motor	3	4,5	1 & 2
	'V' and 'inverted V' curves of synchronous motor	3	4,5	1 & 2

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (5%)		CLA-2 (5%)		CLA-3 (10%)		Mid Term (10% + 20% = 30%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	60%	-	40%	-	20%	-	40%	30%	40%	30%
	Understand										
Level 2	Apply	40%	-	60%	-	80%	-	60%	70%	60%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. Rashid, M.H. (2015). *Microelectronic Circuits: Analysis and Design* (3rd ed.). Cengage.
2. Bimbhra, P.S. (2021). *Electrical Machinery* (Fully Revised ed.). Khanna Publishers.
3. Nagrath, I. J., Kothari, D. P. (2017). Electric Machines (5th ed.). McGraw Hill Education.
4. Fitzgerald, A. E., Kingsley, C. (2017). Electric Machinery (6th ed.) McGraw Hill Education.
5. Langsdorf, A. S. (1984). Theory of Alternating current machines. McGraw Hill Education.

Other Resources

1. Prof. Bhuvaneshwari (2024). Electrical Machines. NPTEL Course IIT Delhi.
   URL: https://archive.nptel.ac.in/courses/108/102/108102146/

Analog Circuits

Course Code	EEE 207	**Course Category**	Core		**L**	**T**	**P**	**C**
					3	0	1	4
Pre-Requisite Course(s)	Circuit Theory	**Co-Requisite Course(s)**	Linear Systems and Control Design	**Progressive Course(s)**	Power Electronics			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- To introduce characteristics, biasing techniques and circuit models of semiconductor devices.
- To provide analog electronic circuits design techniques and analytical skills using diodes, op-amps, MOSFETs and BJTs.
- To introduce students to the various elements of engineering design process, including formulation of specifications, analyses of alternate solutions, synthesis, decision making, iterations, consideration of cost factors, and simulation. Thereafter, design electronic circuits as per the specifications.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	Outline the basic electronic circuit design techniques and analytical skills using diodes, op-amps, MOSFETs and BJTs	2	70%	65%
2	Describe the characteristics, biasing techniques and circuit models of semiconductor devices.	2	70%	65%
3	Apply basic engineering methods to design, analyses and operation of electronic devices and circuits.	3	70%	65%
4	Develop problem solving skills of electronic circuits and design of circuits to meet desired specifications.	3	70%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	2	1	2							1	2	3	1
Outcome 2	3	3	3	3	3							2	2	2	3
Outcome 3	3	3	3	3	3							2	2	2	3
Outcome 4	3	3	2	2	3							2	2	3	1
Course Average	**3**	**3**	**3**	**3**	**3**							**2**	**2**	**3**	**2**

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Importance of electronics; examples of analog circuits; Specifications of Electronic systems; Design of Electronic Circuits: Analysis vs design; Circuit level Design procedure	1	1	1, 2 & 4
	Amplifier characteristics; Amplifier types: Voltage, current, transconductance and transimpedance amplifiers	1	1, 3	1, 2 & 4
	Frequency response of amplifiers: Low pass, high pass, band-pass; gain and bandwidth relation	1	1, 3	1, 2 & 4
	Miller's theorem and frequency response methods	1	1, 3	1, 2 & 4
	Feedback Amplifiers: Topologies; Harmonic distortion	1	1, 3	1, 2 & 4
	Feedback amplifiers: Input and output resistance	1	1, 3	1, 2 & 4
Unit No. 2	Circuit design using Operational Amplifiers (Op-Amps)	1	1, 3	1, 2 & 4
	DC, AC and macro-model of Op-Amps	1	1, 2, 3	1, 2 & 4
	Analysis of Ideal op-amp circuits: Non-inverting/inverting amplifiers	1	1, 3	1, 2 & 4
	Op-Amp applications – I: Voltage follower; Summing Amplifier; The Differential Amplifier; Integrator; Differentiator; Transimpedance Amplifier; Transconductance Amplifier; The Instrumentation Amplifier	2	1, 2, 3	1, 2 & 4
	Op-Amp Applications – II: Optocoupler drivers; negative impedance converters; constant current sources; noninverting integrators; inductance simulators; AC-coupled bootstrapped voltage followers	3	1, 2, 3	1, 2 & 4
	Op-Amp Circuit Design: realistic op-amp; frequency effects; non-ideal effects	1	1, 3, 4	1, 2 & 4
Unit No. 3	Circuit design using Semiconductor diodes: Ideal diodes, transfer characteristics of diode circuits; determination of diode constants	2	2, 3	1, 2 & 4
	Modelling of practical diodes; Analysis of practical diode circuits; Zener diodes and design of Zener regulators	2	2, 3	1, 2 & 4
	Power rating; Diode data sheets	1	2, 3	1, 2 & 4
	Diode rectifiers (using only diode using opamp and diode); output filters for rectifiers	2	2, 3	1, 2 & 4
	Diode peak detectors; clippers and clampers	2	2,3	1, 2 & 4
	Diode function generators	2	2,3	1, 2 & 4
	Nonlinear amplifiers using op-amps and diodes	1	2, 3	1, 2 & 4
Unit No. 4	Small signal model of BJT/MOSFETs and small signal analysis	2	1,2.3	1, 2 & 3
	DC biasing of BJTs: Fixed Bias, Emitter resistance-feedback biasing, emitter follower biasing, two-base resistor biasing; Design of biasing circuits	3	1,2,3	1, 2 & 3
	CE, CC, CB amplifier analysis and design	2	1,3	1, 2 & 4
	Frequency response of BJT amplifiers	1	1,3	1, 2 & 4
	CS, CD and CG MOSFET amplifiers: analysis and design	2	2, 3	1, 2 & 4
	Cascade, current mirror and Darlington pair: motivation and analysis	1	1, 2, 3	1, 2 & 4
Unit No. 5	Waveform Generators: RC oscillators; Comparator, Schmitt Trigger	2	3, 4	1, 2 & 4
	Square-Wave generation; Sine Wave Generation from a Square-Wave Input	1	4	1, 2 & 4
	Triangular Wave Generation; Duty Cycle Modulation; Sawtooth Generation and circuit design	2	4	1, 2 & 4
	Multivibrators design with op-Amps and 555 timers	2	1, 4	1, 2 & 4

Course Unitization Plan - Laboratory

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Familiarization with the laboratory equipment	2	1	2, 4
Unit No. 2	Inverting amplifier and non-inverting amplifier	2	1, 2, 3	2, 4
	Integrator and differentiator using IC 741 op-amp	2	1, 2, 3	2, 4
Unit No. 3	Design and analysis of half wave rectifier and clipping circuits, waveform generation using diodes	2	2, 3, 4	2, 4
	Design and analysis of full-wave rectifier and Zener regulator	2	2, 3, 4	2, 4
	Design of Voltage Clamping Circuits	2	2, 3	2, 4
Unit No. 4	Study of BJT characteristics and BJT amplifier design	2	2, 3	2, 4
	Study of MOSFET characteristics and MOSFET amplifier design	2	2, 3	2, 4
Unit No. 5	Half Wave Precision Rectifier design	2	3, 4	2, 4
	Log and Antilog amplifier for small ac signal	2	3, 4	2, 4
	Summing and Difference Amplifier	2	3, 4	2, 4
	Low pass and High Pass filter	2	3, 4	2, 4
	Comparator and Schmitt Trigger design	2	3, 4	2, 4
	Astable Multivibrator Design	2	3, 4	2, 4
	Monostable Multivibrator Design	2	3, 4	2, 4

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (5%)		CLA-2 (5%)		CLA-3 (10%)		Mid Term (10% + 20% = 30%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	60%	-	40%	-	20%	-	40%	30%	40%	30%
	Understand										
Level 2	Apply	40%	-	60%	-	80%	-	60%	70%	60%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. Rashid, M.H. (2015). *Microelectronic Circuits: Analysis and Design* (3rd ed.). Cengage.
2. Sedra, A.S., Smith, K.C., Carusone, T.C., Gaudet, V. (2020). *Microelectronic Circuits* (8th International ed.). Oxford University Press (OUP).
3. Razavi, B. (2021). *Fundamentals of Microelectronics* (3rd ed.). Wiley.
4. Neamen, Donald A. (2021). *Microelectronics: Circuit Analysis and Design* (4th ed.). Mc Graw Hill

Other Resources

1. Rao, Radhakrishna K. (2024). *Analog Circuits and Systems.* NPTEL Course IIT Madras. URL: https://onlinecourses.nptel.ac.in/noc24_ee81/preview

Linear Systems and Control Design

Course Code	EEE 208	**Course Category**	Core		**L**	**T**	**P**	**C**
					3	0	1	4
Pre-Requisite Course(s)	Circuit Theory	**Co-Requisite Course(s)**	Linear Systems and Control Design	**Progressive Course(s)**	Power Electronics			
Course Offering Department	EEE	**Professional / Licensing Standards**						

Course Objectives / Course Learning Rationales (CLRs)

- To introduce characteristics, biasing techniques and circuit models of semiconductor devices.
- To provide analog electronic circuits design techniques and analytical skills using diodes, op-amps, MOSFETs and BJTs.
- To introduce students to the various elements of engineering design process, including formulation of specifications, analyses of alternate solutions, synthesis, decision making, iterations, consideration of cost factors, and simulation. Thereafter, design electronic circuits as per the specifications.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	Outline the basic electronic circuit design techniques and analytical skills using diodes, op-amps, MOSFETs and BJTs	2	70%	65%
2	Describe the characteristics, biasing techniques and circuit models of semiconductor devices.	2	70%	65%
3	Apply basic engineering methods to design, analyses and operation of electronic devices and circuits.	3	70%	65%
4	Develop problem solving skills of electronic circuits and design of circuits to meet desired specifications.	3	70%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	2	1	2							1	2	3	1
Outcome 2	3	3	3	3	3							2	2	2	3
Outcome 3	3	3	3	3	3							2	2	2	3
Outcome 4	3	3	2	2	3							2	2	3	1
Course Average	**3**	**3**	**3**	**3**	**3**							**2**	**2**	**3**	**2**

Course Unitization Plan - Theory

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Open loop-and closed loop control systems and examples	1	1	1 & 2
	Differential Equations, Laplace Transforms, Transfer Function	1	1	1 & 2
	Modelling Electrical, Mechanical, and Electro-mechanical Systems – Force/Torque-voltage and force/torque-current analogy	2	1	1 & 2
	Block diagram representation - block diagram reduction - signal flow graph - Mason's gain formula	2	1	1 & 2
	Characteristic equation, Concept, and significance of Pole & Zeros	1	1	1 & 2
	Control system components: DC and AC servo motors – synchro -gyroscope - stepper motor - Tacho generator.	2	1	1 & 2
Unit No. 2	Transient and steady state response characterisation, time domain specifications	2	2	1 & 2
	First and second order systems, Standard test input signals & Their application	2	2	1 & 2
	Time domain specifications for step input	2	2	1 & 2
	Steady state error analysis - static error coefficient of type 0,1, 2 systems - Dynamic error coefficients.	3	2	1 & 2
	Numerical Examples	1	2	1 & 2
Unit No. 3	Concept of stability: Time response for various pole locations - stability of feedback system - Routh's stability criterion	2	3	1, 2 & 3
	Root Locus (RL): Qualitative Sketching Rules and Inverse RL	2	3	1, 2 & 3
	Stability from root loci - effect of addition of poles and zeros.	1	3	1, 2 & 3
	Controller design through RL	2	3	1, 2 & 3
	Sensitivity Analysis	1	3	1, 2 & 3
Unit No. 4	Frequency domain specifications- Analysis based on Bode plot (BP) - Log magnitude vs. phase plot	2	4	1, 2 & 3
	Polar plot, Nyquist Plot (NP) mapping & Nyquist stability criterion	3	4	1, 2 & 3
	Non-minimum phase system - transportation lag	1	4	1, 2 & 3
	Analysis of nonminimum system with NP & RL	2	4	1, 2 & 3
	Gain Margin and Phase Margin with BP & NP	1	4	1, 2 & 3
	Loop shaping	1	4	1, 2 & 3
Unit No. 5	Design Using Frequency Response	1	4	1, 2 & 3
	Lag-lead controller design	2	4	1, 2 & 3
	Industrial Controllers, P, PI & PID	2	4	1, 2 & 3
	Controller optimization error performance specification (ISE, IAE & ITASE)	2	4	1, 2 & 3

Course Unitization Plan – Laboratory

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Realization of Open loop and closed loop DC motor Speed control system	2	1	2, 4
Unit No. 2	First order control system and its transient response analysis	1	1, 2, 3	2, 4
	Second order control system and its transient response analysis	1		
	Type zero control systems and its steady state analysis	1		
	Type one control systems and its steady state analysis	1		
	Type two control systems and its steady state analysis	1	1, 2, 3	2, 4
Unit No. 3	Time domain response analysis using root locus technique	2	2, 3, 4	2, 4
Unit No. 4	Frequency domain response analysis using Bode plot technique	2	2, 3	2, 4
	Frequency domain response analysis using Nyquist plot technique	2	2, 3	2, 4
Unit No. 5	Lead compensator design using root locus technique	1	3, 4	2, 4
	Lag compensator design using root locus technique	1	3, 4	2, 4
	Lag-lead compensator design using root locus technique	1	3, 4	2, 4
	Lead compensator design using Bode plot technique	1	3, 4	2, 4
	Lag compensator design using Bode plot technique	1	3, 4	2, 4
	Lag-lead compensator design using Bode plot technique	1	3, 4	2, 4
	Design of P, PI, PID Controller	2	3, 4	2, 4

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (5%)		CLA-2 (5%)		CLA-3 (10%)		Mid Term (10% + 20% = 30%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	60%	-	40%	-	20%	-	40%	30%	40%	30%
	Understand										
Level 2	Apply	40%	-	60%	-	80%	-	60%	70%	60%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. Franklin, G., Powell, D. (2019). *Feedback Control of Dynamic Systems*, Pearson (Global Edition).
2. I. J. Nagrath and M. Gopal (2021). *Control Systems Engineering*, Wiley Eastern, New Delhi.
3. Katsuhiko Ogata *(2021). Modern Control Engineering*, 5th Ed., Pearson Education.
4. Norman S. Nise (2018). *Nise's Control Systems Engineering*, Wiley India E, New Delhi.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Electromagnetic Field Theory

Course Code	EEE 301	**Course Category**	Core		**L**	**T**	**P**	**C**
					3	0	0	3
Pre-Requisite Course(s)	Power Generation, Transmission and Distribution	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	High Voltage Engineering			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- To outline and discuss the basic mathematical tools to deal with electromagnetic fields
- To discuss the characteristics of materials and explain their interactions with electromagnetic fields.
- To analyse electromagnetic wave propagation in transmission lines and to acquire problem solving skills related to electromagnetic fields.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
1	Identify and designate different co-ordinate systems to describe the spatial variations of physical quantities	**2**	70%	65%
2	Clearly explain the synthesis and working electromagnetic energy storage devices like capacitor and inductor.	**2**	70%	65%
3	Justify the process of electromagnetic wave propagation and energy transfer with perturbing factors in unguided medium and analyse the interactions of materials with electromagnetic fields.	**3**	70%	65%
4	Apply the concepts of guided structures such as transmission line to show how energy is transported	**3**	60%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	2	1	2							1	1	2	1
Outcome 2	3	3	3	3	3							2	2	2	3
Outcome 3	3	3	3	3	3							2	3	1	2
Outcome 4	3	3	2	2	3							2	3	1	3
Outcome 5	3	3	3	3	3							2	2	2	3
Course Average	**3**	**2**	**2**	**1**	**2**							**1**	**1**	**2**	**1**

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Review of Electromagnetism: Del operator, Gradient, Divergence, Curl	1	1	1,2,3&4
	Geometric meaning of Gradient, Divergence and curl, Laplacian of a scalar	3	1	1,2,3&4
	Cartesian, Cylindrical and Spherical coordinate system	1	1	1,2,3&4
	General Curvilinear coordinate system	1	1	1,2,3&4
	Transformation of coordinate systems	1	1	1,2,3&4
	Gradient, Divergence and Curl in cylindrical and spherical coordinate systems	2	1	1,2,3&4
Unit No. 2	Static electric and magnetic fields: Electric and Magnetic flux density and Gauss's Law	1	2,3	1,2,3&4
	Electrostatic boundary conditions and problems	3	2,3	1,2,3&4
	Magnetic field intensity and Ampere's circuital law	1	2,3	1,2,3&4
	Magnetic scalar potential	1	2,3	1,2,3&4
	Magnetic boundary conditions and cases/problems	3	2,3	1,2,3&4
Unit No. 3	Time-varying electromagnetic fields: Motional electromotive forces	1	3	1,2,3&4
	Faraday's law of induction	1	3	1,2,3&4
	displacement current, Maxwell's equations	1	3	1,2,3&4
	Maxwell's equations from Ampere's and Gauss's law, their physical significance	2	3	1,2,3&4
	Maxwell's equations and boundary conditions	1	3	1,2,3&4
	Poynting theorem	1	3,4	1,2,3&4
	Wave power and Poynting vector	1	3,4	1,2,3&4
	Problems on average wave power calculations from Poynting vector	1	3,4	1,2,3&4
Unit No. 4	Plane wave propagation: General wave equations	2	3	1,2,3&4
	Plane wave in free space and dielectric medium	1	3	1,2,3&4
	Plane wave in a conducting medium	1	3	1,2,3&4
	Plane wave in a good conductor and dielectric	2	3	1,2,3&4
	Skin effect and skin depth	1	3	1,2,3&4
	Reflection/Refraction of uniform plane waves	2	3	1,2,3&4
Unit No. 5	Transmission lines: Concept of lump and distributed parameters, Transmission line equations	2	4	1,2,3&4
	Lossless propagation, Examples of transmission lines -, characteristic impedance	2	4	1,2,3&4
	Lossless propagation of sinusoidal voltages - complex analysis	1	4	1,2,3&4
	Transmission line equations and their solutions in phasor form, input impedance	2	4	1,2,3&4
	Reflection of waves at discontinuous points	1	4	1,2,3&4
	Standing waves in transmission lines - Voltage standing wave ratio	1	4	1,2,3&4

Learning Assessment

		Continuous Learning Assessments (70%)								End Semester Exam (30%)	
		CLA-1 (10%)		CLA-2 (10%)		CLA-3 (40%)		Mid Term (10%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	40%	-	20%	-	40%	-	40%	-	40%	-
	Understand										
Level 2	Apply	60%	-	80%	-	60%	-	60%	-	60%	-
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**

Recommended Resources

1. Element of Electromagnetic - Mathew N.O. Sadiku, IV Edition (2006), Publisher - Oxford University Press
2. Electromagnetic Field Theory Fundamentals - B S Guru & H R Hizirogul, II Edition (2017), Publisher – Cambridge university press
3. Engineering Electromagnetic - W.H. Hyat & J.A. Buck, XIII Edition (2010), Publisher - McGraw-Hill
4. Electromagnetic Field Theory- K.A.Gangadhar and P.M.Ramnathan .Khanna Publishers (1997)

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Power System Analysis

Course Code	EEE 302	**Course Category**	Core		**L**	**T**	**P**	**C**
					3	0	1	4
Pre-Requisite Course(s)	Power Generation, Transmission and Distribution	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	Switchgear and Protection			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- To develop the impedance diagram (p.u), formation of Ybus, and study the concept of the Zbus building algorithm.
- To analyse power system performance during steady state and fault conditions.
- To analyse the stability status of power systems**.**

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
1	Interpret the impedance diagram (p.u), formation of Ybus,and building of Zbus.	3	70%	65%
2	Use numerical methods concepts to analyse the steady-state operation of power systems.	4	60%	55%
3	Analyse the behaviour of power systems under symmetrical and unsymmetrical fault conditions.	4	60%	55%
4	Analyse the stability status of power systems under given conditions.	4	65%	55%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	3	2	1	1				1	2		1	2	1	1
Outcome 2	3	3	3	3	3				2	2		1	2	2	2
Outcome 3	3	3	3	3	3				2	2		1	2	2	2
Outcome 4	3	3	3	3	3				2	2		1	2	2	2
Course Average	**3**	**3**	**3**	**3**	**3**				**2**	**2**		**1**	**2**	**2**	**2**

Course Unitization Plan - Theory

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Per Unit Representation & Topology: Per Unit Representation –Single line diagram	1	1	1, 2 & 3
	Impedance diagram of a power system	2	1	1, 2 & 3
	Formation of element node incidence and bus incidence matrices	2	1	1, 2 & 3
	Formation of Y–bus matrix by singular transformation and direct inspection methods	3	1	1, 2 & 3
	Formation of Z–Bus: Partial network– Algorithm for the Modification of Zbus Matrix for addition elements	3	1	1, 2 & 3
Unit No. 2	Power Flow Analysis: Necessity of power flow studies – Derivation of static power flow equations	2	2	1, 2 & 3
	Solution of Power Flow Equations by Gauss-Seidel Method	2	2	1, 2 & 3
	Solution of Power Flow Equations by Newton Raphson Method	2	2	1, 2 & 3
	Fast Decoupled Power Flow Solution, Comparison of Power Flow Methods	2	2	1, 2 & 3
Unit No. 3	Symmetrical Fault Analysis: Introduction to Symmetrical Fault Analysis	1	3	1, 2 & 3
	Symmetrical Fault Analysis using Thevenin's Method	3	3	1, 2 & 3
	Symmetrical Fault Analysis using Bus Impedance Matrix	2	3	1, 2 & 3
	Short Circuit Capacity and Example problems	2	3	1, 2 & 3
Unit No. 4	Unsymmetrical Fault Analysis: Fundamentals of Symmetrical Components	1	3	1, 2 & 3
	Sequence Impedances for: Transmission Lines, Star Connected Loads, Synchronous Machines, Transformers	1	3	1, 2 & 3
	Sequence Networks of a Loaded Generator	2	3	1, 2 & 3
	Unsymmetrical Fault Analysis: Single Line-to-Ground Fault, Line-to-Line Fault, Double Line-to-Ground Fault	3	3	1, 2 & 3
	Unsymmetrical Fault Analysis using Bus Impedance Matrix	2	3	1, 2 & 3
Unit No. 5	Power System Stability: Introduction to Power System Stability Problems, Swing Equation	2	4	1, 2 & 3
	Synchronous Machine Models for Stability Studies	1	4	1, 2 & 3
	Steady State Stability Analysis	2	4	1, 2 & 3
	Transient Stability Analysis- Equal Area Criterion	1	4	1, 2 & 3
	Applications of Equal Area Criterion to Sudden Increase in Power Input and Three Phase Fault	3	4	1, 2 & 3

Course Unitization Plan – Laboratory

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No.1	Formation of bus admittance matrix by using MATLAB	3	1	1, 2 & 3
Unit No. 1	Formation of bus impedance matrix by using MATLAB	3	1	1, 2 & 3
Unit No. 1	Sequence impedance of three phase transformer	3	1	1, 2 & 3
Unit No. 2	Load flow study using Gauss-Seidel method by using MATLAB	3	2	1, 2 & 3
Unit No. 2	Load flow study using Newton Raphson method by using MATLAB	3	2	1, 2 & 3
Unit No. 3	L-G Fault analysis for 3-phase transformer	3	3	1, 2 & 3
Unit No. 3	L-L Fault analysis for 3-phase transformer	3	3	1, 2 & 3
Unit No. 3	L-G Fault analysis for 3-phase alternator	3	3	1, 2 & 3
Unit No. 3	LLLG Fault analysis for 3-phase alternator	3	3	1, 2 & 3
Unit No. 4	Power angle characteristics of alternator	3	4	1, 2 & 3

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (5%)		CLA-2 (5%)		CLA-3 (5%)		Mid Term (15% + 20% = 35%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	70%	-	40%	-	40%	-	40%	30%	40%	30%
	Understand										
Level 2	Apply	30%	-	60%	-	60%	-	60%	70%	60%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	-	**100%**	-	**100%**	-	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. H. Saadat (2010). Power System Analysis (3rd ed.). PSA Publishing.
2. D. P. Kothari, I. J. Nagrath, and R. K. Saket (2022). Modern Power System Analysis (5th ed.). McGraw Hill Education.
3. V.K. Mehta and R. Mehta (2006). Principles of Power System (Revised ed.). S Chand & Co Ltd.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Nonlinear Systems and Control

Course Code	EEE 303	**Course Category**	Core		**L**	**T**	**P**	**C**
					2	0	1	3
Pre-Requisite Course(s)	Linear Systems and Control Design	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	**-**			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- To equip the students with the necessary methods along with prerequisites for analyzing the structure and behavior of nonlinear feedback systems.
- To learn the basic design techniques including feedback linearization, Lyapunov design, backstepping, and model reference adaptive control along with suitable application.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	have insight into the basic differences between open-loop and closed-loop systems	3	70%	70%
2	have insight into the basic differences between linear and non-linear systems	3	70%	60%
3	define fundamental control-theoretical stability concepts	3	70%	60%
4	give an overview of modern directions in nonlinear control	3	60%	50%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	3	2	3	2				2	1		2	1	2	3
Outcome 2	3	3	3	3	2				2	1		2	1	2	3
Outcome 3	3	3	3	3	2				2	1		2	1	2	3
Outcome 4	3	3	3	3	3				2	1		2	1	2	3
Outcome 5	3	3	3	3	3				2	1		2	1	2	3
Course Average	**3**	**3**	**3**	**3**	**2**				**2**	**1**		**2**	1	2	3

Course Unitization Plan - Theory

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	**Linear compensators and controllers:** Review of compensators	2	1, 2, 3	1-3
	Review of PI, PD and PID controllers	2	1, 2, 3	1-3
Unit No. 2	**State-space analysis:** State-space solutions and realization	3	1, 2, 3	1, 2
	Stability and Controllability	1	1, 2, 3	1-3
	State Feedback Controller Design	1	1	1, 2
	Observability and Observer Design	1	1	1, 2
Unit No. 3	**Nonlinear Systems Introduction:** Examples of nonlinear systems and their properties	2	1, 2, 3	1-3
	Existence and Uniqueness of Solutions	1	1, 2, 3	1-3
	Vector, Matrix, and Signal Norms	1	1, 2, 3	1-3
Unit No. 4	**Stability of nonlinear systems:** Lyapunov Stability definitions – stability, uniformity, attractivity, asymptotic stability, exponential stability	2	1, 2, 4	1-3
	Function classes; Definiteness, radial boundedness, decrescence; Lyapunov stability theorems	2	1, 2, 4	1-3
	Stability theorems – Stability in the sense of Lyapunov and Asymptotic Stability	2	1, 2, 4	1-3
	LaSalle's invariance principle, worked out examples	1	1, 2, 4	1-3
	Stability of nonautonomous systems	1	1, 2, 4	1-3
Unit No. 5	**Nonlinear control design:** Controllability and observability in non-linear systems	1	1, 2, 4	5
	Control Lyapunov Functions	1	1, 2, 4	5
	Backstepping method for control design, integrator backstepping	2	1, 2, 4	5
	Feedback linearization – motivation, Lie derivatives, relative degree results	2	1, 2, 4	5
	Feedback linearization – Zero dynamics, local Asymptotic Stability.	2	1, 2, 4	4

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (5%)		CLA-2 (5%)		CLA-3 (10%)		Mid Term (10% + 20% = 30%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	60%	-	40%	-	20%	-	40%	30%	40%	30%
	Understand										
Level 2	Apply	40%	-	60%	-	80%	-	60%	70%	60%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	-	**100%**	-	**100%**	-	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. Thomas Kailath, Linear Systems, Pearson, 2016.
2. Gene F. Franklin, J. David Powell, Abbas Emami-Naeini, Feedback Control of Dynamic Systems, Pearson, 7th ed., 2014.
3. M. Gopal, Modern Control Systems Engineering, New Age International, 5th ed., 2008.
4. Frank L. Lewis, Darren M. Dawson, Chaouki T. Abdallah, Robot Manipulator Control, CRC Press, 2nd ed., 2003.
5. Miroslav Krstic, Ioannis Kanellakopoulos, Petar Kokotovic, Nonlinear and Adaptive Control, John Wiley & Sons, 1995.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Power Electronics

Course Code	EEE 304	**Course Category**	Core Course (CC)		**L**	**T**	**P**	**C**
					3	0	1	4
Pre-Requisite Course(s)	Circuit Theory	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	Renewable Energy Sources			
Course Offering Department	EEE	**Professional / L icensing Standards**						

Course Objectives / Course Learning Rationales (CLRs)

- Equip the students with a basic understanding of modern power semiconductor devices.
- Introduce the operation and working of important topologies of power converter circuits for specific types of applications.
- Equips students with an ability to understand and analyze non-linear circuits involving power electronic converters.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	Choose switching devices for a given power converter.	2	70%	65%
2	Evaluate the performance of AC-DC converters.	3	70%	65%
3	Design DC-DC choppers for a given performance.	3	70%	65%
4	Analyze and evaluate the operation of inverters and ac-ac converters.	4	70%	65%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	2	1	2							1	3	1	
Outcome 2	3	3	2	3	3							1	2	3	
Outcome 3	3	3	2	3	2							1	3	3	
Outcome 4	3	3	3	3	2							2	3	3	
Course Average	**3**	**3**	**2**	**3**	**2**							**1**	**3**	**3**	

Course Unitization Plan-Theory

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	**Power Semiconductor Devices:** Concept of power electronics, scope and applications, types of power converters.	1	1	1, 2 & 3
	Power semiconductor switches and their V-I characteristics of Diodes, SCR and TRIAC.	2	1	1, 2 & 3
	V-I characteristics of power MOSFET and IGBT.	2	1	1, 2 & 3
	Thyristor ratings and protection, methods of SCR commutation.	2	1	1, 2 & 3
	Gate drive circuits.	1	1	1, 2 & 3
	Switching and conduction losses in a generic power semiconductor device.	2	1	1, 2 & 3
	Wide bandgap switching devices.	1	1	1, 2 & 3
Unit No. 2	**AC-DC Converters:** Principles of single-phase half-controlled converter with RL and RLE load.	3	2	1, 2 & 3
	Principles of single-phase fully controlled converter with R, RL, and RLE load.	3	2	1, 2 & 3
	Principles of three- phase fully controlled converter operation with RLE load.	2	2	1, 2 & 3
	Effect of source inductance.	1	2	1, 2 & 3
	Single phase and Three phase dual converters.	2	2	1, 2 & 3
Unit No. 3	**Choppers:** Introduction, Basic principles of choppers.	1	3	1, 2 & 3
	Time ratio control.	1	3	1, 2 & 3
	Chopper classification, study of Buck regulator.	2	3	1, 2 & 3
	Study of Boost and Buck-Boost regulators.	2	3	1, 2 & 3
	Tutorial Problems.	1	3	1, 2 & 3
Unit No. 4	**DC-AC Converters:** Introduction, principle of operation, performance parameters.	1	4	1, 2 & 3
	single phase bridge inverters with R, RL and RLC loads.	2	4	1, 2 & 3
	3-phase bridge inverters- 180 degrees mode of operation.	2	4	1, 2 & 3
	3-phase bridge inverters- 120 degrees mode of operation.	1	4	1, 2 & 3
	Voltage control of single-phase inverters –single pulse width modulation and multiple pulse width modulation.	2	4	1, 2 & 3
	Voltage control of single-phase inverters sinusoidal pulse width modulation.	1	4	1, 2 & 3
Unit No. 5	**AC-AC Converters:** Introduction and Single-phase AC voltage controller with R and RL Load.	2	4	1, 2 & 3
	Single-phase AC voltage controller using TRIAC with R and RL Load.	1	4	1, 2 & 3
	Midpoint step down cyclo-converter with R load.	1	4	1, 2 & 3
	Bridge type step down cyclo-converter with R-load.	1	4	1, 2 & 3
	Midpoint step up cyclo-converter with R load.	1	4	1, 2 & 3
	Bridge type step-up cyclo converters with R load.	1	4	1, 2 & 3

Course Unitization Plan – Laboratory

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Study V-I characteristics of SCR and MOSFET.	3	1	1, 2 & 3
Unit No. 2	Characteristics of single-phase fully controlled bridge rectifier.	3	2	1, 2 & 3
Unit No. 2	Characteristics of single-phase semi-controlled bridge rectifier.	3	2	1, 2 & 3
Unit No. 2	Characteristics of three-phase fully controlled rectifier.	3	2	1, 2 & 3
Unit No. 3	Study of characteristics of DC-DC buck chopper.	3	3	1, 2 & 3
Unit No. 3	Study of characteristics of DC-DC boost chopper.	3	3	1, 2 & 3
Unit No. 4	Study of unipolar and bi-polar PWM based single-phase inverter.	3	4	1, 2 & 3
Unit No. 4	Study of 3-Phase PWM inverter.	3	4	1, 2 & 3
Unit No. 4	Study of single-phase ac voltage controller.	3	4	1, 2 & 3
Unit No. 4	Study of step down cyclo converter.	3	4	1, 2 & 3

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (5%)		CLA-2 (5%)		CLA-3 (5%)		Mid Term (15% + 20% = 35%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	70%	-	40%	-	40%	-	40%	30%	40%	30%
	Understand										
Level 2	Apply	30%	-	60%	-	60%	-	60%	70%	60%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	-	**100%**	-	**100%**	-	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. M. H. Rashid. (2018). Power Electronics: Devices, Circuits, and Applications (4th ed.). Pearson.
2. Ned Mohan, Tore M. Undeland, William P. Robbins. (2006). Power Electronics- Converters, Applications and Design (3rd ed.). John Wiley & Sons.
3. M.D. Singh and K.B. Khanchandani. (2006). Power Electronics. (2nd ed.). Tata McGraw-Hill.

Other Resources

1. Prof. B.G. Fernandes. Power Electronics. NPTEL Course IIT Bombay. URL: https://nptel.ac.in/courses/108/101/108101038/
2. Prof. Vivek Agarwal, Prof. L. Umanand. Fundamental of Power Electronics. NPTEL Course IIT Bombay & IISc Bengaluru. URL: https://nptel.ac.in/courses/108/101/108101126/

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Microcontrollers and Applications

Course Code	EEE 305	**Course Category**	Core		**L**	**T**	**P**	**C**
					2	0	1	3
Pre-Requisite Course(s)	-	**Co-Requisite Course(s)**	Design of Power Electronics Circuits Lab	**Progressive Course(s)**	Embedded Systems			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- To understand the internal architecture of 8051 Microcontrollers.
- To understand and acquire knowledge in programming 8051 Microcontroller using Embedded C.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	Describe the architecture and functional block diagram of 8051 microcontroller	2	70%	65%
2	Identify various applications of 8051 microcontroller	2	70%	65%
3	Realize various mathematical and logical operations on 8051 microcontroller using Assembly and Embedded C	3	70%	60%
4	Interface 8051 microcontroller with A/D and D/A converters for serial communication	2	70%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

COs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Life Long Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	2	1	2							1	3	2	3
Outcome 2	3	3	3	3	3							2	1	2	2
Outcome 3	3	3	3	3	3							2	2	2	1
Outcome 4	3	3	2	2	3							2	3	2	3
Course Average	**3**	**3**	**3**	**3**	**3**							**2**	**3**	**2**	**3**

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	The Microcontroller 8051: Introduction and history of microcontrollers.	1	1	1, 2
	Features of 8051 microcontroller. Block diagram of 8051- program status word (PSW), accumulator, program counter	1	1	1, 2
	Memory organization – RAM & ROM, register banks and stack	1	1	1, 2
	8051 microcontrollers: Pin out diagram- description of pins, special function registers, I/O port organization, Interrupts.	1	1	1, 2
Unit No. 2	Instruction Set of 8051 & Addressing modes	2	2, 3	1, 2
	Classification of instruction set - Data transfer group, arithmetic group, logical group, single bit, branching group, CALL and RET instructions and their usage.	2	2, 3	1, 2
	Addressing modes - Immediate, register, direct, register indirect and indexed addressing modes.	2	2, 3	1, 2
	Accessing the data from internal and external memory	1	2, 3	1, 2
	Signed number concepts, generating relative address for loops	1	2, 3	1, 2
Unit No. 3	Introduction to 8051 assembly language programming	1	2, 3	1, 2
	Data types & directives, Simple Programs	1	2, 3	1, 2
	Programming Exercises	2	2, 3	1, 2
	Concept of subroutine and time delay programming	2	2, 3	1, 2,
Unit No. 4	Introduction to Programming 8051 Using Embedded C Language	2	2, 3	1, 2
	C vs. embedded C, compiler vs cross compiler. Storage classes – auto, register, static & extern. Data types	2	2, 3	1, 2
	Programs in embedded C: Sample programs and exercises	3	2, 3	1, 2
Unit No. 5	Serial Communication in 8051 microcontrollers: Serial communication – modes and protocols	1	2,3,4	1, 2
	RS-232 pin configuration and connection. Serial port programming (Transmitting a character, and receiving a character using serial communication) using Assembly and Embedded C	2	2,3,4	1, 2
	Interfacing Data Converters with 8051: Digital to Analog converters – DAC0808 / MC 1408 DAC.	1	2,3,4	1, 2
	Analog-to-Digital Converters - ADC0808, ADC0848, LM34/LM35 temperature measurement.	1	2,3,4	1, 2

Course Unitization Plan - Laboratory

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Familiarization with the laboratory equipment	2	1	1
Unit No. 2	16-bit addition, subtraction and multiplication	2	2, 3	1, 2
	32- Bit Division.	1	2, 3	1, 2
Unit No. 3	Program for addition of two numbers and display it on LCD.	1	2, 3	1, 2
	Moving data form 500 memory locations to 600 memory locations	2	2, 3	1, 2
	Searching a number in given array.	2	2, 3	1, 2
	Program for comparing two strings	1	2, 3	1, 2
Unit No. 4	8051 Embedded C coding with Keil Simulator Open Source: Program to store the data in the accumulator 2.	3	2, 3	1, 2
	Write a program to load three numbers into Accumulator and send them to port 1 3.	2	2, 3	1, 2
	Write a program to send hex values for ASCII characters of 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D and E to port P1	2	2, 3	1, 2
	Program to send values 00-ff to Port 1	2	2, 3	1, 2
	Program to toggle bits of P1 with time delay, Program to read a byte from P1, wait 1/2 second and then send to P2	2	2, 3	1, 2
Unit No. 5	Write a C program for 8051 to transfer the letter “A” serially at 9600 baud continuously. Use 8-bit data and 1 stop bit.	2	2, 3, 4	1, 2
	Write an 8051 C program to transfer the message “SRMAP” serially at 9600 baud, 8-bit data, 1 stop bit. Do this continuously.	2	2, 3, 4	1, 2
	Write an 8051 C Program to send the two messages “first name” and “last name” to the serial port. If SW = 0, send first name else if SW = 1, send last name. Set the baud rate at 9600, 8-bit data, and 1 stop bit	2	2, 3, 4	1, 2
	Program 8051 in C to receive bytes of data serially and put them in P1. Set the baud rate at 9600, 8-bit data, and 1 stop bit.	2	2, 3, 4	1, 2

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (40%)								End Semester Exam (50%)	
		CLA-1 (10%)		CLA-2 (10%)		CLA-3 (10%)		Mid Term (20%)			
		Th (10%)	Prac (0%)	Th (10%)	Prac (0%)	Th (10%)	Prac (0%)	Th (10%)	Prac (10%)	Th (30%)	Prac (20%)
Level 1	Remember	40%	-	40%	-	20%	-	40%	50%	40%	40%
	Understand										
Level 2	Apply	60%	-	60%	-	80%	-	60%	50%	60%	60%
	Analyse										
Level 3	Evaluate	-	-	-	-	-	-	-	-	-	-
	Create	-	-	-	-	-	-	-	-	-	-
Total		**100%**	-	**100%**	-	**100%**	-	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. Kenneth. J. Ayala, The 8051 Microcontroller, Cengage Learning, 3rd Edition.
2. M. A. Mazidi, J. G. Mazidi and R. D. McKinlay (Jan. 2007), The 8051 Microcontroller and Embedded Systems using Assembly and C, Pearson Education India, 2nd Edition

Other Resources

1. NPTEL course on Microprocessors and Microcontrollers by Prof. Santanu Chattopadhyay, Dept. of EECE, IIT Kharagpur. Course page URL: https://archive.nptel.ac.in/courses/108/105/108105102/

CO-CURRICULAR ACTIVITIES

Course Code	VAC 103	**Course Category**	VAC	**L**	**T**	**P**	**C**
				0	0	2	2
Pre-Requisite Course(s)		**Co-Requisite Course(s)**		**Progressive Course(s)**			
Course Offering Department	SA	**Professional / Licensing Standards**					

Course Objectives / Course Learning Rationales (CLRs)

1. Develop essential skills, including leadership, communication, and teamwork, among students.
2. Offer opportunities for students to apply academic concepts in practical, real-world scenarios.
3. Promote self-exploration, confidence-building, and social responsibility.

Course Outcomes / Course Learning Outcomes (CLOs)

	At the end of the course the learner will be able to	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
Outcome 1	Demonstrate confidence in leading group activities, communicate clearly, and collaborate effectively with diverse teams.	2	80%	75%
Outcome 2	Apply theories to practical tasks by solving problems and adapting concepts to real-life situations through cocurricular activities	2	80%	70%
Outcome 3	Develop new experiences with an open approach through guided reflection to assess personal growth, skills, and learning for holistic development.	3	80%	70%

Learning Assessment

Bloom's Level of Cognitive Task		**Continuous Learning Assessments 100%**			
		CLA-1 25%	**CLA-2 25%**	**CLA-3 25%**	**CLA-4 25%**
Level 1	Remember				
	Understand				
Level 2	Apply	15%	15%	15%	15%
	Analyse				
Level 3	Evaluate	10%	10%	10%	10%
	Create				
Total		**25%**	**25%**	**25%**	**25%**

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

COMMUNITY SERVICE AND SOCIAL RESPONSIBILITY

Course Code	VAC 104	**Course Category**	VAC	**L**	**T**	**P**	**C**
				0	0	2	2
Pre-Requisite Course(s)		**Co-Requisite Course(s)**		**Progressive Course(s)**			
Course Offering Department	CEL	**Professional / Licensing Standards**					

Course Objectives / Course Learning Rationales (CLRs)

1. Encourage initiatives that address local needs, foster self-sufficiency, and promote environmental sustainability within the community.
2. Equip participants with a deeper understanding of social issues and a sense of responsibility towards marginalized communities.
3. Inspire active participation in community service programs and foster a culture of giving back among individuals and organizations.
4. Develop and implement programs that contribute to skill development, economic empowerment, and equal opportunities for underprivileged sections of society.

Course Outcomes / Course Learning Outcomes (CLOs)

	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
Outcome 1	Develop effective strategies for identifying and addressing community needs.	3	80%	80%
Outcome 2	Demonstrate empathy and cultural sensitivity when engaging with diverse community groups.	4	80%	75%
Outcome 3	Implement sustainable solutions and evaluate their impact on social well-being.	5	90%	85%
Outcome 4	Collaborate effectively within teams to design and lead community service projects.	6	90%	80%

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments 50%				End Semester Exam 50%
		CLA-1 20%	Mid-1 20%	CLA-2 20%	CLA-3 20%	
Level 1	Remember	10%	10%			20%
	Understand					
Level 2	Apply		10%	10%		20%
	Analyse					
Level 3	Evaluate				10%	10%
	Create					
Total		**10%**	**20%**	**10%**	**10%**	**50%**

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

High Voltage Engineering

Course Code	EEE 306	Course Category	Core		L	T	P	C
					3	0	1	4
Pre-Requisite Course(s)	Circuit Theory, Electromagnetic Field Theory	Co-Requisite Course(s)	-	Progressive Course(s)	-			
Course Offering Department	EEE	Professional / Licensing Standards	-					

Course Objectives / Course Learning Rationales (CLRs)

1. To study the fundamentals, generation and measurement of high voltage electricity.
2. To understand breakdown mechanisms.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
1	Describe electrical fields and breakdown concepts in gas and vacuum medium.	2	70%	60%
2	Describe the breakdown concepts in solid and liquid.	2	70%	60%
3	Explain the generation of high (dc, ac, and impulse) voltage and currents.	2	70%	60%
4	Apply diagnostics techniques for high voltage measurements.	3	70%	60%
5	Apply testing techniques on insulators, cables, transformers.	3	70%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	3	1		2				1	1		3	3	3	3
Outcome 2	3	3	1		2				1	1		3	3	3	3
Outcome 3	3	3	3	2	2				1	1		3	3	3	3
Outcome 4	3	3	3	2	2				1	1		3	3	3	3
Outcome 5	3	3	1						1	1		3	3	3	3
Course Average	**3**	**3**	**2**	**2**	**2**				**1**	**1**		**3**	**3**	**3**	**3**

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Fundamentals of high voltage, vacuum, and gas breakdown: Introduction to electric field stress	1	1	1, 2
	Vacuum, gas, liquid and solid as insulators	1	1	1, 2
	Breakdown in vacuum, non-metallic electron emission, clump mechanism	3	1	1, 2
	Breakdown in gases, Townsend's breakdown mechanism, Streamer mechanism, Paschen's law	3	1	1, 2
	Breakdown in no-uniform field	1	1	1, 2
Unit No. 2	Breakdown mechanism in liquid and solid dielectric materials: Breakdown in liquids, Intrinsic Break down	2	2	1, 2 & 3
	Cavitation Theory, Suspended particle Theory	2	2	1, 2 & 3
	Application of oil in power apparatus	1	2	1, 2 & 3
	Breakdown in solids Intrinsic breakdown, Electromechanical break down, Thermal breakdown, Streamer Breakdown. Electrochemical breakdown	3	2	1, 2 & 3
	Application of solid dielectrics	1	2	1, 2 & 3
Unit No. 3	Generation of dc, ac and impulse voltage: Generation of dc high voltage, voltage doubler circuit	2	3	1, 2 & 3
	Generation of ac high voltage, cascade transformer, resonant transformer	3	3	1, 2 & 3
	Definition of impulse voltage	1	3	1, 2 & 3
	Generation of impulse voltage	2	3	1, 2 & 3
	Multistage impulse generators	1	3	1, 2 & 3
Unit No. 4	Measurement techniques in high voltage: Measurement of dc voltage using resistance potential dividers	2	4	1, 2 & 3
	Measurement of high ac voltage using capacitance potential dividers	2	4	1, 2 & 3
	Measurement of currents, using resistive shunts, current transformers	3	4	1, 2 & 3
	Measurement of currents Rogowski coil and illustrative examples	2	4	1, 2 & 3
Unit No. 5	Testing of electrical equipment: Introduction to testing of insulators and bushings	2	5	1, 2 & 3
	Power frequency test and impulse test on insulators	2	5	1, 2 & 3
	Power frequency test and impulse test on bushings	1	5	1, 2 & 3
	Testing of transformers, impulse testing	2	5	1, 2 & 3
	Testing of cables	2	5	1, 2 & 3

Course Unitization Plan – Laboratory

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1,2,3&4	Introduction to different equipment's, safety features and diagnostics	3	1,2,3&4	1, 2 & 3
Unit No. 1	Breakdown study in air, gases, and vacuum under different electrode arrangements.	3	1	1, 2 & 3
Unit No. 2	Liquid breakdown study.	3	2	1, 2 & 3
Unit No. 2	Breakdown study in solids	3	2	1, 2 & 3
Unit No. 3&4	Generation and measurement of dc voltage	3	3&4	1, 2 & 3
Unit No. 3&4	Generation and measurement of ac voltage.	3	3&4	1, 2 & 3
Unit No. 3&4	Generation and measurement of impulse voltage.	3	3&4	1, 2 & 3
Unit No. 3	Functioning of Cockroft Walton Voltage Multiplier.	3	3	1, 2 & 3
Unit No. 3	Functioning of Voltage Doubler.	3	3	1, 2 & 3
Unit No. 4	Measurement of capacitance and tan delta	3	4	1, 2 & 3

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (5%)		CLA-2 (5%)		CLA-3 (5%)		Mid Term (15% +10%=25%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	60%	-	50%	-	40%	-	60%	30%	60%	30%
	Understand										
Level 2	Apply	40%	-	50%	-	60%	-	40%	70%	40%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	-	**100%**	-	**100%**	-	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. E.Kuffel, W.S.Zaengl, J.Kuffel High Voltage Engineering: Fundamentals, Elsevier, 2nd edition, 2000
2. M.S.Naidu and V. Kamaraju, "High Voltage Engineering", TMH Publications. New Delhi, 5th edition, 2017.
3. C.L.Wadhwa, "High Voltage Engineering", New Age Internationals (P) Limited,3rd edition 2012.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Switchgear and Protection

Course Code	EEE 307	**Course Category**	Core		**L**	**T**	**P**	**C**
					3	0	1	4
Pre-Requisite Course(s)	Electrical Machines-1&2, Power Generation, Transmission and Distribution, Power System Analysis	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	-			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- Understand the operation and basic principles of various types of circuit breakers.
- Understand the operation and application of different types of electromagnetic protective relays.
- Learn the generator and transformer protection schemes.
- Study the feeder and busbar protection schemes.
- Understand the protection schemes of different types of over voltages in a power system.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	Describe the operating principles of given types of circuit breakers.	2	70%	65%
2	Interpret the operation and application of given types of electromagnetic protective relays.	3	70%	65%
3	Demonstrate the generator and transformer protection schemes.	3	70%	65%
4	Illustrate the feeder and busbar protection schemes.	3	70%	60%
5	Explain the protection schemes of different types of over voltages in a power system.	2	70%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**													
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	1	1	1	2							1	3	1	1
Outcome 2	3	2	2	2	2							2	3	1	1
Outcome 3	3	2	2	2	2							2	3	2	2
Outcome 4	3	2	2	2	2							2	3	2	2
Outcome 5	3	2	2	2	2							2	3	2	2
Course Average	**3**	**2**	**2**	**2**	**2**							**2**	**3**	**2**	**2**

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	**Circuit Breakers:** Elementary principles of arc interruption– Restriking Voltage and Recovery voltages	2	1	1&2
	Restriking phenomenon - RRRV– Average and Max. RRRV and Example Problems	2	1	1&2
	Current chopping and Resistance switching– Introduction to oil circuit breakers	2	1	1&2
	Description and operation of Air Blast– Vacuum and SF6 circuit breakers	2	1	1&2
	CB ratings and specifications– Concept of Auto reclosing	1	1	1&2
Unit No. 2	**Electromagnetic Protection:** Relay connection – Balanced beam type attracted armature relay	2	2	1&2
	Induction disc and induction cup relays, Torque equation	2	2	1&2
	Relays classification–Instantaneous– DMT and IDMT types	2	2	1&2
	Applications of relays: Over current and under voltage relays– Directional relays– Differential relays and percentage differential relays	2	2	1&2
	Distance relays: Impedance– Reactance– Mho and offset mho relays– Characteristics of distance relays and comparison	2	2	1&2
Unit No. 3	**Generator and Transformer Protection:** Protection of generators against stator faults	2	3	1&2
	Rotor faults and abnormal conditions	2	3	1&2
	Restricted earth fault and inter turn fault protection– Numerical examples	2	3	1&2
	Protection of transformers: Percentage differential protection– Design of CT's ratio	2	3	1&2
	Buchholz relay protection	1	3	1&2
Unit No. 4	**Feeder and Busbar Protection:** Protection of lines, Overcurrent Protection schemes	2	4	1&2
	PSM, TMS - Numerical examples	2	4	1&2
	Carrier current and three zone distance relay using impedance relays	2	4	1&2
	Protection of busbars by using Differential protection	2	4	1&2
Unit No. 5	**Protection against over voltage and grounding:** Generation of over voltages in power systems– Protection against lightning over voltages	2	5	1&2
	Valve type and zinc oxide lightning arresters	1	5	1&2
	Grounded and ungrounded neutral systems–Effects of ungrounded neutral on system performance	3	5	1&2
	Methods of neutral grounding: Solid–resistance–Reactance–Arcing grounds and grounding Practices	3	5	1&2

Course Unitization Plan – Laboratory

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1 & 2	Study and testing of Electromechanical type over current relay & to plot IDMT /DMT characteristics.	3	2	1&2
Unit No. 1 & 2	Study and testing of Electromechanical type Earth Fault current relay & to plot IDMT /DMT characteristics.	3	2	1&2
Unit No. 2	Study and testing of Digital type Over & under voltage relay(1Ø) & to plot IDMT /DMT characteristics.	3	2	1&2
Unit No. 2	Study and testing of Digital type over current relay (3Ø) & Negative sequence Relay to plot IDMT & DMT characteristics	3	2	1&2
Unit No. 3	Study & Testing of Generator protection simulator under various generator faults in real time (Differential, OC, OV, UV, E/F, Synchronizing etc).	3	3	1&2
Unit No. 3	Study & Testing of Transformer protection simulator under various transformer faults in real time (Differential, OC, OV, UV, E/F etc)	3	3	1&2
Unit No. 3	Study & Testing of Current and Potential Transformers.	3	3	1&2
Unit No. 3	Study and testing of Digital type Frequency relay (1Ø) to plot relay characteristics under testing of FHP Alternator set up.	3	3	1&2
Unit No. 3	Study & Testing of Bucholtz Relay.	3	3	1&2
Unit No. 4	Study & Testing of Feeder protection simulator under various faults in real time.	3	4	1&2

Learning Assessment

Bloom's Level of Cognitive Task		**Continuous Learning Assessments (50%)**								**End Semester Exam (50%)**	
		CLA-1 (5%)		**CLA-2 (5%)**		**CLA-3 (5%)**		**Mid Term (15% + 20% = 35%)**			
		Th	**Prac**	**Th**	**Prac**	**Th**	**Prac**	**Th**	**Prac**	**Th**	**Prac**
Level 1	Remember	70%	-	40%	-	40%	-	40%	30%	40%	30%
	Understand										
Level 2	Apply	30%	-	60%	-	60%	-	60%	70%	60%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	-	**100%**	-	**100%**	-	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. D N Vishwakarma, Badri Ram, and Soumya R Mohanty(2022). Power System Protection and Switchgear (3rd ed.). McGraw Hill Education.
2. Paithankar and S.R.Bhide. (2013). Fundamentals of Power System Protection (2nd ed.). PHI Learning.
3. T.S.Madhava Rao (1989). Power System Protection Static Relays with Microprocessor Applications (2nd ed.). Tata McGraw-Hill.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Renewable Energy Sources

Course Code	EEE 308	**Course Category**	Core		**L**	**T**	**P**	**C**
					3	0	1	4
Pre-Requisite Course(s)	Power Electronics	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	-			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- Realize the need of renewable energy sources and its importance.
- Study the performance of solar thermal systems and solar photovoltaic systems.
- Explore the concepts involved in wind energy conversion systems and performance.
- Study the operation of biogas generation and fuel cell systems.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
1	Understand the need of renewable energy sources.	2	65%	70%
2	Develop the electrical model of PV cell and study the characteristics.	3	65%	70%
3	Illustrate the various solar thermal energy conversion systems.	2	65%	70%
4	Describe the working principle of wind energy conversion systems.	3	65%	70%
5	Understand the biomass energy conversion systems and fuel cell technology.	2	65%	70%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	2	2	2		3					1			3
Outcome 2	2	1	2	3	2		3					2			2
Outcome 3	3	3	3	3	2		3					2		3	3
Outcome 4	3	3	3	3	3		3					2		2	3
Outcome 5	3	1	3	2	2		3					2			2
Course Average	**3**	**2**	**3**	**3**	**2**		**3**					**2**		**3**	**3**

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	**Introduction to Energy Sources and Solar Radiation:** Introduction about the renewable energy sources and Impact of renewable energy generation on environment.	1	1	1, 2, & 4
	Solar constant, extra-terrestrial and terrestrial solar radiation.	1	1	1, 2, & 4
	Types of solar radiation - beam and diffuse radiation.	1	1	1, 2, & 4
	Sun-earth geometry, declination angle, hour angle, LAT with examples.	2	1	1, 2, & 4
	solar angles with examples.	3	1	1, 2, & 4
	Insolation on horizontal flat plate and energy on horizontal flat plate.	2	1	1, 2, & 4
	Instruments for measuring solar radiation and sunshine recorder.	1	1	1, 2, & 4
Unit No. 2	**Solar Photovoltaic Cell:** A historical perspective.	1	2	1, 2, & 4
	PV cell characteristics and equivalent circuit.	2	2	1, 2, & 4
	Model of photovoltaic cell and its parameters.	1	2	1, 2, & 4
	Effect of temperature on open circuit voltage, short circuit current and maximum power point.	1	2	1, 2, & 4
	Data sheet study, cell efficiency and fill factor.	1	2	1, 2, & 4
	Concept of load line, identical and non-identical cells connected in series	1	2	1, 2, & 4
	Identical and non-identical cells connected in Parallel.	1	2	1, 2, & 4
	Concept of maximum power point tracking, input impedance of buck converter.	1	2	1, 2, & 4
	Input impedance of boost and buck-boost converter.	2	2	1, 2, & 4
Unit No. 3	**Solar Thermal Systems:** Introduction to solar collectors and classifications.	1	3	1, 2, & 4
	Performance indices of solar collectors.	1	3	1, 2, & 4
	Non concentrated collectors and Classification of concentrated collectors	1	3	1, 2, & 4
	Modified flat plate collector and compound parabolic concentrator.	1	3	1, 2, & 4
	Applications of solar collectors.	1	3	1, 2, & 4
Unit No. 4	**Wind energy:** Introduction to wind energy, Wind energy conversion system and its merits and demerits.	1	4	1, 2, 3 & 4
	Power and energy from wind turbines with examples.	2	4	1, 2, 3 & 4
	Maximum rotor efficiency with examples.	2	4	1, 2, 3 & 4
	Effect of tower height on wind speeds with examples.	2	4	1, 2, 3 & 4
	General Classification of Wind Turbines-Rotor Turbines-Multiple-Blade Turbines.	1	4	1, 2, 3 & 4
	Downwind and upwind turbine, Pitch control and yaw control.	1	4	1, 2, 3 & 4
	Horizontal axis wind turbine and its important parts.	1	4	1, 2, 3 & 4
	vertical axis wind turbine and its important parts.	1	4	1, 2, 3 & 4
Unit No. 5	**Biomass Energy and fuel cell:** Introduction to biomass, biomass energy and its merits and demerits.	1	5	1, 2, & 4
	Principles of biomass conversion and Photosynthesis.	1	5	1, 2, & 4
	Combustion and fermentation.	1	5	1, 2, & 4
	Types of biogas digesters and its working.	2	5	1, 2, & 4
	Introduction about fuel cell and working of fuel cell.	1	5	1, 2, & 4
	Efficiency of fuel cell and concept of fuel cell technology.	1	5	1, 2, & 4

Course Unitization Plan – Laboratory

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 2	Study the I-V and P-V characteristics of PV modules.	3	2	1, 2, & 4
Unit No. 2	Study the I-V and P-V characteristics of series and parallel combination of PV modules.	3	2	1, 2, & 4
Unit No. 1, 2	Study the effect of variation in tilt angle of PV modules.	3	1, 2	1, 2, & 4
Unit No. 2	Study the effect of shading on PV modules.	3	2	1, 2, & 4
Unit No. 2	Study the working of bypass diodes and blocking diodes.	3	2	1, 2, & 4
Unit No. 2	(a) Study the power flow calculations of stand-alone PV system with DC load and battery. (b) Study the power flow calculations of stand-alone PV system with AC load and battery.	3	2	1, 2, 3 & 4
Unit No. 4	Evaluation of cut-in speed of wind turbine	3	4	1, 2, 3 & 4
Unit No. 4	Characteristics of turbine (power variation) with wind speed	3	4	1, 2, 3 & 4
Unit No. 4	Power analysis at turbine output with DC and AC load	3	4	1, 2, 3 & 4
Unit No. 5	Study the I-V characteristics of a fuel cell.	3	5	1, 2, & 4

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (5%)		CLA-2 (5%)		CLA-3 (5%)		Mid Term (15% + 20% = 35%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	70%	-	40%	-	40%	-	40%	30%	40%	30%
	Understand										
Level 2	Apply	30%	-	60%	-	60%	-	60%	70%	60%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	-	**100%**	-	**100%**	-	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. G. D. Roy. (1988). Non-Conventional Energy Sources (6th ed.). Khanna Publishers.
2. S. P. Sukhatme and J. K. Nayak (2017). Solar Energy (4th ed.). Tata Mc Graw Hill.
3. John Twidell and Tony Weir (2021). Renewable Energy Resources (4th ed.). Taylor & Francis.
4. Solanki, Chetan Singh (2009). Renewable Energy Technologies: Practical Guide For Beginners (2nd ed.). PHI Learning Pvt. Ltd.

Other Resources

1. Prof. R. Anandalakshmi, Prof. Vaibhav Vasant Goud. Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems. NPTEL Course IIT Guwahati.
   URL: https://www.youtube.com/playlist?list=PLwdnzlV3ogoXUifhvYB65lLJCZ74o_fAk.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Numerical Methods for Electrical Engineering

Course Code	EEE 427	**Course Category**	Core Elective I (CE)		**L**	**T**	**P**	**C**
					3	0	0	3
Pre-Requisite Course(s)	Power System Analysis	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	Power System Analysis			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- Demonstrate an understanding of computational methods to obtain approximate solutions.
- Apply computational methods to solve otherwise intractable problems.
- Implement computational methods in MATLAB.
- Find roots of equations, solve simultaneous equations and fit curves for interpolation.
- Utilize numerical integration, differentiation and solving ordinary differential equations to solve engineering problems.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course, the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	obtain approximate solutions of the system through different computational methods.	2	70%	65%
2	solve intractable problems with computational methods.	3	70%	65%
3	Implement computational methods in MATLAB.	3	70%	65%
4	Retrieve roots of equations, explain simultaneous equations and fit curves for interpolation.	4	70%	60%
5	Employ numerical integration, differentiation and solving ordinary differential equations to solve engineering problems.	3	70%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong	PSO 1	PSO 2	PSO 3
Outcome 1	3	3	2	3	2				2	1		2	3	2	
Outcome 2	3	3	3	3	2				2	1		2	2	2	
Outcome 3	3	3	3	3	2				2	1		2	3	2	
Outcome 4	3	3	3	3	3				2	1		2	2	2	
Outcome 5	3	3	3	3	3				2	1		2	2	2	
Course Average	**3**	**3**	**3**	**3**	**2**				**2**	**1**		**2**	**2**	**2**	

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	**Roots of Equations:** Accuracy and precision; round-off and truncation errors;	2	1,2,3	1,2&3
	Bisection method;	2	1,2,3	1,2&3
	Newton-Raphson method,	1	1,2,3	1,2&3
	Secant method;	1	1,2,3	1,2&3
	Bairstow's method.	1	1,2,3	1,2&3
	Illustrative examples	2	1,2,3	1,2&3
Unit No. 2	**Algebraic Equations** :Gauss elimination (naïve and with pivoting),	2	1,2,3	1,2&3
	Gauss-Jordan,	2	1,2,3	1,2&3
	LU decomposition, matrix inverse;	1	1,2,3	1,2&3
	Gauss-Seidel;	2	1,2,3	1,2&3
	Extensions to nonlinear system of equations	1	1,2,3	1,2&3
	Illustrative examples	1	1,2,3	1,2&3
Unit No. 3	**Curve Fitting:** Linear and polynomial regressions;	2	1,2,3,4	1,2&3
	Linear least squares,	1	1,2,3,4	1,2&3
	Nonlinear regression,	1	1,2,3,4	1,2&3
	Newton's, Lagrange and spline interpolations.	3	1,2,3,4	1,2&3
	Illustrative examples	2	1,2,3,4	1,2&3
Unit No. 4	**Numerical Differentiation and Integration** :Integration with unequal segments	1	3,4,5	1,2,3&4
	Newton-Cotes algorithms for equations	1	3,4,5	1,2,3&4
	Romberg integration	1	3,4,5	1,2,3&4
	Adaptive and Gauss quadrature's	1	3,4,5	1,2,3&4
	Differentiation formulas	1	3,4,5	1,2,3&4
	Richardson extrapolation	1	3,4,5	1,2,3&4
	Unequally spaced data	1	3,4,5	1,2,3&4
	Illustrative examples	1	3,4,5	1,2,3&4
Unit No. 5	**Ordinary Differential Equations**: Euler's and Runge-Kutta methods;	2	3,4,5	1,2,3&4
	Systems of equations;	1	3,4,5	1,2,3&4
	Adaptive Runge-Kutta methods;	1	3,4,5	1,2,3&4
	Stiffness and multistep methods;	1	3,4,5	1,2,3&4
	Boundary-value problems;	2	3,4,5	1,2,3&4
	Eigenvalue problems.	2	3,4,5	1,2,3&4

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (10%)		CLA-2 (10%)		CLA-3 (10%)		Mid Term (20%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	70%	-	40%	-	40%	-	40%	-	40%	30%
	Understand										
Level 2	Apply	30%	-	60%	-	60%	-	60%	-	60%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100**%	-	**100**%	-	**100**%	-	**100**%	**-**	**100**%	**100**%

Recommended Resources

1. A S. C. Chapra and R. P. Canale, "Numerical Methods for Engineers," McGraw Hill, 8th edition, 2021.
2. W. Hamming, "Numerical Methods for Scientists and Engineers," Dover Publications, 2nd edition, 1986.
3. W. Y. Yang, W. Cao, J. Kim, K. W. Park. H.H. Park, J. Joung, J. S. Ro, H. L. Lee, C. H. Hong, T. Im, "Applied Numerical Methods using MATLAB", Wiley, 2nd Edition, 2020
4. B. S. Grewal, "Numerical Methods in Engineering and Science," Mercury Learning and Information, 2019.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Indian Standards for Electrical Engineering Applications

Course Code	EEE 428	**Course Category**	Core Elective I (CE)		**L**	**T**	**P**	**C**
					3	0	0	3
Pre-Requisite Course(s)	Electrical Machines, Power Electronics	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	**NA**			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- To understand the significance of Indian Standards in electrical engineering.
- To gain knowledge of various IS codes relevant to electrical design and installation.
- To apply the standards in practical electrical engineering problems and projects.
- To develop skills in using IS codes for ensuring safety and compliance in electrical installations.
- To understand the IS codes in renewable energy systems.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course, the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	To understand the relevance and application of IS codes in electrical engineering.	2	70%	70%
2	To develop the ability to design and evaluate electrical machines according to Indian Standards.	4	70%	60%
3	To ensure compliance with national standards in professional practice in electrical installation.	2	70%	60%
4	To enhance safety and reliability in electrical power systems through adherence to IS codes.	2	60%	50%
5	To understand the standards for energy efficiency and sustainability in renewable energy installations.	2	60%	50%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	2	1								1		2	3	1	1
Outcome 2	3	3	3							1		2	2	1	1
Outcome 3	3	2	1							1		2	2	1	1
Outcome 4	3	2	1							1		2	2	1	1
Outcome 5	3	2								1		2	2	1	1
Course Average	**3**	**2**	**1**							**1**		**2**	**2**	**1**	**1**

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Overview of standardization bodies: BIS, IEC, IEEE	1.5	1	1,2,3
	Importance of standardization in electrical engineering	1.5	1	1,2,3
	Introduction to IS codes: History, development, and current practices	1.5	1	1,3
	Key IS codes for electrical engineering	3	1	1,3
Unit No. 2	IS 325: Three-phase induction motors	1.5	2	1,3,4
	IS 2026: Power transformers	1.5	2	2,3
	IS 996: Alternators	1.5	2	1,2,3
	IS 4722: Rotating electrical machines	1.5	2	1, 2,3
	Standards for testing and performance evaluation	1.5	2	1, 2,3
Unit No. 3	IS 732: Code of practice for electrical wiring installations	1.5	3	1, 2,3
	IS 3043: Code of practice for earthing	1.5	3	1, 2,3
	IS 3646: Interior lighting	1.5	3	1, 2,3
	IS 2309: Protection of buildings and allied structures against lightning	1.5	3	1, 2,3
	Safety standards and best practices	1.5	3	1, 2,3
Unit No. 4	IS 5561: Electric power connectors	1.5	4	2, 3
	IS 9921: Alternating current disconnectors (isolators) and earthing switches	1.5	5	1, 2,3
	IS 1646: Code of practice for fire safety in buildings (electrical aspects)	1.5	4	2, 3
	IS 1885: Electrical and electronics terminology	1.5	4	1, 3
	Standards for substation and transmission line design	3	5	1, 2,3
Unit No. 5	IS 14286: Grid-connected solar photovoltaic systems	1.5	5	1, 2,3
	IS 16159: Wind turbine generator systems	1.5	5	1, 2,3
	Role of IS codes in electrical safety audits	1.5	5	1, 2,3
	Standards for energy efficiency and sustainability in renewable energy installations	3	5	1, 2,3
	Standards for charge controller design	3	5	1, 2,3
	Standards for electric vehicle design	3	5	1, 2,3
Total Contact Hours		**45**		

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)				End Semester Exam (50%)
		CLA-1 (10%)	Mid-1 (20%)	CLA-2 (10%)	CLA-3 (10%)	
		Th	Th	Th	Th	Th
Level 1	Remember	60%	60%	60%	60%	60%
	Understand					
Level 2	Apply	40%	40%	40%	40%	40%
	Analyse					
Level 3	Evaluate	-	-	-	-	-
	Create					
Total		**100%**	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. S.L. Uppal and G.C. Garg, "Electrical Wiring, Estimating and Costing," Khanna Publishers - Provides practical insights into IS codes related to wiring and installations.
2. C.L. Wadhwa, "Electrical Power Systems," New Age International Publishers - Discusses the application of IS codes in power system design.
3. Indian Electricity Rules, 1956 - A reference guide to legal aspects and safety standards in electrical engineering.
4. Bureau of Indian Standards (BIS) Publications - Official publications of various IS codes.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Power System Operation and Control

Course Code	EEE 429	Course Category	Core Elective II (CE)		L	T	P	C
					3	0	0	3
Pre-Requisite Course(s)	Power System Analysis	Co-Requisite Course(s)	-	Progressive Course(s)	-			
Course Offering Department	EEE	Professional / Licensing Standards	-					

Course Objectives / Course Learning Rationales (CLRs)

- Understand the economics of power system operations
- Implement and control voltage and frequency of the power system.
- Compute the unit commitment problems
- Learn the power quality issues related to power system stability.
- Understand the smart grid of the power systems

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
1	Recognize the economics of power system operation	2	70%	65%
2	Demonstrate the requirements and methods of real and reactive power control in power system	4	70%	65%
3	Contrast unit commitment problem in economic load dispatch	3	70%	65%
4	Illustrate the power quality issues and stability analysis	3	70%	65%
5	Illustrate the features of Smart Grid.	3	70%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	3	3	2								1	2	2
Outcome 2	3	3	3	3	2								1	3	3
Outcome 3	3	2	2	2	2								2	3	3
Outcome 4	3	3	3	2	3								2	3	3
Outcome 5	3	3	3	2	3								2	3	3
Course Average	**3**	**2**	**3**	**3**	**2**								**1**	**3**	**3**

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	Nonlinear function optimization: Unconstrained parameter optimization, Constrained parameter optimization: Equality constraints, Inequality constraints	3	1	1 & 2
	Operating cost of thermal power plant	1	1, 2	1 & 2
	Economic dispatch neglecting losses and no generator limits, Economic dispatch neglecting losses and including generator limits	3	1, 2	1 & 2
	Economic dispatch including losses, derivation of loss formula	1	1, 2	1 & 2
	Numerical Problems	3	1, 2	1 & 2
Unit No. 2	Introduction, Basic generator control loop	1	1	1, 2 & 4
	Load frequency control: generator model, load model, prime mover model, governor model	2	1, 2	1, 2 & 4
	Automatic generation control (AGC): AGC in a single area system, AGC in the multi-area system	2	1, 2	1, 2 & 4
	Tie-line bias control, AGC with optimal dispatch of generation	1	1, 2	1, 2 & 4
	Numerical problems	2	1, 2	1, 2 & 4
Unit No. 3	Production and absorption of reactive power, Relation between Voltage, Power, and Reactive Power at a Node	2	3	1, 2 & 3
	Methods of voltage control: shunt reactors, shunt capacitors, series capacitors, Synchronous condensers, static var systems	2	3	1, 2 & 3
	Methods of voltage control: Tap changing transformers	2	3	1, 2 & 3
	Combined Use of Tap-Changing Transformers and Reactive-Power Injection	2	3	1, 2 & 3
	Unit commitment problems	2	3	1,2 & 3
	Numerical problems	1	3	1, 2 & 3
Unit No. 4	Reasons for sinusoidal voltage, Types of voltage variations and voltage events, Types of waveform distortions, Causes and how power flows	2	4	1 & 2
	Small Signal Stability: Analysis techniques, Linearized based and Prony analysis, Modal analysis.	3	4	1 & 2
	Participation factor, QR and Selective methods, Damping Control, PSS and its tuning, WADC	2	4	4
Unit No. 5	Need of smart grid, Motivation, why distributed generation, Concept of microgrid (MG), Typical configuration of hybrid MG.	2	5	4 &5
	Evolution of smart grid and their drivers, characterization of conventional grid versus smart grid, Benefits and application of smart grid, SCADA: functions, merits and demerits.	2	5	4 & 5
	PMU: concept and generic architecture in wide area monitoring. Features of PMU, SCADA Vs PMU	3	5	4 & 5
	Major challenges in smart grid, National initiatives in smart grid.	1	5	5

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (10%)		CLA-2 (10%)		CLA-3 (10%)		Mid Term (20%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	70%	-	40%	-	40%	-	40%	-	40%	30%
	Understand										
Level 2	Apply	30%	-	60%	-	60%	-	60%	-	60%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	-	**100%**	-	**100%**	-	**100%**	**-**	**100%**	**100%**

Recommended Resources

1. Chakrabarti & Haldar, "Power System Analysis: Operation and Control", Prentice Hall of India, 2004
2. Kundur, Prabha. "Power system stability." Power system stability and control, 2007.
3. Saadat, Hadi. Power system analysis. Vol. 2. McGraw-hill, 1999.
4. Graham Rogers "Power System Oscillations" Springer-Verlag New York 2012.
5. P. Palensky and F. Kupzog, "Smart grids," Annual Reviews of Environment and Resources, vol. 38, pp. 201–226, 11 2013.

Other Resources

1. Prof. S N Singh, Power System Operation & Control. NPTEL Course IIT Kanpur.
   URL: https:// https://nptel.ac.in/courses/108104052
2. Prof. A M Kulkarni, Power System Dynamics & Control. NPTEL Course IIT Bombay.
   URL: https:// https://nptel.ac.in/courses/108101004

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Computer Aided Design of Electrical Machines

Course Code	EEE 430	**Course Category**	Core Elective II (CE)		**L**	**T**	**P**	**C**
					2	0	1	3
Pre-Requisite Course(s)	Electrical Machines, Engineering Materials, CAD	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	-			
Course Offering Department	EEE	**Professional / Licensing Standards**						

Course Objectives / Course Learning Rationales (CLRs)

- Study computational electromagnetics understanding the mathematical formulations for magnetic field solutions.
- Understand finite element analysis and computer aided design.
- Learn electromagnetic designs of static and rotating electrical machines.
- Implement machine design optimization using CAD.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
1	Understand various machine design variables and their range of variations, properties of magnetic and insulating materials	2	70%	65%
2	Analyse electromagnetic mechanisms of various electromechanical devices	3	70%	65%
3	Implement machine design problems on computer added platforms applying optimization	4	70%	65%
4	Apply optimization for machine design	3	70%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)													
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	3	3	2							1	2	2	
Outcome 2	3	3	3	3	2							1	3	3	
Outcome 3	3	2	2	2	2							2	3	3	
Outcome 4	3	3	3	2	3							2	3	3	
Course Average	**3**	**2**	**3**	**3**	**2**							**1**	**3**	**3**	

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	**Introduction to computer aided design:** Basic principles of computer aided design of electrical machines	1	1, 2	1, 2 & 3
	Advantages and limitations of computer aided design	1	1, 2	1, 2 & 3
	Design of magnetic circuit	1	1, 2	1, 2 & 3
	CAD: Analysis method of design	1	1, 2	1, 2 & 3
	CAD: Synthesis method of design	1	1, 2	1, 2 & 3
	CAD: Hybrid method of design	1	1, 2	1, 2 & 3
	Optimization	2	1,2	1, 2 & 3
	Tutorial Problems	2	1, 2	1, 2 & 3
Unit No. 2	**Designs of single and three phase transformers:** Constructional features, Comparative characteristics of core and shell type transformers	2	1, 2	1, 2 & 3
	Output equations, window space factor, field density and linear current density	1	1, 2	1, 2 & 3
	EMF per turn and overall dimensions	1	1, 2	1, 2 & 3
	Design procedure-single phase transformer	1	1, 2	1, 2 & 3
	Design procedure-three phase transformer	1		
	Design problem with CAD	2	1, 2	1, 2 & 3
Unit No. 3	**Design of DC machines:** Types and construction of DC machines	1	3	1, 2 & 3
	Salient features of DC motors-electrical and magnetic loadings, air-gap lengths	1	3	1, 2 & 3
	Winding designs-pitches, single and double layer configurations	2	3	1, 2 & 3
	Derivation of output equation, selection of number of poles	2	1, 2	1, 2 & 3
	Design of field system	1	4	1, 2 & 3
	Design of armature circuit	1	4	1, 2 & 3
	Design problem with CAD	2	4	1, 2 & 3
Unit No. 4	**Design of three-phase alternator**: Introduction.	1	4	1, 2 & 3
	Stator and rotor constructions-types and features	1	4	1, 2 & 3
	Magnetic segments and MMF drops	1	4	1, 2 & 3
	Estimation of main dimensions	1	1, 2	1, 2 & 3
	Design of armature and field winding layouts	1	4	1, 2 & 3
	Selection and design of poles, teeth and yokes	1	4	1, 2 & 3
	Estimation and minimization of full load MMF with design tuning	1	4	1, 2 & 3
	Design problem with CAD	1	4	1, 2 & 3
Unit No. 5	**Design of three-phase induction motor:** Introduction, construction details.	1	4	1, 2 & 3
	Specific loadings and output equations	1	4	1, 2 & 3
	Design of winding layouts	1	4	1, 2 & 3
	Design of stator-number of poles, yoke, slots airgap	1	4	1, 2 & 3
	Design of rotor-yoke, slots airgap	1	4	1, 2 & 3
	Performance evaluation and design iterations	2	4	1, 2 & 3
	Design problem with CAD	2	1, 5	1, 2 & 3

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (10%)		CLA-2 (10%)		CLA-3 (10%)		Mid Term (20%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	70%	-	40%	-	40%	-	40%	-	40%	30%
	Understand										
Level 2	Apply	30%	-	60%	-	60%	-	60%	-	60%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	-	**100%**	-	**100%**	-	**100%**	**-**	**100%**	**100%**

Recommended Resources

1. Thomas A. Lipo, Introduction to AC Machine Design (3rd ed.). John Wiley & Sons., IEEE Press Series on Power and Energy Systems, 2017,
2. J. Pyrhonen, T. Jokinen, and V. Hrabovcova, Design of Rotating Electrical Machines, John Wiley and Sons Inc., 2nd edition, 2013,
3. A. K. Sawhney, A Course in Electrical Machine Design", Dhanpat Rai and Co., 2016.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Switched Mode Power Converters

Course Code	EEE 431	**Course Category**	Core Elective III (CE)		**L**	**T**	**P**	**C**
					3	0	0	3
Pre-Requisite Course(s)	Circuit Theory & Power Electronics	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	-			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- Study the working principle of different power converters.
- Gain knowledge on the analysis and design of power converters.
- Know the modelling of power converters.
- Study the working and operation of resonant converters.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
1	Understand the DC-DC converters and their operation.	2	70%	65%
2	Estimate the critical inductance, capacitance in DC-DC converters.	3	70%	65%
3	Modelling of DC-DC converter.	3	70%	65%
4	Synthesize and design magnetic components for power converters.	4	70%	60%
5	Understand the operation of the resonant converter.	3	70%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	3	3	2							1	2	2	
Outcome 2	3	3	3	3	2							1	3	3	
Outcome 3	3	2	2	2	2							2	3	3	
Outcome 4	3	3	3	2	3							2	3	3	
Outcome 5	3	2	2	3	2							1	2	2	
Course Average	**3**	**2**	**3**	**3**	**2**							**1**	**3**	**3**	

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	**Non-isolated DC-DC converters:** Introduction to voltage regulators.	1	1, 2	1, 2 & 3
	Design and analysis of buck converters under continuous conduction and dis-continuous conduction mode of operation.	2	1, 2	1, 2 & 3
	Design and analysis of boost converters under continuous conduction and dis-continuous conduction mode of operation.	2	1, 2	1, 2 & 3
	Design and analysis of buck-boost converters under continuous conduction mode of operation.	2	1, 2	1, 2 & 3
	Design and analysis of CUK converter under continuous conduction.	1	1, 2	1, 2 & 3
	Tutorial Problems	2	1, 2	1, 2 & 3
Unit No. 2	**Isolated Converters:** Design and analysis of flyback converters under continuous conduction and dis-continuous conduction mode of operation.	3	1, 2	1, 2 & 3
	Design and analysis of forward converter.	1	1, 2	1, 2 & 3
	Design and analysis of push-pull converter.	1	1, 2	1, 2 & 3
	Analysis of half bridge and full-bridge converter.	1	1, 2	1, 2 & 3
	Numerical Problems.	2	1, 2	1, 2 & 3
Unit No. 3	**Modelling of Power Converters:** Steady state and small signal modelling of buck converter.	2	3	1, 2 & 3
	Steady state and small signal modelling of boost converter.	2	3	1, 2 & 3
	Steady state and small signal modelling of buck-boost converter.	2	3	1, 2 & 3
	State space modelling of buck converter.	2	3	1, 2 & 3
	Active front-end power factor correction boost converter.	2	1, 2	1, 2 & 3
Unit No. 4	**Design of Power Converters Components**: Introduction.	1	4	1, 2 & 3
	Design of magnetic components - design of inductor with examples.	2	4	1, 2 & 3
	Design of transformer, and Selection of filter capacitors, Selection of ratings for devices, input filter design.	1	4	1, 2 & 3
Unit No. 5	**Resonant Converters:** Introduction, Basic resonant circuit concepts.	1	5	1, 2 & 3
	Resonant switch converters: zero current switching buck converter with examples.	2	5	1, 2 & 3
	Resonant switch converters: zero voltage switching buck converter with examples	2	5	1, 2 & 3
	Series resonant inverter	2	5	1, 2 & 3
	Series, parallel and series-parallel resonant DC-DC converters with examples.	4	5	1, 2 & 3
	Dual active bridge converters and Introduction to high gain converters.	2	1, 5	1, 2 & 3

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (10%)		CLA-2 (10%)		CLA-3 (10%)		Mid Term (20%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	70%	-	40%	-	40%	-	40%	-	40%	30%
	Understand										
Level 2	Apply	30%	-	60%	-	60%	-	60%	-	60%	70%
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	-	**100%**	-	**100%**	-	**100%**	**-**	**100%**	**100%**

Recommended Resources

1. Ned Mohan, Tore M. Undeland, William P. Robbins. (2006). Power Electronics- Converters, Applications and Design (3rd ed.). John Wiley & Sons.
2. Daniel W Hart. (2011). Power Electronics. Tata McGraw Hill,
3. L. Umanand. (2009). Power Electronics: Essentials & Applications. Wiley, Pvt. Limited.

Other Resources

1. Prof. L. Umanand. Design and Simulation of DC-DC converters using open-source tools. NPTEL Course IISC Bengaluru. URL: https://nptel.ac.in/courses/117108124

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Digital Control Systems

Course Code	EEE 432	**Course Category**	Core Elective IV (CE)		**L**	**T**	**P**	**C**
					3	0	0	3
Pre-Requisite Course(s)	Power Electronics	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	**-**			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- Explain the architecture and key components of the C2xx DSP core.
- Implement basic interrupt handling routines using control registers in a C2xx DSP environment.
- Describe the operation of the ADC within the DSP and its role in event management.
- Compare the functionalities of CPLDs and FPGAs, focusing on the Xilinx XC3000 series.
- Differentiate between CPLDs and FPGAs, particularly in the context of the Xilinx XC3000 series, by providing examples.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	Demonstrate understanding of the C2xx DSP core architecture and its components by explaining their functions.	2	70%	65%
2	Apply knowledge by writing and testing interrupt handling routines in a C2xx DSP setup.	3	70%	65%
3	Explain how the ADC operates and integrates with event management systems in DSP.	2	70%	65%
4	Differentiate between CPLDs and FPGAs, particularly in the context of the Xilinx XC3000 series, by providing examples.	2	70%	60%
5	Design and simulate a PWM inverter circuit for DC motor control.	3	70%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	2	1	2							2	2	3	1
Outcome 2	3	3	3	3	3							2	2	2	3
Outcome 3	3	3	3	3	3							2	2	3	3
Outcome 4	3	3	2	2	3							2	2	3	1
Course Average	**3**	**3**	**3**	**3**	**3**							**2**	**2**	**3**	**2**

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	**Overview of the C2xx DSP Core and Code Development:** **C2xx DSP Core Architecture:** Introduction to the C2xx DSP Core, Key Components: ALU, Registers, and Memory Interface	3	1	1 and 2
	Interfacing and Integration: External Device Integration with the C2xx Core, Peripherals and Their Interfaces, System Configuration Registers	2	1	1 and 2
	Memory Management and Programming: Memory Types and Addressing Schemes, Assembly Language Programming with the C2xx DSP	3	1	1 and 2
	Instruction Set and Development Tools: Instruction Set Overview, Software Development Tools	3	1	1 and 2
Unit No. 2	**Pin Multiplexing and Interrupt Management:** **Pin Multiplexing and I/O Control:** Overview of Pin Multiplexing (MUX) and General Purpose I/O, Control Registers for Multiplexing and General Purpose I/O	3	2	1 and 2
	Interrupt Architecture: Basics of Interrupts, Interrupt Hierarchy	2	2	1 and 2
	Interrupt Management and Servicing: Interrupt Control and Management Registers, Software Methods for Initializing and Handling Interrupts	3	2	1 and 2
Unit No. 3	**ADC Functionality and Event Management in DSP:** **ADC Operation in DSP:** Introduction to ADC Functionality, How the ADC Operates within the DSP	3	3	1 and 2
	Event Manager Overview: Overview of the Event Manager (EV), Handling Event Manager Interrupts	2	3	1 and 2
	Timers and Capture Units: General Purpose (GP) Timers, Compare Units and Their Functionality, Capture Units and Quadrature Encoder Pulse (QEP) Systems	3	3	1 and 2
Unit No. 4	**Introduction to Field Programmable Gate Arrays (FPGAs)** **Fundamentals of FPGAs:** Basics of Field Programmable Gate Arrays (FPGA), Comparison between CPLD and FPGA, Different Types of FPGAs	3	4	1-3
	Xilinx FPGA Architecture: Overview of the Xilinx XC3000 Series, Configurable Logic Blocks (CLB), Input/Output Block (IOB) Details, Programmable Interconnect Points (PIP), Overview of the Xilinx 4000 Series	2	4	1-3
	HDL Programming and Case Study: HDL Programming Fundamentals, Case Study: Spartan 3E and Virtex II Pro FPGA Boards	3	4	1-3
Unit No. 5	**Power Electronics and Motor Control Techniques:** **Power Conversion Techniques:** Basics of Controlled Rectifiers, Overview of Switched Mode Power Converters	4	5	4
	Motor Control Methods: Pulse Width Modulation (PWM) Inverters, Control of DC Motors, Techniques for Induction Motor Control	4	5	4

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (30%)	
		CLA-1 (10%)		CLA-2 (10%)		CLA-3 (10%)		Mid Term (20%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	60%	-	40%	-	60%	-	40%	-	40%	-
	Understand										
Level 2	Apply	40%	-	60%	-	40%	-	60%	-	60%	-
	Analyse										
Level 3	Evaluate	-	-	-	-	-	-	-	-	-	-
	Create	-	-	-	-	-	-	-	-	-	-
Total		**100**%	-	**100**%	-	**100**%	-	**100**%	-	**100**%	**100**%

Recommended Resources

1. Toliyat, H. A., & Campbell, S. G. (2003). DSP-based electromechanical motion control. CRC press.
2. Buso, S., & Mattavelli, P. (2015). Digital control in power electronics (2nd ed.). Morgan & Claypool Publishers.
3. XC 3000 series datasheets (version 3.1). Xilinx, Inc., USA, 1998.
4. XC 4000 series datasheets (version 1.6). Xilinx, Inc., USA, 1999.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Power Semiconductor Drives

Course Code	EEE 433	**Course Category**	Core Elective IV (CE)		**L**	**T**	**P**	**C**
					3	0	0	3
Pre-Requisite Course(s)	Power Electronics & Electrical Machines	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	-			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- Learn the basic concepts of power electronic drive system and control.
- Study the operation of rectifier fed dc drives system and its characteristics.
- Know the operation of chopper fed dc drives and its characteristics.
- Study the speed control concept of ac drive systems.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
1	Understand the principle and dynamics of electrical drive systems.	2	65%	60%
2	Apply the concept of phase-controlled rectifiers to control the speed of dc motors.	3	65%	60%
3	Analyse the speed control of chopper fed dc motors.	4	65%	60%
4	Develop the concept of speed control of VSI fed induction motor drives.	3	65%	60%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong	PSO 1	PSO 2	PSO 3
Outcome 1	3	3	2	2	2							1	2		
Outcome 2	3	3	3	3	2							1	2	3	
Outcome 3	3	2	3	2	2							1	2	3	
Outcome 4	3	3	3	3	2							1	3	2	
Outcome 5	3	3	3	3	2							1	2	3	
Course Average	**3**	**3**	**2**	**2**	**2**							**1**	**2**		

Course Unitization Plan

Unit No.	Syllabus topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	**Introduction to Electric Drives**	**9**		
	Introduction to electric drives.	1	**1**	1 & 2
	Dynamics of electric drive, four quadrant operation.	1	**1**	1 & 2
	Equivalent drive parameters, friction component, nature of load torque.	1	**1**	1 & 2
	Steady state stability, load equalization, DC motor characteristics.	2	**1**	1 & 2
	Speed – torque characteristics of separately exited DC motor and series DC motor.	2	**1**	1 & 2
	Field control of series motor, motoring and breaking of separately exited and series motor.	2	**1**	1 & 2
Unit No. 2	**Control of DC Motors by Phase Controlled Converters**	**9**		
	Summary of phase-controlled rectifiers.	1	**2**	1,2,3&4
	Speed control of DC motors using single-phase half-controlled rectifiers in continuous and discontinuous mode of operation.	2	**2**	1,2,3&4
	Speed control of DC motors using single-phase fully-controlled rectifiers in continuous and discontinuous mode of operation.	2	**2**	1,2,3&4
	Speed control of DC motors using three-phase half-controlled rectifiers in continuous and discontinuous mode of operation.	2	**2**	1,2,3&4
	Speed control of DC motors using three-phase fully-controlled rectifiers in continuous and discontinuous mode of operation.	2	**2**	1,2,3&4
Unit No. 3	**Control of DC Motor by Choppers**	**9**		
	Introduction to chopper drives.	1	**3**	1,2,3&4
	Power control or motoring control, regenerative-breaking control.	2	**3**	1,2,3&4
	Two quadrant chopper drives – motoring mode and regenerative breaking mode.	2	**3**	1,2,3&4
	Four quadrant chopper drives – forward motoring mode and forward regenerative breaking mode, Reverse motoring mode reverse regenerative breaking mode.	2	**3**	1,2,3&4
	Problems on chopper fed DC drives.	2	**3**	1,2,3&4
Unit No. 4	**Control of Induction Motor by Stator Side**	**9**		
	Introduction to ac drives.	1	**4**	1,2,3&4
	Analysis and performance of three phase IM	2	**4**	1,2,3&4
	Speed control of three phase IM motor by stator voltage control.	1	**4**	1,2,3&4
	Speed control of three phase IM motor by stator frequency control.	1	**4**	1,2,3&4
	Speed control of three phase IM motor by stator voltage and frequency control.	1	**4**	1,2,3&4
	Speed control of three phase IM motor by stator current control.	1	**4**	1,2,3&4
	Numerical problems	2	**4**	1,2,3&4
Unit No. 5	**Control of Induction Motor by Rotor Side**	**9**		
	Introduction	1	**4**	1,2,3&4
	Conventional rotor resistance control	2	**4**	1,2,3&4
	Static rotor resistance control	1	**4**	1,2,3&4
	Static scherbius drive	1	**4**	1,2,3&4
	Closed loop control of static scherbius drive	1	**4**	1,2,3&4
	Static kramer drive	1	**4**	1,2,3&4
	Numerical problems	2	**4**	1,2,3&4

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (10%)		CLA -2 (10%)		CLA-3 (10%)		Mid - 1 (20%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	70%	-	60%	-	70%	-	60%	-	60%	
	Understand										
Level 2	Apply	30%	-	40%	-	30%	-	40%	-	40%	
	Analyse										
Level 3	Evaluate										
	Create										
Total		**100%**	-	**100%**	-	**100%**	-	**100%**	-	**100%**	

Recommended Resources

1. G.K. Dubey (2007). Fundamentals of Electric Drives (2nd ed.). Narosa Publishers.
2. Vedam Subramanyam (2011). Electric Drives Concepts & Applications (2nd ed.). Tata McGraw Hill.
3. M. H. Rashid. (2018). Power Electronics: Devices, Circuits, and Applications (4th ed.). Pearson.
4. S K Pillai. A First course on Electrical Drives (2nd ed.). New Age International(P)

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Embedded System for Power Applications

Course Code	EEE 434	**Course Category**	Core Elective V (CE)		**L**	**T**	**P**	**C**
					3	0	0	3
Pre-Requisite Course(s)	Microcontrollers and Applications	**Co-Requisite Course(s)**	Power Electronics	**Progressive Course(s)**	-			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- Understand the basics of embedded systems and the architecture of the PIC16F877A microcontroller.
- Acquire programming skills for the PIC16F877A using C.
- Explore various peripherals of PIC16F877A.
- Learn the communication protocols for data transfer and device interfacing.
- Appreciate the role of embedded systems in electrical engineering applications.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
1	Describe the architecture and features of the PIC16F877A microcontroller.	**2**	70%	65%
2	Develop and debug programs for the PIC16F877A using the C programming language.	3	70%	65%
3	Interface digital and analog devices with the PIC16F877A.	3	70%	65%
4	Utilize I2C, SPI, and USART protocols for communication with external devices.	3	60%	65%
5	Design and execute an embedded system project relevant to electrical engineering.	5	50%	65%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	2	2	2				2			3	3	2	1
Outcome 2	3	2	2	2	2				2			3	3	3	2
Outcome 3	3	2	2	2	2				2			3	3	3	2
Outcome 4	3	2	2	2	2				2			3	3	3	2
Outcome 5	3	3	3	3	3				3	**2**	2	3	3	3	2
Course Average	**3**	**2**	**2**	**2**	**2**				**2**	**1**	**1**	**3**	**3**	**3**	**2**

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No.1	**Introduction to Microcontrollers and Development Tools:** Introduction to Embedded Systems: Overview and applications in electrical engineering, Introduction to microcontrollers	2	1	1-3
	PIC16F877A Microcontroller Architecture: Overview of the PIC16F877A, Pin configuration and functions, Memory organization (Flash, RAM, EEPROM)	3	1	1-3
	Development Tools and Programming Environment: MPLAB X IDE setup, Introduction to XC8 Compiler, Writing and simulating the first program (LED blink)	2	1	1-3
	Digital I/O Interfacing: Configuring and using digital I/O ports, Interfacing LEDs and switches	2	1	1-3
Unit No.2	**Fundamentals of C Programming for PIC:** Basic syntax and structure, Variables, data types, and operators, Control structures (if, switch, loops)	6	2	1-3
Unit No.3	**Timers, Counters, and ADC:** Timers and Counters: Understanding timers and counters, Timer configurations and modes, Generating time delays and PWM signals	4	3	1-3
	Analog-to-Digital Conversion (ADC): ADC theory and applications, Configuring the ADC module, Interfacing potentiometers and sensors	3	3	1-3
	Practical Applications of Timers and ADC: Using timers for event counting and frequency measurement, ADC applications in sensor data acquisition and signal processing	3	3	1-3
Unit No.4	**Communication Protocols:** Serial Communication (USART): Basics of serial communication, Configuring USART for communication, Interfacing with serial devices (PC)	3	4	1-3
	I2C and SPI Communication Protocols: Overview of I2C and SPI, Configuring and using I2C and SPI modules, Interfacing with external EEPROM and sensors	4	4	1-3
	Interrupts and Low Power Modes: Understanding interrupts, Configuring and handling interrupts, Power-saving techniques and modes	3	4	1-3
Unit No.5	**Advanced Applications and Project Development using Microcontroller:** Tentative Projects: Power monitoring and management, Energy harvesting and battery management, Electric drives and vehicles	8	5	1-3
	Project Presentations and Review	2	5	N.A.

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (5%)		CLA-2 (5%)		CLA-3 (20%)		Mid Term (20%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	60%	-	50%	-	-	-	60%	-	-	50%
	Understand										
Level 2	Apply	40%	-	50%	-	50%	-	40%	-	-	50%
	Analyse										
Level 3	Evaluate	-	-	-	-	50%	-	-	-	-	-
	Create										
Total		**100%**	-	**100%**	-	**100%**	-	**100%**	-	-	**100%**

Recommended Resources

1. Peatman, J. B. (2013). Design with PIC Microcontrollers. India: Pearson Education.
2. Wilmshurst, T. (2010). Designing Embedded Systems with PIC Microcontrollers: Principles and Applications (2nd ed.). Elsevier Science.
3. Microchip Technology Inc. (2013). PIC16F87XA Data Sheet.

Electric Vehicle Engineering

Course Code	EEE 255	**Course Category**	Open Elective (OE)		**L**	**T**	**P**	**C**
					3	0	0	3
Pre-Requisite Course(s)	Electrical Machines, Power Electronics	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	Indian Standards for Electrical Engineering			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- To understand the various properties and characteristics of batteries and charging systems.
- To investigate different methods of power transfer techniques.
- To analyse the operation of electrical drives and calculate the harmonic component.
- To understand the various controllers and communication systems.
- To understand the recent advancements of electric vehicles.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course, the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	To explore and comprehend the diverse properties and operational characteristics of batteries and their corresponding charging systems.	2	70%	70%
2	To investigate and evaluate various power transfer methodologies, focusing on optimizing energy efficiency and reliability.	4	70%	60%
3	To analyse the functioning of electrical drives and assess harmonic components to improve system performance and minimize energy losses.	4	70%	60%
4	To gain a deep understanding of controllers and communication systems, fostering the development of advanced control strategies and integration of communication protocols for enhanced vehicle performance.	2	60%	50%
5	To understand the recent advancements in electric vehicles with the ability to innovate and contribute to the evolving field.	2	60%	50%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	1								1		2	3	1	1
Outcome 2	3	2								1		2	2	1	1
Outcome 3	3	3								1		2	2	1	1
Outcome 4	3	2								1		2	2	1	1
Outcome 5	3	2								1		2	2	1	1
Course Average	**3**	**2**								**1**		**2**	**2**	**1**	**1**

Course Unitization Plan

Unit No.	Syllabus Topic	Required Contact Hours	CLOs Addressed	References Used
Unit No 1	Introduction to EVs and History of EVs	1.5	1	1,2,3
	Battery Fundamentals, Lithium-Ion Batteries	3	1	2,3
	Battery Characteristics	1.5	1	1,3,4
	Charging Level, Charging Connectors	1.5	1	1,3,4
	Charging Process, DC Fast Chargers	1.5	1	1,2,3
Unit No 2	Vehicle Grid Interface, DC Fast Charger Impact on Grid	1.5	2	1,3,4
	Electric Vehicles in Microgrids: Microgrids and Controls	1.5	2	2,3,4
	V2H and H2V Power Converters	3	2	1,2,3
	Solar Generation Integration with Electric Vehicles	1.5	2	1,2,3
Unit No 3	Introduction to Electric Drive Components	1.5	3	1, 2,3
	Two and Four-Quadrant Chopper Drives	3	3	1, 2,3
	AC Drives: Six-Step Operation with Harmonic Analysis	3	3	1, 2,3
	Pulse Width Modulated Inverter Fed-Drives	1.5	3	1, 2,3,4
Unit No 4	Vehicle Controllers and Types, Microcontroller Types	1.5	4	2, 3
	Microcontroller Components: Central Processing Unit, Memory and Registers, Timers and Counters, Peripherals,	3	4	2,3,4
	Basic Microcontroller Coding	1.5	4	2, 3
	Controller Area Network: Requirement, Communication protocol, Physical and Transfer Layer	3	4	1, 3
Unit No 5	Advanced Electric Drives for EVs	3	5	1, 2,3
	Recent advancements in Fast Charging	1.5	5	1, 2,3
	Wireless Charging	1.5	5	1, 2,3,4
	Innovative Vehicle Designs	1.5	5	1, 2,3,4
	Self-Driving Vehicles	1.5	5	1, 2,3
	Role of AI in Electric Vehicles	1.5	5	1, 2,3
Total Contact Hours		**45**		

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)				End Semester Exam (50%)
		CLA-1 (10%)	Mid-1 (20%)	CLA-2 (10%)	CLA-3 (10%)	
		Th	Th	Th	Th	Th
Level 1	Remember	40%	40%	40%	40%	40%
	Understand					
Level 2	Apply	60%	60%	60%	60%	60%
	Analyse					
Level 3	Evaluate	-	-	-	-	-
	Create					
Total		**100%**	**100%**	**100%**	**100%**	**100%**

Recommended Resources

1. Husain, Electric and Hybrid Vehicles: Design Fundamentals (3rd ed.). CRC Press. https://doi.org/10.1201/9780429490927.
2. Per Enge, Nick Enge, Stephen Zoepf, Electric Vehicle Engineering, McGraw-Hill Education, 15 Dec 2020.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Second Edition, John Wiley & Sons, Ltd, DOI:10.1002/9781118361146.
4. "Electric and Hybrid Vehicles: Technologies, Modeling and Control - An Introduction" by H. K. Khalil.

SRM University *AP*, Andhra Pradesh

Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Introduction to Green Energy Technologies

Course Code	EEE 243	**Course Category**	Open Elective	**L**	**T**	**P**	**C**
				3	0	0	3
Pre-Requisite Course(s)	Basics of Electrical and Electronics Engineering	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	-		
Course Offering Department	EEE	**Professional / Licensing Standards**	-				

Course Objectives / Course Learning Rationales (CLRs)

- Realize the need of renewable energy sources and its importance.
- Study the performance of solar thermal systems and solar photovoltaic systems.
- Explore the concepts involved in wind energy conversion systems and performance.
- Study the operation of biogas generation and fuel cell systems.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
1	Understand the need of renewable energy sources.	2	65%	70%
2	Develop the electrical model of PV cell and study the characteristics.	3	65%	70%
3	Illustrate the various solar thermal energy conversion systems.	2	65%	70%
4	Describe the working principle of wind energy conversion systems.	3	65%	70%
5	Understand the biomass energy conversion systems and fuel cell technology.	2	65%	70%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)													
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	2	2	2		3					1			3
Outcome 2	2	1	2	3	2		3					2			2
Outcome 3	3	3	3	3	2		3					2		3	3
Outcome 4	3	3	3	3	3		3					2		2	3
Outcome 5	3	1	3	2	2		3					2			2
Course Average	**3**	**2**	**3**	**3**	**2**		**3**					**2**		**3**	**3**

Course Unitization Plan

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	**Introduction to Energy Sources and Solar Radiation:** Introduction about the renewable energy sources and Impact of renewable energy generation on environment.	1	1	1, 2, & 4
	Solar constant, extra-terrestrial and terrestrial solar radiation.	1	1	1, 2, & 4
	Types of solar radiation - beam and diffuse radiation.	1	1	1, 2, & 4
	Sun-earth geometry, declination angle, hour angle, LAT with examples.	2	1	1, 2, & 4
	solar angles with examples.	3	1	1, 2, & 4
	Insolation on horizontal flat plate and energy on horizontal flat plate.	2	1	1, 2, & 4
	Instruments for measuring solar radiation and sunshine recorder.	1	1	1, 2, & 4
Unit No. 2	**Solar Photovoltaic Cell:** A historical perspective.	1	2	1, 2, & 4
	PV cell characteristics and equivalent circuit.	2	2	1, 2, & 4
	Model of photovoltaic cell and its parameters.	1	2	1, 2, & 4
	Effect of temperature on open circuit voltage, short circuit current and maximum power point.	1	2	1, 2, & 4
	Data sheet study, cell efficiency and fill factor.	1	2	1, 2, & 4
	Concept of load line, identical and non-identical cells connected in series	1	2	1, 2, & 4
	Identical and non-identical cells connected in Parallel.	1	2	1, 2, & 4
	Concept of maximum power point tracking, input impedance of buck converter.	1	2	1, 2, & 4
	Input impedance of boost and buck-boost converter.	2	2	1, 2, & 4
Unit No. 3	**Solar Thermal Systems:** Introduction to solar collectors and classifications.	1	3	1, 2, & 4
	Performance indices of solar collectors.	1	3	1, 2, & 4
	Non concentrated collectors and Classification of concentrated collectors	1	3	1, 2, & 4
	Modified flat plate collector and compound parabolic concentrator.	1	3	1, 2, & 4
	Applications of solar collectors.	1	3	1, 2, & 4
Unit No. 4	**Wind energy:** Introduction to wind energy, Wind energy conversion system and its merits and demerits.	1	4	1, 2, 3 & 4
	Power and energy from wind turbines with examples.	2	4	1, 2, 3 & 4
	Maximum rotor efficiency with examples.	2	4	1, 2, 3 & 4
	Effect of tower height on wind speeds with examples.	2	4	1, 2, 3 & 4
	General Classification of Wind Turbines-Rotor Turbines-Multiple-Blade Turbines.	1	4	1, 2, 3 & 4
	Downwind and upwind turbine, Pitch control and yaw control.	1	4	1, 2, 3 & 4
	Horizontal axis wind turbine and its important parts.	1	4	1, 2, 3 & 4
	vertical axis wind turbine and its important parts.	1	4	1, 2, 3 & 4
Unit No. 5	**Biomass Energy and fuel cell:** Introduction to biomass, biomass energy and its merits and demerits.	1	5	1, 2, & 4
	Principles of biomass conversion and Photosynthesis.	1	5	1, 2, & 4
	Combustion and fermentation.	1	5	1, 2, & 4
	Types of biogas digesters and its working.	2	5	1, 2, & 4
	Introduction about fuel cell and working of fuel cell.	1	5	1, 2, & 4
	Efficiency of fuel cell and concept of fuel cell technology.	1	5	1, 2, & 4

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (5%)		CLA-2 (10%)		CLA-3 (15%)		Mid Term (20%)			
		Th	**Prac**	**Th**	**Prac**	**Th**	**Prac**	**Th**	**Prac**	**Th**	**Prac**
Level 1	Remember	70%	-	40%	-	40%	-	40%	-	40%	30%
	Understand										
Level 2	Apply	30%	-	60%	-	60%	-	60%	-	60%	70%
	Analyse										
Level 3	Evaluate	-	-	-	-	-	-	-	-	-	-
	Create										
Total		**100**%	-	**100**%	-	**100**%	-	**100%**	**-**	**100**%	**100**%

Recommended Resources

1. G. D. Roy. (1988). Non-Conventional Energy Sources (6th ed.). Khanna Publishers.
2. S. P. Sukhatme and J. K. Nayak (2017). Solar Energy (4th ed.). Tata Mc Graw Hill.
3. John Twidell and Tony Weir (2021). Renewable Energy Resources (4th ed.). Taylor & Francis.
4. Solanki, Chetan Singh (2009). Renewable Energy Technologies: Practical Guide For Beginners (2nd ed.). PHI Learning Pvt. Ltd.

Other Resources

1. Prof. R. Anandalakshmi, Prof. Vaibhav Vasant Goud. Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems. NPTEL Course IIT Guwahati. URL: https://www.youtube.com/playlist?list=PLwdnzlV3ogoXUifhvYB65lLJCZ74o_fAk.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Design of Power Electronics Circuits

Course Code	SEC	**Course Category**	SEC		**L**	**T**	**P**	**C**
					3	0	0	3
Pre-Requisite Course(s)	Analog Circuits	**Co-Requisite Course(s)**	Power Electronics	**Progressive Course(s)**	Power Electronics			
Course Offering Department	EEE	**Professional / Licensing Standards**						

Course Objectives / Course Learning Rationales (CLRs)

- To understand the behaviour of various loads to transient power supplies and acquire the knowledge of losses associated with a power electronic switch.
- To familiarize with advanced simulation tools used to design power electronic and control circuits.
- To understand the PCB fabrication process for power electronic converters and current trends.
- To justify the components used and PCB fabricated for a given power electronic circuit.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	**At the end of the course the learner will be able to**	**Bloom's Level**	**Expected Proficiency Percentage**	**Expected Attainment Percentage**
1	Determine the maximum and minimum operating frequency of a load or a power electronic switch.	3	70%	65%
2	Model a power electronic circuit using industry-standard simulation tools.	3	70%	65%
3	Identify and categorize the PCB fabrication process associated with various parts of a power electronic circuit.	4	70%	65%
4	Develop a power electronic circuit using self-designed PCB for any given load.	5	50%	65%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	**Program Learning Outcomes (PLO)**														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	2	3	1				2			3	3	2	1
Outcome 2	3	1	3	2	3				2			3	3	3	2
Outcome 3	3	2	3	2	3				2			3	3	3	2
Outcome 4	3	3	3	3	3				3		2	3	3	3	2
Course Average	**3**	**2**	**3**	**3**	**3**				**2**		**1**	**3**	**3**	**3**	**2**

Course Unitization Plan - Theory

Unit No.	Syllabus Topics	Required Contact Hours	CLOs Addressed	References Used
Unit No.1	Response to a pulse train and calculation of the time constant of various loads.	3	1	1
	Design of a 1-ϕ inverter using MOSFET and IGBT for 50 Hz, 1 kHZ and 5 kHZ using MATLAB and calculate its losses and efficiency.	3	1,2	1,2
Unit No.2	Design and verification of a digital controller-based 3-ϕ rectifier with PMDC motor load using PSIM.	6	2	3
	Design and verification of a MOSFET/ IGBT driver circuit in Multisim.	3	2	4
	Design and verification of a digital controller-based 3-ϕ rectifier with PMDC motor load using PSIM.	6	2	3
Unit No. 3	Familiarization with available CAD Tools, PCB Layout Design and Planning.	6	3	5
	Generation of the Gerber file for a Hall effect-based current sensing circuit	3	3	5
	Fabrication of the Hall effect-based current sensing circuit using the prototyping machine.	6	3	5
	Component placement and soldering in an existing PCB.	3	3	5
	Familiarization with a multi-layer PCB and to generate the Gerber file of MOSFET/ IGBT driver circuit using a two-layer board.	6	3	5
	The effect of EMI and EMC on PCB and suggest protective measures.	6	3	5
Unit No.4	Design and development of a power electronic converter circuit for a specified load using fabricated PCBs.	15	4	N.A.

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (70%)								End Semester Exam (30%)	
		CLA-1 (10%)		CLA-2 (10%)		CLA-3 (40%)		Mid Term (10%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	-	-	-	-	-	-	50%	-	20%	-
	Understand										
Level 2	Apply	50%	-	60%	-	60%	-	50%	-	30%	-
	Analyse										
Level 3	Evaluate	50%	-	40%	-	40%	-	-	-	50%	-
	Create										
Total		**100%**	-	**100%**	-	**100%**	-	**100%**	-	**100%**	**-**

Recommended Resources

1. Rashid, M.H. (2017). *Power Electronics: Devices, Circuits, and Applications* (4th ed.). Pearson, India.
2. Kumar, L.A., Kalaiarasi, A., Maheswari, Y.U. (2019). *Power Electronics with MATLAB* (2nd ed.). Cambridge University Press.
3. Powersim Inc. (2020). *PSIM User's Guide*.
4. Farzin, A. (2022). *Essential Circuit Analysis Using NI MultisimTM and MATLAB* (1st ed.). Springer Cham.
5. Khandpur, R.S. (2006). *Printed Circuit Board Design, Fabrication Assembly and Testing* (1st ed.). Tata Mc Graw Hill.

SRM University *AP*, Andhra Pradesh
Neerukonda, Mangalagiri Mandal,
Guntur District, Mangalagiri, Andhra Pradesh – 522240.

Design of Industrial Drives

Course Code	SEC	**Course Category**	SEC		**L**	**T**	**P**	**C**
					3	0	0	3
Pre-Requisite Course(s)	Design of Power Electronics Circuits Lab	**Co-Requisite Course(s)**	-	**Progressive Course(s)**	Power Electronics			
Course Offering Department	EEE	**Professional / Licensing Standards**	-					

Course Objectives / Course Learning Rationales (CLRs)

- To familiarize with advanced simulation tools used to design various industrial drives.
- To understand the practical considerations involved and techniques used to design an industrial drive.
- To practice the design of common application-specific industrial drives.
- To justify the machines used and control techniques used for a given industrial drive system.

Course Outcomes / Course Learning Outcomes (CLOs)

CO's	At the end of the course the learner will be able to	Bloom's Level	Expected Proficiency Percentage	Expected Attainment Percentage
1	Model common electrical drives using state-of-the-art simulation tools.	3	70%	65%
2	Illustrate the techniques and practices involved with the design of an industrial drive.	3	70%	65%
3	Predict the design procedure of a power electronic drive for a given application.	3	70%	65%
4	Develop a power electronic drive set-up for specified applications.	6	60%	65%

Course Articulation Matrix (CLO) to Program Learning Outcomes (PLO)

CLOs	Program Learning Outcomes (PLO)														
	Engineering Knowledge	Problem Analysis	Design and Development	Analysis, Design and Research	Modern Tool and ICT Usage	Society and Multicultural Skills	Environment and Sustainability	Moral, and Ethical Awareness	Individual and Teamwork Skills	Communication Skills	Project Management and Finance	Self-Directed and Lifelong Learning	PSO 1	PSO 2	PSO 3
Outcome 1	3	2	3	3	3				3			3	3	3	2
Outcome 2	3	2	2	2	2				3			3	3	3	1
Outcome 3	3	2	3	3	3				3			3	3	3	2
Outcome 4	3	3	3	3	3				3		2	3	3	3	2
Course Average	**3**	**2**	**3**	**3**	**3**				**3**		**1**	**3**	**3**	**3**	**2**

Course Unitization Plan

Unit No.	Experiment Name	Required Contact Hours	CLOs Addressed	References Used
Unit No. 1	To verify the efficiency and losses involved with a 3-ϕ induction machine using Ansys simulation. (Lab Experiment - 1)	6	1	1
	To design an efficient control algorithm for a 3-ϕ induction motor-based industrial blower using PSIM and performing the comparative analysis with V/f control. (Lab Experiment - 2)	6	1	2
Unit No.2	To determine the electrical and mechanical specifications of a DC machine. (Lab Experiment - 3)	6	2	3-4
	To retrieve the position data of a synchronous motor using Hall sensors and position encoders, and to evaluate the precision of each method. (Lab Experiment - 4)	6	2	3-4
	To design a mechanical load emulator for a PMDC motor and validate it with current measurements. (Lab Experiment - 5)	6	2	3-4
Unit No.3	To design a torque control technique using a microcontroller development board for a PMDC motor drive used in engine starters. (Lab Experiment - 6)	6	3	3-4
	To perform basic regenerative braking in an inverter-connected synchronous motor using a microcontroller development board (Lab Experiment - 7)	6	3	3-5
Unit No.4	To develop and report a power electronic drive setup for specified problems.	18	4	N.A.

Learning Assessment

Bloom's Level of Cognitive Task		Continuous Learning Assessments (50%)								End Semester Exam (50%)	
		CLA-1 (5%)		CLA-2 (5%)		CLA-3 (10%)		Mid Term (10% + 20% = 30%)			
		Th	Prac	Th	Prac	Th	Prac	Th	Prac	Th	Prac
Level 1	Remember	-	-	-	-	-	-	-	-	-	50%
	Understand										
Level 2	Apply	-	-	-	-	-	-	-	75%	-	50%
	Analyse										
Level 3	Evaluate	-	-	-	-	-	-	-	25%	-	-
	Create										
Total		-	-	-	-	-	-	-	-	-	**100%**

Recommended Resources

1. Rosu, M., Zhou, P., Lin, D., Ionel, D. M., Popescu, M., Blaabjerg, F., Rallabandi, V., & Staton, D. (2017).
2. Multiphysics simulation by design for electrical machines, power electronics and drives (1st ed.). John Wiley & Sons.
3. Powersim Inc. (2020). PSIM User's Guide.
4. Jufer, M. (2013). Electric drives: design methodology (2nd ed.). John Wiley & Sons.
5. Krause, P. C., Wasynczuk, O., Sudhoff, S. D., Pekarek, S. D. (2013).
6. Analysis of Electric Machinery and Drive Systems (3rd ed.). Wiley.
7. Krishnan, R. (2017). Permanent Magnet Synchronous and Brushless DC Motor Drives (1st ed.). CRC Press.