Program and Course Structure

Department of Electrical Electronics and Communication Engineering

B.Tech. Electrical and Electronics Engineering
SET0404

2019

1. Standard Structure of the Program at University Level

1.1 Vision, Mission and Core Values of the University

Vision of the University

To serve the society by being a global University of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship.

Mission of the University

1. Transformative educational experience
2. Enrichment by educational initiatives that encourage global outlook
3. Develop research, support disruptive innovations and accelerate entrepreneurship
4. Seeking beyond boundaries

Core Values

- Integrity
- Leadership
- Diversity
- Community

1.2 Vision and Mission of the School

Vision of the School

To become a globally acclaimed institution of higher learning in engineering and technology promoting excellence in research, innovation and entrepreneurship

Mission of the School

1. To impart quality education with strong industry & academic connectivity in the expanding fields of Engineering and Technology in a conductive and enriching learning environment.
2. To product technocrats equipped with technical & soft skills and experiential learning required to stay current with the modern tools in emerging technologies to fulfill professional responsibilities and uphold ethical values.
3. To inculcate a culture of interdisciplinary research, innovation and entrepreneurship to provide sustainable solutions to meet the growing challenges and societal needs.
4. To foster collaborative learning and to play adaptive leadership role in professional career and pursuit of higher education through effective mentoring and counseling.

1.2.1 Vision and Mission of the Department

Vision of the Department of Electrical and Electronics Engineering

To become an internationally acclaimed destination of academic excellence in the discipline of Electrical, Electronics, and Communication Engineering by promoting research, innovation, and entrepreneurship to serve society.

Mission of the Department Electrical and Electronics Engineering

M1-To provide comprehensive technical knowledge in Electrical, Electronics and Communication Engineering.

M2- To facilitate and foster the industry-academia collaboration to enhance technical skills and employability.

M3- To promote interdisciplinary and multi-disciplinary research, innovations and entrepreneurship to serve society.

M4- To develop core values, professional ethics and lifelong learning skills through interactive support systems.

1.3 Programme Educational Objectives (PEO)

1.3.1 Writing Programme Educational Objectives (PEO)

The Educational Objectives of UG Program in Electrical and Electronics Engineering are:

PEO1: The graduates will achieve a reputation as a source of providing innovative solutions for complex engineering problems.

PEO2: The graduates will demonstrate sound engineering knowledge and managerial decisions based on ethical and professional standards.

PEO3: The graduates will work on global technological and environmental issues as a successful entrepreneur.

PEO4: The graduates will pursue higher studies to become successful academicians and lead researchers.

1.3.2 Map PEOs with School Mission Statements:

No.	PEO statement	School missions			
		Mission statement 1	Mission statement 2	Mission statement 3	Mission statement 4
1	The graduates will achieve a reputation as a source of providing innovative solutions for complex engineering problems.	3	2	2	3
2	PEO2: The graduates will demonstrate sound engineering knowledge and managerial decisions based on ethical and professional standards.	2	3	3	2
3	PEO3: The graduates will work on global technological and environmental issues as a successful entrepreneur.	2	3	2	3
4	PEO4: The graduates will pursue higher studies to become successful academicians and lead researchers.	2	3	2	2

1.3.2.1 Map PEOs with Department Mission Statements:

PEOs / MISSION STATEMENTS	**PEO1:** The graduates will achieve a reputation as a source of providing innovative solutions for complex engineering problems.	**PEO2:** The graduates will demonstrate sound engineering knowledge and managerial decisions based on ethical and professional standards. .	**PEO3:** The graduates will work on global technological and environmental issues as a successful entrepreneur.	**PEO4:** The graduates will pursue higher studies to become successful academicians and lead researchers.	
M1- To provide comprehensive technical knowledge in Electrical, Electronics, and Communication Engineering	**3**	**3**	**3**	**3**	**12/12**
M2- To facilitate and foster the industry-academia collaboration to enhance technical skills and employability.	**3**	**3**	**3**	**3**	**12/12**
M3- To promote interdisciplinary and multi-disciplinary research, innovations, and entrepreneurship to serve society.	**3**	**2**	**3**	**3**	**11/12**
M4-To develop core values, professional ethics, and lifelong learning skills through interactive support systems	**2**	**3**	**2**	**3**	**10/12**
	11/12	**11/12**	**11/12**	**12/12**	**93.75%**

1. **Slight (Low)** **2. Moderate (Medium)** **3. Substantial (High)**

1.3.3 Program Outcomes (PO's)

PO1: **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **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: **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: **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: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6: **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: **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: **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: **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: **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: **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.

1.3.4 Program Specific Outcomes (PSO's)

PSO 1: An ability to apply hardware and software based embedded smart solutions for industrial automation and power system

PSO 2: Accentuate the application of cutting-edge technology on renewable energy systems and smart grid

PSO 3: To utilize the knowledge of power systems, automation, robotics and sustainable technology in multidisciplinary research

1.3.5 Mapping of Program Outcome Vs Program Educational Objectives

Mapping	PEO1	PEO2	PEO3	PEO4
PO1	2	2	1	1
PO2	1	3	1	1
PO3	3	3	2	2
PO4	3	2	2	1
PO5	2	3	1	-
PO6	1	2	3	3
PO7	2	1	1	3
PO8	1	1	3	2
PO9	2	1	3	1
PO10	1	1	2	3
PO11	2	2	3	1
PO12	1	2	2	-
PSO1	3	1	1	2

PSO2	2	1	1	1
PSO3	2	1	1	2

1. Slight (Low) ***2. Moderate (Medium)*** ***3. Substantial (High)***

1.3.6 The components of the curriculum

Course Component	Curriculum Content (% of total number of credits of the program)	Total number of contact hours	Total number of credits
Basic Sciences	16.25	33	26
Engineering Sciences	8.125	20	13
Humanities and Social	11.25	29	18
Program Core	35	72	56
Program Electives	11.25	18	18
Open Electives	6.25	10	10
Project(s)	11.875	40	19

Course Structure

School of Engineering and Technology
B.Tech-Electrical and Electronics Engineering
Batch: 2019-2023
TERM: I

S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite
			L	T	P		
THEORY SUBJECTS							
1.	CSE113	Programming for Problem Solving	3	0	0	3	
2.	HMM126	Human Values and Ethics	2	0	0	2	
3.	MTH141	Mathematics I	3	1	0	4	
4.	PHY117	Engineering Physics (Semiconductor Physics)	3	1	0	3	
5.	CHY111	Engineering Chemistry	2	1	0	3	
Practical/Viva-Voce/Jury							
6.	ARP101	Comm. Eng-I	0	0	2	2	
7.	CSP113	Programming for Problem Solving	0	0	2	1	
8.	MEP106	Computer Aided Design & Drafting	0	0	3	1.5	
9.	ECP106	Introduction to Engineering	0	0	2	1	
10.	PHY162	Physics Lab II	0	0	2	1	
11.	CHY161	Engineering Chemistry lab	0	0	2	1	
TOTAL CREDITS						**22.5**	

School of Engineering and Technology
B.Tech-Electrical and Electronics Engineering
Batch: 2019-2023
TERM: II

S. No.	Paper ID	Course Code	Course	Teaching Load L	T	P	Credits	Pre-Requisite/Co Requisite
THEORY SUBJECTS								
1.		CSE114	Application based Programming in Python	3	0	0	3	
2.		MTH143	Differential Equations, Spec.Transforms and complex variable	3	1	0	4	
3.		PHY118	Advanced Physics (Electricity and Magnetism)	2	1	0	3	
4.		EEE112	Principles of Electrical and Electronics Engineering	3	0	0	3	
5.		EVS112	Environmental Science	2	0	0	2	
6.		ARP102	Comm. Eng II	1	0	2	2	
Practical/Viva-Voce/Jury								
7.		CSP114	Application based Programming in Python	0	0	2	1	
8.		MEP105	Mechanical Workshop	0	0	3	1.5	
9.		ECP107	Tinkering Lab Electrical	0	0	2	1	
10.		PHY161	Physics Lab	0	0	2	1	
11.		EEP112	Principles of Electrical and Electronics Engineering lab	0	0	2	1	
12.								
TOTAL CREDITS							**22.5**	
Note: Industrial Internship after completion of 2nd Semester and will be evaluated in 3rd Semester								

School of Engineering and Technology
B.Tech-Electrical and Electronics Engineering
Batch: 2019-2023
TERM: III

S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite
			L	T	P		
THEORY SUBJECTS							
1.	HMM305	Management for Engineers	3	0	0	3	
2.	MTH145	Mathematics III (Probability & Statistics)	3	0	0	3	
3.	ECE237	Analog Circuits-I	3	0	0	3	
4.	EEE220	Network Analysis & Synthesis	3	0	0	3	
5.	EEE221	Electrical Machine-I	3	0	0	3	
Practical/Viva-Voce/Jury							
6.	ARP203	Aptitude Reasoning and Business Communication Skills-Basic	0	0	4	2	
7.	MTP145	Mathematics III (Using MATLAB/ Sci Lab)	0	0	2	1	
8.	ECP237	Analog Electronics -1 Lab	0	0	2	1	
9.	EEP221	Electrical Machine-I Lab	0	0	2	1	
10.	EEP251	Project Based Learning (PBL) -1	0	0	2	1	
11.	EEP294	Summer Internship	0	0	2	1	
					TOTAL CREDITS	**22**	

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TERM: IV

S. No.	Course Code	Course	Teaching Load L	T	P	Credits	Pre-Requisite/Co Requisite
THEORY SUBJECTS							
1.	EEE224	Electrical Macines-II	3	0	0	3	
2.	ECE240	Digital System Design	3	0	0	3	
3.	EEE225	Electrical & Electronic Measurements	3	0	0	3	
4.	ECE245	Microprocessor and Microcontroller with Interfacing	3	0	0	3	
5.	BTY 223	Introduction to Biology for Engineers	2	0	0	2	
6.	MOO211	Wheeled Mobile Robots	2	0	0	2	
Practical/Viva-Voce/Jury							
7.	EEP226	Project Based Learning (PBL) -2	0	0	2	1	
8.	EEP224	Electrical Macines-II Lab	0	0	2	1	
9.	ECP240	Digital System Design Lab	0	0	2	1	
10.	EEP225	Electrical & Electronic Measurements Lab	0	0	2	1	
11.	ECP245	Microprocessor and Microcontroller with Interfacing Lab	0	0	2	1	
12.	ARP204	Aptitude Reasoning and Business Communication Skills-Intermediate	0	0	4	2	
					TOTAL CREDITS	**23**	

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TERM: V

S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite
			L	T	P		
Theory Subjects							
1.	EEE330	Control Systems	3	0	0	3	
2.	EEE331	Power System-I	3	0	0	3	
3.	EEE332	Power Electronics	3	0	0	3	
4.	EEE452	Wind and Solor Energy	3	0	0	3	
5.	ECE932/BTY320/ MEC333/MEC319	IoT in smart application/Microbiology /Industry 4.0/Energy Conservation and Management	3	0	0	3	
Practical/Viva-Voce							
6.	EEP321	Control Systems Lab	0	0	2	1	
7.	EEP331	Power System-I Lab	0	0	2	1	
8	EEP332	Power Electronics Lab	0	0	2	1	
9.	EEP337	Technical Skill Enhancement Course-1	0	0	2	1	
10.	EEP333	Project Based Learning (PBL) -3	0	0	2	1	
11.	ARP301	Quantitative Aptitude Behavioral and Interpersonal Skills	0	0	4	2	
12.	EEP391	Summer Internship	0	0	2	1	
13.	ECC301	Community Connect	0	0	4	2	
					TOTAL CREDITS	**25**	

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B.Tech. Electrical and Electronics Engineering
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TERM: VI

S. No.	Course Code	Course	Teaching Load L	T	P	Credits	Pre-Requisite/Co Requisite
THEORY SUBJECTS							
1.	EEE334	Switchgear & Protection	3	0	0	3	
2.	EEE335	Power System-II	3	0	0	3	
3.	EEE442	Embedded System and Robotics	3	0	0	3	
4.	EEE463	Optimization Techniques	3	0	0	3	
5.	MOO307	Computer vision and Image processing-Fundamentals and Application	3	0	0	3	
Practical/Viva-Voce/Jury							
6.	ARP302	Higher Order Mathematics and Advanced People Skills	0	0	4	2	
7.	EEP334	Switchgear & Protection Lab	0	0	2	1	
8.	EEP335	Power System-II Lab	0	0	2	1	
9.	EEP336	Project Based Learning (PBL) -4	0	0	2	1	
10.	EEP339	Technical Skill Enhancement Course-2	0	0	2	1	
TOTAL CREDITS						**21**	

School of Engineering and Technology
B.Tech. Electrical and Electronics Engineering
Batch: 2019-2023
TERM: VII

S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite
			L	T	P		
THEORY SUBJECTS							
1.	EEE444	HVDC and Facts	3	0	0	3	
2.	EEE448	PLC and SCADA	3	0	0	3	
3.	EEE453	Wireless Sensor Networks and Applications	3	0	0	3	
4.	MOO402	Introduction to Smart Grid	2	0	0	2	
Practical/Viva-Voce/Jury							
6.	EEP430	Major Project- 1	0	0	6	3	
7.	SC22	Comprehensive Examination	0	0	0	0	
9.	EEE431	Industrial Internship	0	0	2	1	
10.	ARP401	Problem Solving Creative Thinking and Leadership Skills	0	0	2	1	
					TOTAL CREDITS	**16**	

School of Engineering and Technology
B.Tech. Electrical and Electronics Engineering
Batch: 2019-2023
TERM: VIII

S. No.	Course Code	Course	Teaching Load			Credits	Pre-Requisite/Co Requisite
			L	T	P		
1.	EEP495	Major Project – 2	0	0	16	8	
					TOTAL CREDITS	8	

SYLLABUS TERM-I

Programming for problem solving

School: SET **Program: B.Tech** **Branch: ECE** **Semester:1**				
1	Course Code	**CSE113**	Course Name: Programming for problem solving	
2	Course Title	Programming for problem solving		
3	Credits	4		
4	Contact Hours (L-T-P)	3-0-2		
	Course Status	Core		
5	Course Objective	1. Learn basic programming constructs –data types, decision structures, control structures in C 2. learning logic aptitude programming in c language 3. Developing software in c programming		
6	Course Outcomes	After completion of Course Students will be able to: CO1: demonstrate the algorithm, Pseudo-code and flow chart for the given problem. CO2: develop better understanding of basic concepts of C programming. CO3: create and implement logic using array and function. CO4: construct and implement the logic based on the concept of strings and pointers. CO5: apply user-defined data types and I/O operations in file. CO6: design and develop solutions to real world problems using C.		
7	Course Description	Programming for problem solving gives the Understanding of C programming and implement code from flowchart or algorithm		
8	Outline syllabus			CO Mapping
	Unit 1	**Logic Building**		
	A	Flowchart: Elements, Identifying and understanding input/ output, Branching and iteration in flowchart		CO1,
	B	Algorithm design: Problem solving approach(top down/bottom up approach)		CO1
	C	Pseudo Code : Representation of different construct, writing pseudo-code from algorithm and flowchart		CO1
	Unit 2	**Introduction to C Programming**		
	A	Introduction to C programming language, Data types, Variables, Constants, Identifiers and keywords, Storage classes		CO2
	B	Operators and expressions, Types of Statements: Assignment, Control, jumping.		CO2
	C	Control statements: Decisions, Loops, break, continue		CO2
	Unit 3	**Arrays and Functions**		
	A	Arrays: One dimensional and multi dimensional arrays: Declaration, Initialization and array manipulation (sorting, searching).		CO3
	B	Functions: Definition, Declaration/Prototyping and		CO3

		Calling, Types of functions, Parameter passing: Call by value, Call by reference.	
	C	Passing and Returning Arrays from Functions, Recursive Functions.	CO3
	Unit 4	**Pre-processors and Pointers**	
	A	Pre-processors: Types, Directives, Pre-processors Operators (#,##,\) , Macros: Types, Use, predefined Macros	CO4, CO6
	B	Pointer: Introduction, declaration of pointer variables, Operations on pointers: Pointer arithmetic, Arrays and pointers, Dynamic memory allocation.	CO4 , CO6
	C	String: Introduction, predefined string functions, Manipulation of text data, Command Line Arguments.	CO4, CO6
	Unit 5	**User Defined Data Types and File Handling**	
	A	Structure and Unions: Introduction, Declaration, Difference, Application, Nested structure, self-referential structure, Array of structures, Passing structure in function.	CO5, CO6
	B	Files: Introduction, concept of record, I/O Streaming and Buffering, Types of Files: Indexed file, sequential file and random file,	CO5, CO6
	C	Creating a data file, Opening and closing a data file, Various I/O operations on data files: Storing data or records in file, adding records, Retrieving, and updating Sequential file/random file.	CO5, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 30% / MTE: 20% / ETE: 50%	
	Text book/s*	Kernighan, Brian, and Dennis Ritchie. *The C Programming Language*	
	Other References	1. B.S. Gottfried - Programming With C - Schaum's Outline Series - Tata McGraw Hill 3rd Edition .ISBN 9780070145900 2. E. Balagurusamy - Programming in ANSI C – 8thEdition - Tata McGraw Hill- 2019	

CO , PO & PSO MAPPING:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3		
CSE113.1	1	2	1	_	_	1	_	_	_	_	_	_	1	1	_		
CSE113.2	2	_	2	_	_	1	_	_	_	_	1	_	2	2	_		
CSE113.3	1	_	1	_	_	_	_	_	_	_	_	_	_	1	_		
CSE113.4	1	_	1	_	_	_	_	_	_	_	_	_	_	1	_		
CSE113.5	1	_	1	_	_	_	_	_	_	_	_	_	_	1	_		
CSE113.6	2	2	2	_	_	2	_	_	_	_	1	_	2	2	1		
CSE113	1.3	2	1.3			1.3					1		1.6	1.3	1		

School: School of Basic Sciences and Research		
Program: B.TECH .		**Current Academic Year:**
Branch: CSE/EC/EEE		**Semester: II**
1	Course Code	PHY 117
2	Course Title	Semiconductor Physics
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	To make students proverbial with the fundamental concepts of Semiconductors materials and their real life applications for configuring various electronics devices.
6	Course Outcomes	After the completion of this course, CO1: Students will learn the various fundamental theory of materials and concept of solid classification. CO2: Students will learn the fundamental concepts of mobility, conductivity, electrons and holes in an intrinsic semiconductors, Donor and Acceptor impurities (n-type and p-type semiconductor), Fermi levels etc. CO3: Students will gain knowledge about the formation of depletion region, barrier potential, Zener diode, Characteristics of Zener diode etc. CO4: Students will have a clear understanding of Coherent sources, interaction of radiation with matter (spontaneous and stimulated emission), Einstein's relation, population inversion and pumping, etc. CO5: Students will learn the concept of optical sources: Light emitting diode (construction, basic working principle), semiconductor laser (construction, basic working principle), and optical detectors. CO6: Student will be familiar with the essential concepts of Semiconductors materials technology and their applications in industries.
7	Course Description	This course provides the basic foundation for understanding electronic semiconductor devices and their applications and limitations. It has introductory elements of various concept of material science. This course is essential for students who desire to specialize their engineering in Computer Sciences, Electronics, and Electronics and Electrical engineering.

8	Outline Syllabus		CO Mapping
	Unit 1	**Physics ofSemiconductor**	

	A	Introduction, classical free electron theory (Lorentz-Drude theory and limitations), Quantum theory of free electron	CO1, CO6
	B	(Fermi energy, effect of temperature on Fermi-Dirac distribution) (qualitative analysis)	CO1
	C	Energy bands, Classification of Solids on the basis of energy band.	CO1
	Unit 2	**Transport phenomena in semiconductors**	
	A	Mobility, conductivity, electrons and holes in an intrinsic semiconductors, Donor and Acceptor impurities (n-type and p-type semiconductor)	CO2, CO6
	B	Fermi levels , carrier densities in semiconductor	CO2
	C	Concentration of electrons in conduction band and holes in valence band, Drift and diffusion current, Hall effect.	CO2
	Unit 3	**p-n Junction**	
	A	p-n junction, types of p-n junction (step-graded and Linearly-graded junction)	CO3
	B	formation of depletion region, barrier potential, Zener diode, Characteristics of Zener diode	CO3
	C	Avalanche and Zener breakdown, comparison of Zener diode and pn junction diode, concept of tunneling, I-V characteristics of tunnel diode.	CO3, CO6
	Unit 4	**Laser Physics**	
	A	Coherent sources, interaction of radiation with matter (spontaneous and stimulated emission), Einstein's relation	CO4
	B	population inversion and pumping, active components of laser, optical amplification or gain	CO4
	C	threshold condition for laser action, three and four level lasers, Ruby and He-Ne lasers.	CO4
	Unit 5	**Optoelectronic Devices**	
	A	optical sources: Light emitting diode (construction, basic working principle), semiconductor laser (construction, basic working principle)	CO5
	B	optical detectors: photodiode (working principle), p-i-n photodiode (working principle),	CO5, CO6

	C	Photovoltaic effect, p-n junction solar cell (basic working idea).			CO5, CO6
	Mode of Examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text books	Integrated Electronics- Millman - Halkias, Tata McGraw Hill			
	Other References	1. Semiconductor Devices Physics and Technology- S M Sze, John Wiley & Sons -ISBN: 978-0-470-53794-7 2. Semiconductor Device Fundamentals- Robert F. Pierret Addison Wesley Longman –ISBN:0201543931			

CO , PO & PSO MAPPING:

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
PHY117. 1	3	2	1	1	1	1	1	1	2	1	1	1	-	-	-
PHY117. 2	3	3	2	3	3	2	1	1	1	1	1	1	-	-	--
PHY117. 3	3	3	2	3	3	2	1	1	1	1	1	1	-	-	-
PHY117. 4	3	3	3	2	3	2	1	1	1	1	1	1	-	-	--
PHY117. 5	3	3	3	2	3	2	1	1	1	1	1	1	-	-	-
PHY117. 6	3	3	3	3	3	2	1	1	1	1	1	1	-	-	--
PHY117	3	2.8	2.3	2.3	2.7	1.8	1.0	1.0	1.2	1.0	1.0	1.0	-	-	-

School: SET		
Program: B.Tech.		
Branch: ME, EC, EE, CE		**Semester: I**
1	Course Code	MTH 141
2	Course Title	CALCULUS, ANALYSIS AND LINEAR ALGEBRA
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.
6	Course Outcomes	CO1: Explain the concept of differential calculus, illustrate thecurvature and Maxima, minima and saddle point by using Method of Lagrange. (K2,K3, K4) CO2: Explain the concept of integral calculus,describe Beta and Gamma function, calculatemultiple integration and evaluate area and volume. (K1, K2, K3, K4, K5) CO3:Describe the concept of sequence and series;discuss the test of convergence to evaluate convergence of series. (K1, K2,K3, K5) CO4: Discuss the basic of vector calculus; illustrate gradient, curl and divergence. (K1, K3) CO5: Describe and use the concepts line and surface integral for scalar and vector, explain the Green theorem. (K1,K2,K3, K4) CO6: Explain the basic concepts matrices and determinate, evaluate system of linear equation by using rank and inverse method, calculate Eigen values and Eigen vectors; Diagonalization of matrices; Cayley - Hamilton Theorem.(K2,K 3,K4, K5)
7	Course Description	This course is an introduction to the fundamental of Mathematics. The primary objective of the course is to develop the basic understanding of differential and integral calculus, sequence and series, vector calculus and linear algebra.

8	**Outline Syllabus**	**Calculus, Analysis And Linear Algebra**	**CO Mapping**
	Unit 1	**Differential Calculus**	
	A	Differentiation, Taylor's and Maclaurin's theorems with remainders; indeterminate forms and L' Hospital's rule;	CO1
	B	Limits and continuity for multivariable and Partial derivatives, Euler's theorem total derivative; Tangent plane and normal line (basic concepts);	CO1
	C	Expansion of functions of several variables, Maxima, minima and saddle points; Method of Lagrange	CO1

		multipliers.	
	Unit 2	**Integral Calculus**	
	A	Beta and Gamma functions and their properties; Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals,	CO2
	B	Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass	CO2
	C	Triple integrals (Cartesian), Simple applications of triple integration.	CO2
	Unit 3	**Sequences and series**	
	A	Convergence of sequence and series,	CO3
	B	tests for convergence: comparison test, D' Alembert's ratio test,	CO3
	C	Raabe's test, Cauchy root test; Power series.	CO3
	Unit 4	**Vector Calculus**	
	A	Gradient, curl and divergence, Scalar line integrals,	CO4, CO5
	B	vector line integrals, scalar surface integrals,	CO4, CO5
	C	vector surface integrals, Theorems of Green's theorem.	CO4, CO5
	Unit 5	**Matrices**	
	A	Inverse and rank of a matrix, System of linear equations,	CO6
	B	Symmetric, skew-symmetric and orthogonal matrices; Determinants	CO6
	C	Eigen values and Eigen vectors; Diagonalization of matrices; Cayley - Hamilton Theorem.	CO6
	Mode of examination	Theory	
	Weightage Distribution	CA 30% / MTE 20% / ETE 50%	
	Text book/s*	1. Kreyszig, E., "Advanced Engineering Mathematics", John Wiley & Sons Inc. - ISBN 978-0-470-45836-5 Jain, M.K., and Iyengar, S.R.K., "Advanced Engineering Mathematics", Narosa Publications 2007	
	Other References	1. Simmons, G.F., "Differential Equations with applications with applications", Tata McGraw-Hill.- second edition 2003 ISBN 10: 0070573751ISBN 13: 9780070573758	

CO , PO & PSO MAPPING:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
MTH141.1	3	3	2	2	2	1	-	-	-	1	1	1	-	-	-
MTH 141.2	3	2	3	2	2	2	-	-	-	1	1	2	-	-	-
MTH 141.3	3	2	2	2	3	1	-	-	-	2	1	1	-	-	-
MTH 141.4	3	3	2	2	2	1	-	-	-	2	1	1	-	-	-
MTH 141.5	3	2	2	2	2	1	-	-	-	1	1	2	-	-	-
MTH 141.6	3	3	2	3	2	2	-	-	-	1	1	2	-	-	-
MTH 141	3	2.5	2.2	2.1	2.2	1.3				1.3	1.0	1.5			

FEN101: FUNCTIONAL ENGLISH BEGINNER – I
First Year (Odd Semester)
SYLLABUS

1	Course number	**FEN101**
2	Course Title	**Functional English Beginner-1**
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
5	Course Pre-requisite	A skill-based course designed for undergraduate students with basic understanding of English language
6	Course Objective	To guide students to hone the basic communication skills: listening, speaking, reading and writing. To equip students to minimize the linguistic and socio-cultural barriers emerging in a different environment. To help students to understand different accents and standardise their existing English.
7	Course Outcomes	**CO1 : Students will able to recognise stress patterns in pronunciation of the English sentences.** **C02 : Students will be able to understand the grammatical concepts and use new words.** **C03 : Students will be able to speak confidently in the English language.** **C04 : Students will be able to analyse the paragraphs and identify parts of speech.** **C05 : Students will be able to evaluate and interpret main ideas to differentiate between opinions and facts.** **C06 : Students will be able to construct correct sentences and punctuation.**
8	Outline syllabus: **Functional English Beginner-1 (FEN103)**	

			TOPICS	**Ref. & Chapter**	**Cos**
	FEN101.A	**UNIT A**	**Sentence Structure**		
8.01	FEN101.A1	Topic1	Activities based on Subject Verb Agreement	Ref 1, Ref 2	C02
8.02	FEN101.A2	Topic2	Activities based on parts of speech	Ref 1, Ref 2	
8.03	FEN101.A3	Topic3	Writing well-formed sentences	Ref 1, Ref 2	
	FEN101.B	**UNIT B**	**VocabularyBuilding and Punctuation**		
8.04	FEN101.B1	Topic1	Homonyms/ homophones	Ref 1, Ref 2	C01, C02, C06
8.05	FEN101.B2	Topic2	Synonyms/Antonyms	Ref 1, Ref 2	
8.06	FEN101.B3	Topic3	Punctuation	Ref 1, Ref 2	
	FEN101.C	**UNIT C**	**ReadingComprehension**		
8.07	FEN101.C1	Topic1	Scanning based passages	Ref 4	CO4, C05
8.08	FEN101.C2	Topic2	Skimming based passages	Ref 4	

8.09	FEN101.C3	Topic3	Comprehension and Vocabulary based exercises	Ref 4	
	FEN101.D	**UNIT D**	**Speaking Skills**		
8.10	FEN101.D1	Topic1	Presentation	Ref 1	C03
8.11	FEN101.D2	Topic2	Extempore		
8.12	FEN101.D3	Topic3	Role-play of different situations		
	FEN101.E	**UNIT E**	**Reading texts**		
8.13	FEN101.E1	Topic1	The Thief by Ruskin Bond (short story)		CO4, C05
8.14	FEN101.E2	Topic2	The Hack Driver By Sinclair Lewis (short story)		
8.15	FEN101.E3	Topic3	Texts based discussions		

9	**Course Evaluation**	
9.1	Course work: 30%	
9.2	Attendance	None
9.3	Homework	10 assignments, no weight
9.4	Quizzes	6 best quizzes (based on assignments); 20 marks
9.5	Lab	Separate
9.6	Presentations	None
9.7	Any other	None
9.9	MTE	One, 20%
9.10	End-term Examination: One, 50%	
10	Reference Books, Videos and Internet:	
	Text book	1. Communication Skills by Sanjay Kumar and PushpLata, OUP Publications. 2. Professional Communication by Meenakshi Raman and Sangeeta Sharma, OUP Publications. 3. Functional English Workbook Beginner I
	Reference Books	• Wren, P.C.&Martin H. *High English Grammar and Composition*, S.Chand& Company Ltd, New Delhi. • *Murphy's English Grammar* with CD, Cambridge University Press.

Mapping of Outcomes vs. Topics
FILENAME: Functional English Beginner 1 (FEN101)

Outcome no. →	CO1	CO2	CO3	CO4	CO5	CO6

Syllabus topic↓						
FEN101.A		X				
FEN101.A1		X				
FEN101.A2		X				
FEN101.A3		X				
FEN101.B	X	X				X
FEN101.B1	X	X				X
FEN101.B2	X	X				X
FEN101.B3	X	X				X
FEN101.C				X	X	
FEN101.C1				X	X	
FEN101.C2				X	X	
FEN101.C3				X	X	
FEN101.D			X			
FEN101.D1			X			
FEN101.D2			X			
FEN101.D3			X			
FEN101.E				X	X	
FEN101.E1				X	X	
FEN101.E2				X	X	
FEN101.E3				X	X	

Programming for problem solving lab

School: SET **Program: B.Tech.** **Branch:** **Semester: I**			
1	Course Code	CSP113	
2	Course Title	Programming for problem solving lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	1. Learn basic programming constructs –data types, decision structures, control structures in C 2. learning logic aptitude programming in c language 3. Developing software in c programming	
6	Course Outcomes	After Completion of Course Students will be able to: CO1: demonstrate the algorithm, Pseudo-code and flow chart for the given problem. CO2: develop better understanding of basic concepts of C programming. CO3: create and implement logic using array and function. CO4: construct and implement the logic based on the concept of strings and pointers. CO5: apply user-defined data types and I/O operations in file. CO6: design and develop solutions to real world problems using C.	
7	Course Description	Programming for problem solving gives the Understanding of C programming and implement code from flowchart or algorithm	
8	Outline syllabus		CO Mapping
	Unit 1	**Logic Building**	
		Draw flowchart for finding leap year	CO1
		Write a c Program to Add Two Integers	CO1
		Write a program to create a calculator	CO1
	Unit 2	**Introduction to C Programming**	
		Write a c program to convert length meter to cm	CO2
		Write a c program to convert temp	CO2
		Write a c program to swap two numbers	CO2

	Unit 3	**Arrays and Functions**	
		Write a c program to calculate the average using arrays	CO3
		Write a c program to find the largest element of the array	CO3
	Unit 4	**Pre-processors and Pointers**	
		Write a c program to swap two values using pointers	CO4, CO6
		Write a c program to find largest number from array using pointers	CO4, CO6
	Unit 5	**User Defined Data Types and File Handling**	
		Write a c program to store information of a student using structure	CO5, CO6
		Write a c program to store information of a student using union	CO5, CO6
	Mode of examination	Practical	
	Weightage Distribution	CA: 60% / MTE: 0% / ETE: 40%	
	Text book/s*	Kernighan, Brian, and Dennis Ritchie. *The C Programming Language*	
	Other References	1. E. Balagurusamy - Programming in ANSI C – 8thEdition - Tata McGraw Hill- 2019 ISBN-0070681821	

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CSE113.1	1	2	1	_	_	1	_	_	_	_	_	_	1	1	_
CSE113.2	2	_	2	_	_	1	_	_	_	_	1	_	2	2	_
CSE113.3	1	_	1	_	_	_	_	_	_	_	_	_	_	1	_
CSE113.4	1	_	1	_	_	_	_	_	_	_	_	_	_	1	_
CSE113.5	1	_	1	_	_	_	_	_	_	_	_	_	_	1	_
CSE113.6	2	2	2	_	_	2	_	_	_	_	1	_	2	2	1
CSE113	1.3	1	1.3	-	-	1	-	-	-	-	1	-	1	1.3	1

Computer Aided Design & Drafting Lab

School: SET
Program: B.Tech
Branch:EEE
Semester: I

1	Course Code	MEP 106	
2	Course Title	Computer Aided Design & Drafting Lab	
3	Credits	1.5	
4	Contact Hours (L-T-P)	0-0-3	
	Course Status	Compulsory	
5	Course Objective	The objective of this introductory course is to make students familiar with computer-aided drafting/ design, introduce them about the basic commands, tools and dimension techniques for creation and presentation of various engineering drawing by using AutoCAD software which helps in visualization and problem solving in engineering disciplines.	
6	Course Outcomes	After successful completion of this course the student will be able to: CO1: Understand the fundamental features of AutoCAD workspace and user interface. CO2: Apply the fundamental tools such as draw, edit, and view for creating two dimensional engineering drawings in AutoCAD. CO3: Choose advance features to present an engineering drawing in AutoCAD CO4: Apply text and dimension features in the engineering drawing CO5: Create different orthographic projections from a pictorial view. CO6: Analyze an engineering drawing and use the software packages for drafting and modeling.	
7	Course Description	This introductory course is offered to students to make them proficient in design, layout, product development, and other careers that require technical drawing. Using the current version of the AutoCAD software, students will learn a variety of drawing techniques and be able to replicate specific drawings in multiple perspectives. The pinnacle of the class is to empower and enable students to create using the software provided. Career opportunities and 3-D modelling, manufacturing, and engineering will also be explored. No drafting or computer experience is necessary.	
8	Outline syllabus		CO Mapping
	List of Experiments		
	Experiment 1	Introduction to AutoCAD and its interface with assignment 1	CO1
	Experiment 2	Working with coordinates, Drawing ofline, circle, arc, polygon and creating sketches by using them assignment	CO2

		2	
	Experiment 3	Editing of drawing by using editing Tools and Power tools with assignment 3	CO2
	Experiment 4	Creating of advanced feature like fillet, chamfer, hatch and using of reusable items with assignment 4	CO3, CO6
	Experiment 5	Representing text and dimensioning in AutoCADwith assignment 5	CO4
	Experiment 6	Creating the drawing of the given assignment 6 by using AutoCAD features.	CO2, CO3
	Experiment 7	Creating the drawing of the given assignment 7 in AutoCAD.	CO2,CO6
	Experiment 8	Creating the drawing of the given diagram and giving dimensions in AutoCAD.	CO2, CO4
	Experiment 9	Creating the drawing of TajMahal in Autocad 2D	CO3, CO6
	Experiment 10	Creating of orthographic projections from a 3D figure	CO5, CO6
	Mode of examination	Practical	

	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	1. Ibrahim Zaid,"CAD/CAM- Theory and Practice", McGraw Hill, International Edition. ISBN 0–07–072857–7			
	Software	AutoCAD			

CO , PO & PSO MAPPING:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
MEP106.1	2	2	2	-	3	-	-	-	-	-	-	3	3	3
MEP 106.2	2	-	-	-	-	-	-	-	-	-	-	3	3	3
MEP 106.3	2	-	-	-	-	-	-	-	-	-	-	3	3	3
MEP 106.4	2	-	-	-	-	-	-	-	2	2	-	3	3	3
MEP 106.5	2	-	-	-	-	-	-	-	2	2	-	3	3	3
MEP 106.6	-	2	3	3	-	-	-	-	-	-	-	-	-	-
MEP 106	2	2	2.5	3	3	-	-	-	2	2	-	3	3	3

Introduction to Electronics Engineering

School: SET
Program: B.Tech
Branch:EEE
Semester:1

1	Course Code	ECP109	
2	Course Title	Introduction to Electronics Engineering	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	To be acquainted with few recent technologies in the field of Engineering.	
6	Course Outcomes	After successful completion of this course the student will be able to: CO1: Explain and classify few sensors CO2: Understand the importance of AI CO3: Describe the working of basic IoT system CO4: Demonstrate and Identify the components of drone and practice of indoor pilot CO5: Interpret the working of basic robot CO6: Apply the concept in various hardware based applications	
7	Course Description	This course is an active introduction to developing an engineering mindset by teaching the necessary skills to be added to your engineering toolbox. You will learn to identify opportunities, imagine new solutions, model your creations, make decisions, build prototypes, and showcase your ideas that impact the world.	
8	Outline syllabus		CO Mapping
	Unit 1	**Sensors**	
	A	Different type of Sensors	CO1
	B	Application of Sensors	CO1
	C	Case study	CO1,CO6
	Unit 2	**Artificial Intelligence**	
	A	What is Artificial Intelligence? History of Artificial Intelligence	CO2
	B	Applications	CO2
	C	Case study	CO2,CO6
	Unit 3	**IoT**	
	A	Basics of IoT	CO3
	B	Applications Of IoT	CO3
	C	Case study	CO3,CO6

	Unit 4	**Drone**			
	A	Basics of Drone Technology			CO4
	B	Applications			CO4,CO6
	C	Practicing of indoor pilot system/Case study			CO4,CO6
	Unit 5	**Robotics**			
	A	Basics of Robotics			CO5
	B	Applications			CO5,CO6
	C	Case study of fire bird robot			CO5,CO6
	Mode of examination	Practical & Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	Refer manuals			
	Other References				

CO , PO & PSO MAPPING:

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ECP106.1	3	2	2	1	1	2	-	-	-	-	-	1	2	1	2
ECP106.2	2	2	2	-	2	2	-	-	-	-	-	3	1	1	1
ECP106.3	2	1	1	1	2	1	-	-	-	-	-	2	3	1	2
ECP106.4	2	3	3	1	1	1	-	-	-	-	-	2	-	2	1
ECP106.5	3	2	2	-	-	-	-	-	-	-	-	2	-	2	1
ECP106.6	3	3	3	2	1	1	2	-	-	-	-	3	3	3	3

TERM-II

Principles of Electrical and Electronics Engineering

School: SET
Batch :
Program: B.Tech
Branch: ECE
Semester: II

1	Course Code	EEE112	
2	Course Title	Principles of Electrical and Electronics Engineering	
3	Credits	3	
4	Contact Hours (L-T-P)	2-1-0	
	Course Status	Compulsory	
5	Course Objective	To provide the students with an introductory concept in the field of electrical and electronics engineering to facilitate better understanding of the devices, techniques and equipment's used in engineering applications.	
6	Course Outcomes	After completion of Course Students will be able to: CO1: To analyze and solve basic electrical circuits CO3: To understand the working principle of transformer and identify its applications. CO3: To understand the working principle of dc and ac motors and identify the starting methods of single-phase induction motor CO4: To apply the basics of diode to describe the working of rectifier circuits such as half and full wave rectifiers CO5: To apply the concepts of basic electronic devices to design various circuits CO6:Apply the basic concepts in Electrical and Electronics Engineering for multi-disciplinary tasks	
7	Course Description	This initial course introduces the concepts and fundamentals of electrical and electronic circuits and devices. Topics include basic circuit analysis, diode and transistor fundamentals and applications. This course also introduces working principle and applications of dc/ac motors and transformers.	
8	Outline syllabus		CO Mapping
	Unit 1	**DC & AC Circuits (6 lectures)**	
	A	Electrical circuit elements (R, L and C), series and parallel circuits, concept of equivalent resistance, Kirchhoff current and voltage laws, star-delta conversion	CO1
	B	Analysis of simple circuits with dc excitation and Superposition Theorem, Representation of sinusoidal waveforms, peak and rms values, real power, reactive power, apparent power, power factor	CO1
	C	Introduction to three phase system, relationship between phase voltages and line voltages,	CO1
	Unit 2	**Transformer(4 lectures)**	
	A	Working principle and construction of transformer, EMF equation	CO2

	B	Efficiency of transformer, Power and distribution transformer and difference between them	CO2
	C	Transformer applications in transmission and distribution of electrical power	CO2
	Unit 4	**Electrical Motors (6 lectures)**	
	A	Construction, working principle, torque-speed characteristic and applications of dc motor.	CO3, CO6
	B	Construction, working principle and applications of a three-phase induction motor, significance of torque-slip characteristic	CO3, CO6
	C	Working principle starting methods and applications of single phase induction motor	CO3, CO6
	Unit 4	**Semiconductor Diode and Rectifier (5 lectures)**	
	A	PN junction and its biasing	CO4, CO6
	B	Semiconductor diode, ideal versus practical diode , VI characteristics of diode	CO4, CO6
	C	Half wave and full wave rectifiers with and without filters.	CO4, CO6
	Unit 5	**Transistors (5 lectures)**	
	A	Bipolar Junction Transistor (BJT) –Construction, working principle and input-output characteristics	CO5, CO6
	B	BJT as CE amplifier and as a switch	CO5, CO6
	C	Introduction to JFET	CO5, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 30%; MTE: 20%; ETE: 50%	
	Text book/s*	1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010- ISBN: 1259081532, 9781259081538 2. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson Publication,2011 ISBN-8131754561, 9788131754566 3. Robert L Boylestad, "Electronic Devices and Circuit Theory" Pearson Education, 2013 11th edition ISBN- 9780136064633	
	Other References	1. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 2003 ISBN-9789332551763	

CO , PO & PSO MAPPING:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEE112.1	3	3	2	2	-	-	-	-	-	-	-	-	2		1
EEE112.2	1	1	2	-	-	-	-	-	-	-	-	-	-	2	-
EEE112.3	2	2	1	-	-	-	-	-	--	-	-	-		1	2
EEE112.4	2	1	2	-	-	-	-	-	-	-	1	-	-	2	-
EEE112.5	3	2	1	-	-	-	-	-	-	-	1	-	1	-	1
EEE112.6	2	2	3	1	-	-	-	-	-	-	1	-	-	-	-
EEE112	**2.1**	**1.8**	**1.8**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**1**	**1**

Principles of Electrical and Electronics Engineering Lab

School: SET **Program: B.Tech** **Branch: EEE** **Semester: II**			
1	Course Code	EEP112	
2	Course Title	Principles of Electrical and Electronics Engineering Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	To provide the students with an introductory concept in the field of electrical and electronics engineering to facilitate better understanding of the devices, techniques and equipment's used in engineering applications.	
6	Course Outcomes	After successful completion of this course the student will be able to: CO1: To configure and analyze any given circuit. CO2: To inspect the working of transformer and calculate its efficiency CO3: To understand the working of dc and ac motors and measure its various operating parameters. CO4: To design rectifier circuits such as half and full wave rectifiers and observe its output waveforms. CO5: To obtain the characteristics of BJT. CO6:Apply the basic concepts in Electrical and Electronics Engineering for multi-disciplinary tasks.	
7	Course Description	This initial course introduces the concepts and fundamentals of electrical and electronic circuits and devices. Topics include basic circuit analysis, diode and transistor fundamentals and applications. This course also introduces working principle and applications of dc/ac motors and transformers.	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on DC & AC Circuits**	CO1
		To configure a dc circuit on breadboard, and measure voltage/current across/through each element	CO1
		To verify Kirchhoff's Laws	CO1
		To verify Superposition Theorem	CO1
		To find the real power, reactive power, apparent power and power factor of RL & RC load	CO1
	Unit 2	**Practical related to Transformers**	
		To find the efficiency of transformer by obtaining its losses.	CO2, CO6
	Unit 3	**Practical related to Electrical Motors**	
		To study cut-section of DC motor and induction motor.	CO3, CO6
		To start the DC motor and reverse its direction of rotation.	CO3, CO6
		To start an induction motor and reverse its direction of rotation.	CO3, CO6
	Unit 4	**Practical related to Diode and Rectifier**	
		To determine voltage-current characteristic of diode	CO4, CO6
		To assemble and test half wave and full wave rectifier circuits for their input and output waveform	CO4, CO6
	Unit 5	**Practical related to Transistors**	

		To determine input and output characteristics of BJT	CO5, CO6
		Validation of BJT as a switch	CO5, CO6
	Mode of examination	Practical	
	Weightage Distribution	CA: 60% / MTE: 0% / ETE: 40%	
	Text book/s*	1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010-ISBN:9780070146112 2. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson Publication.ISBN: 9789332586505 3. Robert L Boylestad, "Electronic Devices and Circuit Theory" Pearson Education, 2009 ISBN: 9780131189058	
	Other References	4. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989. SBN:9780132471312	

CO , PO & PSO MAPPING:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEP112.1	3	3	3	1	1	-	-	-	-	-	-	-	2	-	-
EEP112.2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	1
EEP112.3	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
EEP112.4	2	1	3	-	-	-	-	-	-	-	-	-	2	-	-
EEP112.5	2	1	1	-	-	-	-	-	-	-	-	-	2	-	-
EEP112.6	2	2	2	2	2				2		2	-	1	1	-
EEP112	2.1	1.6	2	1	1	-	-	-	1	-	1	-	1.1	1	1

School: SET **Program: B.Tech** **Branch: EEE** **Semester: II**				
1	Course Code	CSE114	Course Name	
2	Course Title	Application Based Programming in Python		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Compulsory		
5	Course Objective	Emphasis is placed on procedural programming, algorithm design, and language constructs common to most high-level languages through Python Programming.		
6	Course Outcomes	Upon successful completion of this course, the student will be able to: CO1. Apply decision and repetition structures in program design. CO2. Demonstrate the use of Python lists, tuples and dictionaries CO3. Implement methods and functions to improve readability of programs. CO4. Describe and apply object-oriented programming methodology. CO5. Apply top-down concepts in algorithm design. CO6. Write Python programs to illustrate concise and efficient algorithms		
7	Course Description	Python is a language with a simple syntax, and a powerful set of libraries. It is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience. We cover data types, control flow, object-oriented programming.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction**		
	A	History, Python Environment, Variables, Data Types, Operators.		CO1
	B	**Conditional Statements:** If, If- else, Nested if-else. **Looping:** For, While, Nested loops.		CO1
	C	**Control Statements:** Break, Continue, And Pass. Comments		CO1, CO6
	Unit 2	**List, Tuple and Dictionaries**		
	A	**Lists and Nested List:** Introduction, Accessing list, Operations, Working with lists, Library Function and Methods with Lists.		CO2
	B	**Tuple:** Introduction, Accessing tuples, Operations, Working, Library Functions and Methods with Tuples.		CO2
	C	**Dictionaries :**Introduction, Accessing values in dictionaries ,Working with dictionaries, Library Functions		CO2
	Unit 3	**Functions and Exception Handling**		
	A	**Functions:** Defining a function, Calling a function, Types of functions, Function Arguments		CO3,CO6
	B	Anonymous functions, Global and local variables		CO3,CO6
	C	**Exception Handling**: Definition Exception, Exception		CO3,CO6

		handling Except clause, Try? finally clause			
	Unit 4	**OOP and File Handling**			
	A	**OOPs concept** : Class and object, Attributes, Abstraction, Encapsulation, Polymorphism and Inheritance			CO4
	B	Static and Final Keyword, Access Modifiers and specifiers, scope of a class			CO4
	C	User Defined Exceptions			CO4
	Unit 5	**Module and Applications**			
	A	**Modules:** Importing module, Math module, Random module			CO5,
	B	Matplotlib, Packages			CO5,
	C	**Applications: Searching Linear Search, Binary Search. Sorting: Bubble Sort**			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	The Complete Reference Python, Martin C. Brown, McGrwHill ISBN:9780072127188			
	Other References	1. Introduction to computing in problem solving using Python, E Balahurusamy, McGrwHill- ISBN:9789352604173 2. Introduction to programming using Python, Y. Daniel Liang, Pearson-ISBN:9780132747189			

CO , PO & PSO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSE114.1	1	3	2	2	1	-	-	-	1	-	1	-	2	2	1
CSE114.2	3	3	3	3	3	-	-	-	3	-	3	-	3	3	3
CSE114.3	3	3	3	3	2	-	-	-	3	-	2	-	3	3	2
CSE114.4	2	2	2	1	2	-	--	-	2	-	1	-	2	1	1
CSE114.5	2	3	2	1	2				1		2		1	2	2
CSE114.6	1	2	1	2	1				1		1		3	2	2
CSE114	2	2.7	2.2	2	1.8				1.8		1.7		2.3	2.2	1.8

Application Based Programming in Python Lab

School: SET		
Program: B.Tech		
Branch:All	**Semester: II**	

1	Course Code	CSP114	
2	Course Title	Application Based Programming in Python Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	Emphasis is placed on procedural programming, algorithm design, and language constructs common to most high level languages through Python Programming.	
6	Course Outcomes	Upon successful completion of this course, the student will be able to: CO1. Apply decision and repetition structures in program design. CO2. Demonstrate the use of Python lists, tuples and dictionaries CO3. Implement methods and functions to improve readability of programs. CO4. Describe and apply object-oriented programming methodology. CO5. Apply top-down concepts in algorithm design. CO6. Write Python programs to illustrate concise and efficient algorithms	
7	Course Description	Python is a language with a simple syntax, and a powerful set of libraries. It is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience. We cover data types, control flow, object-oriented programming.	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on conditional statements and control structures**	
		1. Program to implement all conditional statements 2. Program to implement different control structures	CO1
	Unit 2	**Practical related to List, Tuples and dictionaries**	
		1. Program to implement operations on lists 2. Program to implement operations on Dictionary **3.** Program to implement operations on Tuple	CO2
	Unit 3	**Practical related to Functions and Exception Handling**	
		1. Program to implement Exception Handling **2.** Program to use different functions	CO3
	Unit 4	**Practical related to Object Oriented Programming**	
		1. Program to use object oriented concepts	CO4,CO6

		like inheritance, overloading polymorphism etc. 2. Program for file handling	
	Unit 5	**Practical related to Modules and Applications**	
		1. Program to use modules and package 2. Program to implement searching and sorting	CO5,CO6
	Mode of examination	Practical/Viva	
	Weightage Distribution	CA: 60% / MTE: 0% / ETE: 40%	
	Text book/s*	The Complete Reference Python, Martin C. Brown, McGraw Hill,2010-ISBN:9780072127188	
	Other References	• Introduction to computing in problem solving using Python, E Balagurusamy, McGraw Hill ISBN-9789353160920 • Introduction to programming using Python, Y. Daniel Liang, Pearson ISBN-9780132747189	

CO , PO & PSO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3		
CSP114.1	1	3	2	2	1	-	-	-	1	-	1	-	2	2	1		
CSP114.2	3	3	3	3	3	-	-	-	3	-	3	-	3	3	3		
CSP114.3	3	3	3	3	2	-	-	-	3	-	2	-	3	3	2		
CSP114.4	2	2	2	1	2	-	--	-	2	-	1	-	2	1	1		
CSP114.5	2	3	2	1	2				1		2		1	2	2		
CSP114.6	1	2	1	2	1				1		1		3	2	2		
CSP114	2	2.7	2.2	2	1.8				1.8		1.7		2.3	2.2	1.8		

Calculus and Abstract Algebra

School: SET		
Program: B.Tech.		
Branch: ALL		**Semester: <u>1/2</u>**
1	Course Code	**MTH 142**
2	Course Title	**Calculus and Abstract Algebra**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	The objective of this course is to familiarize the prospective engineers with techniques in basic calculus and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.
6	Course Outcomes	CO1: Explain the concept of differential calculus, illustrate thecurvature and Maxima, minima and saddle point. (K2, K3, K4) CO2: Explain the basic concepts matrices and determinate, evaluate system of linear equation by using rank and inverse method. (K2, K3, K5) CO3: Explain the basic concept of sets, relation, functions, groups Rings and Field. (K2, K4) CO4: Discuss the basic of Vector spaces. (K1, K3) CO5: Describe and use the linear transformation and evaluate nullity and kernel. (K1, K2, K3, K5) CO6:Explain the concept of Eigen values and Eigen vectors; evaluate the diagonalization of matrices,explain the basic introduction of Inner product spaces.(K2, K3, K4, K5)
7	Course Description	This course is an introduction to the fundamental of Mathematics. The primary objective of the course is to develop the basic understanding of differential and integral calculus, linear Algebra and Abstract Algebra.

8	**Outline syllabus:Calculus and Abstract Algebra**		**CO Mapping**
	Unit 1	**Calculus**	
	A	Differentiation, Taylor's and Maclaurin theorems with remainders; indeterminate forms, L' Hospital's rule.	CO1
	B	Maxima and minima, Partial derivatives, Euler's theorem.	CO1
	C	Total derivative. Evaluation of double integration. Applications of double integral (to calculate area).	CO1

	Unit 2	**Matrices**			
	A	Matrices, vectors: addition and scalar multiplication, matrix multiplication.			CO2
	B	Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule			CO2
	C	Inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.			CO2
	Unit 3	**Basic Algebra**			
	A	Sets, relations and functions.			CO3
	B	Basics of groups, cyclic groups.			CO3
	C	Subgroups, basics of Rings and Field.			CO3
	Unit 4	**Vector spaces**			
	A	Vector Space, linear dependence of vectors, basis, dimension.			CO4, CO5
	B	Linear transformations (maps), range and kernel of a linear map, rank and nullity.			CO4, CO5
	C	Inverse of a linear transformation, Matrix associated with a linear map.			CO4, CO5
	Unit 5	**Vector spaces (Prerequisite Module 2 –Matrices & Module-4 Vector spaces)**			
	A	Eigenvalues, Eigenvectors			CO6
	B	Symmetric, skew-symmetric, and orthogonal Matrices, Diagonalization			CO6
	C	Basic introduction of Inner product spaces, Gram-Schmidt orthogonalization.			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002- ISBN:9788177583250. 2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2011- ISBN: 9780470458365			
	Other References	1. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2011-ISBN: 9780538735452 2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008- ISBN:9780070494824 3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010- ISBN:9780230345980			

CO , PO & PSO MAPPING:

	PO 1	PO 2	PO 3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
MTH142. 1	**3**	**3**	**2**	**2**	**3**	**1**	**-**	**-**	**-**	**1**	**1**	**1**	-	-	-
MTH142. 2	**3**	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**1**	**2**	-	-	-
MTH142. 3	**3**	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**1**	**1**	**1**	-	-	-
MTH142. 4	**3**	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**1**	**1**	**1**	-	-	-
MTH142. 5	**3**	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**1**	**1**	**2**	-	-	-
MTH142. 6	**3**	**3**	**2**	**3**	**2**	**2**	**-**	**-**	**-**	**1**	**1**	**2**	-	-	-
MTH142	3	3	2.2	2.1 7	2.2	1.3				1.0		1.5			

School: School of Basic Sciences and Research			
Program: B.TECH.			
Branch: CSE/EC/EEE		**Semester: II**	
1	Course Code	PHY 118	
2	Course Title	Electricity and Magnetism	
3	Credits	3	
4	Contact Hours (L-T-P)	2-1-0	
	Course Status	Compulsory	
5	Course Objective	To make students familiar with the concepts of electrostatics, magnetostatics and electromagnetism and to utilize the laws of electromagnetism on various problems.	
6	Course Outcomes	At the end of the course, the student will be able to: CO1: learn the basic concepts of electrostatics. CO2: learn the fundamental concepts of electric potentials. CO3: gain knowledge about the principle of capacitor, dielectrics materials and electric polarization. CO4: have a clear understanding of fundamentals of magnetic effects of current and magnetism CO5: learn the concept of Maxwell's Equations in differential and integral form and their physical significance. CO6: learn the fundamental concept of electricity and magnetism.	
7	Course Description	Today, life without electromagnetic technologies is almost unthinkable. For this reason, it is critically significant to understand the basic fundamental of this paper. This course is able to explain the required basic knowledge. Both electricity and magnetism may be understood as forces that seek balance and students learn to understand such concepts as charge, field, voltage, potential, current, resistance, and power within this framework.	
7	Outline Syllabus		CO Mapping
	Unit 1	**Electrostatics**	
	A	Introduction to the course and prerequisites required Coulomb's law–force between two point charges, forces between multiple charges; superposition principle and continuous charge distribution.	CO1
	B	Electric field, electric field due to a point charge, electric	CO1

		flux.			
	C	Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell (field inside and outside), charged solid sphere.			CO1
	Unit 2	**Potential**			
	A	Electric potential, potential difference, electric potential due to a point charge,			CO2
	B	a dipole and system of charges; equipotential surfaces,			CO2
	C	Electrical potential energy of a system of two point charges and of electric dipoles in an electrostatic field.			CO2
	Unit 3	**Capacitance**			
	A	Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarization.			CO3
	B	Capacitors and capacitance, capacitance of a parallel plate, Cylindrical and spherical capacitors.			CO3
	C	Capacitance with and without dielectric medium between the plates of capacitor, energy stored in a capacitor.			CO3
	Unit 4	**Magnetic Effects of Current and Magnetism**			
	A	Biot-Savart law and its application to current carrying circular loop,			CO4, CO6
	B	Ampere's law and its applications to infinitely long straight wire.			CO4, CO6
	C	Ampere's law and its applications to toroidal solenoids.			CO4
	Unit 5	**Electromagnetism**			
	A	Electromagnetic induction; Faraday's law, induced emf and induced current,			CO5
	B	Lenz's Law, displacement current.			CO5
	C	Maxwell's Equations in differential and integral form and their physical significance.			CO5, CO6
	Mode of Examination	Theory			
	Weightage	CA	MTE	ETE	

	Distribution	30%	20%	50%	
	Text books	1. Electricity and Magnetism, K.K. Tiwari, S. Chand &Co. New Delhi. ISBN:9788121906678			
	Other References	1. Fundamentals of Physics, Halliday, Resnick and Walker, John Wiley,2014. - ISBN: 9781118230749 2. Electricity and Magnetism, J. Yarwood and J. H. Fewkes. University Tutorial Press.			

CO , PO & PSO MAPPING:

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
PHY118.1	3	2	2	2	2	1	1	1	1	1	2	1	-	-	-
PHY118.2	3	3	2	3	3	2	1	1	1	1	1	1	-	-	--
PHY118.3	3	3	3	3	3	1	1	1	1	1	1	1	-	-	-
PHY118.4	3	3	3	2	2	1	1	1	1	1	1	1	-	-	--
PHY118.5	2	2	2	2	2	1	1	1	1	1	1	1	-	-	-
PHY118.6	3	3	3	3	2	1	1	1	1	1	1	1	-	-	--
PHY118	2.8	2.7	2.5	2.50	2.3	1.2	1.0	1.0	1.0	1.0		1.0	-	-	-

ENGINEERING CHEMISTRY (CHY 111) (TERM I/II)

School: SET		
Program: B.Tech.		
Branch: CS/EC/IT/EEE		**Semester:2**
1	Course Code	CHY 111
2	Course Title	**Chemistry for engineers**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	1. Make it comprehended the importance of clean water. 2. Describe to the basic concepts of spectroscopy as described in the module content and is to teach getting of valuable information from the same to apply in various engineering applications. 3. To provide an introduction to the basic concepts in Electrochemistry and apply them to understand batteries and corrosion. 4. To equip the students with the knowledge of modern technologies i.e. nanotechnology and its various engineering applications.
6	Course Outcomes	Students will be able to understand : 1. Realize the importance of clean and healthy water by giving knowledge about water quality parameters and cleaning measures. 2. In sighting the structural features of material by having the knowledge of spectroscopic techniques. 3. State the main cause of corrosion and prevention measures. Name the components of galvanic cell and applies these to the understand the batteries and corrosion of a metal.

		4. Able to apply the basic information of engineering materials and their applications. 5. Able to have a basic knowledge of technology in modern days i.e. Nanotechnology and its various applications. 6. Have a thorough grounding in chemistry and a working knowledge of advanced chemistry.	
7	Course Description	• The course includes the fundamentals of Thermodynamics, Electrochemistry and batteries, corrosion, introduction to Chemistry of Materials, water technology and nanotechnology. This course satisfies the requirements of the Engineering program.	
8	Outline syllabus		CO Mapping
	Unit 1	**Water: Analysis and its treatment**	
	A	Water and water treatment: Drinking water standards, Water quality parameters and their measurement: pH (alkalinity and acidity –determination by titrimetry), Turbidity, Dissolved Oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), chloride, fluoride, oil and fats,	CO1
	B	hardness (definition and expression, estimation of hardness (EDTA method), nutrients (N, P, etc.), nitrate, dissolved metals.	CO1
	C	Municipal water treatment process - screening, sedimentation, flocculation;Coagulation, Filtration (Slow sand and rapid sand), disinfaction-chlorination.	CO1
	Unit 2	**Spectroscopic studies of materials**	
	A	Principles of spectroscopy and selection rules. Electronic spectroscopy: basic principle, 'Lamberts Beer's law,	CO2
	B	chromophore, effect of conjugation on chromophore and applications, Fluorescence and its applications in medicine.	CO2
	C	Basic principle and applications of Nuclear magnetic	CO2

		resonance and magnetic resonance imaging spectroscopy.	
	Unit 3	**Electrochemistry, energy storage devices and corrosion**	
	A	Electrochemistry: Redox reactions, Nernst Equation, relation of e.m.f. with thermodynamic functions (ΔH, ΔF and Δ S). Electrochemical cells-	CO3
	B	Galvanic cells and Concentration cell, electrode potentials and its relevance to oxidation and reduction, measurement of EMF under standard conditions, determination of pH using Hydrogen electrode,	CO3
	C	primary battery: dry cells, secondary battery: Lead acid accumulator and Li Ion, fuel cells: H 2- O 2 .Corrosion: Types of corrosion, mechanism of Electrochemical corrosion, galvanic corrosion and protection against electrochemicalcorrosion.	CO3, CO6
	Unit 4	**Chemistry of materials**	
	A	:Structure, properties and application of carbon materials such as diamond, graphite, fullerenes, graphene. Liquid crystals: classification, Molecular ordering, identification, polymeric liquid crystals, and application of liquid crystals: displays and thermography.	CO4
	B	Organic and inorganic semiconductors.Basic concepts of Conducting polymer, types,p-doping, n-doping, comparison with metallic conductors, examples and applications.	CO4
	C	Biodegradable polymers: Basic information with common examplesPolyglycolic acid (PGA), Polyhydroxy butyrate (PHB), Polyhydroxybutyrates-co-beta hydroxyl valerate(PHBV), Polycaprolactone(pcl).	CO4, CO6
	Unit 5	**Nano science and technology**	
	A	Introduction to nanoscience and technology, bio-nanoinformation,	CO5, CO6

	B	lithography, soft lithography, Dip pen nanolithography, CNT's			CO5, CO6
	C	Application of nanotechnology in microelectronics and in memory devices.			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	i. Puri, B.R., Sharma, L.R., and Pathania, M.S., "Principles of Physical Chemistry", Vishal publishing company- ISBN: 9780039000493 ii. BahlArun, Bahl B.S. and G.D Tuli, "Essentials of Physical Chemistry", S.Chand& Co.,2000 iii. University chemistry, by B. H. Mahan iv. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan v. Physical Chemistry, by P. W. Atkins vi. Introduction to nanotechnology: C.P poole,Jr. F.J. Owens, willeyinterscience 2003. vii. Nanotechnology, science, innovation and opportunity, LE foster, Pearson education 2007.			
	Other References	i. Collings, P.J., "Liquid Crystals", Princeton University Press.-ISBN:9781439811450 ii. O.P. Vermani, A.K. Narula, "Industrial chemistry", Galgotia Publications			

CO-PO MAPPING EC/EEE

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CHY 111.**1**	3	1	1	2	1	1	1	1	1	1	1	1	1	1	-
CHY 111.**2**	3	1	1	1	1	1	1	1	1	1	1	1	1	1	-
CHY 111.**3**	3	1	1	1	1	1	1	1	1	1	1	1	1	1	-
CHY 111.**4**	3	1	1	1	1	1	1	1	1	1	1	1	1	1	-
CHY 111.**5**	3	1	2	1	2	1	1	1	1	1	1	1	1	1	-
CHY 111.**6**	3	1	2	1	2	1	1	1	1	1	1	1	1	1	-
CHY 111	3.0	1.0	1.3	1.17	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-

FEN104: Functional English Intermediate-2

First Year (Odd Semester)

SYLLABUS

1	Course number	**FEN104**
2	Course Title	**Functional English Intermediate-2**
3	Credits	1
4	Contact Hours (L-T-P)	1-0-0 (However Contact hours : 2 hrs in a week)
5	Course Pre-requisite	A skill-based course designed for undergraduate students with basic understanding of English language
6	Course Objective	To guide the students to hone the basic communication skills: listening, speaking, reading and writing. To equip students to minimize the linguistic and socio-cultural barriers emerging in a different environment. To help students to understand different accents and standardise their existing English.
7	Course Outcomes	**Students would be able to:** **CO1: Utilize receptive language skills in order to comprehend complex factual/literary text** **CO2: Understand long complex speeches and lectures** **CO3: Compose clear and well-structured text to inform/express view point** **CO4: Express opinions about complex subjects by developing arguments through productive language skills** **CO5: Critically evaluate arguments in terms of the strength of evidence and reasoning; draw conclusions through discussion** **CO6: Recognize and apply vocabulary and grammatical knowledge to express thought and action;**
8	Outline syllabus: **Functional English Intermediate-2**	

			TOPICS	Ref. & Chapter	COs
8.01	FEN104.A	**UNIT A**	**LISTENING & DISCUSSION**		
8.02	FEN104.A1	Topic 1	Class discussion on Steven Spielberg's Commencement Speech at Harvard	Ref 3, Ref 2	CO1, CO2, CO5, CO7
8.03	FEN104.A2	Topic 2	Informative listening (Comprehension): Lecture by Johan Rockstrom: Let the Environment Guide our Development	Ref 4, Ref 2	
8.04	FEN104.A3	Topic 3	Expressing views on lessons learnt from the "Inspirational Speech for Students by Dr. APJ Abdul Kalam"	Ref 5, Ref 2	
8.05	FEN104.B	**UNIT B**	**READING TEXT & DISCUSSION**		
8.06	FEN104.B1	Topic 1	Short Stories: *"The Tiger in The Tunnel"* by Ruskin Bond (Comprehension & Critical Analysis)	Ref 6, Ref 2	CO1, CO5, CO7
8.07	FEN104.B2	Topic 2	Poetry: *"Where the Mind is Without Fear"* by Rabindranath Tagore (Critical Appreciation and Discussion)		
8.08	FEN104.B3	Topic 3	*"The Coffee House of Surat"* by Leo Tolstoy (Comprehension & Critical Analysis)		
8.0	FEN104.C	**UNIT C**	**CREATIVE WRITING & DISCUSSION**		

9					
8.10	FEN104.C1	Topic 1	Short Story Writing	Ref 2	CO3, CO4, CO5, CO7
8.11	FEN104.C2	Topic 2	Picture Interpretation		
8.12	FEN104.C3	Topic 3	Review Writing		
8.13	FEN104.D	**UNIT D**	**TECHNICAL WRITING**		
8.14	FEN104.D1	Topic 1	Emails & formal Letters	Ref 1 (pages 478 to 593)	CO3, CO4, CO8
8.15	FEN104.D2	Topic 2	Technical Reports (Informative & Routine based)		
8.16	FEN104.D3	Topic 3	Technical Proposal		
8.17	FEN104.E	**UNIT E**	**VOCABULARY BUILDING AND GRAMMAR (THROUGH READING AND LISTENING THE TEXTS)**		
8.18	FEN104.E1	Topic 1	Phrasal Verbs; Idioms and Phrases; Proverbs; Functional Vocabulary; Notional Concepts; Connectors and Linkers	Ref 2	CO3, CO6
8.19	FEN104.E2	Topic 2	Text based activities on: Non-finite verbs; Reported Speech (Dialogue Writing); Passives (Imperative sentences); Process description; Spotting error; Relative clauses.		
8.20	FEN104.E3	Topic 3	Spellings and Punctuations		

9	**Course Evaluation**	
9.1	Course work: 30%	
9.2	Attendance	None
9.3	Homework	10 assignments, no weight
9.4	Quizzes	6 best quizzes (based on assignments); 20 marks
9.5	Lab	
9.6	Presentations	None
9.7	Any other	None
9.9	MTE	One, 20%
9.10	End-term Examination: One, 50%	
10	Reference Books, Videos and Internet:	
	Text book	1. Communication Skills by Sanjay Kumar and PushpLata, OUP Publications. 2. Functional English Workbook (Intermediate) 2
	Videos and Internet	3. Steven Spielberg's Commencement Speech at Harvard (https://www.youtube.com/watch?v=TYtoDunfu00) 4. Let the Environment Guide our Development (http://www.ted.com/talks/johan_rockstrom_let_the_environment_guide_our_development) 5. Inspirational Speech for Students by Dr. APJ Abdul Kalam (https://www.youtube.com/watch?v=7E-cwdnsiow)

		6. Reading texts

Mapping of Outcomes vs. Topics
FILENAME: Functional English Intermediate-2 (FEN104)

Outcome no. → Syllabus topic↓	CO1	CO2	CO3	CO4	CO5	CO6	CO7	CO8
FEN104.A	X	X			X		X	
FEN104.A1	X	X			X		X	
FEN104.A2	X	X			X		X	
FEN104.A3	X	X			X		X	
FEN104.B	X				X		X	
FEN104.B1	X				X		X	
FEN104.B2	X				X		X	
FEN104.B3	X				X		X	
FEN104.C			X	X	X		X	
FEN104.C1			X	X	X		X	
FEN104.C2			X	X	X		X	
FEN104.C3			X	X	X		X	
FEN104.D			X	X				X
FEN104.D1			X	X				X
FEN104.D2			X	X				X
FEN104.D3			X	X				X
FEN104.E			X			X		
FEN104.E1			X			X		

Engineering Chemistry Lab (CHY-161)

<table>
<tr><td colspan="2">School: SET</td><td colspan="3"></td></tr>
<tr><td colspan="2">Program: B.Tech</td><td colspan="3"></td></tr>
<tr><td colspan="2">Branch: All</td><td colspan="3">Semester: II</td></tr>
<tr><td>1</td><td>Course Code</td><td>CHY-161</td><td colspan="2">Course Name: Engineering Chemistry Lab</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="3">Engineering Chemistry Lab</td></tr>
<tr><td>3</td><td>Credits</td><td colspan="3">1</td></tr>
<tr><td>4</td><td>Contact Hours (L-T-P)</td><td colspan="3">0-0-2</td></tr>
<tr><td></td><td>Course Status</td><td colspan="3">Basic Engineering</td></tr>
<tr><td>5</td><td>Course Objective</td><td colspan="3">1. To learn methods for preparation of solution of different concentration, their standardization
2. To learn quantitative estimation of different chemical species by various volumetric methods.
3. To understand the practical concepts of reaction kinetics
4. To understand the procedure for testing of COD of water samples.</td></tr>
<tr><td>6</td><td>Course Outcomes</td><td colspan="3">CO1.Prepare solutions of different strength and standardize them.
CO2.Estimate water alkalinity and hardness and hence water quality, the chloride ion/residual chlorine after disinfection
CO3.Understand the different order of reactions like Zero, First and Second order.
CO4.Prepare simple thermosetting polymers at small scale in laboratory.
CO5.Understand the importance of microbial free water by testing for COD.
CO6.Understand the basics of analytical chemistry which may be helpful to perform major engineering applications.</td></tr>
<tr><td>7</td><td>Course Description</td><td colspan="3">This course include various titration methods like acid-base titration, complexometric titration, precipitation titration etc. It also describe various calculations and units frequently used in analytical chemistry.</td></tr>
<tr><td>8</td><td colspan="3">Outline syllabus</td><td>CO Mapping</td></tr>
<tr><td rowspan="4"></td><td>Unit 1</td><td colspan="2">Preparation of standard solution</td><td></td></tr>
<tr><td>A</td><td colspan="2">To prepare N/10 normality solution of sodium carbonate and use it to standardize the given hydrochloric acid solution.</td><td rowspan="3">CO1</td></tr>
<tr><td>B</td><td colspan="2">To prepare N/30 normality solution of potassium dichromate and use it to standardize the given hypo solution.</td></tr>
<tr><td>C</td><td colspan="2">To determine the strength of given HCl solution by titrating with standard NaOH solution by (a)Indicator method (b) pH metrically</td></tr>
</table>

	Unit 2	**Analysis of water**	
	A	To determine the amount and constituents of alkalinity of given water sample.	CO2
	B	To determine the hardness of water by EDTA method.	
	C	To determine the chloride content in water by Mohr's Method.	
	D	To determine the residual chlorine in the given water sample.	
	Unit 3	**Synthesis of polymer**	
	A	Preparation of Bakelite and Urea formaldehyde resin.	CO3
	Unit-4	**Determination of kinetic parameters**	
		To determine the rate constant and order of the reaction of hydrolysis of an ester catalyzed by an acid.	CO4
		To determine the rate constant of hydrolysis of ethyl acetate with NaOH and show that the reaction is of second order.	
	Unit-5	**Determination of COD**	
		To determine the chemical oxygen demand (COD) in the given water sample.	CO5,CO6
	Mode of examination	Practical	
	Weightage Distribution	CA / MTE / ETE	
		60% / None / 40%	
	Text book/s*	Text book, Lab Manuals	
	Other References	Other References	

CO and PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CHY161.1	2	3	1	-	2	1	2	-	3	3	2	2	-	-
CHY161.2	2	3	1	-	2	1	2	-	3	3	2	2	-	-
CHY161.3	2	3	1	-	2	1	2	-	3	3	2	2	-	-
CHY161.4	2	3	1	-	2	1	2	-	3	3	2	2	-	-
CHY161.5	2	2	2	-	2	1	1	-	3	3	1	2	-	-
CHY161.6	2	2	2	-	2	1	1	-	3	3	1	2	-	-
CHY161	2.0	2.7	1.3		2.0	1.0	1.7		3.0	3.0	1.7	2	-	-

School: SET
Program: B.Tech
Branch: ECE
Semester: II

1	Course Code	ECP 120
2	Course Title	**Mechanical Workshop**
3	Credits	1.5
4	Contact Hours (L-T-P)	0-0-3
	Course Status	Compulsory
5	Course Objective	The objective of this course is to make the students, familiar with the modern day manufacturing processes, introduce them to various hand tools and equipment, acclimatize with the measuring devices, and perform basic machine tool operations in various machine tools.
6	Course Outcomes	On successful completion of this course, students will be able to CO1: Apply 5S (Seiri,Seiton, Seiso,Seiketsu and Shitsuke) methodology at workplace. CO2: Select the various hand tools used in the basic mechanical engineering workshop sections-smithy, carpentry, assembling, welding etc. CO3: Choose different measuring devices according to the job CO4: Differentiate between various machine tools and their operation CO5: Classify and select suitable tools for machining processes including turning, facing, thread cutting and tapping, milling, drilling and shaping. CO6: Apply the knowledge for advanced manufacturing experiments.
7	Course Description	**Black Smithy Shop:** Simple exercises based on black smithy operations such as upsetting, practice of S -Hook from circular bar using hand forging operations. **Carpentry Shop :** Study of different types of wood , Carpentry Tools, Equipment and different joints, Practice of T joint, cross lap joint, Mortise and Tenon T joint, Bridle T joint **Fitting Shop:** Preparation of Square joint, V joint, half round joint, dovetail jointas per the given specifications, which contains: Sawing, Filing, Grinding, and Practice marking operations. **Sheet Metal Shop:** Study of galvanized Iron (G.I.) Sheet material properties, hand tools and sheet metal machines, and projective geometry, demonstration of different sheet metal operations and practice of development of Tray, cylinder, hopper, funnel etc. **Welding Shop:** Introduction, Study of Tools and welding Equipment (Gas and Arc welding), Selection of welding electrode and current, Bead practice and Practice of Butt Joint, Lap Joint.

		Machine Shop: Study of machine tools in particular Lathe machine (different parts, different operations, study of cutting tools), Demonstration of different operations on Lathe machine, Practice of Facing, Plane Turning, step turning, taper turning, knurling and parting and Study of Quick return mechanism of Shaper. **Foundry Shop:** Introduction to foundry, Patterns, pattern allowances, ingredients of moulding sand and melting furnaces. Foundry tools and their purposes, Demo of mould preparation and Practice – Preparation of mould by using split pattern.			
8	Outline syllabus				CO Mapping
	List of Experiments				
Unit 1	**Experiment 1**	To make a S-shaped hook from a given circular rod using hand forging technique.			CO1
	Experiment 2	To make a dovetail lap joint in Carpentry shop.			CO1
Unit 2	**Experiment 3**	To make a cross-half lap joint in Carpentry shop.			CO2
	Experiment 4	To make a square fit from the given mild steel pieces in fitting shop.			CO2
Unit 3	**Experiment 5**	To prepare a V-Fit from the given mild steel pieces in fitting shop.			CO3,
	Experiment 6	To make a rectangular tray of specified dimensions in sheet metal shop.			CO3
Unit 4	**Experiment 7**	To make a Lap joint, using the given mild steel pieces using arc welding.			CO4 , CO6
	Experiment 8	To perform step turning and taper turning operations on the given work piece			CO4, CO6
Unit5	**Experiment 9**	To prepare a sand mold, using the given single piece pattern			CO5, CO6
	Experiment 10	To prepare a sand mold, using the given Split-piece pattern.			CO5, CO6
	Mode of examination	Practical			
	Weight- age Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	1. Raghuwanshi B.S., Workshop Technology Vol. I & II, DhanpathRai& Sons. -ISBN:9788120340824 2. Kannaiah P. and Narayana K.L., Workshop Manual, 2nd Edn, Scitech publishers. -ISBN:9788122419177,			

CO , PO & PSO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MEP105.1	-	-	-	-	-	2	-	2	-	-	-	2	-	-	-
MEP105.2	1	-	-	-	1	2	-	-	-	-	-	1	1	1	-
MEP105.3	2	-	-	-	1	2	-	-	-	-	-	2	1	1	-
MEP105.4	2	-	1	-	2	2	-	-	-	-	-	2	1	1	-
MEP105.5	2	-	1	-	2	2	-	-	-	-	-	2	2	1	-
MEP105.6	2	-	1	-	2	2	-	-	-	-	-	2	2	-	1
MEP105	**2**	**-**	**1**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**1**

Tinkering Labs

School: SET **Program: B.TECH** **Branch: EEE** **Semester:2**					
1	Course Code	ECP107			
2	Course Title	Tinkering Labs			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	Compulsory			
5	Course Objective	• To be acquainted with hardware's in Consumer Electronics goods			
6	Course Outcomes	After successful completion of this course the student will be able to: CO1: Identify and explain the parts of Cell phone charger CO2: Identify and describe the parts of Mobile phones CO3: Understand the need of USB CO4: Explain and Identify the parts of Speakers CO5: Identify and describe the parts of Computers CO6: Apply the hardware knowledge for different projects.			
7	Course Description	Justify and enhance their Knowledge on consumer products			
8	Outline syllabus				CO Mapping
	Unit 1	**Inside Cell phone Charger**			
	A	Unscrew			CO1
	B	Identifying parts			CO1
	C	Working			CO1, CO6
	Unit 2	**Mobile phones**			
	A	Unscrew			CO2
	B	Identifying parts			CO2
	C	Working			CO2, CO6
	Unit 3	**USB**			
	A	Basics			CO3
	B	Inside USB cable/Port			CO3
	C	Working			CO3, CO6
	Unit 4	**Speakers**			
	A	Unscrew			CO4
	B	Identifying parts			CO4
	C	Working			CO4, CO6
	Unit 5	**Computers**			
	A	Unscrew			CO5
	B	Identifying parts ,Working			CO5
	C	Screw up			CO5, CO6
	Mode of examination	Practical & Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text	Lab Manuals			

	book/s*		
	Other References	https://www.youtube.com/watch?v=WNRzU5DLA0I https://www.youtube.com/watch?v=jghFENiUsBI	

CO , PO & PSO MAPPING:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ECP107.1	3	1	1	-	1	2	1	-	2	1	-	1	1	1	2
ECP107.2	3	1	1	-	1	2	1	-	2	1	-	1	1	1	2
ECP107.3	3	1	1	-	1	2	1	-	2	1	-	1	1	1	2
ECP107.4	3	1	1	-	1	2	1	-	2	1	-	1	1	1	2
ECP107.5	3	1	1	-	1	2	1	-	2	1	-	1	1	1	2
ECP107.6	3	1	1	-	1	2	1	-	2	1	-	1	1	1	2
ECP107	3.0	1.0	1.0		1.0	2.0	1.0		2.0	1.0		1.0	1.0	1.0	**2**

School: School of Engineering and Technology		
Program: B.Tech.		
Branch: Physics		**Semester: I,II**
1	Course Code	PHY 161
2	Course Title	Physics Lab 1
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
6	Course Outcomes	On successful completion of the course the students will have: CO1: Knowledge and study of basic physics experiments based on simple harmonic motion CO2: Use the concept of stress, strain to calculate modulus of rigidity, Young's modulus. CO3: Understand how to determine moment of inertia of different bodies. CO4: Understand how to draw characteristic curves of different electronic components CO5: Understand how to calculate frequency using Melde's Experiment CO6: Apply the mathematical concepts/equations to obtain quantitative results and ability to conduct, analyze and interpret experiments

7	Outline Syllabus		CO Mapping
	Unit 1		
	A B C	1. To verify the relation of time period using simple pendulum. 2. To determine the acceleration due to gravity and radius of Gyration of compound pendulum and compare with theoretical value.	CO1
	Unit 2		
	A B C	3. To measure the moment of inertia of a flywheel. 4. To determine the Young's modulus of a beam using cantilever beam experiment apparatus. 5. To determine vertical distance between two points using sextant.	CO2
	Unit3		
	A B C	6. To determine the modulus of rigidity of a material of a given wire with an inertia table (torsion pendulum) by dynamical method. 7. To calculate Moment of inertia of different irregular shapes.	CO3 CO4
	Unit 4		
	A B C	8. To determine the frequency of an electrically maintained tuning fork using Melde's Apparatus. (i) Transverse mode of vibration (ii) Longitudinal mode of vibration. 9. To determine the coefficient of viscosity of water by Poiseuille's method.	CO4,CO6
	Unit 5		
	A B C	10. To draw the characteristic curve of a PN junction diode. 11. To trace the circuit of a Half Wave Rectifier circuit and determine efficiencies and ripple factors with capacitor and inductor filters.	CO5,CO6

		12. To trace the circuit of a Full Wave Rectifier circuit and determine efficiencies and ripple factors with capacitor and inductor filters.		CO5,CO6
	Mode of Examination	Practical/Viva		
	Weightage Distribution	CA	MTE	ETE
		60%	0%	40%
	Text books	1. B.Sc. Practical Physics- Harnam Singh, S. Chand Publishing. 2. B.Sc. Practical Physics- C L Arora, S. Chand Publishing.		
	Other References	1. GeetaSanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co. 2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New		

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PHY161.1	2	2	2	1	1	1	2	3	3	3	2	3	-	-	-
PHY161.2	2	2	2	1	1	1	2	3	3	3	2	3	-	-	-
PHY161.3	2	2	2	1	1	1	2	3	3	3	2	3	-	-	-
PHY161.4	2	2	2	1	1	1	2	3	3	3	2	3	-	-	-
PHY161.5	2	2	2	1	1	1	2	3	3	3	2	3	-	-	-
PHY161.6	2	2	2	1	1	1	2	3	3	3	2	3	-	-	-
PHY161	2.0	2.0	2.0	1.0	1.0	1.0	2.0	3.0	3.0	3.0	2.0	3.0	-	-	-

III TERM

School: SET		
Program: B. Tech.		
Branch: EEE/EE/ECE		**Semester: 03**
1	Course Code	EEE220
2	Course Title	Network Analysis and Synthesis
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	To develop problem solving skills and understanding of circuit theory through the application of techniques and principles of electrical circuit analysis to common circuit problems.
6	Course Outcomes	After successful completion of the course, student will be able to CO1 Obtain circuit matrices of linear graphs and analyze networks using graph theory CO2 Select appropriate and relevant technique for solving the Electrical network in different conditions CO3 Learn conditions for stability and realizability of network functions CO4 Solve two port network functions CO5 Synthesize driving point functions of RL, RC and RLC networks CO6 Apply mathematics in analyzing and synthesizing the networks in time and frequency domain.
7	Course Description	This course deals with the fundamentals of electric circuits, their components and the mathematical tools used to represent and analyze electrical circuits. It also deals with analysis of stability of network using transfer function and also to design circuit from transfer function.

8	Outline syllabus		CO Mapping
	Unit 1	**GRAPH THEORY**	
	A	Graph of a network, definitions, tree, co tree , link, basic loop and basic cut set	CO1, CO2
	B	Incidence matrix, cut set matrix, tie set matrix	CO1, CO2
	C	Duality, loop and node methods of analysis	CO1, CO2
	Unit 2	**NETWORK THEOREMS (FOR AC NETWORKS)**	
	A	Super-position theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem	CO1, CO2
	B	Reciprocity theorem, Millman's theorem	CO1, CO2
	C	Compensation theorem, Tellegen's theorem	CO1, CO2
	Unit 3	**NETWORK FUNCTIONS**	

	A	Concept of Complex frequency , Transform Impedances Network functions of one port and two port networks,			CO3, CO6
	B	Concept of poles and zeros, properties of driving point and transfer functions			CO3
	C	Time response and stability from pole zero plot			CO3
	Unit 4	**TWO PORT NETWORKS**			
	A	Characterization of LTI two port networks Z, Y, ABCD and h parameters			CO2, CO6
	B	Reciprocity and symmetry, Inter-relationships between the parameters			CO2
	C	Inter-connections of two port networks, Ladder and Lattice networks, T & Π Representation			CO2
	Unit 5	**NETWORK SYNTHESIS**			
	A	Positive real function: definition and properties, properties of LC, RC and RL driving point functions			CO4,CO5
	B	Synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms			CO4, CO5
	C	**FILTERS:** Passive and Active filter fundamentals, low pass, high pass, band pass, band elimination filters.			CO4, CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Franklin F. Kuo,"Network Analysis and Synthesis", John Wiley & Sons ISBN:9788126510016, 8126510013			
	Other References	1. M.E. Van Valkenburg," Network Analysis", Prentice Hall of India ISBN:9788131701584, 8131701581 2. Donald E. Scott: "An Introduction to Circuit analysis: A System Approach" McGraw Hill Book Company. ISBN:9780070561274, 0070561273. 3. W.H. Hayt & Jack E-Kemmerly, Engineering Circuit analysis" Tata McGraw Hill. ISBN:9789814646345, 9814646342			

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COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1			2						2		
CO2	3	3	1	2							2		3	3	
CO3	3	3	3	3	2		3				2		3	3	
CO4	3	2	2	2	1								2	1	
CO5	3	2	1	1	2		3				2		2	2	
CO6	3	2	2	2									2	1	
	3.00	2.33	1.67	1.83	1.67		2.67				2.00		2.33	2.00	

School: SET		
Program: B.Tech		
Branch: EEE/EE		**Semester: 3**
1	Course Code	EEE221
2	Course Title	Electrical Machines-I
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	To provide students with: 1. knowledge of basic principles of electromechanical energy conversion 2. the understanding of operation principles of electrical machines 3. ability to analyse different electrical machines
6	Course Outcomes	1: After completion of this course students will be able to: CO 1. Understand the concepts of magnetic circuits. CO 2. describe the basic energy conversion principles and different magnetic field systems CO 3. Understand the operation of dc machines CO 4. Analyse the differences in operation of different dc machine configurations. CO 5. Analyse single phase and three phase transformers circuits. CO6 Combine an understanding of the established principles, theories, concepts and terminology relevant to electrical machines with practical application.
7	Course Description	The course covers the basics of electromechanical energy conversion and electrical machines. The operating principles of DC machines and transformers are thoroughly described as well as their testing and speed control methods.

8	Outline syllabus		CO Mapping
	Unit 1	**Magnetic fields, Electromagnetic force and torque**	
	A	Review of magnetic circuits - MMF, flux, reluctance, inductance; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air	CO1,CO6
	B	Influence of highly permeable materials on the magnetic flux lines. B-H curve of magnetic materials, energy stored in the magnetic circuit	CO1
	C	force as a partial derivative of stored energy with respect to position of a moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating	CO2

		element.	
	Unit 2	**DC machines**	
	A	Basic construction of a DC machine, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole ; Armature winding and commutation - Elementary armature coil and commutator, lap and wave windings, construction of commutator	CO3, CO6
	B	DC generator: principle of operation, induced EMF in an armature coil, commutation, methods of improving commutation, parallel operation of DC generator	CO3
	C	DC Motor: principle of operation, Derivation of back EMF equation, derivation of torque equation	CO3, CO4
	Unit 3	**DC machine – Speed Control and Testing**	
	A	Armature reaction, Cross magnetizing and de-magnetizing AT/pole, Types of field excitations - separately excited, shunt and series. Characteristics of separately excited and self-excited generators, build-up of EMF, critical field resistance and critical speed	CO3, CO4
	B	Characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control of DC Motors: armature voltage and field flux control methods. Ward-Leonard system	CO3, CO4
	C	Losses of DC machines: constant and variable losses, calculation of efficiency, condition for maximum efficiency. DC machine Testing: direct, indirect and regenerative testing: brake test, Swinburne's test, Hopkinson's test, field's test,	CO4
	Unit 4	**Transformers**	
	A	Principle, construction and operation of single-phase transformers, EMF equation, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency, condition for maximum efficiency, All day efficiency, regulation and condition for maximum voltage regulation	CO5, CO6
	B	Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers,	CO5
	C	Autotransformers - construction, principle, applications and comparison with two winding transformer	CO5
	Unit 5	**Transformers Testing**	
	A	Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses	CO5, CO6
	B	Poly phase connections, third harmonics and their effect	CO5
	C	three winding transformers, tertiary winding, Scott connection	CO5
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage	CA MTE ETE	

	Distribution	30%	20%	50%	
	Text book/s*	Electric Machines by I.J. Nagrath & D.P. Kothari, Tata Mc Graw – Hill Publishers. , ISBN 1259081532 2010			
	Other References	1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2014. ISBN:9780071326469, 0071326464 2. 2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004. ISBN:9780852268131, 0852268130			

COURSE ARTICULATION MATRIC

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2				1				2	2	2
CO2	3	2	3	2	3				1				2	2	3
CO3	3	3	3	2	3				1				3	3	3
CO4	3	3	3	3	3				1				3	3	3
CO5	3	3	3	2	3				1				2	3	3
CO6	3	3	2	3	3				1				3	2	3
	3.00	2.67	2.67	2.33	2.83				1.00				2.50	2.50	2.83

SHARDA UNIVERSITY
Beyond Boundaries

School: SET		
Program: B.Tech		
Branch: EEE/EE		**Semester: 3**
1	Course Code	EEP221
2	Course Title	Electrical Machines-I Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	The capability to analyze the operation of electric machines under different loading conditions The ability to conduct testing and experimental procedures on different types of electrical machines.
6	Course Outcomes	CO1: Experimentally obtain the load characteristics of various dc motors and generators. CO2: Determination of various performance curves of DC Motor CO3: Experimentally perform speed control of DC motor CO4: Understand the concept of efficiency and the short circuit impedance of a single-phase transformer from no-load test, winding resistance, short circuit test, and load test CO5: Understand the concept of parallel operation of transformer. CO6 Combine an understanding of the established principles, theories, concepts and terminology relevant to electrical machines with practical application.
7	Course Description	The course covers practical experiment on transformers and DC machines. It includes load test on various dc machines and transformer and also speed control of DC motor.

8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on Load Test of DC Generator**	
		Load test on DC shunt generator and determination of characteristics.	CO1,CO6
		Load test on DC series generator and determination of characteristics.	CO1
		Load test on DC compound generator and determination of characteristics.	CO1
	Unit 2	**Practical related to Characteristic of DC Generator**	
		Magnetization characteristics of DC shunt generator and determination of critical field resistance and critical speed.	CO1

	Unit 3	**Practical related to DC Motor**			
		Swinburne's test of DC Machine			CO2, CO6
		Brake test on DC compound motor and determination of performance curves.			CO2
		Hopkinson test on two identical DC machine.			CO2
		Brake test on DC shunt motor and determination of performance curves.			CO2
		speed control of DC shunt motor and predetermination of efficiency.			CO3
	Unit 4	**Practical related to Testing of Transformer**			
		OC and SC tests on single phase transformer			CO4, CO6
		Sumpner's test on a pair of single phase transformers.			CO4
		To perform load test on 1-phase transformer.			CO4
	Unit 5	**Practical related to Transformer**			
		Parallel operation of single phase transformers.			CO5, CO6
		Polarity test on 1-phase transformer.			
		Study of Scott Connection			
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	Electric Machines by I.J. Nagrath & D.P. Kothari, Tata Mc Graw – Hill Publishers ISBN 1259081532 2010			
	Other References	1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2014. ISBN:9780071326469, 0071326464 2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004. ISBN:9780852268131, 0852268130			

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	3								3	3	3
CO2	3	2	2	2	3								2	2	3
CO3	3	3	2	2	2								3	3	2
CO4	3	2	3		3								2	3	3
CO5	3	2	2		3								2	2	3
CO6	3	3	2	2	3								3	2	2
	3.00	2.33	2.17	1.75	2.83								2.50	2.50	2.67

IV TERM

School: SET			
Program: B.Tech			
Branch: EEE/EE		**Semester: 4**	
1	Course Code	EEE224	
2	Course Title	Electrical Machines-II	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	To provide students with: 1. fundamentals of AC machine construction 2. the understanding of operation principles of AC electrical machines 3. ability to analyse performance characteristics of ac machines	
6	Course Outcomes	After completion of this course students will be able to: CO 1. Understand the concepts of rotating magnetic field. CO 2. demonstrate the operation of Synchronous generator and motor CO 3. define, analyse and solve problem based on Three-phase Induction machine CO 4. identify the problem in three-phase Induction motor starting and analyse different type of starters CO 5. analyse the principle of operation of special electrical machines CO6 Combine an understanding of the established principles, theories, concepts and terminology relevant to electrical machines with practical application.	
7	Course Description	This course provides a basic understanding of AC machinery fundamentals, constructional features, operational analysis through phasor diagrams, equivalent circuits ,determination of performance parameters, testing and applications	
8	Outline syllabus		CO Mapping
	Unit 1	**Fundamentals of AC machine windings**	
	A	Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single turn coil - active portion and overhang;	CO1,CO6
	B	full-pitch coils, concentrated winding, distributed winding, winding axis, 3D visualization of the above winding types	CO1
	C	Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factor	CO1
	Unit 2	**Synchronous machines**	
	A	Principle of rotating magnetic field, Constructional features, cylindrical rotor synchronous machine, Salient pole, generated EMF, equivalent circuit and phasor diagram, armature reaction, voltage regulation: EMF, MMF, ZPF and ASA methods.	CO2, CO6

	B	Synchronous motor: Principle of operation, Starting methods. Operating characteristics of synchronous machines, V-curves. Salient pole machine – two reaction theory,	CO2
	C	Analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division	CO2
	Unit 3	**3- Phase Induction Machines**	
	A	Principle of operation, constructional details , types of rotors, equivalent circuit, slip-torque characteristics.	CO3,CO6
	B	Condition for maximum torque and maximum power, losses and efficiency, load test, no load and blocked rotor tests, cogging and crawling, Circle diagram: separation of no load losses.	CO3
	C	Double cage rotor, induction generator.	CO3
	Unit 4	**Starting and Speed Control of 3-Phase Induction Motor**	
	A	Requirements for starters, types of starters: stator resistance and reactance, rotor resistance, autotransformer and star-delta starters.	CO4,CO6
	B	Speed control: change of voltage, torque, number of poles and slip.	CO4
	C	V/f control method, cascaded connection, slip power recovery scheme.	CO4
	Unit 5	**Special Electrical Machines**	
	A	Single phase induction motor, double revolving field theory and operation and its type	CO5
	B	Principle of operation and constructional features of universal and stepper motors	CO5
	C	Principle of operation and constructional features of brushless DC motor and servomotor	CO5
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA: 30% / MTE: 20% / ETE: 50%	
	Text book/s*	Electric Machines by I.J. Nagrath & D.P. Kothari, Tata Mc Graw – Hill Publishers ISBN 1259081532 2010	
	Other References	2. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2014. ISBN:9780071326469, 0071326464 2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004. ISBN:9780852268131, 0852268130	

Course Articulation Matrix:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EEE213.1	3	2	2	1	2	1		1					2	2	2
EEE213.2	3	3	2	2	2	2		2	1	1			3	2	3
EEE213.3	3	3	3	2	3	3		2	1	1			3	3	3
EEE213.4	3	3	3	3	3	3		2					3	3	3
EEE213.5	3	3	3	3	3	2		3		1			3	3	2
EEE213.6	3	3	3	3	3	2		3		1			3	2	3
	3.00	2.83	2.67	2.33	2.67	2.17		2.17	1.00	1.00			2.83	2.50	2.67

School: SET			
Program: B.Tech			
Branch: EEE/EE		**Semester: 4**	
1	Course Code	EEP224	
2	Course Title	Electrical Machines-II Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	• The capability to analyze the operation of electric machines under different loading conditions • The ability to conduct testing and experimental procedures on different types of electrical machines.	
6	Course Outcomes	CO1: Experimentally obtain the load characteristics of induction motor. CO2: Determination of various performance characteristic of induction motor CO3: Experimentally perform speed control of induction motor CO4: Understand the effect of variation of field current on armature current and power factor of a synchronous motor. CO5: Understand the concept of parallel operation of alternator. CO6 Understand the concept of parallel operation of alternator.	
7	Course Description	The course covers practical experiment on three phase induction motor, single phase induction motor and synchronous machines.	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on three phase induction motor**	
		To perform no-load and blocked rotor tests on three-phase induction motor	CO1,CO6
		To perform load test on three-phase induction motor.	CO1
		To obtain the characteristic of three-phase induction generator.	CO1, CO2
	Unit 2	**Practical related to single phase induction motor**	
		To start single-phase induction motor using auxiliary winding and capacitor and to reverse its direction of rotation	CO1, CO2
		To perform no-load and blocked rotor tests on single-phase induction motor.	CO1, CO2
		To perform load test on single-phase induction motor.	CO1, CO2
	Unit 3	**Practical related to speed control of induction motor**	
		To perform speed control of single-phase induction motor using v/f method.	CO3,CO6
		To perform speed control of three-phase slip-ring induction motor by varying rotor resistance	CO3
	Unit 4	**Practical related to Synchronous machine**	

		To obtain the effect of variation of field current on armature current and power factor of a synchronous motor.	CO4
		To perform open-circuit and short-circuit tests on synchronous generator	CO4
	Unit 5	**Practical related to parallel operation of synchronous generator**	
		To carry-out parallel operation of three-phase synchronous generators. .	CO5,CO6
	Mode of examination	Jury/Practical/Viva	
	Weightage Distribution	CA 60% / MTE 0% / ETE 40%	
	Text book/s*	Electric Machines by I.J. Nagrath & D.P. Kothari, Tata Mc Graw – Hill Publishers ISBN 1259081532 2010	
	Other References	3. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2014. ISBN:9780071326469, 0071326464 2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004. ISBN:9780852268131, 0852268130	

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	2	3			2			3	3	3
CO2	3	2	2	2	3	2	3			2			2	2	3
CO3	3	3	2	2	2	2	2			2			3	3	2
CO4	3	2	3	2	3	2	2			2			2	3	3
CO5	3	2	2	2	3	2	2			2			2	2	3
CO6	3	3	2	2	3	2	2			2			3	2	2
	3.00	2.33	2.17	2.17	2.83	2.00	2.33			2.00			2.50	2.50	2.67

School: SET			
Program: B.Tech			
Branch: EEE		**Semester: IV**	
1	Course Code	EEE225	
2	Course Title	ELECTRICAL AND ELECTRONICS MEASUREMENTS	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Department	
5	Course Objective	• To discuss about basic instrument and measurement system • To identify basic structure of electrical meters • To study techniques of RLC measurement • To explain different principle of special instruments • To get knowledge and discuss on basic industry sensors and transducers	
6	Course Outcomes	After completion of this course students will be able to: CO1: Getting knowledge of basic instrument and measurement systems CO2: Applying knowledge and concept on construction of different electrical meters CO3: Analyzing concepts of RLC measurements CO4: Understanding knowledge of construction of CRO working and other special instruments CO5: identifying principles and applications of different industry sensors CO6: Studying applications of instruments in industry	
7	Course Description	Instrumentation field is very important in industry field. Internal details of different types of analog and digital instruments will be discussed here. How to find the suitable instrument for a particular application can be done by the student after going through this subject. Some of special instruments of industry and workbench instrument details will be discussed. Basics of sensors and their applications are explained	
8	Outline syllabus		CO Mapping
	Unit 1	**Philosophy Of Measurement**	
	A	Methods of Measurement, Measurement System, Classification of instrument system	CO1,CO6
	B	Characteristics of instruments & measurement system	CO1
	C	Errors in measurement & its analysis, Standards.	CO1
	Unit 2	**Analog Measurement of Electrical Quantities**	
	A	Electrodynamic ,Thermocouple, Electrostatic & Rectifier type Ammeters & Voltmeters	
	B	Different types of wattmeters, measurement of power in single phase and three phase	CO2,CO6
	C	Different types of energy meters, measurement of energy in single phase and three phase	CO2

	Unit 3	**Measurement of parameters and Instrument transformers**	
	A	Measurement resistance (low, medium & high) using bridge and megger	CO3,CO6
	B	Measurement of inductance & capacitance using AC bridges	CO3
	C	Instrument transformers: CT & PT	CO3
	Unit 4	**CRO, DSO & Special Instruments**	
	A	CRO, DSO block diagram, working principle, basic measurements, testing of components using CRO;	CO4,CO6
	B	Electronic multimeter, digital multimeter; Digital tachometer; Digital frequency meter	CO4
	C	Harmonic analyzer; wave analyzer; distortion analyzer	CO4
	Unit 5	**Sensors and Transducers**	
	A	Sensors and transducers classification; Temperature sensors types and working principle;	CO5, CO6
	B	Pressure sensors types and working principle; Flow sensors types and working principle;	CO5
	C	Displacement sensors types and working principle; Calibration of sensors	CO5
	Mode of examination	Theory	
	Weightage Distribution	CA: 30%, MTE: 20%, ETE: 50%	
	Text book/s*	E.W. Golding & F.C. Widdis, "Electrical Measurement & Measuring Instrument", A.W. Wheeler& Co. Pvt. Ltd. India ISBN:9788185614311, 8185614318 Sensors and Transducers by D. Patranabi ISBN:9788120321984, 8120321987	
	Other References	W.D.Cooper," Electronic Instrument & Measurement Technique " Prentice Hall International ISBN:9798129707313 A.K. Sawhney,"Electrical & Electronic Measurement & Instrument", Dhanpat Rai & Sons , India ISBN:9788177001006, 8177001000	

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1	1		-	-	2	3	3	3
CO2	3	3	3	3	3	3	-	2	2			2	3	3	3
CO3	3	3	2	3	3	3	-	2	2	-	1	2	3	3	3
CO4	3	3	3	2	3	1	-	2	2	1	-	3	3	3	3
CO5	3	3	3	2	3	-	1	1	1	-	1	3	3	2	3
CO6	3	2	2	2	2							1	2	2	3
	3.00	2.83	2.50	2.33	2.67	2.25	1.00	1.60	1.75	1.00	1.00	2.17	2.83	2.67	3.00

School:			
Program:			
Branch:		**Semester:4**	
1	Course Code	EEP225	
2	Course Title	Electrical & Electronics Measurements Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory/Elective	
5	Course Objective	• To know calibration and diagnosing problems electrical instruments • To measure and read unknown electrical components value using meters and bridges • To measure electrical parameters like voltage , frequency using CROs • To know characteristics of sensors and transducers • To know constructions of analog and digital insturments	
6	Course Outcomes	CO1: Getting knowledge of basic instrument and measurement systems CO2: Applying knowledge and concept on construction of different electrical meters CO3: Analyzing concepts of RLC measurements CO4: Able to select proper sensors to sense a parameter CO5: Understanding knowledge of construction of CRO working and other special instruments CO6: Finding applications of instruments	
7	Course Description	This course gives idea about how to use different types of meters in measurements. Some experiments give practice of RLC measurement using AC & DC bridges. One section gives practice of measurement using CRO. The last two sections about sensors and case studies	
8	Outline syllabus		CO Mapping
	Unit 1	**Calibration**	
	A	Calibration of voltmeter and ammeter	CO1,CO6
	B	Measurement of RMS, average and form factor using rectifier and meters	CO1
	C	Calibration of wattmeter and energy meter	CO1
	Unit 2	**RLC Bridges**	
	A	DC Bridge for R measurement	CO2,CO6
	B	AC Bridge for L measurement	CO2
	C	AC Bridge for C measurement	CO2
	Unit 3	**CRO and DSO**	
	A	Identifying of controls and functions switches on CRO & DSO	CO3,CO6
	B	Measurements using CRO	CO3
	C	Measurements using DSO	CO3
	Unit 4	**Sensors Characteristics**	

	A	Characteristics of temperature sensor	CO4,CO6
	B	Characteristics of force sensor	CO4
	C	Characteristics of displacement or flow sensor	CO4
	Unit 5	**Case study of Instruments**	
	A	Digital Energy Meter	CO5,CO6
	B	Digital Temperature Meter	CO5
		Digital Multimeter	
	Mode of examination	Practical & Viva	
	Weightage Distribution	CA / MTE / ETE	
		60% / 0% / 40%	
	Text book/s*	Refer lab manuals	
	Other References		

COURSE ARTICULATION MATRIC

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1	1		-	-	2	3	2	2
CO2	3	3	3	3	3	3	-	2	2			2	3	3	2
CO3	3	3	2	3	3	3	-	2	2	-	1	2	3	3	1
CO4	3	3	3	2	3	1	-	2	2	1	-	3	3	3	2
CO5	3	3	3	2	3	-	1	1	1	-	1	3	3	2	2
CO6	3	2	2	2	2							1	2	2	1
	3.00	2.83	2.50	2.33	2.67	2.25	1.00	1.60	1.75	1.00	1.00	2.17	2.83	2.50	1.67

V TERM

School: SET		
Program: B.Tech		
Branch: EEE		**Semester:** V
1	Course Code	EEE330
2	Course Title	Control Systems
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	Control Systems is the study of the analysis and regulation of the output behaviors of dynamical systems subject to input signals. The concepts and tools discussed in this course can be used in a wide spectrum of engineering disciplines. The emphasis of this course will be on analysis and feedback controller design methods for linear time-invariant systems.
6	Course Outcomes	CO1:Apply transfer function models, signal flow graphs and block diagram algebra to obtain the transfer function of a given system CO2: Obtain system response in time domain CO3: Design a closed-loop control system to satisfy dynamic performance specifications using frequency response CO4:Analyze closed-loop control systems for stability and steady-state performance CO5: Design simple feedback controllers and compensators to meet desired performance specifications CO6: Apply different types of analysis and explain the nature of stability of any given linear system
7	Course Description	This course shall introduce the fundamentals of modeling and control of linear time invariant systems. The course will be useful for students from major streams of engineering to build foundations of time/frequency analysis of systems as well as the feedback control of such systems.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Control Problem**	
	A	Feedback Control: open-loop and closed-loop systems, benefits of feedback,block diagram algebra	CO1,CO6
	B	Mathematical models of physical systems, signal flow graph	CO1
	C	Transfer function models of linear time-invariant systems	CO1
	Unit 2	**Time Response Analysis**	
	A	Standard test signals, time response of first order systems for standard test inputs	CO2
	B	Time response of second order systems for standard test inputs	CO2
	C	Design specifications for second-order systems based on	CO2

		the time-response			
	Unit 3	**Frequency Response Analysis**			
	A	Introduction and frequency domain specifications			CO3
	B	Correlation between frequency domain and time domain.			CO3
	C	Polar plot and Bode plot			CO3,CO6
	Unit 4	**Stability of Control Systems**			
	A	Concept of stability			CO4
	B	Characteristic equation, location of roots in s plane for stability, Routh Hurwitz criterion.			CO4
	C	Root-locus technique. Construction of root-loci			CO4
	Unit 5	**Modern Control System**			
	A	Lag, lead, lag-lead compensator and their performance criteria			CO5,CO6
	B	Concepts of state variables and state space model.			CO5
	C	Solution of state equations, concept of controllability and observability.			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991. ISBN:9780135891285, 0135891280 2. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997. ISBN:9780070482890, 0070482896			
	Other References	1. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009 ISBN:9788122417753, 8122417752 2. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995. ISBN:9780471134763, 0471134767			

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	-	-	1	1	-	-	2	3	3
CO2	3	3	3	2	3	-	-	-	1	1	-	-	3	3	3
CO3	3	3	3	2	3	-	-	-	1	1	-	-	2	3	2
CO4	3	3	3	2	3	-	-	-	1	1	-	-	2	3	3
CO5	3	3	3	2	3		-	-	1	1	-	-	2	3	3
CO6	3	3	3	2	3	-	-	-	1	1	-	-	3	3	3
	3.00	3.00	3.00	2.00	2.83				1.00	1.00			2.33	3.00	2.83

School: SET		
Program: B. Tech.		
Branch: EEE		**Semester:** 05
1	Course Code	EEE331
2	Course Title	Power System-I
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	To provide students with the ability of: • understanding of the basic components of Power System and then analyze the system using the technique of per unit system. Also introducing the students to cables, insulators and the corono phenomena which occurs in transmission system • representing the transmission system with the help of their equivalent circuits • calculating various design parameters of transmission lines
6	Course Outcomes	On successful completion of this course students will be able to CO1: assimilate necessary fundamental knowledge of different power system elements CO2: Apply concepts from basic electromagnetics to determine the inductance, capacitance, and resistance of three-phase transmission lines, including lines with conductor bundling . CO3: Derive the model for short, medium and long transmission lines CO4: Analyse the mechanical and electrical design aspects of transmission system CO5: Analyse different types of distribution systems and its design. CO6: Examine the various design features of overhead transmission lines
7	Course Description	This course will cover major topics of power engineering and intended to deliver basic knowledge of fundamentals of power systems including transmission, and distribution of electrical power. Course will guide students to design transmission line having perfect sag and insulator design and minimum

		corona loss.

8	Outline syllabus		CO Mapping
	Unit 1	**Fundamentals of Power System**	
	A	Single phase transmission, three phase transmission, basic components of a power system.	CO1,CO6
	B	Need of EHV Transmission	CO2
	C	Types of Distribution System	CO1, CO2
	Unit 2	**Transmission Line Constants and Performance**	
	A	Inductance of solid, stranded and bundled conductors, symmetrical and unsymmetrical spacing and transposition, application of self and mutual GMD	CO1, CO3, CO6
	B	Capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition, application of self and mutual GMD	CO1, CO3
	C	Characteristics and performance of lines - short line, medium line and long line; equivalent circuits, ABCD constants, Ferranti effect.	CO4
	Unit 3	**Corona, Interference and Insulated Cables**	
	A	Critical disruptive voltage and visible disruptive voltage, corona loss, line design based on corona, advantages and disadvantages of corona.	CO1, CO2, CO5
	B	Skin and proximity Effects, Interference with neighbouring communication circuits and Radio Interference.	CO1, CO2, CO5
	C	Insulation, Shielding and Armouring of cables, types of cables, EHV cables, insulation resistance, capacitance and loss angle, capacitance grading, heating of cables, current rating	CO1, CO2, CO5
	Unit 4	**Mechanical Design of Transmission Lines**	
	A	Catenary curve, sag-tension calculations, supports at different levels	CO1, CO2, CO5
	B	Stringing chart, sag template, equivalent span, vibration and vibration dampers.	CO1, CO2, CO5
	C	Types, voltage distribution in insulator string and grading, methods of equalizing potentials.	CO1, CO2, CO5
	Unit 5	**HVDC Transmission**	
	A	Components of HVDC transmission system, Comparison of AC and DC transmission.	CO5,CO6
	B	Application of DC Transmission	CO5
	C	Types of HVDC links	CO5
	Mode of	Theory	

	examination				
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book*	I.J.Nagrath and D.P.Kothari, "Power System Engineering", Tata McGraw- Hill Publishers. ISBN:9789353165123, 9353165121			
	Other References	1. C.L.Wadhwa, "Electrical Power Systems", New Age International Publishers. ISBN:9788122417739, 8122417736			

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	2	1	-	-	-	1	1	-	-	3	3	2
CO2	2	2	1	2	1	-	-	-	1	1	-	-	3	2	2
CO3	3	3	1	2	2	-	-	-	1	1	-	-	3	2	2
CO4	2	2	1	1	2	-	-	-	1	1	-	-	3	3	2
CO5	2	2	1	1	2	-	-	-	1	1	-	-	3	3	1
CO6	3	2	1	2	2	-	-	-	1	1	-	-	3	2	2
	2.50	2.33	1.00	1.67	1.67				1.00	1.00			3.00	2.50	1.83

School: SET		
Program: B. Tech.		
Branch: EEE		**Semester: 05**
1	Course Code	EEP331
2	Course Title	Power System-1 Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	To provide students with the ability of: • understanding of the basic components of Power System and then analyze the system using the technique of per unit system. Also introducing the students to cables, insulators and the corono phenomena which occurs in transmission system • representing the transmission system with the help of their equivalent circuits • calculating various design parameters of transmission lines
6	Course Outcomes	On successful completion of this course students will be able to CO1: design three-phase power system model in PSCAD software CO2: design of transmission lines of specified parameters CO3: analyse Ferranti Effect in transmission line CO4: derive the model for short, medium and long transmission lines CO5: examine the various design features of overhead transmission lines CO6: do fault analysis in transmission and distribution system.
7	Course Description	This course will cover major topics of power engineering and intended to deliver basic knowledge of fundamentals of power systems including transmission, and distribution of electrical power. Course will guide students to design transmission line having perfect sag and insulator design and minimum corona loss.

8	Outline syllabus		
	Unit 1	**Practical based on fundamentals of Power System**	
	A	To design single-phase power system model consisting of generator, transformer, transmission line and motors in PSCAD	CO1,CO6
	B	To design three-phase power system model consisting of generator, transformer, transmission line and motors in PSCAD	CO2

	C	To design different types of distribution systems and to measure voltages and currents at different feeder point in PSCAD			CO1, CO2
	Unit 2	**Practical based on transmission line constants and performance**			
	A	To calculate inductance of transmission line using line data in MATLAB			CO1, CO3,CO6
	B	To calculate capacitance of transmission line using line data in MATLAB			CO1, CO3
	C	To determine ABCD parameters in transmission line kit			CO4
	Unit 3	**Practical related to Corona, Interference and Insulated Cables**			
	A	To plot a graph between critical disruptive voltage, temperature and conductor radius vs corona loass in MATLAB			CO1, CO2, CO5
	B	To examine Ferranti effect in transmission line kit.			CO1, CO2, CO5
	C	To determine the location of fault in a cable using cable fault locator.			CO1, CO2, CO5
	Unit 4	**Practical related to Mechanical Design of Transmission Lines**			
	A	To calculate sag taking required inputs from user in MATLAB			CO1, CO2, CO5
	B	To plot stringing chart and sag template in MATLAB			CO1, CO2, CO5
	C	To determine the string efficiency of insulating disc			CO1, CO2, CO5
	Unit 5	**Practical related to HVDC Transmission**			
	A	To design a rectifier model in PSCAD			CO5,CO6
	B	To design an inverter model in PSCAD			CO5
	C	To design a complete HVDC system in PSCAD			CO5
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	I.J.Nagrath and D.P.Kothari, “Power System Engineering”, Tata McGraw- Hill Publishers. ISBN:9789353165123, 9353165121			
	Other References	2. C.L.Wadhwa, “Electrical Power Systems”, New Age International Publishers. ISBN:9788122417739, 8122417736			

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	-	1	1	-	-	-	3	3	3
CO2	2	3	3	2	2	-	-	1	1	-	-	-	3	3	3
CO3	3	2	2	2	2	-	-	1	1	-	-	-	3	3	3
CO4	2	1	2	2	2	-	-	1	1	-	-	-	3	3	3
CO5	2	2	1	2	3	-	-	1	1	-	-	-	3	3	3
CO6	3	2	1	2	3	-	-	1	1	-	-	-	3	3	3
	2.50			2.00	2.33			1.00	1.00				3.00	3.00	3.00

School: SET		
Program: B.Tech		
Branch: EEE/EE		**Semester: V**
1	Course Code	EEE332
2	Course Title	Power Electronics
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	1. Analysis of modern power semiconductor devices, their strengths, and their switching and protection techniques 2. Ability to analyze various important topologies of power converter circuits for specific types of applications including controlled and uncontrolled rectifiers, DC-DC converters and inverters 3. Ability to understand and analyze the qualities of waveforms at input and output ends of these converters
6	Course Outcomes	On successful completion of this course students will be able to CO1: summerise the characteristics and principle of operation of different types of semiconductor switches CO2: "analyse the principles of operation of silicon controlled rectifiers. CO3: Analyse controlled rectifier circuits CO4: Analyse the operation of DC-DC choppers CO5: Analyse the operation of voltage source inverters. CO6: Classification of different type of controller
7	Course Description	Power electronics is the application of solid-state electronics for the control and conversion of electrical power. During the course it is taught that how in modern system the conversion is performed with semiconductor switching device such as SCR, MOSFET, IGBT, and GTO.

8	Outline syllabus		CO Mapping
	Unit 1	**Power Semiconductor Devices**	
	A	Thyristors : Silicon Controlled Rectifiers (SCR's) , BJT, power MOSFET, power IGBT, TRIAC and their characteristics	CO1
	B	Gate characteristics of SCR, turn on and turn off methods.	CO1
	C	Series and parallel operation of SCRs, line commutation and forced commutation circuits.	CO1
	Unit 2	**Phase Controlled Converters**	
	A	Principle of phase control, circuit, waveform and analysis of	CO2, CO6

		single phase half wave and full wave line commutated converters with R, RL, RLE load.			
	B	Circuit, waveform and analysis of three pulse and six pulse converters with R and RL load.			CO2
	C	Operation of dual converter.			CO2
	Unit 3	**Choppers**			
	A	Principle of operation, time ratio control and current limit control strategies			CO3,CO6
	B	Circuit, operation and analysis of Step down and step up choppers.			CO3
	C	Types of choppers: A, B, C, D and E choppers.			CO3
	Unit 4	**Inverters**			
	A	Principle of operation of single phase inverter, basic series inverter bridge inverter.			CO4
	B	Three phase Inverter: 120^0 and 180^0 mode, circuit, operation and analysis.			CO4
	C	Voltage control techniques for inverters, VSI & CSI and their comparison.			CO4
	Unit 5	**Other Applications of Power Electronics**			
	A	AC voltage controllers with R and RL loads.			CO5,CO6
	B	Cycloconverters			CO5
	C	UPS,SMPS, Induction heating, HVDC			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Rashid M.D., " Power Electronics", Pearson Education; Fourth edition ,2017 ISBN:9780080467658, 0080467652			
	Other References	1. Bose B.K., "Power Electronics and AC drives", Prentice Hall, 2017. ISBN:9780780310841, 0780310845 2. Sen P.C., "Power Electronics", Mc.Graw Hill,2016. 3. Singh M.D., Kanchandani K.B., ''Power Electronics'', McGraw-Hill, 2017. ISBN:9788126511013, 812651101X			

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	-	-	-	1	1	-	-	3	3	3
CO2	2	2	3	2	3	-	-	-	1	1	-	-	3	3	2
CO3	3	3	3	2	2	-	-	-	1	1	-	-	3	3	3
CO4	2	2	3	3	2	-	-	-	1	1	-	-	3	3	2
CO5	2	2	3	3	2	-	-	-	1	1	-	-	3	3	1
CO6	3	2	3	2	2	-	-	-	1	1	-	-	3	2	2
	2.50	2.33	3.00	2.33	2.33				1.00	1.00			3.00	2.83	2.17

School: SET		
Program: B.Tech		
Branch:EEE/EE		**Semester: V**
1	Course Code	EEP332
2	Course Title	Power electronics lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	Ability to analyze various important topologies of power converter circuits for specific types of applications including controlled and uncontrolled rectifiers, DC-DC converters and inverters
6	Course Outcomes	On successful completion of this course students will be able to CO1: Analysis of different power electronic devices. CO2: study of characteristics of SCR, BJT, MOSFET and IGBT CO3: eperimental verification of the design and control of rectifiers, inverters. CO4: Experimental study of different communication methods CO5: Experimental verification the DC-DC chopper circuit CO6: Design and Experiment of AC voltage controller and Cyclo Converter
7	Course Description	Electronic power conversion is vital in modern electrical energy systems and devices. The primary goal of the course is to give students an in-depth laboratory experience in the design, operation, characterization, and application of electronic circuits for conversion and control of electrical energy.

8	Outline syllabus		CO Mapping
	Unit 1	**Power Semiconductor Devices**	
	A	To obtain VI Characteristics of SCR.	CO1
	B	To control the thyristor using different gate firing circuits.	CO1
	Unit 2	**Phase Controlled Converters**	
	A	To observe the output voltage waveforms and to find the average and rms output voltages of a single phase half controlled converter with R load.	CO2
	B	To observe the output voltage waveforms and to find the average and rms output voltages of a three-phase half controlled bridge converter with R-load.	CO2

	C	To observe the output voltage waveforms and to find the average and rms output voltages of a single phase fully controlled bridge converter with R and RL loads	CO2
	Unit 3	**Choppers**	
	A	To observe the output voltage waveforms and to find the average voltage of a voltage commutated chopper.	CO3
	B	Simulation of step-up and step down chopper	
	Unit 4	**Inverters**	
	A	To observe the output voltage waveforms and to find the output voltage of a single phase series inverter with R and RL loads	CO4
	B	Simulation of three phase inverter	CO4
	Unit 5	**AC voltage controllers & cycloconverters**	
	A	To observe the output voltage waveforms and to find the output voltage of a Single phase cycloconverter with R and RL loads	CO5,C06
	B	Simulation of AC voltage controllers with R and RL loads	CO5,CO6
	Mode of examination	Viva-voce	
	Weightage Distribution	CA: 60% / MTE: 00% / ETE: 40%	
	Text book/s*	Rashid M.D., " Power Electronics", Prentice Hall, 2017	
	Other References	1. Bose B.K., "Power Electronics and AC drives", Prentice Hall, . ISBN:9780780310841, 0780310845 2. Sen P.C., "Power Electronics", TataMc.Graw Hill,. 3. Singh M.D., Kanchandani K.B., ''Power Electronics'', Tata McGraw-Hill. ISBN:9788126511013, 812651101X	

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	2	1			1			1	1	2
CO2	3	2	1	1	2	1	2			1			1	1	2
CO3	2	3	3	2	2	2	2			1			3	3	3
CO4	3	3	3	3	2	1				1			3	3	2
CO5	3	3	3	3	2	2	2			1			3	3	3
CO6	3	3	3	2	2	2	2			1			3	3	3
	2.83	2.67	2.33	2.00	1.83	1.67	1.80			1.00			2.33	2.33	2.50

VI TERM

Branch: EEE		**Semester:** VI	
1	Course Code	EEE334	
2	Course Title	Switchgear and Protection	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	The objective of the course is to expose students to the techniques of protecting the various subsystems of a power system during their normal operation and also under fault condition. The students will also be acquainted with the techniques to coordinate these protecting devices and systems	
6	Course Outcomes	CO1:Understand the basic terminologies related to power system protection and analyse power system faults for balanced and unbalanced conditions. CO2: compare the protection techniques used for protection of different power system components CO3:Identify, apply, and calculate settings for transformers, generators and transmission line protection schemes. CO4: discuss the theory of circuit interruption and physical phenomena of arc CO5: Identify the challenges and solutions to industrial power system protection problems. CO6 An ability to develop protection schemes/algorithms for all components of power system.	
7	Course Description	Reliability of electrical energy systems to a large extent is a consequence of the reliability of its protection system. Basic building blocks of the protection system are fuses, over current and distance relays and differential protection schemes. In this course, we will introduce their principles and applications to apparatus and system protection.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Power System Protection**	
	A	Nature and causes of faults on power system elements need of protection.	CO1,CO6
	B	Zones of protection, essential qualities of protection, primary and backup protection	CO1
	C	CTs and VTs and their applications in protection.	CO1
	Unit 2	**Operating Principles and Construction of Relays**	
	A	Principle of various Electromagnetic relays and their constructions.	CO2
	B	over-current, directional, differential and distance relays and their operating characteristics	CO2
	C	Introduction to digital/numerical relays and Intelligent	CO2

		Electronic Device (IED) relays		
	Unit 3	**Protection of Power Apparatus**		
	A	Faults on transformers and its protection: protection againstexternal faults, protection against internal faults, protection against magnetic inrush, concept of lightning phenomenon, protection against lightning surges		CO3,CO6
	B	Faults on Generator and its protection: Stator protection, protection against inter-turn faults, stator-overheating, Rotor protection, field ground-fault protection,loss of excitation protection, overvoltage protection,overspeed protection.		CO3
	C	Faults on transmission lines and its protection: wire pilot protection, carrier current protection		CO3
	Unit 4	**Theory of Circuit Interruption**		
	A	Physics of arc phenomena and arc interruption.		CO4
	B	Restriking voltage & recovery voltage, rate of rise of recovery voltage.		CO4
	C	Resistance switching, current chopping, interruption of capacitive current.		CO4
	Unit 5	**Circuit Breakers**		
	A	Types of circuit breakers,		CO5,CO6
	B	principle of operation and construction of air-break, air blast, oil, SF6 and vacuum circuit breakers, their merits and demerits, MCB and MCCB.		CO5
	C	Concept of HVDC circuit breaker.		CO5
	Mode of examination	Theory		
	Weightage Distribution	CA / 30%	MTE / 20%	ETE / 50%
	Text book/s*	1. Badri Ram, D.N.Vishwakarma, 'Power System Protection & Switchgear', TataMcGraw –hill publishing company ltd, New Delhi. ISBN:9780071077743, 007107774X 2. C.L Wadhwa, 'Electrical Power Systems', New Age International (p) limited. ISBN:9788122417739, 8122417736		
	Other References	Bhavesh Bhalja, R.P. Maheswari and Nilesh G. Chothani, "Protection and Switchgear", Oxford. ISBN:9780199470679, 0199470677		

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1			3			3			1	1	1
CO2	3	3	3	2			2			3			1	2	1
CO3	3	3	3	2						3			3	3	2
CO4	3	3	3				3			3			2	2	1
CO5	3	3	3							3			2	3	2
CO6	3	3	2	2			3			3			1	1	2
	3.00	3.00	2.83	1.75			2.75			3.00			1.67	2.00	1.50

School: SET			
Program: B.Tech			
Branch: EEE		**Semester: VI:**	
1	Course Code	EEP335	
2	Course Title	Power System-II Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	The objective of the course is to expose students to the techniques of protecting the various subsystems of a power system during their normal operation and also under fault condition. The students will also be acquainted with the techniques to coordinate these protecting devices and systems	
6	Course Outcomes	CO1: Exposure to the modeling of individual power system components like transmission lines and generators CO2: Formulate the load flow problems using various methods CO3: Perform the numerical and phasor analysis of fault occurrences in power system and calculate current and voltages in faulted power system. CO4: Perform stability analysis using various methods CO5: Identify and employ the methods to control real and reactive power and frequency and voltage of power system CO6: Analyse of stability, security and control of power system.	
7	Course Description	Reliability of electrical energy systems to a large extent is a consequence of the reliability of its protection system. Basic building blocks of the protection system are fuses, over current and distance relays and differential protection schemes. In this course, we will introduce their principles and applications to apparatus and system protection.	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on Power System Protection**	
		To analyse the single-phase fault on a power system network using MATLAB/PSCAD	CO1
		To analyse the Line-Line fault on a power system network using MATLAB/PSCAD	CO1
		To analyse the three-phase fault on a power system network using MATLAB/PSCAD	CO1
	Unit 1I	**Practical based on Relays**	
		To determine the operating characteristics of over-current relay.	CO2
		To determine the operating characteristics of over-voltage relay.	CO2

	Unit III	**Practical based on Power Apparatus**			
		To determine the operating characteristics of inverse definite mean time relay.			CO2
		To determine the operating characteristics of bimetallic Thermal relay.			CO2
	UniT IV	**Practical based on Circuit Interruption**			
		To obtain the characteristics of a circuit breaker during circuit interruption in a power system using MATLAB/PSCAD			CO4
	UNIT V	**Practical based on Circuit Breakers**			
		To study the working and application of ac circuit breaker and dc circuit breaker			CO4 CO4
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	3. Badri Ram, D.N.Vishwakarma, 'Power System Protection & Switchgear', TataMcGraw –hill publishing company ltd, New Delhi. ISBN:9780071077743, 007107774X 4. C.L Wadhwa, 'Electrical Power Systems', New Age International (p) limited. ISBN:9788122417739, 8122417736			
	Other References	Bhavesh Bhalja, R.P. Maheswari and Nilesh G. Chothani, "Protection and Switchgear", Oxford. ISBN:9780199470679, 0199470677			

COURSE ARTICULATION MATRIC

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1								3			3	3	3
CO2	3	3	1	3						3			2	3	3
CO3	2	3	1	2						3			2	3	3
CO4	2	3	1	2						3			2	3	3
CO5	2	2	3		3					3			2	3	3
CO6	3	3	3	3	3					3			3	3	3
	2.50	2.50	1.80	2.50	3.00					3.00			2.33	3.00	3.00

School: SET		
Program: B. Tech.		
Branch: EEE		**Semester:** VI
1	Course Code	EEE335
2	Course Title	Power System-II
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	To acquaint the students with the tools for performing power flow and fault analysis in power system and modern method for control of power flow through existing lines.
6	Course Outcomes	On successful completion of this course students will be able to CO1: Exposure to the modeling of individual power system components like transmission lines and generators CO2: Formulate the load flow problems using various methods CO3: Perform the numerical and phasor analysis of fault occurrences in power system and calculate current and voltages in faulted power system. CO4: Perform stability analysis using various methods CO5: Identify and employ the methods to control real and reactive power and frequency and voltage of power system CO6: Analyse of stability, security and control of power system
7	Course Description	This course will introduce and explain the fundamental concept in the field of electrical power system engineering. The basic concepts of per unit system will be introduced along with their applications in circuit applications. Basic load flow algorithms will be cover in details along with short circuit analysis and the method of symmetrical components. Unbalanced fault analysis and basic power system stability analysis will also be covered in these lecture series. By the end of the course, the students should be able to gather high quality knowledge of electrical power system components, its operation strategies, and stability analysis.

8	Outline syllabus		CO Mapping
	Unit 1	**Review of Basic Concept**	
	A	Representation of synchronous machine and transformer in power system	CO3, CO4
	B	Single line diagram, Impedance and Reactance Diagram	CO3, CO4
	C	Per-unit system and its significance, change of base	CO3, CO4
	Unit 2	**Power Flow Analysis**	
	A	Formation of bus admittance matrix (YBUS) using inspection method and singular transformation method	CO1
	B	Bus classifications, Solution of non-linear algebraic equations	CO1, CO2
	C	Gauss Seidel method, Newton Raphson method and Fast-decoupled method (Algorithms and flow-charts),	CO1, CO2

		comparison of the three methods			
	Unit 3	**Fault Analysis**			
	A	Types of faults, Short circuit capacity			CO1, CO3
	B	Symmetrical components of unsymmetrical phasor, Sequence impedances, Sequence networks			CO1, CO3
	C	Fault analysis of L-G, L-L and L-L-G faults			CO1, CO3
	Unit 4	**Power System Stability**			
	A	Basic concepts and definitions, Classification of stability, rotor angle stability and voltage stability, Comparison of steady-state stability, dynamic stability and transient stability			CO1, CO4
	B	Power angle equation, swing equation, Equal area criteria, Solution of swing equation by step by step method			CO1, CO4
	C	Factors influencing transient stability, Techniques for transient stability improvement			CO1, CO4
	Unit 5	**Power System Control and FACTS**			
	A	Concept of load frequency control			CO5
	B	Methods of voltage control			CO5
	C	Introduction to FACTS			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Kothari D.P. and Nagrath I.J., 'Modern Power System Analysis' Tata McGraw Hill Publishing Company Limited			
	Other References	1. Grainer J.J. and Stevenson W.D., 'Power System Analysis' McGraw Hill. 2. H. Saadat, 'Power System Analysis' McGraw Hill.			

COURSE ARTICULATION MATRIX:

COs	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO335. 1	3	1											3			3
CO335. 2	3	3	1	3									2			3
CO335. 3	2	3	1	2									2			2
CO335. 4	2	3	1	2									2			2
CO335. 5	2	2	3		3								2	3	2	2
CO335. 6	3	3	3	3	3								3	3		3
	2.50	**2.50**	**1.80**	**2.50**	**3.00**								**2.33**	**3.00**	**2.00**	**2.50**

PROGRAM ELECTIVES

SET			
Program: B.Tech			
Branch: EEE/EE		**Semester:**	
1	Course Code	EEE444	
2	Course Title	HVDC and FACTS	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Department Elective	
5	Course Objective	To provide students with the ability of: 1. Comprehend the concept behind planning of HVDC transmission and comparison with AC power transmission. 2. Implementing control strategies for the power flow control in AC-DC Systems. 3. An thoughtful on the fundamentals of power flow control 4. An indulgent on the fundamentals of FACTS controllers	
6	Course Outcomes	On successful completion of this course students will be able to CO1: Explain the objective and functions of different components of HVDC System. CO2: Differentiate between different controls schemes for the control of DC link. CO3: Analyzed the process of commutation failure and also understand the techniques to protect the HVDC system against over-voltage and over-currents. CO4: Summarized the benefits of FACTS devices. CO5: Describe principle of operation and configuration of FACTS devices CO6 Acquire the knowledge of FACTS and HVDC system concept and general system considerations	
7	Course Description	This subject deals with the importance of HVDC transmission, analysis of HVDC Converters, Harmonics and Filters, Reactive power control and Power factor improvements of the system. It also deals with basic FACTS concepts, static shunt and series compensation and combined compensation techniques	
8			
	Unit 1	**HVDC System Configuration and Components**	
	A	Classification of HVDC links, components of HVDC transmission system.	CO1
	B	Comparison of AC and DC Transmission, application of DC Transmission.	CO1,CO6
	C	Graetz Bridge, Choice of converter configuration, characteristics of a twelve pulse converter.	CO1
	Unit 2	**HVDC System Control**	

	A	Basic principle of control, control implementation.	CO2,CO6
	B	Starting and stopping of DC link, firing angle control, current and extinction angle control.	CO2
	C	Harmonics and filters	CO2
	Unit 3	**Converter Faults and Protection**	
	A	Types of converter faults, commutation failure.	CO3,CO6
	B	DC line fault, AC system fault	CO3
	C	Smoothing reactors, DC Breakers, surge arresters.	CO3
	Unit 4	**Introduction to FACTS**	
	A	Introduction to power flow control, loading capability.	CO4,CO6
	B	Steady state and dynamic limits of power transmission.	CO4
	C	Applications of FACTS and its benefits.	CO4
	Unit 5	**Types of FACTS Controllers**	
	A	Shunt controllers: Principle of operation, configuration and control of SVC and STATCOM	CO5,CO6
	B	series controllers : Principle of operation, configuration and control of SSSC and TCSC	CO5
	C	Hybrid controllers: Principle of operation, configuration and control of UPFC and IPFC	CO5
	Mode of examination	Theory	
	Weightage Distribution	CA 30% / MTE 20% / ETE 50%	
	Text book/s*	1. Padiyar K.R., HVDC Transmission Systems, New Age International, 2011 ISBN:9781906574772, 1906574774 2. .G. Hingorani and L. Gyugi, "Understanding FACTS: concepts and technology of Flexible AC Transmission systems", 1999, Wiley-IEEE Press ISBN:9780780334557, 0780334558	
	Other References	1. Y. H. Song and A. T. Johns, "Flexible AC Transmission Systems", IEEE Power Series, IET. ISBN:9780852967713, 0852967713	

COURSE ARTICULATION MATRIX

	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	1			1	2			2	3	2
CO2	3	2	2	2	3	2			1	2			2	3	3
CO3	3	3	3	2	3	1			1	2			3	3	3
CO4	3	3	2	3	3	3			1	2			3	3	3
CO5	3	3	2	2	2	2			1	2			2	2	2
CO6	3	3	2	2	2	2			1	2			2	2	3
	3.	2.6	2.17	2.33	2.67	1.83			1.00	2.00			2.33	2.67	2.67

	00	7													

School: SET			
Program: B.Tech			
Branch:EEE/EE/ECE		**Semester:**	
1	Course Code	**EEE448**	
2	Course Title	**PLC and SCADA**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory /Elective/Open Elective	
5	Course Objective	To provide students with: 1.The conceptual as well as practical knowledge of the Industrial Automation & latest technologies being used to achieve Industrial Automation.	
6	Course Outcomes	CO1: inerpret basic components and their symbols used in conventional control boards CO2: apply the concept of electrical ladder logic in programming of PLC instruction CO3: indentify various input output components and design wiring circuit for a PLC CO4: implement the input-output and programming techniques for interfacing PLC CO5: design monitoring and control schemes for industrial applications CO6: apply PLC based automation in indusrial applications	
7	Course Description	This course is aimed at equipping students with appropriate knowledge and skills required in configuring, programming and operating Industrial automation systems with the use of Industrial Field Instruments, PLCs, SCADA/ HMI and DCS.	
8	Outline syllabus		CO Mapping
	Unit 1	**Computer Based Industrial Control**	
	A	Microprocessor/microcontroller based industrial controller: concept and configuration	CO1
	B	Computer based industrial controller: concept and configuration	CO1
	C	Introduction to direct digital control (DDC), distributed control system (DCS) and supervisory control and data acquisition (SCADA)	CO1
	Unit 2	**PLC Basics**	
	A	Introduction to PLC, PLC versus microprocessor/microcontroller/computer; Advantages and disadvantages of PLC	CO2

	B	Hardware, internal architecture and physical forms of PLC; Digital inputs/ outputs; Analog inputs/ outputs			CO3
	C	PLC programming: ladder programming, function blocks, Instruction lists, Sequential function chart, mnemonic programming			CO2
	Unit 3	**PLC Functions**			
	A	Registers: holding, input and output registers; Timers and timer functions; Counters and counter functions			CO4
	B	Data handling functions; Bit functions;			CO4
	C	Advanced functions; PLC programming using various functions			CO4
	Unit 4	**SCADA Basics, Layout and Functions**			
	A	Introduction; Definition and purpose; Controlled / uncontrolled variables and remotely / locally controlled objects in controlled plant			CO5
	B	Layout and parts of SCADA system; Detailed block schematic of SCADA system			CO5
	C	Functions of SCADA system: data acquisition and transmission, monitoring, control, data collection and storage, data processing and calculation, report generation			CO5
	Unit 5	**SCADA Hardware and Software**			
	A	Master Terminal Unit (MTU): functions, single processor and multiprocessor MTU, single and dual computer configurations of MTU			CO5
	B	Remote Terminal Unit (RTU): functions, architecture / layout; RTU programming			CO5
	C	MTU-RTU communication and RTU-field device communication			CO5
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. J.W. Webb and R.A. Reis, Programmable Logic Controllers, Prentice-Hall India 2. . Stuart A. Boyer, Supervisory Control and Data Acquisition (SCADA), 4th Edition, International Society of Automation, 2010.			
	Other References	J.R. Hackworth and F.D. Hackworth, Programmable Logic Controllers, Pearson Edition 2. W. Boston, Programmable Logic Controllers, Newnes,(Elsevier). 3. H.K. Verma, SCADA, e-monograph at www.profhkverma.info, Chapter 1: Basics of SCADA, Chapter 2: Functions of SCADA System, Chapter 3: Hardware of SCADA System.			

COURSE ARTICULATION MATRIX:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO448 .1	3	2	1	-	1	2	-	-	-	-	-	2	2	2	2	3
CO448 .2	3	3	3	1	3	1	-	-	-	-	-	2	2	2	2	3
CO448 .3	3	3	3	3	3	2	-	-	-	-	-	2	2	2	2	3
CO448 .4	3	2	1	1	3	1	-	-	-	-	-	2	2	2	2	3
CO448 .5	3	3	3	3	3	2	-	-	-	-	-	2	2	2	2	3
CO448 .6	3	1	1	1	1	1	-	-	-	-	-	1	2	2	2	3
	3.00	2.33	2.00	1.80	2.33	1.50						1.83	2.00	2.00	2.00	3.00

School: SET		
Program:		
Branch: EEE		**Semester:**
1	Course Code	MOO402
2	Course Title	Introduction to smart grid
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
	Course Status	
5	Course Objective	• To introduce the concept of demand-side management for residential, commercial and industrial energy users. • To give an overview of the different types of demand-side measures. • To describe energy auditing and routine data collection and monitoring, andto indicate their benefits. • To outline information dissemination on demand-side management. • To provide an overview of the major implementation challenges for DSM programmes
6	Course Outcomes	CO1 : To be able to define demand-side management. CO2: To understand the different types of demand-side management measures and their suitability to various energy users. CO3: To be aware of the benefits of good reliable data collection for regular performance analysis, and as an essential part of energy auditing CO4: To appreciate the need for effective information dissemination. CO5: To understand the challenges facing the implementation of demand-side management CO 6: To be able to design housekeeping and preventative maintenance in commerce and industry can be used to reduce energy demand.
7	Course Description	Demand-side management (DSM) has been traditionally seen as a means of reducing peak electricity demand so that utilities can delay building further capacity. In fact, by reducing the overall load on an electricity network, DSM has various beneficial effects, including mitigating electrical system emergencies, reducing the number of blackouts and increasing system reliability. Possible benefits can also include reducing dependency on expensive imports of fuel, reducing energy prices, and reducing harmful emissions to the environment. Finally, DSM has a major role to play in deferring high investments in generation, transmission and distribution networks. Thus DSM applied to electricity

		systems provides significant economic, reliability and environmental benefits	
8	**Outline syllabus**		**CO Mapping**
	Unit 1	**Energy Scenarios**	**CO1**
	A	Energy Conservation, Energy Audit, Energy Scenarios,	**CO1**
	B	Energy Consumption, Energy Security,	**CO1**
	C	Energy Strategy, Clean Development Mechanism	**CO1**
	Unit 2	**Energy Audit**	
	A	Definition of Energy Audit, Place of Audit,	**CO2**
	B	Energy – Audit Methodology, Financial Analysis, Sensitivity Analysis, Project Financing Options,	**CO2**
	C	Energy Monitoring and Training Solar power plant	**CO2**
	Unit 3	**Electrical-Load Management**	**CO3**
	A	Electrical Basics, Electrical Load Management,	**CO3**
	B	Variable- Frequency Drives, Harmonics and its Effects,	**CO3**
	C	Electricity Tariff, Power Factor, Transmission and Distribution Losses	**CO3**
	Unit 4	**Demand side Management**	**CO4, CO6**
	A	Scope of DSM, Evolution of DSM concept, DSM planning and Implementation	**CO4, CO6**
	B	Load management as a DSM strategy, Applications of Load Control, End use energy conservation,	**CO4, CO6**
	C	Tariff options for DSM, customer acceptance, implementation issues, Implementation strategies, DSM and Environment	**CO4, CO6**
	Unit 5	**Energy Conservation**	**CO5,CO6**
	A	Motivation of energy conservation, Principles of Energy conservation, Energy conservation planning,	**CO5, CO6**
	B	Energy conservation in industries, EC in SSI, EC in electrical generation, transmission and distribution,	**CO5, CO6**
	C	EC in household and commercial sectors, EC in transport, EC in agriculture, EC legislation	**CO5, CO6**
	Mode of examination	Theory	
	Weightage Distribution	CA: 30% / MTE: 20% / ETE: 50%	
	Text book/s*	1. Renewable Energy- Power for a sustainable future, third edition, Edited by Godfrey Boyle, Oxford University Press, 2013.	
	Other References	1. Microgrids and Active Distribution Networks, S. Chowdhury, S.P. Chowdhury and P. Crossley, The Institution of Engineering and Technology, London, U.K, 2009	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	2	2	1	-	-	-	-	-	-	-	-	2	1	2
CO.2	3	1	2	2	-	-	-	-	-	-	-	-	-	-	2
CO.3	3	2	2	2	-	-	-	-	-	-	-	-	2	3	2
CO.4	3	1	2	2	-	-	-	-	-	-	-	-	2	-	2
CO.5	1	2	2	1	-	-	-	-	-	--	-	-	3	2	2
CO.6	3	3	3	2	-	-	-	-	-	-	-	-	2	-	-

School: SET		
Program: B.Tech		
Branch: EEE		
1	Course Code	
2	Course Title	**Advanced Control Engineering and Controllers**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	
5	Course Objective	To provide students with: 1. some advanced concepts in Control Systems Engineering and their applications 2. A theoretical understanding of advanced linear control systems and strategies, including the principles of digital control. 3 understanding of performing stability analysis of digital control systems. 4. knowledge of Analog controller, computer based controller and intelligent controller
6	Course Outcomes	After completion of this course students will be able to: CO1: Understand advanced concepts and approaches to control system designs.. CO2: Understand industrial controllers of continuous and discontinuous types and advanced control concepts of cascaded and feed forward controls. CO 3design, develop and operate analog controllers, both electronic and pneumatic types. CO4: Design develop and operate computer based control systems. CO5Understand simulate and design artificial intelligence based control system. CO 6: Industrial experiences in control engineering
7	Course Description	This course introduces systematic approaches to the design and analysis of advance control systems for industrial applications.

8	Outline syllabus		CO Mapping
	Unit 1	**Overview of Control System**	
	A	Elements of control systems; Concept of open loop and closed loop systems; Examples and application of open loop and closed loop systems	CO1
	B	Brief idea of multivariable control systems; Concept of stability and necessary conditions, Routh-Hurwitz criteria and limitations. Correlation between time and frequency responses	CO1
	C	State variable modelling of linear discrete systems, controllability and observability; Nonlinear control systems; Fundamentals-common nonlinearities (saturation, dead-zone, relay, on-off nonlinearity, backlash, hysteresis	CO1
	Unit 2	**Controller Principles**	

	A	Process Characteristics; Control system parameters: error, variable range, control parameter range, control lag, dead time, cycling	CO2
	B	Discontinuous controller modes: two-position mode, multi-position mode; Continuous controller modes	CO2
	C	proportional, integral and derivative control modes; Composite Control modes: proportional-integral (PI), proportional-derivative (PD) and three mode controller (PID); Cascaded and feed-forward controls	CO2
	Unit 3	**Analog Controllers**	
	A	Introduction; General features	CO3
	B	Electronics controllers : error detector, single mode and composite mode controller;	CO3
	C	Pneumatic controllers: proportional, proportional-integral (PI), proportional-derivative (PD) and PID controller.	CO3
	Unit 4	**Computer Based Control**	
	A	Introduction; Digital applications: alarms, two-position control	CO4,CO6
	B	Computer based controller	CO4,CO6
	C	hardware configurations, software requirements	CO4,CO6
	Unit 5	**Intelligent Control Systems**	
	A	Fuzzy-logic control system: Fuzzy set theory, basic fuzzy set operations, fuzzy relations, fuzzy logic controller, methods of determination of membership functions	CO5,CO6
	B	Methods of defuzzification, fuzzy rule base, design of fuzzy logic control system.	CO5,CO6
	C	Neural-network control system :Artificial neural networks, operation of a single artificial neuron, network architecture, learning in neural networks, back-propagation, Neurofuzzy control	CO5,CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA: 30% / MTE: 20% / ETE: 50%	
	Text book/s*	1. Curtis D. Johnson "Process Control Instrumentation Technology,"8th Edition Pearson. 2. I.J. Nagrath and M. Gopal, "Control Systems Engineering," 4th Edition, New Age International Publishers.	
	Other References	1. S.N. Sivanandam and S.N. Deepa, "Principles of soft computing," Wiley India Pvt. Limited. 2. S.Rajashekaran and G.A. Vijayalakshmi Pai, " Neural Nwtworks,Fuzzy logic, and Genetic Algorithms," PHI Pvt. Limited.	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	2	2	1	-	-	-	-	-	-	-	-	2	1	2
CO.2	3	1	2	2	-	-	-	-	-	-	-	-	-	-	2
CO.3	3	2	2	2	-	-	-	-	-	-	-	-	2	3	2
CO.4	3	1	2	2	-	-	-	-	-	-	-	-	2	-	2
CO.5	1	2	2	1	-	-	-	-	-	--	-	-	3	2	2
CO.6	3	3	3	2	-	-	-	-	-	-	-	-	2	-	-

School: SET		
Program: B.Tech		**Current Academic Year:**
Branch: EEE		**Semester:**
1	Course Code	
2	Course Title	Digital Relaying for Power Systems
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	1. to understand the concept of digital protection and computer relaying forpower system. 2. to acquire an in-depth knowledge on different generations of protectiverelays 3. to identify different components of a numerical relay 4. to apply discrete Fourier transform technique in Power System Protection 5. to design and develop relay algorithms for protection of power system apparatus
6	Course Outcomes	CO1: to compare, analyse the advantages and disadvantages of all the three generations of protective relay and also identify the different components of a numerical relay CO2: to develop relay algorithms based on relaying signals CO3: to develop algorithm for digital protection of generator CO4: to develop algorithm for digital protection of transformer CO5: to apply ANN for protection of transmission line and power transformer CO6: to design and evaluate protection algorithms for protection of anypower system component
7	Course Description	The first and foremost driving force for advances in relaying systems is theneed to improve reliability. In turn, this implies increase in dependability as well as security. This need to improve reliability propelled the development of digital relaying. In this course, the students will have an exposure to the three generations of protective relays. Throughout the course, students will have an opportunity to be exposed to different numerical techniques for protection of generators, transformers and transmission lines.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction and Architecture of Digital Relay**	

	A	Three generations of protective relays: electromechanical, static and digital/numerical	CO1

	B	architecture and elements of a digital relay		CO1
	C	Multifunctional relays, management relays and IED Relays		CO1
	Unit 2	**Relay Algorithms and Mathematical Basis**		
	A	Relay Algorithms based on pure sinusoidal relaying signals, distorted relaying signals and differential equation representation of system;		CO2 & CO6
	B	Z transform, sine and cosine Fourier series, Fourier Transform and DFT		CO2 & CO6
	C	Walsh functions, digital filters, windows and windowing.		CO2 & CO6
	Unit 3	**Digital Relaying for Generator**		
	A	Various protection functions: differential, stator earth fault, loss of excitation and reverse power protection		CO3 & CO6
	B	Abnormal frequency and voltage protection: over andunder frequency protection, over and under voltage protection		CO3 & CO6
	C	Numerical differential protection of generator		CO3 & CO6
	Unit 4	**Digital Relaying for Transformer**		
	A	Types of faults encountered in transformer, basic considerations for transformer differential protection,		CO4
	B	stabilizing of differential protection during magnetizing inrush current		CO4
	C	Numerical protection of transformer		CO4
	Unit 5	Artificial Intelligence Based Numerical Protection		CO5
	A	Types of Neural Network Models, Artificial Neural Network, Design Procedure and Consideration		CO5
	B	Application of ANN to transmission line protection		CO5
	C	ANN based power transformer protection		
	Mode of examination	Theory		
	Weightage Distribution	CA / 30%	MTE / 20%	ETE / 50%
	Text book/s*	1. Arun G Phadke and James S. Thorp, "Computer Relaying for Power Systems", John Wiley and SonsInc, New York. 2. Badri ram, D.N.Vishwakarma, 'Power System Protection & Switchgear', Tata McGraw –hill publishing company ltd, New Delhi.		
	Other References	1. Bhavesh Bhalja, R.P. Maheswari and Nilesh G. Chothani, "Protection and Switchgear", Oxford.		

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	2	2	1	-	-	-	-	-	-	-	-	2	1	2
CO.2	3	1	2	2	-	-	-	-	-	-	-	-	-	-	2
CO.3	3	2	2	2	-	-	-	-	-	-	-	-	2	3	2
CO.4	3	1	2	2	-	-	-	-	-	-	-	-	2	-	2
CO.5	1	2	2	1	-	-	-	-	-	--	-	-	3	2	2
CO.6	3	3	3	2	-	-	-	-	-	-	-	-	2	-	-

COURSE ARTICULATION MATRIX

School: SET		
Program: M.Tech		
Branch: EEE		**Semester:**
1	Course Code	
2	Course Title	Distributed Generation Technology
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	
5	Course Objective	To introduce the concept of distributed generation, microgrids, electric vehicles and energy storage. To familiarize the students with renewable generation system modelling, and their grid integration issues. To impart an understanding of economics, policies and technical regulations for DG integration
6	Course Outcomes	CO1 : Analyse the concept and importance of distributed generation. CO2: Understand different renewable energy sources, micro-grid and storage Devices. CO3: Evaluate the technical impact of DG in power system CO4: Analyze the operation and control strategies for grid connected and off-grid System. CO5: Evaluate the effect of DG placement in the existing system CO 6: Industrial experiences in renewable energy integration
7	Course Description	This syllabus gives an overview of distributed energy resources, photovoltaic systems, small hydro, fuel cells, energy storage technologies; wind turbines, Principles of control of distributed generation systems; Electric power distribution systems, installation, interconnection and integration; Economic and financial aspects of distributed generation, the regulatory environment and standards.

8	**Outline syllabus**		**CO Mapping**
	Unit 1	**Introduction to Distributed Generation**	**CO1**
	A	Concept of DG and, its definition, Current scenario in distributed generation	**CO1**
	B	Need for distributed generation	**CO1**
	C	Advantage and limitation of DG	**CO1**
	Unit 2	**Renewable based Distributed generation**	
	A	Wind power plant	**CO2**
	B	Solar power plant	**CO2**
	C	Small hydro other alternate DG	**CO2**
	Unit 3	**Technical impacts of DG**	**CO3**
	A	Transmission systems, Distribution systems	**CO3**
	B	Impact of DGs upon protective relaying	**CO3**
	C	Impact of DGs upon transient and dynamic stability of existing distribution systems	**CO3**

	Unit 4	**Operation and Economic aspects of DGs**			**CO4, CO6**
	A	De-regulation of power system			**CO4, CO6**
	B	Voltage control techniques, Reactive power control, Harmonics, Power quality issues, Reliability of DG based systems			**CO4, CO6**
	C	Economic impacts: Market facts, issues and challenges			**CO4, CO6**
	Unit 5	**Grid integration of DGs**			**CO5,CO6**
	A	Optimal placement of DG sources in distribution systems			**CO5, CO6**
	B	Different types of interfaces , Inverter based DGs and rotating machine based interfaces , Aggregation of multiple DG units			**CO5, CO6**
	C	Energy storage elements, Batteries, ultra capacitors, flywheels			**CO5, CO6**
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	2. Renewable Energy- Power for a sustainable future, third edition, Edited by Godfrey Boyle, Oxford University Press, 2013.			
	Other References	2. Microgrids and Active Distribution Networks, S. Chowdhury, S.P. Chowdhury and P. Crossley, The Institution of Engineering and Technology, London, U.K, 2009			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	2	2	1	-	-	-	-	-	-	-	-	2	1	2
CO.2	3	1	2	2	-	-	-	-	-	-	-	-	-	-	2
CO.3	3	2	2	2	-	-	-	-	-	-	-	-	2	3	2
CO.4	3	1	2	2	-	-	-	-	-	-	-	-	2	-	2
CO.5	1	2	2	1	-	-	-	-	-	--	-	-	3	2	2
CO.6	3	3	3	2	-	-	-	-	-	-	-	-	2	-	-

School: SET		
Program: B.Tech	**Current Academic Year:**	
Branch: EEE	**Semester :**	
1	Course Code	
2	Course Title	Intelligent Actuators and Mechatronics
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	
5	Course Objective	• Discussing of basic components of actuators and mechatronics • Discussing of electronics and digital circuits concepts of the subject • Explaining concept of intelligent and smart system • Discussing of interfacing concepts of mechatronics systems • Giving case studies and exploring knowledge on designing
6	Course Outcomes	CO 1: Getting knowledge on basic components of actuators and mechatronics CO 2: Exploring knowledge and getting design concepts of circuits CO 3: Identifying concepts smart and intelligent on mechatronics systems CO 4: Able to design of interfacing circuits for the subject CO 5: Able to design of tailor-made systems CO 6: Industrial experiences in mechatronics systems
7	Course Description	The field of mechatronics has braddened the scope of the traditional field of elctromechanics. The subject is made to know modern trends on mechatronics system, hybrid of different engineerings, stand alone mechatronics systems.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Definitions: Mechatronics & actuator; Overview of sensors, current & voltage sources; Grounding	CO1
	B	Solenoids, relays, electrical motors for actuators	CO1
	C	Basics of open loop and closed loop systems , block diagram of mechatronics system ; Scope of the course	CO1
	Unit 2	**Overview of Analog and Digital Electronics**	CO2
	A	Active electronic devices for mechatroics, basics of operation amplifiers and instrumentation amplifiers	
	B	Display systems, measurement systems, testing and calibration	CO2
	C	Combination logic and logic classes; Flip-flops and their applications; Microcontroller concepts	CO2
	Unit 3	**Smart and Intelligent Actuators**	
	A	Definitions: Smart and intelligent actuators; Architecture and operation of smart actuator	CO3
	B	Intelligent actuator without feedback sensor in detail	CO3
	C	Intelligent actuator with feedback sensor in detail	CO3

	Unit 4	**Mechanical-Electronic Interfacing**			
	A	Concept of three-state (tri-state) outputs; Interfacing of pushbutton, keyboard and sensors			CO4,CO6
	B	Interfacing of relays, solenoids, DC, AC motors and special motors to microcontroller			CO4,CO6
	C	Selecting of motor for actuators			CO4,CO6
	Unit 5	**Case studies & Design Exercise**			
	A	Case study 1: Mechatronic design of a coin counter; Case study			CO5,CO6
	B	Case study 2: Mechatronics for conveyor based material handling system			CO5,CO6
	C	Design exercise on mechatronic system			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	David G, Alciatore et al., “Introduction to Mechatronics and Measurement Systems”, Tata McGraw Hill, 2003			
	Other References	1. W.Bolton, “Mechatronics “, Pearson Education, 2005 2. Godfrey C. Onwubolu, “Mechatronics”, Elsevier, 2005			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	2	2	1	-	-	-	-	-	-	-	-	2	1	2
CO.2	3	1	2	2	-	-	-	-	-	-	-	-	-	-	2
CO.3	3	2	2	2	-	-	-	-	-	-	-	-	2	3	2
CO.4	3	1	2	2	-	-	-	-	-	-	-	-	2	-	2
CO.5	1	2	2	1	-	-	-	-	-	--	-	-	3	2	2
CO.6	3	3	3	2	-	-	-	-	-	-	-	-	2	-	-

School: SET		
Program: B.Tech		**Current Academic Year:**
Branch:EEE		**Semester:**
1	Course Code	
2	Course Title	**Operation and Control of smart grid**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	
5	Course Objective	The objective of the subject on smart grid technologies is to integrate and optimize distributed energy resources to achieve a more efficient and reliable grid, enable active participation of consumers with more environmental constraints
6	Course Outcomes	The students should be able to CO1: Identify different tools and approaches to modelling a Smart Grid. CO2: Apply Optimal Power Flow (OPF) solutions to evaluate the performance of a power system with renewable energy sources. CO3: Analyze power system dynamics (frequency stability) to achieve active power balance. CO3: To familiarize the students with modelling of smart grids components. CO5. Identify control-room technologies for system-wide remote monitoring, protection, and risk management of smart grid cyber security CO 6: Able to design, implementation, evaluation and management of smart electricity infrastructure.
7	Course Description	Smart grid communications and control, covering several special topics in the field of smart grid including advanced metering infrastructures, demand response, distributed storage, vehicle-to-grid systems, wide area measurement, smart grid cyber security, etc

8	Outline syllabus		CO Mapping
	Unit 1	**Modeling of Smart Grids**	
	A	Operating principles and models of smart gird components,;.	CO1
	B	Key technologies for generation, networks, loads and their control capabilities decision-making tools	CO1
	C	Hardware, Software, Communication. Approaches to estimation, scheduling, management and control of next generation smart grid	CO1
	Unit 2	**Smart Grid Communications**	
	A	Two-way Digital Communications Paradigm,Network Architectures	CO2
	B	IP-based Systems, Power Line Communications	CO3
	C	Advanced Metering Infrastructure,	CO2
	Unit 3	**Security and Privacy**	
	A	Cyber Security Challenges in Smart Grid,Load Altering Attacks	CO4
	B	False Data Injection Attacks, Defense Mechanisms	CO4

	C	Privacy Challenges Data handling functions; Bit functions			CO4
	Unit 4	**IoT for power systems**			
	A	Internet of things for electricity infrastructure and energy management.			CO5,CO6
	B	SCADA, Demand response, AMI, IoT aided smart grid,			CO5,CO6
	C	Big data for power system and introduction to data analytics.			CO5,CO6
	Unit 5	**Flexible AC transmission system (FACTS)**			
	A	Congestion management and loadability enhancement, reactive power compensation,.			CO5,CO6
	B	concept of series compensation, shunt compensation, FACTS: working principle			CO5,CO6
	C	Classification, series controllers, shunt controllers, series-series controllers, series-parallel controllers			CO5,CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley & sons inc, 2015. 2. . James Momoh, "Smart Grid: Fundamentals of design and analysis", John Wiley & sons Inc, IEEE press 2012			
	Other References	1.Fereidoon P. Sioshansi, "Smart Grid: Integrating Renewable, Distributed & Efficient Energy", Academic Press, 2012. 2.Clark W.Gellings, "The smart grid: Enabling energy efficiency and demand response", Fairmont Press Inc, 2009. 3. H.K. Verma, SCADA, e-monograph at ww.profhkverma.info,.			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	2	2	1	-	-	-	-	-	-	-	-	2	1	2
CO.2	3	1	2	2	-	-	-	-	-	-	-	-	-	-	2
CO.3	3	2	2	2	-	-	-	-	-	-	-	-	2	3	2
CO.4	3	1	2	2	-	-	-	-	-	-	-	-	2	-	2
CO.5	1	2	2	1	-	-	-	-	-	--	-	-	3	2	2
CO.6	3	3	3	2	-	-	-	-	-	-	-	-	2	-	-

School: SET			
Program: B. Tech.			
Branch: EEE			
1	Course Code		
2	Course Title	**Operation and Control of smart grid Lab**	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status		
5	Course Objective	Learn modern numerical techniques and analytical methods for dealing with and solving operation and protection related problems in electric power systems	
6	Course Outcomes	After the completion of course student will be able to CO1: explore the concept of automatic generation control. CO2: apply the modes of excitation systems and exercises voltage control. CO3: employ incremental cost curve and penalty factor for economic operation. CO4: plan unit commitment for optimal operation. CO5: evaluate power system security and methods of improvement. CO6: compare the protection techniques used for protection of different power system components	
7	Course Description	This course aims to convince the student that constancy of frequency and voltage are the primary health indicator of the power system for maintaining the real and reactive power balance in systems. The concepts of economic load dispatch and unit commitment are also given in the course. The concept of close coordination between thermal and hydro power plant to meet the load demand has been included in the course.	
8			
	Unit 1	**Practical related to economic load dispatch and Unit Commitment**	
	A	To perform economic load dispatch without considering losses using MATLAB	CO3
	B	To perform economic load dispatch with considering losses using MATLAB	CO3
	C	To solve unit commitment method using priority list scheme in MATLAB	CO4
	Unit 2	**Practical related to load frequency control and voltage**	

		control	
	A	To design load frequency control model in MATLAB	CO1
	B	To connect shunt capacitor in most optimal location and to study improvement in voltage profile using MATLAB/PSCAD.	CO2
	C	To connect series capacitor in most optimal location and to study improvement in power transfer capability using MATLAB/PSCAD	CO2
	Unit 3	**Practical related to power system security and excitation control**	
	A	To design DC/AC excitation control model in PSCAD.	CO2
	B	To design static excitation control model in PSCAD.	CO2
	C	To evaluate security index of a system using contingency analysis in MATLAB	CO5
	Unit 4	**Practical related to fault analysis**	
	A	To simulate single line to ground in PSCAD and to measure voltage and current at different locations	CO6
	B	To simulate line to line in PSCAD and to measure voltage and current at different locations	CO6
	C	To simulate double line to ground in PSCAD and to measure voltage and current at different locations	CO6
	Unit 5	**Practical related to relay**	
	A	Principle of various Electromagnetic relays and their constructions.	CO6
	B	Over-current, directional, differential and distance relays and their operating characteristics	CO6
	C	Modern relays: introduction to static and digital/numerical (microprocessor based) relays and Intelligent Electronic Device(IED) relays	CO6
	Mode of examination	Practical	
	Weightage Distribution	CA: 60% / MTE: 0% / ETE: 40%	
	Text book/s*	Allen. J. Wood and Bruce F. Wollenberg, “Power Generation, Operation and Control”,John Wiley & Sons, Inc., 2003.	

	Other References	1. P.Kundur, "Power System Stability and Control"MC Craw Hill Publisher, USA, 1994. 2. Olle.I.Elgerd, "Electric Energy Systems Theory An Introduction" Tata McGraw Hill Publishing Company Ltd. New Delhi, Second Edition 2003	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	2	2	1	-	-	-	-	-	-	-	-	2	1	2
CO.2	3	1	2	2	-	-	-	-	-	-	-	-	-	-	2
CO.3	3	2	2	2	-	-	-	-	-	-	-	-	2	3	2
CO.4	3	1	2	2	-	-	-	-	-	-	-	-	2	-	2
CO.5	1	2	2	1	-	-	-	-	-	--	-	-	3	2	2
CO.6	3	3	3	2	-	-	-	-	-	-	-	-	2	-	-

School: SET		
Program: B.Tech		
Branch: EEE		**Semester:**
1	Course Code	**EEE448**
2	Course Title	**PLC and SCADA**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	
5	Course Objective	To provide students with: 1. The conceptual as well as practical knowledge of the Industrial Automation & latest technologies being used to achieve Industrial Automation.
6	Course Outcomes	The students should be able to CO1: understand the concepts of computer based Industrial Control, including PLC, DCS and SCADA. CO2: understand hardware of PLC and ladder programming for PLC. CO3: use various PLC functions and develop PLC programs for industrial control and automation applications. CO4: understand the purpose, layout, components and functions of SCADA systems and use the knowledge for the operation of SCADA systems in Industry CO5.design SCADA system including layout, communication system and software. CO 6: Industrial experiences in PLC and SCADA.
7	Course Description	This course is aimed at equipping students with appropriate knowledge and skills required in configuring, programming and operating Industrial automation systems with the use of Industrial Field Instruments, PLC and SCADA systems.

8	Outline syllabus		CO Mapping
	Unit 1	**Computer Based Industrial Control**	
	A	Microprocessor/microcontroller based industrial controller: concept and configuration	CO1
	B	Computer based industrial controller: concept and configuration	CO1
	C	Introduction to direct digital control (DDC), distributed control system (DCS) and supervisory control and data acquisition (SCADA)	CO1
	Unit 2	**PLC Basics**	
	A	Introduction to PLC, PLC versus microprocessor/microcontroller/computer; Advantages and disadvantages of PLC	CO2
	B	Hardware, internal architecture and physical forms of PLC; Digital inputs/ outputs; Analog inputs/ outputs	CO3

	C	PLC programming: ladder programming, function blocks, Instruction lists, Sequential function chart, mnemonic programming	CO2
	Unit 3	**PLC Functions**	
	A	Registers: holding, input and output registers; Timers and timer functions; Counters and counter functions	CO4
	B	Data handling functions; Bit functions;	CO4
	C	Advanced functions; PLC programming using various functions	CO4
	Unit 4	**SCADA Basics, Layout and Functions**	
	A	Introduction; Definition and purpose; Controlled / uncontrolled variables and remotely / locally controlled objects in controlled plant	CO5,CO6
	B	Layout and parts of SCADA system; Detailed block schematic of SCADA system	CO5,CO6
	C	Functions of SCADA system: data acquisition and transmission, monitoring, control, data collection and storage, data processing and calculation, report generation	CO5,CO6
	Unit 5	**SCADA Design**	
	A	Master Terminal Unit (MTU): functions, single processor and multiprocessor MTU, single and dual computer configurations of MTU; Remote Terminal Unit (RTU): functions, architecture / layout; RTU programming	CO5,CO6
	B	MTU-RTU communication and RTU-field device communication	CO5,CO6
	C	Design of SCADA system : HARDWARE, Communication and Software.	CO5,CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA: 30% / MTE: 20% / ETE: 50%	
	Text book/s*	1. J.W. Webb and R.A. Reis, Programmable Logic Controllers, Prentice-Hall India 2. . Stuart A. Boyer, Supervisory Control and Data Acquisition (SCADA), 4th Edition, International Society of Automation, 2010.	
	Other References	J.R. Hackworth and F.D. Hackworth, Programmable Logic Controllers, Pearson Edition 2. W. Boston, Programmable Logic Controllers, Newnes,(Elsevier). 3. H.K. Verma, SCADA, e-monograph at www.profhkverma.info, Chapter 1: Basics of SCADA, Chapter 2: Functions of SCADA System, Chapter 3: Hardware of SCADA System.	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	2	2	1	-	-	-	-	-	-	-	-	2	1	2
CO.2	3	1	2	2	-	-	-	-	-	-	-	-	-	-	2
CO.3	3	2	2	2	-	-	-	-	-	-	-	-	2	3	2
CO.4	3	1	2	2	-	-	-	-	-	-	-	-	2	-	2
CO.5	1	2	2	1	-	-	-	-	-	--	-	-	3	2	2
CO.6	3	3	3	2	-	-	-	-	-	-	-	-	2	2	2

School:				
Program: B.Tech				
Branch: EEE		**Semester: II**		
1	Course Code			
2	Course Title	PLC and SCADA Lab		
3	Credits	2		
4	Contact Hours (L-T-P)	0-0-4		
	Course Status	Compulsory		
5	Course Objective	To equip students with the working knowledge about the PLC based process control and SCADA functions.		
6	Course Outcomes	CO1: To study and perform basic experiments on PLC. CO2: To perform process control using PLC. CO3: To perform motor control using PLC. CO4: To implement basic SCADA functions. CO5: To implement advanced SCADA functions CO6: Industrial experiences in PLC and SCADA.		
7	Course Description	The contents of this course covers the implementation of basic and advanced functions of PLC and SCADA and their applications in controls.		
8	Outline syllabus			CO Mapping
	Unit 1	**PLC based basic experiments**		
	A	1.To study and use of NO and NC bit 2.To study and use of S (Set) and R (Reset) bit		CO1
	B	1.To study and use of Timer instruction 2.To study and use of Cumulative timer instruction		CO1
	C	1.To study and use of Counter instruction 2. To study logic gates in PLC.		CO1
	Unit 2	**PLC based process control**		
	A	Water Level Control using PLC		CO2
	B	Conveyor Belt Control Module using PLC		CO2
	C	Traffic control using PLC		
	Unit 3	**PLC based Motor Control**		
	A-B	Ac motor speed control module using PLC.		CO3
	C	Dc motor speed control module using PLC		CO3
	Unit 4	**Basic SCADA functions**		
	A	Parameter reading of PLC in SCADA.		CO4
	B-C	Alarm annunciation using SCADA.		CO4
	Unit 5	**Advanced SCADA functions**		
	A	SCADA communication with PLC		CO5, CO6
	B	Trend Monitoring on SCADA		CO4, CO6
	C	Reporting on SCADA		CO6
	Mode of examination	Practical & Viva		
	Weightage	CA	MTE	ETE

	Distribution	60%	0%	40%	
	Text book/s*	`1. J.W. Webb and R.A. Reis, Programmable Logic Controllers, Prentice-Hall India 2. . Stuart A. Boyer, Supervisory Control and Data Acquisition (SCADA), 4th Edition, International Society of Automation, 2010.			
	Other References	Refer lab manuals			

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	2	2	1	-	-	-	-	-	-	-	-	2	1	2
CO.2	3	1	2	2	-	-	-	-	-	-	-	-	-	-	2
CO.3	3	2	2	2	-	-	-	-	-	-	-	-	2	3	2
CO.4	3	1	2	2	-	-	-	-	-	-	-	-	2	-	2
CO.5	1	2	2	1	-	-	-	-	-	--	-	-	3	2	2
CO.6	3	3	3	2	-	-	-	-	-	-	-	-	2	2	2

School: SET			
Program: B.Tech			
Branch:EEE		**Semester:**	
1	Course Code		
2	Course Title	Robotics and Industrial Robots	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status		
5	Course Objective	1.To understand the construction industrial robotics 2.To explore knowledge on selection of end-effectors of robotics 3.To get knowledge of electrical drive systems of industrial robotics 4.To know types of sensors of industrial robotics 5.To understand of electrical and electronics interfacings 6.To study about applications of industrial robots	
6	Course Outcomes	CO1: Basic construction of robot and robotics components CO2: Understanding interfacing & building techniques of robots CO3: Knowing different types of actuators of robotics CO4: Getting knowledge of robotics sensors and transducers CO5: Developing interfacing circuits for robotics applications CO 6: Industrial experiences in Robotics	
7	Course Description	This course gives coverage of robotics components, architecture, and electronics interfacing circuits knowledge. Students can also practice programming of robotics using embedded C on open source software after going through this subject. Finally students are able to do tailor-made projects on robotics engineering	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Robotics and Motion Analysis**	
	A	Historical background; Laws of robotics and robot definitions;	CO1
	B	Robotics systems and robot anatomy: Basic diagram, basic components and their uses; Specifications of robots.	CO1
	C	Position representation; Forward and reverse transformation: 2 & 3 DOF	CO1
	Unit 2	**Robot End-Effectors, Robot Drives and Actuators**	
	A	Classification of end-effectors; Mechanical grippers, Magnetic grippers and vaccum grippers; Gripper force analysis.	CO2
	B	Functions of drive systems; Electrical drives: DC, BLDC motors, AC motors, stepper motor, piezoelectric actuators;	CO2,CO3
	C	Drive Mechanisms: rack and pinion, ball screws, gear trains and harmonic drive.	CO2
	Unit 3	**Sensors of Robotic System**	
	A	Uses of sensors in robotics; Shaft Encoders (linear and rotational);	CO4
	B	Proximity Sensors (inductive and capacitive); Tactile sensors;	CO4
	C	Basic block diagram of vision systems of robotic system.	CO4
	Unit 4	**Controlling Technologies of Industrial Robots**	

	A	Basics of PC interfacings			CO5
	B	Microcontroller interfacings			CO5
	C	Robot languages and classification; Robot software.			CO5
	Unit 5	**Industrial Robot Applications**			
	A	Material handling robots			CO6
	B	Welding Robots			CO6
	C	Assembling robots			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1.S.R. Deb and S. Deb, "Robotics Technology and Flexible Automation", Second edition, McGraw Hill, 2011.			
	Other References	2. Mikell P Groover et al., "Industrial Robotics", fifth print, McGraw Hill, Special Indian Edition, 2013			

Course Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	2	2	1	-	-	-	-	-	-	-	-	2	1	2
CO.2	3	1	2	2	-	-	-	-	-	-	-	-	-	-	2
CO.3	3	2	2	2	-	-	-	-	-	-	-	-	2	3	2
CO.4	3	1	2	2	-	-	-	-	-	-	-	-	2	-	2
CO.5	1	2	2	1	-	-	-	-	-	--	-	-	3	2	2
CO.6	3	3	3	2	-	-	-	-	-	-	-	-	2	2	2

School: SET			
Program: B.Tech			
Branch: EEE		**Semester:**	
1	Course Code		
2	Course Title	Smart Power Grid and Micro-Grid	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status		
5	Course Objective	1. To understand the concepts of smart power grid and micro grid 2. To acquire in depth knowledge of smart distribution, distribution automation, smart transmission and substation automation 3. To identify various components of smart grid and micro grid 4. To apply principles of automation to transmission and distribution 5. To design smart micro grid for a given application	
6	Course Outcomes	CO1: To understand concept, motivation and benefits of Smart Power Grid CO2: To develop knowledge of demand-side management as a tool of smart distribution CO3: to design advanced metering infrastructure for Distribution Automation CO4: To design AC, DC and hybrid micro grids CO5: To design phasor measurement and develop wide area monitoring system using PMU CO6: Industrial experiences in renewable energy integration in distribution system	
7	Course Description	The course deals with the concept of smart power grid and includes inv depth study of its its various components, namely smart distribution, distribution automation and management, advanced metering infrastructure , smart micro grid, smart transmission and substation automation.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Smart Power Grid (4 hours)**	
	A	Traditional power grid, Smart power grid (or smart grid) concept and objectives	CO1
	B	Benefits of smart power grid, traditional-grid and smart-grid comparison	CO1
	C	Stake-holders in smart-grid development, Smart grid solutions.	CO1
	Unit 2	**Smart Distribution**	
	A	Demand-side management: Energy efficiency, time of use and spinning reserve	CO2
	B	Demand response: Market driven DR and operation-driven DR, incentive-based DR and TOU-based rates DR	CO2

	C	Distributed generation, Energy storage, Use of plugged electric and hybrid electric vehicles			CO2
	Unit 3	**Distribution Automation and Management**			
	A	Overview of distribution system, Components of DA: customer automation, feeder automation and substation automation, Distribution control centre (DCC)			CO3
	B	Distribution management system (DMS), Outage management system (OMS)- unplanned and planned outages, Asset management system (AMS), Customer information system (CIS)			CO3
	C	Meaning and benefits of advanced metering, Structure and components of AMI, AMI integration with DA, DMS and OMS.			CO3
	Unit 4	**Smart Microgrid**			
	A	Definition, components and benefits of microgrid			CO4,CO6
	B	Types of micro grid: AC, DC and hybrid, Modes of operation: grid-connected and island modes			CO4,CO6
	C	Meaning of smart micro grid, Micro grid operation and control			CO4,CO6
	Unit 5	**Smart Transmission and Substation Automation**			
	A	Meaning and challenges of smart transmission			CO5,CO6
	B	Phasor measurement unit: concept, layout, components and applications, Wide area monitoring system: concept and impact on EMS and DMS			CO5,CO6
	C	Need of substation automation (SA), Technical issues of SA, SA architecture, SA function.			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Mini S. Thomas and John D. McDonald, Power System SCADA and Smart Grids, CRC Press, 2015.			

	Other References	1. Janak Eknayake at el., Smart Grid: Technology and Applications, John Wiley and Sons, 2012 2. H. K. Verma , e-Monograph on " Smart – Grid", www.profhkverma.info	

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	2	2	1	-	-	-	-	-	-	-	-	2	1	2
CO.2	3	1	2	2	-	-	-	-	-	-	-	-	-	-	2
CO.3	3	2	2	2	-	-	-	-	-	-	-	-	2	3	2
CO.4	3	1	2	2	-	-	-	-	-	-	-	-	2	-	2
CO.5	1	2	2	1	-	-	-	-	-	--	-	-	3	2	2
CO.6	3	3	3	2	-	-	-	-	-	-	-	-	2	-	-

School:		**School of Engineering and Technology**
Program:		
Branch: EEE		
1	Course Code	
2	Course Title	Virtual Instrumentation
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	
5	Course Objective	1. Introduction to the various models of Virtual Instruments, their comparison with traditional instruments and major application areas of VI. 2. Introduction to basics of LabVIEW 3. VI Programming techniques like loops, arrays, clusters, plotting and Strings and files. 4. Basics of signal conditioning techniques along with DAQ hardware and software and various signal processing techniques available in LABVIEW. 5. Advanced concepts in LabVIEW with main concepts of real time applications in Image acquisition and Motion control. 6. Building of Virtual Instruments with various types of controls and indicators. 7. Configuring DAQ card and acquisition of real time signals from sources and sensors. 8. Simulate a signal in LabVIEW and generate a virtual source using DAQ cards.
6	Course Outcomes	CO1: Understand various models and areas of application of Virtual Instrumentation. CO2: Understand various components of LabVIEW required for the development of VI. CO3: Understand and apply various programming functions of LabVIEW like loops, arrays, clusters and file I/Os for building of simple Virtual instruments. CO4: Understand the concepts of Data acquisition hardware and software and to apply basic signal processing techniques available in LabVIEW. CO5: Understand the real time applications of LabVIEW in motion control and Image acquisition. CO6: Able to build VI for simulated and real time applications.
7	Course Description	The course content of this subject includes an introduction to graphical

		system design. This course also focuses on introduction to LabVIEW which extensively elaborate the Graphical programming language .In Unit 3, building of VI by using loops, arrays, clusters etc. have been dealt with. Use of strings and I/O are also elaborated in this course. Data acquisition and various signal processing techniques are also covered in this course. Two real time applications motion control and Image acquisition by using LabVIEW have been elaborated in this course.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	CO1
	A	Graphical system design model - design model, prototype model, deployment model	
	B	Building blocks of VI; Virtual instrument versus traditional instrument, Hardware and software in VI	
	C	Graphical system Design using LabVIEW; Graphical programming and Textual programming	
	Unit 2	**Graphical system Design using LabVIEW**	CO2,CO6
	A	Advantages of LabVIEW; Components of VI Software - Front panel windows, Block diagram windows, Icon /connector pane	
	B	Creating and saving a VI; Toolbars, Palettes, Front panel controls and indicators, Block diagram – terminals, nodes, functions	
	C	Sub VIs, Express VIs and VIs, wires; Data types, Data flow program	
	Unit 3	**Programming Techniques**	**CO3,CO6**
	A	Modular Programming in Lab View; Building VI front panel and block diagram	
	B	Loops – for and while loops, Local and Global variables in LabVIEW, Arrays in LabVIEW,	
	C	Clusters in LabVIEW; Conversion between arrays and clusters, Plotting data in LabVIEW, Strings and File I/O in LabVIEW	
	Unit 4	**Data Acquisition and Signal Processing in LabVIEW**	**CO4,CO6**
	A	Transducers and Signal conditioning ,sampling and aliasing	
	B	Basics of DAQ hardware and software, DAQ modules and drivers for building virtual instruments	
	C	Fourier transforms; Power spectrum, Correlation methods; Windowing & filtering	
	Unit 5	**Advanced concepts in LabVIEW**	**CO5, CO6**
	A	Data Socket, TCP/IP VI's synchronization	
	B	Serial interface buses - RS 232, RS485,USB	
	C	Concepts of real time systems; Image acquisition; Motion control	
	Mode of examination	Theory/Jury/Practical/Viva	

	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Jovitha Jerome, "Virtual Instrumentation and LABVIEW", PHI Learning			
	Other References	1. C.L. Clark, "LabVIEW Digital Signal Processing", TMH Publishing Company. 2. Technical Manuals for DAQ Modules, Advantech and National Instruments 3. www.profhkverma.info: Chapter 2: Technologies/ Protocols for Wired Sensor Network 4. NI USER MANUAL http://www.ni.com/pdf/manuals/376445b.pdf 5. www.ni.com			

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 008.1	1	2	2	2	2	1	1	2	1	2	-	2	2	2	1
CO008.2	3	2	1	2	3	1	2	2	1	1	-	2	2	2	2
CO008.3	3	2	3	2	3	2	2	2	1	2	-	2	2	2	2
CO008.4	2	2	2	2	1	2	2	2	2	2	-	3	3	2	2
CO008.5	2	3	3	2	2	2	2	2	2	2	-	3	3	2	2
CO008.6	2	3	3	2	3	2	2	2	2	3	2	3	3	2	3

School: SET			
Program: B.Tech			
Branch:EEE		**Semester:**	
1	Course Code		
2	Course Title	Virtual Instrumentation Lab	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status	Compulsory/Elective	
5	Course Objective	• To understand the basic concepts of Lab VIEW. • To build VI using Lab VIEW. • To acquire data using data acquisition card. • To build real time applications using Lab VIEW.	
6	Course Outcomes	CO1: To implement simple arithmetic and Boolean systems using Lab VIEW. CO2: To create VI using arrays. CO3: To build VI using clusters operations of LabVIEW. CO4: To acquire and generate a signal using DAQ cards. CO5: To develop real time application of a VI. CO6: Able to build VI for simulated and real time applications.	
7	Course Description	The main aim of this course is to give hand on training to the students on the Lab VIEW platform for the designing of VI. This course deals with the use of loops , arrays, clusters and various programming techniques of Lab VIEW for building the Virtual instruments.	
8	Outline syllabus		CO Mapping
	Unit 2	**Practical related to --**	**CO1**
		1. To study various types of Boolean controls and Indicators. Also study various Boolean programming functions available in function palate. 2. Create a VI to compute the Boolean expression (A*B) +(C*D*E). 3. Create a front panel and block diagram to implement half ladder and full adder. 4. To study various types of numeric controls and indicators and numeric programming functions available in function palate. 5. Create the front panel and block diagram of VI to show the trigonometric values Of sine and cosine of a given angle in degrees.	
	Unit 3	**Practical related to---**	**CO2**
		6. Create a VI to create 2D numeric arrays & add them. 7. Create a VI consisting of two clusters of LEDs Perform the AND operation between the clusters and display the	

		output in another clusters of LEDs. 8. Create a VI using cluster to display information of student, name, age, status, marks. Use Bundle and Unbundle Functions.			
	Unit 4	**Practical related to---**			**CO4**
		9. Create a VI to produce voltage output from 0 to 10 volts in steps of 0.5 volts. View the same on the CRO using a DAQ card. 10. Create a VI to acquire an analog signal from a source using USB6008. Also extract the information related to the various voltage parameters and frequency of this signal.			
	Unit 5	**Practical related to---**			**CO5**
		11. Create a VI to acquire an analog signal of LM35 temperature sensor on a DAQ signal accessory.. 12. Design a Virtual Resistance Meter. 13. Design a Virtual Sinusoidal Voltage Source. 14. Design a Virtual CRO.			
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	1.Jovitha Jerome, "Virtual Instrumentation and LABVIEW", PHI Learning			
	Other References	2. Technical Manuals for DAQ Modules, Advantech and National Instruments 3. NI USER MANUAL http://www.ni.com/pdf/manuals/376445b.pdf 4. www.ni.com			

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 008.1	1	2	2	2	2	1	1	2	1	2	-	2	2	2	1
CO008.2	3	2	1	2	3	1	2	2	1	1	-	2	2	2	2
CO008.3	3	2	3	2	3	2	2	2	1	2	-	2	2	2	2
CO008.4	2	2	2	2	1	2	2	2	2	2	-	3	3	2	2
CO008.5	2	3	3	2	2	2	2	2	2	2	-	3	3	2	2
CO008.6	2	3	3	2	3	2	2	2	2	3	2	3	3	2	3