SRI SHAKTHI

INSTITUTE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University)

Coimbatore – 641 062

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM AND SYLLABI

B.E – ELECTRICAL AND ELECTRONICS ENGINEERING

REGULATION – 2019

SRI SHAKTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

COIMBATORE – 641 062.

REGULATIONS- 2019

CHOICE BASED CREDIT SYSTEM

B.E ELECTRICAL AND ELECTRONICS ENGINEERING

VISION AND MISSION OF THE INSTITUTION

VISION

To make the institution one of our nations great engineering schools recognized nationally and internationally for excellence in teaching, research and public service. We seek to be the preferred destination for students, practitioners seeking an engineering education, employers hiring engineering graduates and organizations seeking engineering knowledge.

MISSION

To provide an encouraging environment to develop the intellectual capacity, critical thinking, creativity and problem-solving ability of the students.

VISION AND MISSION OF THE DEPARTMENT

VISION

To become the center of excellence in the area of Electrical and Electronics Engineering and Technology and the transmitter of moral values with focus on the development of society and rural masses.

MISSION

To achieve the vision, the department will

M1: Equip the students with advanced knowledge in the field of Electrical and Electronics Engineering as well as professional skills necessary to face the challenges of the future

M2: Enable students to become responsible citizens of the country with a willingness to serve the society

M3: Encourage the Students to engage in research activities leading to innovative applications of technology for the benefit of mankind

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1	:	To provide the students with fundamental knowledge, methodologies and use of cutting-edge technologies.
PEO 2	:	To provide the students with an awareness of skills in lifelong learning and self-education.
PEO 3	:	To cultivate team work, technical writing and oral communication skills.
PEO 4	:	To provide students with an appreciation of engineering's impact on society and the professional responsibilities of engineers.

PROGRAMME OUTCOMES:

Engineering Graduates will be able to:

PO1	**a**	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**b**	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**c**	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**d**	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid

		conclusions.
PO5	**e**	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**f**	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**g**	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**h**	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**i**	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**j**	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**k**	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**l**	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOME (PSOs)

PSO1	**:**	To gain a promising knowledge on basic engineering science with hands on training that would enhance the students in designing the technical concepts and furnish the knowledge on real time applications in Electrical and electronics engineering

PSO2	:	To enrich the student's competence with analysis, synthesis and development capabilities using latest methodologies in the Electrical and Electronics Engineering field.
PSO3	:	Ability to adapt in multidisciplinary environment and expertise the student's skills in advanced technologies and creating engineering solutions for technical and non technical aspects
PSO4	:	Graduates will be talented to innovate, creative applications and to provide solutions for complex problems related to society.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**
1	2	2	2	3	2	2	2	2	2	2	2	1
2	0	0	1	1	1	1	1	1	1	1	1	1
3	1	0	1	2	2	3	2	2	3	3	3	2
4	2	0	0	1	1	2	3	3	2	2	2	1

MAPPING OF PROGRAM SPECIFIC OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Objectives and the outcomes is given in the following table

PROGRAMME SPECIFIC OBJECTIVES	PROGRAMME OUTCOMES											
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**
1	2	3	2	2	2	1	1	0	0	0	2	1
2	2	3	2	2	3	1	1	2	0	0	2	1
3	3	3	2	2	2	1	1	1	1	2	2	2
4	2	2	3	2	2	2	2	1	2	2	3	2

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MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES:

A broad relation between the Course Outcomes and Programme Outcomes is given in the following table

COURSE OUTCOMES		PROGRAMME OUTCOMES											
Sem	Course Name	A 1	B 2	C 3	D 4	E 5	F 6	G 7	H 8	I 9	J 10	K 11	L 12
I	Communicative English										✓		✓
	Matrices and Calculus for EEE	✓	✓	✓									✓
	Applied Chemistry	✓	✓					✓					
	Elements of Electrical Engineering	✓	✓	✓		✓						✓	✓
	Computational thinking and Problem Solving	✓		✓		✓	✓					✓	✓
	Language - Tamil												✓
	Language – Malayalam												✓
	Foundation English												✓
	Applied Chemistry Laboratory	✓	✓	✓									
	Elements of Electrical Engineering Laboratory	✓	✓	✓									
	Computational thinking and Problem Solving Laboratory	✓	✓	✓									
	Communicative English Laboratory										✓		
	Engineering Exploration I	✓	✓	✓				✓				✓	
	Crop Production Laboratory - I	✓	✓	✓				✓				✓	
II	English for Engineers	✓									✓		
	Laplace Transforms and Advanced Calculus for Electrical Engineers	✓	✓	✓									✓
	Physics for Electronics Engineering	✓	✓	✓			✓						
	Network Analysis	✓	✓	✓									
	Fundamentals of Mechanical for Electrical applications	✓	✓									✓	

	C Programming	✓		✓		✓						✓	
	Fundamentals of Mechanical for Electrical applications Laboratory	✓											
	Physics for Electronics Engineering Laboratory	✓											
	Network Analysis Laboratory	✓										✓	
	C Programming Laboratory	✓		✓	✓			✓					
	English for Engineers Laboratory										✓		
	Engineering Exploration-II	✓		✓									✓
III	Transforms and Partial Differential Equations for Electrical Engineers	✓	✓									✓	
	Generation Transmission and Distribution	✓		✓		✓	✓					✓	
	Electrical Machines and Design-I	✓		✓		✓	✓					✓	
	Semiconductor Devices and IC's	✓		✓		✓	✓					✓	
	Digital Electronics	✓	✓										
	Python Programming	✓				✓							
	Basics of Programmable Logic controller		✓	✓								✓	
	Embedded System Design Using Arduino Microcontroller	✓	✓	✓								✓	
	Engineering Exploration – III	✓											
	Python Programming Laboratory	✓											
	Digital Electronics Laboratory		✓										
	Generation Transmission and Distribution Laboratory			✓									
	Electrical Machines and Design-I Laboratory		✓	✓									
	Semiconductor Devices and IC's Laboratory		✓										
	Career Enhancement Program – I	✓					✓				✓		
IV	Numerical Methods for Electrical Engineers	✓	✓								✓		
	Measurements and Instrumentation	✓				✓							
	Electrical Machines and Design – II	✓	✓	✓		✓							✓
	Control System Engineering	✓	✓	✓			✓					✓	✓
	Microprocessor and Microcontroller Design	✓	✓	✓			✓					✓	✓
	Embedded System design using PIC Microcontroller	✓		✓		✓						✓	

	Measurements and Instrumentation Laboratory	✓				✓							
	Electrical Machines and Design - II Laboratory	✓										✓	✓
	Control System Engineering Laboratory	✓										✓	
	Microprocessor and Microcontroller Design Laboratory	✓										✓	
	Engineering Exploration – IV	✓	✓										
	Career Enhancement Program-II	✓									✓		
V	Power System Analysis		✓										
	Power Electronics and Applications	✓	✓	✓									
	Communication Engineering	✓				✓							
	Principles of Digital Signal Processing	✓	✓		✓								
	Embedded Design using ARM	✓	✓		✓							✓	
	Electrical Vehicles I	✓		✓	✓								✓
	Power System Analysis Laboratory	✓											
	Power Electronics and Applications Laboratory		✓			✓							
	Communication and Signal Processing Laboratory		✓										
	Engineering Exploration-V	✓										✓	✓
	Career Enhancement Program –III										✓		
VI	Protection and Switch gear	✓		✓		✓						✓	✓
	Internet of Things	✓	✓										
	Solid State Drives		✓										
	Electrical Vehicles II	✓	✓			✓					✓	✓	
	RTOs using STM Controller / SCADA and DCS in Industrial Automation		✓			✓						✓	
	Medical Electronics		✓	✓									
	Design Project	✓		✓								✓	
	Protection and switchgear Laboratory	✓	✓										
	Internet of Things Laboratory		✓			✓							
	Solid State Drives Laboratory												
	Career Enhancement IV										✓		
VII	Power System Operation and Control	✓		✓			✓					✓	
	Industrial Embedded System	✓				✓							✓
	Soft Computing	✓										✓	
	Industrial Embedded System Laboratory		✓										

	Project Work – I							✓				✓	✓
VIII	High Voltage Engineering	✓						✓					
	Principles of Management and Professional Ethics	✓									✓		✓
	Project Work – II	✓	✓	✓	✓						✓		

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CURRICULUM

SEMESTER I

SL. NO	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U19ENTL101T	Communicative English	HS	4	2	0	0	2
2	U19MATH107	Matrices and Calculus for EEE	BS	4	3	1	0	4
3	U19CHTL101T	Applied Chemistry	BS	4	2	0	2	3
4	U19EETL101T	Elements of Electrical Engineering	PC	4	2	0	2	3
5	U19CSTL101T	Computational thinking and Problem Solving	ES	4	2	0	2	3
6	U19LATH101 U19LATH102 U19LAEN101	Language - Tamil Language – Malayalam Foundation English	HS	2	2	0	0	2
PRACTICALS								
7	U19CHTL101L	Applied Chemistry Laboratory	BS	2	0	0	2	1
8	U19EETL101L	Elements of Electrical Engineering Laboratory	PC	2	0	0	2	1
9	U19CSTL101L	Computational thinking and Problem Solving Laboratory	ES	2	0	0	2	1
10	U19ENTL101L	Communicative English Laboratory	HS	2	0	0	2	1
11	U19CCEX101	Engineering Exploration I	EEC	3	1	0	2	2
12	U19AEPC101	Crop Production Laboratory - I	BS	4	0	0	4	2
		TOTAL		**37**	**14**	**1**	**20**	**25**

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U19ENTL202T	English for Engineers	HS	2	2	0	0	2
2	U19MATH216	Laplace Transforms and Advanced Calculus for Electrical Engineers	BS	4	3	1	0	4
3	U19PHTL206T	Physics for Electronics Engineering	BS	2	2	0	0	2
4	U19EETL202T	Network Analysis	PC	2	2	0	0	2
5	U19METL220T	Fundamentals of Mechanical for Electrical applications	ES	2	2	0	0	2
6	U19CSTL203T	C Programming	ES	3	3	0	0	3
PRACTICALS								
7	U19METL220L	Fundamentals of Mechanical for Electrical applications Laboratory	ES	2	0	0	2	1
8	U19PHTL206L	Physics for Electronics Engineering Laboratory	BS	2	0	0	2	1
9	U19EETL202L	Network Analysis Laboratory	PC	2	0	0	2	1
10	U19CSTL203L	C Programming Laboratory	ES	2	0	0	2	1
11	U19ENTL202L	English for Engineers Laboratory	HS	2	0	0	2	1
12	U19CCEX202	Engineering Exploration-II	EEC	3	1	0	2	2
		TOTAL		**28**	**15**	**1**	**12**	**22**

SEMESTER III

SL. NO	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U19MATH324	Transforms and Partial Differential Equations for Electrical Engineers	BS	4	3	1	0	4
2	U19EETL303T	Generation Transmission and Distribution	PC	2	2	0	0	2
3	U19EETL304T	Electrical Machines and Design-I	PC	2	2	0	0	2
4	U19EETL305T	Semiconductor Devices and IC's	PC	2	2	0	0	2
5	U19ECTL306T	Digital Electronics	PC	2	2	0	0	2
6	U19ITTL302T	Python Programming	ES	2	2	0	0	2
7	U19EELC301	Basics of Programmable Logic controller	PC	4	0	0	4	2
8	U19ECLC301	Embedded System Design Using Arduino Microcontroller	PC	4	0	0	4	2
PRACTICALS								
9	U19CCEX303	Engineering Exploration – III	EEC	2	0	0	2	1
10	U19ITTL302L	Python Programming Laboratory	ES	2	0	0	2	1
11	U19ECTL306L	Digital Electronics Laboratory	PC	2	0	0	2	1
12	U19EETL303L	Generation Transmission and Distribution Laboratory	PC	2	0	0	2	1
13	U19EETL304L	Electrical Machines and Design-I Laboratory	PC	2	0	0	2	1
14	U19EETL305L	Semiconductor Devices and IC's Laboratory	PC	2	0	0	2	1
15	U19CCLC301	Career Enhancement Program – I	EEC	2	0	0	2	1
		TOTAL		**36**	**13**	**1**	**22**	**25**

SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U19MATH431	Numerical Methods for Electrical Engineers	BS	3	3	0	0	3
2	U19EETL406T	Measurements and Instrumentation	PC	3	3	0	0	3
3	U19EETL407T	Electrical Machines and Design – II	PC	2	2	0	0	2
4	U19EETL408T	Control System Engineering	PC	3	3	0	0	3
5	U19EETL409T	Microprocessor and Microcontroller Design	PC	2	2	0	0	2
6		Professional Elective – I	PE	3	3	0	0	3
PRACTICALS								
7	U19EETL406L	Measurements and Instrumentation Laboratory	PC	2	0	0	2	1
8	U19EETL407L	Electrical Machines and Design - II Laboratory	PC	2	0	0	2	1
9	U19EETL408L	Control System Engineering Laboratory	PC	2	0	0	2	1
10	U19EETL409L	Microprocessor and Microcontroller Design Laboratory	PC	2	0	0	2	1
11	U19CCEX404	Engineering Exploration – IV	EEC	2	0	0	2	1
12	U19CCLC402	Career Enhancement Program-II	EEC	2	0	0	2	1
		TOTAL		**28**	**16**	**0**	**12**	**22**

SEMESTER V

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U19EETL510T	Power System Analysis	PC	3	3	0	0	3
2	U19EETL511T	Power Electronics and Applications	PC	3	3	0	0	3
3	U19EETL512T	Communication Engineering	PC	3	3	0	0	3
4	U19EETL513 T	Principles of Digital Signal Processing	PC	3	3	0	0	3
5		Professional Elective - II	PE	3	3	0	0	3
6		Professional Elective - III	PE	3	3	0	0	3
PRACTICALS								
7	U19EETL510L	Power System Analysis Laboratory	PC	2	0	0	2	1
8	U19EETL511L	Power Electronics and Applications Laboratory	PC	2	0	0	2	1
9	U19EETL512L	Communication and Signal Processing Laboratory	PC	2	0	0	2	1
10	U19CCEX505	Engineering Exploration-V	EEC	2	0	0	2	1
11	U19CCLC503	Career Enhancement Program –III	EEC	2	0	0	2	1
		TOTAL		**28**	**18**	**0**	**10**	**23**

SEMESTER VI

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U19EETL614T	Protection and switch gear	PC	2	2	0	0	2
2	U19ECTL614T	Internet of Things	PC	3	3	0	0	3
3	U19EETL615T	Solid State Drives	PC	2	2	0	0	2
4		Professional Elective -IV	PE	3	3	0	0	3
5		Professional Elective -V	PE	3	3	0	0	3
6		Open Elective-I	OE	3	3	0	0	3
PRACTICALS								
7	U19EEPR601	Design Project	EEC	4	0	0	4	2
8	U19EETL614L	Protection and switchgear Laboratory	PC	2	0	0	2	1
9	U19ECTL614L	Internet of Things Laboratory	PC	2	0	0	2	1
10	U19EETL615L	Solid State Drives Laboratory	PC	2	0	0	2	1
11	U19CCLC604	Career Enhancement IV	EEC	2	0	0	2	1
		TOTAL		**28**	**16**	**0**	**12**	**22**

SEMESTER VII

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT	L	T	P	C

				PERIODS				
THEORY								
1	U19EETH701	Power System Operation and Control	PC	4	4	0	0	4
2	U19EETL716T	Industrial Embedded System	PC	3	3	0	0	3
3		Open Elective-II	OE	3	3	0	0	3
PRACTICALS								
4	U19EETL716L	Industrial Embedded System Laboratory	PC	2	0	0	2	1
5	U19EEPR702	Project Work – I	EEC	4	0	0	4	2
		TOTAL		**16**	**10**	**0**	**6**	**13**

SEMESTER VIII

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U19EETH802	High Voltage Engineering	PC	4	4	0	0	4
2	U19METH707	Principles of Management and Professional Ethics	PC	3	3	0	0	3
PRACTICALS								
3	U19EEPR803	Project Work – II	EEC	12	0	0	12	6
		TOTAL		**19**	**7**	**0**	**12**	**13**

HUMANITIES AND SOCIALSCIENCES (HS)								
SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT	L	T	P	C

				PERIODS				
1	U19ENTL101T	Communicative English	HS	4	2	0	0	2
2	U19LATH101 U19LATH102 U19LAEN101	Language - Tamil Language – Malayalam Foundation English	HS	2	2	0	0	2
3	U19ENTL101L	Communicative English Laboratory	HS	2	0	0	2	1
4	U19ENTL202T	English for Engineers	HS	2	2	0	0	2
5	U19ENTL202L	English for Engineers Laboratory	HS	2	0	0	2	1

BASIC SCIENCES (BS)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	U19MATH107	Matrices and Calculus for EEE	BS	4	3	1	0	4
2	U19CHTL101 T	Applied Chemistry	BS	4	2	0	2	3
3	U19CHTL101L	Applied Chemistry Laboratory	BS	2	0	0	2	1
4	U19AEPC101	Crop Production Laboratory - I	BS	4	0	0	4	2
5	U19MATH216	Laplace Transforms and Advanced Calculus for Electrical Engineers	BS	4	3	1	0	4
6	U19PHTL206T	Physics for Electronics Engineering	BS	2	2	0	0	2
7	U19PHTL206L	Physics for Electronics Engineering Laboratory	BS	2	0	0	2	1
8	U19MATH324	Transforms and Partial Differential Equations for Electrical Engineers	BS	4	3	1	0	4
9	U19MATH431	Numerical Methods for Electrical Engineers	BS	3	3	0	0	3

ENGINEERING SCIENCES (ES)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	U19CSTL101T	Computational thinking and Problem Solving	ES	4	2	0	2	3
2	U19CSTL101L	Computational thinking and Problem Solving Laboratory	ES	2	0	0	2	1
3	U19METL220T	Fundamentals of Mechanical for Electrical applications	ES	2	2	0	0	2
4	U19METL220L	Fundamentals of Mechanical for Electrical applications Laboratory	ES	2	0	0	2	1

5	U19CSTL203T	C Programming	ES	3	3	0	0	3
6	U19CSTL203L	C Programming Laboratory	ES	2	0	0	2	1
7	U19ITTL302T	Python Programming	ES	2	2	0	0	2
8	U19ITTL302L	Python Programming Laboratory	ES	2	0	0	2	1
PROFESSIONAL CORE (PC)								
SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	U19EETL101 T	Elements of Electrical Engineering	PC	4	2	0	2	3
2	U19EETL101L	Elements of Electrical Engineering Laboratory	PC	2	0	0	2	1
3	U19EETL202T	Network Analysis	PC	2	2	0	0	2
4	U19EETL202L	Network Analysis Laboratory	PC	2	0	0	2	1
5	U19EETL303T	Generation Transmission and Distribution	PC	2	2	0	0	2
6	U19EETL304T	Electrical Machines and Design-I	PC	2	2	0	0	2
7	U19EETL305T	Semiconductor Devices and IC's	PC	2	2	0	0	2
8	U19ECTL306T	Digital Electronics	PC	2	2	0	0	2
9	U19EELC301	Basics of Programmable Logic controller	PC	4	0	0	4	2
10	U19ECLC301	Embedded System Design Using Arduino Microcontroller	PC	4	0	0	4	2
11	U19ECTL306L	Digital Electronics Laboratory	PC	2	0	0	2	1
12	U19EETL303L	Generation Transmission and Distribution Laboratory	PC	2	0	0	2	1
13	U19EETL304L	Electrical Machines and Design-I Laboratory	PC	2	0	0	2	1
14	U19EETL305L	Semiconductor Devices and IC's Laboratory	PC	2	0	0	2	1
15	U19EETL406T	Measurements and Instrumentation	PC	3	3	0	0	3
16	U19EETL407T	Electrical Machines and Design – II	PC	2	2	0	0	2
17	U19EETL408T	Control System Engineering	PC	3	3	0	0	3
18	U19EETL409T	Microprocessor and Microcontroller Design	PC	2	2	0	0	2
19	U19EETL406L	Measurements and Instrumentation Laboratory	PC	2	0	0	2	1
20	U19EETL407L	Electrical Machines and	PC	2	0	0	2	1

		Design - II Laboratory						
21	U19EETL408L	Control System Engineering Laboratory	PC	2	0	0	2	1
22	U19EETL409L	Microprocessor and Microcontroller Design Laboratory	PC	2	0	0	2	1
23	U19EETL510T	Power System Analysis	PC	3	3	0	0	3
24	U19EETL511T	Power Electronics and Applications	PC	3	3	0	0	3
25	U19EETL512T	Communication Engineering	PC	3	3	0	0	3
26	U19EETL513 T	Principles of Digital Signal Processing	PC	3	3	0	0	3
27	U19EETL510L	Power System Analysis Laboratory	PC	2	0	0	2	1
28	U19EETL511L	Power Electronics and Applications Laboratory	PC	2	0	0	2	1
29	U19EETL512L	Communication and Signal Processing Laboratory	PC	2	0	0	2	1
30	U19EETL614T	Protection and switch gear	PC	2	2	0	0	2
31	U19ECTL614T	Internet of Things	PC	3	3	0	0	3
32	U19EETL615T	Solid State Drives	PC	2	2	0	0	2
33	U19EETL614L	Protection and switchgear Laboratory	PC	2	0	0	2	1
34	U19ECTL614L	Internet of Things Laboratory	PC	2	0	0	2	1
35	U19EETL615L	Solid State Drives Laboratory	PC	2	0	0	2	1
36	U19EETH701	Power System Operation and Control	PC	4	4	0	0	4
37	U19EETL716T	Industrial Embedded System	PC	3	3	0	0	3
38	U19EETL716L	Industrial Embedded System Laboratory	PC	2	0	0	2	1
39	U19EETH802	Automotive Electronics	PC	3	3	0	0	3
40	U19EETH803	Ethics and Management	PC	3	3	0	0	3

PROFESSIONAL ELECTIVES (PE)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT	L	T	P	C

				PERIODS				
1	U19EEPE001	Advanced Programmable logic controller	PE	4	3	0	0	3
2	U19ECPE002	Design of Embedded Systems	PE	4	3	0	0	3
3	U19ECPE003	Programming Paradigms	PE	4	3	0	0	3
4	U19ECPE005	Synthesis and STA	PE	4	3	0	0	3
5	U19EEPE0014	MATLAB	PE	4	3	0	0	3
6	U19ECPE004	Embedded Design using ARM	PE	4	3	0	0	3
7	U19EEPE002	Automation system Design	PE	4	3	0	0	3
8	U19CSPE009	Full stack web development	PE	4	3	0	0	3
9	U19ECPE007	Protocols in PIC Controller	PE	4	3	0	0	3
10	U19EEPE005	PCB Design using ORCAD and ECAD	PE	4	3	0	0	3
11	U19EEPE003	LabVIEW	PE	4	3	0	0	3
12	U19EEPE004	Electrical Vehicles I	PE	4	3	0	0	3
13	U19CSTL306T	Database Management Systems	PE	4	3	0	0	3
14	U19EEPE006	Engineering for MV Substations	PE	4	3	0	0	3
15	U19EEPE007	Automotive Embedded System	PE	4	3	0	0	3
16	U19ECPE013	Embedded Linux and device driver development	PE	3	3	0	0	3
17	U19ITPE012	MERN Stack- WEB Application Development	PE	3	3	0	0	3
18	U19EEPE008	Electrical Vehicles II	PE	4	3	0	0	3
19	U19EEPE009	Advanced LabVIEW Programming	PE	4	3	0	0	3
20	U19EEPE010	Industrial Power Systems	PE	4	3	0	0	3
21	U19ECPE019	RTOs using STM Controller	PE	3	3	0	0	3
22	U19CSTL408T	Advanced Databases	PE	3	3	0	0	3
23	U19ECPE020	System Verilog	PE	3	3	0	0	3
24	U19EEPE011	Energy Auditing and Conservation Techniques	PE	3	3	0	0	3
25	U19EEPE012	SCADA and DCS in Industrial Automation	PE	3	3	0	0	3
26	U19EEPE013	Energy Storage Technology	PE	3	3	0	0	3
27	U19EEPE014	High Voltage Engineering	PE	4	4	0	0	4
28	U19EEPE015	Special Electrical Machines	PE	3	3	0	0	3
29	U19EEPE016	Power Quality	PE	3	3	0	0	3

30	U19EEPE017	Fibre Optics and Laser Instrumentation	PE	3	3	0	0	3
31	U19EEPE018	Microprocessor Based System Design	PE	3	3	0	0	3
32	U19EEPE019	VLSI Design	PE	3	3	0	0	3
33	U19EEPE020	Power Systems Transients	PE	3	3	0	0	3
34	U19EEPE021	FACTS and HVDC	PE	3	3	0	0	3
35	U19EEPE022	Smart Grid Engineering	PE	3	3	0	0	3

OPEN ELECTIVE (OE)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	U19AEOE001	Agricultural Waste Management	OE	3	3	0	0	3
2	U19AEOE002	Farm Management	OE	3	3	0	0	3
3	U19BTOE001	Basics of Bioinformatics	OE	3	3	0	0	3
4	U19BTOE002	Introduction to Bio Energy and Bio Fuels	OE	3	3	0	0	3
5	U19BMOE001	Bio Healthcare and Telemedicine	OE	3	3	0	0	3
6	U19BMOE002	Embedded Systems in Medical Devices	OE	3	3	0	0	3
7	U19CEOE001	Green buildings	OE	3	3	0	0	3
8	U19CEOE002	Disaster Prepardness and Management	OE	3	3	0	0	3
9	U19CSOE001	Software Engineering	OE	3	3	0	0	3
10	U19CSOE002	Database Management systems	OE	3	3	0	0	3
11	U19ECOE003	Consumer Electronics	OE	3	3	0	0	3
12	U19ECOE006	Medical Electronics	OE	3	3	0	0	3
13	U19FTOE001	Food Science and Nutrition	OE	3	3	0	0	3
14	U19FTOE002	Food Preservation Techniques	OE	3	3	0	0	3
15	U19CHOE203	Environmental Engineering	OE	3	3	0	0	3
16	U19AEOE003	Introduction to Bio-Energy	OE	3	3	0	0	3
17	U19AEOE004	Robotics in Agriculture	OE	3	3	0	0	3
18	U19BTOE003	Analytical methods and Instrumentation	OE	3	3	0	0	3
19	U19BTOE004	Industrial Waste management	OE	3	3	0	0	3
20	U19BMOE003	Hospital Management system	OE	3	3	0	0	3
21	U19BMOE004	Biomedical Instrumentation	OE	3	3	0	0	3

22	U19CEOE006	Metrorail and Systems Engineering	OE	3	3	0	0	3
23	U19CEOE010	Advanced Concrete Technology	OE	3	3	0	0	3
24	U19CSOE003	Data Structures and Algorithms	OE	3	3	0	0	3
25	U19ECOE001	Soft Computing	OE	3	3	0	0	3
26	U19ECOE004	Advanced Mobile Communication	OE	3	3	0	0	3
27	U19EEOE003	Sensors and Transducers	OE	3	3	0	0	3
28	U19EEOE004	Energy Technology	OE	3	3	0	0	3
29	U19FTOE003	Beverage Technology	OE	3	3	0	0	3
30	U19FTOE004	Principles of Food Materials	OE	3	3	0	0	3
31	U19CHTH401	Environment Science and Engineering	OE	3	3	0	0	3
EMPLOYABILITY ENHANCEMENT COURSES (EEC)								
SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	U19CCEX101	Engineering Exploration I	EEC	3	1	0	2	2
2	U19CCEX202	Engineering Exploration-II	EEC	3	1	0	2	2
3	U19CCEX303	Engineering Exploration – III	EEC	2	0	0	2	1
4	U19CCLC301	Career Enhancement Program – I	EEC	2	0	0	2	1
5	U19CCEX404	Engineering Exploration – IV	EEC	2	0	0	2	1
6	U19CCLC402	Career Enhancement Program- II	EEC	2	0	0	2	1
7	U19CCEX505	Engineering Exploration-V	EEC	2	0	0	2	1
8	U19CCLC503	Career Enhancement Program –III	EEC	2	0	0	2	1
9	U19EEPR601	Design Project	EEC	4	0	0	4	2
10	U19CCLC604	Career Enhancement IV	EEC	2	0	0	2	1
11	U19EEPR702	Project Work – I	EEC	4	0	0	4	2
12	U19EEPR803	Project Work – II	EEC	12	0	0	12	6

CREDIT DISTRIBUTION

CATEGORY / SEMESTER	I	II	III	IV	V	VI	VII	VIII	TOTAL CREDITS	%
HS	5	3	0	0	0	0	0	0	8	4.88
BS	10	7	4	3	0	0	0	0	24	14.63
ES	4	7	3	0	0	0	0	0	14	8.54
PC	4	3	16	14	15	10	8	7	77	46.66
PE	0	0	0	0	6	6	0	0	12	7.32
OE	0	0	0	3	0	3	3	0	9	5.49
EEC	2	2	2	2	2	3	2	6	21	12.80
TOTAL CREDITS	25	22	25	22	23	22	13	13	165	100

U19ENTL101T **COMMUNICATIVE ENGLISH** **L T P C**

(Common to all Programmes) **2 0 0 2**

COURSE OBJECTIVES

- To enhance learners' listening skills so as to help them to comprehend conversations and lectures in diverse contexts.
- To develop the speaking skills of learners with fluency and appropriacy to express their ideas, views, and opinions in varied formal and informal contexts and social situations.
- To inculcate the habit of reading using different types of reading strategies for understanding contextual situations.
- To develop the learners to write various writing forms effectively and coherently in an appropriate style.
- To develop linguistic competence and performance to express ideas effectively and appropriately in different contexts.
- Developing the vocabulary of a general kind by developing their reading skills.

PREREQUISITES

- Nil

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION TO BUSINESS COMMUNICATION 6

Parts of Speech - Jumbled words - Making mild Suggestions/offers/invitations - Discourse Markers - Letter writing (Request / Complaint / Thanking).

UNIT II EXTENDED WRITING 6

Seeking advice / Information politely - Root words - Present Tense - Reading Comprehension (MCQ) - Paragraph writing.

UNIT III READING COMPREHENSION 6

Past Tense - Phrasal Verbs - Jargon - Making polite requests - Reading and comprehending newspaper articles - Hints Development.

UNIT IV EXTENDED GRAMMAR CONCEPTS 6

Future Tense - Determiners - Making inquiries/requests indirectly and politely - Indicating Preference - Reading Comprehension (Short questions) - Constructing conversations (Formal and Informal).

UNIT V TECHNICAL COMMUNICATION 6

Pointing out mistakes and unpleasant things politely - Asking yes or no type questions and wh-questions indirectly and politely - Misspelled words - Cloze reading - Picture Description – Jumbled sentences.

Total: 30 Hours

Course Outcome

At the end of the course, students should be able to

CO1 Listen and comprehend technical and non-technical spoken experts critically and functionally.

CO2 Write different forms of writing effectively and apparently create an advanced level of writing in English.

CO3 Read different genres of text, analyzing and interpreting it by guessing the meaning from the context and employing it for new ideas, to learn and present.

CO4 Speak fluently using the appropriate vocabulary, modulation, articulation, and pronunciation.

CO5 Familiarize the soft skills needed for employability and gain a functional understanding of the language.

CO6 Familiarize the soft skills needed for the technical papers presentations.

TEXTBOOKS

T1. Means, L. Thomas and Elaine Langlois. English & Communication for Colleges. Cengage Learning,USA: 2007.

T2. Redston, Chris & Gillies Cunningham. Face2Face (Pre-intermediate Student's Book). Cambridge University Press, New Delhi: 2005.

REFERENCE BOOKS

R1. Carter, R., & McCarthy, M. (2006). Cambridge grammar of English: A comprehensive guide: spoken and written English grammar and usage. Cambridge University Press.

R2. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011.

R3. Meenakshi Raman and Sangeeta Sharma. Technical Communication. Oxford University Press. 2018.

WEB RESOURCES

W1. http://www.bbc.co.uk/worldservice/learningenglish/language/

W2. http://www.bbc.co.uk/learningenglish/english/features/pronunciation/introduction

W3. http://toefl.uobabylon.edu.iq/papers/itp_2015_1817487.pdf

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
Cos	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	-	2	2	2	3	3	2	-	-	2	3
CO2	-	-	-	-	-	-	-	1	2	3	3	2	-	-	2	3
CO3	-	-	-	-	-	2	-	2	3	3	1	2	-	-	2	3
CO4	-	-	-	-	-	-	3	2	1	3	3	3	-	-	3	1
CO5	-	-	-	-	-	3	3	3	3	3	2	3	-	-	3	3
CO6	-	-	-	-	-	-	2	2	2	3	3	2	-	-	2	3

20MA107	MATRICES AND CALCULUS FOR ELACTRICAL ENGINEERS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

Engineering Mathematics is an essential tool for describing and analyzing engineering process and systems. It enables precise representation and communication of knowledge. The objective of the course is to expose students to understand the basics and importance of Matrix Theory, Differential Calculus, Integral Calculus and Ordinary Differential Equations which are being widely used in Electrical and Electronics Engineering studies.

PRE-REQUISITES :

- Basic concepts of Matrices
- System of linear equations
- Limits and Continuity
- Basic concepts of Differentiation
- Basic concepts of Integration

THEORY COMPONENT CONTENTS

UNIT I MATRICES 9+3

Consistency of linear system of equations – Rouche's theorem– Linear transformations – Vectors – Linear dependence – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (excluding proof) – Applications of Matrices in Electrical and Electronics Engineering.

UNIT II DIAGONALIZATION OF A REAL SYMMETRIC MATRICES 8+3

Cayley - Hamilton theorem (excluding proof) – Orthogonal matrix –Diagonalization of matrices – Reduction of Quadratic form to Canonical form by orthogonal transformation– Applications of Diagonalization of real symmetric matrices in Electrical and Electronics Engineering.

UNIT III DIFFERENTIAL CALCULUS AND ITS GEOMETRICALAPPLICATIONS 9+3

Derivatives – Curvature – Radius of curvature in Cartesian and Parametric forms – Simple problems – Centre of curvature – Circle of curvature – Involutes and Evolutes of Parabola – Applications of Differential Calculus in Electrical and Electronics Engineering.

UNIT IV INTEGRAL CALCULUS AND MULTIPLE INTEGRALS 9+4

Definite and Indefinite integrals – Substitution rule – Integration by parts –Double integrals – Area enclosed by plane curves – Triple integrals in Cartesian coordinates – Applications of Integrals in Electrical and Electronics Engineering.

UNIT V ORDINARY DIFFERENTIAL EQUATIONS 9+3

Higher order linear differential equations with constant coefficients – Cauchy's linear equations – Simultaneous first order linear equations with constant coefficients – Applications of Ordinary Differential Equations in Electrical and Electronics Engineering.

Total: 60 Hours

TEXT BOOKS:

SIET - Curriculum & Syllabi (R 2019)

T1. Grewal. B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2017.

T2. James Stewart., " Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Unit IV-Sections 5.2, 5.4(excluding net change Theorem),5.5 and 7.1]

REFERENCE BOOKS:

R1.Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley and sons, 2011.

R2. Peter V. O. 'Neil., "Advanced Engineering Mathematics", 7th Edition Cengage learning, India pvt., Ltd, New Delhi. 2011.

R3. Veerarajan T., "Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi (2008).

R4. Weir. M. D and Joel Hass., " Thomas Calculus", 14th Edition, Pearson India, 2017.

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Calculate the rank of a matrix, Eigen values, Eigen vectors and solutions ofsystem of linear equations.

CO2: Use the applicability of Cayley - Hamilton theorem to find the inverse of amatrix and Diagonalization of matrix

CO3: Gain knowledge to find the radius of curvature and torsion of a curve,which are used for analyzing the output data.

CO4: Gain knowledge to determine values of definite integrals exactly and applyto regions under and between curves.

CO5: Gain knowledge to solve differential equations arising in Electrical and Electronics Engineering.

CO6: Determine convergence/divergence of improper integrals and evaluate convergent improper integrals

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	2	-	-	-	-	-	1	2	3	1	1	1
CO2	3	3	3	2	1	-	-	-	-	-	1	2	3	3	3	3
CO3	3	3	3	1	2	-	-	-	-	-	2	2	3	2	2	1
CO4	2	1	1	2	1	-	-	-	-	-	2	3	3	3	3	2
CO5	3	1	3	2	2	-	-	-	-	-	2	2	3	2	3	3
CO6	3	3	3	2	2	-	-	-	-	-	1	3	2	3	3	3

20CH101 APPLIED CHEMISTRY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To make the students understand the principles of electrochemical reactions, corrosion.
- To gain the knowledge on electrochemical processing and the methods for prevention and protection of corrosion.
- To understand the principles and fabrication of batteries and fuel cells.
- To gain knowledge on the principles of polymer chemistry and its engineering application.
- To know the properties and applications of important Nano materials.
- To acquire the knowledge about polymer, Nano materials, fuels cell and its application.

UNIT I ELECTROCHEMISTRY & CORROSION 9

Electrochemical cells – Reversible and irreversible cells – EMF – Electrochemical series - Significance – Single electrode potential – Nernst equation –Chemical corrosion: oxidation corrosion - Pilling–Bedworth rule – Electrochemical corrosion – Types (Galvanic corrosion, Differential aeration corrosion) – Factors influencing corrosion.

UNIT II ELECTROCHEMICAL PROCESSES & METAL FINISHING 9

Corrosion control – Modifying metal - Cathodic protection (Sacrificial anode, Impressed current method) – Corrosion inhibitors; Protective coatings – Electroplating (Cu and Ni only), Electroless plating of Ni & Cu – Anodizing & Chromating – applications; Electro polishing, Electrochemical machining.

UNIT III BATTERIES & FUEL CELLS 8

Batteries - Types – characteristics - fabrication and working of batteries (alkaline battery, lead – acid battery, Ni-Cd battery and lithium ion batteries) - super capacitors; Fuel cells - principle, working and applications of hydrogen - oxygen, solid oxide, direct methanol and proton exchange membrane fuel cells.

UNIT IV POLYMERS 10

Polymers - Functionality - Degree of polymerization; Polymerization: Types –Glass transition temperature; Plastics - Thermo plastics (Teflon and PMMA)thermosets (Bakelite and Urea formaldehyde resin) – Preparation and applications of polymers(Nylon66 and Epoxy resins); Fabrication: Compression moulding - Injection moulding - Blow moulding.

UNIT V NANOMATERIALS 9

Nano materials - Types (Nano particles, Nano clusters, Nano wires, Nan rods and Nano tubes) – Properties – Synthesis & Applications; Role of bottom up and top down approaches in nano technology – solgel process, CVD and Laser ablation – Nano dynamics - Carbon Nano tubes & Graphene - Applications;

Total:45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Understand the cells, potentials, types of corrosion and factors influencing it.

CO2: Know the corrosion control techniques and metal finishing techniques

CO3: Learn about various types of batteries, fuel cells and its applications.

CO4: Gain knowledge on the properties of polymers and manufacturing methods.

CO5: Understand the importance of nanomaterials and concepts.

CO6: Application of polymer, Nano materials, fuels cell and batteries.

TEXT BOOKS:

T1. P. C. Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publications Pvt. Ltd, New Delhi, 16th Edition, 2017.

T2. S. S. Dara and S.S. Umare, "Textbook of Engineering Chemistry", S. Chand & Company Ltd, New Delhi, 2017.

REFERENCE BOOKS

R1. PrasantaRath, "Engineering Chemistry", Cengage Learning India Pvt. Ltd, 2013.

R2. O.G. Palanna, "Engineering Chemistry", Tata McGraw-Hill Education Pvt. Ltd, New Delhi, 2017.

R3. Sunita Rattan, "A Textbook of Engineering Chemistry", S.K. Kataria& Sons, New Delhi, 2013.

R4. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry', Wiley India Pvt. Ltd, New Delhi, 2nd Edition 2014.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	1	-	-	1	1	-	-	-	-	1	1	1	1	2
CO2	3	3	1	-	-	1	1	-	-	-	-	1	1	2	2	1
CO3	3	3	1	-	-	1	1	-	-	-	-	1	2	3	2	3
CO4	3	3	3	-	-	3	1	-	-	-	-	1	2	3	1	2
CO5	3	3	1	-	-	2	2	-	-	-	-	3	2	3	3	1
CO6	3	3	1	-	-	1	1	-	-	-	-	1	1	1	2	2

U19CHTL101L	APPLIED CHEMISTRY LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives

- To equip the students to understand the concept of conductivity and pH.
- To acquire the knowledge about the various types of volumetric reaction.
- To know the electrochemical characterization techniques.
- To provide a basic knowledge on different instrumental analysis.
- To gain knowledge about the synthesis of nanomaterials.
- To equip the students to understand the concept electro deposition and electroplating.

Course Outcomes

At the end of the course, learners will be able to

C01: Estimate the amount of substance present in the given solution using potentiometer and conductivity meter.

C02: Examine the total hardness and chemical oxygen demand in the given solution by volumetric analysis method

C03: Apply the use of internal and external indicators and their comparison for redox titrations and mechanisms of iodo metric titrations and use of double indicator method in a single titration.

C04: Learn about instrumental analysis and chemical components.

C05:Gain knowledge of mechanism chemical reaction.

C06: They would learn about electroplating techniques.

LIST OF EXPERIMENTS

- Testing the conductivity and pH of various types of water (municipal water, distilled water, salt water, and waste water).
- Construction of voltaic cells & batteries.
- Determination of strength of HCl using pH meter.
- Determination of strength of HCl using Conductivity meter.
- Determination of corrosion rate of steel in acid media by weight loss method.
- Determination of Dissolved Oxygen content of water sample by Winkler's method.
- Electro-deposition of Copper for corrosion control.
- Electroplating of Nickel for corrosion control.
- Redox reactions – Finding emf of Fe in sample by Potentiometry.
- Determination of molecular weight by Viscometry.
- Synthesis of conductive polymers & its electrochemical characterization.
- Synthesis of silver nanoparticles & its electrochemical characterization.

Total: 30 Hours

REFERENCES

Vogel's textbook of quantitative chemical analysis (8th edition, 2014).

CO No	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	2	2	1	1	-	-	-	-	2	1	-	1	-	-	-	-
2	2	2	1	1	-	-	-	-	1	-	-	1	-	-	-	-
3	1	1	1	2	1	-	-	-	2	1	-	1	-	-	-	-
4	2	1	2	1	-	-	-	-	2	1	-	1	-	-	-	-
5	2	2	3	2	-	-	-	-	2	1	-	1	-	-	-	-
6	1	1	2	-	-	2	2	-	-	-	-	1	-	-	-	-

U19EETL101T ELEMENTS OF ELECTRICAL ENGINEERING

L	T	P	C
2	0	2	3

COURSE OBJECTIVES

- To remember the basic concepts of DC circuits
- To remember the basic concepts of AC circuits
- To expose to the basic magnetic circuits
- To create awareness about the domestic wiring
- To provide the basics of power systems and electrical instruments

PRE-REQUISITES: Physics for Electronics Engineering

THEORY COMPONENT CONTENTS

UNIT I BASICS OF DC CIRCUITS **6**

Electrical quantities – Definitions -SI Unit**s** **-**Concepts of circuit and Classification of network elements–Dependent and Independent sources –Ohm's Law –Kirchoff's Current Law – Kirchoff's Voltage Law – Introduction to graph theory – Tree – Co-tree – Incidence matrix – Tie-set matrix and cut-set matrix – Problems

UNIT IV BASICS OF AC CIRCUITS **6**

AC fundamentals – Power, Average value, rms value, instantaneous value, peak value – Form Factor and Peak Factor for different patterns of alternating waveforms – Phase relation inPure R, L & C –Power factor –Phasor diagram

UNIT III MAGNETIC CIRCUITS **6**

Introduction – Definition of Magnetic quantities – Permanent magnet -Electromagnet -Laws of Electromagnetic Induction–Len's law-Inductance and types – Induced EMF- Statically and Dynamically induced EMF, Magnetomotive force –Properties of magnetic materials-Applications.

UNIT IV DOMESTIC WIRING **6**

Introduction –Wiring materials & accessories (Switches, Fuse, Socket outlet, plugs, circuit Breaker, Cables) - Types of Wiring – Rules of wiring -Specifications of Wires – Two-way control of lamps – Fluorescent lamp wiring – Earthing.

UNIT V BASIC POWER SYSTEM & ELECTRICAL INSTRUMENTS **6**

Introduction - Structure of Power system -Types of Power generating stations – Transmission - types -Distribution and their types.

Introduction- Classification- Principle of Analog Instruments -Basic DC Ammeter -Voltmeter, Wattmeter, Megger, Digital multi-meters, Energy meter.

Total: 30 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Understand the basic concepts of DC circuits
CO2: Explain the basic concepts of AC circuits
CO3: Explore about the basic magnetic circuit
CO4: Ability to build the Domestic wiring
CO5: Explain the basics of power system and Instruments
CO6: Developing the vocabulary of a general kind by developing their reading skills

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	2	2	3	3	3	3	3	-	-	3	3
CO2	-	-	-	-	-	2	2	3	3	3	3	3	-	-	3	3
CO3	-	-	-	-	-	1	3	2	2	3	3	3	-	-	3	3
CO4	-	-	-	-	-	2	2	3	3	3	3	3	-	-	1	3
CO5	-	-	-	-	-	2	2	3	1	2	1	1	-	-	2	2
CO6	-	-	-	-	-	2	2	3	1	3	3	1	-	-	3	1

TEXT BOOKS

T1. V.Jagathesan, K.Vinoth Kumar &R.Saravanakumar,"Basic Electrical and Electronics Engineering",Wiley-India,2011
T2. R.Muthusubramanian, S.Salivahanan, Basic Electrical and Electronics Engineering, Tata McGraw Hill Publishing Company Limited, Chennai, 2016.
T3. Sudhakar A., Shyam Mohan S.P., "Circuits, Network Analysis and Synthesis", TataMcGraw Hill Publishing Company Limited, New Delhi, 2015.

REFERENCE BOOKS

R1. Joseph A. Edminister, MahmoodNahri, "Electric Circuits", Schaum's series, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2010
R2. B.L Theraja, Fundamentals of Electrical Engineering and Electronics. Chand & Co, 2008.
R3 Bharti Dwivedi ,AnuragTripathi ,"Fundamentals of Electrical Engineering",Wiley-India,2014

WEB RESOURCES

W1. https://www.youtube.com/watch?v=gW45N2WpD64
W2. https://www.youtube.com/watch?v=LAtPHANEfQo

LAB COMPONENT CONTENTS

1	Experimental verification of Ohm's Law
2	Experimental verification of Kirchhoff's Current Law and Voltage Law
3	Measurement of electrical quantities – voltage, current, power & power factor in RLC Circuit
4	Measurement of AC signal parameter (peak-peak, RMS period, frequency) using CRO.
5	Study of Magnetic core and coil
6	Experimental verification of Faraday's Law
7	Measurement of Resistance - color coding
8	Soldering practice – Components Devices and Circuits – Using general purpose PCB
9	Residential house wiring using switches, fuse, indicator, lamp and Energy meter.
10	Fluorescent lamp wiring
11	Stair case wiring
12	Study of Relays, MCB, Fuses and Panel Board

Total: 15 Hours

U19CSTL101L	COMPUTATIONAL THINKING AND PROBLEM SOLVING LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

The course aims to provide the students

- To understand the various general steps in problem solving.
- To analyze the efficiency of the algorithms.
- To learn to solve problems using C.
- To understand the concept of arrays and strings.
- To learn C functions and storage classes

LAB COMPONENTS

1. Design an Algorithm, Flow chart for various problems.
2. Design an algorithm, a flowchart using sequence
3. Algorithm using selection.
4. Algorithm using Boolean logic and number systems.
5. Design an algorithm,a flowchart using Repetition.
6. Construct an algorithm using List
7. Design an algorithm for encoding and decoding.
8. Demonstrate various algorithms using Factoring Techniques.
9. Demonstrate various Searching Techniques.
10. Demonstrate various sorting techniques.
11. Design various algorithms for Recursive problems.
12. Construct an algorithm for Text processing.

CO1	Understand the syntax and semantics of the C language
CO2	Recognize how to develop and implement a program in the C language
CO3	Understand the concept of a branching and looping
CO4	Develop various forms of data representation and array supported by the C language
CO5	Understand string representation and its operations supported by the C language
CO6	Implementing function concept with examples

Total: 30 Hours

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	-	-	-	-	1	1	2	1	1	2
CO2	3	2	3	-	-	-	-	-	-	-	1	1	2	1	1	2
CO3	3	2	2	2	-	-	-	-	-	-	2	3	2	2	2	2
CO4	3	3	2	2	-	-	-	-	-	-	3	3	1	2	3	2
CO5	3	2	3	2	-	-	-	-	-	-	1	1	2	1	1	1
CO6	3	2	3	2	-	-	-	-	-	-	1	1	2	1	1	2

U19CCEX101	ENGINEERING EXPLORATION I	L	T	P	C
		1	0	2	2

COURSE OBJECTIVES

- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab
- To inculcate ethics and sustainability perspectives and enable students to work in a team

PRE-REQUISITES

NIL

CONTENTS

S No	Topics	No of Hours
1	Introduction to Engineering	3
2	Platform based development	12
3	Mechanisms	9
4	Requirements	3
5	Design	
6	Ethics	6
7	Sustainability	
8	Project Management Principles	3
9	Guided Project	
10	Final Project	9

COURSE OUTCOMES

CO1. Understand the role of an engineer as a problem solver
CO2. Apply multi-disciplinary principles and build systems using engineering design process and tools
CO3. Analyze engineering solutions from ethical and sustainability perspectives
CO4. Use basics of engineering project management skills while doing projects
CO5. Communicate, Collaborate and work as a team

GUIDELINES

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 3-4 students.
3. Groups can select to work on specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model at the end of semester.
6. The progress of the course is evaluated based on class performance and final demonstration of prototype.

Total:45 Hours

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	-	2	-	2	2	2	2	1	1	1	1	3
CO2	3	3	3	3	-	2	-	2	2	2	2	1	2	2	2	3
CO3	3	3	3	3	-	2	-	2	2	2	2	1	2	2	2	3
CO4	3	3	3	3	-	2	-	2	2	2	2	1	2	2	2	2
CO5	3	3	3	3	-	2	-	2	2	2	2	1	2	2	2	2
CO6	3	2	2	1	-	2	-	2	2	2	2	1	1	1	1	2

U19LATH101	LANGUAGE - TAMIL	L	T	P	C
		2	0	0	2

Course Objectives

The students should be made

- To enhance listening skill of the learners and practicing it for a better professional as well as moral skills
- To read different text without barriers using reading strategies

UNIT I [illegible] – 1 **5**

[illegible]

UNIT II [illegible] **- 2** **5**

[illegible]

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UNIT III □□□□ – 3 **5**

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UNIT IV □□□□ – 4 **5**

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UNIT V □□□□ **– 5** **5**

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UNIT VI □□□□ **– 6** **5**

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Total: 30 Hours

Course Outcomes

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

CO1	Learn the language literature concepts
CO2	Speak fluently using the proper vocabulary.

CO3 Familiarize the functional understanding of the language grammar

CO4 Understand the concepts of new era tamil literature works

CO5 To develop the reading skills of tamil novels and stories

CO6 To enhance the features of story telling, conversation and creative skills of writing in students

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	-	-	-	-	-	2	2	3	3	3	2	2	1	-	3	3
CO2	-	-	-	-	-	2	2	3	3	3	2	2	1	-	2	3
CO3	-	-	-	-	-	2	2	3	3	3	2	1	1	-	3	1
CO4	-	-	-	-	-	1	3	2	3		2	1	1	-	3	3
CO5	-	-	-	-	-	2	2	3	3	3	2	3	1	-	3	1
CO6	-	-	-	-	-	2	2	3	3	3	2	2	1	-	3	3

		L	T	P	C
U19LAEN101	**Foundation English** (Common to all Programs)	1	0	0	1

COURSE OBJECTIVES

- Educate students in both the artistry and utility of the English language through the study of literature and other contemporary forms of culture.
- Provide students with the critical faculties necessary in an academic environment, on the job, and in an increasingly complex, interdependent world.
- Graduate students who are capable of performing research, analysis, and developing content from different genres.
- Assist students in the development of intellectual flexibility, creativity, and cultural literacy so that they may engage in life-long learning.
- Write analytically in a variety of formats, including essays, research papers, reflective writing, and critical reviews of secondary sources.

PRE-REQUISITES

- Nil

UNIT I **3**

Introduction to the English Language – Introduction to Indian writing in English - Palanquin Bearers by Sarojini Naidu – To me, fair friend, you never can be old, Sonnet 104 byShakespeare

UNIT II **3**

Ode on a Grecian Urn by John Keats – Gitanjali by Rabindranath Tagore

UNIT III **3**

Short Stories: A Christmas Carol by Charles Dickens - The Open Window by Saki - The Interpreter of Maladies by Jhumpa Lahiri – Success Stories of inspirational leaders: Martin Luther King, Malala Yousafzai &SaalumaradaThimmakka, also known as AaladaMaradaTimakka, an Indian environmentalist.

UNIT IV **3**

Novel: The Man-Eater of Malgudi by R.K.Narayan

UNIT V **3**

A Doll's House by Norwegian playwright Henrik Ibsen

Total: 15 Hours

COURSE OUTCOMES

At the end of the course, students should be able to

CO1 : Students should be familiar with literary and cultural texts within a significant number of historical, geographical, and cultural contexts.

CO2 : Students should be able to apply critical and theoretical approaches to the reading and analysis of literary and cultural texts in multiple genres.

CO3 : Students should be able to ethically gather, understand, evaluate, and synthesize Information from a variety of written and electronic sources from different genres.

CO4 : Students should be able to write analytically in a variety of formats, including essays, research papers, reflective writing, and critical reviews of secondary sources.

CO5 : Students should be able to understand the process of communicating and interpreting human experiences through literary representation using historical contexts and disciplinary methodologies.

TEXTBOOKS

1. Palanquin Bearers Paperback by Sarojini Naidu (Author), Indu Harikumar (Illustrator)
2. Sonnet 104: To Me, Fair Friend, You Never Can Be Old Emma Abbate & Ashley RichesFrom the Album Mario Castelnuovo-Tedesco: Shakespeare Sonnets
3. Ode On A Grecian Urn And Other Poems (English, Paperback, Keats John), Publisher: Kessinger Publishing Co, Genre: Poetry, ISBN: 9781419137730
4. A Doll's House by Henrik Ibsen, Maple Press, Genre: Fiction, ISBN: 9789350330685

REFERENCE BOOKS

1. The Open Window and Other Short Stories, Kindle Edition
2. Charles Dickens' Christmas Stories: A Classic Collection, 2019, Kindle Edition

WEB RESOURCES

1. https://www.deccanchronicle.com/lifestyle/books-and-art/220418/saalumarada-thimmakka-the-green-legend-now-on-stage.html
2. https://malala.org/malalas-story

CO/PO MAPPING													CO/PSO Mapping		
Cos	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	3	1	2	3	-	2	-	-	2
CO2	-	-	-	-	-	-	-	2	-	3	-	2	-	-	2
CO3	-	-	-	-	-	-	3	-	3	3	-	2	-	-	3
CO4	-	-	-	-	-	-	1	-	2	3	-	3	-	-	3
CO5	-	-	-	-	-	-	-	1	3	3	-	3	-	-	3

		L	T	P	C
U19LAML101	**Malayalam** (Common to all Programs)	1	0	0	1

COURSE OBJECTIVES

- To Write analytically in a variety of formats, including essays, research papers, reflective writing, and critical reviews of secondary sources.
- To develop an interest in the Mother tongue through the study of literature and other contemporary forms of culture.
- To be proficient in speaking and listening and assist students in the development of intellectual flexibility, creativity, and cultural literacy so that they may engage in life-long learning
- To enhance reading and writing skills for a better understanding of the main contextual ideas
- To use their mother tongue in the formal setup to express their views and ideas using the appropriate vocabulary and phrases.

PRE-REQUISITES

- Nil

UNIT I **3**

Writing- letters, swaraksharangal, vyanjanaksharangal, Error-free Malayalam: 1. Language; 2. Clarity of expression; 3. Punctuation.

UNIT II **3**

Letter writing: Formal (applications, letter to the editor of a Newspaper, commercial correspondence, complaints) and informal letters.

UNIT III **3**

Reading section: Comprehension of unseen prose passages and Short stories

UNIT IV **3**

Expansion of ideas: Proverbs, poems, and philosophical statements.

UNIT V **3**

Critical appreciation of literary works (Books and Films). Literary & Cultural figures of Kerala and their literary contributions.

Total: 15 Hours

COURSE OUTCOMES

At the end of the course, students should be able to

CO1 : Students should be familiar with literary and cultural texts within a significant number of historical, geographical, and cultural contexts.

CO2 : Students should be able to apply critical and theoretical approaches to the readingand analysis of literary and cultural texts in multiple genres.

CO3 : Students should be able to ethically gather, understand, evaluate, and synthesize Information from a variety of written and electronic sources from different genres.

CO4 : Students should be able to write analytically in a variety of formats, including essays, research papers, reflective writing, and critical reviews of secondary sources.

CO5 : Students should be able to understand the process of communicating and interpreting human experiences through literary representation using historical contexts and disciplinary methodologies.

TEXT BOOKS

1. John D Kunnathu, Lissy J Kunnathu, Learn Basic Malayalam In Six Weeks: With Daily Worksheets & Answer Key; CreateSpace Independent Publishing Platform (June 22, 2015)
2. Vidvan C. L. Meenakshi Amma. Learn Malayalam, manuals_contributions; manuals; additional_collections, 1975
3. Learn Basic Malayalam in Six Weeks: With Daily Worksheets & Answer Key, by John D. Kunnathu (Author), Lissy J. Kunnathu (Author), Kindle Edition
4. A Grammar of the Malayalam Language by Rev H.Gundert, Basel Mission Press, 2002
5. Malayalam Grammar Book Paperback, Kindle Edition, 2018

REFERENCE BOOKS

1. Malayalam: A University Course and Reference Grammar. - Fourth Edition, The Center for Asian Studies at The University of Texas at Austin, 2018
2. An Intensive Course in Malayalam (An Old and Rare Book) by B.Shyamala Kumari, Central Institute of Indian Languages, Mysore, 1999

WEB RESOURCES

1. https://e-resources.saraswatihouse.com
2. https://www.alllanguageresources.com/malayalam/
3. Learning Malayalam: A Complete Self-Study Guide - https://www.alllanguageresources.com › Malayalam

CO/PO MAPPING													CO/PSO Mapping		
Cos	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	3	1	2	3	-	2	-	-	2
CO2	-	-	-	-	-	-	-	2	-	3	-	2	-	-	2
CO3	-	-	-	-	-	-	3	-	3	3	-	2	-	-	3
CO4	-	-	-	-	-	-	1	-	2	3	-	3	-	-	3
CO5	-	-	-	-	-	-	-	1	3	3	-	3	-	-	3

U19AEPC101	CROP PRODUCTION- I LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives

- To introduce the students to principles of field crops production and to introduce the production practices of crops.
- To delineate the role of agricultural and irrigation engineers in relation to various crop production practices.
- To equip the students with necessary theoretical and practical knowhow on basic principles of cropping and acquaint them with the cultivation practice of few important crops of Tamil Nadu..

Course Outcomes

At the end of the course, learners will be able to

CO1 : Knowledge on crop selection, production and management.

CO2 : Able to understand the importance of crop water management

C03 :Understand the cultivation practices for some of the important crops in Tamil Nadu

C04: Good knowledge in the fileld preparation of crops including systems of tillage

C05: Sound understanding of the production practices of vegetable crops

C06: Students will gain good knowledge in the production of agricultural and horticultural crops

LIST OF COMPONENTS

- To introduce the different crop production practices in wet land, dry land and garden land through hands on experience and demonstrations.
- Identification of different crops in local region
- Visit to meteorological observatory
- Visit to wetlands and irrigate dry lands to learn important cropping systems and Hi Tec nursery
- Seed selection and seed treatment procedures
- Seed bed and nursery preparation
- Sowing / Transplanting
- Biometric observation for crops
- Nutrient management studies
- Water management and irrigation scheduling
- Weed management studies
- Integrated Pest Management studies
- Harvesting
- Post harvesting

Total: 30 Hours

TEXT BOOKS

T1 : Rajendra Prasad, Text Book of Field Crop Production. Directorate of Information and Publication, Krishi Anusandhan Bhavan, Pusa, New Delhi, 2015.

T2 : Hand Book of Agriculture. 2009 (6th revised edition), Indian Council of Agricultural Resarch (ICAR), New Delhi

T3: Balasubramanian P and Palaniappan SP. 2001. Principles and practices of Agronomy. Agrobios Publishers, Ludhiana

REFERENCES

R1: Ramasamy S and Siddeswran K 2018. Agriculture and crop production. Sri Shakthi Institute of Engineering and Technology, Coimbatore

R2: Crop Production Guide, Tamil Nadu Agricultural University Publication, Coimbatore. 2005

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	-	-	-	2	-	3	3	3	3	3	2	2	3	3
CO2	3	3	-	2	-	2	2	3	3	3	3	1	2	2	2	3
CO3	3	3	-	2	2	2	1	3	3	3	3	3	2	2	3	1
CO4	3	3	-	1	2	2	2	2	1	2	1	2	2	2	3	3
CO5	3	3	-	-	-	2	2	3	3	3	3	3	2	2	3	1
CO6	3	3	-	2	-	2	-	3	3	3	3	3	2	2	3	3

U19ENTL202T	ENGLISH FOR ENGINEERS (Common to all Programmes)	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To develop learners' ability to listen and comprehend talks for the application of language in various contexts.
- To develop the students' abilities to use English accurately, appropriately, and fluently in different social and professional situations.
- To comprehend advanced technical passages and to identify the author's purpose and tone.
- To enhance the advanced level of writing by organizing ideas and achieving consistency in academic as well as workplace contexts.
- To enhance the technical components of the English language for formulating effective and appropriate sentences.

PREREQUISITES

- Nil

THEORY COMPONENT CONTENTS

UNIT I BASICS OF GRAMMAR 6

Use of the Gerund - Use ofthe infinite -'Used to' for habitual actions - Degrees of Comparison – Reading Comprehension passage and answering- Essay writing ((Narrative / Descriptive / Expository / Persuasive)- Letter Writing (Suggestions / Apology/ Acceptance).

UNIT II FOCUS ON LANGUAGE DEVELOPMENT 6

Modal verbs (Possibility, ability, Permission, Suggestions and obligations obligation) - Simple Past vs Present Perfect - Subject and verb agreement - Interpreting charts / Graphs / Tables – Instructions.

UNIT III FUNCTIONAL GRAMMAR AND FORMAL WRITING 6

Relative Pronouns for people and things - Future with 'be going to' and 'will' - Personal and impersonal passive - Email writing - Memo writing - Expansion of a Proverb.

UNIT IV EXTENDED WRITING 6

Fixed and Semi-fixed expressions - Wishes and hypotheses - Conditional clauses -Process Description- Notice / Agenda / Minutes of Meeting.

UNIT V TECHNICAL COMMUNICATION 6

Idioms: guessing meaning based on the context - Question Tags - Reported speech - Technical Proposal – Report Writing (Project / Survey).

Total: 30 Hours

COURSE OUTCOMES

At the end of the course, students should be able to

CO1 Communicate with one or many listeners using appropriate communicative strategies.

CO2 Speak clearly, confidently, and comprehensively using appropriate communicative strategies.

CO3 Read different genres of texts adopting various reading strategies.

CO4 Understand the form and function of the basic official correspondences and perform a range of official support through formal and informal writings.

CO5 Comprehend and apply language learning strategies to read, comprehend, organize and retain written information.

CO6 Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization

TEXTBOOKS

T1. Richards, C. Jack. Interchange Students Book-2 New Delhi: CUP, 2015.

T2. Means,L. Thomas and Elaine Langlois. English and Communication for Colleges. Cengage Learning, USA: 2007.

REFERENCE BOOKS

R1. Redston, Chris & Gillies Cunningham. Face2Face (Upper-intermediate Student Book). Cambridge University Press, New Delhi: 2005.

R2. Daise, Debra &CharlNorloff. Q:Skills for Success Reading and Writing (2nd Edition). Oxford University Press. 2019.

R3. Sudharshana N Pand Savitha C. English for Technical Communication. Cambridge University Press. 2018.

WEB RESOURCES

W1. https://learnenglish.britishcouncil.org/grammar

W2. https://www.kau.edu.sa/Files/0013287/Subjects/academic-writing-handbook-international-students-3rd-ed%20(2).pdf

W3. https://owl.purdue.edu/owl/general_writing/academic_writing/essay_writing/descriptive_essays.html.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	1	2	1	1	3	2	3	-	-	2	3
CO2	-	-	-	-	-	2	2	2	2	3	2	1	-	-	2	3
CO3	-	-	-	-	-	3	3	1	2	3	3	3	-	-	2	1
CO4	-	-	-	-	-	1	1		1	3	1	2	-	-	3	3
CO5	-	-	-	-	-	3	3	3	3	3	3	3	-	-	3	1
CO6	-	-	-	-	-	1	2	1	1	3	2	3	-	-	2	3

U19ENTL202L	ENGLISH FOR ENGINEERS LABORATORY	L	T	P	C
	(Common for all branches)	0	0	2	1

LAB COMPONENT CONTENTS

1. Telephone conversation
2. One-Minute Talk (Prepared)
3. Describing a holiday/festival / special events
4. BBC Hard Talk / NDTV Big Fight
5. Impromptu Speech
6. Story writing
7. Storytelling
8. Open-ended stories
9. Pecha Kucha
10. Book Review
11. Blog writing
12. TED Talk Presentation

Total: 15 Hours

U19MATH216	LAPLACE TRANSFORMS AND ADVANCED CALCULUS FOR EEE	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

Engineering Mathematics is an essential tool for describing and analyzing engineering process and systems. It enables precise representation and communication of knowledge. The objective of the course is to expose students to understand the basics and importance of Laplace transforms, Differential Calculus of Several Variables, Vector Calculus, Complex Differentiation and Complex Integration which are being widely used in Electrical and Electronics Engineering studies

PRE-REQUISITES

- Basic concepts of Differentiation.
- Basic concepts of Integration.
- Basic concepts of Vectors and Trigonometric functions.

THEORY COMPONENT CONTENTS

UNIT I LAPLACE TRANSFORMS 9 + 4

Definition–Transforms of Elementary functions–Properties of Laplace transforms (Statement only) –Transforms of Periodic functions – Transforms of derivatives and integrals (Statement only)–Inverse transforms– Convolution theorem (problems only) – Application to linear ODE of second order with constant coefficients– Applications of Laplace transforms in Electrical and Electronics Engineering.

UNIT II VECTOR DIFFERENTIATION 9 + 3

Scalar and Vector Point functions –Gradient – Directional derivative – Divergence and Curl –Irrotational and Solenoidal vector fields – Del applied twice to Point functions (Problems only)–Applications of Vector Differentiation in Electrical and Electronics Engineering.

UNIT III VECTOR INTEGRATION 9+ 4

Line integral–Green's theorem in the plane (excluding proof) – Stoke's theorem (excluding proof) – Gauss divergence theorem (excluding proof) – Simple applications involving cubes and rectangular parallelepipeds– Applications of Vector Integration in Electrical and Electronics Engineering.

UNIT IV COMPLEX DIFFERENTIATION 8 + 3

Limit and derivative of a complex function–Analytic functions –Cauchy-Riemann equations – Harmonic functions –Orthogonal properties of analytic functions (excluding proof) – Construction of analytic functions by Milne - Thomson's Method –Conformal transformation :w= z + c,cz,1/z and Bilinear transformation– Applications of complex differentiation in Electrical and Electronics Engineering.

UNIT V COMPLEX INTEGRATION 8 +3

Complex integration–Statements of Cauchy's theorem and Cauchy's integral formula– Laurent's series–Singular points–Residues– Calculation of Residues– Cauchy's Residue theorem (excluding proof) – Applications of complex integration in Electrical and Electronics Engineering

Total: 60 Hours

TEXT BOOKS:

T1 Grewal. B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2017.

T2 Bali. N. P and Manish Goyal., "A Text book of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt., Ltd., 2010.

REFERENCE BOOKS:

R1 Glyn James, "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education - 2011.

R2 Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley and sons, 2011.

R3 Peter V. O 'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage earning India Pvt., Ltd, New Delhi, 2011.

R4 Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Apply the knowledge of Laplace transforms to solve the differential and integral equations.

CO2: Perform vector calculus operations such as gradient, divergence and curl in vector and scalar fields

CO3: Apply the techniques of line, surface and volume integrals to solve application problems.

CO4: Gain knowledge to construct the analytic function and to find the image of given region under conformal mapping.

CO5: Gain knowledge to solve the problems by using complex integration.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	2	0	0	0	0	0	2	2	3	3	2	2
CO2	3	3	1	3	2	0	0	0	0	0	2	2	3	3	2	2
CO3	1	2	1	2	1	0	0	0	0	0	2	1	3	3	2	2
CO4	3	3	3	2	1	0	0	0	0	0	3	1	2	2	1	1
CO5	3	3	1	2	1	0	0	0	0	0	3	1	2	2	1	1

U19PHTL206T	PHYSICS FOR ELECTRONICS ENGINEERING (Common for EEE and ECE)	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To develop strong fundamental knowledge on electrostatics and magneto statics.
- To understand the interaction of electromagnetic waves with matter.
- To understand the difference between classical and quantum free electron theory, and able to know the concept of holes.
- To enrich the understanding of charge carriers in semiconducting materials and devices.
- To ensure the electrical behavior of dielectric materials.
- To ensure the physical properties of materials of superconductor.

PRE-REQUISITES: As a prerequisite for this course on Engineering Physics, knowledge in physics like Mechanics, Optics, Waves and basic mathematics is essentially required.

UNIT I ELECTROSTATICS AND MAGNETOSTATICS 6

Coulomb's law – Electric Field- Electric Potential Difference- Electric Flux—Gauss's Intensity of field due to point charge- Electric field due to uniform charge sphere - Faradays Law-Ampere's Law- Lenz's law- Maxwell's equation in differential form- Wave equation in free space –conducting media. Laws of incidence and reflectance, Snell's law, Brewster law – Fresnel's equations.

UNIT II ELECTROMAGNETIC WAVES & INTERACTION WITH MATTER 6

Electromagnetic waves in a vacuum – Energy and momentum of EMW – EMW in the matter – Propagation in linear media – Reflection and transmission at Normal incidence – Reflection and Transmission at Oblique incidence – Implications: Laws of incidence and reflectance, Snell's law, Brewster law – Fresnel's equations – wave guides- rectangular waveguide.

UNIT III FREE ELECTRON AND BAND THEORIES OF SOLIDS 6

Electronic Materials: Classical free electron theory of metals (Drude Lorentz Theory)-Electrical and Thermal conductivity – Wiedemann Franz Law-Fermi energy and Fermi - Dirac distribution function –Density of states-Thermionic Emission.

Band Theory of Solids-Electronic periodic potential- Bloch Theorem- Kronig Penny Model (concept) -Origin of Energy Bands - Concept of Holes - Classification of solids into a conductor, semiconductor- Insulator

UNIT IV SEMICONDUCTOR FUNDAMENTALS 6

Intrinsic Semiconductors – Energy band diagram – direct and indirect semiconductors – Carrier Concentration in intrinsic semiconductors – extrinsic semiconductors – Carrier concentration in N type & P-type semiconductors – Carrier transport: Velocity-electric field relations – drift and diffusion transport– Hall effect and devices.

UNIT V DIELECTRIC MATERIALS AND SUPERCONDUCTING MATERIALS 6

Electric susceptibility-Dielectric Constant – Electronic, Ionic, Orientational and space charge polarization – Frequency and temperature dependence of polarization- Internal field and deduction of Clausius-Mosotti equation –Use of dielectric materials (Capacitor and transformer)-Superconductivity phenomena - Thermodynamics of superconductivity transition - Type I and Type II superconductors - BCS theory - Josephson's tunnelling - DC and AC Josephson's Effect – High-temperature superconductors – SQUIDS

Total:30 Hours

COURSE OUTCOME

At the end of the course students should be able to

CO1 Understand the phenomenon of electrostatics and magneto statics
CO2 Describe the propagation and interaction of electromagnetic waves in different mediums
CO3 Understand the phenomenon of free electron and band theories
CO4 Understand the fundamental concept of semiconducting physics and their applications.
CO5 Understand the concepts of dielectric materials
CO6 Understand the concepts of superconducting materials

TEXT BOOKS

T1 S. J. Gupta, Sanjeev Gupta, ***Modern Engineering Physics***, Dhanpatrai Publication, New Delhi, 2015.
T2 V. Rajendran, ***Engineering Physics***, Mc Graw Hill Education, tenthprint,2017
T3 Brijlal and Subramaniam, ***Electricity and Magnetism*** –, S. Chand and Co., 20th revised edition, 2007

REFERENCE BOOKS

R1 Becherrawy, Tamer, ***Electromagnetism***, John Wiley, (2012)
R2 David Halliday, Robert Resnick and Jearl Walker, ***Fundamentals of Physics***, John Wiley & Sons, New Delhi, 9th Edition, 2010
R3 Myron F. Uman, ***Introduction to the Physics of Electronics***, Prentice Hall (June 1974)
R4 B.K. Pandey, S. Chaturvedi, ***Engineering Physics***, Cengage Publication, New Delhi, 2018.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping		
CO s	PROGRAMME OUTCOMES (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-

U19PHTL206L	PHYSICS FOR ELECTRONICS ENGINEERING LABORATORY (Common for EEE and ECE)	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.
- To make the students to apply the physics concepts to engineering applications

LAB COMPONENT CONTENTS (any 10 experiments)

1	Determination of rigidity modulus of the material of a wire-Torsional Pendulum
2	Determination of Viscosity of a liquid – Poiseuille's method.
3	Uniform Bending - Determination of Young's Modulus.
4	Determination of thickness of a thin wire –Air Wedge
5	Determination of wavelength of mercury spectrum – spectrometer grating
6	Basic operation of Logic Gates
7	Laser (i) Determination of Wavelength and (ii) Determination of Particles size analysis
8	V-I characterization of PNP and NPN transistors
9	V-I characterization of Solar Cells
10	Energy band gap using a -n junction
11	Determination of thermal conductivity of a bad conductor by Lee's disc method
12	Determination of Velocity of Ultrasonic waves in a given liquid using Ultrasonic Interferometer.

Total: 30 Hours

COURSE OUTCOME

At the end of the course students should be able to

CO1	Understand the functioning of various physics laboratory equipment.
CO2	Use graphical models to analyse laboratory data
CO3	Use mathematical models as a medium for quantitative reasoning and describing physical Reality
CO4	Access, process and analyse scientific information.
CO5	Solve problems individually and collaboratively.
CO6	Understand how to apply the physics concepts for the engineering applications

TEXT BOOKS

T1 H. Sathayaseelam, ***Laboratory Manual in Applied Physics***, Second edition, -New age International Publication, 2015.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping		
CO s	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-

CO6	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-

U19EETL202T **NETWORK ANALYSIS** **L T P C**
2 0 0 2

COURSE OBJECTIVES

- To impart knowledge on solving circuit equations using network theorems
- To educate on obtaining the transient response of circuits.
- To introduce Phasor diagrams and analysis of three phase circuits
- To introduce the phenomenon of resonance in coupled circuits.
- To understand the interconnection of a two-port network.

PRE-REQUISITES: Elements of Electrical Engineering

THEORY COMPONENT CONTENTS

UNIT I **ELECTRIC CIRCUIT VARIABLES & ELEMENTS** **6**

Introduction to Electric Circuit variables- Circuit elements–Resistive circuits: Kirchhoff's law, series resistors and voltage division, parallel resistors and current division, series voltage source and parallel current sources.

UNIT II **METHOD OF ANALYSIS OF RESISTIVE CIRCUITS & CIRCUIT THEOREMS** **6**

Node voltage analysis, Mesh current analysis - Source Transformation - Thevenin's theorem -Norton's theorem –Super Position Theorem - Maximum power transfer theorem.

UNIT III **TRANSIENT RESPONSE OF CIRCUITS&THREE PHASE CIRCUITS** **6**

Response of RL, RC and RLC circuits - Three phase circuit – Delta to Delta circuit - Star to Delta circuit, Balanced three phase circuits: Instantaneous and average power in a balanced three phase load - Two wattmeter power measurement.

UNIT IV **RESONANCE&TUNED CIRCUITS** **6**

Resonance – Series Resonance – Parallel Resonance – Bandwidth – Quality Factor– Selectivity-Single Tuned Circuits – Double tuned circuits.

UNIT V **TWO PORT NETWORKS** **6**

T to π transformation and two port three terminal networks-Equation of two port networks – Z and Y parameters for circuit with dependent sources, Hybrid and transmission parameters, Relationship between two-port network.

Total: 30 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Ability to analyse the Series and Parallel network circuits.
CO2: Ability to analyse the AC network using network theorems.
CO3: Analyse the transient response of a circuit and three phase circuits
CO4: Understand the concept of resonance in networks.
CO5: Understand and apply interconnections of a two-port network
CO6: Synthesize one port network using Foster and Cauer Forms.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	2	2	-	-	-	2	-	1	2	3	2	1	2
CO2	3	3	1	2	2	-	-	-	2	-	1	2	3	2	1	2
CO3	1	2	1	2	2	-	-	-	2	-	1	2	3	2	1	2
CO4	3	3	3	2	2	-	-	-	3	-	3	3	1	2	1	2
CO5	3	3	1	1	2	-	-	-	2	-	1	2	3	3	3	1
CO6	3	3	1	2	1	-	-	-	2	-	1	2	3	2	1	2

TEXT BOOKS

T1. James A.Svoboda and Richard C.Dorf-Dorf's Introduction to Electric Circuits,WileyIndia Edition,2018.

T2. A Sudhakar, and Shyammohan S Pali, —Circuits and Networks: Analysis andSynthesis Tata McGraw Hill Publishing Company, 2010

T3. Charles K Alexander, and Mathew N O Sadiku, Fundamentals of Electric Circuits,Tata McGraw Hill Publishing Company, 2013.

REFERENCE BOOKS

R1. William H Hayt Jr., Jack E Kemmerly, and Steven M Durbin, —Engineering Circuit AnalysisII, Tata McGraw Hill Publishing Company, 2012.

R2. Mahmood Nahvi, and Joseph AEdminister, Electric Circuits, Tata McGraw HillPublishing Company, 2014.

R3 SmarajitGhosh,IINetwork Theory- Analysis and SynthesisII Prentice Hall of India, NewDelhi, 2008

R4 Navhi M, and Edminister J A, —Theory and Problems of Electric CircuitsII, TataMcGraw-Hill, New Delhi, 2011

R5 Gopal G B, Prem R C and Duresh C K, —Engineering Network Analysis and FilterDesign, Umesh Publications, New Delhi, 2003

WEB RESOURCES

W1. https://nptel.ac.in/courses/108102097/3

W2. http://www.nptelvideos.in/2012/11/circuit-theory.html

LAB COMPONENT CONTENTS

1 Experimental verification of Series and Parallel Circuits
2 Analysing resistive circuits using MATLAB
3 Experimental Verification of Superposition theorem, Thevenin‘s theorem andMaximum power transfer theorem
4 Determination of Thevenin equivalent circuit using MATLAB/ PSPICE
5 Analysis of first order RL and RC circuits using PSPICE
6 Transient analysis of RLC series and Parallel Circuit using MATLAB/ PSPICE
7 3-Phase Power measurement by two wattmeter method
8 Series and Parallel resonance circuits
9 Study and Measurement of self and mutual inductance of a coil
10. To determine equivalent parameters of parallel connection of two-port network.
11. To determine the equivalent parameters of series connection of two port network.
12. To calculate and verify 'H' parameters of two-port network.

Total:30 Hours

U19CSTL203T	C PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The course aims to provide the students

- Write modular programs consisting of structure, functions and pointer concepts.
- Use structure variables for data storage and manipulation.
- Develop an application using strings.
- Gain knowledge about memory management in C.
- To learn the files and perform file manipulations

PREREQUISITES

- **U19CSTL101 -** Computational Thinking and Problem Solving

UNIT I INTRODUCTION: C PROGRAMMING 9

Structure of C program, Comments, Data types, Variables, Tokens: Keyword, Identifier, Constants, Operators, Expression and evaluation, Input and Output statements, Decision making-statements, Iterative statements, Storage Classes: auto, register, static and extern, Preprocessor Directives.

UNIT II ARRAYS AND STRING 9

Introduction to arrays: Declaration, Initialization. One dimensional array Multi-dimensional arrays, Searching: Linear and Binary Search, Sorting: Bubble sort, Selection Sort. Introduction to string, Built in string functions, String manipulation with and without built in functions, Array of strings, Pattern matching application using strings.

UNIT III FUNCTIONS AND POINTERS 9

Introduction to functions, Function prototype, Function definition, Function call, User defined functions and Standard functions (math function), Parameter passing: Call by value, Call by reference, Recursive functions, Passing arrays to functions, Command line arguments. Pointer in C, Importance of pointer, Types of pointer, Pointer expression and arithmetic, Pointer and array, String as pointer, Pointer to function, Dynamic Memory Allocation

UNIT IV USER DEFINED DATATYPES 9

Structure: Declaration, Accessing structure elements, Array of structure, Nested structure, Pointers to structure, Structure to function, type def vs #define. Union: Declaration, Accessing union elements, Difference between structure and union, Enum and its uses

UNIT V FILE HANDLING 9

Introduction to file, File Operations: Create, Open: File modes, Read, Write, Move, Close, File Processing: Sequential access and Random access.

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Explain the syntax for C programming

CO2: Associate the programs in 'C' for real world situation

CO3: Apply the concepts of Arrays, Strings in 'C' language for user defined problems.

CO4: Apply the concept of functions and pointers.

CO5: Associate the programs with structure using 'C' language.

CO6: Discuss to read and write data from/to files in 'C' Programs.

TEXT BOOKS:

T1: Programming in C, Ashok N. Kamthane, 2nd Edition ,Pearson Education India, 2011

T2: Behrouz A. Forouzan and Richard F. Filberg, "Computer Science A Structures Programming Approach using C", Third Edition, Cengage Learning, 2006.

REFERENCE BOOKS:

R1: A first book of ANSI C by Gray J.Brosin 3rd edition Cengage delmer Learning India P.Ltd

R2: Pradip Dey, Manas Ghosh, "Programming in C", second edition, Oxford University Press, 2011.

R3: Seyed H Roosta,"Foundations of programming languages design & implementation", Cengage Learning. 2009.

	CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PS04
CO1	2	1	1	1		-	-	-	-	-	-	-	1	-	-	-
CO2	2	1	1	1	2	-	-	-	-	-	-	-	2	3	1	-
CO3	3	2	2	1	3	-	-	-	-	-	-	-	1	2	-	-
CO4	3	2	2	1	3	-	-	-	-	-	-	-	2	2	-	-
CO5	2	1	1	1	2	-	-	-	-	-	-	-	2	3	-	-
CO6	2	1	1	1	2	-	-	-	-	-	-	-	1	2	-	-

LAB COMPONENT CONTENTS

1. Solve some mathematical and scientific problems using functions.
2. Solve problems using arrays.
3. Create a programs using recursive functions.
4. Demonstrate various Predefined String functions.
5. Manipulate string using user defined functions.)
6. Solve problems using pointers.
7. Develop a C program using Enum data type.
8. Design a C program using typedef.
9. Create programs using structures and unions.
10. Develop a C program using Dynamic Memory Allocation.
11. File handling in sequential access.
13. File handling in random access.

Total: 30 Hours

U19CCEX202	ENGINEERING EXPLORATION - II	L	T	P	C
		0	0	3	2

COURSE OBJECTIVES

- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab
- To inculcate ethics and sustainability perspectives and enable students to work in a team

PRE-REQUISITES

NIL

CONTENTS

S No	Topics	No of Hours
1	Introduction to Engineering	3
2	Platform-based development	12
3	Mechanisms	9
4	Requirements	3
5	Design	
6	Ethics	6
7	Sustainability	
8	Project Management Principles	3
9	Guided Project	
10	Final Project	9

COURSE OUTCOMES

1. Understand the role of an engineer as a problem solver
2. Apply multi-disciplinary principles and build systems using engineering design process
3. Use appropriate tools for designing and development of solutions.
4. Analyze engineering solutions from ethical and sustainability perspectives
5. Use basics of engineering project management skills while doing projects
6. Communicate, Collaborate and work as a team

GUIDELINES

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 3-4 students.
3. Groups can select to work on specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model at the end of semester.
6. The progress of the course is evaluated based on class performance and final demonstration of prototype.

Total:45 Hours

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	1	1	-	-	-	-	-	-	-	-	2	1	-	-	3
CO2	3	3	3	2	-	-	-	-	-	-	-	-	3	3	-	3
CO3	-	-	3	3	3	-	-	-	-	-	-	2	3	3	-	3
CO4	-	-	-	-	-	3	3	3	-	-	-	-	-	3	3	2
CO5	-	-	-	-	-	-	-	-	3	3	3	2	-	3	2	2
CO6	-	-	-	-	-	-	-	-	3	3	3	2	-	2	2	2

U19METL220T	FUNDAMENTALS OF MECHANICAL FOR ELECTRICAL APPLICATIONS	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To introduce and explain fundamentals of fluid mechanics, importance of fluid flow measurement and its applications in Industries,
- To give an overview of different types of turbo machinery used for energytransformation, such as pumps, as well as hydraulic, steam and gas-turbines,
- To introduce principles of classical thermodynamics and basic laws and also
- To learn working principles of energy storage systems and air conditioning systems.

PRE-REQUISITES

- NIL.

THEORY COMPONENT CONTENTS

UNIT I FLUID MECHANICS 3

Properties of fluids. Concept of gauge and absolute pressures, measurement of pressure using manometers, flow measurement using Orifice, venturi, and nozzle meters. Pilot tubes, multi- hole probe and anemometer, Turbine meter.

UNIT II PUMPS AND TURBINES 3

Basic concept of centrifugal and reciprocating pump, priming, cavitation, head, operating characteristics. Hydraulic Turbine – Types, working principles and operating characteristics. Steam turbine - working principle.

UNIT III BASIC CONCEPTS OF THERMODYNAMICS 3

System, property, state and equilibrium, process and cycle, work, heat and other forms of energy. Zeroth law and application, first law statement, applications to closed and open systems.

UNIT IV ENERGY STORAGE SYSTEM & ITS APPLICATION 3

Batteries-Hydrogen energy storage-Fuel cell-Super capacitor-Environmental impact of energy storage - e-Vehicle.

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 3

Terminology of Refrigeration and Air Conditioning. Principle of vapor compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air conditioner.

Total: 15 Hours

TEXT BOOKS:

T1 R K Bansal , A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications(P) Limited, New Delhi, Nineth Edition,2005.

T2 P K Nag ,'Engineering Thermodynamics", Tata McGraw Hill,Fourth Edition,2008.

T3 Alfred Rufer,"Energy Storage Systems and Components, CRC Press,US,2018.

T4 Mahesh M Rathore,"Thermal Engineering", Tata McGraw Hill, 2010.

REFERENCE BOOKS

R1. Kumar D S, "Fluid Mechanics and Fluid Power Engineering", Katarina S K and Sons,New Delhi, 2010
R2. Cengel Y Al and Boles M A "Thermodynamics, An Engineering Approach" TataMcGraw Hill, 2003.
R3. Paul Breeze,"Power System Energy Storage Technologies",Academic Press,UK,2018. R4. Venugopal K and Prabu Raja,"Basic Mechanical Engineering" Anuradha Publications, Chennai, 2007.
R5. Hydraulics and Fluid Mechanics Including Hydraulic Machin.es (In SI Units), StandardBook House 2004

WEB RESOURCES

W1. http://www.myengineeringmechanics.com/
W2. https://nptel.ac.in/
W3 http://web.mit.edu/hml/ncfmf.html

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Identify how properties of fluids change with temperature and their effect onpressure and fluid flow; describe fluid pressure and its measurement.
CO2: Explain the working principles of pumps and turbines and apply it to various types of machines
CO3: Explain the basic concepts of thermodynamics like system, properties, equilibrium, pressure, specific volume, temperature, zeroth law of thermodynamics, temperaturemeasurement and temperature scales
CO4: Demonstrate knowledge of the energy storage systems
CO5: Demonstrate an understanding of the engineering and operation of vapor compression and possibly heat-driven refrigeration systems and evaporative cooling systems and understand contemporary issues with respect to refrigeration systems
CO6: Elaborate the components of refrigeration and Air conditioning cycle

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	1	-	-	1	-	2	-	2	2	3	3	2	2
CO2	1	3	-	1	-	-	1	-	2	-	2	2	3	3	2	2
CO3	3	2	-	1	-	-	3	-	2	-	2	2	3	3	2	2
CO4	3	3	-	3	-	-	1	-	1	-	2	2	3	3	1	3
CO5	3	3	-	1	-	-	1	-	2	-	1	3	1	2	2	2
CO6	3	3	-	1	-	-	1	-	2	-	2	2	3	3	2	2

LAB COMPONENT CONTENTS

1. To verify the testing of Water Gauge
2. To verify the testing of Pressure Gauge
3. To verify the testing and usage of Pitot's tube
4. To determine the pressure head using Manometers
5. To verify the Measurement of flow using Orifice Meters.
6. To verify the Measurement of flow discharge using centrifugal pumps
7. To estimate the performance of Steam turbines
8. To find experimentally the reactions of Batteries
9. To find experimentally the reactions of super capacitors
10. To determine the efficiency of e-vehicle
11. To estimate the performance of air conditioners
12. To Study of domestic refrigerator

Total: 30 Hours

U19MATH324	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS FOR ELECTRICAL ENGINEERS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

- Engineering Mathematics is an essential tool for describing and analyzing engineering process and systems.
- It enables precise representation and communication of knowledge.
- The objective of the course is to expose students to understand the basics and importance of Fourier series, Fourier transforms, Partial Differential Equations, Applications of PDE, Z- Transforms which are being widely used in Electrical and Electronics Engineering studies.

PREREQUISITES

- Differentiation
- Integration
- Trigonometric Identities

THEORY COMPONENT CONTENTS

UNIT I FOURIER SERIES 9 + 3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Parseval's identity – Harmonic Analysis – Applications of Fourier series in Electrical and Electronics Engineering.

UNIT II FOURIER TRANSFORM 9 + 3

Fourier integral theorem (statement only) – Fourier transform pair – Sine and Cosine transforms – Properties (statement only) – Transform of elementary functions – Convolution theorem (statement only) – Parseval's identity – Applications of Fourier transform in Electrical and Electronics Engineering.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Solutions of first order partial differential equations – Clairaut's form – Lagrange's linear equation – Solution of homogenous linear partial differential equations of second order with constant coefficients – Applications of partial differential equations in Electrical and Electronics Engineering.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Introduction – Method of separation of variables – Vibration of a stretched string – Wave equation (concept only) – Solution of one dimensional wave equation by Fourier series – One dimensional heat flow (concept only) – Solution of one dimensional heat equation (excluding insulated ends) by Fourier series – Applications Boundary value problem in Electrical and Electronics Engineering.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 9 + 3

Z- Transform – Elementary properties (problems only) – Inverse Z – transform Problems using partial fractions and residue methods – Solution of difference equation using Z – transform – Applications of Z - transform in Electrical and Electronics Engineering.

Total:60 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 Apply the concepts of the Fourier series for the periodic function.

CO2 Analyse the given system using the Fourier transform techniques.

CO3 Solve the first and second order partial differential equation.

CO4 Solve the one dimensional wave and heat equation using the Fourier series techniques.

CO5 Apply the Z-transform techniques for discrete time systems.

TEXT BOOKS

T1. Grewal B.S., "Higher Engineering Mathematics ", Khanna Publishers, New Delhi,44rd Edition, 2017.

REFERENCE BOOKS

R1. Bali, N.P. and Manish Goyal, "A Text Book of Engineering Mathematics", Lakshmi Publications Pvt. Ltd., New Delhi, 9 th Edition, 2016.

R2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons,10th Edition, New Delhi, 2016.

R3. Glyn James, "Advanced Modern Engineering Mathematics", Prentice Hall of India, 5th Edition, 2018.

R4. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2017.

R5. Veerarajan T., "Engineering Mathematics" , Tata McGraw Hill, New Delhi (2001).

	CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak												**CO / PSO Mapping**			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**	**PSO 4**
CO1	3	3	2	-	2	-	-	-	-	-	-	2	2	2	2	2
CO2	3	3	2	-	2	-	-	-	-	-	-	2	2	3	2	2
CO3	2	2	1	-	1	-	-	-	-	-	-	1	1	2	1	1
CO4	3	2	1	-	1	-	-	-	-	-	-	1	1	2	1	1
CO5	3	3	2	-	2	-	-	-	-	-	-	2	2	3	2	2
CO6	3	3	2	-	2	-	-	-	-	-	-	2	2	3	2	2

U19EETL303T	GENERATION, TRANSMISSION & DISTRIBUTION	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To understand the Power Plant Engineering practices on Conventional Power Generation
- To understand the Power Plant Engineering practices on Non- ConventionalPower Generation
- To understand the power system configuration, the transmission concepts , varioustypes of substations and grounding methods
- To obtain equality circuit of Transmission line and modeling their parameters and mechanical design of Transmission line.
- To analyze voltage Distribution in insulators and cables
- To understand basic structure of electrical power system including substation, EHVAC / HVDC Transmission line.

PRE-REQUISITES:

Basics of Electrical Engineering

THEORY COMPONENT CONTENTS

UNIT I CONVENTIONAL POWER GENERATION 8

Layout and operating functions of Hydro Power Plant ,Thermal Power Plant, Nuclear Power Plant, Diesel, Gas and combined cycle Power plants

UNIT II NON – CONVENTIONAL POWER GENERATION 7

Operation of Solar energy – Wind energy – OTEC – Tidal energy – Geothermal resources –Fuel cell, MHD Power generation.

UNIT III POWER SYSTEM CONFIGURATION AND PARAMETERS 10

Structure of Power system - Parameters of RLC – Single and Three Phase Transmission line – Single and Double circuits – Types of conductors – Symmetrical and unsymmetrical spacing – Transposition of lines – concepts of GMR and GMD – skin and proximity effects– Methods of grounding

UNIT IV MODELLING AND PERFORMANCE OF TRANSMISSION LINES 10

Performance of Transmission lines - short line, medium line and long line - equivalent circuits, phasor diagram, – voltage regulation and transmission efficiency – real and reactive power flow in lines – Power Circle diagrams - Formation of Corona – Critical Voltages

UNIT V MECHANICAL DESIGN OF LINES AND DISTRIBUTIONSYSTEM 10

Mechanical design of lines: Classification of insulators - voltage distribution in insulator string and grading – improvement of string efficiency – Types and Grading of cables –– Types of towers – Stress and Sag calculation -

Distribution system: Types of AC / DC distribution system –AC distribution – Single phase and three phase 4 wire system DC distribution 2 wire and 3 wire, radial and ring main system – Techniques of voltage control and Improvement of power factor**. -** Types of substation

Trends in Transmission and Distribution: EHVAC - HVDC and FACTS (Qualitativetreatment only).

Total: 30 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Ability to illustrate the working of various Conventional Energy source power plants

CO2 : Ability to illustrate the working principle of various Non – conventional energy sources

CO3 : Evaluate the structure of power system with components of substation , Transmission line and grounding methods.

CO4 : Analyse the performance of Transmission line by modelling the parameter of line.

CO5 : Understand the working of insulators in over head line, distribution of AC /DC in underground cables and feeder distributors

CO6: To become familiar with the function of different components used in power system

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	3	2	3	1	2	1	-	-	-	1	2	3	3	2	2
CO2	3	2	2	3	1	2	1	-	-	-	1	2	3	3	2	2
CO3	3	3	2	3	1	2	1	-	-	-	1	2	3	3	2	2
CO4	3	3	1	2	1	2	1	-	-	-	1	2	3	3	2	2
CO5	3	3	2	2	3	1	1	-	-	-	3	1	3	3	2	1
CO6	3	3	2	2	3	2	2	-	-	-	3	1	1	1	3	1

TEXT BOOKS

T1. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008

T2. D.P.Kothari, I.J. Nagarath, 'Power System Engineering', McGraw-Hill PublishingCompany limited, New Delhi, Second Edition, 2008

T3. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', PrenticeHallof India Pvt. Ltd, New Delhi, Second Edition, 2011.

T4 V.K.Mehta, Rohit Mehta, 'Principles of power system', S. Chand & Company Ltd,New Delhi, 2013

REFERENCE BOOKS

R1. C.L.Wadhwa, 'Electrical Power Systems', New Academic Science Ltd, 2009.

R2. B.R.Gupta, 'Power System Analysis and Design' S. Chand, New Delhi, Fifth Edition,2008.

R3 Luces M.Fualken berry, Walter Coffer, 'Electrical Power Distribution andTransmission', Pearson Education, 2007.

R4 J.Brian, Hardy and Colin R.Bayliss 'Transmission and Distribution in Electrical Engineering', Newnes; Fourth Edition, 2012.

R5 El-Wakil. M.M., "Power Plant Technology", Tata McGraw – Hill PublishingCompany Ltd., 2010

WEB RESOURCES

W1. https://nptel.com
W2. https://www.electrical4u.com/Transmission&Distribution/

LAB EXPERIMENTS

1 To simulate a small Hydro Plant using MATLAB

2 To plot Voltage/Current characteristics of a solar cell and determination of itsparameters using MATLAB

3 To analysis the effect of grounding on harmonics Analysis of solar power generationNetworks

4 Survey of rural electrification and draw Single Line Diagram.
- Visit to a village.
- Supply is taken from pole mounted transformer and distributed in variouspart of village.
- Load calculation, loading capacity of different equipments.
- Verification of 3-phase balanced loading.
- Finding transformer rating based on loading.

5 Determination of Voltage Regulation of a long transmission line model withresistive inductive and capacitive loads

6 Modelling of a long transmission line when open circuited and on load conditionusing MATLAB

7 To study different types of Line insulators and determine their breakdowncharacteristics.

8 Determination and Analysis of voltage sag and stress in transmission lines.

9 To design a schematic for testing of insulator against rain.

10 Design of distribution network and measurement of voltage and current distributionin distributors

Total: 45 Hours

U19EETL304T ELECTRICAL MACHINES AND DESIGN - I

L	T	P	C
2	0	0	2

COURSE OBJECTIVES

- To familiarize the constructional details, the principle of operation and characteristicsof DC machines.
- To analyze the design of dc machines.
- To understand the construction, principle of operation and testing of transformers.
- To analyze the design of transformers.
- To select dc machines and transformers for various applications

PRE-REQUISITES:

THEORY COMPONENT CONTENTS

UNIT I DC GENERATORS 6

Construction and components of DC Machine – Principle of operation - EMF equations –methods of excitation-armature reaction - commutation and inter poles – compensating winding – characteristics of DC generators-parallel operation of generators - Applications

UNIT II DC MOTORS 6

Principle of operation- Back EMF-Torque equation-Types and characteristics-Need for starters and types-Speed control of DC shunt and series motors- Braking of DC Motors- Introduction to PMBLDC motors - Applications. Losses and efficiency–Testing of DC machines: Brake test - Swinburne's test – Hopkinson's test.

UNIT III DESIGN OF DC MACHINES 6

Major Considerations in Electrical Machine Design-Output Equation of DC Machines, Main Dimensions, Selection of number of poles - Design of Armature, Commutator and Brushes, Design of field, Computer program: Design of armature main dimensions.

UNIT IV TRANSFORMERS 6

Single phase Transformer : Construction and Principle of Operation – EMF Equation - Transformer on No Load and Load – Phasor diagram - Equivalent Circuit – Voltage Regulation - Losses – Efficiency - All Day Efficiency - Polarity test – Open circuit and Short circuit tests - Parallel Operation - Three Phase Transformer connections –Auto transformers-
Construction and applications.

UNIT V DESIGN OF TRANSFORMERS 6

KVA rating of Single Phase and Three Phase Transformers, Design of Core, Yoke and Windings for Core and Shell Type Transformers, Overall Dimensions, Design of Welding Transformer, Current and Potential Transformers, Design of Cooling Tanks and tubes,Computer program: Design of single phase core transformer.

Total: 30 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Ability to understand the working principle of DC generator with their characteristics

CO2 : Understand the components, operation, methods of starting and speed control of DC motor

CO3 : Ability to design armature and field of DC machines.

CO4 : Ability to visualize the construction and performance of transformers with suitable testing methods.

CO5 : Ability to analyse about the design of Transformers

CO6: Ability to understand the uses of dc machines and transformers with real world

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	3	3	-	-	1	2	3	3	2	2
CO2	2	3	2	3	3	2	1	-	-	-	1	2	3	3	2	2
CO3	3	3	1	1	3	1	1	-	-	-	1	2	3	3	2	2
CO4	3	2	2	1	2	2	2	-	-	-	3	1	2	1	2	2
CO5	3	3	2	1	2	1	1	-	-	-	1	1	2	1	3	2
CO6	3	3	3	1	2	2	1	-	-	-	1	1	2	3	3	3

TEXT BOOKS

T1. Nagrath I. J and Kothari D. P. 'Electric Machines', Tata McGraw Hill PublishingCompany Ltd, 1990.

T2. B.L.Theraja, A.K.Theraja, ' Electrical Technology', Vol II – AC and DC Machines,S.Chand publications, 2015

T3. Sawhney.A.K.,' A course in Electrical Machine Design', Dhanpat Rai & Sons, NewDelhi, Fifth edition , 1984.

REFERENCE BOOKS

R1. P. C. Sen., 'Principles of Electrical Machines and Power Electronics', John Wiley&Sons, 1997.

R2. J.B. Gupta, 'Theory and Performance of Electrical Machines', S.K.Kataria andSons, 2002.

R3 Sen.S.K.,'Principles of Electrical Machine Design with computer programmes',Oxford and IBH Publishing and Co Pvt Ltd, New Delhi, Second Edition,2009.

WEB RESOURCES

W1. https://circuitglobe.com
W2. https://www.electrical4u.com/electric-machines/

LAB EXPERIMENTS

1 Open Circuit and load characteristics of DC shunt generator.
2 Load test on DC compound generator
3 Load characteristics of DC shunt motor
4 Swinburn's test
5 Speed control of DC shunt motor
6 Load characteristics of DC series motor
7 Load test on DC compound motor
8 Hopkinson's test on DC motor generator set
9 Load test on single-phase transformer
10 OC and short circuit test on single-phase transformer
11 Separation of no load losses of transformer

Total: 15 Hours

U19EETL305T SEMICONDUCTOR DEVICES AND IC's

L	T	P	C
2	0	0	2

COURSE OBJECTIVES

- Understand the properties and structure of basic semiconductor devices.
- To explore knowledge on Transistors and Thyristors.
- To apply the concept of transistor in amplifier and oscillator circuits.
- To explore knowledge on operation amplifier.
- To apply operational amplifier in waveform generators and special function IC's.

PRE-REQUISITES:

Electronic Devices and circuits

THEORY COMPONENT CONTENTS

UNIT I PN JUNCTION DEVICES 6

Semiconductor Materials and Properties, the p-n Junction, The ideal diode, Terminal characteristics of junction diodes, Modelling diode, forward-reverse VI characteristics, Rectifier circuits, Limiting and clamping circuits, Special diodes - Zener diode characteristics- Zener Reverse characteristics – Zener as regulator, LED, LASER Diode.

UNIT II TRANSISTORS AND THYRISTORS 6

Transistor: Definition, Formation of transistor PNP and NPN, BJT,JFET,MOSFET - Structure, symbol, working characteristics, CE, CB, CC Configurations of BJT. Thyristor: Definition, formation of thyristor, SCR, GTO, TRIAC-Structure, operation and characteristics, Application-Over voltage protection using SCR.

UNIT III AMPLIFIERS AND OSCILLATORS 6

BJT as an amplifier, Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis), Advantages of negative feedback – voltage / current, series, Shunt feedback –positive feedback, Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

UNIT IV OPERATIONAL AMPLIFIER 6

Ideal Operational Amplifier – General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations– Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor.

UNIT V WAVEFORM GENERATOR AND SPECIAL FUCNTION IC's 6

Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters. Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC. Timer IC 555.

Total: 30 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Understand the structure of basic semiconductor devices.

CO2: Explore the working of transistor and thyristors.

CO3: To apply the concept of transistor in amplifier and oscillator.

CO4: Explore the operation of operation amplifier.

CO5: To apply the concept of op-amp in waveform generators and special function IC's.

CO6: Learn the required functionality of positive and negative feedback systems

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	3	-	-	-	2	-	1	2	3	2	2	1
CO2	3	3	1	3	3	-	-	-	2	-	1	2	3	2	2	1
CO3	2	1	2	2	1	-	-	-	2	-	3	1	2	1	2	1
CO4	3	3	1	3	3	-	-	-	2	-	1	2	3	2	3	1
CO5	3	3	1	3	3	-	-	-	1	-	1	2	3	2	2	1
CO6	3	3	1	3	3	-	-	-	2	-	1	2	3	2	2	2

TEXT BOOKS

T1. Jacob Millman & Christos C. Halkias, 'Integrated Electronics', Tata -McGraw Hill, Second Edition

T2 D.Roy Choudhry, Shail Jain, —Linear Integrated Circuitsll, New Age International Pvt. Ltd., Fifth Edition.

REFERENCE BOOKS

R1. Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits" PHI learning private limited, 2 edition.

R2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory",PHI. 9TH Edition.

R3 David A. Bell, "Electronic Devices and Circuits", PHI, 4th Edition.

R4 Ramakant A. Gayakwad, —OP-AMP and Linear ICsll, 4th Edition, Prentice Hall / Pearson Education.

WEB RESOURCES

W1. Fundamentals of semiconductor devices – NPTEL https://nptel.ac.in/courses/108/108/108108122/

W2. Integrated circuits, MOSFET's, Op-Amp and its Applications – NPTEL https://nptel.ac.in/courses/108/108/108108111/

W3 Learn to build electronic circuits – https://www.build-electronic-circuits.com/

LAB EXPERIMENTS

1 Characteristics of PN Junction diode and Zener diode
2 Single Phase half-wave and full wave rectifiers with inductive and capacitive filters
3 Clipping and clamping diode circuits
4 Characteristics of a NPN Transistor under common emitter, common collector andcommon base configurations
5 BJT as Amplifier
6 Characteristics of MOSFET
7 Inverting, Non-inverting and differential amplifiers using op-amplifier
8 Integrator and differentiator using op-amp
9 RC phase shift and Wien bridge oscillator using op-amp
10 Astable & monostable multivibrator using IC 555 timer
11 Dc power supply using LM317 and LM723
12 Study of CRO for frequency and phase measurements

Total: 15 Hours

U19ECTL306T **DIGITAL ELECTRONICS**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES

- To Gain knowledge on the fundamentals of digital logic
- To Understand the various number systems and codes
- To Study the design and issues related combinational circuits, sequential circuitsand VHDL programming

PRE-REQUISITES:

THEORY COMPONENT CONTENTS

UNIT I DIGITAL FUNDEMENTALS 9

Number Systems-Decimal, Binary, Octal, Hexa decimal,1's and 2's complements.

Boolean theorems- De Morgans theorems-Implementing circuits from Boolean expressions-Logic gates-Universal gates, NAND and NOR implementation- Sum of Product- Product of Sum-Standard representation of logic functions – Min term to Max termconversion-Simplification of logic functions using K Map- Quine McCluskey Method.

UNIT II COMBINATIONAL LOGIC DESIGN AND ITS APPLICATIONS 9

Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor – Parallel binary adder, parallel binary Subtractor – Fast Adder - Carry Look Ahead adder – Serial Adder - BCD adder – Binary Multiplier - Multiplexer/Demultiplexer – decoder - encoder – parity checker – parity generators – code converters - Magnitude Comparator

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Latches, Flip flops –SR, JK, T, D, Master/Slave FF –operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits –Design of Counters-Ripple Counters, Ring Counters, Shift registers.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 9

Analysis and design of clocked Asynchronous sequential circuits, cycles and races, Hazards, Design of Hazard free circuits.

UNIT V MEMORY DEVICES AND ITS APPLICATIONS 9

Classification of memories – RAM-ROM - PROM – EPROM – EAPROM – Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable ArrayLogic (PAL) - Implementation of combinational logic circuits using ROM, PLA, PAL.

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Perform logic reduction using Boolean theorems
CO2: Design and implement combinational logic circuits.
CO3: Construct and analyze the operation of latches and flip-flops
CO4: Design and implement sequential circuits.
CO5: Design and simulate digital circuits using VHDL
CO6: Ability to introduce digital simulation for development of application-oriented logic circuits

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	O4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	3	-	-	-	2	-	1	1	2	1	2	3
CO2	2	2	2	2	3	-	-	-	2	-	2	1	2	1	2	3
CO3	1	3	2	2	3	-	-	-	2	-	3	1	2	1	2	3
CO4	2	2	3	1	2	-	-	-	2	-	2	1	2	1	2	3
CO5	2	2	2	2	3	-	-	-	1	-	3	2	1	2	3	1
CO6	2	2	2	2	3	-	-	-	2	-	2	1	2	1	2	3

TEXT BOOKS

T1. M. Morris Mano, Michael D. Ciletti, 'Digital Design', 5th Edition, PearsonEducation, New Delhi, 2012.

REFERENCE BOOKS

R1. Ronald J Tocci, Neal S Widmer, Gregory L Moss Digital Systems: Principles and Applications,10th edition, Person , 2009
R2. Thomas L.Floyd, Digital Fundamentals, Prentice Hall, 11th Edition, 2015.
R3 M.Morris Mano, Michael D Ciletti Digital Design 4th edition Pearson, 2011
R4 J.Bhaskar, A VHDL Primer, Prentice Hall, 1998
R5 A.Anand Kumar, Fundamentals of Digital Electronics, 2nd Edition PHI LearningPrivate Limited, 2013.
R6 D. Donald Givone, Digital principles and design, Tata McGraw Hill, 2008.

WEB RESOURCES

W1 https://www.electronics-tutorials.ws/
W2 https://www.udemy.com/course/digital-electronics-logic-design/

LAB EXPERIMENTS

1 Design and implementation of code converters using logic gates BCD to excess-3 code
2 Design and implementation of code converters using logic gates excess-3 code to BCD
3 Design and implementation of code converters using logic gates Binary to gray
4 Design and implementation of code converters using logic gates gray to Binary
5 Design and implementation of 4 bit binary Adder/ Subtractor and BCD adderusing IC 483
6 Design and implementation of Multiplexer and De-multiplexer using logic gates
7 Design and implementation of encoder and decoder using logic gates
8 Construction and verification of 4 bit ripple counter and Mod-10 Ripple counters
9 Construction and verification of 4 bit ripple counter and Mod-12 Ripple counters
10 Design and implementation of 3-bit synchronous up/down counter

Total: 15 Hours

		L	T	P	C
U19ITTL302T	PYTHON PROGRAMMING	2	0	0	2

COURSE OBJECTIVES

- To learn about basic Python language syntax and semantics.
- To develop Python programs using control statements and immutable Data types.
- To develop Python programs using mutable Data types.
- To create user defined functions in Python.
- To develop Python Programs using Collections Packages.

PRE-REQUISITES:

THEORY COMPONENT CONTENTS

UNIT I BASICS OF PYTHON PROGRAMMING 9

Introduction to Python - Introduction to Python Language – History of Python – Features – Version-Python as Interpreter-Executing a Python Program - Basic structure of a Python Program**-** python as calculator, values and types (int, float, boolean, string, complex and list), keywords, Variables, Identifiers, expressions, commenting in python(single-line, multi-line, and documentation),Multiline Statements-Reading input from console-Operators(arithmetic, relational, assignment, logical, bitwise, membership and identity), Precedence of operator ,Type Conversion, Command line arguments

UNIT II CONTROL STRUCTURE AND IMMUTABLE DATAT YPES 9

Control Structures - Decision making statement, iterative Statements, unconditional statements, pass statement, range()-Using else with loops, Nested Looping Statements. String - mutable Vs immutable types, String Operations- indexing-slicing-Striding, string functions, format function. Tuple - tuple operations and functions, tuple assignment. Pattern Programs.

UNIT III MUTABLE DATA TYPES 9

List - list operations, list slicing, Built-in list functions, Advanced List Processing –List as Array- Stack-Queue, list comprehension Set - set operations-Built-in functions –Set Comprehension. Dictionary - key-value pair, dictionary operations - functions-Nested Dictionary-Yield ()- Dictionary Comprehension.

UNIT IV FUNCTIONS 9

Functions - Python built in functions (python standard library). User Defined Functions -Creating function, invoking functions, types of functions (required arguments, keyword arguments, default arguments and variable length arguments), and recursion. Modules and Packages-importing random, math and time module functions, creating and importing own modules, importing packages, creating own packages, package folder structure.

UNIT V COLLECTIONS 9

Anonymous functions –Lambda, reduce, filter, map .Collections-Counter, Chainmap, Named Tuple, Default dict, Ordered Dict, deque. Files- text files, file modes, reading and writing files. Multithreading - start new thread, the thread module, synchronizing thread, multithreaded priority
queue.

Total:45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Understood about basic Python language syntax and semantics.

CO2 : DevelopedPython programs using control statements and immutable Data types

CO3: ImplementedPython programs using mutable Data types.

CO4: Created user defined functions in Python

CO5: Developed Python Programs using Collections Packages

CO6: Read and write data from/to files in Python Programs

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	2	1	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	2	1	3	1	3	3	3	3	3	3
CO3	1	2	3	3	3	2	2	1	3	1	2	1	3	3	3	2
CO4	3	3	2	3	1	2	1	1	1	1	2	1	2	1	3	2
CO5	3	3	2	1	2	2	1	2	2	2	2	1	2	2	1	2
CO6	3	3	2	1	2	2	1	1	2	2	2	1	2	2	1	2

TEXT BOOKS

T1. Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python Revisedand updated forPython 3.2”, Network Theory Ltd.,2011, 2nd edition.

T2. Mark Summerfield, ”Programming in Python 3”, 1st Edition, Indian edition published byDorling Kindersley India Pvt. Ltd.,2009

REFERENCE BOOKS

R1 Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”,2nd Edition, O’Reilly,2016

R2 Mark Lutz, “Learning Python”, 5th Edition, O’Reilly Media,2013.

R3 Python Documentation “https://docs.python.org/3.5/”.

WEB RESOURCES

W1. www.nptel.ac.in/courses/117106113/34

W2. www.docs.python.org/3/tutorial/

W3. www.tutorialspoint.com/python/

W4. www.javatpoint.com/python-tutoria

LAB EXPERIMENTS

1. Write a Python program for implementing string concepts with minimum of two functions.
2. Write a Python program involving the usage of dictionaries
3. Write a Python program mentioning the usage of lists and Tuples
4. Write a Python program involving the usage of set.
5. Write a Python program for implementing built-in functions.
6. Write a Python program involving the usage of user defined functions with requiredarguments.
7. Write a Python program involving the usage of user defined functions with Default arguments
8. Write a Python program to implement reduce functions.
9. Write a Python program for implementing lambda functions.
10. Write a Python program involving collections modules.

Console Based Project:

1. Library Management System
2. Simple game Development (Tic Tac Toe, Dice Rolling Simulator etc.)

Total: 15 Hours

U19CCEX303	ENGINEERING EXPLORATION III	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab
- To inculcate ethics and sustainability perspectives and enable students to work in a team

PRE-REQUISITES

NIL

CONTENTS

S No	Topics	No of Hours
1	Introduction to Engineering	3
2	Platform based development	12
3	Mechanisms	9
4	Requirements	3
5	Design	
6	Ethics	6
7	Sustainability	
8	Project Management Principles	3
9	Guided Project	
10	Final Project	9

COURSE OUTCOMES

CO1. Understand the role of an engineer as a problem solver

CO2. Apply multi-disciplinary principles and build systems using engineering design process and tools

CO3. Analyze engineering solutions from ethical and sustainability perspectives

CO4. Use basics of engineering project management skills while doing projects

CO5. Communicate, Collaborate and work as a team

Course Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	-	2	-	2	2	2	2	1	1	1	1
2	3	3	3	3	-	2	-	2	2	2	2	1	2	2	2
3	3	3	3	3	-	2	-	2	2	2	2	1	2	2	2
4	3	3	3	3	-	2	-	2	2	2	2	1	2	2	2
5	3	3	3	3	-	2	-	2	2	2	2	1	2	2	2
6	3	3	3	3	-	2	-	2	2	2	2	1	2	2	2

GUIDELINES

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 3-4 students.
3. Groups can select to work on specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model at the end of semester.
6. The progress of the course is evaluated based on class performance and final demonstration of prototype.

Total:45 Hours

U19ECLC301	EMBEDDED SYSTEM DESIGN USING ARDUINO MICROCONTROLLER	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

1	To Understand the significance of input-output device interface.
2	To know the features of AVR microcontroller
3	To Get comprehensive knowledge on the interrupts and Communication Protocols
4	To work latest trends in the embedded systems field
5	To work on different projects making use of the Arduino microcontroller
6	To know the basics arduino Programming.

PRE-REQUISITES

Basic Programmable Logic Controller

THEORY COMPONENT CONTENTS

UNIT I BASIC ELECTRONICS **4**

Resistor-Capacitor-Inductor-Diode –Transistor –IC (555, LM358) –Circuit Designing Simulation using proteus.

UNIT II INTRODUCTION TO ARDUINO **4**

Introduction to ARDUINO, ARDUINO IDE

Programming in Embedded-C, Concepts of C language.

General Hardware Interfacing: LED‘s, Switches, Seven Segment Display, Relays (AC Appliance Control), LCD, Buzzer, IR Sensors.

UNIT III INTERFACING WITH SENSORS **4**

Reading data from analog and digital sensors on Serial Monitor/LCD Monitor, Connect relays and servomotors to ARDUINO Board.

Introduction to sensors and actuators - Humidity, Proximity, IR Motion, Accelerometer, Sound, Light Distance, Pressure.

UNIT IV COMMUNICATION PROTOCOLS **4**

Communication Protocols-UART –SPI-I2C-CAN.

Communication Technology: GPS-GSM-RFID-NRF-Bluetooth –ZigBee.

UNIT V ARDUINO BASED APPLICATION AND DEVELOPMENT **4**

ARDUINO based home automation, Solar Street Light system, Alarm Clock, Car Parking System, automatic irrigation system, Hand Gesture Controlled Robot.

Total: 20 Hours

TEXT BOOKS:

T1	The AVR Microcontroller and Embedded Systems: A System Approach by Muhammad A. Mazidi, 1st Ed., PHI, 2013.
T2	Furber,S., “ARM System on Chip Architecture” Addison Wesley trade Computer Publication, 2000

REFERENCE BOOKS:

R1	Arm System Developer's Guide: Designing and Optimizing System Software - Andrew N. Sloss, Elsevier Publication, 2005

COURSE OUTCOMES:

CO1: Identify and understand function of different blocks of AVR microcontroller

CO2: Develop programs for data transfer, arithmetic, logical and I/O port operations

CO3: Develop programs for Arduino using ”C”

CO4: Develop program for Arduino Serial port and Interrupts using “C”

CO5: Interface LCD, Keyboard, ADC, DAC, Sensors, Relays, DC motor and Stepper motor witharduino microcontroller.

CO6: Develops a basic Aruduino programming using a platform.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	1	2	2	-	-	-	2	-	1	2	3	3	1	2
CO2	3	3	1	2	2	-	-	-	2	-	1	2	3	3	1	2
CO3	3	3	1	2	2	-	-	-	2	-	1	2	3	3	1	2
CO4	3	3	1	3	3	-	-	-	3	-	2	1	2	3	2	1
CO5	2	1	1	2	2	-	-	-	2	-	1	2	3	1	1	2
CO6	3	3	2	2	2	-	-	-	2	-	1	2	3	3	1	2

U19EEPC301 **BASICS OF PROGRAMMABLE LOGIC CONTRLLER**

L	T	P	C
0	0	2	1

COURSE OBJECTIVES

- To understand S7-1200 PLC Automation Platform and automation concept
- To evaluate and apply various sensors, actuators and logic design concepts in PLC applications.
- To Learn and apply OB1, Ladder Logic, Statement List, Function Block Diagram, Functional blocks, instance data blocks and block calls
- To understand design and debugging techniques and apply them in PLC projects.
- To evaluate various PLC Automation case studies.

PRE-REQUISITES: NIL

THEORY COMPONENT CONTENTS

UNIT I PLC AUTOMATION PLATFORM - INTRODUCTION 6

Introducing the S7-1200 PLC platform - Features of the Automation system SIMATIC S7-1200 modules - Basic HMI panels – Combining Hardware and Software - PLC Architecture – Different protocols for PLC to PC communication - Profibus, Profinet /Ethernet - Tasks and functional areas – Inputs and Outputs – Configuration diagram - Project Setup in STEP7

UNIT II SENSORS, ACTUATORS AND LOGIC DESIGN 6

Inputs and Outputs – Sourcing and sinking - Relays and PLC panel wiring - Sensor wiring – TTL – Solid state relays – Input Sensors - Contact and reed switches – Optical, capacitive, inductive, ultrasonic and hall effect sensors – Fluid flow - Output Actuators – Solenoids, Hydraulics, Pneumatics and Motors - Boolean Logic Design – Event based logic – Timing diagrams – Latches – Timers – Counters – Design Examples

UNIT III PLC PROGRAMMING 6

ɔgramming with symbols – Absolute addresses – symbolic programming – LAD/STL/FBD Program Window – Programming OB1 in Ladder Logic, Statement List and Function Block Diagram – Functions - Function Blocks in LAD, STL and FBD – Instance Data Blocks – Programming a Block Call in LAD, STL and FBD

UNIT IV DESIGNING AND DEBUGGING 6

Shared data blocks – System function blocks – System Functions - Configuring the Central Rack Hardware – debugging and online testing - Testing the Program with Program Status, Variable Table and Diagnostic Buffer – Organization blocks for Interrupt driven program processing – Time delay - Cyclic interrupt – hardware interrupt – Error handling

UNIT V PROJECT CASE STUDIES - INTRODUCTION 6

Case studies - Traffic light control - Simple Elevator Control - Conveyor belt automation - Hydraulic press control - Welding station control - Wrapping process automation

Total: 30 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : understand PLC Automation Platform and Create Automation Projects
CO2 : know and apply the sensors, actuators and logic design in PLC applications.
CO3 : acquire knowledge on PLC programming fundamentals.
CO4 : create PLC applications with design and debugging techniques
CO5 : To evaluate various PLC Automation case studies and create applications.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													CO/PSO Mapping	
COs	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	3	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	2	3	-	-	-	-	-	-	-	-	-	2	-	-
CO6	3	2	3	-	-	-	-	-	-	-	-	-	2	-	-

TEXT BOOKS

T1. Getting started and working with STEP 7, SIEMENS Training Manual, 2006 Edition
Doc No. C79000-P7076-C48-01

T2. Programming with STEP 7, SIEMENS Function Manual, 2017 Edition
Doc No. A5E41552389-AA

REFERENCE BOOKS

R1. Automated Manufacturing Systems using PLCs, Hugh Jack
http://www.cfdvs.iitb.ac.in/download/Docs/verification/course/plcbook.pdf

R2. SIMATIC Easy Book, S7- 1200, SIEMENS Training Manual, 2015 Edition
Doc No. A5E02486774-AG

WEB RESOURCES

W1. 'Startup' PLC- Programming with STEP 7
https://www.automation.siemens.com/sce-static/learning-training-documents/classic/basics-programming/a03-startup-en.pdf

W2. Programming with STEP 7
https://cache.industry.siemens.com/dl/files/056/18652056/att_70829/v1/S7prv54_e.pdf

W3 Programming with STEP 7, SIEMENS Function Manual,
https://cache.industry.siemens.com/dl/files/825/109751825/att_933142/v1/STEP_7_-_Programming_with_STEP_7.pdf

W4 Getting started and working with STEP 7,
https://www.slideshare.net/akbarla/simens-plc-training-simatic-workingwithstep7

LAB EXPERIMENTS

1 Exploring and creating the new project using S7-1200 and TIA platform
2 PLC Panels and Relays Wiring
3 Boolean Logic Design with switches, lamps and relays
   (a) Develop a program that will cause output D to go true when switch A and switch B are closed or when switch C is closed.
   (b) Develop a program that will cause output D to be on when push button A is on, or either B or C are on
   (c) Design a motor controller that has a forward and a reverse button
4 Implementation of Car Safety System using Ladder logic design
5 Implementation of a burglar alarm using ladder logic design
6 Implementation of AND logic with Ladder Logic, Statement List and Function Block Diagram
7 Organization Block for Cyclic Program Processing in LAD, STL and FBD
8 Function Blocks in LAD, STL and FBD
9 Instance Data Blocks and Block Call in LAD, STL and FBD
10 Event based design using latches, Timers and Counters
11 Traffic light control
12 Simple Elevator Control

Total: 30 Hours

U19MATH431	NUMERICAL METHODS FOR ELCTRICAL ENGINEERS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the solutions of algebraic, transcendental, exponential and logarithmic equations and Gain the knowledge of interpolation with equal and unequal intervals.
- The objective of the course is to expose students to understand the basics and importance of numerical derivatives and numerical integration and Evaluation of numerical derivatives and numerical integration and the knowledge of solving the ODE and PDE numerically.

PRE-REQUISITES:

THEORY COMPONENT CONTENTS

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton -Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting -Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigen values of a matrix by Power method

UNIT II CURVE FITTING AND INTERPOLATION 9

Curve fitting – Method of least squares – Interpolation: Lagrange's interpolation –Inverse interpolation - Newton's forward and backward difference formulae – Divided differences – Newton's divided difference formula.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Approximation of derivatives using interpolation polynomials - Newton's forward and backward with derivatives - Numerical integration using Trapezoidal- Simpson's rule – Evaluation of double integrals by trapezoidal and Simpson's 1/3 rules.

UNIT IV INTIAL VALUE PROBLEM FOR ORDINARY DIFFERENTIALEQUATIONS 9

Taylor series method-Euler method- Fourth order Runge-Kutta method- multi stepmethod - Milne method - Adams-Bash forth predictor corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEM IN PARTIAL DIFFERENTIALEQUATIONS 9+3

Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit(Crank Nicholson) methods – One dimensional wave equation by explicit method.

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Apply the solution of equations and eigenvalue problem.

CO2 : Apply Numerical techniques for solving the problems involving the interpolation.

CO3 : Understand the fundamental knowledge of the concepts of differentiation and Integration .

CO4 : Understand the set of algebraic equations representing steady state models formed in Engineering problems, Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables and Predict the system dynamic behavior through solution of ODEs modeling the system

CO5: Understanding various methods for solving first and second order differential equations

CO6: Solve the partial and ordinary differential equations with initial and boundary conditions with engineering applications

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	2	2	-	-	-	-	-	1	2	2	3	3	1
CO2	3	3	1	2	2	-	-	-	-	-	1	2	2	3	3	1
CO3	2	1	3	1	2	-	-	-	-	-	2	1	2	3	3	1
CO4	3	3	3	2	2	-	-	-	-	-	1	2	3	1	1	2
CO5	3	3	3	2	3	-	-	-	-	-	1	2	2	3	3	1
CO6	3	3	3	2	2	-	-	-	-	-	1	2	2	3	3	1

TEXT BOOKS

T1. Grewal. B.S., and Grewal. J.S.,"Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi, 2007.

T2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education,Asia, 6th Edition, New Delhi, 2006.

REFERENCE BOOKS

R1. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill, 5th Edition, New Delhi, 2007.

R2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi, 2007.

R3. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, 3rd Edition, New Delhi, 2007

U19EETL406T MEASUREMENTS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To introduce the basic concepts related to the operation of Electrical and Electronic Measuring Instruments to measure various electrical quantities and to study about the transducers.

PRE-REQUISITES: NIL

THEORY COMPONENT CONTENTS:

UNIT I INTRODUCTION OF INSTRUMENTS **9**

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration

UNIT II ELECTRICAL INSTRUMENTS **9**

Principle and types of Analog and Digital voltmeters, Ammeters, Multimeters – Single and Three phase wattmeter and Energy meters – Magnetic measurements – Determination of B-Hcurve and measurements of iron loss – Instruments for measurement of frequency and phase.

UNIT III DC AND AC BRIDGE MEASUREMENTS **9**

D.C & A.C potentiometers, D.C & A.C Bridges - Wheatstone Bridge, Kelvin Bridge, Maxwell Bridge, Hay's Bridge, Unbalance Conditions, Wein Bridge, Anderson's Bridge, De Sauty's Bridge, Schering Bridge, transformer ratio bridges, self-balancing bridges – Multiple earth and earth loops - Electrostatic and electromagnetic interference – Groundingtechniques.

UNIT IV DIGITAL INSTRUMENTS AND DISPLAY DEVICES **9**

Comparison of analog and digital techniques-Automation in digital instruments-Automatic polarity indication-automatic ranging-automatic zeroing-fully automatic digital instruments- Computer controlled test systems-Virtual instruments. CRT display, digital CRO, LED, LCD & dot matrix display – Data Loggers – DSO.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEM **9**

Transducers: Classification of transducers – Resistive, capacitive & inductive transducers – Piezoelectric, Hall effect, optical and digital transducers

Data acquisition system: Smart sensors – signal conditioning, A/D, D/A converters. DigitalData Acquisition System: Interfacing transducers to Electronics Control and Measuring System.

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Understand the fundamental Characteristics of an instrument

CO2 : Analyze instruments adopted for measurement of current, voltage, power and Energy

CO3 : To study different methods available for measurement of active, passive elementsand various signal conditioning devices.

CO4 : Analyze the problems in various electrical parameter measurements.

CO5 : Study and analyze the storage of digital signal and analyzers.

CO6: Ability to model and analyse electrical and electronic Instruments and understand the operational features of display Devices and Data Acquisition System

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	-	-	-	-	-	2	2	3	3	3	2	2
CO2	1	2	3	2	-	-	-	-	-	2	2	3	3	3	2	2
CO3	3	2	3	2	-	-	-	-	-	1	3	1	1	2	1	2
CO4	3	1	2	1	-	-	-	-	-	2	2	3	3	3	1	1
CO5	3	2	3	2	-	-	-	-	-	2	2	3	3	3	2	2
CO6	3	2	3	2	-	-	-	-	-	2	2	3	2	2	1	2

TEXT BOOKS

T1. E.O. Doebelin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2003.

T2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements &In

T3. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria&Sons, Delhi,2003.

REFERENCE BOOKS

R1. A.J.Bouwens,'Digital Instrumentation',TataMcGrawHill, 1997.

R2. D.V.S.Moorthy,'Transducers and Instrumentation', Prentice Hall ofIndiaPvtLtd, 2007.

R3 H.S.Kalsi,'ElectronicInstrumentation',TataMcGrawHill,IIEdition2004.

R4 Martin Reissland,'Electrical Measurements',New AgeInternational(P) Ltd.,Delhi,2001.

WEB RESOURCES

W1. https://nptel.ac.in/courses/112/107/112107242/

W2. https://nptel.ac.in/courses/108/105/108105153/

W3 http://www.nptelvideos.in/2012/11/industrial-instrumentation.html

LAB EXPERIMENTS

1. To design on Calibration of Instruments
2. Calibration of single–phase and three -phase energy meter
3. Power measurement using Wattmeter
4. Measurement of frequency using CRO and Function generator
5. AC bridges –Anderson and Schering bridge
6. DC bridges-Wheatstone and Kelvin double bridge
7. To measure electrical parameters by Digital storage oscilloscope
8. Experimental verification of CRT,LED and LCD display
9. To simulate pressure, flow and temperature measurement system using LAB VIEW.
10. Design of experiments to Analog – Digital converter
11. Design of experiments to Digital –Analog converter.

Total:15 Hours

U19EETL408T CONTROL SYSTEM ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To provide an introduction to modelling, analysis, and design of feedback control systems and analysis and regulation of the output behaviours of dynamical systems subject to input signals.
- To provide a basic understanding of the concepts and techniques involved in designing control schemes for dynamic systems.
- Formulate different types of analysis in frequency domain to explain the nature of stability of the system.

PRE-REQUISITES:

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION 6

Elements of control systems, concept of open loop and closed loop systems and Examples, Applications, Brief idea of multivariable control systems. Laplace and Inverse transformation function (Simple Problems).Mathematical Modelling of Physical Systems: Electro Mechanical system by differential equations, Determination of transfer function by block diagram reduction techniques and signal flow method. Sensors and Encoders in control systems, DC motors in control systems.

UNIT II TIME RESPONSE ANALYSIS 6

Time Response Analysis of I & II Order System: Types of Test Input, Steady state errors and error constants, Obtaining solutions from mathematical models. Poles and zeros and their effects on solutions, time-domain specifications and their formulae, Root locus Construction, Effects of P, PI, PID modes of feedback Control.

UNIT III FREQUENCY RESPONSE ANALYSIS 6

Frequency response, correlation between time and frequency responses, polar and inverse polarplots, Bode plots

Stability in Frequency Domain: Nyquist stability criterion, assessment of relative stability:gain margin and phase margin, M and N Loci, Nichols chart.

UNIT IV STABILITY CONCEPTS & NECESSARY COMPENSATOR DESIGN 6

Characteristic Equation, Routh Hurwitz Criterion concepts, Lead compensator, lag compensator,lead-lag/lag-lead compensators, and their design.

UNIT V STATE SPACE ANALYSIS & SYSTEM DESIGN 6

Concepts of State variable, Controllability & Observability, Controllable Companion Form, Observable Companion Form (For SISO And MIMO Systems), Pole Placement By State Feedback.

Total: 30 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Categorize different types of system and identify a set of algebraic equations torepresent and model a complicated system into a more simplified form.

CO2: Characterize any system in Laplace domain to illustrate different specification of thesystem using transfer function concept.

CO3: Interpret different physical and mechanical systems in terms of electrical system toconstruct equivalent electrical models for analysis.

CO4: Employ time domain analysis to predict and diagnose transient performanceparameters of the system for standard input functions.

CO5: Formulate different types of analysis in state space variable to explain the nature ofthe physical system.

CO6: Ability to understand use of PID controller in closed loop system

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	1	2	2	1	2	-	2	-	1	2	3	3	1	1
CO2	3	3	1	2	2	1	2	-	2	-	1	2	2	1	2	2
CO3	2	3	1	3	2	1	2	-	2	-	1	1	3	3	1	2
CO4	3	1	1	2	1	2	1	-	1	-	3	2	3	3	1	2
CO5	3	3	1	2	2	1	2	-	2	-	1	2	3	3	1	2
CO6	3	3	1	2	2	1	2	-	2	-	1	2	3	3	1	2

TEXT BOOKS

T1 Control Systems Engineering by I.J. Nagrath & M. Gopal, Wiley eastern limited.

T2 Kuo B.C., Automatic Control Systems, Prentice-Hall of India Pvt Ltd., New Delhi, 6th edition, 1991.

T3 Ogata K., Modern Control Engineering, Prentice-Hall of India Pvt Ltd., New Delhi, 3rd edition, 2000.

REFERENCE BOOKS

R1. Franklin G.F., Powell J.D., Emami-Naeini A., Feedback Control of DynamicSystems, Pearson, Upper Saddle River, New Jersey, 5th edition, 2006.

R2 Control Systems Engineering" by Norman S Nise, Bejamin/Cummings PublishingCompany, 1995

R3 John J.D., Azzo Constantine, H. and Houpis Sttuart, N Sheldon, "Linear ControlSystem Analysis and Design with MATLAB", CRC Taylor& Francis Reprint 2009

R4 M.Gopal, "Control System: Principle and design", McGraw Hill Education, 2012.

R5 "Problems and Solutions of Control Systems : With Essential Theory" by Jairath A K

WEB RESOURCES

W1 NPTEL Video Lecture Notes on "Control Engineering "by Prof. S. D. Agashe, IITBombay

W2 https://nptel.ac.in/courses/107/106/107106081/

W3 http://www.nptelvideos.com/video.php?id=1423&c=14

LAB EXPERIMENTS

1	To study the basic open loop and closed loop control System
2	Characteristics of AC & DC Servo Motors
3	Characteristics of Synchro pair
4	Experiment to draw the frequency response characteristic of a given lag- leadcompensating network.
5	To determine experimentally the frequency response of a second –order system andevaluation of frequency domain specifications.
6	AC Position control systems
7	DC Position control systems
8	Closed loop P,PI,PID controllers
9	Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system usingsuitable software
10	Design of Lead, lag and lead lag compensator

Total:15 Hours

U19EETL407T	ELECTRICAL MACHINES AND DESIGN - II	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

- To determine the performance characteristics of three phase induction motor
- To acquire knowledge about the starting and speed control of three phase inductionmotor
- Analyze the performance of single phase induction motors and design of induction machine.
- To determine the voltage regulation by analyzing the performance of alternators
- Understand the performance of synchronous motor and design of synchronous machine.

PRE-REQUISITES:

Electrical Machines I

THEORY COMPONENT CONTENTS

UNIT I THREE PHASE INDUCTION MOTORS 6

Constructional details – Types– Principle of operation – Rotating Magnetic Field- Slip – Equivalent circuit – Torque and power output - Slip-torque characteristics - Condition for maximum torque – Losses and efficiency – No load and blocked rotor test - Circle diagram – Linear induction motors.

UNIT II STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTORS 6

Need for starters – Types of starters. Cogging and crawling - Speed control – Change ofvoltage / frequency, number of poles – Cascaded connection – Slip power recovery scheme- Braking of Induction motors. Universal motors – Repulsion motors.

UNIT III SINGLE PHASE INDUCTION MOTORS AND DESIGN 6

Principle of operation of single phase induction motor–Double field revolving theory – Starting methods–Split phase, Capacitor type, Shaded pole motor–Equivalent circuit.
Output equation of Induction motor – Main dimensions – choice of specific loadings – Design of squirrel cage rotor and wound rotor-Operating characteristics : Magnetizing current - Short circuit current - Computer program: Design of slip-ring rotor

UNIT IV SYNCHRONOUS GENERATORS 6

Constructional details – Types of rotors Brushless Excitation System– EMF equation - Armature reaction - Predetermination of regulation by synchronous impedance, MMF and Potier methods-Power and torque-Two reaction theory – Determination of direct and quadrature axis synchronous reactance using slip test.

UNIT V SYNCHRONOUS MOTORS AND DESIGN 6

Principle of operation – Hunting – Methods of starting - Torque and Power - Effect of change in Excitation - V and Inverted V curves - Power factor improvement using Synchronous condenser.
Output equations – Choice of specific loading-Design of salient pole machines – short circuit ratio – Armature design – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field MMF – Design of field winding – Design of turbo alternators - Computer program: Design of Stator main dimensions-Brushless DC Machines.

Total: 30 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Ability to understand the working principle of three phase induction motor with their characteristics

CO2 : Understand the necessity of starters and speed control of three phase induction motor

CO3 : Ability to design of induction machines and performance of single phase induction motor

CO4 : Ability to understand the construction and performance of alternators using various methods of voltage regulation.

CO5 : Ability to analyse about the design of synchronous machines and performance of synchronous motor

CO6: Ability to understand the uses of induction and synchronous machines with real world

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	2	2	-	-	-	2	-	1	2	3	3	1	2
CO2	3	3	1	2	2	-	-	-	2	-	1	2	3	3	1	2
CO3	3	3	1	2	2	-	-	-	2	-	1	2	3	3	1	2
CO4	3	3	1	3	3	-	-	-	3	-	2	1	2	3	2	1
CO5	2	1	1	2	2	-	-	-	2	-	1	2	3	1	1	2
CO6	3	3	2	2	2	-	-	-	2	-	1	2	3	3	1	2

TEXT BOOKS

T1. D P Kothari, and I J Nagrath, “Electric Machines”, McGraw Hill Education(India) PrivateLimited, New Delhi, 2013.

T2. B.L.Theraja, A.K.Theraja, ‘ Electrical Technology’, Vol II – AC and DCMachines, S.Chand publications, 2015

T3. Sawhney.A.K.,’ A course in Electrical Machine Design’, DhanpatRai& Sons,New Delhi, Fifth edition , 1984.

REFERENCE BOOKS

R1. P. C. Sen., ‘Principles of Electrical Machines and Power Electronics’, JohnWiley&Sons, 1997.

R2. J.B. Gupta, ‘Theory and Performance of Electrical Machines’, S.K.Kataria andSons, 2002.

R3 Sen.S.K.,’Principles of Electrical Machine Design with computer programmes’,Oxford and IBH Publishing and Co Pvt Ltd, New Delhi, Second Edition,2009.

WEB RESOURCES

W1. https://circuitglobe.com

W2. https://www.electrical4u.com/electric-machines/W3 https://www.machinedesign.com/

LAB EXPERIMENTS

S.No	LIST OF EXPERIMENTS
1.	Load test on three-phase induction motor
2.	Predetermination of performance characteristics of 3 phase induction motor byNo load and blocked rotor tests
3.	Separation of No-load losses of three-phase induction motor.
4.	Study of Induction motor Starters
5.	Load test on single-phase induction motor.
6.	Predetermination of performance characteristics of 3 phase induction motor byNo load and blocked rotor tests on single-phase induction motor.
7.	Regulation of three phase alternator by EMF and MMF methods.
8.	Regulation of three phase salient pole alternator by slip test.
9.	Measurements of negative sequence and zero sequence impedance of alternators
10.	V and Inverted V curves of Three Phase Synchronous Motor.

Total: 15 Hours

U19EETL409T	MICROPROCESSORS AND MICROCONTROLLERS DESIGN	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

impart knowledge on the following Topics

- Architecture of µP8085 & µC 8051
- Addressing modes & instruction set of 8085 & 8051.
- Need & use of Interrupt structure 8085 & 8051.
- Simple applications development with programming 8085 & 8051

PRE-REQUISITES:

THEORY COMPONENT CONTENTS

UNIT I 8085 PROCESSOR **6**

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II PROGRAMMING OF 8085 PROCESSOR **6**

Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up tability - Subroutine instructions - stack.

UNIT III 8051 MICRO CONTROLLER **6**

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts- Data Transfer, Manipulation, Control Algorithms& I/O instructions, Comparison to Programming concepts with 8085.

UNIT IV PERIPHERAL INTERFACING **6**

Study on need, Architecture, configuration and interfacing, with ICs: 8255, 8259, 8254, 8279, - A/D and D/A converters &Interfacing with 8085& 8051.

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS **6**

Simple programming exercises- key board and display interface –Control of servo motor- stepper motor control- Application to automation systems.

Total: 30 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Ability to acquire knowledge in Addressing modes & instruction set of 8085 & 8051.
CO2 : Ability to need & use of Interrupt structure 8085 & 8051.
CO3 : Ability to understand the importance of Interfacing
CO4 : Ability to explain the architecture of Microprocessor and Microcontroller.
CO5 : ility to develop the Microprocessor and Microcontroller based applications.

TEXT BOOKS

T1 Sunil Mathur &Jeebananda Panda, “Microprocessor and Microcontrollers”, PHI Learning Pvt. Ltd, 2016.

T2 R.S. Gaonkar, ‘Microprocessor Architecture Programming and Application’, with 8085, Wiley Eastern Ltd., New Delhi, 2013.

T3 Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely ‘The 8051 Micro Controller and Embedded Systems’, PHI Pearson Education, 5th Indian reprint, 2003.

REFERENCE BOOKS

R1. shna Kant, “Microprocessor and Microcontrollers”, Eastern Company Edition, Prentice Hall of India, New Delhi, 2007

R2 B.RAM,” Computer Fundamentals Architecture and Organization” New age International Private Limited, Fifth edition, 2017.

R3 Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.

WEB RESOURCES

W1 https://nptel.ac.in/courses/107/106/107106081/

W2 http://www.nptelvideos.com/video.php?id=1423&c=14

LAB EXPERIMENTS

1. Simple arithmetic operations: addition / subtraction / multiplication / division.
2. Programming with control instructions: (i) Ascending / Descending order, Maximum / Minimum of numbers. (ii) Programs using Rotate instructions. (iii) Hex / ASCII / BCD code conversions.
3. Interface Experiments: with 8085 (i) A/D Interfacing. & D/A Interfacing.
4. Traffic light controller.
5. I/O Port / Serial communication.
6. Programming Practices with Simulators/Emulators/open source
7. Read a key ,interface display
8. Demonstration of basic instructions with 8051 Micro controller execution, including: (i) Conditional jumps & looping (ii) Calling subroutines
9. Programming I/O Port and timer of 8051 (i) study on interface with A/D & D/A (ii) Study on interface with DC & AC motors
10. Application hardware development using embedded processors.

Total: 45 Hours

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													**CO/PSO Mapping**	
CO s	**PROGRAMME OUTCOMES (Pos)**												**PSOs**	
	PO1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PS O2**	**PSO3**
CO1	-	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	2	2	2	-	-	-	-	-	-	-	3	-	3
CO3	-	3	3	2	-	2	-	-	-	-	-	-	-	2	2
CO4	3	2	2	1	-	1	-	-	-	-	-	-	2	2	2
CO5	3	2	3	3	1	-	-	-	-	-	-	-	2	2	3
CO6	2	2	3	3	1	-	-	-	-	-	-	-	-	-	-

U19CCEX404 **ENGINEERING EXPLORATION IV**

L	T	P	C
0	0	2	2

COURSE OBJECTIVES

- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab
- To inculcate ethics and sustainability perspectives and enable students to work in a team

PRE-REQUISITES

NIL

CONTENTS

S No	Topics	No of Hours
1	Introduction to Engineering	3
2	Platform based development	12
3	Mechanisms	9
4	Requirements	3
5	Design	
6	Ethics	6
7	Sustainability	
8	Project Management Principles	3
9	Guided Project	
10	Final Project	9

COURSE OUTCOMES

CO1. Understand the role of an engineer as a problem solver
CO2. Apply multi-disciplinary principles and build systems using engineering design process and tools
CO3. Analyze engineering solutions from ethical and sustainability perspectives
CO4. Use basics of engineering project management skills while doing projects
CO5. Communicate, Collaborate and work as a team

Course Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	-	2	-	2	2	2	2	1	1	1	1
2	3	3	3	3	-	2	-	2	2	2	2	1	2	2	2
3	3	3	3	3	-	2	-	2	2	2	2	1	2	2	2
4	3	3	3	3	-	2	-	2	2	2	2	1	2	2	2
5	3	3	3	3	-	2	-	2	2	2	2	1	2	2	2
6	3	3	3	3	-	2	-	2	2	2	2	1	2	2	2

1

GUIDELINES

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 3-4 students.
3. Groups can select to work on specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model at the end of semester.
6. The progress of the course is evaluated based on class performance and final demonstration of prototype.

Total:45 Hours

		L	T	P	C
U19CCLC402	CAREER ENHANCEMENT PROGRAM – II	0	0	2	1

COURSE OBJECTIVES

- To enable students to gain strong foundation by expanding their logical, numerical and reasoningskills.
- To help them master mathematical concepts to understand and solve problems.
- To ensure students develop ability to comprehend, work with, and apply general mathematicaltechniques and models to different situations.
- To enhance listening skill for better understanding of the main contextual ideas
- To comprehend visual communication and analyse the details for analysis.
- To inculcate the ability of speaking skills of the learners and express their views and ideas usingthe appropriate vocabulary and phrases.
- To make use of the ideas and concepts gathered from different sources and delivering itprofessionally using proper organization and body language.

PRE-REQUISITES: CAREER ENHANCEMENT PROGRAM – I

THEORY COMPONENT CONTENTS

UNIT I

CLOCKS AND CALENDAR - Minute Spaces - Hour Hand and Minute Hand - Odd Days - Leap Year – Ordinary Year - Counting of Odd Days

LAB - Listening as a Key Skill - Listening Comprehension - Understanding Key Vocabulary - Listening for Main Ideas and Details - Consonant Clusters - Listening for Examples - Telephonic etiquette - Homonyms, Homophones and Homographs.

UNIT II

ANALOGY PATTERN RECOGNITION - Relating two objects - Problems on Number Analogy

LAB - Predicting Content using Visuals - Attention to Details -Understanding the Attitude - Linking Words - Video-based Activities - Phrasal Verbs – Idioms

UNIT III

NUMBER SERIES PATTERN RECOGNITION - Find the next Image- Mirror Image- Water Image- Embedded Image

LAB - Introducing and Starting a Talk - Small Talk - Give Information as part of a simple explanation - Stressing Syllables and Speaking Clearly - Intonation Patterns - Self-introduction using Simile or Metaphor

UNIT IV **CODING AND DECODING PATTERN RECOGNITION**

CODING AND DECODING PATTERN RECOGNITION - Coding and decoding by letter shifting- Coding Letters of a Word-Coding and decoding in fictitious language

LAB - Product Description – Describing the Mechanism – Describing its Purpose – Scope of Development - Describing Charts and Data - Persuasion – Negotiation

UNIT V

ANALYTICAL REASONING - Problems related to Triangles – To find the missing numbers

LAB - Strategies for Presentation – Individual Presentation Practice – Presenting the Visuals Effectively – Organizing the Information – Techniques of Speech Delivering and Rehearsal -Signpost - Decision making - Problem solving.

Total:45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: To help students understand with quantitative ideas and at ease in applying quantitative methods. Individuals who are quantitatively confident routinely use mental estimates to quantify, interpret, and check other information. Listen and understand the contextual ideas of different concept.

CO2 : To help students understand with analogies to comprehend change and find similarities in the unfamiliar. Analyse and understand different visual aids and utilize for career enhancement.

CO3: To test a candidate's ability to determine the descriptions of the objects and how the objects are related and to find the next picture or missing pictures. Speak and express views and ideas using appropriate vocabulary and phrases.

CO4: To enable students to solve the problems by an indirect and creative approach. Apply communicative strategy in presenting ideas through proper delivery.

CO5: To judge the ability of the candidates to Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives, and select optimal results.

CO6: Students can enhance their career through group discussions

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	-	-	-	-	-	2	2	3	3	3	3	3	-	-	3	3
CO2	-	-	-	-	-	2	2	3	3	3	3	3	-	-	3	3
CO3	-	-	-	-	-	2	2	3	3	3	3	3	-	-	2	1
CO4	-	-	-	-	-	1	3	1	2	1	2	1	-	-	3	3
CO5	-	-	-	-	-	2	2	3	3	3	3	3	-	-	3	3
CO6	-	-	-	-	-	2	2	3	3	3	3	3	-	-	3	3

TEXT BOOKS

T1. Aggarwal, R.S. "Quantitative Aptitude", Revised Edition 2016, Reprint 2018, S.Chand& Co Ltd.,New Delhi.

T2 Pearson Publication, "A Complete Manual for the CAT", 2018

T3. Analytical Reasoning by M.K Pandey

T4. Brooks, Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press,Oxford: 2011.

T5. White, N. M. Unlock: Listening and Speaking Skills 1. Cambridge University Press, Delhi. 2015.

REFERENCE BOOKS

R1 Dhaval Bathia, Vedic Mathematics, JAICO Publishing House, 29th Edition, Mumbai, 2014

R2 Arun Sharma “How to Prepare for Quantitative Aptitude for the CAT ” , McGraw Hill Education; Eighth edition 2018

R3 Dr. R.S.Aggarwal “A Modern Approach to Logical Reasoning “ , S.Chand& Co Ltd., New Delhi.-2018

R4 Arun Sharma “How to Prepare for Logical Reasoning for the CAT ” , McGraw Hill Education;Eighth edition 2018

R5. Dimond-Bayir, Stephanie. Unlock: Listening and Speaking Skills 2. Cambridge University Press,Delhi. 2015.

R6. Ostrowska, Sabina. Unlock: Listening and Speaking Skills 3. Cambridge University Press, Delhi.2015.

R7. Lansford, Lewis. Unlock: Listening and Speaking Skills 4. Cambridge University Press, Delhi. 2015.

WEB RESOURCES

W1. https://www.indiabix.com/aptitude/questions-and-answers/

W2. https://testbook.com/aptitude-practice/

W3. https://www.edudose.com/reasoning/

W4. https://learnenglish.britishcouncil.org/skills/listening

W5. https://learnenglish.britishcouncil.org/skills/speaking

19EETL510T POWER SYSTEM ANALYSIS L T P C
3 0 0 3

OBJECTIVES:

- To model the power system under steady state operating condition
- To understand and apply iterative techniques for power flow analysis
- To model and carry out short circuit studies on power system
- To model and analyze stability problems in power system
- To understand the reactive power compensation

UNIT I POWER SYSTEM **9**

Need for system planning and operational studies - Power scenario in India - Power system components – Single line diagram - per unit quantities - Network graph, Bus incidence matrix Primitive parameters.

UNIT II POWER FLOW STUDIES **9**

Bus classification - Formulation of Power Flow problem in polar coordinates - Power flow solution using Gauss Seidel method and Newton Raphson method**.**

UNIT III FAULT ANALYSIS **9**

Assumptions in short circuit analysis - Symmetrical short circuit analysis using Thevenin's theorem - Bus Impedance matrix building algorithm – Symmetrical fault analysis through bus impedance matrix – Symmetrical components - Sequence impedances - Analysis of unsymmetrical faults at generator terminals: LG, LL and LLG

UNIT IV STABILITY ANALYSIS **9**

Classification of power system stability - Swing equation –- Equal area criterion - Critical clearing angle and time- Factors affecting steady state and transient stability and methods of improvement

UNIT V POWER SYSTEM COMPENSATION **9**

Need of compensation - load and line compensation- compensation technique: series and shunt - Flexible AC Transmission Systems(FACTS) – FACT Controllers - Static Var compensator(SVC) – Static Synchronous compensator(STATCOM)- Thyristor controlled series compensator(TCSC)-Unified power flow controller(UPFC) - Power quality – causes of power quality problem – Application of FACTS controllers for power quality improvement in distribution system.

Total: 45 Hours

OUTCOMES:

- Ability to model the power system under steady state operating condition
- Ability to understand and apply iterative techniques for power flow analysis
- Ability to model and carry out short circuit studies on power system
- Ability to model and analyze stability problems in power system
- Ability to acquire knowledge on Fault analysis.
- Ability to model and understand various power system components and carry outpower flow, short circuit and stability studies.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	1	1	1	-	-	-	1	2	3	3	2	2
CO2	3	3	-	3	1	1	1	-	-	-	1	2	3	3	2	2
CO3	1	3	-	3	1	1	1	-	-	-	2	1	2	2	2	2
CO4	3	2	-	1	2	3	1	-	-	-	1	1	2	1	3	1
CO5	3	3	-	2	2	1	2	-	-	-	1	1	2	1	3	1
CO6	3	3	-	2	2	1	1	-	-	-	1	1	2	1	3	1

TEXT BOOKS:

1. John J. Grainger, William D. Stevenson, Jr, 'Power System Analysis', Mc Graw HillEducation (India) Private Limited, New Delhi, 2015.
2. Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw-Hill Education,Second Edition, 2008.
3. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi,21st reprint, 2010.
4. Narain G Hingorani, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, Wiley, 2011

REFERENCES

1. Pai M A, 'Computer Techniques in Power System Analysis', Tata Mc Graw-Hill PublishingCompany Ltd., New Delhi, Second Edition, 2007.
2. J. Duncan Glover, Mulukutla S.Sarma, Thomas J. Overbye, 'Power System Analysis &Design', Cengage Learning, Fifth Edition, 2012.
3. Gupta B.R., 'Power System - Analysis and Design', S. Chand Publishing, 2001.
4. Kundur P., 'Power System Stability and Control', Tata McGraw Hill Education Pvt. Ltd., NewDelhi, 10th reprint, 2010.
5. Math H.J. Bollen (Author) Understanding Power Quality Problems: Voltage Sags andInterruptions, wiley, 1999
6. K.R.Padiyar, FACTS Controllers in Power Transmission & Distribution, New AgeInternational Publishers, 2007.

List of Experiments:

1. Power flow solution with tap changing transformer using Gauss-Seidel Method by usingETAP software
2. Voltage in ring main distribution system with interconnection by using ETAP software
3. Symmetrical fault analysis using Thevenin/s theorem by using ETAP software
4. Determining the critical clearing time using equal area criterion by using ETAP software
5. Verification of reactive power compensation in distribution system by using ETAP software

Total: 15 Hours

U19EETL511T POWER ELECTRONICS AND APPLICATIONS L T P C
3 0 0 3

OBJECTIVES:

1. To understand different types of Power semiconductor devices and their switching.
2. To demonstrate and build a various single and three phase AC-DC power converter circuits and understand their applications.
3. To illustrate the operating principle and construct a various type of DC-DCconverters.
4. To Analyze various Inverter configuration with different types of load.
5. To understand working of different configurations of electric vehicles andPropulsion systems.

UNIT 1 POWER SWITCHES AND ITS CHARACTERISTICS 9

Power MOSFET& IGBT: construction, working, transfer and switching characteristics, output characteristics, and application-SCR construction, working, transfer characteristics, output characteristics, and application-SIT: construction, working, VI characteristics, and application- MCT: construction, working, VI characteristics, and application-FCT: construction, working, VI characteristics, and application.

UNIT 2 CONVERTER CONFIGURATION 9

Single & Three Phase Half wave, semi and fully controlled converters with R, RL, RLE loadsand freewheeling diode and related problems.– Continuous and discontinuous mode of operation
- inversion operation – Sequence control of converters –performance parameters: harmonics, ripple, distortion, power factor– effect of source impedance and overlap –Dual converter- Single & Three Phase AC voltage Controller- Cyclo converter

UNIT 3 DC-DC CONVERTERS 9

Principles of step-down and step-up converters – classification of chopper configuration –controlstrategy: time ratio and current limit control -Analysis of buck, boost, buck-boost, Cuk and Zeta

Regulators – Resonant converters: ZCS and ZVS converters.

UNIT 4 INVERTERS 9

Single phase voltage source bridge inverters and their steady state analysis, modified Mcmurray half bridge inverter, series inverters- three phase bridge inverters with 180 degree and 120 degree modes- Single-phase PWM inverters- current source inverters-Harmonics -CSI with R load.

UNIT: 5 E VEHICLE PROPULSION TECHNOLOGY 9

Introduction to Hybrid Electric Vehicles, Hybrid Electric Drive-trains and Electric Drive-trains- Electric Propulsion -Electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

TOTAL: 45 Hours

OUTCOMES:

1. Acquire knowledge about fundamental concepts of Power devices used in powerelectronics.
2. Formulate and analyze the various single phase and three phase power convertercircuits and understand their applications.
3. Learn the basic concepts of operation of dc-dc converters in steady state in Continuous and discontinuous modes and be able to analyze basic convertertopologies.
4. Apply the different modulation techniques to pulse width modulated inverters andidentify the harmonic reduction methods.
5. Develop the electric propulsion unit and its control for application of electricvehicles.
6. Ability to model and understand various power system components and carry out power flow, short circuit and stability studies

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	2	-	-	-	-	-	-	1	3	2	2	2
CO2	1	3	2	2	2	-	-	-	-	-	-	1	3	2	2	2
CO3	3	1	2	2	2	-	-	-	-	-	-	2	3	2	2	2
CO4	3	3	3	1	3	-	-	-	-	-	-	1	1	2	2	2
CO5	3	3	2	2	2	-	-	-	-	-	-	1	3	3	1	3
CO6	3	3	2	2	2	-	-	-	-	-	-	1	3	2	2	2

TEXT BOOKS:

1. Modern Power Electronics SenP.C. S. Chand & Company, New Delhi; 2013,ISBN: 978-8121924252.
2. Thyristors: Theory and Applications Sugandhi R. K. and Sugandhi K. K. NewAge International Publishers, New Delhi, 2009, ISBN:978-0852268520.
3. Power Electronics and its Applications Jain Alok Penram International PublishingMumbai, 2006; ISBN: 978-8187972228.
4. Power Electronics Circuits Devices and Applications Rashid , Muhammad H.Pearson Education India, Noida, 2014; ISBN: 978-0133125900.
5. Power Electronics Singh, M. D. and Khanchandani, K.B. McGraw Hill PublishingCo. Ltd, New Delhi, 2008 ISBN: 978-0070583894.
6. Power Electronics Bimbhra P.S. Khanna Publication New Delhi,2008 ISBN-13:978-8174092793

REFERENCES

1. Sira -Ramirez, R.Silva Ortigoza, “Control Design Techniques in PowerElectronics Devices”, Springer, 2006.
2. Siew-Chong Tan, Yuk-Ming Lai, Chi Kong Tse, “Sliding mode control ofswitching Power Converters”, CRC Press, 2011.
3. Erickson, Robert W., and Dragan Maksimovic, “Fundamentals of powerelectronics”, Springer Science & Business Media, 2nd Edition, 2007.

List of Experiments:

1. Volt- Ampere characteristics of an SCR/MOSFET/IGBT
2. Verification of Single Phase Full controlled converter with R, RL&RLELoad (for firing angles 30,60,90) with/without FD
3. Experimental verification of DC-DC BOOST CONVERTER AND DC-DCBUCK CONVERTER with different loads.
4. Experimental Verification of Open-loop and closed-loop & speed control ofPMSM motor.
5. Analysis of SoC & DoD (Depth of Discharge) for various types of Batteries

U19EETL512T COMMUNICATION ENGINEERING L T P C
3 0 0 3

Course Objectives:

1. To equip students with the knowledge of Analog and digital communication engineering fundamentals.
2. To teach the students various communication systems and its analysis & applications
3. To provide basic understanding of appropriate tools and technologies to develop communication-engineering solutions.

OUTCOMES:

- Apply Analog and digital communication techniques.
- Use data and pulse communication techniques.
- Analyse Source and Error control coding.
- To study the various analog and digital modulation techniques
- To study the various digital communication techniques
- To introduce the relevance of this course to the existing technology through contributions of scientist, national/international policies with a socio-economic impact and issues

UNIT I INTRODUCTION TO COMMUNICATION SYSTEM 9

Communication systems: Introduction, need, importance, elements, block diagram and role of each block, types, frequency ranges, Amplitude Modulation – AM, DSBSC, SSBSC, VSB – PSD, modulators and demodulators – Angle modulation – PM and FM – PSD, modulators and demodulators – Super heterodyne receivers

UNIT II PULSE MODULATION 9

Low pass sampling theorem – Quantization – PAM – Line coding – PCM, DPCM, DM, and ADPCM And ADM, Channel Vocoder - Time Division Multiplexing, Frequency Division Multiplexing, Internal noise – external noise – noise voltage – signal-to-noise ratio– noise figure – noise temperature– noise in CW modulation systems.

UNIT III DIGITAL MODULATION AND TRANSMISSION 9

Phase shift keying – BPSK, DPSK, QPSK – Principles of M-ary signaling M-ary PSK & QAM – Comparison, ISI – Pulse shaping – Duo binary encoding – Cosine filters – Eye pattern, equalizers. Amplitude shift keying – frequency shift keying – phase shift keying – advantages and disadvantages of digital communication systems.

UNIT IV SPREAD SPECTRUM AND MULTIPLE ACCESS 9

PN sequences – properties – m-sequence – DSSS – Processing gain, Jamming – FHSS –Synchronisation and tracking – Multiple Access – FDMA, TDMA, CDMA. Channel assignment strategies – interference and system capacity – spread spectrum modulation – direct sequence spread spectrum – Frequency hop spread spectrum – code division multiplexing – OFDM for wireless communication – Broadband integrated services network.

UNIT V SATELLITE COMUNICATION 9

Fundamental of Satellite Communication - frequency allocation - Indian Satellite systems - Power supply units - Station keeping - Thermal control, TT&C Subsystem, transponders, antenna subsystem - SPACE LINK: Introduction, EIRP, transmission losses, link power budget Equation, system noise, CNR, uplink and downlink, combined CNR - receive only home TV system, outdoor unit, indoor unit, MATV, CATV, Tx–Rx earth station.

Total: 45 Hours

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	1	2	3	3	3	3	3	-	-	3	3
CO2	-	-	-	-	-	2	3	3	3	3	3	3	-	-	3	2
CO3	-	-	-	-	-	2	2	2	1	2	3	1	-	-	1	3
CO4	-	-	-	-	-	2	2	3	3	3	3	3	-	-	3	3
CO5	-	-	-	-	-	2	2	3	3	3	1	3	-	-	3	3
CO6	-	-	-	-	-	2	2	3	3	3	3	3	-	-	3	3

TEXT BOOKS:

1.H Taub, D L Schilling, G Saha, “Principles of Communication Systems” 3/e, TMH 2007.
2. S. Haykin “Digital Communications” John Wiley 2005

REFERENCES:

1. B.P.Lathi, “Modern Digital and Analog Communication Systems”, 3rd edition, Oxford University Press, 2007
2. H P Hsu, Schaum Outline Series – “Analog and Digital Communications” TMH 2006
3. B.Sklar, Digital Communications Fundamentals and Applications” 2/e Pearson Education 2007.

U19EETL513 T PRINCIPLES OF DIGITAL SIGNAL PROCESSING L T P C
3 0 0 3

OBJECTIVES:

- To impart knowledge about the following topics:
- Signals and systems & their mathematical representation.
- Discrete time systems.
- Transformation techniques & their computation.
- Filters and their design for digital implementation.
- Programmability digital signal processor & quantization effects.

UNIT I INTRODUCTION 12

Classification of systems: Continuous, discrete, linear, causal, stability, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect.

UNIT II DISCRETE TIME SYSTEM ANALYSIS 12

Z-transform and its properties, inverse z-transforms; difference equation – Solution by ztransform, application to discrete systems – Stability analysis, frequency response – Convolution – Discrete Time Fourier transform , magnitude and phase representation.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION 12

Discrete Fourier Transform- properties, magnitude and phase representation –Computation of DFT using FFT algorithm – DIT &DIF using radix 2 FFT – Butterfly structure.

UNIT IV DESIGN OF DIGITAL FILTERS 12

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. Analog filter design – Butterworth and Chebyshev approximations; IIR Filters, digital design using impulse invariant and bilinear transformation Warping, pre warping.

UNIT V DIGITAL SIGNAL PROCESSORS 12

Introduction – Architecture – Features – Addressing Formats – Functional modes – Introduction to Commercial DS Processors.

Total: 60 Hours

OUTCOMES:

1. Ability to understand the importance of Fourier transform, digital filters and DS Processors.
2. Ability to acquire knowledge on Signals and systems & their mathematical representation.
3. Ability to understand and analyze the discrete time systems.
4. Ability to analyze the transformation techniques & their computation.
5. Ability to understand the types of filters and their design for digital implementation.
6. Ability to acquire knowledge on programmability digital signal processor & quantization effects

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	-	-	-	-	-	-	2	2	3	3	2	2
CO2	3	1	2	3	-	-	-	-	-	-	2	2	3	3	2	2
CO3	2	3	1	2	-	-	-	-	-	-	2	2	3	3	2	2
CO4	3	3	1	2	-	-	-	-	-	-	1	3	3	3	2	2
CO5	3	3	1	2	-	-	-	-	-	-	1	3	1	2	1	3
CO6	3	3	1	2	-	-	-	-	-	-	1	3	1	2	1	3

TEXT BOOKS:

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, PHI. 2003.
2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', McGraw Hill Edu, 2013.
3. Lonnie C.Ludeman ,"Fundamentals of Digital Signal Processing",Wiley,2013

REFERENCES

1. Poorna Chandra S, Sasikala. B ,Digital Signal Processing, Vijay Nicole/TMH,2013.
2. Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using Matlab",Cengage Learning,2014.
3. B.P.Lathi, 'Principles of Signal Processing and Linear Systems', Oxford University Press, 2010 3. Taan S. ElAli, 'Discrete Systems and Digital Signal Processing with Mat Lab', CRC Press, 2009.
4. SenM.kuo, woonseng…s.gan, "Digital Signal Processors, Architecture, Implementations & Applications, Pearson,2013
5. DimitrisG.Manolakis, Vinay K. Ingle, applied Digital Signal Processing,Cambridge,2012

U19CCLC503 CAREER ENHANCEMENT PROGRAM – IIICOURSE

L	T	P	C
0	0	2	1

OBJECTIVES

- To enable students to learn to interpret given information correctly, determine which mathematical model best describes the data, and apply the model correctly.
- To improve students' analytical and data interpretation skills.
- To enable students to improve their overall communicative competence which in-turn will contribute towards uniqueness of a student in the crowd.
- To develop the reading skills of the learners for understanding discrete queries in
- competitive exams
- To guide the learners in writing preferable technical Reports, Project and Proposal writing and also to build foundation for a structured content.
- To improve the critical and analytical thinking skills of the learners

PRE-REQUISITES: Career Enhancement Program - II

THEORY COMPONENT CONTENTS

UNIT I **9**

VEDIC MATHEMATICS AND SUDOKU -Addition- Subtraction- System ofMultiplication- Squaring numbers- Cube roots – Square roots - Logic- based Sudoku

LAB - Reading comprehension – Strategies for effective reading – Read and recognize differenttext types - Reading for main ideas - Making inference from the text – Identifying purpose –Synthesis Information- Identifying the Theme - Title formation- Parallelism –Rules – Exercise

UNIT II **9**

NUMBER SYSTEM – LCM & HCF – SIMPLIFICATION – SURDS & INDICES – CYCLICITY-EQUATIONS - Classification on Numbers -Power cycles and remainders - Concept of highest common factor - concept of least common multiple - Divisibility Rule - Number of zeros in an expression - Problems on Surds and Indices - Concept of Unit digit - Simultaneous equations- Quadratic equations – In equation

LAB - Paragraph writing – Structure of the paragraph - Cohesion - Coherence - Types of Paragraph: Expository, Narrative and Argumentative – Linkers – Types – Applications – Para jumbles – Intro - Rules and Strategies to solve Para Jumble questions – Practice Exercise.

UNIT III **9**

FUNDAMENTALS OF ALGEBRA - AVERAGES - Variables - Algebraic expressions - Substitution & evaluating expressions - Writing algebraic expressions- Combining like terms

- Algebraic expressions Nested fractions - Introduction - average of different groups - addition or removal of items and change in average replacement of some of the items

LAB - Email writing - Email etiquettes – Elements of good essay - Types of Essay: Issue based, Analytical, Argumentative and Expository – Phrases – Useful Phrases – Exercise – Modifiers - Definition & Explanation – Types of Modifiers (Dangling & Misplaced) – Practice Exercise

UNIT IV **9**

PERCENTAGES – RATIOS AND PROPORTION - Utility of percentage - importance of base/denominator for percentage calculations - concept of percentage values through additions - fraction to percentage conversion table-Introduction- Ratio- properties-dividing a given number in the given ratio - comparison of ratios - proportions - relation among the quantities more than two – variation

LAB - Resume and cover letter – Types – Practical Exercise - Visumes - Letter of recommendation - Format of writing, useful phrases – Applications - Practice Exercise- Statement of Purpose - Intro - Purpose of writing - Format- Useful phrases – Practice

UNIT V **9**

ARTNERSHIP - MIXTURES AND ALLEGATIONS - PROBLEM ON AGES - Definition - Alligation rule - mean value (cost price) of the mixture - Problems on ages and Problems related toratios

LAB - Scientific / Technical Reports – Useful phrases for report writing – Structure of reportwriting - Writing a proposal - Structure of proposal writing – Exercise – Critical Reasoning – Intro– Elements – Statement and Conclusion – Exercise

Total: 45 Hours

COURSE CODE	COURSE OUTCOME
CO1 :	Ability to to study advanced engineering developments
CO2 :	Ability to prepare and present technical reports
CO3 :	Encouraging the students to use various teaching aids such as presentation and demonstrative models
CO4 :	Ability to review, prepare and present technological developments
CO5 :	Ability to face the placement interviews
CO6:	Students can enhance their career through group discussions

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	-	1	2	-	-	3	3	3	2	2	3	2	1	1
CO2	3	2	-	1	2	-	-	3	3	3	2	2	3	2	1	1
CO3	3	1	-	1	2	-	-	3	3	3	2	2	3	2	1	1
CO4	3	1	-	1	2	-	-	1	2	1	2	1	3	2	2	1
CO5	3	1	-	2	1	-	-	3	3	3	1	1	2	1	1	3
CO6	3	1	-	1	1	-	-	3	3	3	1	1	2	1	1	3

TEXT BOOKS

T1. Arihant Publications," Quantitative Aptitude Quantam CAT ", Sarvesh Kumar Verma

T2. Aggarwal, R.S. "Quantitative Aptitude", Revised Edition 2016, Reprint 2018, S.Chand& CoLtd., New Delhi.

T3. Pearson Publication, "A Complete Manual for the CAT", 2018

T4. Sowton, Chris. Unlock: Reading and Writing 4. Cambridge University Press: Delhi, 2015.

T5. Sudharshana, N. P and C Savitha. English for Technical Communication. Cambridge University Press: UK, 2017

REFERENCE BOOKS

R1. Dhaval Bathia, Vedic Mathematics, JAICO Publishing House, 29th Edition, Mumbai, 2014

R2. Arun Sharma "How to Prepare for Quantitative Aptitude for the CAT " , McGraw Hill Education;Eighth edition 2018

R3. Arun Sharma "How to Prepare for Logical Reasoning for the CAT " , McGraw Hill Education;Eighth edition 2018

R4. Daise, Debra and Charl Norloff. Q: Skills for Success Reading and Writing. Oxford Press: USA,2019.

R5. O'Neill, Richard. Unlock: Reading and Writing 2. Cambridge University Press: Delhi, 2015.

R6. Westbrook, Carolyn. Unlock: Reading and Writing 3. Cambridge University Press: Delhi, 2015.

WEB RESOURCES

W1. https://www.indiabix.com/aptitude/questions-and-answers/

W2. https://testbook.com/aptitude-practice/

W3. http://www.allindiaexams.in/online-test/online-aptitude-test/all

U19EETL614T **PROTECTION AND SWITCH GEAR** **L T P C**
2 0 0 2

OBJECTIVES:

- To teach the principles and need for protection schemes by different fault current calculations
- To teach the basic principles, construction and characteristics of different Electromagnetic relays
- To learn to protect different power equipments like transformer, generator etc.,
- To teach different aspects of static relays and numerical protection schemes
- To learn the principles, construction and problems associated with different types of circuit breaker

UNIT I PROTECTION SCHEMES **6**

Principles and need for protective schemes – nature and causes of faults – types of faults– fault current calculation — Zones of protection and essential qualities of protection. Methods of Neutral grounding.

UNIT II ELECTROMAGNETIC RELAYS **9**

Operating principles of relays - Torque equation – R-X diagram – Electromagnetic Relays – Over current, Directional, Distance, Differential, Negative sequence and Under frequency relays.

UNIT III APPARATUS PROTECTION **9**

Application of Current transformers and Potential transformers in protection schemes – Protection of transformer, generator, motor, bus bars and transmission line.

UNIT IV STATIC RELAYS AND NUMERICAL PROTECTIO **9**

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Block diagram of Numerical relays – Over current protection, transformer differential protection, distant protection of transmission lines.

UNIT V CIRCUIT BREAKERS **12**

Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - current chopping - interruption of capacitive current - resistance switching- Types of circuit breakers – air, oil, SF6 and vacuum circuit breakers – comparison of different circuit breakers – Rating and selection of Circuit breakers.

TOTAL: 45 PERIODS

OUTCOMES:

CO1 Ability to analyse different types of faults and their effects on the power system and understand the practical significance of protection zones

CO2 Understanding the basic principles, construction and characteristics of different Electromagnetic relays

CO3 Ability to protect different power equipments like transformer, generator etc., against various electrical faults

CO4 Understanding different aspects of static relays and numerical protection schemes

CO5 Able to understand the principles, construction, selection and problems associated with different types of circuit breaker

CO6: Ability to acquire knowledge on functioning of circuit breaker

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	2	1	-	-	-	-	1	1	3	2	2	2
CO2	3	3	3	2	2	1	-	-	-	-	1	1	3	2	2	2
CO3	1	3	3	2	1	2	-	-	-	-	2	3	1	2	2	2
CO4	3	2	1	1	1	1	-	-	-	-	1	3	1	1	1	3
CO5	3	3	3	1	1	1	-	-	-	-	1	3	1	1	1	3
CO6	3	3	3	1	1	1	-	-	-	-	1	3	1	1	1	3

TEXT BOOKS:

1. Sunil S.Rao, Switchgear and Protection, Khanna publishers, New Delhi, 2008. Switchgear Protection and Power Systems (Theory, Practice & Solved Problems)

2. Y.G.Paithankar and S.R.Bhide, Fundamentals of power system protection, Second Edition, Prentice Hallof India Pvt. Ltd., New Delhi – 2010

REFERENCES:

1. BadriRam ,B.H.Vishwakarma, Power System Protection and Switchgear, New Age International Pvt Ltd Publishers, Second Edition 2011.

2. B.Rabindranath and N.Chander, Power System Protection and Switchgear, New Age International (P) Ltd., First Edition 2011.

3. M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarti, A Text Book on Power System Engineering, Dhanpat Rai & Co., 1998.

4. C.L.Wadhwa, Electrical Power Systems, 6th Edition, New Age International (P) Ltd., 2010.

5. RavindraP.Singh, " Switchgear and Power System Protection " PHI Learning Private Ltd., New Delhi 2009.

U19EETL615T	SOLID STATE DRIVES	L	T	P	C
		2	0	0	2

Course Objective

- Steady state operation and transient dynamics of a motor load system.
- Analyse the operation of the converter/chopper fed dc drive, both qualitatively and quantitatively.
- Operation and performance of AC motor drives.
- Analyse and design the current and speed controllers for a closed loop solid state DCmotor drive.
- To gain experimental knowledge about hardware implementation

UNIT I CLASSIFICATION OF ELECTRIC DRIVES 9

Electric Drives -Selection of motor power rating-Thermal model of motor for heating and cooling-Classes of duty cycle- Determination of motor rating-Drive classifications – Closed loop control of electric drives -Modes of operation - Speed control

UNIT II SOLID STATE CONTROL OF DC DRIVES 9

DC Motor Drives - DC motors and their performance, Braking, Transient Analysis-Separately excited motor with armature and field control-Ward Leonard drives -Transformer and uncontrolled rectifier control-Controlled rectifier fed DC drives-Chopper controlled DC drives – Single, two and four quadrant operations.

UNIT III SOLID STATE CONTROL OF INDUCTION MOTORDRIVE 9

Induction motor drives -Stator control, Stator voltage and frequency control -AC chopper fed induction motor drives -Voltage source inverter- current source inverter - Z – source inverter fed induction motor drive -Cyclo-converter fed induction motor drives-Rotor control -Static rotorresistance control and slip power recovery schemes matrix from element stiffness

UNIT IV SOLID STATE CONTROL OF SYNCHRONOUSMOTOR DRIVE 9

Synchronous motor drives-Speed control of three-phase synchronous motor drives-Voltage source inverter and current source inverter fed synchronous motor drive-Z - source inverter fed synchronous motor drive-Cyclo-converter fed synchronous motor drive

UNIT V DIGITAL CONTROL OF DRIVES AND ITS APPLICATIONS 9

Digital technique in speed control-Advantages and Limitations-Microprocessor based control of drives-Solar powered pump drives-Selection of drives and control schemes for paper mills-Selection of drives for lifts and cranes.

Total: 45 Hours

Course Outcomes

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

- Ability to understand and suggest a converter for solid state drive.
- Ability to select suitability drive for the given application.
- Ability to study about the steady state operation and transient dynamics of a motorload system.
- Ability to analyse the operation of the converter/chopper fed dc drive.
- Ability to analyse the operation and performance of AC motor drives.
- Ability to analyse and design the current and speed controllers for a closed loop solidstate DC motor drive.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	2	2	-	-	-	2	-	1	2	3	3	1	2
CO2	3	3	1	2	2	-	-	-	2	-	1	2	3	3	1	2
CO3	1	3	1	2	3	-	-	-	2	-	1	2	3	3	1	2
CO4	3	2	1	1	2	-	-	-	1	-	3	1	1	2	1	2
CO5	3	3	3	2	2	-	-	-	2	-	1	2	3	3	1	3
CO6	3	3	1	2	2	-	-	-	2	-	1	2	3	3	1	2

TEXT BOOKS

[1]G.K. Dubey, “Fundamentals of Electrical Drives”, Narosa Publishing House Pvt. Ltd., 2nd Edition, 2010
[2]Pillai.S.K., “A First Course on Electrical Drives”, New Age International (P) Ltd., 2nd Edition, 2015

REFERENCES

[1] Vedam Subramanyam, “Thyristor control of Electrical Drives”, Mc Graw Hill Education(India) Pvt.Ltd., 3rd Edition, 2015.
[2] BimalK.Bose “Modern Power Electronics and AC Drives”, Prentice Hall of India, 2nd Edition, 2010
[3] Theodore Wildi, “Electrical Machines, Drives and power systems ,6th edition, Pearson Education ,2015

U19EETH701 POWER SYSTEM OPERTAION AND CONTROL **L T P C**
4 0 0 4

COURSE OBJECTIVES

- To impart knowledge on the significance of power system operation and control.
- Real power and Reactive power interaction and design of power-frequency controller and maintaining the voltage profile
- To study the economic operation of power system.
- To teach about SCADA and its application for real time operation and control of power systems.
- Overview of electrical energy utilisation and conservation

UNITI INTRODUCTION **9**

An overview of power system operation and control - Power scenario in Indian grid – National and Regional load dispatching centers - necessity of voltage and frequency regulation - real power vs frequency and reactive power vs voltage control loops load curves and load-duration curve - load factor - diversity factor - Load forecasting – Load dispatching - plant level and system level controls

UNIT II REAL AND REACTIVE POWER CONTROL **9**

Real Power Control

Load Frequency Control (LFC) of single area system- LFC of two area system - tie line modeling - block diagram representation of two area system - static and dynamic analysis - tie line with frequency bias control.

Reactive Power Control

Generation and absorption of reactive power - basics of reactive power control – Automatic Voltage Regulator (AVR) – brushless AC excitation system – block diagram representation of AVR loop - static and dynamic analysis – stability compensation - methods of reactive power injection - tap changing transformer, SVC (TCR + TSC) and STATCOM for voltage control

UNIT III ECONOMIC OPERATION OF POWER SYSTEM **9**

Statement of economic dispatch problem - input and output characteristics of thermal plant - incremental cost curve - optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) - base point and participation factors method - statement of unit commitment (UC) problem - constraints on UC problem - solution of UC problem using priority list – special aspects of short term and long term hydrothermal problems.

UNIT IV COMPUTER CONTROL OF POWER SYSTEM **9**

Need of computer control of power systems-concept of energy control centers and functions - PMU - system monitoring, data acquisition and controls - System hardware configurations SCADA and EMS functions - state estimation problem – measurements and errors - weighted least square estimation - various operating states - state transition diagram

UNIT V OVERVIEW OF ENERGY UTILISATION AND CONSERVATION **9**

Types of lamps –Domestic refrigerator and water coolers - Air-Conditioning-Various types of air-conditioning system and their applications – Online and OFF line UPS – Induction heating – dielectric heating – electric arc furnaces – requirements of electric traction system – mechanics of train movement – traction motors and control.

Total: 45 Hours

OUTCOMES:

- Ability to understand the day-to-day operation of electric power system.
- Ability to acquire knowledge on real power-frequency and reactive power-voltage interaction.
- Ability to understand the economic operation of power system
- Ability to design SCADA and its application for real time operation.
- Ability to understand about the electric energy utilization and conservation

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	1	1	1	-	-	-	1	2	3	3	2	2
CO2	3	3	-	3	1	1	1	-	-	-	1	2	3	3	2	2
CO3	3	3	-	3	1	1	1	-	-	-	1	2	3	3	2	2
CO4	2	1	-	2	2	3	1	-	-	-	1	2	3	2	1	1
CO5	3	3	-	2	2	1	3	-	-	-	3	1	2	2	1	1
CO6	3	3	-	2	2	1	1	-	-	-	1	1	2	2	1	1

TEXT BOOKS:

1. Olle.I.Elgerd, 'Electric Energy Systems theory - An introduction', McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint,2010.
2. Allen. J. Wood and Bruce F. Wollen berg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc.,2016.
3. Abhijit Chakrabarti and Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition,2010.
4. Wadhwa, C.L. "Generation, Distribution and Utilization of Electrical Energy", New Age International Pvt. Ltd,2003

REFERENCES

1. Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw-Hill Education, Second Edition,2008.
2. Hadi Saadat, 'Power System Analysis', McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint,2010.
3. Kundur P., 'Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint,2010.

U19EETL716T **INDUSTRIAL EMBEDDED SYSTEM** **LT P C**
3 0 0 3

COURSE OBJECTIVES

- To Understand acquire knowledge in Microprocessor 8086and microcontroller 8051
- To impart the knowledge on the significance of PIC Microcontroller.
- To apply the Knowledge on Fundamentals of PIC Communication Protocol.
- To impart the knowledge on the significance of Arm Microcontrollers
- To apply the Knowledge on Fundamentals of ARM Communication Protocol.

UNIT I: INTRODUCTION 9

Microprocessor - Microcontroller - Difference of microprocessor and microcontroller - CISC Vs RISC design philosophy, Von-Neumann vs Harvard architecture.8-bit and 16-bit microcontroller. Architecture of microcontroller. I/O ports, stack and use of stack pointer, priority. Memory structure, Data Memory, Program Memory and execution of programs, different registers (SFR's), addressing modes, timing diagram.

UNIT II PIC MICROCONTROLLERS - PIC16F887 9

PIC16F887: Introduction to PIC microcontrollers -Advantage of PIC micro controllers – Types and products of PIC

UNIT III PERIPHERAL INTERFACES AND PROTOCOLS - PIC16F887 9

I/O Programming, interfacing with simple switches, LCD. Keypad, Interrupts, operations of timers, ADC, EEPROM. Communication Protocols-UART,I2C,SPI, GSM Module, Bluetooth, RFID,RF Tx,Rx, GPS Modules.PWM –Stepper and Servomotor.

UNIT IV ARM MICROCONTROLLERS - STM32F103 9

STM32F103: Introduction to ARM Microcontroller - Power supply – Program Memory – Data Memory – Clock Circuit – Reset Circuit – Programming Tool Chain – KEIL IDE - Simulation using Proteus – List of ARM Peripherals – Pin Configuration

UNIT V PERIPHERAL INTERFACES AND PROTOCOLS - STM32F103 9

Embedded C programming – Accessing of Digital Inputs and Outputs – ADC Programming – LED Motor, Switches, Sensors, LCD, Keypad, Programming of interrupts, Timer and their applications, ADC EEPROM Communication Protocols-UART Communication,I2C,SPI,GSM Module, Bluetooth,RFID,RF Tx,Rx,GPS Modules.PWM –Stepper and Servomotor.

Total : 45 Hours

OUTCOMES:

- Ability to acquire knowledge in Microprocessor8086 & Microcontroller 8051
- Ability to understand the basic concept of PIC Microcontroller
- Ability to acquire knowledge in PIC Interfacing Protocol.
- Ability to understand the basic concept of ARM Microcontroller
- Ability to acquire knowledge in ARM Interfacing Protocol
- Ability to acquire knowledge on Fundamentals of ARM Communication Protocol

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	2	-	-	-	-	-	2	2	3	3	2	2
CO2	3	3	1	3	2	-	-	-	-	-	2	2	3	3	2	2
CO3	1	2	1	2	1	-	-	-	-	-	2	1	3	3	2	2
CO4	3	3	3	2	1	-	-	-	-	-	3	1	2	2	1	1
CO5	3	3	1	2	1	-	-	-	-	-	3	1	2	2	1	1
CO6	3	3	1	2	1	-	-	-	-	-	3	1	2	2	1	1

TEXT BOOKS:

1. The 8051 Microcontroller: A System Approach by Muhammad A. Mazidi, 1st Ed., PHI, 2012.
2. The AVR Microcontroller and Embedded Systems: A System Approach by Muhammad A. Mazidi, 1st Ed., PHI, 2013.
3. Peatman,J.B., “Design with PIC Micro Controllers”PearsonEducation,3rdEdition, 2004..
4. Furber,S., “ARM System on Chip Architecture” Addison Wesley trade Computer Publication, 2000.

REFERENCES

1. Arm System Developer's Guide: Designing and Optimizing System Software - Andrew N. Sloss, Elsevier Publication, 2005
2. Embedded System - Raj Kamal, 2nd Ed.,TATA McGraw Hill, 2009.
3. Embedded C Programming and the ATMEL AVR by R H Barnett 2nd Ed., Cengage Learning Publication, 2006
4. Designing Embedded System with PIC microcontroller, Tim Wilmshurst, 2nd Ed., Newnes Publication, 2009
5. Mazidi, M.A.,“PIC Microcontroller” Rollin Mckinlay, Danny causey ,Prentice Hall of India, 2007

*Texas Instruments MSP 430 microcontroller, Guide and Datasheet

U19EETH802	HIGH VOLTAGE ENGINEERING	L	T	P	C
		4	0	0	4

OBJECTIVES:

To impart knowledge on the following Topics

- Various types of over voltages in power system and protection methods.
- Generation of over voltages in laboratories.
- Measurement of over voltages.
- Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- Testing of power apparatus and insulation coordination

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages, Corona and its effects — Bewley lattice diagram- Protection against over voltages.

UNIT II DIELECTRIC BREAKDOWN 9

Properties of Dielectric materials - Gaseous breakdown in uniform and non-uniform fields – Corona discharges — Vacuum breakdown — Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality — Breakdown mechanisms in solid and composite dielectrics- Applications of insulating materials in electrical equipments.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9

Generation of High DC voltage: Rectifiers, voltage multipliers, vandigraff generator: generation of high impulse voltage: single and multistage Marx circuits – generation of high AC voltages: cascaded transformers, resonant transformer and tesla coil- generation of switching surges — generation of impulse currents - Triggering and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9

High Resistance with series ammeter — Dividers, Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters — Sphere Gaps - High current shunts- Digital techniques in high voltage measurement.

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION 9

High voltage testing of electrical power apparatus as per International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers- Insulation Coordination& testing of cabilitys.

Total: 45 Hours

OUTCOMES:

- Ability to understand Transients in power system.
- Ability to understand Generation and measurement of high voltage.
- Ability to understand High voltage testing.
- Ability to understand various types of over voltages in power system.
- Ability to measure over voltages.
- Ability to test power apparatus and insulation coordination

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	1	2	1	-	-	-	1	2	3	2	2	3
CO2	3	3	2	3	1	2	1	-	-	-	1	2	3	2	2	3
CO3	3	3	2	3	1	2	1	-	-	-	1	2	2	1	3	2
CO4	2	1	1	3	1	3	1	-	-	-	1	2	2	1	3	1
CO5	3	3	2	2	2	1	2	-	-	-	2	3	2	1	3	1
CO6	3	3	2	2	2	2	1	-	-	-	1	3	2	1	3	1

TEXT BOOKS:

1. S.Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, FifthEdition, 2013.
2. E. Kuffel and W.S. Zaengl, J.Kuffel, 'High voltage Engineering fundamentals',Newnes Second Edition Elsevier , New Delhi, 2005.
3. C.L. Wadhwa, 'High voltage Engineering', New Age International Publishers, ThirdEdition, 2010.

REFERENCES

1. L.L. Alston, 'High Voltage Technology', Oxford University Press, First Indian Edition,2011.
2. Mazen Abdel – Salam, Hussein Anis, Ahdab A-Morshedy, Roshday Radwan, High Voltage Engineering – Theory &Practice, Second Edition Marcel Dekker, Inc., 2010.
3. Subir Ray,' An Introduction to High Voltage Engineering' PHI Learning PrivateLimited, New Delhi, Second Edition, 2013.

		L	T	P	C
U19METH707	**PRINCIPLES OF MANAGEMENT AND PROFESSIONAL ETHICS**	3	0	0	3

COURSE OBJECTIVES

The course aims to provide the students

To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

PREREQUISITES : NIL

UNIT I MANAGEMENT CONCEPTS 9

Management – Definition – Importance – Functions – Skills required for managers - Roles and functions of managers – Science and Art of Management –Management and Administration-Evolution of Classical, Behavioural and Contemporary management thoughts

UNIT II PLANNING and ORGANISATION 9

Nature & Purpose – Steps involved in Planning – Forms of Planning – Types of plans – Plans at Individual, Department and Organization level - Managing by Objectives. Forecasting – Purpose – Steps and techniques. Decision-making – Steps in decision making-Nature and Purpose of Organizing - Types of Business Organization - Formal and informal organization – Organization Chart – Structure and Process – Strategies of Departmentation– Line and Staff authority –Benefits and Limitations. Centralization Vs De-Centralization and Delegation of Authority. Staffing – Manpower Planning –Recruitment – Selection – Placement – Induction.

UNIT III DIRECTING AND CONTROLLING 9

Nature & Purpose – Manager Vs. Leader - Motivation - Theories and Techniques of Motivation. Leadership – Styles and theories of Leadership. Communication – Process – Types – Barriers – Improving effectiveness in Communication. Controlling – Nature – Significance – Tools and Techniques- Corporate Governance Social responsibilities – Ethics in business – Recent issues. American approach to Management, Japanese approach to Management, Chinese approach to Management and Indian approach to Management

UNIT IV HUMAN VALUES AND ENGINEERING ETHICS 8

Definition, Moral issues, Human values -Types of inquiry- Morality and issues of morality- Kohlberg and Gilligan's theories-consensus and controversy- Professional and professionalism-moral reasoning and ethical theories-virtues, professional responsibility, integrity, self-respect, duty ethics, ethical rights,
self-interest, moral obligations-Engineering as social experimentation- codes of ethics

UNIT V RIGHTS, RESPONSIBILITY OF ENGINEERS AND GLOBAL ISSUES 8

Safety and risk – assessment of safety and risk-Collegiality and loyalty – respect for authority – collective bargaining – confidentiality – conflicts of interest – occupational crime – professional rights – employee rights – Intellectual Property Rights (IPR) – discrimination - Multinational Corporations – Environmental ethics – computer ethics – weapons development- –Engineers as trend setters for global values.

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

1	(Understand) Explain the management concepts, evolution of management and contemporary management thoughts and issues
2	(Analyze) Analyze steps in planning, decision making and structure of organization
3	(Apply) Apply motivational theories and leadership qualities
4	(Apply) Apply human values in engineering ethics
5	(Understand) Explain safety, Rights and responsibilities of employee and employer
6	Learning the applications behind management in an organization

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	1	2	1	-	-	-	1	2	3	2	2	3
CO2	3	3	2	3	1	2	1	-	-	-	1	2	3	2	2	3
CO3	3	3	2	3	1	2	1	-	-	-	1	2	2	1	3	2
CO4	2	1	1	3	1	3	1	-	-	-	1	2	2	1	3	1
CO5	3	3	2	2	2	1	2	-	-	-	2	3	2	1	3	1
CO6	3	3	2	2	2	2	1	-	-	-	1	3	2	1	3	1

TEXT BOOKS:

T1: Tripathy PC And Reddy PN, “Principles of Management”, Tata McGraw-Hill, 9th Edition, 2018.

T2: Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2018.

REFERENCE BOOKS:

R1: Dinkar Pagare, “Principles of Management”, Sultan Chand & Sons, 2017.

R2: Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management”, 9th Edition, Pearson Education, 2017.

R3: Harold Koontz & Heinz Weihrich, “Essentials of Management – An International perspective”, 10th edition. Tata McGraw-Hill, 2019.

R4: Mike Martin and Roland Schinzinger, “Ethics in Engineering”. (2015) McGraw-Hill, New York

U19EEPE001	ADVANCED PROGRAMMABLE LOGIC CONTROLLER	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To know about the basics of PLC and Automation
2	To understand the importance of Automation
3	To explore various types and manufactures of PLCs.
4	To introduce types of programming languages of PLC and some exercise few programs.
5	To explore the various signal standards in PLC.
6	To understand the concept of digitalization embedded with PLC.

PRE-REQUISITES

Basic Programmable Logic Controller

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION **9**

Programmable Logic Controller (PLC)- Block diagram of PLC- Programming languages of PLCBasicinstruction sets- Design of alarm and interlocks- Networking of PLC- Overview of safety ofPLC with case studies- Process Safety Automation: Levels of process safety through use ofPLCs- IEC 61131-3 Standard - Application of international standards in process safety control.

UNIT II IEC 61131-3 **9**

Rails- Rungs- Relay Logic- Latch switch- Timers- Counters- Boolean logics- Math Instructions-Data manipulation Instructions- Requirement of communication networks for PLC, PLC to PCCommunication to computer- FBD equivalent to LL- FBD Programming- IL-SFC-ST.

UNIT III SCADA **9**

Elements of SCADA system- History of SCADA, Remote Terminal Unit- Discrete control-Analogcontrol, Master Terminal Unit- Operator interface.

UNIT IV HART and FIELD BUS **9**

Introduction- Evolution of signal standards- HART communication protocol-communicationmodes- HART networks- HART commands- HART and OSI model- Field bus- Architecture-Basic requirements of field Busstandard- Field bus Topology-

Interoperability- Interchangeability.

UNIT V PLC PROGRAMMING 9

Exercise in Programming Languages from IEC 61131-3: Traffic Light Control- Two way- Fourways – Water Level Control- Automatic Material Sorting System- Automatic Bottle Filling System Code Converters- DC motor Control- Alarm Circuit.

Total: 45 Hours

TEXT BOOKS:

T1 Frank D. Petruzella, "Programmable Logic Controllers", 5th Edition, McGraw- Hill, New York, 2019.

T2 Stuart Boyer A, "SCADA: Supervisory control and data Acquisition", Fourth Edition, ISA- The Instrumentation, Systems, and Automation Society,2010.

REFERENCE BOOKS:

R1 Bolton. W, "Programmble Logic Controllers", Elsevier Newnes, 6th Edition 2015.

COURSE OUTCOMES:

CO1: Understand the basics and need for Automation in industries.

CO2: Explain the logic and flow of any particular programming written for a process.

CO3: Apply the knowledge to design or improve an existing program to increase productivity of anyprocess.

CO4: Break down SCADA architecture and communication protocols.

CO5: Build and logic in any of the programming languages from IEC- 61131- 3 standard

CO6: Exercise in Programming Languages from IEC 61131-3: can be implemented

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1	2	-	-	-	1	-	1	1	2	1	2	2
CO2	3	3	2	1	2	-	-	-	1	-	1	1	2	1	2	2
CO3	2	1	3	3	2	-	-	-	1	-	1	3	1	1	2	2
CO4	1	3	2	3	2	-	-	-	2	-	1	1	2	1	3	3
CO5	3	3	2	3	2	-	-	-	1	-	1	1	2	1	2	3
CO6	3	3	2	3	1	-	-	-	1	-	1	1	2	1	2	2

U19ECPE002	DESIGN OF EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To provide knowledge on the basics, building blocks of Embedded System.
2	To discuss Input/output Interfacing & Bus Communication with processors.
3	To teach automation using scheduling algorithms and Real time operating system.
4	To discuss on different Phases & Modeling of a new embedded product.
5	To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills
6	To understand the recent design concept in embedded systems.

PRE-REQUISITES

Fundamentals coupled Microprocessor and Microcontroller

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Introduction to Embedded Systems –built in features for embedded Target Architecture - selection of Embedded processor – DMA- memory devices – Memory management methods-memory mapping, cache replacement policies- Timer and Counting devices, Watchdog Timer, Real Time Clock- Software Development tools-IDE, assembler, compiler, linker, simulator, debugger, In circuit emulator, Target Hardware Debugging- Overview of functional safety standards for embedded systems.

UNIT II EMBEDDED NETWORKING BY PROCESSORS 9

Embedded Networking: Introduction, I/O Device Ports & Buses- multiple interrupts and interrupt service mechanism – Serial Bus communication protocols -RS232 standard–RS485–USB–Inter Integrated Circuits (I2C)- CAN Bus –Wireless protocol based on Wifi , Bluetooth, Zigbee – Introduction to Device Drivers.

UNIT III RTOS BASED EMBEDDED SYSTEM DESIGN 9

Introduction to basic concepts of RTOS- Need, Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication- context switching, interrupt latency and deadline shared memory, message passing-, Interprocess Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time

Operating systems: VxWorks, uC/OS-II, RT Linux.

UNIT IV MODELLING WITH HARDWARE/SOFTWARE DESIGN APPROACHE **9**

Modelling embedded systems- embedded software development approach --Overview of UML modeling with UML, UML Diagrams-- Hardware/Software Partitioning, Co-Design Approaches for System Specification and modeling- Co Synthesis- features comparing Single-processor Architectures & Multi-Processor Architectures--design approach on parallelism in uniprocessors & Multiprocessors.

UNIT V EMBEDDED SYSTEM APPLICATION DEVELOPMENT **9**

Objective, Need, different Phases & Modelling of the EDLC, choice of Target Architectures for Embedded Application Development-for Control Dominated-Data Dominated Systems-Case studies on Digital Camera, Adaptive Cruise control in a Car, Mobile Phone software for key inputs.

Total: 45 Hours

TEXT BOOKS:

T1 PIC Microcontroller and Embedded Systems: Using assembly and C for PIC 18 Pearson Education India; 1st edition (1 January 2008)

T2 Designing Embedded Systems with PIC Microcontrollers: Principles and Applications Newnes (an imprint of Butterworth-Heinemann Ltd); 1st edition (24 October 2006)

REFERENCE BOOKS:

R1 Embedded Systems Design: An Introduction to Processes, Tools, and Techniques (UK PROFESSIONAL COMPUTING Computing) McGraw Hill / Europe, Middle East & Africa; 1st edition (16 December 2001).

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: To understand the functionalities of processor internal blocks, with their requirement.

CO2: Observe that Bus standards are chosen based on interface overheads without sacrificing processor performance

CO3: Understand the role and features of RT operating system, that makes multitask execution possible by processors.

CO4: Understand that using multiple CPU based on either hardcore or soft-core

helps data overhead management with processing- speed reduction for uC execution.

CO5: Guidelines for Embedded consumer product design based on phases of product development.

CO6: To understand the specific design concepts implemented in embedded design.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	2	2	-	-	-	-	-	3	2	3	3	3	3
CO2	3	3	2	2	2	-	-	-	-	-	3	2	3	3	3	2
CO3	3	3	2	2	2	-	-	-	-	-	3	2	3	2	3	3
CO4	1	3	1	1	1	-	-	-	-	-	3	1	2	3	2	2
CO5	3	1	2	2	2	-	-	-	-	-	3	2	3	3	3	3
CO6	3	3	2	2	2	-	-	-	-	-	3	2	2	2	2	3

U19ECPE003	PROGRAMMING PARADIGMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To understand regex and how to use it in java applications.
2	To equip the students with the advanced feature of contemporary java which will enable them to handle complex programs relating to managing data and processes over the network
3	To provide a sound foundation to the students on the concepts, precepts and practices, in a field that is of immense concern to the industry and business.
4	To provide the ability to design console based, GUI based and web based applications.
5	To understand integrated development environment to create, debug and run multi-tier and enterprise-level applications
6	To Design Enterprise based applications by encapsulating an application's business logic

PRE-REQUISITES

Basic Programming Languages like C,C++,etc.,

THEORY COMPONENT CONTENTS

UNIT I REGEX AND COLLECTIONS FRAMEWORK – I 9

Java Regex API - Understanding Regular Expressions - Matcher class - Methods of Matcher class - Pattern class - Methods of Pattern class – Understanding Pattern Syntax Exception – POSIX Standards – Basic Set and Extended Set

Java Arrays in depth – Collections Overview – Collections Framework – Collection Interface – Collection Vs Collections – Generics. List Interface – Implementation Classes. – Array List, Linked List, Vector and Stack. Cursors – Enumeration, Iterator, List Iterator, Spliterator. Iterators – Fail fast and Fail Safe. Set Interface and its implementation classes – Hash Set, Linked Hash Set, Sorted Set, Navigable Set, Tree Set.

UNIT II COLLECTIONS FRAMEWORK – II 9

Comparable and Comparator Interfaces-Sorting objects in collection – using comparable and Comparator interface. Comparable Vs Comparator.

Queue Interface and its implementation classes – Priority Queue. Map Interface and its implementations classes. Map Introduction, Hashing, HashMap – Internal Working, Hash map Vs HashTable, Linked HashMap, Identity HashMap, Weak HashMap, SortedMap, Navigable Map, Tree Map

Concurrent Collections – Need for concurrent collections, Concurrent Modification Exception, Concurrent HashMap Hierarchy and methods. Concurrent HashMap Internal Implementation – Copy On Write Array List – Copy On Write Array Set.

UNIT III JSP 9

Basics of JSP – Introduction, Life Cycle of JSP , Creating a JSP page - JSP Scripting Elements–Scriptlet Tag, Declaration Tag, Directive Tag, Expression tag. JSP implicit objects - JSP Directive Elements –Include directive and Taglib directive. JSP Exception Handling – JSP Standard Tag – JSP Action Element, JavaBean Component, JSP Expression Language – How EL is used ? , EL Implicit Objects. JSP – Jsp Standard Tag Library(JSTL) – Core, Formatting, sql, XML, functions. JSP Custom tags – format of custom tag, Creating a custom tag in JSP. JSP Pagination.

UNIT IV WEB APPLICATIONS AND SERVLETS 9

Web Applications – Server Side Programming, Web Protocols and Web Applications, Role of Web Servers, Java Servlets, Using Tomcat Web Server, Structure of a Java Servlet. Servlets Architecture – Servlet Architecture, Servlet and Http Servlet, Request and Response, Reading Request parameters, Producing a HTML response, Redirecting the web server, Deployment Descriptors, Servlets Life Cycle, Relationship to a container Interactive Web Applications – Building an HTML interface, HTML forms, Handling form inputs, Application Architecture, Single Servlet Model, Multiple Servlet Model, Routing Servlet Model, Template Parsers.

UNIT V DATABASE ACCESS - JDBC 9

JDBC - JDBC Drivers –Using JDBC in a Servlet, Data Access Objects, Threading Issues, Transactions, Connection Pooling. Configuration and Context: The need for configuration, Initialization Parameters, Properties Files, JNDI and Component Environment, JDBC data sources, Working with XML data. Steps to Connect to a Database – Driver Manager, Connection Interface, Statement Interface, Result set Interface, Prepared Statement Interface - connecting to mysql with JDBC – Connectivity with Access without DSN.

Total:60 Hours

TEXT BOOKS:

T1 Philip Wadler, Maurice Naftalin, ―Java Generics and Collections‖, O„ReillyMedia, Inc. 2006.

T2 Marty Hall and Larry Brown, ―Core Servlets and JavaServer Pages‖, Second Edition.

REFERENCE BOOKS:

R1 Herbert Schildt, ―Java The complete Referencell, Ninth Edition, Mcgraw Hill, 2016.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Use the type hierarchy in Collections Framework of Java and write code which uses iterators, either directly or indirectly using the enhanced for loop.

CO2: Use Comparator objects, and write code to implement their own Comparator objects

CO3: Understand and use Map types in Java.

CO4: Create a dynamic web application, using Servlet and JSP.

CO5: Understand the multi-tier architecture of web-based enterprise applications

CO6: Use JDBC statements to process JDBC Result Sets, M

LIST OF EXPERIMENTS

1. Write a Java program for implementing Matcher Class in string
2. Write a Java program using extended functions
3. Write a Java program mentioning the usage of Array list
4. Write a Java program involving collections.
5. Write a Java program involving hash map.
6. Write a Java program to implement comparator.
7. Write a Java program involving the usage servlets
8. Write a Java program create forms.
9. Write a Java program for managing JDBC Exceptions.
10. Write a Java program to implement hash set.

Total : 15 Hours

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													**CO/PSO Mapping**			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	2	2	-	-	-	-	-	3	2	3	3	3	3
CO2	3	3	2	2	2	-	-	-	-	-	3	2	3	3	3	2
CO3	3	3	2	2	2	-	-	-	-	-	3	2	3	2	3	3
CO4	1	3	1	1	1	-	-	-	-	-	3	1	2	3	2	2
CO5	3	1	2	2	2	-	-	-	-	-	3	2	3	3	3	3
CO6	3	3	2	2	2	-	-	-	-	-	3	2	2	2	2	3

U19ECPE005	SYNTHESIS and STA	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To Understand the basics of Synthesis
2	To know about Input and output of synthesis
3	To expose about various types of synthesis.
4	To learn about static timing analysis and timing exceptions in VLSI synthesis
5	To explore real time constraints in timing path.
6	To understand the recent development in synthesis and STA.

PRE-REQUISITES

VLSI

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION TO SYNTHESIS **9**

ASIC Design Methodology, Introduction to backend flow, introduction to synthesis, Basics of inputs and output of synthesis.

UNIT II INPUT AND OUTPUT OF SYNTHESIS **9**

Input synthesis – Library files, SDC(synopsis Design Constraints),RTL(Register Transfer Level).Output synthesis – Netlist, Area, power, timing report, Output constraints.

UNIT III TYPES OF SYNTHESIS **9**

Types of synthesis – logical synthesis and physical synthesis, command flow of synthesis.

UNIT IV STATIC TIMING ANALYSIS **9**

Introduction to static timing analysis, timing paths, timing slack calculations, constraint designing.

UNIT V TIMING PATH **9**

Timing paths – Register to Register, Register to Output, Input to Register, Input to Output, report analysis of timing paths, timing exceptions, time borrowing, data to data checks.

Total: 45 Hours

TEXT BOOKS:

T1 Static Timing Analysis for Nanometer Designs: A Practical Approach by J. Bhasker (Author), Rakesh Chadha (Author) Springer-Verlag New York Inc.; 2009th edition (8 September 2011).

T2 "Physical Design Essentials: An ASIC Design Implementation Perspective" by KhoshrowGolshan Springer; 2007th edition (4 May 2007).

REFERENCE BOOKS:

R1 Verilog HDL : A Guide to Digital Design and Synthesis by Samir Palnitter , Person Education.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Design of net list using synthesis

CO2: Understand about input of synthesis

CO3: Understand about output of synthesis

CO4: Understand about various types of Synthesis for proceeding towards back end flow.

CO5: Design of static timing for checking timing delays in the logic circuits.

CO6: Design of static timing path for various logic circuits

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													**CO/PSO Mapping**			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	2	3	2	-	-	-	-	2	2	3	2	3	2	2
CO2	2	3	2	3	2	-	-	-	-	2	2	3	1	2	2	3
CO3	1	2	1	3	2	-	-	-	-	2	2	3	2	2	1	2
CO4	2	3	2	2	1	-	-	-	-	2	2	3	2	2	1	3
CO5	2	3	2	3	2	-	-	-	-	1	1	2	1	3	2	2
CO6	2	3	2	3	2	-	-	-	-	2	2	3	1	2	1	2

U19EEPE0014	MATLAB	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To explore MATLAB software on how to approach for solving Engineering problems using simulation tools.
2	To offer a foundation in use of this software for real time applications.
3	To write and simulate basic mathematical, electrical, electronic problems in MATLAB.
4	Make them to connect programming files with GUI Simulink.
5	To get ready the students to use MATLAB in their project works
6	Simple modeling in power system and power electronics are executed

PRE-REQUISITES

Lab view

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION TO MATLAB ENVIRONMENT 9

Introduction- Basic features - Starting MATLAB - Introduction to MATLAB environment - Usage of MATLAB - Running MATLAB - MATLAB as a Calculator.

UNIT II BASIC PLOTTING USING MATHEMATICAL FUNCTIONS 9

Overview - Creating simple plots - Adding titles, axis labels, and annotations - Multiple data sets in one plot - Specifying line styles and colours -Exercises.

UNIT III PROGRAMMING AND DEBUGGING M-FILES 9

M-File Scripts - Script side-effects - M-File functions - Anatomy of a M-File function - Input and output arguments -Input to a script file -Output commands. Debugging process Preparing for debugging - Setting breakpoints - Running with breakpoints - Examining values - Correcting and ending debugging - Ending debugging - Correcting an M-file.

UNIT IV MATRIX GENERATION USING MATHEMATICAL FUNCTIONS 9

Entering a vector-Entering a matrix- Matrix indexing- Colon operator- Linear spacing - Colon operator in a matrix -Creating a sub-matrix -Deleting row or column – Dimension continuation -Transposing a matrix - Concatenating matrices- Matrix generators -Special matrices – Exercises.

UNIT V **BASICS OF ELECTRIC POWER SYSTEMS AND POWER ELECTRONICS** **9**

Introduction – electrical power system and power electronic components- introduction of simscape- simple modeling in power system and power electronics - Exercises.

Total: 45 Hours

TEXT BOOKS:

T1 Introduction to MATLAB for engineering students, professor David Houcqu, Northwestern University.

T2 Beginner's Guide to MATLAB*, Professor Christos Xenophontos, Loyola College.

T3 Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers, RudraPratap Oxford University Press, 2010

REFERENCE BOOKS:

R1 Matlab: Programming with MATLAB for Beginners: A Practical Introduction To Programming And Problem Solving, UpSkill Learning, CreateSpace Independent Publishing Platform, 2016

COURSE OUTCOMES:

Attheendofthecoursestudentsshouldbeableto

CO1: At the end of the course student will have ability to express programming & simulation for engineering problems.

CO2: Find importance of this software for Lab Experimentation.

CO3: Write basic mathematical, electrical, electronic problems in MATLAB

CO4: Simulate basic electrical circuit in Simulink.

CO5: Connect programming files with GUI Simulink

CO6: Fully familiar to all the features of MATLAB software and easily handle the software

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	3	2	3	1	2	1	-	-	-	1	2	3	3	2	2
CO2	3	2	2	3	1	2	1	-	-	-	1	2	3	3	2	2
CO3	3	3	2	3	1	2	1	-	-	-	1	2	3	3	2	2
CO4	3	3	1	2	1	2	1	-	-	-	1	2	3	3	2	2
CO5	3	3	2	2	3	1	1	-	-	-	3	1	3	3	2	1
CO6	3	3	2	2	3	2	2	-	-	-	3	1	1	1	3	1

U19ECPE004	EMBEDDED DESIGN USING ARM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To learn the fundamental programming concepts a to build embedded projects
2	To know the features of STM32F446RE microcontroller
3	To get comprehensive knowledge on data types and operators in the embedded target board
4	To know the operation of functions and dynamic memory allocation
5	To work on mini projects using STM32
6	To workonminiprojectsusingSTM32

PRE-REQUISITES

Having knowledge of C Programming Language.

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION TO EMBEDDED C 9

Introduction to C & Embedded C- Compilation process- Memory organization: CPU- RAM- ROM- Microprocessor & Microcontroller- Machine Level Language- Assembly/Low Level Language- High Level Language- Translators: Assembler- Compiler- Cross compiler- Interpreter- Loader- Linker- Bootloader- Programming Language for embedded systems.

UNIT II HARDWARE FEATURES 9

ARM Design Philosophy & RISC Architecture-Programmer's Model. ARM Cortex M, Cortex M Architecture, ARM Cortex-M Internals & Debugging.

Introduction to STM32F466RE: STM32CubeIDE: Introduction & Installation- Registers- Code & Data Memory- ELF analysis- Disassembly- Instruction Level Debugging- Power on reset- Brownout reset- Watchdog timer- Powerup Timer- SWO in STM- printf () &scanf () function in STM.

UNIT III GPIO MANAGEMENT 9

GPIO Configuration-Driving De-Initialization-Interfacing IO devices and its type – LEDs, Switches, Buzzer- Relay.

Big Endian & Little Endian- Optimization and Flags: Const- Volatile- Const Volatile- Volatile & Optimization effect.

UNIT IV INTERRUPT MANAGEMENT & DMA 9

Interrupt Service Routine- Volatile with ISR- Interrupt Latency- Operators- Conditional operator- Testing a bit with bitwise operator- SET & CLEAR a bit- Modifying LED using bitwise shift operator- Bit Extraction.

Dynamic memory allocation: malloc ()-calloc ()- realloc ()- free ()- Memory leak.

UNIT V ADC IN STM32 9

Analog-To-Digital Converters (ADC) - STM32 ADC - STM32 ADC Functional Description- STM32 ADC Modes of Operation- ADC Conversion On ExternalTriggers - STM32 ADC Calibration - Sampling Time - STM32 ADC Resolution, Reference, Formulas -STM32 ADC Conversion Errors - ADC Example Applications.

Total: 45Hours

TEXT BOOKS:

T1 Embedded Systems Architecture: Explore architectural concepts, pragmatic design patterns, and best practices to produce robust systems by Daniele Lacamera Packt Publishing (May 30, 2018).

T2 Rajkamal, 'Embedded system-Architecture, Programming, Design', TMH,2011.

REFERENCE BOOKS:

R1 Shibu .K.V, "Introduction to Embedded Systems", Tata Mcgraw Hill,2009.

R3 Lyla B Das," Embedded Systems-An Integrated Approach",Pearson2013.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Identify and understand function of different hardware & software used in Embedded systems.

CO2: Develop programs for I/O functions using serial data output.

CO3: Develop programs for STM32F446RE using data types & operators.

CO4: Develop program for STM32F446RE using the ADC peripheral.

CO5: Ability to understand and analyze Embedded systems.

CO6: Ability to suggest an embedded system for a given application.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	3	2	-	-	-	-	2	2	3	2	3	2	2
CO2	2	3	2	3	2	-	-	-	-	2	2	3	1	2	2	3
CO3	1	2	1	3	2	-	-	-	-	2	2	3	2	2	1	2
CO4	2	3	2	2	1	-	-	-	-	2	2	3	2	2	1	3
CO5	2	3	2	3	2	-	-	-	-	1	1	2	1	3	2	2
CO6	2	3	2	3	2	-	-	-	-	2	2	3	1	2	1	2

U19EEPE002	AUTOMATION SYSTEM DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To describe and analyze about various networks
2	To introduces the importance of network performance in manufacturing and process industries.
3	To Impart the role of automation in manufacturing industry.
4	Expose to automation in process industry.
5	Expose to automation in process industry.
6	Develop automation system for manufacturing and process industries through Distributed Control System

PRE-REQUISITES

Network and Embedded System.

THEORY COMPONENT CONTENTS

UNIT I MODERN NETWORKS **9**

Mobile Networks, Sensor Networks, Vehicular Networks, Underwater Networks and Body Area networks and related performance issues.

UNIT II NETWORK PERFORMANCE **9**

Network Simulation and Modeling, Performance issues in networks, Protocol case studies (e.g. HTTP, HTTPS, SSL, DHCP, DNS, Transport protocols and Routing protocols in wired and wireless networks and their performance.

UNIT III AUTOMATION IN MANUFACTURING INDUSTRIES **9**

Automated Manufacturing Systems-Components, Classification and overview of manufacturing systems, Cellular manufacturing, Flexible manufacturing system(FMS), FMS and its planning and implementation, Automated assembly system –design and types of automated assembly systems, Analysis of multi-station and single station assembly machine. Cascade, ratio and feedback controller.

UNIT IV AUTOMATION IN PROCESS INDUSTRIES **9**

Computer based industrial automation-Direct Digital Control (DDC), Distributed Control System (DCS) and supervisory control and data acquisition (SCADA) based architectures. SCADA for process industries includes understanding of RTUs, Pumping stations, Evacuation processes, Mass Flow Meter sand other flow meters, Leak-flow studies of

pipelines. P&I diagram.

UNIT V DISTRIBUTED CONTROL SYSTEM 9

Distributed Control System-Local Control Unit (LCU) architecture, LCU Process Interfacing Issues, Block diagram and Overview of different LCU security design approaches, Networking of DCS. Introduction to communication protocols - Profi bus, Field bus, HART protocols.

Total: 60 Hours

TEXT BOOKS:

T1 M.P.Groover,"Automation, Production Systems and Computer Integrated Manufacturing", 5 th Edition, Pearson Education, 2009.

T2 Computer Networking: A Top-Down Approach (6th Edition), J Kurose and KW Ross,Pearson, 2012

T3 Krishna Kant, "Computer -Based Industrial Control", 2nd Edition, Prentice Hall, New Delhi, 2011.

T4 Top-Down Network Design-Networking Technology, Author PriscillaOppenheimer,Publisher- Pearson Education, 2010.

REFERENCE BOOKS:

R1 Curtis D. Johnson, "Process Control Instrumentation Technology", 8thEdition, Pearson New International, 2013.

R2 Lukas M.P, " Distributed Control Systems", Van Nostrand Reinhold Co., New York, 1986

R3 N. Viswanandham, Y. Narahari, "Performance Modeling of Automated Manufacturing Systems", 1st Edition, 2009.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Familiar with various automation technologies in manufacturing and process industries.

CO2: Understand various automation tools and methods in manufacturing industry.

CO3: Implement various control and automation method in process industries.

CO4: Familiar with various communication technologies in manufacturing and process industries.

CO5: Develop automation system for manufacturing and process industries

CO6: Learn principles and strategies of automation in manufacturing systems

List of Experiments

1.Design of HART and Field bus protocol

2.Development of HMI and annunciator circuits using DCS simulation software

3.Development of Cascade, ratio and feedback controller using DCS simulation software

4. Development of Distributed Control System and different instruction sets.

5.P&I diagram development using simulation software for complex processes

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	3	2	-	-	-	-	2	2	3	2	3	2	2
CO2	2	3	2	3	2	-	-	-	-	2	2	3	1	2	2	3
CO3	1	2	1	3	2	-	-	-	-	2	2	3	2	2	1	2
CO4	2	3	2	2	1	-	-	-	-	2	2	3	2	2	1	3
CO5	2	3	2	3	2	-	-	-	-	1	1	2	1	3	2	2
CO6	2	3	2	3	2	-	-	-	-	2	2	3	1	2	1	2

20PEE06	FULL STACK WEB DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. Understand the fundamentals of Web.
2. Learn to build web page with NodeJS and Express JS.
3. Learn to integrate a Relational Database with a Web Application.
4. Learn to develop web pages using Bootstrap.
5. Learn to design a web application with NoSQL Database.
6. Learn to design a web application with NoSQL Database.

PRE-REQUISITES

Java

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION 9

The Internet- Basic Internet Protocols - Web Fundamentals - Web Clients - Web Servers. - Overview of Full stack – MVC Architecture – Front-end and Backend technologies - Middleware – Handling request and response - MEAN – MERN – Django.

UNIT II DESIGNING A STATIC WEB PAGE 9

HTML – Structure of HTML - HTML tags - CSS – Styling – JavaScript -Introduction - Overview of NPM - Node.js – Introduction - Modules - HTTP Module –Installation and configuration – File structure - Express.js - Request - Response - Get - Post – Routing.

UNIT III RELATIONAL DATABASE 9

DOM Manipulation - DOM Events - Call back function – Promises - Database Integration using MySQL - Working with Database Schemas - Implementing MVC in Express - Retrieve the data from Database - Template Engines - HTML Injection - EJS – Handle bars.

UNIT IV BOOTSTRAP 9

Bootstrap - Introduction to Bootstrap- Bootstrap Basics - Grid system - Basic Components - Page Header - Button Groups – Dropdown -Nav&Navbars - Responsive Web Design - Viewport - Grid View - Media Queries – Validation - Understanding Client-side validation – JavaScript in Validation.

UNIT V NOSQL DATABASE 9

NoSQL – Serialization - Modelling NoSQL data - Document Databases (MongoDB) – MongoDB - MongoDB Environment - Database - Collection - Read Operations - Write Operations –Working with NoSQL and MongoDB - Working with Mongoose – Creating a Cluster in MongoDB Atlas- Defining a Schema (Model in Node JS) – MongoDB Integration with NodeJS.

Total: 60 Hours

TEXT BOOKS:

T1 The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer by Chris Northwood Apress; 1st ed. edition (20 November 2018)

T2 Hands-On Full Stack Development with Spring Boot 2 and React by JuhaHinkulaPackt Publishing.

REFERENCE BOOKS:

R1 John Duckett, ―HTML and CSS design and build websitesǁ, John Wiley & Sons, Inc.

R2 Shay Howe, ―Learn to Code HTML & CSS Develop & Style Websitesǁ, New Riders, Pearson Education, 2014.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Differentiate between Frontend and Backend Technologies.

CO2: Build a web page using NodeJS and Express JS.

CO3: Work on JavaScript Events, Database schemas and Integrate a Relational Database with the web application.

CO4: Develop a responsive web page using Bootstrap.

CO5: Connect the web application with NoSQL Database.

CO6: Design a web application with NoSQL Database.

LIST OF EXPERIMENTS

1. Develop a static page (HTML and CSS) for an onlineBook store. The website should consist the following pages. Home page, Registration and user Login, User profile page, Books Catalogue, Shopping cart, Payment by credit card, order confirmation
2. Develop a HTML page that includes JavaScript functions to check whether the,
   a. Position in the string has right-most vowel
   b. Number of characters in the string does not exceeds 12
3. DOM Manipulation and JS Events
4. Implement CRUD operations using MySQL in a web application
5. Design a web page to store information about a student in an engineering college affiliated to Anna University. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3 students.
6. Create an administrative interface for an online voting application that lets add, change and delete votes with JS Validation

LIST OF PROJECTS

1. Online Auction Management web application using Express, Node JS.
2. Movie – Ticket Booking
3. Secure messaging application
4. E-learning Site
5. E-Signature (Online Petition Signing app)
6. E-Blood Bank site

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	1	2	2	-	-	-	2	-	1	2	3	2	1	2
CO2	3	3	1	2	2	-	-	-	2	-	1	2	3	2	1	2
CO3	3	3	1	2	2	-	-	-	2	-	1	2	3	2	1	3
CO4	1	2	3	1	3	-	-	-	3	-	2	1	1	1	3	1
CO5	3	3	1	2	2	-	-	-	2	-	1	2	3	2	1	2
CO6	3	3	1	2	2	-	-	-	2	-	1	2	3	2	1	3

U19ECPE007	PROTOCOLS IN PIC CONTROLLER	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To Understand the significance of ADC & USART interfacing.
2. To know the features of SPI communication protocol.
3. To Get comprehensive knowledge on I2C & EEPROM.
4. To work latest trends in the embedded systems field.
5. To work on different projects making use of the PIC microcontroller.
6. To understand about Wireless home automation.

PRE-REQUISITES

Having knowledge of electronics fundamentals coupled with some programming experience

THEORY COMPONENT CONTENTS

UNIT I ADC **9**

Introduction to A/D converter module- Block diagram- ADCON0- ADCON1- A/D pin configuration- Selecting A/D conversion clock- Program to interface potentiometer- Simulation.

UNIT II USART **9**

USART introduction- TXSTA- RCSTA- USART baud rate- USART asynchronous mode- USART synchronous master/slave mode- LM35 Interfacing – PIC to PIC communication using USART- Program & Simulation.

UNIT III SPI **9**

MSSP introduction- SPI basics- Applications- Synchronous vs Asynchronous- Block diagram- Operation- SSPSTAT- SSPCON- SSPBUF- Enabling SPI I/O- SPI master mode- SPI slave mode- Waveform of master/slave mode- PIC to PIC communication using SPI – Program & Simulation.

UNIT IV I2C **9**

I2C introduction- Application- Block diagram- Registers- Data frame- Operation- I2C slave mode- Clock stretching- I2C master mode- Baud rate generator- Repeated start condition- Waveform of master/slave mode- PIC to PIC communication is using I2C.

UNIT V APPLICATIONS OF PIC PROTOCOLS 9

Speed control of DC motor using PWM- GSM Interfacing – Bluetooth Interfacing – EEPROM introduction- EEADR- EEADRH- EECON1- EECON2-EEPROM Interfacing: Read data from EEPROM- Write date from EEPROM- RF interfacing- Wireless home automation.

Total: 45 Hours

TEXT BOOKS:

T1 Dogan Ibrahim, "Advanced PIC microcontroller projects in C", Newnes publication, 2012.

T2 Tim Wilmshurst, "Designing Embedded Systems with PIC microcontrollers-Principles and Applications", Newnes Publications, 2007.

T3 Douglas V.Hall, "Microprocessor and Interfacing, Programming and Hardware", Tata McGraw Hill Revised, 2nd Edition 2016, 11th Reprint 2011.

REFERENCE BOOKS:

R1 Martin Bates, "Interfacing PIC microcontrollers-Embedded Design by Interactive Simulation", Newnes Publication, 2006.

R2 Muhammad Ali Mazidi, RolinMcKinlay, Danny Causey, "PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18", Prentice Hall publications, 2007.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Identify and understand operation of ADC & Serial communication protocol

CO2: Develop programs to communicate two or more devices with SPI protocol

CO3: Develop programs to communicate two or more devices with I2C protocol

CO4: Develop program for PIC Timers, Serial port and Interrupts using –CII

CO5: Interface LCD, Keyboard, ADC, DAC, Sensors, Relays, DC motor and Stepper motor with PIC microcontroller

CO6: Ability to suggest an embedded system for a given application

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	2	-	-	-	-	-	2	2	3	3	2	2
CO2	3	3	1	3	2	-	-	-	-	-	2	2	3	3	2	2
CO3	3	3	1	3	2	-	-	-	-	-	2	2	3	3	2	1
CO4	3	3	1	2	3	-	-	-	-	-	1	3	1	1	3	1
CO5	1	3	1	2	3	-	-	-	-	-	1	3	2	3	3	2
CO6	3	2	2	2	3	-	-	-	-	-	1	3	2	3	3	2

U19EEPE005	PCB Design using ORCAD	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To impart knowledge and provide hands on experience to design simple electronic circuits by understanding their characteristics.
2. To impart knowledge and provide hands-on experience in circuit development using PSPICE design tool
3. To impart knowledge and provide hands-on experience in circuit development using orcad capture design tool
4. To impart basic knowledge and provide hands –on experience in PCB layout and design
5. To gain basic knowledge and provide hands –on experience in PCB fabrication and IPC standards
6. Board Outlines and Cut outs, Drill Details, Documentation Layers, Components Outlines, Reference Designation, Text are analysed

PRE-REQUISITES

- Basic knowledge on Electron Devices & Circuits.
- Fundamentals of Circuit Theory.

THEORY COMPONENT CONTENTS

UNIT I FUNDAMENTALS OF BASIC ELECTRONICS 9

Component Identification, Component Symbols, Introduction & Brief History, What is PCB, Difference between PWB and PCB, Types of PCBs: Single Sided (Single Layer), Multi-Layer (Double Layer), PCB Materials Introduction to Electronic design Automation (EDA), Brief History of EDA, Latest Trends in Market, How it helps and Why it requires, Different EDA tools, Introduction to SPICE and PSPICE Environment, Introduction and Working in OrCAD tool.

UNIT II ORCAD PSPICE (ELECTRONIC CIRCUIT SIMULATION SOFTWARE) 9

Modifying Schematic for Simulation, PSpiceNetlist creation, Error identification and rectification (DRC Markers), Creation and configuration of Simulation profile. Bias Point analysis (To display DC bias values), Transient analysis (Time domain Response), Single Window, Single window with multiple Y-axis, Split window and Multi window representation, Parametric analysis (Design response variation with respect to Design element parameters), DC Sweep analysis (Design response variation with respect to DC parameters), AC Sweep analysis (Design response variation with respect to Frequency)

UNIT III **ORCAD CAPTURE** (ELECTRONIC SCHEMATIC DESIGN SOFTWARE) **9**

Introduction to OrCAD Capture, Introduction to component database, How to place the parts in the design, Connecting the parts with wire, bus, net alias and power symbol in the design, How to modify the properties of the parts (Property Editor), How to edit the physical appearance of the parts (Part Editor), How to create a new library, How to create a new part, How to work in Multi sheet projects, How to make connectivity between schematic pages, Design Processing (Annotate, Back Annotate, DRC, Create Netlist, Cross reference parts and BOM)

UNIT IV **9**

Flow Chart, Schematic Entry, Net listing, PCB Layout Designing, Prototype Designing, Design Rule Check(DRC), Design For Manufacturing(DFM), PCB Making-Printing, Etching, Drilling, Assembly of components, PCB layers-Electrical Layers, Top Layer, Mid Layer, Bottom Layer, Mechanical Layers, Board Outlines and Cut outs, Drill Details, Documentation Layers, Components Outlines, Reference Designation, Text.

UNIT V **PCB MATERIALS AND IPC STANDARDS** **9**

Keywords, Footprint, Pad stacks, Vias, Tracks, Color of Layers, PCB Track Size Calculation Formula, PCB materials-Standard FR-4 Epoxy Glass, Multifunctional FR-4, Tetra Functional FR-4, NelcoN400-6, GETEK, BT Epoxy Glass, Cyanate Aster, Plyimide Glass, Teflon, Rules for track, Rules for track, Track Length, Track Angle, Rack Joints, Track Size, Study of IPC standards-IPC Standard For Schematic Design, IPC Standard For PCB Designing, IPC Standard For PCB Materials, IPC Standard For Documentation and PCB Fabrication.

Total : 45 Hours

LABORATORY EXPERIMENTS

1. Design and Build a Compact 3.3V/1.5A SMPS Circuit for Space Constraint Applications
2. Build a Simple Stereo Audio Amplifier Board
3. Build a High Power, High Efficiency Boost Converter
4. Build a Compact and Low Power Solid-State Relay to Control AC Home Appliances
5. Design and Build a Digital Wall Clock on PCB
6. Design and build a Breadboard Power Supply Circuit on PCB
7. Build a Power Bank Circuit on PCB
8. Build a Simple, Compact Power Supply for Analog and Mixed-Signal Systems
9. Design a Custom Microcontroller Programming and Testing Board
10. Automatic lamp control circuit based on brightness
11. Testing of regulated power supply fabricated

Total: 15 Hours

TEXT BOOKS:

T1 ORCAD PSpice for Windows, Vol. 1: DC and AC circuit," 3rd Edition by Goody

T2 "Fundamentals of Electrical Engineering," by Bobrow (2nd edition) Oxford University Press

T3 Complete PCB Design Using OrCad Capture and Layout by Kraig Mitzner

REFERENCE BOOKS:

R1 "Microelectronic Circuits," by Sedra and Smith (4th edition) (HRW)

R2 "Student manual for the Art of Electronics" by Hayes & Horowitz

R3 "Art of Electronics," by Horowitz & Hayes

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Will learn Basic Electronics Theory, Circuit Design and Analysis, Basics of Printed Circuit Board, Electronic Components, and Instruments. Study notes

CO2: Switching schematic to Board Design (Netlist Creation), Thorough knowledge on Constraint Management Settings, Board Shape Creation (DXF import included)

CO3: Plan Creation of Power and Ground. Also Split Plan Creation. Design Rule Checking and DRC updates. Work on Artwork. Setting up all required film layer setups.

CO4: You will work on Printed Circuit Board Layout Design such as Schematic creation, Library Creation: Electronic Symbol and Package (Footprint Creation) Designing.

CO5: Work on Single sided Board Design, Double sided Board Design, Via creation and application. Routing on Top and Bottom Layer includes enough practice modules.

CO6: Gerber Generation and Gerber analysis and improvements. PCB Manufacturing overview.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													**CO/PSO Mapping**			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	2	2	-	-	-	-	-	1	2	2	3	3	1
CO2	1	2	2	2	2	-	-	-	-	-	1	2	2	3	3	1
CO3	3	3	3	3	1	-	-	-	-	-	1	1	1	2	3	2
CO4	3	3	3	2	2	-	-	-	-	-	2	2	2	3	1	1
CO5	3	3	3	2	2	-	-	-	-	-	3	2	2	3	3	1
CO6	3	3	3	2	2	-	-	-	-	-	1	2	2	3	3	1

U19EEPE003	LabVIEW	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	Understand the concept of virtual instrumentation using LabVIEW.
2	To explore knowledge on data structures and debugging techniques in LabVIEW.
3	To acquire knowledge on NI-Hardware and data acquisition.
4	To understand about variables and design patterns in LabVIEW.
5	To create a stand-alone LabVIEW application program.
6	To create a sample CLAD question paper review.

PRE-REQUISITES

Basic Programming languages.

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION TO LABVIEW PLATFORM 9

Introduction to virtual instrumentation – Labview history and development – Navigating Labview: Project explorer, Parts of VI, Front panel, Block diagram, controls and functions – creating first application using data flow programming – Data types in labview – programming tools – building a basic VI – Application: Acquire, analyse and visualise a VI – Build a VI which generates a signal and analyse the signal using signal processing and display the results.

UNIT II DATA STRUCTURES AND DEBUGGING 9

Using Loops: For loop, while loop, timing a VI, data feedback in loops – Creating and leveraging data structure: Arrays, polymorphism, auto-indexing, clusters, type definition – Debugging techniques – error handling – Application: Debugging a VI, passing data through tunnels, calculating average temperature VI, temperature warning VI using cluster and type definition.

UNIT III DATA ACQUISITION USING NI-HARDWARE 9

Case structures: Event driven programming – Modularity: Documentation, Sub-VI – File I/O: File formats, creating file and folder path, write and read library files, accessing TDMS files – Sequential programming and state programming – State machine – DAQmx: Measurement fundamentals with NI-hardware – NI-MAX: Programming with DAQmx API, Instrument configuration with NI-MAX – Application: Create a Sub-VI, Temperature measurement using NI-Hardware, Temperature monitoring and data logging.

UNIT IV VARIABLES AND DESIGN PATTERN 9

Using variables in Labview – Race condition – Communicating data between parallel loops:

Queues, Notifiers, comparing queues with local variables – Implementing design pattern: Simple and multiple loop design pattern, Functional global variable design pattern, Error handlers, generating error codes and messages, timing a design pattern – Controlling user interface: VI server architecture, property nodes, invoke nodes, control reference – Application: Building a weather station, producer/consumer design pattern, displaying temperature and its limits, Read and write TDMS files.

UNIT V APPLICATION DEVELOPMENT 9

Refactoring codes – Creating and distributing applications: preparing files, build specifications, create and debug an application, creating an installer – CLAD: Importance of certification, Topics covered, sample CLAD question paper review.

Total: 45 Hours

TEXT BOOKS:

T1	LabVIEW for Everyone: Graphical Programming Made Easy and Fun (3rd ed.) by Jeffrey Travis and James Kring.
T2	LabVIEW Graphical Programming, Fifth Edition [Jennings, Richard, De la Cueva, Fabiola]
T3	A Software Engineering Approach to LabVIEW (SEA) by Jon Conway and Steve Watts

REFERENCE BOOKS:

R1	Labview Core 1 – Course manual, National Instruments Corp.,
R2	Labview Core 2 – Course manual, National Instruments, Corp.,
R3	The LabVIEW Style Book (LSB) by Peter Blume.

LAB EXPERIMENTS

1	Find the sum of a number.
2	Find the Fibonacci series of a number.
3	Build a virtual calculator.
4	Find the smallest number in an array other than “0”.
5	In an Airport the data received from an arrival of plane is in the form HH:MM:SS, display the data individually.
6	Design a virtual 4-way traffic light controller.
7	Design a virtual temperature management system for a boiler.
8	Design a serial LED with corresponding time delay.
9	Develop a counter program using IR sensor and NI-DAQ system.
10	Design a switch controller for LED and light using relay.
11	Design a temperature management application for a server room

using NI-DAQ system.

12 Acquire a sound file and process the wave and play the waveform using NI-DAQ system.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Understandthe concept ofvirtualinstrumentationusingLabVIEW.

CO2: Toexploreknowledgeondatastructuresanddebuggingtechniques inLabVIEW

CO3: To acquire knowledge of NI-Hardware and data acquisition.

CO4: To understand about variables and design patterns in LabVIEW.

CO5: To create a stand-alone LabVIEW application program.

CO6: Transform an information model into a relational database schema and to use a data definition languageand/or utilities to implement the schema using a DBMS

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													**CO/PSO Mapping**			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	1	3	2	-	-	-	-	-	2	2	3	3	2	2
CO2	3	3	1	3	2	-	-	-	-	-	2	2	3	3	2	2
CO3	1	2	1	2	1	-	-	-	-	-	2	1	3	3	2	2
CO4	3	3	3	2	1	-	-	-	-	-	3	1	2	2	1	1
CO5	3	3	1	2	1	-	-	-	-	-	3	1	2	2	1	1
CO6	3	3	1	2	1	-	-	-	-	-	3	1	2	2	1	1

19EEPE004	ELECTRICAL VEHICLES I	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. Electrical vehicle needs are studies
2. Different energy resources are implemented as hybrid system
3. Various motors and drives are studied
4. Converters and controllers are operated in different modes
5. Four quadrant operations are performed
6. Hybrid electrical systems are implemented

PRE-REQUISITES

THEORY COMPONENT CONTENTS

UNIT I DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLE **9**

Need for Electric vehicle- Comparative study of diesel, petrol, hybrid and electric Vehicles.Advantages and Limitations of hybrid and electric Vehicles. - Design requirement for electricvehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle.Various Resistance- Transmission efficiency- Electric vehicle chassis and Body Design, ElectricVehicle Recharging and Refuelling Systems.

UNIT II ENERGY SOURCES **9**

Battery Parameters- - Different types of batteries – Lead Acid- Nickel Metal Hydride - Lithium ionSodium based- Metal Air. Battery Modelling - Equivalent circuits, Battery charging- QuickCharging devices. Fuel Cell- Fuel cell Characteristics- Fuel cell types-Half reactions of fuel cell.Ultra capacitors. Battery Management System.

UNIT III MOTORS AND DRIVES **9**

Types of Motors- DC motors- AC motors, PMSM motors, BLDC motors, Switched reluctancemotors working principle, construction and characteristics.

UNIT IV POWER CONVERTERS AND CONTROLLERS **9**

Solid state Switching elements and characteristics – BJT, MOSFET, IGBT, SCR and TRIAC -Power Converters – rectifiers, inverters and converters - Motor Drives - DC, AC motor, PMSMmotors, BLDC motors, Switched reluctance motors – four quadrant operations –operating modes

UNIT V HYBRID AND ELECTRIC VEHICLES **9**

Main components and working principles of a hybrid and electric vehicles, Differentconfigurations of hybrid and electric vehicles. Power Split devices for Hybrid Vehicles – Operationmodes - Control Strategies for Hybrid Vehicle - Economy of hybrid Vehicles - Case study onspecification of electric and hybrid vehicles.

Total: 45Hours

TEXT BOOKS:

T1 Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.

T2 MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.

T3 James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

REFERENCE BOOKS:

R1 Larminie, James, and John Lowry, "Electric Vehicle Technology Explained" John Wiley and Sons, 2012

R2 Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, MehrdadEhsaniYiminGao Stefano Longo Kambiz M. Ebrahimi, Taylor & Francis Group, LLC, 2018.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: **Understand the operation and architecture of electric and hybrid vehicles.**

CO2: Identify various energy source options like battery and fuel cell

CO3: Select suitable electric motor for applications in hybrid and electric vehicles.

CO4: Explain the role of power electronics in hybrid and electric vehicles

CO5: Analyze the energy and design requirement for hybrid and electric vehicles.

CO6: To design an hybrid electrical vehilce

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2	1	-	3	2	-	-	-	-	2	-	1	3	-
CO2	1	1	2	1	-	3	2	-	-	-	-	2	-	1	3	-
CO3	1	1	2	1	-	3	2	-	-	-	-	2	-	1	3	-
CO4	1	1	2	1	-	3	2	-	-	-	-	2	-	1	3	-
CO5	1	1	2	1	-	3	2	-	-	-	-	2	-	1	3	-
CO6	1	1	2	1	-	3	2	-	-	-	-	2	-	1	3	-

U19CSTL306T	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To learn the fundamentals of data models, relational algebra and SQL
2	To represent a database system using ER diagrams and to learn normalization techniques
3	To understand the fundamental concepts of transaction, concurrency and recovery processing
4	To understand the internal storage structures using different file and indexing techniques which will help in physical DB design
5	To have an introductory knowledge about the Distributed databases, NOSQL and database security
6	To do the database for the advanced topics

PRE-REQUISITES

Basic Computer Programming

THEORY COMPONENT CONTENTS

UNIT I RELATIONAL DATABASES **10**

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL

UNIT II DATABASE DESIGN **8**

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

UNIT III TRANSACTIONS **9**

Transaction Concepts – ACID Properties – Schedules – Serializability – Transaction support in SQL – Need for Concurrency – Concurrency control –Two Phase Locking- Timestamp – Multiversion – Validation and Snapshot isolation– Multiple Granularity locking – Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging – ARIES Algorithm.

UNIT IV IMPLEMENTATION TECHNIQUES **9**

RAID – File Organization – Organization of Records in Files – Data dictionary Storage – Column Oriented Storage– Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for Selection, Sorting and join operations – Query optimization using Heuristics - Cost Estimation.

UNIT V ADVANCED TOPICS **9**

Distributed Databases: Architecture, Data Storage, Transaction Processing, Query processing and optimization – NOSQL Databases: Introduction – CAP Theorem – Document Based systems – Key value Stores – Column Based Systems – Graph Databases. Database Security: Security issues – Access control based on privileges – Role Based access control – SQL Injection – Statistical Database security – Flow control – Encryption and Public Key infrastructures – Challenges.

Total: 45Hours

TEXT BOOKS:

T1 Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, McGraw Hill, 2020.

T2 RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2017.

REFERENCE BOOKS:

R1 C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Construct SQL Queries using relational algebra

CO2: Design database using ER model and normalize the database

CO3: Construct queries to handle transaction processing and maintain consistency of the database

CO4: Compare and contrast various indexing strategies and apply the knowledge to tune the performance of the database

CO5: Appraise how advanced databases differ from Relational Databases and find a suitable database for the given requirement.

CO6: Encryption and Public Key infrastructures are developed

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	2	-	-	-	-	-	2	2	3	3	2	2
CO2	3	3	1	3	2	-	-	-	-	-	2	2	3	3	2	2
CO3	1	2	1	2	1	-	-	-	-	-	2	1	3	3	2	2
CO4	3	3	3	2	1	-	-	-	-	-	3	1	2	2	1	1
CO5	3	3	1	2	1	-	-	-	-	-	3	1	2	2	1	1
CO6	3	3	1	2	1	-	-	-	-	-	3	1	2	2	1	1

U19EEPE006	ENGINEERING FOR MV SUBSTATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To learn the concepts of electrical sub stations.
2	To identify the requirement of different equipment for sub stations.
3	To gain knowledge about load flow and short circuit analysis
4	To develop skills in performing relay coordination using ETAP and CYME
5	To equip students with the knowledge of Substation Automation System
6	To give understanding of the Protection schemes

PRE-REQUISITES

Having knowledge of generation, transmission and distribution electrical power system.

THEORY COMPONENT CONTENTS

UNIT I OVERVIEW AND BASIC DESIGN PHILOSOPHY FOR SUBSTATIONS **9**

Introduction - Classification of substations - Standard system voltages - Governing standards - Utility - Insulation levels - Environmental factors.

UNIT II TRANSFORMERS & SWITCHGEAR **9**

Transformers & switchgear - construction types - Standard equipment ratings - Equipment sizing - Specifications and data sheets - Installation requirements.

UNIT III SURGE ARRESTOR & CABLES **9**

Application of surge arrestor - Industry specifications - Data-sheet, typical GA & installation requirements -Types of cables & construction (cables, terminations) - Standard cable sizes - Ratings Industry specifications.

UNIT IV LOAD FLOW, SHORT CIRCUIT & PROTECTION **9**

Load flow - Short circuit analysis - Short circuit current calculation - Voltage profiles -Primary & secondary protection – Synchronizing- Line, cable, transformer & standard generator protection - GA drawings - Auxiliary relays - Typical specifications of standard relays.

UNIT V CURRENT & POTENTIAL TRANSFORMERS, CVT, RELAY COORDINATION **9**

Transformers - CT /VT - Typical industry standards - Industry specifications & datasheets - About relay coordination - Grading principle – O/C & E/F -| Grading margin - Fault calculation - Trip characteristics - Software used for relay coordination – ETAP, CYME.

Total: 45 Hours

TEXT BOOKS:

T1 The Electric Power Engineering Handbook,Third Edition,Edited by Leonard L. Grigsby

T2 Electric Power Generation, Transmission, and Distribution Edited by Leonard L. Grigsby

T3 Electric Power Transformer Engineering, Third Edition Edited by James H. Harlow

REFERENCE BOOKS:

R1 Power System Stability and Control Edited by Leonard L. Grigs

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Able to understand the concepts of electrical sub stations.

CO2: Describe essential equipment for sub stations.

CO3: Analysis and develop knowledge about load flow and short circuit analysis

CO4: Integrate skills in performing relay coordination using ETAP and CYME

CO5: Analysis Able to understand the different methods of protection schemes and automation system

CO6: Construct and develop the design concepts of substation layout.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													**CO/PSO Mapping**			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	3	2	3	1	2	1	-	-	-	1	2	3	3	2	2
CO2	3	2	2	3	1	2	1	-	-	-	1	2	3	3	2	2
CO3	3	3	2	3	1	2	1	-	-	-	1	2	3	3	2	2
CO4	3	3	1	2	1	2	1	-	-	-	1	2	3	3	2	2
CO5	3	3	2	2	3	1	1	-	-	-	3	1	3	3	2	1
CO6	3	3	2	2	3	2	2	-	-	-	3	1	1	1	3	1

U19EEPE007	AUTOMOTIVE EMBEDDED SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To expose the students to the fundamentals and building of Electronic Engine Control systems.
2. To teach on functional components and circuits for vehicles
3. To discuss on programmable controllers for vehicles management systems
4. To teach logics of automation & commercial techniques for vehicle communication
5. To introduce the embedded systems concepts for E-vehicle system development
6. To design a Plug in Electrical vehicle

PRE-REQUISITES

Basic Embedded Systems

THEORY COMPONENT CONTENTS

UNIT I BASIC OF ELECTRONIC ENGINE CONTROL SYSTEMS **9**

Overview of Automotive systems, fuel economy, air-fuel ratio, emission limits and vehicleperformance; Automotive microcontrollers- Electronic control Unit- Hardware & software selection andrequirements for Automotive applications – open source ECU-RTOS - Concept for Enginemanagement-Standards; Introduction to AUTOSAR and Introduction to Society SAE- Functional safetyISO 26262- Simulation and modeling of automotive system components.

UNIT II SENSORS AND ACTUATORS FOR AUTOMOTIVES **9**

Review of sensors- sensors interface to the ECU, conventional sensors and actuators, Modern sensor
and actuators - LIDAR sensor- smart sensors- MEMS/NEMS sensors and actuators for automotive applications.

UNIT III VEHICLE MANAGEMENT SYSTEMS **9**

Electronic Engine Control-engine mapping, air/fuel ratio spark timing control strategy, fuel control,electronic ignition- Adaptive cruise control - speed control-anti-locking braking system-electronicsuspension - electronic steering , Automatic wiper control- body control system ; Vehicle systemschematic for interfacing with EMS, ECU. Energy Management system for electric vehicles- Batterymanagement system , power management system-electrically assisted power steering system- Adaptive lighting system- Safety and CollisionAvoidance.

UNIT IV ONBOARD DIAGONSTICS AND TELEMATICS **9**

On board diagnosis of vehicles -System diagnostic standards and regulation requirements Vehiclecommunication protocols Bluetooth, CAN, LIN, FLEXRAY, MOST, KWP2000 and

recent trends invehicle communications- Navigation- Connected Cars technology – Tracking- Security for datacommunication- dashboard display and Virtual Instrumentation, multimedia electronics- Role of IOTin Automotive systems

UNIT V ELECTRIC VEHICLES 9

Electric vehicles –Components- Plug in Electrical vehicle- Charging station – Aggregators- Fuelcells/Solar powered vehicles- Autonomous vehicles.

Total: 45 Hours

TEXT BOOKS:

T1 Peckol, "Embedded system Design",JohnWiley&Sons,2010

T2 Lyla B Das," Embedded Systems-An Integrated Approach", Pearson 2013.

REFERENCE BOOKS:

R1 Tammy Noergaard, "Embedded System Architecture, A comprehensive Guide for Engineers and Programmers", Elsevier, 2006

R2 Jonathan W.Valvano,"Embedded Microcomputer Systems ,Real Time Interfacing",Cengage Learning,3rd edition,2012

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: The learning process delivers insight into the significance of the role of embedded system for automotive applications.

CO2: Understanding the need, selection of sensors and actuators and interfacing with ECU

CO3: Applying the Embedded concepts for vehicle management and control systems.

CO4: Understanding the need of Electrical vehicle and able to apply the embedded system

CO5: Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design and its application in automotive systems.

CO6: Foster a temperament to manage projects, organizations and entrepreneurial ventures maintaining financial integrity and professional ethics.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	2	-	-	-	-	-	2	2	3	3	2	2
CO2	3	3	1	3	2	-	-	-	-	-	2	2	3	3	2	2
CO3	1	2	1	2	1	-	-	-	-	-	2	1	3	3	2	2
CO4	3	3	3	2	1	-	-	-	-	-	3	1	2	2	1	1
CO5	3	3	1	2	1	-	-	-	-	-	3	1	2	2	1	1
CO6	3	3	1	2	1	-	-	-	-	-	3	1	2	2	1	1

U19ITPE012 MERN STACK- WEB APPLICATION DEVELOPMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1	Understand the concept of Authentication
2	Learn to design a web application with Server-side validation
3	Learn to create web page using Angular JS
4	Understand the basics of React
5	Learn to develop a web application using MERN
6	Develop applications with MongoDB

PRE-REQUISITES

Basic Programming languages.

THEORY COMPONENT CONTENTS

UNIT I AUTHENTICATION **9**

Session and Cookies- Authentication – Passport.js – Installation and Configuration - Serializing and Deserializing User Instances – Passport Strategies – Logout Functionality – Protecting rules – JWT.

UNIT II VALIDATION AND API **9**

Validation – Server-side Validation - Client vs Server-side – Error Handling – API – Introduction - Integration of Weather API – Email Authorization –Transporter Object - Token Verification – REST API – Working of REST API – Postman.

UNIT III ANGULAR JS **9**

AngularJS -Introduction to AngularJS - Expressions - Modules - Data Binding - Scope - Directives & Events - Controllers - Filters - Services - HTTP - Tables - Select - Fetching Data from MySQL - Validation – AngularJS API - Animations – AngularJS i18n and i10n

UNIT IV REACT **9**

React - React Accessibility – React Code Splitting - Context – Error Boundaries – Forwarding Refs – Fragments – Higher Order Components – Integrating with Other Libraries – JSX in depthOptimizing Performance – Portals – React without ES6 – React without JSX – ReconciliationRefs and DOM – Render Props – Static Type Checking – Strict Mode – Typechecking – Uncontrolled Components – Web Components

UNIT V MONGO DB **9**

Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases – Managing collections – Connecting to MongoDB fromNode.js – simple applications

Total: 45 Hours

TEXT BOOKS:

T1 Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development', Addison-Wesley, Second Edition, 2018

T2 Vasan Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo,Express, React, and Node', Second Edition, Apress, 2019.

REFERENCE BOOKS:

R1 Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', Apress; 1st edition, 2018

R2 KirupaChinnathambi, 'Learning React: A Hands-On Guide to Building Web Applications Using React and Redux', Addison-Wesley Professional, 2nd edition, 2018

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Understand the various stacks available for web application development.

CO2: Use Node.js for application development

CO3: Develop applications with MongoDB

CO4: Use the features of Angular and Express

CO5: Develop React applications

CO6: MongoDB designs are implemented

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	3	2	3	1	2	1	-	-	-	1	2	3	3	2	2
CO2	3	2	2	3	1	2	1	-	-	-	1	2	3	3	2	2
CO3	3	3	2	3	1	2	1	-	-	-	1	2	3	3	2	2
CO4	3	3	1	2	1	2	1	-	-	-	1	2	3	3	2	2
CO5	3	3	2	2	3	1	1	-	-	-	3	1	3	3	2	1
CO6	3	3	2	2	3	2	2	-	-	-	3	1	1	1	3	1

U19EEPE008 ELECTRICAL VEHICLES II

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To understand the electric vehicles.
2. Analyse the operation of the communication technologies for vehicles.
3. Expose the knowledge on design issues in EV‟s power management system.
4. To model and analyse the chassis electrical systems and auxiliaries.
5. Analyse and design the various charging technique
6. Renewable energy-based charging stations, Wireless charging system are designed

PRE-REQUISITES

ELECTRICAL VEHICLES I

THEORY COMPONENT CONTENTS

UNIT I DESIGN FOR ELECTRIC VEHICLES 9

Introduction of Electric vehicle, Self-Drive Cars, Sensors in automobile, Introduction to Energy Storage Requirements in electric vehicles, Selection of batteries, BLDC Motor - Configuration and control, Induction Motor - Configuration and control, Selection of Motors.

UNIT II COMMUNICATION TECHNOLOGIES FOR VEHICLES 9

Introduction to vehicle communication technology, Vehicle to network (V2N), Vehicle to infrastructure (V2I), Vehicle to vehicle (V2V), Vehicle to cloud (V2C), Vehicle to pedestrian(V2P), Vehicle to device (V2D), Vehicle to grid (V2G).

UNIT III POWER MANAGEMENT SYSTEM 9

Lithium ion, Lithium Polymer - Battery based energy storage and its analysis, Ultra Capacitor based energy storage and its analysis, Hybridization of different energy storage devices.

UNIT IV CHASSIS ELECTRICAL SYSTEMS ANDAUXILIARIES 9

Anti-Lock Brakes, Active Suspension, Traction Control, Automatic Transmission, Other Chassis Electrical Systems, Diagnosing Chassis Electrical System Faults, Advanced Chassis Systems Technology.

UNIT V AUTOMOTIVE ELECTRONICS: CHARGING AND TESTING 9

Sensor & Actuators in an Electric Vehicle, four quadrant operation of three-phase induction motor, Battery tester and charging technique, renewable energy-based charging stations, Wireless charging.

Total: 45 Hours

TEXT BOOKS:

T1 Husain, I. "Electric and Hybrid Vehicles" Boca Raton, CRC Press, 2010.

T2 MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, HybridElectric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.

T3 Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

T4 Larminie, James, and John Lowry, "Electric Vehicle Technology Explained" JohnWiley and Sons, 2012.

REFERENCE BOOKS:

R1 Hybrid Electric Vehicle System Modelling and Control - Wei Liu, General Motors, USA, John Wiley & Sons, Inc., 2017.

R2 Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market Gianfranco Pistoia Consultant, Rome, Italy, Elsevier Publications, 2017.

R3 Emadi, A. (Ed.), Miller, J., Ehsani, M., "Vehicular Electric Power Systems" Boca Raton, CRC Press, 2003.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Ability to model the electric vehicles.

CO2: Ability to understand and apply communication technologies for vehicles.

CO3: Ability to model and carry out the design issues in EV‟s power management system

CO4: Ability to model and analyse the chassis electrical systems and auxiliaries.

CO5: Ability to model and understand various charging technique.

CO6: AUTOMOTIVE ELECTRONICS: CHARGING AND TESTING are implemented

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													**CO/PSO Mapping**			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	3	2	3	1	2	1	-	-	-	1	2	3	3	2	2
CO2	3	2	2	3	1	2	1	-	-	-	1	2	3	3	2	2
CO3	3	3	2	3	1	2	1	-	-	-	1	2	3	3	2	2
CO4	3	3	1	2	1	2	1	-	-	-	1	2	3	3	2	2

CO5	3	3	2	2	3	1	1	-	-	-	3	1	3	3	2	1
CO6	3	3	2	2	3	2	2	-	-	-	3	1	1	1	3	1

ADVANCED LAB VIEW PROGRAMMING **L T P C**

U19EEPE009 **3 0 0 3**

COURSE OBJECTIVES

1. To analyse the review of Labview application development environment
2. Building application architecture developed
3. Global error handling and error logging system are implemented
4. Top-level approach system are developed
5. To Design a boiler start-up controller using Labview
6. To Design an Automated Teller Machine controller

PRE-REQUISITES

Lab View

THEORY COMPONENT CONTENTS

UNIT I OVERVIEWOFLABVIEWANDMULTISIM **9**

Review of Labview application development environment: Creating a virtual instrument, Dataflow programming, Sub-VI"s, Data structures, Array, File I/O and Data acquisition using MyDAQ – Multisim: The design process, simulation models – Design and analyse of basic electronic circuits – result and post processing – communication and transfer – design variant/sharing – co-simulation with labview.

UNIT II SOFTWARE DEVELOPMENT PRACTICE **9**

Softwaredevelopment:Overview,requirement,taskanalysis,process– Projectorganisation:Projectlibraries, project exploration tools and organization, project conflicts – Building application architecture:architecturetesting, guidelines,userevents,queuedmessagehandler,applicationdatatypesandnotifiers.

UNIT III USER INTERFACE **9**

Customizing user interface (UI): UI style guidelines, prototypes, customizing, extending, windows appearance and documentation, application initialization and user interface testing. Managing and logging errors: error testing, local error handling, global error handling and error logging.

UNIT IV TOP-LEVELAPPROACH **9**

Designing modular applications – code module testing – integration testing. Professional application development using Labview: Design concepts, User interface design, block diagram layout and style, Sub- VI design, Architecture selection, Timing function, error handling, testing and documentation.

UNIT V APPLICATIONDEVELOPMENT **9**

Design a boiler start-up controller using Labview, Design an Automated Teller Machine controller using Labview, Design a car wash controller setup using Labview.

Total: 45 Hours

TEXT BOOKS:

T1 LabView: Advanced Programming Techniques, Second Edition 2nd Edition by Rick Bitter (Author), Taqi Mohiuddin (Author)

T2 Hands-On Introduction to LabVIEW for Scientists and Engineers 3rd Edition by John Essick (Author).

REFERENCE BOOKS:

R1 Lab View Advanced Programming Techniques, Second Edition By Rick Bitter, Taqi Mohiuddin, Matt Nawrocki, 2nd Edition, CRC Press

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: The review of Labview application development environment
CO2: The building application architecture are designed
CO3: Global error handling and error logging system are implemented
CO4: Top-level approach system are developed
CO5: To Design a boiler start-up controller using Labview
CO6: To Design an Automated Teller Machine controller

LIST OF EXPERIMENTS

1 DesignanddevelopasevensegmentLEDdisplay
2 InterfaceandcontrolamotorwithLabview
3 DesignaSMPSusingMultisim
4 Generateaconvertercontrolswitching logicusingco-simulationapproach
5 Designatemperaturemanagementunit
6 BuildanapplicationtoselectAirconditionunitbasedonroomsize
7 Developanapplicationtomonitortherenewablepowergeneration
8 Designanddevelopasprinkler controller
9 Designanddevelophumanheartrate,pulseandbloodpressuremonitoringsystem
10 Designanddevelop aprogramtointerfacekeypad

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	2	-	-	-	-	-	2	2	3	3	2	2
CO2	3	3	1	3	2	-	-	-	-	-	2	2	3	3	2	2
CO3	1	2	1	2	1	-	-	-	-	-	2	1	3	3	2	2
CO4	3	3	3	2	1	-	-	-	-	-	3	1	2	2	1	1

CO5	3	3	1	2	1	-	-	-	-	-	3	1	2	2	1	1
CO6	3	3	1	2	1	-	-	-	-	-	3	1	2	2	1	1

U19EEPE010 INDUSTRIAL POWER SYSTEMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To understand the basics of Electrical system Components.
2. To acquire knowledge about residential and commercial electrical systems.
3. Analyze the performance of illuminations systems.
4. Design of Industrial Electrical system.
5. Understand the basics of automation in Industrial Electrical systems.
6. PLC based control system is designed

PRE-REQUISITES

Power System Analysis, Protection and Switchgear

THEORY COMPONENT CONTENTS

UNIT I ELECTRICAL SYSTEM COMPONENTS **9**

LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, Protection components- Fuse, MCB, MCCB, ELCB, Symbols for wiring components, Single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices.

UNIT II **9**

Types of residential and commercial wiring systems, General rules and guidelines for installation, Load calculation and sizing of wire, Rating of main switch, distribution board and protection devices, Earthing system calculations, Requirements of commercial installation, Deciding lighting scheme and number of lamps, Earthing of commercial installation, Selection and sizing of components

UNIT III **9**

Understanding various terms regarding light- lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, Various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, Energy saving in illumination systems, Design of a lighting scheme for a residential and commercial premises, Flood lighting

UNIT IV **9**

HT connection, Industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

UNIT V **9**

Study of basic PLC, Role of automation, Advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution

automation.

Total: 45 Hours

TEXT BOOKS:

T1 Khan, Shoaib; Khan, Sheeba; Ahmed, Ghariani, "Industrial Power Systems", CRC Press; 1st edition (December 17, 2007).

T2 Power Systems Protective Relaying Volume 4 by J.C. Das

REFERENCE BOOKS:

R1 Industrial and Commercial Power Systems Handbook, F.S.Prabhakara, Robert L. Smith, **Ray P Startford, "McGraw Hill 1996".**

R2 Industrial and Commercial Power Systems 1st edition, 2022 Handbook

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Understanding the basics of Electrical system Components.
CO2: Acquiring knowledge about residential and commercial electrical systems.
CO3: Analyzing the performance of illuminations systems.
CO4: Designing theIndustrial Electrical system.
CO5: Understanding the basics of automation in Industrial Electrical systems.
CO6: PLC based control system is designed

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	1	3	2	-	-	-	-	-	2	2	3	3	2	2
CO2	3	3	1	3	2	-	-	-	-	-	2	2	3	3	2	2
CO3	1	2	1	2	1	-	-	-	-	-	2	1	3	3	2	2
CO4	3	3	3	2	1	-	-	-	-	-	3	1	2	2	1	1
CO5	3	3	1	2	1	-	-	-	-	-	3	1	2	2	1	1
CO6	3	3	1	2	1	-	-	-	-	-	3	1	2	2	1	1

U19ECPE019	RTOS USING STM CONTROLLER	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. Understand the concepts of embedded system design and analysis
2. Learn the architecture and programming of ARM processor
3. Be exposed to the basic concepts of embedded programming
4. Learn the real time operating systems
5. To learn the Clock Synchronization
6. To learn MPSoCs and shared memory multiprocessors

PRE-REQUISITES

Basics of Embedded Systems

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION TO EMBEDDEDSYSTEM DESIGN 9

Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques - Designing with computing platforms – consumer electronics architecture – platform-level performance analysis.

UNIT II EMBEDDED PROGRAMMING 9

Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

UNIT III REAL TIME SYSTEMS 9

Structure of a Real Time System — Estimating program run times – Task Assignment and Scheduling – Fault Tolerance Techniques – Reliability, Evaluation – Clock Synchronisation.

UNIT IV PROCESSES AND OPERATING SYSTEMS 9

Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-Distributed embedded systems – MPSoCs and shared memory multiprocessors. – Design Example - Audio player, Engine control unit – Video accelerator.

UNIT V STM32 9

Development Tools - Developing the First Application - Building and Flashing the Code (Basics) - Interrupt System - Extended Interrupts and Events Controller (EXTI) - External Interrupt and GPIO mapping

Total: 45 Hours

TEXT BOOKS:

T1 Marilyn Wolf, ―Computers as Components - Principles of Embedded Computing System Design‖, Third Edition ―Morgan Kaufmann Publisher (An imprint from Elsevier), 2012

T2 Jane W.S.Liu,‖ Real Time Systems‖, Pearson Education, Third Indian Reprint, 2003.

REFERENCE BOOKS:

R1 Lyla B.Das, ―Embedded Systems : An Integrated Approach‖ Pearson Education, 2013.

R2 Jonathan W.Valvano, ―Embedded Microcomputer Systems Real Time Interfacing‖, Third Edition Cengage Learning, 2012.

R3 David. E. Simon, ―An Embedded Software Primer‖, 1st Edition, Fifth Impression, Addison- Wesley Professional, 2007.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Describe the architecture and programming of ARM processor
CO2: Outline the concepts of embedded systems
CO3: Explain the basic concepts of real time operating system design
CO4: Model real-time applications using embedded-system concepts
CO5: Learning the Clock Synchronization
CO6: Learning theMPSoCs and shared memory multiprocessors

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	2	-	-	-	-	-	2	2	3	3	2	2
CO2	3	3	1	3	2	-	-	-	-	-	2	2	3	3	2	2
CO3	1	2	1	2	1	-	-	-	-	-	2	1	3	3	2	2
CO4	3	3	3	2	1	-	-	-	-	-	3	1	2	2	1	1

CO5	3	3	1	2	1	-	-	-	-	-	3	1	2	2	1	1
CO6	3	3	1	2	1	-	-	-	-	-	3	1	2	2	1	1

U19CSTL408T **ADVANCED DATABASES** **L T P C**
3 0 0 3

COURSE OBJECTIVES

1. To learn the modeling and design of databases.
2. To acquire knowledge on parallel and distributed databases and their applications.
3. To study the usage and applications of Object Oriented and Intelligent databases.
4. To understand the usage of advanced data models.
5. To learn emerging databases such as XML, Cloud and Big Data.
6. To acquire inquisitive attitude towards research topics in databases.

PRE-REQUISITES

Basic of Programming Language

THEORY COMPONENT CONTENTS

UNIT I PARALLEL AND DISTRIBUTED DATABASES 9

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems- Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Case Studies.

UNIT II OBJECT AND OBJECT RELATIONAL DATABASES 9

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL/Oracle – Case Studies.

UNIT III INTELLIGENT DATABASES 9

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy- Applications- Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases- TSQL2- Deductive Databases: Logic of Query Languages – Datalog- Recursive Rules-Syntax and Semantics of Datalog Languages- Implementation of Rules and Recursion- Recursive Queries in SQL- Spatial Databases- Spatial Data Types- Spatial Relationships- Spatial Data Structures- Spatial Access Methods- Spatial DB Implementation.

UNIT IV ADVANCED DATA MODELS 9

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models -

Concurrency Control - Transaction Commit Protocols- Multimedia Databases- Information Retrieval- Data Warehousing- Data Mining- Text Mining.

UNIT V EMERGING TECHNOLOGIES 9

XML Databases: XML-Related Technologies-XML Schema- XML Query Languages- Storing XML in Databases-XML and SQL- Native XML Databases- Web Databases- Geographic Information Systems- Biological Data Management- Cloud Based Databases: Data Storage Systems on the Cloud- Cloud Storage Architectures-Cloud Data Models- Query Languages- Introduction to Big Data-Storage-Analysis.

Total: 45 Hours

TEXT BOOKS:

T1 RamezElmasri, Shamkant B. Navathe, —Fundamentals of Database Systemsll, Sixth Edition , Pearson, 2011.

T2 Thomas Cannolly and Carolyn Begg, —Database Systems, A Practical Approach to Design, Implementation and Managementll, Fourth Edition, Pearson Education, 2008.

REFERENCE BOOKS:

R1 Henry F Korth, Abraham Silberschatz, S. Sudharshan, —Database System Conceptsll, Sixth Edition, McGraw Hill, 2011.

R2 C.J.Date, A.Kannan, S.Swamynathan, —An Introduction to Database Systemsll, Eighth Edition, Pearson Education, 2006.

R3 Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, —Advanced Database Systemsll, Morgan Kaufmann publishers,2006.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: To develop in-depth understanding of relational databases and skills to optimize database performance in practice.

CO2: To understand and critique on each type of databases.

CO3: To design faster algorithms in solving practical database problems.

CO4: To implement intelligent databases and various data models.

CO5: To implement mobile Transaction Models -Concurrency Control

CO6: Cloud Based Databases system are implemented

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	3	2	-	-	-	-	2	2	3	2	3	2	2
CO2	2	3	2	3	2	-	-	-	-	2	2	3	1	2	2	3
CO3	1	2	1	3	2	-	-	-	-	2	2	3	2	2	1	2
CO4	2	3	2	2	1	-	-	-	-	2	2	3	2	2	1	3
CO5	2	3	2	3	2	-	-	-	-	1	1	2	1	3	2	2
CO6	2	3	2	3	2	-	-	-	-	2	2	3	1	2	1	2

U19ECPE020	SYSTEM VERILOG	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To Understand the concepts of verification methodologies and data types.
2. To Summarize the concepts of procedural statements, routines and assertions.
3. To Illustrate the concepts of OOP terminology.
4. To Demonstrate the randomization in System Verilog.
5. To Analyze the concepts of functional coverage.
6. To know the INTERPROCESS COMMUNICATION AND FUNCTIONAL COVERAGE

PRE-REQUISITES

Digital Logic Design

THEORY COMPONENT CONTENTS

UNIT I VERIFICATION GUIDELINES AND DATA TYPES **9**

Verification guidelines: Verification Process, Basic Test bench functionality, directed testing,Methodology basics, Constrained-Random stimulus, Functional coverage, Test bench components,Layered test bench, Building layered test bench, Simulation environment phases, Maximum codereuse, Test bench performance

UNIT II ROUTINES AND CONNECTING THE TEST BENCH & DESIGN **9**

Procedural statements and routines: Procedural statements, tasks, functions and void Functions, Routine arguments, returning from routine, local data storage, Time values. Connecting the test bench and design: Separating the test bench and design, Interface constructs, Stimulus timing, Interface driving and sampling, connecting it all together, Top-level scope, Program – Module interactions, System Verilog assertions.

UNIT III BASIC OOP **9**

Introduction, first class, define a class, OOP(Object Oriented Programming) terminology, Creatingnew objects, Object de-allocation, Using objects, Static variables vs. Global variables, Classmethods, Defining methods outside of the class, Scoping rules, Using one class inside another,Understanding dynamic objects, Copying objects, Public vs. private, Straying off course, buildinga test bench.

UNIT IV RANDOMIZATION **9**

Introduction, randomization, Randomization in SystemVerilog, Constraint details,

solutionprobabilities, Controlling multiple constraint blocks, Valid constraints, In-line constraints, Thepre_randomize and post_randomize functions, Constraints tips and techniques, commonrandomization problems.

UNIT V INTERPROCESS COMMUNICATION AND FUNCTIONAL COVERAGE **9**

Interprocess Communication, Events, Semaphores, Mailboxes, Coverage Types, Functional Coverage Strategies, Simple Functional Coverage Example, Anatomy of a Cover Group, Triggering a Cover Group, Data Sampling, Cross Coverage, Generic Cover Groups, Coverage Options, Analyzing Coverage Data, Measuring Coverage Statistics During Simulation.

Total: 45 Hours

TEXT BOOKS:

T1 Chris Spears, System Verilog for Verification, 2nd Edition, Springer, 2008.

T2 Vijayaraghavan, Srikanth, and MeyyappanRamanathan. A practical guide for SystemVerilog assertions , Springer Science & Business Media, 2006.

REFERENCE BOOKS:

R1 Bergeron, Janick. Writing testbenches using SystemVerilog , 1st Edition,Springer Science & Business Media, 2007.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Understand the concepts of verification methodologies and data types.

CO2: Summarize the concepts of procedural statements, routines and assertions.

CO3: Illustrate the concepts of OOP terminology.

CO4: Demonstrate the randomization in System Verilog.

CO5: Analyze the concepts of functional coverage.

CO6: An interprocess communication and functional coverage are studied

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													**CO/PSO Mapping**			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	2	3	2	-	-	-	-	2	2	3	2	3	2	2
CO2	2	3	2	3	2	-	-	-	-	2	2	3	1	2	2	3

CO3	1	2	1	3	2	-	-	-	-	2	2	3	2	2	1	2
CO4	2	3	2	2	1	-	-	-	-	2	2	3	2	2	1	3
CO5	2	3	2	3	2	-	-	-	-	1	1	2	1	3	2	2
CO6	2	3	2	3	2	-	-	-	-	2	2	3	1	2	1	2

U19EEPE011	ENERGY AUDITING AND CONSERVATION TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To understand the basics principles of Energy Audit and Management Energy Audit
2	To understand the basics of lighting modifications to the existing systems
3	Design of high performance computing Power factor measurement devices.
4	To know the basics of space heating and ventilation techniques
5	To design a Heat space models for air conditioning system
6	To design Energy efficient motors

PRE-REQUISITES

THEORY COMPONENT CONTENTS

UNIT I	BASIC PRINCIPLES OF ENERGY AUDIT AND MANAGEMENT ENERGY AUDIT		9

Definitions – Concept – Types of audit – Energy index – Cost index – Pie charts – Sankey diagrams – Load profiles – Energy conservation schemes and energy saving potential – Numerical problems – Principles of energy management – Initiating, planning, controlling, promoting, monitoring, reporting – Energy manager – Qualities and functions – Language – Questionnaire – Check list for top management.

UNIT II	LIGHTING MODIFICATION OF EXISTING SYSTEMS		9

Replacement of existing systems – Priorities: Definition of terms and units – Luminous efficiency – Polar curve – Calculation of illumination level – Illumination of inclined surface to beam – Luminance or brightness – Types of lamps – Types of lighting – Electric lighting fittings (luminaries) – Flood lighting – White light LED and conducting Polymers – Energy conservation measures.

UNIT III	BIO-ENERGY		9

Methods of improvement – Location of capacitors – Power factor with non linear loads – Effect of harmonics on Power factor – Numerical problems. Energy Instruments – Watt–hour meter – Data loggers – Thermocouples – Pyrometers – Lux meters – Tong testers – Power analyzer.

UNIT IV	OTHER TYPES OF ENERGY		9

Air–Conditioning (HVAC) and Water Heating: Introduction – Heating of buildings – Transfer of Heat–Space heating methods – Ventilation and air–conditioning – Insulation–Cooling load – Electric water heating systems – Energy conservation methods.

UNIT V	DIRECT CONVERSION OF THERMAL TO ELECTRICAL ENERGY		9

Depreciation Methods – Time value of money – Rate of return – Present worth method – Replacement analysis – Life cycle costing analysis – Energy efficient motors (basic concepts).	
Total:45 Hours	
TEXT BOOKS:	
T1	Energy management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications. 2012.
T2	Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd–2nd edition, 1995.
T3	Hand book of Energy Audits by Albert Thumann.
REFERENCE BOOKS:	
R1	Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd. New Delhi.
R2	Energy management by Paul o' Callaghan, Mc–Graw Hill Book company–1st edition, 1998
R3	Energy management hand book by W.C.Turner, John wiley and sons.
COURSE OUTCOMES: At the end of the course students should be able to	
CO1:	Energy conservation schemes are implemented
CO2:	Illumination of the system are identified
CO3:	Various loggers are studies
CO4:	Various meters are implemented
CO5:	Heat space models for air conditioning system are implemented
CO6:	Energy efficient motors are designed

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													**CO/PSO Mapping**			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	2	3	2	-	-	-	-	2	2	3	2	3	2	2
CO2	2	3	2	3	2	-	-	-	-	2	2	3	1	2	2	3
CO3	1	2	1	3	2	-	-	-	-	2	2	3	2	2	1	2
CO4	2	3	2	2	1	-	-	-	-	2	2	3	2	2	1	3

CO5	2	3	2	3	2	-	-	-	-	1	1	2	1	3	2	2
CO6	2	3	2	3	2	-	-	-	-	2	2	3	1	2	1	2

U19EEPE012 SCADA AND DCS IN INDUSTRIAL AUTOMATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. The ON-OFF temperature control Tank level control are implemented
2. Automatic liquid mixing and Automatic stamping system are developed
3. To design a PLC field bus.
4. To analyse the role of SCADA in Industrial Automation
5. Components of RTU are developed
6. DCS applications are implemented

PRE-REQUISITES

PLC and Labview

THEORY COMPONENT CONTENTS

UNIT I INDUSTRIAL AUTOMATION **9**

Architecture of Industrial Automation system - Components of automation – actuators - Encoders - transducer and advanced sensors - Measurement of temperature, flow, pressure, force, displacement, speed, level - Developing a ladder logic ON-OFF temperature control Tank level control - elevator - Automatic liquid mixing – Automatic stamping.

UNIT II COMMUNICATION PROTOCOLS **9**

Introduction to communication protocols – PLC communication ports – Parallel communication - IEEE-488 - serial communications - RS232 – RS422 – RS485 - Modbus - Ethernet/IP – Profibus - standard requirements - communication between multiple PLCs - PLC field bus.

UNIT III HUMAN-MACHINE INTERFACE **9**

Introduction to HMI - Designing in HMI software - different types of operator interfaces, textual and graphical - properties for the design - I/o configuration - wiring practice of HMI - data handling with HMI - Configuration and interfacing to PLC and PC - Interfacing PLC to VFD - speed modulation - ON/off command - trip status / speed tuning - Real time interface of PLC, SCADA and HMI.

UNIT IV SCADA **9**

Introduction – Open system: Need and advantages – Building blocks of SCADA – Remote Terminal Unit (RTE): Evolution of RTE – Components of RTU – SCADA communication systems - Master Station: Master station software components, Master station hardware components, Server systems in the master station, Small, medium, and large master stations - Role of SCADA in Industrial Automation.

UNIT V DISTRIBUTED CONTROL SYSTEMS **9**

Introduction to DCS System elements of DCS: Field station, Intermediate station, Central computer station and Reliability parameters of DCS - Operator interfaces: Introduction –

Low level operator interface – High level operator interface - Engineering interfaces - DCS applications: Power Plants - Cement plants – Pulp and Paper plants.

Total: 45 Hours

TEXT BOOKS:

T1 F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2010

T2 Michael P. Lukas, Distributed Control Systems: Their Evaluation and Design, Van Nostrand Reinhold Co., 1986

T3 D. Popovic and V.P.Bhatkar, Distributed computer control for industrial Automation Marcel Dekker, Inc., Newyork ,1990.

REFERENCE BOOKS:

R1 T.A. Hughes, Programmable Controllers, Fourth edition, ISA press, 2005

R2 Krishna Kant, Computer Based Industrial Control, Second edition, Prentice Hall of India, New Delhi, 2010.

R3 John W. Webb and Ronald A. Reis, Programmable Logic Controllers, Fifth edition, Prentice Hall of India, New Delhi, 2010.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: The ON-OFF temperature control Tank level control are implemented

CO2: Automatic liquid mixing and Automatic stamping system are developed

CO3: To design a PLC field bus.

CO4: To analyse the role of SCADA in Industrial Automation

CO5: Components of RTU are developed

CO6: DCS applications are implemented

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	3	2	-	-	-	-	2	2	3	2	3	2	2
CO2	2	3	2	3	2	-	-	-	-	2	2	3	1	2	2	3
CO3	1	2	1	3	2	-	-	-	-	2	2	3	2	2	1	2

CO4	2	3	2	2	1	-	-	-	-	2	2	3	2	2	1	3
CO5	2	3	2	3	2	-	-	-	-	1	1	2	1	3	2	2
CO6	2	3	2	3	2	-	-	-	-	2	2	3	1	2	1	2

U19EEPE013 ENERGY STORAGE TECHNOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To understand the basics principles of Energy storage
2. To understand the basics configurations of energy
3. Design of high performance Hybrid energy storage devices.
4. Analysis of Hybrid energy storage devices.
5. Electrical energy storage system are developed
6. To know Pumped Hydro Storage system with its applications

PRE-REQUISITES

Renewable Energy Sources

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION TO ENERGY STORAGE FOR POWER SYSTEMS **9**

Role of energy storage systems, applications.

Overview of energy storage technologies: Thermal, Mechanical, Chemical, Electrochemical, Electrical. Efficiency of energy storage systems.

UNIT II ELECTRICAL ENERGY STORAGE CONFIGURATIONS AND APPLICATIONS **9**

Batteries, Super capacitors, Superconducting Magnetic Energy Storage (SMES), charging methodologies, SoC, SoH estimation techniques. Hydrogen production and storage, fuel cells. Mobile storage system: electric vehicle, G2V, V2G.

UNIT III HYBRID ENERGY STORAGE SYSTEMS **9**

Storage for renewable energy systems: Solar energy, Wind energy, Pumped hydro energy, fuel cells. Energy storage in Micro-grid and Smart grid. Energy Management with storage systems, Battery SCADA, Increase of energy conversion efficiencies by introducing energy storage.

UNIT IV ELECTRICAL ENERGY STORAGE **9**

Fundamental concept of batteries – measuring of battery performance, charging and discharging, power density, energy density, and safety issues. Types of batteries – Lead Acid, Nickel -Cadmium, Zinc Manganese dioxide, Li-ion batteries – Mathematical Modelling for Lead Acid Batteries – Flow Batteries.

UNIT V ALTERNATE ENERGY STORAGE TECHNOLOGIES **9**

Flywheel, Super capacitors, Principles & Methods – Applications, Compressed air Energy storage, Concept of Hybrid Storage – Applications, Pumped Hydro Storage – Applications.

Total: 45 Hours

TEXT BOOKS:

T1 A.G.Ter-Gazarian, "Energy Storage for Power Systems", Second Edition, The Institution of Engineering and Technology (IET) Publication, UK, (ISBN – 978-1-84919-219-4), 2011.

T2 Francisco Díaz-González, Andreas Sumper, OriolGomis-Bellmunt," Energy Storage in Power Systems" Wiley Publication, ISBN: 978-1-118-97130-7, Mar 2016.

T3 A. R. Pendse, "Energy Storage Science and Technology", SBS Publishers & Distributors Pvt. Ltd., New Delhi, (ISBN – 13:9789380090122), 2011.

REFERENCE BOOKS:

R1 Electric Power Research Institute (USA), "Electricity Energy Storage Technology Options: A White Paper Primer on Applications, Costs, and Benefits" (1020676), December 2010.

R2 Paul Denholm, Erik Ela, Brendan Kirby and Michael Milligan, "The Role of Energy Storage with Renewable Electricity Generation", National Renewable Energy Laboratory (NREL) – A National Laboratory of the U.S. Department of Energy – Technical Report NREL/ TP6A2-47187, January 2010.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Understand different types storage technologies
CO2: Design a thermal storage system
CO3: Model battery storage system
CO4: Analyze the thermodynamics of fuel cell
CO5: Analyze the appropriate storage technologies for different applications
CO6: Explore the alternate energy storage technologies.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													**CO/PSO Mapping**			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	2	3	2	-	-	-	-	2	2	3	2	3	2	2
CO2	2	3	2	3	2	-	-	-	-	2	2	3	1	2	2	3
CO3	1	2	1	3	2	-	-	-	-	2	2	3	2	2	1	2

CO4	2	3	2	2	1	-	-	-	-	2	2	3	2	2	1	3
CO5	2	3	2	3	2	-	-	-	-	1	1	2	1	3	2	2
CO6	2	3	2	3	2	-	-	-	-	2	2	3	1	2	1	2

U19EEPE014 HIGH VOLTAGE ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. Various types of over voltages in power system and protection methods.
2. Generation of over voltages in laboratories.
3. Measurement of over voltages.
4. Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
5. Testing of power apparatus and insulation coordination
6. To know impulse voltage and DC testing of Insulators

PRE-REQUISITES

Transmission and Distribution, Power System Operation and control

THEORY COMPONENT CONTENTS

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS **9**

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages, Corona and its effects – Bewley lattice diagram- Protection against over voltages.

UNIT II DIELECTRIC BREAKDOWN **9**

Properties of Dielectric materials - Gaseous breakdown in uniform and non- uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics- Applications of insulating materials in electrical equipments.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS **9**

Generation of High DC voltage: Rectifiers, voltage multipliers, vandigraff generator: generation of high impulse voltage: single and multistage Marx circuits – generation of high AC voltages: cascaded transformers, resonant transformer and tesla coil- generation of switching surges – generation of impulse currents - Triggering and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS **9**

High Resistance with series ammeter – Dividers, Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters – Sphere Gaps - High current shunts- Digital techniques in highvoltage measurement.

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION **9**

High voltage testing of electrical power apparatus as per International and Indian standards– Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers- Insulation Coordination& testing of abilities.

Total: 45 Hours

TEXT BOOKS:

T1 S.Naidu and V. Kamaraju, „High Voltage Engineering", Tata McGraw Hill, FifthEdition, 2013.

T2 E. Kuffel and W.S. Zaengl, J.Kuffel, „High voltage Engineering fundamentals",Newnes Second Edition Elsevier , New Delhi, 2005.

T3 C.L. Wadhwa, „High voltage Engineering", New Age International Publishers, ThirdEdition, 2010.

REFERENCE BOOKS:

R1 L.L. Alston, „High Voltage Technology", Oxford University Press, First Indian Edition, 2011.

R2 Mazen Abdel – Salam, Hussein Anis, Ahdab A-Morshedy, RoshdayRadwan, High Voltage Engineering – Theory &Practice, Second Edition Marcel Dekker, Inc., 2010.

R3 Subir Ray," An Introduction to High Voltage Engineering" PHI Learning PrivateLimited, NewDelhi, Second Edition, 2013.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Ability to understand Transients in power system.

CO2: Ability to understand Generation and measurement of high voltage.

CO3: Ability to understand High voltage testing.

CO4: Ability to understand various types of over voltages in power system.

CO5: Ability to measure over voltages.

CO6: Ability to test power apparatus and insulation coordination

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	2	2	2	2	2	2	-	-	3	3	3	3
CO2	2	3	3	3	3	3	3	3	3	3	-	-	2	2	2	2
CO3	3	3	3	3	3	3	3	3	3	3	-	-	3	3	3	3
CO4	3	2	2	2	2	2	2	2	2	2	-	-	3	3	3	3
CO5	1	3	3	3	3	3	3	3	3	3	-	-	1	1	1	1
CO6	3	2	2	2	2	2	2	2	2	2	-	-	3	3	3	3

U19EEPE015	SPECIAL ELECTRICAL MACHINES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. Construction, principle of operation, control and performance of stepping motors.
2. Construction, principle of operation, control and performance of switched reluctance motors.
3. Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
4. Construction, principle of operation and performance of permanent magnet synchronous motors.
5. Construction, principle of operation and performance of other special Machines.

PRE-REQUISITES

Electrical Machines I & II

THEORY COMPONENT CONTENTS

UNIT I STEPPER MOTORS **9**

Constructional features –Principle of operation –Types – Torque predictions – Linear Analysis – Characteristics – Drive circuits – Closed loop control – Concept of lead angle - Applications.

UNIT II SWITCHED RELUCTANCE MOTORS **9**

Constructional features –Principle of operation- Torque prediction–Characteristics Steady state performance prediction – Analytical Method – Power controllers – Control of SRM drive- Sensor less operation of SRM – Applications.

UNIT III PERMANENT MAGNET BRUSHLESS D.C. MOTORS **9**

Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis- EMF and Torque equations- Power Converter Circuits and their controllers - Characteristics and control- Applications.

UNIT IV PERMANENT MAGNET SYNCHRONOUS MOTORS **9**

Constructional features -Principle of operation – EMF and Torque equations - Sine wave motor with practical windings - Phasor diagram - Power controllers – performance characteristics -Digital controllers – Applications.

UNIT V OTHER SPECIAL MACHINES **9**

Constructional features -Principle of operation – EMF and Torque equations - Sine wave motor with practical windings - Phasor diagram - Power controllers – performance characteristics -Digital controllers – Applications.

Total: 45 Hours

TEXT BOOKS:

T1 K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.

T2 T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.

T3 E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

REFERENCE BOOKS:

R1 R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.

R2 . Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Ability to analyze and design controllers for special Electrical Machines.

CO2: Ability to acquire the knowledge on construction and operation of stepper motor.

CO3: Ability to acquire the knowledge on construction and operation of stepper switched reluctance motors.

CO4: Ability to construction, principle of operation, switched reluctance motors.

CO5: Ability to acquire the knowledge on construction and operation of permanent magnet brushless D.C. motors.

CO6: Ability to acquire the knowledge on construction and operation of permanent magnet synchronous motors

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4

CO1	2	3	2	3	2	-	-	-	-	2	2	3	2	3	2	2
CO2	2	3	2	3	2	-	-	-	-	2	2	3	1	2	2	3
CO3	1	2	1	3	2	-	-	-	-	2	2	3	2	2	1	2
CO4	2	3	2	2	1	-	-	-	-	2	2	3	2	2	1	3
CO5	2	3	2	3	2	-	-	-	-	1	1	2	1	3	2	2
CO6	2	3	2	3	2	-	-	-	-	2	2	3	1	2	1	2

U19EEPE016 **POWER QUALITY** **L T P C**
3 0 0 3

COURSE OBJECTIVES

1. Causes & Mitigation techniques of various PQ events.
2. Various Active & Passive power filters.
3. Harmonics Vs transients and its Effect of harmonics are implemented
4. To estimation the sag severity
5. Resonance of Passive Filters with the Supply System and Its Mitigation are implemented
6. DVR Structure are implemented

PRE-REQUISITES

Power System Analysis

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION TO POWER QUALITY **9**

Terms and definitions & Sources – Overloading, under voltage, over voltage - Concepts of transients - Short duration variations such as interruption - Long duration variation such as sustained interruption - Sags and swells - Voltage sag - Voltage swell - Voltage imbalance – Voltage fluctuations - Power frequency variations - International standards of power quality – Computer Business Equipment Manufacturers Associations (CBEMA) curve.

UNIT II VOLATGE SAG AND SWEL **9**

Estimating voltage sag performance - Thevenin's equivalent source - Analysis and calculation of various faulted condition - Estimation of the sag severity - Mitigation of voltage sag, Static transfer switches and fast transfer switches. - Capacitor switching – Lightning - Ferro resonance - Mitigation of voltage swell.

UNIT III HARMONICS **9**

Harmonic sources from commercial and industrial loads - Locating harmonic sources – Power system response characteristics - Harmonics Vs transients. Effect of harmonics – Harmonic distortion - Voltage and current distortions - Harmonic indices - Inter harmonics – Resonance Harmonic distortion evaluation, IEEE and IEC standards.

UNIT IV PASSIVE POWER COMPENSATORS **9**

Principle of Operation of Passive Shunt and Series Compensators, Analysis and Design of Passive Shunt Compensators Simulation and Performance of Passive Power Filters-Limitations of Passive Filters Parallel Resonance of Passive Filters with the Supply System and Its Mitigation. Fundamentals of load compensation – voltage regulation & power factor correction.

UNIT V POWER QUALITY MONITORING & CUSTOM POWER DEVICES **9**

Monitoring considerations - Monitoring and diagnostic techniques for various power quality problems - Quality measurement equipment - Harmonic / spectrum analyzer - Flicker meters Disturbance analyzer - Applications of expert systems for power quality monitoring. Principle& Working of DSTATCOM – DSTATCOM in Voltage control mode, current control mode, DVR Structure – Rectifier supported DVR – DC Capacitor supported DVR -Unified power quality conditioner.

Total: 45 Hours

TEXT BOOKS:

T1 Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.WayneBeaty, "Electrical Power Systems Quality", McGraw Hill,2003

T2 J. Arrillaga, N.R. Watson, S. Chen, "Power System Quality Assessment", (New York : Wiley),2000.

T3 Bhim Singh, Ambrish Chandra, Kamal Al-Haddad," Power Quality Problems & Mitigation Techniques" Wiley, 2015.

REFERENCE BOOKS:

R1 G.T. Heydt, "Electric Power Quality", 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994.

R2 M.H.J Bollen, "Understanding Power Quality Problems: Voltage Sags and Interruptions", (New York: IEEE Press), 2000.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Ability to understand various sources, causes and effects of power quality issues, electrical systems and their measures and mitigation.

CO2: Ability to analyze the causes & Mitigation techniques of various PQ events.

CO3: Ability to study about the various Active & Passive power filters.

CO4: Ability to understand the concepts about Voltage and current distortions, harmonics.

CO5: Ability to analyze and design the passive filters.

CO6: Ability to acquire knowledge on compensation techniques.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO1	PSO2	PSO3	PSO4

										0	1	2				
CO1	2	3	2	3	2	-	-	-	-	2	2	3	2	3	2	2
CO2	2	3	2	3	2	-	-	-	-	2	2	3	1	2	2	3
CO3	1	2	1	3	2	-	-	-	-	2	2	3	2	2	1	2
CO4	2	3	2	2	1	-	-	-	-	2	2	3	2	2	1	3
CO5	2	3	2	3	2	-	-	-	-	1	1	2	1	3	2	2
CO6	2	3	2	3	2	-	-	-	-	2	2	3	1	2	1	2

U19EEPE017 FIBRE OPTICS AND LASER INSTRUMENTATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To expose the students to the basic concepts of optical fibres and their properties.
2. To provide adequate knowledge about the Industrial applications of optical fibres.
3. To expose the students to the Laser fundamentals.
4. To provide adequate knowledge about Industrial application of lasers.
5. To provide adequate knowledge about holography and Medical applications of Lasers
6. Types of Interactions and Selecting an Interaction Mechanism are implemented

PRE-REQUISITES

Power System Protection & Switchgear

THEORY COMPONENT CONTENTS

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 9

Construction of optical fiber cable: Guiding mechanism in optical fiber and Basic component of optical fiber communication, –Principles of light propagation through a fibre: Total internal reflection, Acceptance angle (θa), Numerical aperture and Skew mode, – Different types of fibres and their properties: Single and multimode fibers and Step index and graded index fibers,– fibre characteristics: Mechanical characteristics and Transmission characteristics, – Absorption losses – Scattering losses – Dispersion – Connectors and splicers –Fibre termination – Optical sources: Light Emitting Diode (LED), – Optical detectors: PIN Diode.

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9

Fibre optic sensors: Types of fiber optics sensor, Intrinsic sensor- Temperature/ Pressure sensor, Extrinsic sensors, Phase Modulated Fibre Optic Sensor and Displacement sensor (Extrinsic Sensor) – Fibre optic instrumentation system: Measurement of attenuation (by cut back method), Optical domain reflectometers, Fiber Scattering loss Measurement, Fiber Absorption Measurement, Fiber dispersion measurements, End reflection method and Near field scanning techniques – Different types of modulators: Electro-optic modulator (EOM) – Interferometric method of measurement of length – Moire fringes – Measurement of

pressure, temperature, current, voltage, liquid level and strain

UNIT III LASER FUNDAMENTALS 9

Fundamental characteristics of lasers – Level Lasers: Two-Level Laser, Three Level Laser, Quasi Three and four level lasers – Properties of laser: Monochromaticity, Coherence, Divergence and Directionality and Brightness –Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers; – Gas lasers, solid lasers, liquid lasers and semiconductor lasers.

UNIT IV INDUSTRIAL APPLICATION OF LASERS 9

Laser for measurement of distance, Laser for measurement of length, Laser for measurement of velocity, Laser for measurement of acceleration, Laser for measurement of current, voltage and Laser for measurement of Atmospheric Effect: Types of LIDAR, Construction And Working, and LIDAR Applications – Material processing: Laser instrumentation for material processing, Powder Feeder, Laser Heating, Laser Welding, Laser Melting, Conduction Limited Melting and Key Hole Melting – Laser trimming of material: Process Of Laser Trimming, Types Of Trim, Construction And Working Advantages – Material Removal and vaporization: Process Of Material Removal.

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9

Holography: Basic Principle, Holography vs. photography, Principle Of Hologram Recording, Condition For Recording A Hologram, Reconstructing and viewing the holographic image– Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser-0Tissue Interactions Photochemical reactions, Thermalisation, collisional relaxation, Types of Interactions and Selecting an Interaction Mechanism – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

Total: 45 Hours

TEXT BOOKS:

T1 J.M. Senior, 'Optical Fibre Communication – Principles and Practice', Prentice Hall of India,1985.

T2 J. Wilson and J.F.B. Hawkes, 'Introduction to Opto Electronics', Prentice Hall of India, 2001.

T3 Eric Udd, William B., and Spillman, Jr., "Fiber Optic Sensors: An Introduction for Engineers and Scientists ", John Wiley & Sons, 2011.

REFERENCE BOOKS:

R1 G. Keiser, 'Optical Fibre Communication', McGraw Hill, 1995.

R2 M. Arumugam, 'Optical Fibre Communication and Sensors', Anuradha Agencies, 2002.

R3

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Students knows the basic concepts of optical fibres and their properties.

CO2: Adequate knowledge about the Industrial applications of optical fibers are implemented

CO3: To expose the students to the Laser fundamentals.
CO4: To provide adequate knowledge about Industrial application of lasers.
CO5: To provide adequate knowledge about holography and Medical applications of Lasers
CO6: Types of Interactions and Selecting an Interaction Mechanism are implemented

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	2	3	2	-	-	-	-	2	2	3	2	3	2	2
CO2	2	3	2	3	2	-	-	-	-	2	2	3	1	2	2	3
CO3	1	2	1	3	2	-	-	-	-	2	2	3	2	2	1	2
CO4	2	3	2	2	1	-	-	-	-	2	2	3	2	2	1	3
CO5	2	3	2	3	2	-	-	-	-	1	1	2	1	3	2	2
CO6	2	3	2	3	2	-	-	-	-	2	2	3	1	2	1	2

U19EEPE018	MICROPROCESSOR BASED SYSTEM DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. Architecture of PIC microcontroller
2. Interrupts and timers
3. Peripheral devices for data communication and transfer
4. Functional blocks of ARM processor
5. Architecture of ARM processors
6. ARM coprocessor interface are implemented

PRE-REQUISITES

Microprocessor and Microcontroller

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION TO PIC MICROCONTROLLER 9

Introduction to PIC Microcontroller–PIC 16C6x and PIC16C7x Architecture–IC16cxx–-Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – Simple Operations.

UNIT II INTERRUPTS AND TIMER 9

PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine Timers-Timer Programming– Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variability strings.

UNIT III PERIPHERALS AND INTERFACING 9

I2C Bus for Peripherals Chip Access– Bus operation-Bus subroutines– Serial EEPROM—Analog to Digital Converter–UART-Baud rate selection–Data handling circuit–Initialization - LCD and keyboard Interfacing -ADC, DAC, and Sensor Interfacing.

UNIT IV INTRODUCTION TO ARM PROCESSOR 9

Architecture –ARM programmer's model –ARM Development tools- Memory Hierarchy – ARM Assembly Language Programming–Simple Examples–Architectural Support for Operating systems.

UNIT V ARM ORGANIZATION **9**

3-Stage Pipeline ARM Organization– 5-Stage Pipeline ARM Organization–ARM Instruction Execution- ARM Implementation– ARM Instruction Set– ARM coprocessor interface– Architectural support for High Level Languages – Embedded ARM Applications.

Total: 45 Hours

TEXT BOOKS:

T1 Peatman,J.B., "Design with PIC Micro Controllers"PearsonEducation,3rdEdition, 2004.

T2 Furber,S., "ARM System on Chip Architecture" Addison Wesley trade Computer Publication, 2000

REFERENCE BOOKS:

R1 Mazidi, M.A.,"PIC Microcontroller" Rollin Mckinlay, Danny causey ,Prentice Hall of India, 2007.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Ability to understand and apply computing platform and software for engineering problems.

CO2: Ability to understand the concepts of Architecture of PIC microcontroller.

CO3: Ability to acquire knowledge on Interrupts and timers.

CO4: Ability to understand the importance of Peripheral devices for data communication.

CO5: Ability to understand the basics of sensor interfacing.

CO6: Ability to acquire knowledge in Architecture of ARM processors

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													**CO/PSO Mapping**			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	2	3	2	-	-	-	-	2	2	3	2	3	2	2
CO2	2	3	2	3	2	-	-	-	-	2	2	3	1	2	2	3
CO3	1	2	1	3	2	-	-	-	-	2	2	3	2	2	1	2
CO4	2	3	2	2	1	-	-	-	-	2	2	3	2	2	1	3

CO5	2	3	2	3	2	-	-	-	--	1	1	2	1	3	2	2
CO6	2	3	2	3	2	-	-	-		2	2	3	1	2	1	2

U19EEPE019 **VLSI DESIGN** **L T P C**
3 0 0 3

COURSE OBJECTIVES

1. To understand the basics of MOS Transistor
2. To acquire knowledge about the combinational logic circuits
3. Analyze the performance of sequential circuit design
4. Design of Arithmetic building blocks and subsystem
5. Understand the implementation strategies and testing of VLSI
6. To understand the concept of IDDQ Testing

PRE-REQUISITES

Communication Networks

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION TO MOS TRANSISTOR **9**

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

UNIT II COMBINATIONAL MOS LOGIC CIRCUITS **9**

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls. Power: Dynamic Power, Static Power, Low Power Architecture.

UNIT III SEQUENTIAL CIRCUIT DESIGN **9**

Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits. Timing Issues : Timing Classification Of Digital System, Synchronous Design.

UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM **9**

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.

Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

UNIT V IMPLEMENTATION STRATEGIES AND TESTING 9

FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: Ad Hoc Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan.

Total: 45 Hours

TEXT BOOKS:

T1 Neil H.E. Weste, David Money Harris —CMOS VLSI Design: A Circuits and SystemsPerspectiveII, 4th Edition, Pearson , 2017 (UNIT I,II,V)

T2 Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic, IIDigital Integrated Circuits: A Design perspectiveII, Second Edition , Pearson , 2016.(UNIT III,IV)

REFERENCE BOOKS:

R1 Keshab K. Parhi, "VLSI Digital Signal Processing Systems, Design and implementation ", Wiley, Interscience, 2007.

R2 U. Meyer – Baese, "Digital Signal Processing with Field Programmable Gate Arrays", Springer, Second Edition, 2004.

R3

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Understanding the basics of MOS Transistor

CO2: Acquiring knowledge about the combinational logic circuits

CO3: Analyzing the performance of sequential circuit design

CO4: Designing the Arithmetic building blocks and subsystem

CO5: Understanding the implementation strategies and testing of VLSI

CO6: Understanding the concept of IDDQ Testing

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair		CO/PSO Mapping
COs	**PROGRAMME OUTCOMES (POs)**	**PSOs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	3	2	-	-	-	-	2	2	3	2	3	2	2
CO2	2	3	2	3	2	-	-	-	-	2	2	3	1	2	2	3
CO3	1	2	1	3	2	-	-	-	-	2	2	3	2	2	1	2
CO4	2	3	2	2	1	-	-	-	-	2	2	3	2	2	1	3
CO5	2	3	2	3	2	-	-	-	-	1	1	2	1	3	2	2
CO6	2	3	2	3	2	-	-	-	-	2	2	3	1	2	1	2

U19EEPE020 POWER SYSTEMS TRANSIENTS L T P C
3 0 0 3

COURSE OBJECTIVES

1. Generation of switching transients and their control using circuit – theoretical concept.
2. Mechanism of lighting strokes and the production of lighting surges.
3. Propagation, reflection and refraction of travelling waves.
4. Voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.
5. To understand the importance of propagation, reflection and refraction of travelling waves.
6. To find the voltage transients caused by faults.

PRE-REQUISITES

Transmission and Distribution

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION AND SURVEY 9

Review and importance of the study of transients - causes for transients. RL circuit transient with sine wave excitation - double frequency transients - basic transforms of the RLC circuit transients. Different types of power system transients - effect of transients on power systems – role of the study of transients in system planning.

UNIT II SWITCHING TRANSIENTS 9

Over voltages due to switching transients - resistance switching and the equivalent circuit for interrupting the resistor current - load switching and equivalent circuit - waveforms for transient voltage across the load and the switch - normal and abnormal switching transients. Current suppression - current chopping - effective equivalent circuit. Capacitance switching - effect of source regulation - capacitance switching with a restrike,

with multiple restrikes. Illustration for multiple restriking transients - ferro resonance.

UNIT III LIGHTNING TRANSIENTS 9

Review of the theories in the formation of clouds and charge formation - rate of charging of thunder clouds – mechanism of lightning discharges and characteristics of lightning strokes – model for lightning stroke - factors contributing to good line design - protection using ground wires - tower footing resistance - Interaction between lightning and power system.

UNIT IV TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS 9

Computation of transients - transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept - step response - Bewely's lattice diagram - standing waves and natural frequencies - reflection and refraction of travelling waves.

UNIT V TRANSIENTS IN INTEGRATED POWER SYSTEM 9

The short line and kilometric fault - distribution of voltages in a power system - Line dropping and load rejection - voltage transients on closing and reclosing lines - over voltage induced by faults -switching surges on integrated system Qualitative application of EMTP for transient computation

Total:45 Hours

TEXT BOOKS:

T1 Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Inter Science, New York, 2ndEdition, 1991.

T2 PritindraChowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., Second Edition, 2009.

T3 C.S. Indulkar, D.P.Kothari, K. Ramalingam, 'Power System Transients – A statistical approach', PHI Learning Private Limited, Second Edition, 2010.

REFERENCE BOOKS:

R1 M.S.Naidu and V.Kamaraju, 'High Voltage Engineering', McGraw Hill, Fifth Edition, 2013.

R2 R.D. Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986.

R3 Y.Hase, Handbook of Power System Engineering," Wiley India, 2012.

COURSE OUTCOMES:

Attheendofthecoursestudentsshouldbeableto

CO1: Ability to understand and analyze switching and lightning transients.

CO2: Ability to acquire knowledge on generation of switching transients and their control.

CO3: Ability to analyze the mechanism of lighting strokes.

CO4: Ability to understand the importance of propagation, reflection and refraction of travelling waves.

CO5: Ability to find the voltage transients caused by faults.

CO6: Ability to understand the concept of circuit breaker action, load rejection on integrated power system.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	2	3	2	-	-	-	-	2	2	3	2	3	2	2
CO2	2	3	2	3	2	-	-	-	-	2	2	3	1	2	2	3
CO3	1	2	1	3	2	-	-	-	-	2	2	3	2	2	1	2
CO4	2	3	2	2	1	-	-	-	-	2	2	3	2	2	1	3
CO5	2	3	2	3	2	-	-	-	-	1	1	2	1	3	2	2
CO6	2	3	2	3	2	-	-	-	-	2	2	3	1	2	1	2

U19EEPE021	FACTS AND HVDC	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. Summarize the different types of HVDC Transmission systems.
2. Distinguish AC and DC transmission system
3. Illustrate the power flow analysis of AC and DC systems.
4. Illustrate the power flow analysis of AC and DC systems.
5. Classify different types of FACTS devices which are used in compensation of reactive power.
6. Analyze the Static series and combined compensators.

PRE-REQUISITES

Power System Operation and Control

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION **9**

Introduction: Comparison of AC-DC transmission systems, application of DC transmission, types of DC links, typical layout of HVDC converter station. HVDC converters, pulse number, analysis of Gratez circuit with and without overlap, converter bridge characteristics, equivalent circuits or rectifier and inverter configurations of twelve pulse converters.

UNIT II CONVERTER & HVDC System CONTROL **9**

Converter & HVDC system control: Principles of DC Link control, converter control characteristics, system control hierarchy, firing angle control, current and excitation angle control, starting and stopping of DC Link.

UNIT III HARMONICS, FILTERS AND REACTIVE POWER CONTROL **9**

Harmonics, Filters and Reactive power control: Introduction, generation of harmonics, AC

and DC Filters, Reactive power Requirements in steady state, sources of reactive power, static VAR systems.

UNIT IV INTRODUCTION TO FACTS 9

Introduction to FACTS: Flow of power in AC Parallel paths and meshed systems, basic types of FACTS controllers, brief description and definitions of FACTS controllers.

Static shunt compensators: Objectives of shunt compensation, methods of controllable VAR generation, static VAR compensators, SVC and STATCOM, comparison between SVC and STATCOM.

UNIT V STATIC COMPENSATORS 9

Static Compensators: Objectives of Series compensation, Variable impedance type and thyristors switched series capacitors (TCSC), and switching converter type series compensators, static series synchronous compensator (SSSC), power angle characteristics, basic operating control schemes.

Total: 45 Hours

TEXT BOOKS:

T1 HVDC Transmission systems, S Kamakshaiah, V. Kamaraju, The McGraw Hill Companies.

T2 Understanding FACTS, Concepts and Technology of Flexible AC Transmission systems, Narain. G. Hingorani, Laszlo Gyugyi, IEEE press, Wiley India.

REFERENCE BOOKS:

R1 HVDC and FACTS Controllers applications of static converters in power systems, Vijay K. sood, Kluwer Accademic Publishers.

R2 HVDC Power transmission systems, K R Padiyar, New Age International.

COURSE OUTCOMES:

Attheendofthecoursestudentsshouldbeableto

CO1: Illustrate the layout of HVDC converter stations.

CO2: Classify different FACTS controllers and their operation.

CO3: Describe the converter control characteristics of HVDC systems.

CO4: Design AC and DC converters.

CO5: Explain the necessity of Static series and combined compensators.

CO6: Discuss the principle of operation of unified power flow controller.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO1	PSO2	PSO3	PSO4

										0	1	2				
CO1	2	3	2	3	2	-	-	-	-	2	2	3	2	3	2	2
CO2	2	3	2	3	2	-	-	-	-	2	2	3	1	2	2	3
CO3	1	2	1	3	2	-	-	-	-	2	2	3	2	2	1	2
CO4	2	3	2	2	1	-	-	-	-	2	2	3	2	2	1	3
CO5	2	3	2	3	2	-	-	-	-	1	1	2	1	3	2	2
CO6	2	3	2	3	2	-	-	-	-	2	2	3	1	2	1	2

U19EEPE022 SMART GRID ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. Smart Grid technologies, different smart meters and advanced metering infrastructure.
2. The power quality management issues in Smart Grid.
3. The high performance computing for Smart Grid applications.
4. AMI needs in the smart grid are studied
5. IP based Protocols are developed
6. Web based Power Quality monitoring system are implemented

PRE-REQUISITES

Power systems and Renewable energy

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION TO SMART GRID 9

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES 9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plugin Hybrid Electric Vehicles(PHEV).

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

IntroductiontoSmartMeters,AdvancedMeteringinfrastructure(AMI)driversandbenefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED)&their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

Local Area Network(LAN),House Area Network(HAN), Wide Area Network(WAN), Broad band over Power line(BPL),IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

Total: 45 Hours

TEXT BOOKS:

T1 Stuart Borlase "Smart Grid: Infrastructure, Technology and solutions",CRC Press2012.

T2 JanakaEkanayake, Nick Jenkins,KithsiriLiyanage,JianzhongWu,AkihikoYokoyama, "Smart Grid: TechnologyandApplications",Wiley2012.

T3 VehbiC. Güngör ,Dilan Sahin, TaskinKocak, SalihErgüt, ConcettinaBuccella, Carlo Cecati, and Gerhard P. Hancke, "Smart Grid Technologies: Communication Technologies and Standards" IEEE Transactions On Industrial Informatics, Vol.7,No.4, November2011.

REFERENCE BOOKS:

R1 Xi Fang, SatyajayantMisra, GuoliangXue, and DejunYang"SmartGrid –The New and Improved Power Grid: A Survey" ,IEEE Transaction on Smart Grids,vol.14,2012.

R2 James Momohe "Smart Grid: Fundamentals of Design and Analysis,", Wiley-IEEE Press , 2012.

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: To study the Smart Grid technologies, different smart meters and advanced metering infrastructure.

CO2: The power quality management issues in Smart Grid.

CO3: The high performance computing for Smart Grid applications.

CO4: AMI needs in the smart grid are studied

CO5: IP based Protocols are developed

CO6: Web based Power Quality monitoring system are implemented

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	3	2	-	-	-	-	2	2	3	2	3	2	2
CO2	2	3	2	3	2	-	-	-	-	2	2	3	1	2	2	3
CO3	1	2	1	3	2	-	-	-	-	2	2	3	2	2	1	2
CO4	2	3	2	2	1	-	-	-	-	2	2	3	2	2	1	3
CO5	2	3	2	3	2	-	-	-	-	1	1	2	1	3	2	2
CO6	2	3	2	3	2	-	-	-	-	2	2	3	1	2	1	2

U19AEOE001	AGRICULTURAL WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To impart knowledge to students on various methods of agricultural waste management for eco-friendly energy and manure production.

PREREQUISITES: NIL

UNIT I INTRODUCTION 10

Availability of different types of agriculture wastes - its overall characteristics – classification of agro wastes based on their characteristics- its recycling and utilization potential- current constraints in collection and handling of agricultural wastes – its environmental impact.

UNIT II COMPOSTING 8

Definition- Solid waste suitable for composting – Methods of composting - vermicomposting - Mineralization process in composting - Biochemistry of composting – Factors involved – Infrastructure required – maturity parameters – value addition – application methods

UNIT III BIOMASS BRIQUETTING 9

Definition – potential agro residues and their characteristics for briquetting – fundamental aspects and technologies involved in briquetting – economic analysis of briquetting – setting up of briquetting plant-appliances for biomass briquettes.

UNIT IV BIOCHAR PRODUCTION 9

Definition - characteristics of agro wastes suitable for Biochar production – Methods of Biochar production – fast and slow pyrolysis – characteristics of Biochar – role of Biochar in soil nutrition and carbon sequestration

UNIT V BIOGAS AND BIO ETHANOL PRODUCTION 9

Screening of suitable lingo cellulosic substrate for biogas production -determination of bio-energy potential of agro-waste by estimating total solids - volatile solids - Calorific value- per cent total carbohydrates, moisture, lignin and cellulosic contents – preparation of feed stocks for anaerobic bio- digestion – types of digesters – factors affecting - nutrient value and utilization of biogas slurry. Ethanol production from lingo cellulosic wastes - Processing of Biomass to Ethanol –pre- treatment-fermentation-distillation

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 Build various eco-friendly methods for agricultural waste management

CO2 To develop the process of composting of different types of solid wastes

CO3 To understand the techniques of briquetting from agro-residues

CO4 To understand the role of biochar in soil nutrition and carbon sequestration

CO5 Nutritive value and energy production potential of agro wastes

CO6 To develop and understand the techniques for processing of ethanol and biogas production

TEXT BOOKS:

T1: Rai G.D,Non conventional sources of Energy, Khanna publishers, New Delhi, 1995.

T2: Diaz,l.F.,M. de Bertoldi and W. Bidlingmaier. 2007. Compost science and technology, Elsevier pub., PP.1-380.

REFERENCE BOOKS:

R1: P.D. Grover & S.K. Mishra, "Biomass Briquetting: Technology and Practices". Published by FAO Regional Wood Energy Development Programme in Asia, Bangkok, Thailand, 1996.

R2: Magdalena Muradin and Zenon Foltynowicz, "Potential for Producing Biogas from Agricultural Waste in Rural Plants in Poland". Sustainability, 2014, 6, 5065-5074.

R3: Biochar production from agricultural wastes via low-temperature microwave carbonization

Course Articulation Matrix : 3- High, 2- Medium, 3- Low															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	3	3
CO3	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2
CO4	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2
CO5	2	1	1	-	-	-	-	-	-	-	-	-	-	3	3
CO6	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2

U19AEOE002	FARM MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To impart the fundamental knowledge and basic concepts of Economics and Farm Management
- To understand the types of resources and Investment analysis in agriculture sector
- To understand the Farm financial analysis, Investment and Budgeting for farms.
- To expose the students to different extension methods for communication to take the work from lab to field
- To plan the financial aspects, economics related to farm management in a cost effective manner.

PREREQUISITES: NIL

UNIT I FARM MANAGEMENT & PLANNING 10

Farm Management – definition – scope- Classification of farms – Basic concepts in farm management - Relationship between farm management and other basic sciences - Farm layout – Farm records and accounts– Farm appraisal techniques – Valuation - Farm management- need and analysis –Elements of farm planning– Whole farm planning and partial planning – Farm level management system – Farm budgeting – whole farm budgeting and partial budgeting – Estimation of credit - examples of farm planning and budgeting

UNIT II LAWS OF ECONOMICS 8

Agricultural Economics – definition and scope – Basic laws of economics – demand and supply concepts – law of increasing, diminishing and constant returns – Equi-marginal returns - Product relationship – Production function – definition and types – Production function curves – Optimum level of input use – Economies of scale external and internal economies and diseconomies - Cost concepts – types - Opportunity cost – comparison of costs – Factor relationship – concepts.

UNIT III COST CURVES 10

Principle of substitution – isoquant, isocline, expansion path, ridge line and least cost combination of inputs- Product-product relationship – Production possibility curve, isorevenue line and optimum combination of outputs – Cost curves –Optimum input and output levels – Factor &relationship – Least cost combination of inputs – Estimation of cost of cultivation and cost of production of crops - annual and perennial crops

UNIT IV MANAGEMENT OF RESOURCESAND FINANCIAL ANALYSIS 9

Concept of risk and uncertainty – causes for uncertainty – Managerial decisions to reduce risks in production process – Management of resources – types of resources- land, labour, capital and measurement of their efficiencies – Mobilization of farm resources- Cost of machinery and maintenance – Break even analysis – Investment analysis – Discounting techniques- Farm financial analysis – Balance sheet – Income statement –Cash flow analysis – Farm investment analysis – Time comparison principles - Preparation of interview schedule and farm visit for data collection.

UNIT V AGRICULTURAL EXTENSION 8

Communication – models – elements and their characteristics – types and barriers - Programme planning – monitoring and evaluation - Extension teaching methods - Audio-Visual aids – classification – purpose, planning and selection – individual, group and mass contact methods –Modern communication sources – internet, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), village kiosks, Kissan Call Centre (KCC), mobile phone – Diffusion - Adoption –Capacity building of extension personnel and farmers –types of training, training to farmers, farm women and rural youth, FTC & KVK

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 Gain knowledge in various farm management and farm layout aspects

CO2 Familiarize with the various laws of economics and product relationship aspects

CO3 Gain knowledge on cost curves and its applications

CO4 Understand about the various concepts of management of resources

CO5 Gain knowledge on farm management and financial analysis

CO6 Familiarize with budgeting and cost estimation for farm layout

TEXT BOOKS:

T1: Johl, S.S., and Kapur, T.R.,Fundamentals of Farm Business Management", Kalyani publishers, Ludhiana, 2007

T2: Subba Reddy, S., Raghu Ram, P., NeelakantaSastry T.V and Bhavani 3. Devi, I., "Agricultural Economics"Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2006.

REFERENCE BOOKS:

R1: Raju, V.T., "Essentials of Farm Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.

R2: Subba Reddy, S., and Raghu Ram, P. „ "Agricultural Finance and Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.

Course Articulation Matrix : 3- High, 2- Medium, 3- Low															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	–	–	–	–	–	–	–	–	–	–	–	–	–	-
CO2	3	–	–	–	–	–	–	–	–	–	–	–	–	–	-
CO3	3	2	2	2	–	–	–	–	–	–	–	–	–	-	-
CO4	3	2	2	2	–	–	–	–	–	–	–	–	–	–	-
CO5	3	3	2	2	–	–	–	–	–	–	–	–	–	1	1
CO6	2	3	2	1	-	-	-	-	-	-	-	-	-	1	1

U19BTOE001	BASICS OF BIOINFORMATICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To enable the students

- To improve the programming skills of the student
- To let the students know the recent evolution in biological science

COURSE OUTCOMES

At the end of the course, learners will be able to

CO1. Use bioinformatics tools with programming skills.

CO2. Apply computational based solutions for biological perspective

CO3. Alignment of nucleotide and protein sequences

CO4. Predict gene and protein structure.

CO5. Construct, interpret and assess the different molecular phylogenetic tree prediction and gene prediction algorithms

CO6. understand the Application of Bioinformatics

UNITI DATABASES 9

Introduction to Bioinformatics-Biological information resources-Genome sequence acquisition and analysis-Retrieval of biological data-Data acquisition, databases, structure and annotation-Data mining and data characteristics.

UNITII SEQUENCE ALIGNMENT AND DATABASE SEARCHES 9

Database searches and Sequence Alignment-Pair wise and multiple sequence alignment-Methods of local and global alignment-Dynamic programming, Scoring matix, PAM, searching sequence databases by sequence similarity-BLAST and FASTA.

UNITIII PHYLOGENY ANALYSIS 9

Phylogenetics, Molecular Phylogeny and evolutionary analysis-Clustal W, MSA, Dendrogram-Maximum likelihood, Maximum Parsimony, convergent and parallel evolution, Bootstrapping, Jackknifing-Phylograms.

UNITIV STRUCTURAL BIOINFORMATICS 9

Structural bioinformatics, analysis for protein structure, Predicting protein structure and function from Sequence-Homology modeling-Microarray Data analysis- proteomic data analysis-Visualization of molecular structures.

UNITV APPLICATIONS OF BIOINFORMATICS 9

Scope of bioinformatics-Bioinformatics in the Pharmaceutical Industry- Structure-Based Rational Drug Design and discovery-Chemi-informatics in Biology.

Total: 45 Hours

TEXT BOOKS:

1. Attwood, T. and P.S. David. 2006. Introduction to Bioinformatics. Pearson Education Ltd., New York.
2. Axevanis, A.D., and Ouellette, B.F.F. (eds) 2006. Bioinformatics A Practical Guide to Analysis of Genes and Proteins. 3rd Edition, John Wiley and Sons, New York.

Course Articulation Matrix

3 - High, 2 - Medium, 1 – Low

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	1	-	-	-	2	-	-	-	-	-	-	-	-	-
2	-	-	3	-	2	3	-	-	-	-	-	-	-	-	1
3	-	-	2	-	3	3	-	-	-	-	-	-	-	-	1
4	-	3	2	-	-	2	-	-	-	-	-	-	-	1	1
5	-	-	2	-	2	3	-	-	-	-	-	-	-	2	-
6	1	-	-	-	1	-	-	-	-	-	-	-	-	2	-

U19BTOE002	INTRODUCTION TO BIOENERGY AND BIOFUELS	L	T	P	C
		3	0	0	3

Course Objectives

To enable the students

- This course will be focused on achievement, acquisition of knowledge and enhancement of comprehension of information regarding bio energy and biofuel technologies and their sustainable applications..

Course Outcomes

At the end of the course, learners will be able to

CO1. Understand in depth of the bioenergy and biofuels.
CO2. Distinguish various forms of bioenergy and bio fuels production
CO3. Analyse concepts related to and advantages of bioenergy.
CO4. Develop novel products from biofuels.
CO5. Understand the environmental sustainability.
CO6. Understand the yield and efficiency of Biofuels

UNITI BASIC CONCEPTS OF BIO-FUELS **9**

Biopower, Bioheat, Biofuesl, advanced liquid fuels, drop-in fuels, biobased products

UNITII FEEDSTOCKS **9**

Harvested Feedstocks: First generation biofuels, Second generation biofuels, third generation biofuels. Residue Feedstocks: Agricultural wastes, forestry wastes, farm waste, organic components of residential, commercial, institutional and insdustrial waste.

UNITIII CONSERVATION TECHNOLOGIES **9**

Biorefinery concept – biorefineries and end products, Biochemical conversion – hydrolysis, enzyme and acid hydrolysis, fermentation, anaerobic digestion and trans-esterification, Thermochemical conversion – Combustion, Gasification, Pyrolysis, other thermochemical conversion technologies. Scaling up of emerging technologies.

UNITIV BIOMETHANE AND BIOHYDROGEN **9**

Biomethanol − Principles, materials and feedstocks, Process technologies and techniques, Advantages and limitations − Biological hydrogen production methods, Fermentative hydrogen production, Hydrogen economy − Advantages and limitations

UNITV SUSTAINABILITY AND RESILIENCE **9**

Environmental Sustainability, bioenergy sustainability, emissions of biomass to power generation applications, emissions from biofuels. ILUC issues, Carbon footprint, Advanced low carbon fuels

Total: 45 Hours

TEXT BOOKS:

1. Biorenewable Resources – Engineering new products. Robert C Brown. Blackwell Publishing Professional, 2003.
2. Biomass for Renewable Energy, Fuels and Chemicals. Donald Klass. Academic press. 1999

3. Introduction to Bioenergy.Vaughn C. Nelson and Kenneth L. Starcher

Course Articulation Matrix

3 - High, 2 - Medium, 1 – Low

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	3	-	-	-	-	-	-	-	-	-	2	-	-
2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3	3	3	3	2	2	2	-	1	3	-	-	-	-	2	-
4	3	1	1	-	-	1	-	1	-	-	-	-	-	1	-
5	3	3	2	1	2	-	-	1	-	-	-	-	-	1	-
6	3	3	2	1	2	-	-	1	-	-	-	-	-	1	-

U19BMOE001	BIO HEALTHCARE AND TELEMEDICINE	L	T	P	C
		3	0	0	3

Course Objective

The student should be made:

- To enable the students to acquire knowledge about the principles and application of telemedicine in biomedical industry

UNIT I BACKGROUND OF TELEMEDICINE 9

Introduction ,definitions of telemedicine, telehealth and telecare, Origins and development of telemedicine: from beginning to modern times, modern telemedicine and telecare Drivers of telemedicine and telecare: technology drivers, non technological drivers, the funding dilemma Telemedicine in developed and underdeveloped countries ,benefits and limitations of telemedicine Types of information and transmission in telemedicine: audio, video, still images, text and data, Fax

UNIT II COMMUNICATION AND NETWORK SYSTEMSIN TELEMEDICINE 9

Types of communication and network: public switched telephone network, plain old telephone service, integrated services digital network, internet, asynchronous transfer mode Wireless communications basics and its types Wireless sensor standards and homecare concerns, medical sensors for mobile communication devices Development of disposable adhesive wearable human monitoring system Implantable systems: implantable system architecture Signal Processing in implantable neural recording micro systems, electronic health signal processing

UNIT III TECHNOLOGIES FOR SAFEGUARDING MEDICAL DATA AND PRIVACY 9

Data Exchanges: Network configuration, circuit and packets witching, H.320 series Data security and standards: Encryption, cryptography, mechanisms of encryption, phases of encryption Cryptography, safeguarding patient medical history Anonymous data collection and processing, biometric security
and identification

UNIT IV TELEHEALTH AND MOBILE HEALTH 9

Medical robotics: surgical robots, rehabilitation robots Modern devices for tele-surgery: Main component and functionalities of a robotics tele-surgery System, design guidelines and methodology Microsurgery Systems: Robot-assisted microsurgery system, miniaturization, microsurgical tools, visualization methods and systems Image-guided microsurgery: Image guidance component and workflow, image guidance by surgical domain

UNIT V IMPLEMENTATION OF TELEMEDICINE AND FUTURE TRENDS IN TECHNOLOGY 9

Telecardiology: Tools and devices Teleradiology and Tele-audiology Telepathology system development and implementation Acute care telemedicine and monitoring for elderly care Virtual doctor systems for medical practices, wireless electrical impedance tomography Synthetic biometrics in biomedical systems, bio-kinematics for mobility

Total:45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Explain the development and transmission techniques used in telemedicine

CO2: Describe the types of communication and network systems

CO3: Explain the technologies used in data exchange and privacy of telemedicine

CO4: Illustrate the current system of tele-health and mobile health

CO5: Describe the currents and futures perspective of telemedicine

CO6: Acquire knowledge about the principles and application of telemedicine

TEXTBOOKS:

T1 Bernard Fong, A.C.M. Fong, C.K. Li, ―Telemedicine Technologies: Information Technologies in Medicine and Telehealth‖, Wiley, 1st edition,2010.

T2 HalitEren,JohnG.Webster,―TheE-Medicine,E-Health,M-Health,Telemedicine,and Telehealth Handbook‖, CRC Press,1st edition, 2015.

T3 OlgaFerrer-Roca,M.SosaLudicissa,―HandbookofTelemedicine‖,IOSpress,1stedition,2002.

REFERENCEBOOKS:

R1 GeorgiGraschew,StefanRakowsky,―TelemedicineTechniquesandApplications,Intech, 1stedition,2011

R2 A.C.Norris,―EssentialsofTelemedicineandTelecare,JohnWiley&Sons,1stedition,2002.

R3 RichardW.Carlson,―TelemedicineintheICU,AnIssueofCriticalCareClinics,(The Clinics: Internal Medicine)‖, Elsevier, 1st edition,2015.

Course Articulation Matrix

3 - High, 2 - Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO.1	2	2	3	1	-	-	-	-	-	-	-	-	2	2
CO.2	2	2	3	1	-	-	-	-	-	-	-	-	2	2
CO.3	2	2	3	1	-	-	-	-	-	-	-	-	2	2
CO.4	2	2	3	1	-	-	-	-	-	-	-	-	2	2
CO.5	3	2	3	1	-	-	-	-	-	-	-	-	3	2
CO.6	2	2	3	1	-	-	-	-	-	-	-	-	2	2

U19BMOE002	EMBEDDED SYSTEMS IN MEDICAL DEVICES	L	T	P	C
		3	0	0	3

Course Objective

The student should be made:

- Understand the design of embedded system for various medical devices.

UNIT I EMBEDDED DESIGN WITH MICROCONTROLLERS 9

Product specification – hardware / software partitioning- Detailed hardware and software design – integration,product testing- Microprocessor Vsmicro controller- Performance tools, bench marking processors- RTOS micro controller -issues in selection of processors.

UNIT II PARTITIONING DECISION 9

Hardware / software duality- Hardware-software portioning, coding for hardware/software development, ASIC revolution- Managing the risk,co-verification, execution environment- Memory organization of controller, memory enhancement- Firmware, speed and code density, system startup.

UNIT III FUNCTIONALITIES FOR SYSTEM DESIGN 9

Timers, watch dog timers- RAM, flash memory, basic toolset, integration of hardware & firmware- Application programming, IDE, target configuration- Host based debugging analyser- Remote debugging, ROM emulators, logic

UNIT IV DESIGN OF PATIENT MONITORING DEVICES 9

Design consideration of patient monitoring systems- Basic block diagram of pulse oximeter, design requirementof device- Circuit implementation of interfacing of oximeter sensors with microcontroller- Software coding and implementation.

UNIT V DESIGNING OF PACEMAKER 9

System description of pacemaker- Design requirement and basic block diagram of pacemaker- Interfacing of pacemaker elements with processors- Software coding of pacemaker and implementation.

Total:45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Attain knowledge on the basic concepts and the building blocks for embedded system

CO2: Understand the hardware and software partitioning in embedded systems

CO3: Gain knowledge about timers and memory organization of embedded systems

CO4: Design a pulse oximeter using embedded tool

CO5: Design a pacemaker using embedded tool

CO6: Understand the design of embedded system for various medical devices

TEXTBOOKS:

T1 James K. Peckol, ―Embedded system Design‖, John Wiley & Sons, 1st edition, 2010

REFERENCEBOOKS:

R1 Geo EliciaWhite,―MakingEmbeddedSystems‖,O'ReillySeries,SPD,1stedition,2011.
GeorgiGraschewStefanRakowsky,―TelemedicineTechniquesandApplications,InTech, 1stedition,2011

R2 G. Baura, "A Biosystems Approach to Industrial Patient Monitoring and DiagnosticDevices‖, Morgan&Claypool, IEEE,2008.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO.1	2	2	2	2	2	2	-	-	-	-	2	2	3	3
CO.2	2	2	2	2	2	2	-	-	-	-	2	2	3	3
CO.3	3	3	2	3	2	1	-	-	-	-	2	2	2	2
CO.4	3	3	3	2	2	2	-	-	-	-	2	2	2	2
CO.5	2	2	2	3	2	1	-	-	-	-	2	2	2	2
CO.6	2	2	2	2	2	1	-	-	-	-	2	2	2	2

U19CEOE001	GREEN BUILDINGS	L T P C 3 0 0 3

Course Objectives:

This course aims to provide the students,

- To imbibe basics of green design and sustainable development concept.
- To identify various area of implementing strategies for green design in projects to enhance built environment.
- To learn institutional guidelines for development and certification of green designs.

UNIT I INTRODUCTION **9**

Green Building - Need for Green Building - Benefits of Green Buildings - Green Building Materials and Equipment in India - Key Requisites for Constructing a Green Building - Important Sustainable features for Green Building.

UNIT II GREEN BUILDING CONCEPTS AND PRACTISES **9**

Indian Green Building Council - Green Building Moment in India - Benefits Experienced in Green Buildings - Launch of Green Building Rating Systems - Residential Sector - Market Transformation. Green Building Opportunities And Benefits: Opportunities of Green Building - Green Building Features, Material and Resources - Water Efficiency - Optimum Energy Efficiency - Typical Energy Saving Approach in Buildings - LEED India Rating System and Energy Efficiency.

UNIT III GREEN BUILDING DESIGN **9**

Introduction - Reduction in Energy Demand - Onsite Sources and Sinks - Maximize System Efficiency - Steps to Reduce Energy Demand and Use Onsite Sources and Sinks - Use of Renewable Energy Sources. Eco-friendly captive power generation for factory - Building requirement.

UNIT IV UTILITY OF SOLAR ENERGY IN BUILDINGS **9**

Utility of Solar energy in buildings. Concepts of Solar Passive Cooling and Heating of Buildings - Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.

UNIT V GREEN COMPOSITES FOR BUILDINGS **9**

Concepts of Green Composites - Water Utilisation in Buildings - Low Energy Approaches to Water Management, Management of Solid Wastes, Management of Sullage Water and Sewage, Urban Environment and Green Buildings, Green Cover and Built Environment.

Total: 45 Hours

Course Outcomes:

At the end of the course, students should be able to

CO1 : Know about the importance and necessity of green buildings.

CO2 : Understand the principles of green building certifications (LEED) and low-energy building strategies.

CO3 : Understand the concepts and principles in Green Building Design.

CO4 : Suggest materials and technologies to improve energy efficiency of building.

CO5 : Gain ideas various green composites used in building and sustainable development.

CO6 : Have an Insight about criteria for rating systems along with established Indian codes an guideline.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	2	1	3	-	3	-	-	-	-	2	2	1	3
CO2	2	1	3	2	1	2	3	-	-	-	-	1	2	1	3
CO3	2	2	2	3	1	1	3	-	-	-	-	3	2	1	3
CO4	-	-	1	-	-	-	3	-	-	-	-	2	2	1	3
CO5	2	-	1	2	1	-	3	-	-	-	-	3	3	1	3
CO6	3	2	1	2	-	1	3	-	-	-	-	1	3	3	3

TEXTBOOKS

T1. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. “Alternative Building Materials and Technologies”. New Age International, 2007.

T2. Low Energy Cooling for Sustainable Buildings. John Wiley and Sons Ltd, 2009.

T3. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

REFERENCE Books

R1. Osman Attmann, “Green Architecture Advanced Technologies and Materials”. McGraw Hill, 2010.

R2. Jerry Yudelson, “Green building Through Integrated Design”. McGraw Hill, 2009.

R3. Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke.

U19CEOE002 DISASTER PREPARDNESS AND MANAGEMENT L T P C
3 0 0 3

Course Objectives:

This course aims to provide the students,

- To Understand the basic concepts of disaster management.
- To acquire knowledge on types and categories of disasters.
- To understand the impacts and challenges posed by disasters.

UNIT I INTRODUCTION TO DISASTER 9

Concepts and definitions - disaster, hazard, vulnerability, resilience, risks severity, frequency and details, capacity, impact, prevention, mitigation. Global trends in disasters - urban disasters, pandemics, complex emergencies, Climate change. Disaster's classification - natural disasters - manmade disasters - hazard and vulnerability profile of India - mountain and coastal areas, ecological fragility. Dos and Don'ts during various types of Disasters.

UNIT II DISASTER IMPACTS 9

Disaster impacts (environmental, physical, social, ecological, economic, political, etc.) - health, psycho, social issues - demographic aspects (gender, age, special needs) - hazard locations - global and national disaster trends - climate change and urban disasters.

UNIT III DISASTER RISK REDUCTION 9

Disaster management cycle – its phases : prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures - risk analysis - vulnerability and capacity assessment - early warning systems - Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications) - Roles and responsibilities of government – community - local institutions - NGOs and other stakeholders - Policies and legislation for disaster risk reduction - DRR programmes in India and the activities of National Disaster Management Authority

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTERS, ENVIRONMENT AND DEVELOPMENT 9

Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land use changes, urbanization etc.), sustainable and environmentally friendly recovery; reconstruction and development methods.

Total: 45 Hours

Course Outcomes:

At the end of the course, students should be able to,

CO1 : Understand the foundations of hazards, disasters and associated natural/social phenomena.

CO2 : Familiarity with disaster management theory (cycle, phases) and Methods of

community involvement as an essential part of successful DRR.

CO3 : Apply knowledge about existing global frameworks and existing agreements.

CO4 : Understand consequences and inter relationship between development and disasters.

CO5 : Draw the hazard and vulnerability profile of India, Scenarios in the Indian context.

CO6 : Conduct independent DM study including data search, analysis and presentation of disaster case study.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													**CO/PSO Mapping**		
CO s	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	-	1	1	3	3	-	-	1	-	2	3	1	1
CO2	-	2	1	1	2	2	3	-	3	-	-	2	2	1	-
CO3	-	3	2	1	-	3	1	-	3	-	-	2	2	1	-
CO4	3	3	-	1	3	3	2	-	-	-	-	2	3	1	-
CO5	-	3	2	1	3	3	2	-	-	3	-	2	3	1	3
CO6	3	3	2	-	1	3	2	-	-	-	-	-	2	1	3

TEXT BOOKS:

T1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010.

T2. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.

T3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.

REFERENCE BOOKS:

R1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.

R2. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003.

R3. Government of India, National Disaster Management Policy,2009.

U19CSOE001 SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

To understand the phases in a software project

- To understand fundamental concepts of requirements engineering and Analysis Modeling.
- To understand the various software design methodologies
- To learn various testing and maintenance measures

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT 9

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION 9

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

UNIT III SOFTWARE DESIGN 9

– Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components..

UNIT IV TESTING AND MAINTENANCE 9

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering..

UNIT V PROJECT MANAGEMENT 9

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 Identify the key activities in managing a software project and recognize different process model

CO2 Explain the concepts of requirements engineering and Analysis Modeling.

CO3 Outline the systematic procedures for software design and deployment

CO4 Compare various testing and maintenance methods

CO5 Interpret the project schedule, estimate project cost and effort required.

CO6 Develop a software using the software engineering principles

TEXT BOOKS:

T1: Roger S. Pressman, "Software Engineering – A Practitioner‟s Approach", Seventh Edition, Mc Graw-Hill International Edition, 2010..

T2: Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.

REFERENCE BOOKS:

R1: Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited, 2009

R2: Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.

R3: Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.

R4: Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited,2007.

Course Articulation Matrix : 3- High, 2- Medium, 3- Low															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2
CO2	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO6	3	2	2	-	-	-	-	-	-	-	-	-	-	2	2

U19CSOE002 **DATABASE MANAGEMENT SYSTEMS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To learn the fundamentals of data models and to represent a database system using ER diagrams.
- To study SQL and relational database design.
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.
- To have an introductory knowledge about the Storage and Query processing Techniques

PREREQUISITES: NIL

UNIT I RELATIONAL DATABASES **10**

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL

UNIT II DATABASE DESIGN **8**

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

UNIT III TRANSACTIONS **9**

– Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery

UNIT IV TESTING AND MAINTENANCE **9**

RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation.

UNIT V PROJECT MANAGEMENT **9**

Distributed Databases: Architecture, Data Storage, Transaction Processing – Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL - XML Databases: XML Hierarchical Model, DTD, XML Schema, XQuery – Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems.

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 Discuss the fundamental concepts of relational database and SQL

CO2 Use ER model for Relational model mapping to perform database design effectively

CO3 Summarize the properties of transactions and concurrency control mechanisms

CO4 Outline the various storage and optimization techniques

CO5 Compare and contrast various indexing strategies in different database systems

CO6 Explain the different advanced databases

TEXT BOOKS:

T1: Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011.

T2: Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Sixth Edition, Pearson Education, 2011.

REFERENCE BOOKS:

R1: C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.

R2: Raghu Ramakrishnan, ―Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.

R3: G.K.Gupta,"Database Management Systems", Tata McGraw Hill, 2011.

Course Articulation Matrix : 3- High, 2- Medium, 3- Low															
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	3	3
CO3	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2
CO4	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2
CO5	2	1	1	-	-	-	-	-	-	-	-	-	-	3	3
CO6	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2

U19ECOE003 **CONSUMER ELECTRONICS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- .Understand troubleshooting in loudspeakers and Microphones
- Gain knowledge on television signals and components
- Gain knowledge on various types of audio recording and playback techniques
- Understand communication systems
- Understand principle of working of home appliances

PREREQUISITES

- Basic Electronics
- Electronic devices

UNIT I LOUDSPEAKERS AND MICROPHONES 9

Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters - Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones

UNIT II TELEVISION STANDARDS AND SYSTEMS 9

Components of a TV system – interlacing – composite video signal. Colour TV – Luminance and Chrominance signal; Monochrome and Colour Picture Tubes - Colour TV systems – NTSC, PAL,SECAM - Components of a Remote Control.

UNIT III OPTICAL RECORDING AND REPRODUCTION 9

– Audio Disc – Processing of the Audio signal – read out from the Disc –Reconstruction of the audio signal – Video Disc – Video disc formats- recording systems – Playback Systems.

UNIT IV TELECOMMUNICATION SYSTEMS 9

Telephone services - telephone networks – switching system principles –PAPX switching – Circuit, packet and message switching, LAN, MAN and WAN, Integrated Services Digital Network. Wireless Local Loop. VHF/UHF radio systems, Limited range Cordless Phones; cellular modems

.

UNIT V HOME APPLIANCES 9

Basic principle and block diagram of microwave oven; washing machine hardware and software; components of air conditioning and refrigeration systems

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Troubleshoot different types of microphones and speakers

CO2: Maintain audio systems

CO3: Analyse composite video signal used in TV transmission

CO4: Troubleshoot TV Receivers

CO5: Construct various home appliances

CO6: Maintain various home appliances

TEXT BOOKS:

T1: S.P.Bali, "Consumer Electronics", Pearson Education, 2005.

T2: Gupta. R.G, " Audio Video Systems principles maintenance and trouble shooting, Mc graw Hill, New Delhi, India, 2010

REFERENCE BOOKS:

R1: Dhake .A.M, " Television and Video Engineering", Mc graw Hill, New Delhi, India, 2006

R2: Modern television practice: Transmission, reception and applications, New age International, New Delhi, 2015

CO/PO MAPPING (S/M/W indicates strength of correlation)													CO/PSO		
3-Strong, 2-Moderate, 1-Fair													Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO2	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO3	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO4	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO5	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO6	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1

U19ECOE006 **MEDICAL ELECTRONICS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters
- To study about the various assist devices used in the hospitals
- To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques

PREREQUISITES

- Basic Electronics
- Electronic devices

UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING 9

Sources of bio medical signals, Bio-potentials, Biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics.

UNIT II NON ELECTRICAL PARAMETER MEASUREMENTS 9

Blood flow meter-Types, Cardiac output measurements-Types, respiratory measurement, blood pressure measurement, temperature and pulse measurement, Blood Cell Counters

.

UNIT III THERAPEUTIC EQUIPMENTS 9

Cardiac pacemakers - types, Cardiac defibrillators-types, Dialyzers, Heart Lung Machines –Oxygenations, Diathermies-Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy

UNIT IV MEDICAL IMAGING 9

X-Ray machine, computer axial tomography- CT scans, Positron Emission Tomography- PET Scans. MRI and NMR Ultrasonic Imaging systems, Medical Thermograph

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION AND APPLICATION IN MEDICINE 9

Bio medical telemetry- remote patient monitoring systems, Telemedicine, Radio pill, Application of cryogenics in medicine, Application of LASERS in medicines. Diagnosis of Cancers and tumors using image processing, diagnosis of dental plague using image processing, diagnosis of various eye problems using image processing

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Know the human body electro- physiological parameters and recording of bio-potentials

CO2: Comprehend the non-electrical physiological parameters and their measurement – body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.

CO3: Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators

CO4: Comprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgical diathermies , and bio-telemetry principles and methods

CO5: Know about recent trends in medical instrumentation

CO6: Implement application of Instruments

TEXT BOOKS:

T1: Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice Hall of India, New Delhi, 2007. (UNIT I – V)

T2: Khandpur, R.S., -Handbook of Biomedical Instrumentation, TATA McGraw-Hill, New Delhi, 2003.(UNIT I – V)

REFERENCE BOOKS:

R1: Dhake .A.M, " Television and Video Engineering", Mc graw Hill, New Delhi, India, 2006

R2: Modern television practice: Transmission, reception and applications, New age International, New Delhi, 2015

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO2	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO3	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO4	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO5	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO6	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1

U19FTOE001	FOOD SCIENCE AND NUTRITION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

lain the basic concepts of food and nutrition. Define the overall classification, function, and source of carbohydrates, lipids and proteins. Discuss the overall aspects of vitamins. Outline the role of health and nutritional importance of micro and macro minerals. Summarize the recent trends in nutrition

PREREQUISITES

- Basic idea on biomolecules
- Knowledge of essential nutrition requirement
- Health benefits and function of nutrition
- Diet based nutrition
- Effect of storage and processing on nutrition

UNITI HUMAN NUTRITION 9+3

Historical perspective of nutrient requirements – Assessment of nutritional status – recommended dietary allowances of macronutrients for all age groups – Assessment of protein quality – Malnutrition and related disorders – Balanced Diet. Factors influencing dietary intake: Food habits, food fads and fallacies, their influence on health and wellbeing.

UNITII BIOMOLECULES 9+3

Carbohydrates- Definition, classification, Functions, Sources of Carbohydrates, Deficiency. Lipids – Definition, classification, function, sources, Refined & Hydrogenated fats process. Proteins – Definitions, Classification, Function, Amino Acids, Sources of Proteins.

UNITIII VITAMINS 9+3

Physiological role, bio-availability, requirements, sources and deficiency of Fat Soluble Vitamins: Vitamin A, Vitamin D, E & K. Water soluble vitamins: Vitamin C, Thiamine, Riboflavin, Niacin, Pantothenic acid, Biotin, Folic acid, Vitamin B12, VitaminB6.

UNITIV MINERALS 9+3

Physiological role, bio-availability, requirements, sources and deficiency of Macro minerals: Calcium, Phosphorus Magnesium, Sodium, Potassium chloride. Micro minerals: Iron, Zinc, copper, selenium, chromium, iodine, manganese, Molybdenum and fluoride.

UNITV RECENT TRENDS IN DIETETICS 9+3

Principles of dietary management in gout, rheumatism, AIDS/HIV – Cancer-risk factors, symptoms, dietary management, role of food in prevention of Cancer. Role of functional foods, health foods and novel foods, organically grown foods, recent concepts in human nutrition like nutrigenomics, nutraceuticals etc.

Total:60 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Discuss the basics in the area of nutritional assessment in health and disease and to categorize the recommended dietary allowances for different age groups

CO2: Express the classifications, functions and sources of carbohydrates, lipids and proteins

CO3: List the various attributes of fat- and water-soluble vitamins

CO4: Report the role, bioavailability, sources and deficiency diseases of macro and micro minerals

CO5: Recognize the diets and concepts of foods suggested for nutritional, chronic and acute disorders

CO6: Classify and to analyse the different techniques of qualitative and quantitative analysis

TEXT BOOKS:

T1: Gordon M. Wardlaw. Perspectives in Nutrition. WCB McGraw-Hill Publishers, Boston, 9th Edition. 2013.

T2: Shubhangini A. Joshi. Nutrition and Dietetics. Tata Mc Grow- Hill publishing Company Ltd, New Delhi. 4th Edition. 2016.

T3: Srilakshmi. B. Nutrition Science. New Age International Pvt. Ltd, Publishers. 6th Edition. 2017.

REFERENCE BOOKS:

R1: Ronald Ross Watson. Functional foods and Nutraceuticals in Cancer Prevention. Ed. Wiley – Blackwell. 2003.

R2: Sunetra Roday. Food Science and Nutrition. Oxford Higher Education/Oxford University Press. 3rd edition 2018.

Course Articulation Matrix

3 – High, 2 – Medium, 1 – Low

CO No	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
2	3	2	-	3	-	-	-	-	-	-	-	-	-	1	-
3	1	3	-	-	3	-	-	2	-	-	-	-	-	-	1
4	1	-	-	-	3	-	-	2	-	-	-	-	-	-	1
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	1	1	-	2	-	-	-	-	-	-	-	-	-	-	-

U19FTOE002	FOOD PRESERVATION TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives

- To introduce the students to the area of Food Processing and preservation.
- To have an effective understanding of food processing and technology subjects.
- To enable students to appreciate the importance of food processing with respect to the large-scale production.
- To import knowledge on processing of food waste

UNIT I PROCESSING OF FOOD AND ITS IMPORTANCE 12

Source of food - significance for processing and preservation of foods – Different food groups-, food pyramids, classification and functions, cooking of foods – methods and cooking media, advantages of processing of foods, changes of nutritional components in cooking, effects of processing of foods on anti-nutritional components.

UNIT II FOOD COMPONENTS 12

Classification, Structure, nutritive value, processing outlines of major Cereals and millets-Pulses-fruits and vegetables, fats, oilseeds and nuts. Major and minor nutrients, sugar and related products, spices and aromatics, beverages and appetizers, organic foods

UNIT III PROCESSING OF ANIMAL FOODS 12

Meat, Poultry and Fish-Structure, composition, nutritive value and processing outline. Processing of milk and milk products, egg processing and storage, need and nutritional benefits of animal products, value added products

UNIT IV INTRODUCTION TO FOOD PROCESSING AND PRESERVATION 12

Food spoilage, fermentation, methods of preservation - High temperature and Low temperature Preservation, traditional methods of food processing and preservation, radiation processing, microwave, non-thermal techniques. Role of enzymes and additives in food preservation

UNIT V FOOD PACKAGING AND QUALITY 12

Food packaging – importance, types and functions, packaging materials – synthetic and natural, Impact of packaging materials on food quality, shelf-life of foods, bottling and canning, nutritional labelling, labelling of vegan and animal based products

Total: 60 Hours

TEXT BOOKS

T1 : Karnal, Marcus and D.B. Lund “Physical Principles of Food Preservation”. Rutledge, 2003.

T2: Sivasankar, B. “Food Processing & Preservation”, Prentice Hall of India, 2002.

REFERENCES

R1 : Khetarpaul, Neelam, “Food Processing and Preservation”, Daya Publications, 2005

WEBSITES:

1. https://www.heartfoundation.org.nz/educators/edu-resources/food-tech
2. https://www.stemcrew.org/guides/subjects/food-technology-teaching-resources/

Course Outcomes

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

C01: Describe the fundamentals of food processing and preservation

C02: Familiar with the functional properties of Carbohydrates, fats, lipids, proteins in food

C03: Knowledge about the importance of food additives and their function and will develop strategies that will promote food safety and prevent food borne illness

C04: Analyze the uses of enzymes, modified proteins and develop novel products, explain, analyze and evaluate scenarios related to various unit operations in food processing and preservation

C05: Identify spoilage and deterioration mechanism in food and methods to control deterioration and spoilage

C06: Demonstrate packing methods, materials and factors affecting food packing.

Course Articulation Matrix

3 - High, 2 - Medium, 1 – Low

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	3	-	-	-	-	-	-	-	-	-	-	-	3
2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
3	2	-	3	-	-	-	-	-	-	-	-	-	3	-	2
4	3	3	2	-	-	-	-	-	-	-	3	-	-	2	-
5	-	3	2	-	-	-	-	-	-	-	3	-	-	2	-
6	3	2	2	2	2	1	2	-	-	-	-	-	-	-	-

U19AEOE003 INTRODUCTION TO BIO-ENERGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To introduce to the students the concepts of bio energy resources
- To expose the students to types of energy resources
- To enhance knowledge on estimation of bio energy plants.
- To expose the students to bio fuel production.

UNIT I BIO RESOURCE - AN INTRODUCTION **9**

Bio resource – origin – biomass types and characteristics- biomass conversion technology- Biodegradation - steps in biogas production- parameters affecting gas production- Types of biogas plants- Construction details- operation and maintenance.

UNIT II BIO ENERGY **9**

Slurry handling- enrichment and utilization – Biogas appliances- Biochemical characteristics of bio resources- Bioenergetics –Biocatalysis –Kinetics of product formation.

UNIT III BIO REACTORS AND FERMENTORS **9**

Bio reactors/ fermentors – Batch type – continuous stirred tank reactors- Biological waste water treatment- Activated sludge process- Downstream processing-Recovery and purification of products.

UNIT IV ALCOHOL PRODUCTION **9**

Alcohol ethanol production - Acid hydrolysis - enzyme hydrolysis-Methanol synthesis - Antibiotics- enzymes- principles of thermo chemical conversion – combustion - pyrolysis- Gasification – types of gasifiers

UNIT V ENERGY AND ENVIRONMENT **9**

Principles of operation- chemical reaction- cleaning and cooling - Utilization- Improved wood burning stove - Energy plantations- Biomass briquetting - co generation- Impact on Environment – Bioenergy policy.

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 Understanding the importance of bio resources .

CO2 Ability to classify the bio energy and characteristics of bio energy.

CO3 Knowledge in bio reactors and fermentors.

CO4 Ability to gain knowledge in Alcohol production process

CO5 Understanding the importance of Energy and Environment

CO6 Knowledge in capturing and applying bioenergy on replacement of fossil fuels.

TEXT BOOKS:

T1: Rai G.D,Non conventional sources of Energy, Khanna publishers, New Delhi, 1995.

T2: Bouley James .E & David Follis - Biochemical Engineering Fundamentals Mc Graw-Hill publishing company, Tokyo.1986

REFERENCE BOOKS:

R1: Chawla O.P, Advances in Biogas Technology ICAR publication New Delhi 1986

R2: Khandelwal K.C. and Mahdi, S.S. 1986. Biogas Technology. Tata Mc Graw Hill Pub. Co. Ltd., New Delhi.

R3: Srivastava, P.K., Shukla, B.D. and Ojha, T.P. 1993. Technology and application of biogas. Jain Brothers, New Delhi.

R4: Mathur,A.N.and Rathore,N.S.1993.,Biogas production Management and Utilisation. Himanshu Publication. New Delhi

				Course Articulation Matrix : 3- High, 2- Medium, 3- Low										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO2	PSO3
CO1	3	2	-	-	-	2	2	-	-	-	-	-	2	2
CO2	3	2	-	-	-	2	2	-	-	-	-	-	3	3
CO3	3	2	-	-	-	2	2	-	-	-	-	-	2	2
CO4	3	2	-	-	-	2	2	-	-	-	-	-	2	2
CO5	3	2	-	-	-	2	2	-	-	-	-	-	3	3
CO6	3	2	-	-	-	2	2	-	-	-	-	-	2	2

U19AEOE004 **ROBOTICS IN AGRICULTURE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To introduce the overview of robotic systems and their dynamics
- To impart knowledge on system stability
- To acquire knowledge on joint space and task space control schemes
- To understand the concept of nonlinear control and observer schemes

PREREQUISITES: NIL

UNIT I INTRODUCTION AND OVERVIEW OF ROBOTIC SYSTEMS AND THEIR DYNAMICS **10**

Forward and inverse dynamics. Properties of the dynamic model and case studies. Introduction to nonlinear systems and control schemes.

UNIT II SYSTEM STABILITY AND TYPES OF STABILITY **8**

Lyapunov stability analysis, both direct and indirect methods. Lemmas and theorems related to stability analysis.

UNIT III JOINT SPACE AND TASK SPACE CONTROL SCHEMES **10**

Position control, velocity control, trajectory control and force control.

UNIT IV NONLINEAR CONTROL SCHEMES **9**

Proportional and derivative control with gravity compensation, computed torque control, sliding mode control, adaptive control, observer based control, robust control and optimal control

UNIT V NONLINEAR OBSERVER SCHEMES: **8**

Design based on acceleration, velocity and position feedback. Numerical simulations using software packages namely MATLAB/MATHEMATICA.

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 Understand basic concept of robotic systems and their dynamics.

CO2 Analyze system stability and types of stability

CO3 Know about joint space and task space control schemes

CO4 Understand the concept of nonlinear control and observer schemes

CO5 Gain knowledge on farm management and financial analysis

CO6 Familiarize with budgeting and cost estimation for farm layout

TEXT BOOKS:

T1: R Kelly, D. Santibanez, LP Victor and Julio Antonio, ―Control of Robot Manipulators in Joint Spaceǁ, Springer, 2005.

T2: A Sabanovic and K Ohnishi, ―Motion Control Systemsǁ, John Wiley & Sons (Asia), 2011

REFERENCE BOOKS:

R1: R M Murray, Z. Li and SS Sastry, ―A Mathematical Introduction to Robotic Manipulationǁ, CRC Press, 1994.

R2: J J Craig, ―Introduction to Robotics: Mechanics and Control, Prentice Hall, 4th Ed, 2018.

Course Articulation Matrix : 3- High, 2- Medium, 3- Low															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	–	–	–	–	–	–	–	–	–	–	–	–	–	-
CO2	3	–	–	–	–	–	–	–	–	–	–	–	–	–	-
CO3	3	2	2	2	–	–	–	–	–	–	–	–	–	-	-
CO4	3	2	2	2	–	–	–	–	–	–	–	–	–	–	
CO5	3	3	2	2	–	–	–	–	–	–	–	–	–	1	**1**
CO6	2	3	2	1	-	-	-	-	-	-	-	-	-	1	**1**

U19BTOE003	ANALYTICAL METHODS AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objectives

- To inculcate the entrepreneurship spark among the student community by converting their research ideas into commercial products
- To develop the entrepreneurial skill in the field of biotechnology
- To study the Business strategy and Technology Transfer

Course Outcomes

At the end of the course, learners will be able to

CO1. Learn the different bio potential and its propagation.

CO2. get Familiarize the different electrode placement for various physiological recording

CO3. design bio amplifier for various physiological recording

CO4. understand various technique non electrical physiological measurements

CO5. Understand the different biochemical measurements

CO6. Characterize and analyze various macromolecules

UNIT I SPECTROMETRY **9**

Properties of electromagnetic radiation- wave properties – components of optical instruments-Sources of radiation – wavelength selectors – sample containers – radiation transducers -Signal process and read outs – signal to noise ratio – sources of noise – Enhancement of signal to noise – types of optical instruments – Applications.

UNITII MOLECULAR SPECTROSCOPY **9**

Molecular absorption spectrometry – Measurement of Transmittance and Absorbance – Beers law – Instrumentation – Applications -Theory of fluorescence and Phosphorescence – Instrumentation – Applications – Theory of Infrared absorption spectrometry – IR instrumentation – Applications -Theory of Raman spectroscopy – Instrumentation – applications.

UNITIII NMR AND MASS SPECTROMETRY **9**

Theory of NMR — chemical shift- NMR-spectrometers – applications of 1H and 13C NMR-Molecular mass spectra – ion sources. Mass spectrometer. Applications of molecular mass -Electron paramagnetic resonance- g values – instrumentation.

UNITIV SEPARATION METHODS **9**

General description of chromatography – Band broadening and optimization of column performance- Liquid chromatography – Partition chromatography – Adsorption chromatography – Ion exchange chromatography -size exclusion chromatography- Affinity chromatography principles of GC and applications – HPLC- Capillary electrophoresis – Applications.

UNITV ELECTRO ANALYSIS AND SURFAVE MICROSCOPY **9**

Electrochemical cells- Electrode potential cell potentials – potentiometry- reference electrode – ion selective and molecular selective electrodes – Instrument for potentiometric studies – Voltametry -Cyclic and pulse voltametry- Applications of voltametry . Study of surfaces – Scanning probe microscopes – AFM and STM.

Total: 45 Hours

TEXT BOOKS:

1. Skoog, D.A. F. James Holler, and Stanky, R.Crouch Instrumental Methods of Analysis.Cengag Learning , 2007
2. Willard, Hobart, etal., Instrumental Methods of Analysis. VIIth Edition, CBS, 1986
3. Haven, Mary C., etal., Laboratory Instrumentation .IVth Edition, John Wiley, 1995.

Course Articulation Matrix

3 - High, 2 - Medium, 1 – Low

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	-	2	-	-	-	-	-	-	-	-	-	2	-
2	3	1	2	1	-	1	-	-	-	-	-	-	1	2	-
3	3	2	3	-	-	-	-	-	-	-	-	-	1	1	-
4	2	2	3	-	-	-	-	-	-	-	-	-	-	2	-
5	2	2	3	-	-	3	-	-	-	-	-	-	-	-	-
6	2	2		-	-	-	-	-	-	-	-	-	-	-	-

U19BTOE004	INDUSTRIAL WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

To emphasize on the importance of waste management in the industries

Course Outcomes

At the end of the course, learners will be able to

- CO1. This course will make the students to design biological treatment units
- CO2. To undertake projects on biological wastewater treatment
- CO3. To design the treatment plants with fundamental understanding
- CO4. Be familiar with sampling of wastes.
- CO5. The students will undertake projects related to waste management.
- CO6. Understand various case studies related to waste management

UNIT I INTRODUCTION TO WASTE MANAGEMENT 9

Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health Environmental legislations related to prevention and control of industrial effluents and hazardous wastes.

UNIT II CLEANER PRODUCTION 9

Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications.

UNIT III POLLUTION FROM MAJOR INDUSTRIES 9

Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants – Wastewater reclamation concepts

UNIT IV REACTORS USED IN WASTE WATER TREATMENT 9

Theory: Modeling of Ideal Attached Growth Reactors, Bio-film Modeling Aerobic Growth of Biomass in PackedTowers, Aerobic Growth of Heterotrophs in Rotating Disc Reactors, Fluidized Bed Biological Reactors.

UNIT V CASE STUDIES 9

Industrial manufacturing process description, Wastewater characteristics, Pollution Prevention Options and Treatment Flow sheets for selected Industries – Tanneries- Textiles- Pulp and PaperMetal finishing – Sugar and Distilleries.

Total: 45 Hours

Course Articulation Matrix

3 - High, 2 - Medium, 1 – Low

CO No	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	2	3	3	-	-	-	-	-	-	-	-	-	2	-	-
2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3	3	3	3	2	2	2		1	3	-	-	-	-	2	-
4	3	1	1	-	-	1	-	1	-	-	-	-	-	1	-
5	3	3	2	1	2	-	-	1	-	-	-	-	-	1	-
6	3	3	2	1	2	-	-	1	-	-	-	-	-	1	-

U19BMOE003 **HOSPITAL MANAGEMENT SYSTEM** **L T P C**

3 0 0 3

Course Objective

The student should be made:

- To understand the fundamentals of hospital administration and management.
- To know the market related research process
- To explore various information management systems and relative supportive services.
- To learn the quality and safety aspects in hospital.

UNIT I OVERVIEW OF HOSPITAL ADMINISTRATION 9

Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning· Equipment Planning – Functional Planning - Current Issues in Hospital Management – Telemedicine - Bio· Medical Waste Management.

UNIT II HUMAN RESOURCE MANAGEMENT IN HOSPITAL 9

Principles of HRM – Functions of HRM – Profile of HRD Manager – Tools of HRD –Human Resource Inventory – Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines –Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer, Communication – nature, scope, barriers, styles and modes of communication.

UNIT III MARKETING RESEARCH PROCESS 9

Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations – Consumer Markets & Consumer Buyer Behaviour - Model of consumer behaviour - The buyer decision process - Model of business buyer behavior – Major types of buying situations - WTO and its implications.

UNIT IV HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES 9

Management Decisions and Related Information Requirement - Clinical Information Systems - Administrative Information Systems - Support Service Technical Information Systems – Medical Transcription, Medical Records Department – Central Sterilization and Supply Department –Pharmacy– Food Services - Laundry Services.

UNIT V QUALITY AND SAFETY ASPECTS IN HOSPITAL 9

Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – Environment Management Systems. NABA, JCI, NABL. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules. Health Insurance & Managing Health Care – Medical Audit – Hazard and Safety in a hospital Setup.

Total: 45 hours

Course Outcomes

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

CO1: Explain the principles of Hospital administration.

CO2: Identify the importance of Human resource management.

CO3:List various marketing research techniques.

CO4: Identify Information management systems and its uses.

CO5: Understand safety procedures followed in hospitals

C06: Analyze the quality and safety aspects in hospital.

TEXT BOOKS

1. R.C.Goyal, ―Hospital Administration and Human Resource Management‖, PHI – Fourth Edition, 2006.

2. G.D.Kunders, ―Hospitals – Facilities Planning and Management – TMH, New Delhi – Fifth Reprint 2007.

REFERENCE BOOKS

1. Cesar A.Caceres and Albert Zara, ―The Practice of Clinical Engineering, Academic Press, New York, 1977.

2. Norman Metzger, ―Handbook of Health Care Human Resources Management‖, 2nd edition Aspen Publication Inc. Rockville, Maryland, USA, 1990.

3. Peter Berman ―Health Sector Reform in Developing Countries‖ - Harvard University Press, 1995.

4. William A. Reinke ―Health Planning For Effective Management‖ - Oxford University Press.1988

5. Blane, David, Brunner, ―Health and SOCIAL Organization: Towards a Health Policy for the 21st Century‖, Eric Calrendon Press 2002.

6. Arnold D. Kalcizony& Stephen M. Shortell, ―Health Care Management‖, 6th Edition Cengage Learning, 2011.

Course Articulation Matrix

3 - High, 2 - Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO.1	3	2	3	3	-	1	2	-	-	-	1	-	2	2
CO.2	2	3	3	3	-	1	3	-	-	-	1	-	3	2
CO.3	2	3	3	3	-	1	3	-	-	-	1	-	3	3
CO.4	3	2	3	3	-	1	2	-	-	-	1	-	2	3
CO.5	2	2	3	3	-	1	2	-	-	-	1	-	2	2
CO.6	2	2	3	3	-	1	2	-	-	-	1	-	2	2

U19BMOE004 BIOMEDICAL INSTRUMENTATION

L	T	P	C
3	0	0	3

Course Objective

The student should be made:

- To impart knowledge of the principle of operation and design of sensory equipment's.
- To render a broad and modern account of neurological, muscular, cardiological and respiratory instruments.
- To introduce idea about instrumentation in patient care and diagnosis.

UNIT I RECORDING OF BIOSIGNALS 9

Biosignals characteristics – frequency and amplitude ranges. ECG – Einthoven's triangle, Lead configuration, 12 lead ECG machine circuit, common mode and interference reduction circuits, Vector cardiograph EEG – 10-20 electrode system. EMG– Recording, Electro encephalogram, Magneto encephalogram, EOG & ERG: origin, measurement of EOG, electroretinogram.

UNIT II SENSORY INSTRUMENTATION 9

Psychophysiological Measurements – polygraph, basal skin resistance (BSR), galvanic skin resistance (GSR), Sensory responses - Audiometer-Pure tone, Hearing and speech aids: conductive and nervous, hearing aids- Types, constructional and functional characteristics. Cochlear implants- Need, constructional details, speech trainer.

UNIT III CARDIAC EQUIPMENTS 9

Normal and abnormal ECG waveform, diagnosis interpretation, cardiac pacemaker-external pacemaker, implantable pacemaker, different types of pacemakers, fibrillation, defibrillator, AC defibrillator, DC defibrillator, electrodes, synchronised and unsynchronised types. EEG diagnostic interpretation, recording and analysis of EMG waveforms.

UNIT IV RESPIRATORY MEASUREMENT SYSTEM 9

Instrumentation for measuring the mechanics of breathing – Spirometer -Lung Volume and vital capacity, measurements of residual volume, Pneumotachometer – Airway resistance measurement, Whole body Plethysmograph, Intra-Alveolar and Thoracic pressure measurements, Apnoea Monitor. Types of Ventilators – Pressure, Volume, and Time controlled. Flow, Patient Cycle Ventilators, Humidifiers, Nebulizers, Inhalators.

UNIT V ADVANCED DEVICES 9

Cardiac pacemakers and modern stimulators, Hemodyalysis ventilators, incubators, drug delivery devices, surgical instruments, Therapeutic application of laser, Neonatal Monitoring.

Total:45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Demonstrate the principle of operation and design of sensory equipments

CO2: Determine the basic parameters of the equipment used in patient diagnosis

CO3: Analyze the broad and modern account of neurological equipments.

CO4: Illustrate the principle and working of muscular and respiratory instruments

CO5: Render a broad and modern account of neurological, muscular, cardiological and respiratory instruments..

CO6: Gain idea about instrumentation in patient care and diagnosis.

TEXTBOOKS:

T1 Siamak Najarian, Javad Dargahi, Ali AboueiMehrizi, ―Artificial Tactile Sensing in Biomedical Engineering‖,McGraw Hill publication,2009

T2 Martin Grunwald, ―Human HapticPerception‖, Birkhaeuser Verlag AG, Boston Basel Berlin publication,2008

REFERENCE BOOKS:

R1 Abdulmotaleb El Saddik, Mauricio Orozco, Mohamad Eid, JongeunCha,―Haptics Technologies: Bringing touch to multimedia‖, Springer,2011

R2 MyerKutz.,―BiomedicalEngineeringandDesignHandbook‖Vol2,McGrawHill

Course Articulation Matrix

3 - High, 2 - Medium, 1 – Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO.1	2	2	2	2	2	2	-	-	-	-	2	2	3	3
CO.2	2	2	2	2	2	2	-	-	-	-	2	2	3	3
CO.3	3	3	2	3	2	1	-	-	-	-	2	2	2	2
CO.4	3	3	3	2	2	2	-	-	-	-	2	2	2	2
CO.5	2	2	2	3	2	1	-	-	-	-	2	2	2	2
CO.6	2	2	2	2	2	1	-	-	-	-	2	2	2	2

U19CSOE003 DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- Understand the various algorithm design and analysis techniques
- To learn linear data structures – lists, stacks, and queues
- To learn different sorting and searching algorithms
- To understand Tree and Graph data structures

PREREQUISITES: NIL

UNIT I ALGORITHM ANALYSIS, LIST ADT **11**

Algorithms: Notation - analysis – running time calculations. Abstract Data Types (ADTs): List ADT – array-based implementation – linked list implementation – singly linked lists- applications of lists: Polynomial Manipulation. Implementation of List ADT using an array and using a linked list in C.

UNIT II STACKS AND QUEUES **7**

Divide and conquer methodology - Searching: Linear Search - Binary Search. Sorting: Insertion sort – Merge sort – Quick sort – Heap sort. Analysis of searching and sorting techniques. Implementation of linear search, binary search, insertion sort, merge sort and quick sort algorithms in C.

UNIT III SEARCHING AND SORTING ALGORITHMS **10**

Tree ADT – tree traversals - Binary Tree ADT – expression trees – binary search tree ADT – applications of trees. Heap – applications of heap. Implementation of Binary search tree and its operations, tree traversal methods, finding height of the tree using C. Implementation of heap and heap sorting using arrays in C.

UNIT IV TREES **9**

Tree ADT – tree traversals - Binary Tree ADT – expression trees – binary search tree ADT – applications of trees. Heap – applications of heap. Implementation of Binary search tree and its operations, tree traversal methods, finding height of the tree using C. Implementation of heap and heap sorting using arrays in C.

UNIT V GRAPHS **8**

Definition – Representation of Graph – Breadth-first traversal - Depth-first traversal – Dynamic programming Technique – Warshall's and Floyd's algorithm – Greedy method - Dijkstra's algorithm – applications of graphs. Implementation of graph, graph traversal methods, finding shortest path using Dijkstra's algorithm in C

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 Define data structures like array, stack, queues and linked list.

CO2 Explain insertion, deletion and traversing operations on data structures.

CO3 Identify the asymptotic notations to find the complexity of an algorithm.

CO4 Compare various searching and sorting techniques.

CO5 Choose appropriate data structure while designing the algorithms.

CO6 Design advance data structures using non linear data structures.

TEXT BOOKS:

T1: Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education,1997..

T2: Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson Education, 1988.

REFERENCE BOOKS:

R1: Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,1983

R2: S.Sridhar, "Design and Analysis of Algorithms", First Edition, Oxford University Press. 2014

R3: Byron Gottfried, Jitender Chhabra, "Programming with C" (Schaum's Outlines Series), Mcgraw Hill Higher Ed., III Edition, 2010

R4: Yashvant Kanetkar, "Data Structures Through C", BPB publications, II edition, 2003

Course Articulation Matrix : 3- High, 2- Medium, 3- Low															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	–	–	–	–	–	–	–	–	–	–	–	–	–	-
CO2	3	–	–	–	–	–	–	–	–	–	–	–	–	–	-
CO3	3	2	2	2	–	–	–	–	–	–	–	–	–	-	-
CO4	3	2	2	2	–	–	–	–	–	–	–	–	–	–	
CO5	3	3	2	2	–	–	–	–	–	–	–	–	–	1	1
CO6	2	3	2	1	-	-	-	-	-	-	-	-	-	1	1

U19ECOE001	SOFT COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To learn the basic concepts of Soft Computing
- To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
- To apply soft computing techniques to solve problems.

PREREQUISITES

- Basic concepts of communication theory
- Basics of Computer Networks
- Basics of Biological systems
- Linear Algebra

UNIT I INTRODUCTION TO SOFT COMPUTING **9**

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

UNIT II ARTIFICIAL NEURAL NETWORKS **9**

Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.

UNIT III FUZZY SYSTEMS **9**

– Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

UNIT IV GENETIC ALGORITHMS **9**

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm.

UNIT V HYBRID SYSTEMS **9**

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Apply suitable neural computing techniques for various applications.

CO2: Explain various ANN models

CO3: Apply fuzzy concepts for various applications

CO4: Apply genetic algorithms to solve problems

CO5: Integrate various soft computing techniques for complex problems.

CO6: Apply neural techniques for various applications

TEXT BOOKS:

T1: N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.

T2: S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt.Ltd., 2nd Edition, 2011.

T3: S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt.Ltd., 2017.

REFERENCE BOOKS:

R1: Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, ―Neuro-Fuzzy and Soft Computing‖, Prentice-Hall of India, 2002.

R2: Kwang H.Lee, ―First course on Fuzzy Theory and Applications‖, Springer, 2005.

R3: George J. Klir and Bo Yuan, ―Fuzzy Sets and Fuzzy Logic-Theory and Applications‖, Prentice Hall, 1996.

CO/PO MAPPING (S/M/W indicates strength of correlation)													CO/PSO		
3-Strong, 2-Moderate, 1-Fair													Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs		
CO s	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PSO**	**PSO**	**PSO**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO2	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO3	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO4	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO5	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO6	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1

U19ECOE004 ADVANCED WIRELESS COMMUNICATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To expose the students to the importance of improving capacity of wireless channel using MIMO
- To enable understanding of channel impairment mitigation using space-time block and Trellis codes
- To teach advanced MIMO system like layered space time codes, MU-MIMO System and MIMO-OFDM systems

PREREQUISITES

- Basic concepts of communication theory
- Basics of Computer Networks
- Limits and Continuity
- Basic concepts of Differentiation
- Basic concepts of Integration

UNIT I CAPACITY OF WIRELESS CHANNELS **9**

The crowded spectrum, need for high data rate, MIMO systems – Array Gain, Diversity Gain, Data Pipes, Spatial MUX, MIMO System Model. MIMO System Capacity – channel known at the TX, Channel unknown to the TX – capacity of deterministic channels, Random channels and frequency selective channels.

UNIT II RADIO WAVE PROPAGATION **9**

Radio wave propagation – Macroscopic fading- free space and out door, small scale fading Fading measurements – Direct pulse measurements, spread spectrum correlation channel sounding frequency domain channel sounding, Antenna Diversity – Diversity combining methods

UNIT III SPACE TIME BLOCK CODES **9**

Delay Diversity scheme, Alamoti space time code – Maximum likelihood decoding maximum ratio combining. Transmit diversity space time block codes for real signal constellation and complex signal constellation - decoding of STBC.

–

UNIT IV SPACE TIME TRELLIS CODES **9**

Space time coded systems, space time code word design criteria, design of space time T C on slow fading channels, design of STTC on Fast Fading channels, performance analysis in slow and fast fading channels, effect of imperfect channel estimation and Antenna correlation on performance, comparison of STBC & STTC.

UNIT V LAYERED SPACE TIME CODES **9**

LST transmitter – Horizontal and Vertical LST receiver – ML Rx, Zero forcing Rx; MMSE Rx, SIC Rx, ZF V-blast Rx- MMSE V-blast Rx, Iterative Rx - capacity of MIMO – OFDM systems – capacity of MIMO multi user systems.

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Comprehend and appreciate the significance and role of this course in the present contemporary world

CO2: Apply the knowledge about the importance of MIMO in today's communication

CO3: Appreciate the various methods for improving the data rate of wireless systems

CO4: Explain the working of layered space time transmitter and receiver

CO5: Describe various radio propagation techniques

CO6: Explain various MIMO systems

TEXT BOOKS:

T1: Mohinder Jankiraman, Space-time codes and MIMO systems, Artech House, Boston, London . www.artech house.com, ISBN 1-58053-865-7-2004

T2: Paulraj Rohit Nabar, Dhananjay Gore, Introduction of space time wireless communication systems, Cambridge University Press, 2003.

REFERENCE BOOKS:

R1: David Tse and Pramod Viswanath, —Fundamentals of Wireless Communication‖, Cambridge University Press, 2005.

R2: Sergio Verdu — Multi User Detection‖ Cambridge University Press, 1998

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping PSOs		
	PROGRAMME OUTCOMES (POs)														
CO s	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO2	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO3	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO4	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO5	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1
CO6	3	2	2	2	-	-	-	-	-	-	2	1	3	3	1

U19EEOE003 SENSORS AND TRANSDUCERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To understand the concepts of measurement technology
- To learn the various sensors used to measure various physical parameters
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

UNIT I INTRODUCTION **9**

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.

UNIT II MOTION, PROXIMITY AND RANGING SENSORS **9**

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

UNIT III FORCE, MAGNETIC AND HEADING SENSORS **9**

Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.

UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS **9**

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

UNIT V SIGNAL CONDITIONING AND DAQ SYSTEMS **9**

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

Total: 45 Hours

COURSE OUTCOMES

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

CO 1 Expertise in various calibration techniques and signal types for sensors.

CO 2 Understand about the various sensors

CO3 Apply the various sensors in the Automotive and Mechatronics applications

CO4 Study the basic principles of various smart sensors.

CO5 Implement the DAQ systems with different sensors for real time applications

CO6 Understand about different sensors with applications

TEXT BOOKS:

T1: Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGraw-Hill, 2009.

T2: Sawney A K and Puneet Sawney, "A Course in Mechanical Measurements and Instrumentation and Control", 12th edition, Dhanpat Rai & Co, New Delhi, 2013.

REFERENCE BOOKS:

R1: Patranabis D, "Sensors and Transducers", 2nd Edition, PHI, New Delhi, 2010.

R2: John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications, 1999

R3: Richard Zurawski, "Industrial Communication Technology Handbook" 2nd edition, CRC Press,2015.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													CO/PSO Mapping			
COs	PROGRAMME OUTCOMES (POs)												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	3	-	3	2	-	-	2	-	2	-	2	2	2	2
CO2	2	-	3	-	3	2	-	-	2	-	2	-	3	2	2	2
CO3	2	-	3	-	3	2	-	-	2	-	2	-	2	3	3	3
CO4	2	-	3	-	3	2	-	-	2	-	2	-	3	2	2	2
CO5	2	-	3	-	3	2	-	-	2	-	2	-	2	2	2	3
CO6	2	-	3	-	3	2	-	-	2	-	2	-	3	2	1	3

U19EEOE004 ENERGY TECHNOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- Students will gain knowledge about different energy scenario
- To understand about the conventional energy sources.
- To understand about the non-conventional energy sources.
- To understand about the biomass energy sources.
- To learn the concept of energy conservation

PREREQUISITES

- Fundamentals of electrical engineering
- Basic concepts of Differentiation
- Basic concepts of Integration

UNIT I ENERGY **9**

Introduction to energy – Global energy scene – Indian energy scene - Units of energy, conversion factors, general classification of energy, energy crisis, energy alternatives.

UNIT II CONVENTIONAL ENERGY **9**

Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants

NON-CONVENTIONAL ENERGY

UNIT III **9**

Solar energy, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, energy plantations. Wind energy, types of windmills, types of wind rotors, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy.

UNIT IV BIOMASS ENERGY **9**

Biomass origin - Resources – Biomass estimation. Thermo chemical conversion – Biological conversion,– Hydrolysis & hydrogenation, solvolysis, biocrude, biodiesel power generation gasifier, biogas, integrated gasification.

UNIT V ENERGY CONSERVATION **9**

Energy conservation - Act; Energy management importance, duties and responsibilities; Energy audit – Types methodology, reports, instruments. Benchmalcing and energy performance, material and energy balance, thermal energy management.

Total: 45 Hours

COURSE OUTCOMES

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

CO1 Understand energy scenario in India

CO2 Understand conventional Energy sources,

CO3 Understand Non- conventional Energy sources,

CO4 Understand biomass sources and develop design parameters for equipment to be used in Chemical process industries

CO5 Understand energy conservation in process industries

CO6 Understand about different energy technology

TEXT BOOKS:

T1: Rao, S. and Parulekar, B.B., Energy Technology, Khanna Publishers, 2005.

T2: Rai, G.D., Non-conventional Energy Sources, Khanna Publishers, New Delhi, 1984.

T3: Nagpal, G.R., Power Plant Engineering, Khanna Publishers, 2008.

REFERENCE BOOKS:

R1: Nejat Vezirog, Alternate Energy Sources, IT, McGraw Hill, New York.

R2: Handbook of Energy Audit by 7th edition Albert Thumann, P.E., C.E.M & William J Younger C.E.M, Faiment Press 2008

R3: El. Wakil, Power Plant Technology, Tata McGraw Hill, New York, 2002.

CO/PO MAPPING (S/M/W indicates strength of correlation) 3-Strong, 2-Moderate, 1-Fair													**CO/PSO Mapping**			
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	1	3	-	3	-	2	-	2	-	2	-	2	2	2	2
CO2	2	1	3	-	3	-	2	-	2	-	2	-	2	2	2	2
CO3	2	1	3	-	3	-	2	-	2	-	2	-	2	3	3	3
CO4	2	1	3	-	3	-	2	-	2	-	2	-	3	2	3	2
CO5	2	1	3	-	3	-	2	-	2	-	2	-	2	3	2	3
CO6	2	1	3	-	3	-	2	-	2	-	2	-	3	2	1	3

U19FTOE003	BEVERAGE TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

Impart knowledge on processing and ingredients applied for beverage preparation according to the standard categorization of beverages. Based on the ingredients incorporated and type of processing method applied will give a classification of beverages. Sanitization schemes and quality control measures according to standards and regulations.

PREREQUISITES

- Basic classification of beverages in the market
- Storage and preparation of beverages
- Purpose of preparing beverages
- Market and trends in beverages sector

UNITI INGREDIENTS IN BEVERAGES 9+3

Beverage-definition--ingredients- water, quality evaluation and raw and processed water, bulk and intense sweeteners, water miscible and water dispersible flavouring agents, colours – natural and artificial, Micro and nano-emulsions of flavors and colors in beverages, preservatives, emulsifiers and stabilizers.

UNIT II CARBONATED BEVERAGES 9+3

Procedures- ingredients- preparation of Syrup making, carbonation of soft drinks. Carbonation equipments and machineries- -containers and closures. low-calorie and dry beverages; isotonic and sports drinks; Fruit based carbonated beverages, carbonated water

UNIT III NON-CARBONATED BEVERAGES 9+3

Beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, dairy based beverages, RTS beverages, isotonic Beverages. Flash pasteurization, Canning and Aseptic Packaging of beverages. bottled. Water; mineral water, natural spring water, flavored water.

UNIT IV ALCOHOLIC BEVERAGES 9+3

Alcoholic beverages- types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, equipment's used for brewing and distillation, wine and related beverages, distilled spirits

UNIT V SANITATION AND QUALITY CONTROL 9+3

Quality control, Filling-inspection and quality controls-sanitation and hygiene in beverage industry-Quality of water used in beverages threshold limits of ingredients. FSSAI, EFSA and FDA regulations

Total:60 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Capable of formulating beverages using various ingredients.
CO2: Demonstrate various unit operations involved in the food beverage manufacturing
CO3: Understand the various production techniques in beverages
CO4: Evaluate the quality parameters of all beverages
CO5: Familiarize with food laws and regulations of beverages

CO6: Understand the natural and artificial colourants used in beverages

TEXT BOOKS:

T1: L.Jagan Mohan Rao and K.Ramalakshmi (2011)"Recent trend in Soft beverages", Woodhead Publishing India Pvt Ltd.

T2: Boulton, Christopher, and David Quain (2008) Brewing yeast and fermentation. John Wiley & Sons.

REFERENCE BOOKS:

R1: Hui, Yiu H., et al., eds. (2004) Handbook of food and beverage fermentation technology. Vol. 134. CRC Press.

R2: Mitchell, Alan J. (199) "Formulation and Production Carbonated Soft Drinks". Springer Science & Business Media.

R3: Woodroof, Jasper Guy, and G. Frank Phillips. (1981) Beverages: carbonated and noncarbonated. AVI Pub. Co

Course Articulation Matrix

3 - High, 2 - Medium, 1 – Low

CO No	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO11	PO12	PSO 1	PSO 2	PSO 3
1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
2	1	3	-	-	-	-	-	-	-	-	-	-	-	1	-
3	1	-	-	3	-	-	-	-	-	-	-	-	-	1	-
4	-	-	-	-	3	-	-	2	-	-	-	-	-	-	1
5	-	-	-	-	3	-	-	2	-	-	-	-	-	-	1
6	1	1	-	2		-	-	-	-	-	-	-	-	-	-

U19FTOE004 PRINCIPLES OF FOOD MATERIALS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

Explain the milling, extraction and manufacture of tremendous products from cereals, pulses and oil seeds. Summarize the production and processing methods of fruits and vegetables and to discuss the chemical composition, processing, production, spoilage and quality of milk and milk product. Outline the overall processes involved in the production of meat, poultry and fish products Review the production and processing methods of plantation and spice products

PREREQUISITES

- Need an idea of nature of food materials to be handled
- Prior storage conditions before processing the materials
- Basic handling techniques of materials
- Preparation of materials prior to processing

UNITI CEREAL, PULSES AND OIL SEEDS TECHNOLOGY 9+3

Rice milling, Pulse milling, Wheat milling - Oil extraction - Methods of manufacture of Bread - different processes of manufacture - types of breads - buns, biscuits, cakes and cookies -Pasta products -Tortilla - Method of manufacture.

UNITII FRUITS AND VEGETABLE PROCESSING 9+3

Production of Fruits and vegetables in India, Cause for heavy losses, preservation treatments - Basics of Canning, Minimal processing and Hurdle technology as applied to Vegetable and Fruit processing, Processing of fruit juices, Dehydration, Aseptic processing.

UNITIII DAIRY PROCESSING 9+3

Basic dairy terminology, composition, General tests at reception, Dairy Processing - Method of manufacture of Standardized, toned and double toned milk, milk powder - Equipment - Pasteurizers, homogenizers and pumps - Method of manufacture of dairy products – Ice cream, Cheese, Paneer, Yoghurt - Pasteurization and microorganisms involved in spoilage of milk.

UNITIV MEAT, POULTRY AND FISH PROCESSING 9+3

Meat composition from different sources, Definitions and measurements, Carcass Processing, Meat Products, Processing of Poultry Products, Fish and other Marine Products Processing.

UNITV PLANTATION PRODUCT TECHNOLOGY 9+3

Processing of Tea, Coffee and Cocoa - Outline of the methods of manufacture of - green tea, black tea, instant tea, Instant coffee, Cocoa and Chocolate. Outline of the methods of processing of Pepper, cardamom, ginger, vanilla and turmeric

Total: 60 Hours.

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Discuss the various processing technologies involved in cereal, pulses and oilseed technology
CO2: Demonstrate the major operations applied in fruits and vegetable processing
CO3: Illustrate the techniques involved in the processing of dairy products
CO4: List the overall processing of meat, poultry and fish processing
CO5: Outline the processing of spices and plantation products
CO6: Analyse the manufacturing methods involved in various byproducts of food materials

TEXT BOOKS:

T1: Srivastava R.P. and Kumar S. Fruit and Vegetable Preservation: Principles and Practices. International Book Distributing Co. Lucknow. 3rd Edition. 2010.

T2: Chakraverty A., Mujumdar A.S., Raghavan G.S.V and Ramaswamy H.S. Handbook of Post-harvest Technology: Marcel Dekker Press. USA. 1st Edition. 2003.

REFERENCE BOOKS:

R1: Sukumar De. Outlines of Dairy Technology. Oxford University Press. New Delhi. 23rd impression. 2016.

Course Articulation Matrix

3 - High, 2 - Medium, 1 – Low

CO No	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
2	1	3		3	-	-	-	-	-	-	-	-	-	-	-
3	1	-	-	-	-	-	-	-	-	-	-	-	-	1	
4	-	-	-	-	-	3	-	-	2	-	-	-	-	1	-
5	-	-	-	-	-	3	-	-	2	-	-	-	-	-	1
6	1	1		2	-	-	-	-	-	-	-	-	-	-	1