SREE VIDYANIKETHAN ENGINEERING COLLEGE
(AUTONOMOUS)
SreeSainath Nagar, Tirupati

Department of Electrical and Electronics Engineering

Supporting Document for 1.1.2

Syllabus Revision carried out in 2019

Program: B.Tech.-Electrical and Electronics Engineering

Regulations: SVEC-19

This document details the following:

1. Courses where syllabus has been changed 20% and more.
2. Course-wise revised syllabus with changes highlighted.

Note: *For SVEC-19 revised syllabus, SVEC-16 (previous syllabus) is the reference.*

List of the courses where the syllabus content has been changed (20% and more)

S. No	Course code	Name of course	Percentage of content changed	Page number in which details are highlighted
1.	19BT1BS02	Biology for Engineers	100	4
2.	19BT10341	Basic Civil and Mechanical Engineering	100	6
3.	19BT10201	Basic Electrical and Electronics Engineering	100	8
4.	19BT10231	Basic Electrical and Electronics Engineering Lab	100	10
5.	19BT1AC01	Spoken English	100	12
6.	19BT10501	Programming for Problem Solving	100	14
7.	19BT10531	Programming for Problem Solving Lab	100	16
8.	19BT4BS01	Material Science	100	18
9.	19BT4HS12	Women Empowerment	100	20
10.	19BT40231	Digital Electronics Lab	100	22
11.	19BT40232	Electrical Engineering Workshop	100	24
12.	19BT315AC	Design Thinking	100	26
13.	19BT40403	Linear and Digital IC Applications	100	28
14.	19BT4HS05	Gender and Environment	100	30
15.	19BT4HS09	Life Skills	100	32
16.	19BT4HS11	Professional Ethics	100	34
17.	19BT40107	Sustainable Engineering	100	36
18.	19BT50206	Instrumentation	20	38
19.	19BT50208	Intellectual Property Rights	100	42
20.	19BT51041	PLC and SCADA	100	44
21.	19BT50231	Socially Relevant Project-I	100	46
22.	19BT61531	Internet of Things Lab	100	47
23.	19BT503AC	Foundations of Entrepreneurship	100	49
24.	19BT60204	High Voltage Engineering	20	51
25.	19BT60206	PIC Microcontrollers	100	55
26.	19BT60208	Distributed Generation and Microgrid	100	59
27.	19BT50406	FPGA Architectures and Applications	100	61
28.	19BT61003	Industrial Data Communications	100	63
29.	19BT60231	Electrical CAD Lab	100	65
30.	19BT60233	Socially Relevant Project-Ii	100	67
31.	19BT5MC01	Universal Human Values	100	68

S. No	Course code	Name of course	Percentage of content changed	Page number in which details are highlighted
32.	19BT60232	Electrical Power Systems Lab	75	70
33.	19BT70201	Solid State Drives	35	73
34.	19BT70204	Electric Vehicles	100	77
35.	19BT70205	Flexible AC Transmission System	20	79
36.	19BT70207	Soft Computing Techniques	20	83
37.	19BT70209	Power Electronics for Renewable Energy Systems	100	87
38.	19BT70233	Internship	100	89
39.	19BT702AC	Electrical Safety And Safety Management	100	90
40.	19BT70232	Power System Simulation Lab	42	92
		Average %**(A)**	88.3	-
		Total No. of Courses in the Program **(T)**	119	
		No. of Courses where syllabus (more than 20% content) has been changed **(N)**	40	
		Percentage of syllabus content change in the courses **(C)=(A x N)/100**	35.32	
		Percentage of Syllabus Content changed in the Program (P)= C/T *100	**29.68**	

DEAN (Academics)

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SREE VIDYANIKETHAN ENGINEERING COLLEGE
Sree Sainath Nagar, A. RANGAMPET
CHITTOOR (DT.)-517 102, A.P.

PRINCIPAL

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(AUTONOMOUS)
Sree Sainath Nagar, A. RANGAMPET
Chittoor (Dist.) - 517 102, A.P., INDIA.

I B. Tech - I Semester

(19BT1BS02) **BIOLOGY FOR ENGINEERS**

(Common to EEE, ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	2	-	-	2

PRE-REQUISITES: -

COURSE DESCRIPTION: Living Organisms; Proteins, Nucleic acids and Enzymes; Genetics and Molecular Biology; Recombinant DNA technology; Human Physiology and Applied Biology.

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

CO1. Apply the basic knowledge of biology to understand the significance of various biological techniques.

CO2. Identify the role of DNA in the molecular basis of information transfer and understand single gene disorders related to the health perspective.

CO3. Apply the basic knowledge of bio-analytical devices and methods to assess health issues.

DETAILED SYLLABUS:

UNIT-I: LIVING ORGANISMS (6 Periods)

Comparison of biological organisms with man-made systems, Classification of living organisms, Cellular basis of life, differences between prokaryotes and eukaryotes, classification on the basis of carbon and energy sources, molecular taxonomy.

UNIT-II: PROTEINS, NUCLEIC ACIDS AND ENZYMES (6 Periods)

Biomolecules, structure and functions of proteins and nucleic acids, Industrial applications of enzymes, Fermentation and its industrial applications.

UNIT-III: GENETICS AND MOLECULAR BIOLOGY (6 Periods)

Mendel's laws, single gene disorders in humans, Genetic code, DNA replication, Transcription, Translation.

UNIT-IV: RECOMBINANT DNA TECHNOLOGY (6 Periods)

Recombinant DNA Technology: recombinant vaccines, transgenic microbes, plants and animals, animal cloning, biosensors, biochips.

UNIT-V: HUMAN PHYSIOLOGY AND APPLIED BIOLOGY (6 Periods)

Fundamentals of Human physiology, neurons, synaptic and neuromuscular junctions, Introduction to EEG, DNA fingerprinting, DNA Micro array and Genomics.

Total Periods: 30

Topics for Self-study are provided in the Lesson Plan.

TEXT BOOKS:

1. Rajiv Singal, Gaurav Agarwal, *Biology for Engineers*, CBS, 2019.
2. S. Sing and T. Allen, *Biology for Engineers*, Vayu Education of India, 2014.

REFERENCE BOOKS:

1. B. Alberts, A. Johnson et al., *The molecular biology of the cell*, Garland Science, 6th edition, 2014.
2. A. T. Johnson, *Biology for Engineers*, CRC press, 2011.

ADDITIONAL LEARNING RESOURCES:

1. Structure and function of Proteins: https://nptel.ac.in/courses/104102016/16
2. Enzyme catalysis: https://nptel.ac.in/courses/103103026/module3/lec35/4.html
3. Biochips: https://nptel.ac.in/courses/112104029/3

I B.Tech – I Semester

(19BT10341) **BASIC CIVIL AND MECHANICAL ENGINEERING**

(Common to EEE, ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Overview of Civil Engineering; Surveying, Civil Engineering Materials, Mechanics of Materials, Building Components, Civil Engineering Infrastructure; Overview of Basic Mechanical Engineering; Internal Combustion Engines and Turbines, Mechanical Power Transmission Systems, Manufacturing Processes, Machining Processes, Non-Conventional Machining.

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

CO1. Apply the basic principles of civil engineering, Techniques and tools for analyzing civil structures and solve related problems.

CO2. Describe the working of principles of basic mechanical engineering and solve problems related to it.

DETAILED SYLLABUS:

Part – A: CIVIL ENGINEERING

UNIT–I: SURVEYING AND CIVIL ENGINEERING MATERIALS (10 Periods)

Overview of Civil Engineering: Civil Engineering contributions to the welfare of society, specialized sub disciplines in Civil Engineering.

Surveying: Objectives, classification and principles; Measurements – distances, angles, levels, areas and volumes; contouring; Illustrative examples.

Civil Engineering Materials: Bricks, stones, concrete, steel, glass, timber, composite materials.

Mechanics of Materials: Forces, system of forces, laws of mechanics ,moment of a force, equilibrium, resultant, Internal and External forces, Stress, Strain, Hooke's law and Elasticity.

UNIT–II: BUILDING COMPONENTS AND CIVIL ENGINEERING INFRASTRUCTURE (8 Periods)

BUILDING COMPONENTS:

Sub structure - Types of foundations, Bearing capacity and settlement, Requirement of good foundations.

Superstructure - Civil engineering construction - Brick masonry, Stone masonry, Beams, Columns, Lintels, Roofs, Floors, Stairs, Building bye-laws - bye-laws floor area, carpet area and floor space index, basics of interior design and landscaping.

Civil Engineering Infrastructure - Types of Bridges and Dams, Water supply and Sanitary systems, Rainwater harvesting, Types of Highways and Railways, Ports and Harbours.

Part – B: MECHANICAL ENGINEERING

UNIT–III: INTERNAL COMBUSTION ENGINES, TURBINES AND PUMPS

(9 Periods)

Overview of Mechanical Engineering: Introduction to Mechanical Engineering**,** specialized sub disciplines in Mechanical Engineering.

Internal Combustion Engines - Classification – Working principle of Petrol and Diesel Engines – Four stroke and two stroke engines – Comparison of four stroke and two stroke engines.

Turbines and Pumps – Classifications of Steam turbines - Impulse turbine, Reaction turbines; Working principle of Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps.

UNIT–IV: MECHANICAL POWER TRANSMISSION SYSTEMS (9 Periods)

Power Transmission Systems: Belt, rope and chain drives, Gears and Transmission screw.

Power transmission by belts: Classification of belts, Length of the Belt (Open and Crossed-Belt Drives), Power Transmitted by Belt Drive, Tension due to Centrifugal Forces, Initial Tension, Maximum Power Transmitted.

Power transmission by Gear train: Gear terminology, Classification of gears, Gear train- Simple Gear Train and Compound Gear Train, Power Transmitted by Simple Gear Train.

UNIT–V: MANUFACTURING PROCESSES (9 Periods)

Manufacturing processes: Elementary ideas of Casting, Forging, Rolling, Welding, Soldering and Brazing.

Machining processes- Lathe-Turning, Taper turning, Thread cutting, Shaping, Drilling, Grinding, Milling (simple sketches and short notes).

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. Shanmugam G and Palanichamy MS, *Basic Civil and Mechanical Engineering*, Tata McGraw Hill PublishingCo.,NewDelhi, 1st edition 2018.
2. R. Vaishnavi, Prof. M. Prabhakaran & Prof. V. Vijayan, *Basic Civil and Mechanical Engineering*, S.CHAND Publications, 2nd edition, 2013.
3. B.C Punmia, Ashok Kumar Jain, Arun kumar Jain, *Surveying (vol-I),* Laxmi publications, 16th edition, 2005.
4. B.C Punmia, Ashok Kumar Jain, Arun kumar Jain, *Building Construction,* Laxmi publications, 10th edition, 2008.

REFERENCES BOOKS:

1. Seetharaman S., *Basic Civil Engineering*, Anuradha Agencies, 2005.
2. Ramamrutham S., *Basic Civil Engineering*, Dhanpat Rai Publishing Co.(P) Ltd.1999.
3. Kalpakjian, Serope, *Manufacturing Engineering and Technology,* Pearson Education, 7th edition, 2014.
4. Prabhu.T.J, Jai Ganesh. V and Jebaraj.S, *Basic Mechanical Engineering*, Scitech Publications, Chennai, 2000.
5. Pravin Kumar, *Basic Mechanical Engineering* Pearson Education, 1st edition, 2013.

I B. Tech. – I Semester

(19BT10201) **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**

(Common to EEE, ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Principles of Electrical Systems; AC Machines; Semiconductor Devices and Op-Amps.

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

CO1. Analyze electrical circuits by applying the conceptual knowledge of circuit elements.

CO2. Demonstrate knowledge on various generation technologies, protection devices, safety procedures and BEE standards.

CO3. Demonstrate knowledge on characteristics and applications of transformers and AC machines.

CO4. Demonstrate knowledge on characteristics and applications of diode, BJT and Op-amps.

DETAILED SYLLABUS:

UNIT-I: PRINCIPLES OF ELECTRICAL SYSTEMS-I (9 Periods)

Basic electrical sources: DC-Battery, AC sources–Single loop generator; Single phase and three phase supply; Electrical circuit elements (R, L and C), Ohm's law, Kirchhoff's laws, Representation of sinusoidal waveforms, peak and RMS values, phasor representation, reactive power, apparent power, real power, energy and power factor.

UNIT-II: PRINCIPLES OF ELECTRICAL SYSTEMS-II (9 Periods)

Significance of Power factor and power factor correction, most economical power factor. Typical layout of electrical grid; Typical layout and operation of Hydro, Thermal and Solar Power Plants; Fuse, circuit breaker (MCB, MCCB, RCCB, ELCB), relay (elementary treatment); Inverter and UPS (block diagram approach only). Earthing – importance of earthing, pipe earthing and plate earthing; Safety measures. Energy Efficiency (Star rating) standards by BEE.

UNIT-III: TRANSFORMERS AND AC MACHINES (9 Periods)

Construction and working of a single phase transformer, EMF Equation; Construction and working of three phase induction motor, torque equation, torque-slip characteristics, applications; construction and working of a resistor start &capacitor start and run single phase induction motor, applications; Construction and working of synchronous machine, applications.

UNIT-IV: SEMICONDUCTOR DEVICES (10 Periods)

PN Junction diode, Characteristics, applications - half wave and full wave rectifier. Zener diode, characteristics, application–Regulator. BJT- operation, configurations, characteristics, applications - switch and amplifier.

UNIT-V: OP-AMPS (8 Periods)

Operational Amplifier: Block diagram of Op-Amp, equivalent circuit, Op-Amp AC and DC Characteristics, Inverting and Non-Inverting modes. Applications - Adder, Comparator, Integrator and Differentiator.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. Ashfaq Hussain*, Fundamentals of Electrical Engineering,* Dhanpatrai & Co. (P) Ltd., *3rd* edition, New Delhi, 2009.
2. R. L. Boylestad and Louis Nashelsky, *Electronics Devices and Circuits*, PHI, 11th edition, 2009.

REFERENCE BOOKS:

1. M.S. Naidu, S. Kamakshaiah, *Introduction to Electrical Engineering,* Tata McGraw-Hill Education, New Delhi, 2007.
2. D. Roy Chowdhury, *Linear Integrated Circuits*, New Age International Pvt. Ltd., 4th edition, 2011.

I B. Tech. – I Semester

(19BT10231) **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB**

(Common to EEE, ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A course onPhysics at intermediate level.

COURSE DESCREPTION: Practical investigations on Electrical circuits, AC Machines, Semiconductor Devices and Op-Amps.

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

CO1. Analyze, measure, interpret and validate the practical observations by applying the fundamental knowledge of electrical circuits, machines and electronic devices.

CO2. Design Op-amp based amplifier, voltage summer and integrator circuits for desired specifications.

CO3. Work independently and in teams to solve problems with effective communication.

List of Experiments: Minimum **Ten** experiments are to be conducted.

1. Measurement of electrical quantities (AC & DC) using Voltmeter, Ammeter and Wattmeter.
2. Verification of Ohm's law and Kirchhoff's laws.
3. Circuit
   (a) With one lamp controlled by one switch and provision of 2-pin or 3-pin socket PVC surface conduit system.
   (b) With two lamps controlled by two switches with PVC surface conduit system.
   (c) For Stair case wiring and Godown wiring.
4. Measurement of Power factor and it's improvement.
5. Load test on 1-Phase Transformer.
6. Brake test on 3-Phase Induction Motor.
7. Brake test on 1- phase induction motor.
8. VI Characteristics of PN and Zener Diodes.
9. Ripple factor and load regulations of rectifier with and without filters.
10. Input and output characteristics of CE configuration.
11. Design of inverting and non-inverting amplifiers using op-amp.
12. Design of voltage summer and integrator using op-amp.
13. Soldering practice.

REFERENCES BOOKS/ LAB MANUALS:

1. P. S. Dhogal, *Basic Practicals in Electrical Engineering*, Standard Publishers, 2004.
2. Yannis Tsividis, *A First Lab in Circuits and Electronics*, Wiley, 1st edition, 2001.

ADDITIONAL LEARNING RESOURCES:

1. www.vlab.co.in, Virtual Electric Circuits Lab, A initiative of MHRD under NMEICT.
2. www.vlab.co.in, Basic Electronics Lab, A initiative of MHRD under NMEICT.
3. https://nptel.ac.in/courses/117106108/
4. https://ocw.mit.edu/high-school/physics/exam-prep/electric-circuits/
5. https://nptel.ac.in/courses/108105017/
6. https://nptel.ac.in/courses/108108112/
7. https://nptel.ac.in/courses/117107094/

I B. Tech. – I Semester

(19BT1AC01) **SPOKEN ENGLISH**

(Audit Course)

(Common to EEE, ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	-	-	2	-	-	-

PRE-REQUISITES: -

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

CO1. Demonstrate knowledge of grammar and vocabulary in writing effective formal letters and e-mails.

CO2. Communicate effectively by applying appropriate speaking and writing techniques by examining and applying functional English.

DETAILED SYLLABUS:

UNIT-I: FUNCTIONAL ENGLISH (6 Periods)

Introduction - Functional Spoken English; Just a Minute; **Listening – Speaking:** Do's and Don'ts; **Expressing:** Ability/ Admiration/ Agreement/ Anger/ Annoyance/ Appreciation/ Pleasure/ Sarcasm/ Satisfaction/ Surprise/ Approval/ Capability/ Certainty/ Condolences/ Doubt/ Fear/ Gratitude/ Possibility/ Worry; **Asking for:** Advice/ Clarification/ Direction/ Information/ Permission/ Predictions/ a recommendation.

UNIT-II: VOCABULARY BUILDING (6 Periods)

Vocabulary for day-to-day conversations; Introduction: Vegetables/ Groceries/ Fruits/ Weather; Parts of a Human body/ Dresses/ Furniture/ Relations; Birds/ Cries of Animals; Food/ Hospitality/ Houses/ Rooms/ Tools; Airport/ News Paper/ Books/ Gems; Corporate Vocabulary/ Jobs/ Occupations/ Diseases; British/ American spelling; Slang Words and Technical Jargon.

UNIT-III: FUNCTIONAL GRAMMAR - I (6 Periods)

English Grammar and the Indian Student; Introduction: Parts of Speech, Verb forms; Tenses; Voice; Speech.

UNIT-IV: FUNCTIONAL GRAMMAR – II (6 periods)

Universal Auxiliaries; Sentence making for an effective communication; Sentence Structure -WH- Questions - How to frame Questions and give answers; Question Tags; Subject and verb agreement; Spotting Errors.

UNIT-V: COMMUNICATION SKILLS (6 Periods)

Polite, Courteous and diplomatic terms; Useful daily expressions; Courtesy, Good manners and Etiquette; Conversation Techniques; Narrating/ Reading/ Listening to stories; Telling Stories.

Total Periods: 30

TEXT BOOKS:

1. L. Adinarayana and V. Prakasam, *Spoken English*, Neelkamal Publications Pvt. Ltd., New Delhi, 2008
2. Ram Bhasker Raju, *The Complete Book on Spoken English*, Goutham Buddha Publications, Hyderabad, 2002.

REFERENCE BOOKS:

1. Sabina Pillai, *Spoken English for my World,* Oxford University Press, New Delhi, 2016.
2. K. R. Lakshminarayanan, *Speak in English,* Scitech Publications, Chennai, 2009.

ADDITIONAL LEARNING RESOURCES:

1. https://www.britishcouncil.in/programmes/english-partnerships/state/skills-projects/AP-English-Skills.
2. https://www.fluentu.com/blog/english/websites-to-learn-english/

I B. Tech. – II Semester

(19BT10501) **PROGRAMMING FOR PROBLEM SOLVING**

(Common to EEE, ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	1	-	4

PRE-REQUISITES: A course on Basic Mathematics.

COURSE DESCRIPTION: Introduction to problem solving approach, Introduction to Python programming, control structures, sequences, sets, Dictionaries, Implementation of Data structures using Python, Modular programming, file handling, Data representation and Visualization.

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

CO1. Demonstrate knowledge on Python constructs to solve basic problems.

CO2. Develop and use Python modules to provide solutions to problems.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO PROBLEM SOLVING AND PYTHON PROGRAMMING (10 Periods)

Problem Solving Aspect: top-down design, implementation of algorithms, building blocks of flow charts, program verification and efficiency of algorithms.

Python Programming: tokens, literals, identifiers, keywords, special symbols and operators; fundamental data types, expressions, type conversions, handling Input and output in Python.

UNIT-II: CONTROL STRUCTURES (8 Periods)

Selection Statements: if statement, if-else statement, if-elif-else statement, nested-if statement.

Iterative Statements: while loop, for loop, break statement, continue statement, pass and else statements used with loops.

UNIT-III: SEQUENCES, SETS, DICTIONARIES AND DATA STRUCTURES (9 Periods)

Sequences: Lists and operations - creating, inserting elements, updating elements, deleting elements, searching and sorting, list comprehensions, nested lists; **tuples -** creating, searching and sorting, nested tuples; **strings -** Initializing a string and string operations, string handling methods, string formatting; **sets -** set creation and operations; **dictionaries -** operations on dictionaries, dictionary methods, sorting elements using lambdas.

Data structures: Stacks - push, pop, peek and display operations on stack, applications of stack; **Queues –** enqueue, dequeue and display operations on queue, applications of queues.

UNIT-IV: MODULAR PROGRAMMING AND FILE HANDLING (10 Periods)

Modular Programming: need for functions, function definition, function call, variable scope and lifetime, return statement, positional arguments, keyword arguments, default arguments and variable-length arguments, recursive functions; Modules - math, NumPy, date and time.
File Handling: types of files, opening and closing files, reading and writing data.

UNIT-V: DATA REPRESENTATION AND VISUALIZATION (8 Periods)

Pandas: creating data frame, reading data from CSV files, indexing and selecting data, dealing with rows and columns; Visualization - bar plots, histogram, Scatter Plot.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. R. Nageswara Rao, *Core Python Programming,* 2nd edition, Dreamtech Press, 2018.
2. R. G. Dromey, *How to solve it by Computer,* Pearson, 2006.

REFERENCE BOOKS:

1. Reema Thareja, *Python Programming using Problem Solving Approach*, 1st edition, Oxford University Press, 2017.
2. Charles Dierbach, *Introduction to Computer Science using Python: A Computational Problem-Solving Focus*, Wiley India, 2016.

I B. Tech. – II Semester

(19BT10531) PROGRAMMING FOR PROBLEM SOLVING LAB

(Common to EEE, ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A course on Basic Mathematics

COURSE DESCRIPTION: The course is designed to provide hands on practice on Scratch programming and python programming for problem solving.

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

CO1. Develop scripts using Scratch tool to simulate simple problems.
CO2. Apply Python Constructs and Modules to develop solutions for real-life problems.
CO3. Function effectively as an individual and in team to foster knowledge and creativity.
CO4. Write and present a substantial technical report/ document effectively.

PRACTICAL EXERCISES:

1) a) Design a script in Scratch to simulate Airplane for take-off and land.
   b) Design a script in Scratch to make a sprite to ask the user to enter two different numbers and an arithmetic operator and then calculate and display the result.

2) a) Design a script in Scratch to calculate factorial of a given number.
   b) Design a script in Scratch to simulate Maze game. (Hint: To get Maze images refer http://inventwithScratch.com/downloads/)

3) a) Write a python script to read two integer numbers and perform arithmetic operations.
   b) Write a python script to evaluate following expressions by considering necessary inputs.
   i) $ax^2 + bx + c$ ii) $ax^5 + bx^3 + c$ iii) (ax + b) / (ax - b) iv) x - a / b + c

4) a) Write a python script to convert given decimal number into octal, hexa decimal and binary.
   b) Write a python script to read four integer values separated with commas and display the sum of those four numbers.
   c) Write a python script to print "SVEC" with prefix of ten spaces by using format().

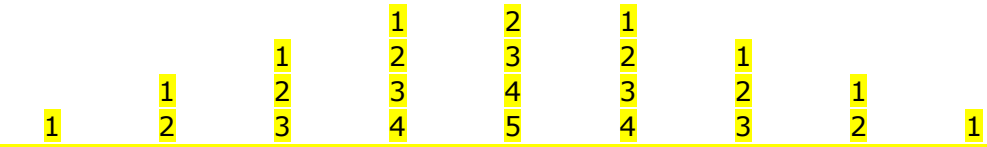
5) a) Write a python script to calculate electricity bill based on following slab rates.

Consumption units	**Rate (in Rupees/Unit)**
0-100	4
101-150	4.6
151-200	5.2
201-300	6.3
Above 300	8

(Hint: To get Consumption units take current Meter reading, old meter reading from the user as input)

   b) Print the following pattern using python script.

1



6) a) Write a python script to read *N* student details like name, roll number, branch and age. Sort the student details based on their names and display.

b) Write a python script to delete duplicate strings from a list of strings. (Insertion order should maintain after deleting duplicate string).

c) Write a python script to read N number of student details into nested list and convert that as a nested dictionary.

7) a) Design a function that can perform sum of two or three or four numbers.

b) Write a python script to implement towers of Hanoi problem.

c) Write a Python function primesquare(l) that takes a nonempty list of integers and returns True if the elements of l alternate between perfect squares and prime numbers, and returns False otherwise. Note that the alternating sequence of squares and primes may begin with a square or with a prime. Here are some examples to show how your function should work.

```
>>>primesquare([4])
True
>>>primesquare([4,5,16,101,64])
True
>>>primesquare([5,16,101,36,27])
False
```

8) a) Write a python script to perform arithmetic operations on numpyarrays.

b) Write a python script to perform following matrix operations using numpy.
i) Dot product ii) Matrix product iii) Determinant iv) Inverse

9) a) Write a python script to Create Pandas dataframe using list of lists.

b) Write a python script to load data from a CSV file into a Pandas DataFrame and perform basic operations on it.

10) a) Draw a Scatter Plot by considering an appropriate data set.

b) Draw histograms by considering an appropriate data set.

11) **Mini Project-1**

12) **Mini Project-2**

TEXT BOOK:

1. R. Nageswara Rao, *Core Python Programming*, 2nd edition, Dreamtech Press, 2018.

II B. Tech. – II Semester

(19BT4BS01) **MATERIAL SCIENCE**

(Open Elective-1)

(Common EEE, ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Introduction to Material Science and Engineering; Composite Materials; Smart Materials; Nano and Biomimetic Materials; Emerging Materials.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1. Attain the basic knowledge on composites, smart materials, biomimetic materials and nano materials.

CO2. Demonstrate essential information about structure and properties of various composites used in various engineering applications.

CO3. Understand the basic properties of electro-rheostatic, magneto-rheostatic and shape memory alloys used in device applications.

CO4. Accomplish the basic knowledge in nano materials to familiarize various nano structured device applications.

CO5. Outline the processing and properties of functionally graded materials and identify its applications in various fields.

DETAILED SYLLABUS:

UNIT- I: INTRODUCTION TO MATERIAL SCIENCE AND ENGINEERING (8 Periods)

Introduction - historical perspective - material science and engineering, classification of materials (metals, ceramics, polymers and composites) and advanced materials and their applications (biomaterials, smart materials and nano materials), modern materials needs. Processing, properties and applications of metals, polymers and ceramics (Qualitative).

UNIT- II: COMPOSITE MATERIALS (10 Periods)

Composite Materials - Classification, Laminated composites and Reinforced composite materials – Classification, structure and properties of sandwich composites – applications (commercial Aircraft, Marine Grade Sandwich, Automobile Grade Sandwich and Wind Turbine Blades), properties and applications of Nano composites - Advantages and Limitations of composites.

UNIT- III: SMART MATERIALS (7 Periods)

Classification of smart materials -Magneto-rheostatic (MR) and Electro-rheostatic (ER) materials - Shape Memory Alloys (SMA)- characteristics, Shape memory effect applications in different fields, advances in smart materials.

UNIT – IV: NANO AND BIOMIMETIC MATERIALS (10 Periods)

Nanomaterials: Introduction, Low dimensional structures and energy quantization. Fabrication of nano materials - Lithographic technique using photons, metallic, semiconducting and magnetic properties of nano materials and applications (renewable energy and nano electro-mechanical systems (NEMS)).
Biomimetic materials – Introduction- classification and their applications (Lotus effect, Dolphin sound wave technology and viper as a model in defence)

UNIT- V: EMERGING MATERIALS (10 Periods)
Functionally graded materials (FGM) - Types, processing, properties and potential applications, functionally graded fibre cement – structural material, Functionally Graded Nanoelectronic, Optoelectronic and Thermoelectric Materials (Qualitative) and its applications.

Total Periods: 45

Topics for Self Study are provided in the Lesson Plan

TEXT BOOKS:

1. William D Callister, David G Rethwisch, *Materials Science and Engineering*, Wiley, 9th edition, 2014.
2. K M Gupta, *Engineering Materials – Research, Applications and Advances*, CRC press (Taylor & Francis group), 2015.

REFERENCE BOOKS:

1. Sulabha K Kulkarni, *Nanotechnology: Principles and practices*, Springer, 9th edition, 2014.
2. Charles P. Poole and Frank J. Owens, *Introduction to Nanotechnology*, Wiley-Interscience, May 2003.
3. Sulabha K Kulkarni, *Nanotechnology: Principles and Practices,* Springer, 3rd edition, 2014.

II B. Tech. - II Semester

(19BT4HS12) **WOMEN EMPOWERMENT**

(Open Elective-1)

(Common to EEE, ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Concept & Framework, Status of Women, Women's Right to work, International Women's Decade, and Women Entrepreneurship.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1. Demonstrate the characteristics of empowered women, their achievements, and frame work for women empowerment, legal laws, and political status of women.

CO2. Apply the knowledge of women rights to address various societal issues and obstacles in different fields including science and technology.

CO3. Understand the significance of participation in policy debates, National conferences and common forums for women's' equality and development.

CO4. Analyze the concept of women entrepreneurship, government schemes and entrepreneurial challenges and opportunities.

DETAILED SYLLABUS:

UNIT -I: CONCEPT & FRAMEWORK (9 Periods)

Introduction- Empowered Women's Characteristics- Achievements of Women's Empowerment **Concept of Empowerment:** Meaning& Concept- Generalizations about Empowerment -Empowerment Propositions - Choices women can make for empowerment - Women's participation in decision making, development process & in Governance. **Framework for Women's Empowerment** - Five levels of equality- Tenets of Empowerment- Elements - Phases and aspects - Techniques - Categories and Models – Approaches.

UNIT- II: STATUS OF WOMEN (9 Periods)

Legal Status: Present Scenario- Call for Social change- Significant trends - Legal & Schemes - Personal Law- Joint Family- Criminal Law- Shift towards Dowry - Deterrent Punishment - Criminal Law(II Amendment) - Discrimination in Employment

Political Status: Present Scenario - Political Participation & its Nature- Socio-economic Characteristics - Political Mobilization: Mass Media - Campaign Exposure - Group Orientation - Awareness of issues and participation - Progress & Future Thrust.

UNIT -III: WOMEN'S RIGHT TO WORK (9 Periods)

Introduction- Present Scenario - Changes in Policy &Programme - National Plan of Action- Women's Cells and Bureau - Increase in work participation rate- Discrimination in labour market - Women in unorganized sector - Issues and Obstacles- Women in Education - Women in Science & Technology - **Case Study:** Linking Education to Women's Access to resources.

UNIT- IV: WOMEN'S PARTICIPATORY DEVELOPMENT (9 Periods)

Dynamics of social change- conscious participation - Information Explosion - Organized Articulation - National Conference - Common Forums - Participatory Development - New Issues Identified - Role of other Institutions.

UNIT- V: WOMEN ENTREPRENEURSHIP (9 Periods)

Introduction–Definition-Concept- Traits of women Entrepreneurs- Role of women Entrepreneurs in India -Reasons of Women Entrepreneurship- Government schemes & Financial Institutions to develop Women Entrepreneurs - Key policy recommendations - Project Planning-Suggestions and measures to strengthen women entrepreneurship - Growth & Future challenges - Training and Opportunities - **Case Study:** Training Women as Hand-pump Mechanics- **Case Study** : Literacy for Empowering Craftswomen

Total Periods: 45

Topics for Self Study are provided in the Lesson Plan

TEXT BOOKS:

1. NayakSarojini, Nair Jeevan(2017), "Women's Empowerment in India". Pointer Publishers, Jaipur
2. SahaySushama(2013), "Women and Empowerment" Discovery Publishing House, New Delhi.

REFERENCE BOOKS:

1. Baluchamy. S (2010), "Women's Empowerment of Women". Pointer Publishers, Jaipur.
2. KhobragadeGrishma (2020), "Women's Empowerment: Challenges and Strategies Empowering Indian Women, BooksclinicPublishing,Chhattisgarh.
3. https://www.economicsdiscussion.net/entrepreneurship/women-entrepreneurs-in-india
4. https://www.businessmanagementideas.com/entrepreneurship-2/women-entrepreneurs

II B. Tech. – II Semester
(19BT40231) **DIGITAL ELECTRONICS LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A course on Electronic devices and circuits.

COURSE DESCRIPTION: Practical investigations through simulation on logic gates; minimization of circuits; design of various combinational and sequential logic circuits.

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

CO1. Perform various arithmetic operations on number systems and analyze simplification methods in logical circuits, to perform desired logical operations optimally using logical gates.
CO2. Design combinational logical circuits for performing various arithmetic operations and data encoding and decoding for engineering applications.
CO3. Analyze various sequential circuits for realizing counters and registers using flip-flops.
CO4. Work independently or in teams to solve problems with effective communication.

Practical Exercises/List of Experiments:

Part-A: Analytical Exercises:
1. Number systems and their conversions.
2. Arithmetic operations on weighted non-weighted numbers.

Part-B: Any EIGHT experiments are to be conducted from the following
1. Verification of logic gates.
2. Minimization of logic circuits using K-Map.
3. Design of half adder & subtractor and full adder & subtractor.
4. Design of 4 bit comparator.
5. Design of 3 to 8 decoder & 8 to 3 encoder for an engineering application.
6. Design of 8 to 1 multiplexer.
7. Design of 4 bit
    a. binary adder and
    b. binary adder-subtractor
8. Design of 4 bit binary in crementer using 4 half adders.
9. Design of 4-bit combinational circuit shifter.
10. Design of BCD to seven segment decoder.
11. Design of 1 stage of logic circuit using logical gates and 4x1 multiplexer.
12. Design SR, JK, T and D Flip flops using logic gates.
13. Design a ring counter using flip flops.

TEXT BOOKS:

1. M. Morris Mano, *Digital Design*, Pearson education, 5th edition, 2013.

REFERENCE BOOKS

1. Anand Kumar, *Switching Theory and Logic Design*, PHI, 2008
2. ZviKohavi and NirahK.Jha, *Switching theory and Finite Automata Theory*, Tata McGraw-Hill, 2nd edition, 1978

ADDITIONAL LEARNING RESOURCES:

1. http://cse15-iiith.vlabs.ac.in/
2. http://vlabs.iitb.ac.in/vlabs-dev/labs/dldgates/labs/index.php

II B.Tech. – II Semester
(19BT40232) ELECTRICAL ENGINEERING WORKSHOP

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	2

PRE-REQUISITES: Courses on Electric Circuits Lab and Electrical Machines-I Lab.

COURSE DESCRIPTION: Exercises on assessing of electrical parameters and functionality of electrical apparatus; Design and estimation of electrical systems, and protection system for electrical devices and systems; Troubleshooting of electrical appliances and Calibration of measuring instruments.

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

CO1. Evaluate various electrical quantities using modern utilities, assess the functionality of various devices and analyze the practical observations for calibration.

CO2. Design operating equipment for the various electrical appliances for sustainable operation, and estimate typical house wiring system following the code of conduct and realize the technological developments in design of operating equipment.

CO3. Analyze various electrical appliances for troubleshooting and maintenance, and protection schemes for safety of personals and apparatus, and realize the technological developments in protection.

CO4. Work independently or in teams to solve problems with effective communication.

List of Exercises/List of Experiments: Minimum **Ten** experiments are to be conducted.

1. Measurement of electrical quantities using MFM.
2. Operation and testing of Fuse, MCB and Relays.
3. Calibration of measuring instruments.
4. Practice bridges for measurement of circuit element parameters.
5. Design of starter for DC Motors.
6. Practicing and testing of DOL starter for Induction Motors.
7. Design of Timers for operation of electrical appliances.
8. Design and estimation of wiring for a typical house.
9. Troubleshooting of electrical appliances —Fan, Mixer/grinder, Water heater/Iron box.
10. Practicing plate and pipe earthing system.
11. Protection scheme for a 3-Phase Induction Motor. (Single Phasing, OL, Dry Run)
12. Installation and maintenance of UPS.

REFERENCE BOOKS/LABORATORY MANUALS:

1. http://www.srisaiuniversity.org/downloads/files/n59b79d6117211.pdf
2. https://www.gtu.ac.in/syllabus/NEW_Diploma/sem-1/Pdf%20Content%20detailing/3312401Electrical%20&%20Electronic%20Workshop.pdf

ADDITIONAL LEARNING RESOURCES:

1. https://www.youtube.com/watch?v=ax-KUL17YJ4
2. https://www.youtube.com/watch?v=TJpQ3fZIt20
3. https://www.youtube.com/watch?v=6RJnsa83xTA
4. https://www.youtube.com/watch?v=w2M4tS2OMsU
5. https://www.youtube.com/watch?v=DzVJiSQNbew

II B. Tech. – II Semester

(19BT315AC) **DESIGN THINKING**
(Audit Course)
(Common to EEE, ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	-	-	2	-	-	-

PRE-REQUISITES: -

COURSE DESCRIPTION: Design thinking process, Design thinking phases, empathy tools; Idea generation, visualizing and empathizing; Fidelity for prototypes, prototyping; prototyping for physical products.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1. Analyze design thinking concepts and principles to perform human centered design process for creative problem solving.
CO2. Create empathy maps to visualize user attitudes and behavior for gaining insights of customers.
CO3. Develop innovative products or services for a customer base using ideation techniques.
CO4. Build prototypes for complex problems using gathered user requirements.
CO5. Apply design thinking tools techniques to produce good design and relevant products or services for a specific target market.
CO6. Improve prototype by testing it with a specific set of users for making it sustainable by following ethics.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO DESIGN THINKING (6 Periods)
Design Thinking Process: Types of the thinking process, Common methods to change the human thinking process, Design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs Design thinking, Problem solving, Understanding design thinking and its process model, Design thinking tools.

UNIT-II: EMPATHIZE (6 Periods)
Design thinking phases, How to empathize, Role of empathy in design thinking, purpose of empathy maps, Things to be done prior to empathy mapping, Activities during and after the session, Understanding empathy tools : Customer Journey Map, Personas.

UNIT-III: IDEATION (6 Periods)
Challenges in idea generation, need for systematic method to connect to user, Visualize, Empathize, and Ideate method, Importance of visualizing and empathizing before ideating, Applying the method, Ideation Tools: How Might We? (HMW), Story board, Brainstorming.

UNIT-IV: PROTOTYPING (6 Periods)

What is a prototype? - Prototyping as a mindset, prototype examples, prototyping for products; Why we prototype? Fidelity for prototypes, Process of prototyping- Minimum Viable prototype

UNIT-V: TESTING PROTOTYPES (6 Periods)

Prototyping for digital products: What's unique for digital, Preparation; Prototyping for physical products: What's unique for physical products, Preparation; Testing prototypes with users.

Total Periods: 30

Topics for Self-Study are provided in Lesson Plan

TEXTBOOK:

1. S.Salivahanan, S.Suresh Kumar, D. Praveen Sam, "*Introduction to Design Thinking*" ,Tata McGraw Hill, First Edition,2019.
2. Kathryn McElroy, "*Prototyping for Designers: Developing the best Digital and Physical Products*", O'Reilly,2017.

REFERENCE BOOKS

1. **Michael G. Luchs, Scott Swan , Abbie Griffin, *"Design Thinking – New Product Essentials from PDMA"*, Wiley, 2015.**
2. Vijay Kumar, "101 Design Methods: A Structured Approach for Driving Innovation in Your Organization", John Wiley & Sons, 2012.

ADDITIONAL LEARNING RESOURCES:

1. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process
2. https://www.ibm.com/design/thinking/page/toolkit
3. https://www.interaction-design.org/literature/article/define-and-frame-your-design-challenge-by-creating-your-point-of-view-and-ask-how-might-we
4. https://www.culturepartnership.eu/en/article/ten-tools-for-design-thinking
5. https://nptel.ac.in/courses/109/104/109104109/
6. https://nptel.ac.in/courses/110106124/

III B. Tech. – I Semester

(19BT40403) LINEAR AND DIGITAL IC APPLICATIONS

(Common to ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Analog Electronics and Digital Electronics.

COURSE DESCRIPTION: Linear & Non-Linear Applications of Op-Amp; IC 555 timer and phase locked loops; Application of PLL; filters; A-D & D-A Converters; CMOS and Bipolar Logic Interfacing; HDL with combinational and sequential logic design.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1. design different applications of op-amp, timer circuits and analyze PLL for specified applications.
CO2. design active filters using op-amp for audio processing applications.
CO3. analyze different analog to digital and digital to analog converters for data acquisition system.
CO4. analyze Verilog HDL capabilities to model digital circuits.
CO5. model combinational and sequential ICs using Verilog HDL to synthesize digital Circuits.

DETAILED SYLLABUS:

UNIT- I:OP-AMP APPLICATIONS, IC555 TIMERS & PLL (11 Periods)
Review of operational Amplifiers, Instrumentation amplifier, Log and Antilog amplifiers, RC phase shift oscillator.
Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications. PLL - Introduction, block schematic, principles and description of individual blocks, Voltage Controlled Oscillator (IC 566).

UNIT- II: FILTERS &D-A AND A-D CONVERTERS (9 Periods)
Filters: First - order and second order LPF, HPF Butterworth Filters.
D-A Converter: Weighted resistor DAC, R-2R Ladder DAC.
A-D Converters: Flash type, Successive Approximation type and Dual slope ADC.

UNIT- III: Verilog HARDWARE DESCRIPTION LANGUAGE (8 Periods)
Introduction, Language Elements, operators, Expressions, Modeling-gate level modeling, data flow modeling, behavioral modeling, structural modeling.

UNIT-IV: COMBINATIONAL LOGIC DESIGN APPLICATIONS (8 Periods)
74x999 Adder and Subtractor, 74X138 3-to-8 Decoder,74x148 Priority Encoder,74x151 8X1 Multiplexer, 74x181 Arithmetic and Logic Unit,74x280 9-Bit Parity Generator, 74x85 4-bit Comparator, Barrel Shifter using 74x151 multiplexer, Simple Floating-Point Encoder, Dual priority Encoder, modeling of circuits by using Verilog HDL.

UNIT- V: SEQUENTIAL LOGIC DESIGN APPLICATIONS (9 Periods)

Flip-Flops- JK-74LS109 and D-74LS74. Counters - 74x163 binary counter, Modulo-11 & 193 counters with a counting sequence, Modulo-8 Binary counter, Excess 3 decimal Counter using 74X163,74x169 up/down counter, Self-Correcting Ring & Johnson Counter,3-bit LFSR Counter.74x194 universal shift register, Modeling of circuits using Verilog HDL.

Total Periods: *45*

Topics for Self-Study are provided in the Lesson Plan.

TEXT BOOKS:

1. D. Roy Chowdhury, *Linear Integrated Circuits*, New Age International (p) Ltd, 4th Edition, 2011.
2. John F. Wakerly, *Digital Design Principles & Practices*, Pearson Education Asia, 4th Edition, 2008.

REFERENCE BOOKS:

1. Ramakanth A. Gayakwad, *Op-Amps & Linear ICs*, PHI, 3rd Edition, 1998
2. J. Bhaskar, *A Verilog HDL Primer*, BS Publications, 2nd Edition, 2001

ADDITIONAL LEARNING RESOURCES:

1. https://www.coursera.org/learn/electronics
2. https://www.youtube.com/results?search_query=james+roberge

III B. Tech. – I Semester

(19BT4HS05) **GENDER AND ENVIRONMENT**

Open Elective-2

(Common to ECE, EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Gender and the environment relationship, Gendered Roles in the family & community, Gender and sustainable development, Gender in environmental justice, Gender &environmental security.

COURSE OUTCOMES: *After successful completion of the course, students will be able to:*

CO1. Apply the knowledge of gender & environment connections, key issues and topics within global environmental politics in environmental decision-making.

CO2. Comprehend the concepts of gender and sustainable development through debates, and policy documents.

CO3. Analyze the concept of environmental security and justice by identifying the sources of insecurity.

DETAILED SYLLABUS:

UNIT- I: GENDER ANDENVIRONMENT RELATIONSHIP (9 Periods)

Introduction–Gender and Environment–Development of gender roles–Society, gender & environment – Understanding environmental politics – Gender-environment connections–Eco-feminism - Cultural eco-feminism–Social eco-feminism - Feminist political ecology.

UNIT- II: GENDERED ROLES IN THE FAMILY & COMMUNITY (9 Periods)

Organization of the household – Domestic division of labour - Food: growing, harvesting, shopping, preparing, and cooking.

Gender & Power- Planning – Politics – NGO – Gendering of environmental protest – Environmental decision-making.

UNIT- III: GENDER ANDSUSTAINABLE DEVELOPMENT (9 Periods)

Concept of sustainability & its achievement – Concept of sustainable development – Ecological Modernization – Gender & sustainability debates – Gender & sustainable development debates - Gender in policy documents – Gender, poverty & equity in sustainable development.

UNIT- IV: GENDER IN ENVIRONMENTAL JUSTICE (9 Periods)

Normative Concerns (Fairness, Inequality & Justice) - Making sense of Environmental justice – Ecological debt, Transnational harm, & human rights – Ecological justice – Gender & Environmental Justice – Gender, Vulnerability & risk – Women in environmental justice movements – Knowledge & participation – Gender, sustainability & justice as guiding concepts.

UNIT-V: GENDER AND ENVIRONMENTAL SECURITY (9 Periods)

Connections between security & the environment – **Gender, environment & security**: Sustainability as security - poverty & insecurity – Insecurity as injustice – Competing ways of thinking security – Reflecting on sources of insecurity – **Case Study** – Food Security -**Case Study** – The impacts of natural disasters.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Nicole Detraz, *Gender and the Environment*, Polity Press, Cambridge, UK, 2017.
2. Susan Buckingham- Hatfield, *Gender and Environment*, Routledge, London, 2000.

REFERENCE BOOKS:

1. Promillakapur (ed). (2000). "*Empowering Indian Women*" Publication Division, Government of India, New Delhi.
2. Ronnie Vernooy, (Ed). (2006). "*Social and gender Analysis Natural Resource Management: Learning studies and lessons from Aisa*" Sage, New Delhi.
3. Swarup, Hemlata and Rajput, Pam. (2000). *Gender Dimensions of Environmental and Development Debate: The Indian Experience*" In SturatS. Nagel, (ed). "India"s Development and Public Policy", Ashgate, Burlington.

III B. Tech. – I Semester

(19BT4HS09) **LIFE SKILLS**

Open Elective-2

(Common to ECE, EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Positive attitude; Self-discovery-Interpersonal relationships; Cross-cultural communication; Core thinking-Problem solving and Decision making; Business presentations and Public speaking.

COURSE OUTCOMES: *After successful completion of the course, students will be able to:*

CO1. Gain knowledge in strategies involved in developing positive attitude, process of knowing oneself and managing effective interpersonal relationships.

CO2. Analyse problem solving strategies in Decision Making and SWOT analysis.

CO3. Communicate effectively with Engineering Community and Society by demonstrating presentation skills in professional arena.

DETAILED SYLLABUS:

UNIT- I: POSITIVE ATTITUDE (9 Periods)

Introduction, Features of attitudes, Formation of attitudes, Ways of changing attitude in a person, Attitude in a work place, Developing positive attitude, Obstacles in developing positive attitude, Measuring attitude.

UNIT- II: SELF DISCOVERY AND INTERPERSONAL RELATIONSHIPS (9 Periods)

Importance of knowing yourself, Process of knowing yourself, SWOT Analysis, Elements of attitude in interpersonal relationships, Methods to deal with different types of interpersonal relationship skills.

UNIT- III: CROSS-CULTURAL COMMUNICATION (9 Periods)

Different Communication Styles, Cultural variables, communication sensitivity and variables of national culture, Individual Cultural Variables, Cross-cultural Communication Strategies, Potential hot spots in cross-cultural communication, Cross-cultural communication – Basic Tips.

UNIT- IV: CORE THINKING, PROBLEM SOLVING AND DECISION MAKING (9 Periods)

Process of developing core thinking skills, Categories of thinking: Critical & Creative, Understanding problem solving, Cause of problems, Stages of problem solving, Methods of problem solving, Types of decision making.

UNIT- V: BUSINESS PRESENTATIONS AND PUBLIC SPEAKING (9 Periods)

Business presentations and speeches, structuring the material, Types of delivery, Guidelines for delivery, Effective sales presentation, Controlling nervousness and stage fright.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Dr. K. Alex (2018) *Soft Skills*, S. Chand and Company Limited, New Delhi.
2. Manmohan Joshi (2017) *Soft Skills*, bookboon.com, Bangalore.

REFERENCE BOOKS:

1. Meenakshi Raman and Prakash Singh (2013), *Business Communication*, Oxford University Press, New Delhi.
2. Jeff Butterfield (2011) *Soft Skills for Everyone*, Cengage Learning India Private Limited, Delhi.

III B. Tech. – I Semester

(19BT4HS11) **PROFESSIONAL ETHICS**

Open Elective-2

(Common to ECE, EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Engineering Ethics; Professional Ideals and Virtues; Engineering as Social Experimentation; Responsibilities and Rights; Global Issues.

COURSE OUTCOMES: *After successful completion of the course, students will be able to:*

CO1. Demonstrate knowledge in Engineering Ethics, Responsibilities and Rights.
CO2. Analyze the concepts of Engineering in Social Experimentation and Global Issues.
CO3. Apply the nuances of professional ideals at work place and in social context.

DETAILED SYLLABUS:

UNIT –I: ENGINEERING ETHICS (9 Periods)

Scope and aim of engineering ethics, Senses of engineering ethics, Variety of moral issues, Types of inquiry, Moral dilemmas, Moral autonomy-Kohlberg's theory, Gilligan's theory, Consensus and controversy.

UNIT-II: PROFESSIONAL IDEALS AND VIRTUES (8 Periods)

Theories about virtues, Professions, Professionalism, Characteristics, Expectations, Professional responsibility, Integrity, Self-respect, Sense of responsibility, Self-interest, Customs and religion, Self-interest and ethical egoism, Customs and ethical relativism, Religion and divine command ethics, Use of ethical theories, Resolving moral dilemmas and moral leadership.

UNIT- III: ENGINEERING AS SOCIAL EXPERIMENTATION (10 Periods)

Engineering as experimentation, Similarities to standard experiments, Learning from the past and knowledge gained, Engineers as responsible experimenters, Conscientiousness, Moral autonomy and accountability, The challenger case, Codes of ethics and limitations, Industrial standards, Problems with the law of engineering.

UNIT- IV: RESPONSIBILITIES AND RIGHTS (9 Periods)

Collegiality and loyalty, Respect for authority, Collective bargaining, Confidentiality, Conflict of interests, Occupational crime, Rights of engineers, Professional rights, Whistle-blowing, The BART case, Employee rights and discrimination.

UNIT-V: GLOBAL ISSUES (9 Periods)

Multinational corporations, Professional ethics, Environmental ethics, Computer ethics, Engineers as consultants, Witnesses, Advisors and Leaders, Engineers as Managers, Managerial ethics applied to Engineering Profession, moral leadership.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, *Ethics in Engineering*, Tata McGraw-Hill, 3rd edition, 2007.
2. Govindarajan, M., Nata Govindarajan, M., Natarajan, S. and Senthil kumar, V. S., *Engineering Ethics*, Prentice Hall of India, 2004.

REFERENCE BOOKS:

1. S. Kannan and K. Srilakshmi, *Human Values and Professional Ethics*, Taxmann Allied Services Pvt Ltd., 2009.
2. Edmund G. Seebauer and Robert L. Barry, *Fundamental of Ethics for Scientists and Engineers*, Oxford University Press, 2001.

III B. Tech. – I Semester

(19BT40107) **SUSTAINABLE ENGINEERING**

Open Elective-2

(Common to ECE, EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Principles of sustainability; Sustainability metrics and assessment tools; Sustainable engineering practices; Sustainable engineering applications; Sustainable urbanization and industrialization.

COURSE OUTCOMES: *After successful completion of the course, students will be able to:*

CO1. Analyze the principles of sustainability to solve complex environmental problems following relevant standards/protocols considering society, health, safety and environment.

CO2. Analyze sustainability metrics and assessment tools to solve complex environmental problems following relevant standards and emerging trends considering society, health, safety, environment and economics besides communicating effectively in graphical form.

CO3. Analyze sustainable engineering practices to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.

CO4. Design sustainable engineering applications to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.

CO5. Analyze sustainable urbanization and industrialization principles to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.

DETAILED SYLLABUS:

UNIT- I: PRINCIPLES OF SUSTAINABILITY (9 Periods)

Emerging challenges, Sustainability and sustainable engineering; Environmental concerns; Social, economic and legal issues; Availability and depletion of natural resources, Disaster resiliency; Multilateral environmental agreements – Basel convention, Clean development mechanism (CDM), Montreal and Kyoto protocols.

UNIT- II: SUSTAINABILITY METRICS AND ASSESSMENT TOOLS (9 Periods)

Sustainability indicators, metrics and assessment tools, Material flow analysis and material budget, Carbon footprint analysis, Life cycle assessment, Streamlined life-cycle assessment (SLCA), Economic input output-life cycle analysis, Environmental health risk assessment, Other emerging assessment tools.

UNIT- III: SUSTAINABLE ENGINEERING PRACTICES (9 Periods)

Sustainable energy engineering, Sustainable waste management, Green and sustainable buildings and infrastructure, Sustainable civil infrastructure, Sustainable remediation of contaminated sites, Climate geoengineering.

UNIT- IV: SUSTAINABLE ENGINEERING APPLICATIONS (9 Periods)

Environmental and chemical engineering projects, Materials engineering projects, Infrastructure engineering projects – Background, Methodology, Goal and Scope, Study area, Technical design, Environmental sustainability, Life cycle assessment, Economic sustainability, Social sustainability, Rating systems – ENVISION, LEED, GRIHA, IGBC; Conclusions.

UNIT- V: SUSTAINABLE URBANIZATION AND INDUSTRIALIZATION (9 Periods)

Sustainable urbanization and industrialization, United Nations sustainable development goals – Right to education, Poverty eradication, Social and technological changes; Industrial Processes - Material selection, Energy efficiency, Pollution prevention and control techniques, Industrial Ecology, Industrial symbiosis.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Reddy, K.R., Cameselle, C., and Adams, J.A., *Sustainable Engineering: Drivers, Metrics, Tools, and Applications*, John Wiley &Sons, Inc., Hoboken, New Jersey, 2019, 544p (ISBN: 978-1-119-49393-8).
2. Allen, D. T. and Shonnard, D. R., *Sustainability Engineering: Concepts, Design and Case Studies*, Pearson Education, 1st Edition, 2012.

REFERENCE BOOKS:

1. Bradley. A.S; Adebayo, A.O., Maria, P., *Engineering Applications in Sustainable Design and Developmen*t, Cengage Learning, 1st Edition, 2016.
2. Purohit, S. S., *Green Technology: An Approach for Sustainable Environment*, Agrobios Publication, 1st Edition, 2016.
3. *Energy Conservation Building Code (ECBC) 2007*, Bureau of Energy Efficiency, Govt. of India, New Delhi.
4. Twidell, J. W. and Weir, A. D., *Renewable Energy Resources*, Routledge, Taylor & Francis Group, 3rd Edition, 2015.

ADDITIONAL LEARNING RESOURCES:

1. Daniel A. Vallero and Chris Brasier, *Sustainable Design: The Science of Sustainability and Green Engineering*, Wiley-Blackwell, 1st Edition, 2008.
2. Jorge A. Vanegas, *Sustainable Engineering Practice: An Introduction*, Committee on Sustainability, American Society of Civil Engineers, https://doi.org/10.1061/9780784407509, 2004.
3. Mackenthun, K.M., *Basic Concepts in Environmental Management*, CRC Press, Taylor & Francis Group, 1st Edition, 1999.
4. *Environment Impact Assessment Guidelines*, Notification of Government of India, 2006.

III B. Tech. – I Semester

(19BT50206) **INSTRUMENTATION**

(Professional Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Analog Electronic Circuits and Electrical Measurements.

COURSE DESCRIPTION: Principle of operation, advantages and limitations of various types of electronic and digital instruments for measurement of electrical quantities; Signal Analyzers, Data acquisition, display devices and recorders.

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

CO1. understand the construction and working principle of various electronic instruments and apply them to measure various electrical parameters.

CO2. apply various transducers for the measurement of various non-electrical quantities.

CO3. understand the principle of operation of various spectral analysers and their applications for various signals.

CO4. understand the principle of data acquisition systems and apply these principles for recording/storing the data.

CO5. apply monitoring instruments for recording various electrical and non-electrical quantities and determine the required precision.

DETAILED SYLLABUS:

UNIT – I: ELECTRONIC INSTRUMENTS (10 Periods)

Electronic voltmeter using rectifiers; AC voltmeter — Average, Peak and true RMS voltmeters; Vector impedance meter, Vector voltmeter, Digital phase meter, Capacitance meter, Digital LCR meter; Q meter— measurement of low, high impedance, band width and errors.

UNIT – II: NON-ELECTRIC QUANTITIES MEASUREMENT (9 Periods)

Measurement of Torque — Torque transducers, Inductive torque transducer and Digital methods. Measurement of Low Pressure — Thermocouple vacuum gauge and Pirani Gauges.

Measurement of Flow — Turbine meters, Hotwire Anemometers and Electromagnetic flow transducer.

UNIT – III: SIGNAL ANALYZERS (10 periods)

Analyzers — Resonant wave analyzer, Frequency selective analyzer, Heterodyne analyzer, Harmonic distortion analyzer, Total Harmonic distortion analyzer, logic analyzer and Power analyzer; Application of wave analyzer; Spectrum analyzer — basic spectrum analyzer, spectra of different signals.

UNIT – IV: DATA ACQUISITION SYSTEMS (09 periods)

Generalized data acquisition system and its components, Types of multiplexing systems — time division and frequency division multiplexing; Digital data acquisition system, use of data acquisition systems and recorders in digital systems; Digital recording systems — block diagram and its working; Modern digital DAS — Analog multiplexer operation and operation of Sample-Hold circuits.

UNIT – V: DISPLAY DEVICES AND RECORDERS (07 periods)

Display devices — LED, LCD, LVD and VDU; Recorders — graphic, ultraviolet, magnetic tape recorders, digital tape recorders, biomedical recorders.

Total Periods: 45

Topics of self-study are provided in the lesson plan

TEXT BOOKS:

1. A.K.Sawhney, A course in *Electrical and Electronics Measurements & Instrumentation*, DhanpatRai and Co. Publishers,19th edition, 2015.
2. J.B. Gupta, A course in *Electrical and Electronics Measurements & Instrumentation*, S.K. Kataria publishers, 14th edition, 2015.

REFERENCE BOOKS:

1. H. S. Kalsi, *Electronic Instrumentation*-by Tata MC Graw Hill Company, 3rd edition, 2010.
2. D.V.S Murthy, *Transducers and Instrumentation*, Prentice Hall of India, New Delhi, 2nd edition, 2010.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/105/108105064/
2. https://nptel.ac.in/courses/108/105/108105153/

IIIB.Tech.-IISemester

(16BT60209)**INSTRUMENTATION**

(ProgramElective-2)

Int.MarksExt.MarksTotalMarksLTPC

307010031--3

PREREQUISITES:CoursesonAnalogElectronicCircuits,ElectricalMeasurements,ComputerArchitectureandOrganization.

COURSEDESCRIPTION:

Principleofoperation,advantagesandlimitationsofvarious typesofelectronicanddigitalinstrumentsformeasurementof electricalquantities;Storageoscilloscopes,Data acquisition,displaydevicesandrecorders.

COURSEOUTCOMES:Onsuccessfulcompletionofthecourse, studentswillbeableto

CO1.demonstrationknowledgeon

- •varioustypesofelectronicanddigitalinstruments.
- •signalanalyzersandstorageoscilloscopes.
- •dataacquisitionsystems,displaydevicesandrecorders.

CO2.analyze

- •varioustypesofelectronicanddigitalinstruments.
- •signalanalyzersandstorageoscilloscopes.
- •displaydevices,recordersandvariousdataacquisition systems.

CO3.designan appropriatedisplaysystemforindustrialand commercialapplications.

CO4.estimatethemagnitude,phase,frequencyandspectrumofsignalwithoscilloscopetoprovidefeasiblesolution.

CO5.selectanappropriateinstrumentationprinciplesandtechniquestosubstantiatetheindustrialrequirements.

CO6.applytheconceptualknowledgeofvariousinstrumentationprinciplesandtechniquesinrelevancetoindustry.

DETAILEDSYLLABUS:

UNIT-I:ELECTRONICINSTRUMENTS(10periods)

Electronicvoltmeterusingrectifiers,ACvoltmeter-Average, Peakand trueRMSvoltmeters;Electronicmultimeters-electronicohmmeter;Vectorimpedancemeter,Vectorvoltmeters, Qmeter-measurementoflow,highimpedanceandbandwidth, errors.

UNIT-II:DIGITALINSTRUMENTS(09periods)

Basicdigitalinstrument.Digitalfrequencymeter-Periodand Timeintervalmeasurement;Digitalphasemeter,Capacitance meter,DigitalTachometer,DigitalLCRmeter,LCRBridge,Characteristicsofdigitalmeters,specificationofDVM,Digitalmulti meter.MicroprocessorbasedramptypeDVM.

UNIT-III:SIGNALANALYZERS&STORAGEOSCILLOSCOPES (10periods)

Analyzers-Resonantwaveanalyzers,Frequency-selectiveanalyzers,Heterodyneanalyzers,Applicationofwaveanalyzers; Harmonicdistortionanalyzers,TotalHarmonicdistortionanalyzers,logicanalyzers,Poweranalyzers.

Spectrumanalyzers-basicspectrumanalyzers,spectraofdifferentsignal.

Storageoscilloscope-Samplingoscilloscope,digitalstorageoscilloscope,electronicswitch,oscilloscopeprobes.

UNIT-IV:DATAACQUISITIONSYSTEMS(09periods)
Generalizeddataacquisitionsystemanditscomponents,Types ofmultiplexingsystems-timedivisionandfrequencydivision multiplexing;Digitaldataacquisitionsystem,useofdataacquisitionsystemsandrecordersindigitalsystems,Digitalrecordingsystems-blockdiagramanditsworking;moderndigitalDAS-AnalogMultiplexeroperation,OperationofSample-Holdcircuits.

UNIT-V:DISPLAYDEVICESANDRECORDERS(07periods)
Displaydevices-LED,LCD,LVD,VDU;Recorders-graphic,ultravioletandmagnetictaperecorders,digitaltaperecorders,biomedicalrecorders.

TotalPeriods:45
TEXTBOOKS:

1.A.K.Sawhney,Acourseon*ElectricalandElectronicsMeasurements&Instrumentation*,DhanpatRaiandCo.Publishers,19_{th}edition,2015.
2.J.B.Gupta,Acourseon*Electricaland ElectronicsMeasurements&Instrumentation*,S.K.Katariapublishers,14_{th}edition,2015.

REFERENCEBOOKS:

1.H.S.Kalsi,*ElectronicInstrumentation*-byTataMCGrawHill Company,3_{rd}edition,2010.
2.D.V.SMurthy,*TransducersandInstrumentation*,Prentice HallofIndia,NewDelhi,2_{nd}edition,2010.

III B. Tech. – I Semester

(19BT50208) **INTELLECTUAL PROPERTY RIGHTS**

Open Elective-2

(Common to ECE, EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Introduction to Intellectual Property; Trade Marks; Law of Copy Rights; Law of Patents; Trade Secrets; Unfair Competition; New Development of Intellectual Property.

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

CO1. Understand the concepts of intellectual property right and new amendments enforced in filling intellectual property right.

CO2. Understand the processes and principles of trade mark registration and apply them for registering trade mark.

CO4. Understand the process and principles of copy rights for registration and judicial consequences for violating laws of copyright/patents.

CO5. Understand the process and principles of trade secrets and judicial consequences for coping trade secrets.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO INTELLECTUAL PROPERTY (10 Periods)

Introduction and the need for intellectual property rights (IPR); types of intellectual property- Design, Geographical Indication; International organizations, agencies and treaties.

UNIT- II: TRADEMARKS (8 Periods)

Introduction to trademark, Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT – III: LAW OF COPYRIGHTS (9 Periods)

Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

UNIT- IV: TRADESECRETS (9 Periods)

Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

UNIT- V: NEW DEVELOPMENT OF INTELLECTUAL PROPERTY (9 Periods)

New developments in: trade mark law, copy right law, patent law, intellectual property audits. International overview on intellectual property; international - trade mark law, copy right law, international patent law, international development in trade secrets law.

Total Periods: 45

Topics for self-study are provided in the lesson plan

TEXT BOOKS:

1. Deborah, E. Bouchoux, *Intellectual property: The law of Trademarks, Copyright, Patents, and Trade Secrets,* Cengage learning, 4th edition, 2013.
2. PrabuddhaGanguli, *Intellectual property right - Unleashing the knowledge economy*, Tata McGraw Hill Publishing Company Ltd.

REFERENCE BOOKS:

1. Neeraj P and Khusdeep D. *Intellectual Property Rights*. India, IN: PHI learning Private Limited. 1st edition 2019.

ADDITIONAL LEARNING RESOURCES:

1. Subramanian, N., &Sundararaman, M. (2018). *Intellectual Property Rights – An Overview*. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
2. World Intellectual Property Organisation. (2004). *WIPO Intellectual property Handbook*.
   Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf

IIIB.Tech I Semester
(19BT51041) PLC and SCADA

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PREREQUISITES:A course on Digital Electronics.

COURSE DESCRIPTION: Introduction to PLC, PLC ladder diagrams, programming on PLC, timers, counters and sequences used in PLC,Display Conventions and Navigation, Remote Terminal Units, Master Terminal Units,SCADA Works Station Application Programmes.

COURSE OUTCOMES: On successful completion of this course, the student will be able to

CO 1. Demonstrate knowledge on programmable logic controllers and various functions of PLCs.

CO 2. Develop PLC program, to solve various problems in process industries.

CO 3. Demonstrate knowledge on various elements of SCADA Software.

CO 4. Analyse the industrial process by using various displays in SCADA software and provide appropriate solutions.

DETAILED SYLLABUS:

UNIT-I: PLC BASICS AND PROGRAMMING (10 periods)

Introduction, PLC system, CPU, I/O modules and interfacing, power supplies, Programming equipment, Programming formats, Construction of PLC ladder diagrams, Devices connected to I/O modules. Input instructions, Outputs, Operational procedures.

UNIT-II: LADDER DIAGRAMS, REGISTERS AND TIMER FUNCTIONS (10 periods)

Digital logic gates, Boolean algebra PLC programming, Fail-Safe Circuits, characteristics of Registers, module addressing, holding registers, Input Registers, Output Registers. Timer function, Counter function & industrial applications.

UNIT-III: INTERMEDIATE AND DATA HANDLING FUNCTION (9 periods)

Intermediate functions: Arithmetic functions, Number comparison functions, Number conversion functions. Skip, Master control relay, Jump functions, Sequencer functions and applications, Controlling of two-axis & three axis Robots with PLC, Matrix functions.

UNIT- IV: The Elements of SCADA Software (10 periods)

SCADA System Architecture - Field Devices and Signals, Programmable Process Controller, Communication Network, Central Control Facilities, Display Conventions and Navigation. Remote Terminal Units-Discrete control, analog control, Monitor discrete signals, monitor analog signals. Master terminal Units.

UNIT-V: SCADA WORKS STATION APPLICATION PROGRAMME (6 periods)

Identifying the process areas, configuring HMI applications. Process Graphic Displays-Current Process Operations, Equipment Control Displays, Alarm and Event Summaries, Trends and Historical Reports, Maintenance Displays. Configuration of I/O Server, System graphic displays Sample Application: Water Treatment Plant SCADA System.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOK:

1. John W. Webb & Ronald A. Reiss, *Programmable Logic Controllers Principles and Applications*, 5th edition, PHI, 2009.
2. Stuart G. Mc. Crady, *Designing SCADA Application Software A Practical Approach*, 1st Elsevier, 2013.

REFERENCE BOOK:

1. Frank D. Petruzella, *Programmable Logic Controller*, 3rd edition, Tata McGraw-Hill Edition 2010.
2. Stuart A. Boyer, *Supervisory Control and Data Acquisition*, 3rd edition, ISA 2004.

WEBLINKS:

1. https://openautomationsoftware.com/use-cases/allen-bradley-wpf-scada/
2. https://new.siemens.com/global/en/products/automation/industry-software/automation-software/scada.html
3. https://ab.rockwellautomation.com/Programmable-Controllers
4. https://en.wikipedia.org/wiki/SCADA
5. http://www.isa.org
6. http://www.controleng.com
7. http://literature.rockwellautomation.com
8. http://www.automation.siemens.com

III B. Tech. – I Semester

(19BT50231) **SOCIALLY RELEVANT PROJECT-I**

(Common to ECE, EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	-	1

PREREQUISITES: -

COURSE DESCRIPTION: Identification of topic for the socially relevant project; Literature survey; Collection of preliminary data; Identification of implementation tools and methodologies; Performing critical study and analysis of the topic identified; Time and cost analysis; Implementation of the socially relevant project; Preparation of thesis and presentation.

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

CO1. Create/Design engineering systems or processes to solve complex societal problems using appropriate tools and techniques following relevant standards, codes, policies, regulations and latest developments.

CO2. Consider environment, sustainability, economics and project management in addressing societal problems.

CO3. Perform individually or in a team besides communicating effectively in written, oral and graphical forms on socially relevant project.

III B. Tech. – I Semester
(19BT61531)**INTERNET OF THINGS LAB**
(Common to ECE, EEE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	1	2	2

PRE-REQUISITES:-

COURSE DESCRIPTION: Setting up **IoT** work-flow, Programming with Python, Micro-controller programming using Arduino, Building **IoT** Applications using Raspberry Pi, **IoT** Cloud Infrastructure.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1. Design an interface to embedded systems using real time sensors with Arduino and Raspberry Pi.
CO2. Develop applications to capture the data generated by sensors and send to cloud.
CO3. Develop real time applications using Node MCU and BLYNK.
CO4. Design applications to push sensor data to cloud using MQTT protocol.
CO5. Work independently and in team to solve problems with effective communication.

Theory Component: **(10 Periods)**

Arduino IDE, 7-segment display, Servo motor, ultrasonic sensor, LCD, Flame sensor, gas sensor, Humidity & temperature sensors, MQTT protocols, ECG System, Raspberry Pi, Home security system with camera, PIR sensor, light sensor, motion detector, NodeMCU, BLYNK, cloud

LIST OF EXPERIMENTS:

1. (a) Design and Simulate LED 7-Segment Display interfacing with Arduino.
   (b) Design and Simulate Servo motor interfacing with Arduino.
2. (a) Design and Simulate ultrasonic sensor and LCD interfacing with Arduino.
   (b) Design and Simulate Flame Sensor interfacing with Arduino.
3. Design and Implement to capture Gas Sensor and send sensor data to cloud from your NodeMCU device using Arduino IDE.
4. Design and Implementation of Humidity and Temperature Monitoring Using Arduino and upload data to cloud using MQTT.
5. Design and Implementation of an IoT ECG (Electrocardiogram) System to record hearts electrical activity.
6. Design and Simulate controlling an LED 7-Segment Display with Raspberry Pi.

7. Design and implementation of Raspberry Pi Home Security System with Camera and PIR Sensor with Email Notifications.
8. Design and Implement to upload Light sensor (TSL) data to cloud through Raspberry Pi.
9. Design and Implementation of Motion Detector with NodeMCU and BLYNK.
10. Design and Implementation of Fire notification IoT system with BLYNK.

III B. Tech. – I Semester

(19BT503AC) **FOUNDATIONS OF ENTREPRENEURSHIP**

(Common to CE, ME, ECE, EEE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	-	-	2	-	-	-

PRE-REQUISITES: -

COURSE DESCRIPTION: The nature and growth of entrepreneurship; Characteristics of an entrepreneur; Types of Entrepreneurs;Ethics and social responsibility of entrepreneurs;Generating ideas; Opportunity identification; Implementing and managing the venture; Principles of creativity and innovation; Methods of protecting innovation and creativity; Market research; Feasibility analysis;Sources of funding;Preparation of business plan;Start-Ups;Social Entrepreneurship; Rural entrepreneurship.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1: Demonstrate knowledge on personal attributes that enable best use of entrepreneurial opportunities.

CO2: Apply suitable method to protect creativity and innovation.

CO3: Design and prepare high impact strategic and business plan.

CO4: Analyze the major steps and requirements in order to convert innovative idea into a successful start-up.

CO5: Develop an idea to create a business for social change by identifying social entrepreneurship opportunities.

DETAILED SYLLABUS

UNIT–I: ENTREPRENEURIAL MINDSET (6 Periods)

The nature and growth of entrepreneurship, Entrepreneurship and Intrapreneurship, Characteristics of an entrepreneur, Types of Entrepreneurs, Women as an Entrepreneur, Factors that contribute to the success of entrepreneurs, Ethics and social responsibility of entrepreneurs.

UNIT–II: **ENTREPRENEURIAL PROCESS (6 Periods)**

Generating ideas, Opportunity identification, Business concepts, Resources (Financial, Physical and Human), Implementing and managing the venture, Harvesting the venture, Harvesting strategies: Absorption of new concept into mainstream operations, Licensing of rights, Family succession, Liquidate (Shut down) venture, Selling the venture, Management Buy-Out (MBO).

UNIT–III: CREATIVITY AND INNOVATION (6 Periods)

Principles of creativity and innovation, Disruptive, incremental and open innovations, Nurturing and managing innovation, Methods of protecting innovation and creativity: Intellectual property rights, Branding, Trademarks, Patents, Copyrights, Registered design protection, Trade secrets.

UNIT–IV: NEW VENTURE PLANNING AND CREATION (6 Periods)

Market research (venture opportunity screening), Feasibility analysis, Start-up capital;

Sources of funding: equity financing, debt financing (loans, venture funding, angel funding), grants, gifts, bequests and financial statements, Introduction to the business plan, Preparation of business plan.

UNIT–V: Start-Ups and Social Entrepreneurship (6 Periods)

Start-Ups: Definition to start-up, Start-up activities, Promising start-ups, Venture-backed start-ups, Corporate-supported start-ups.

Social Entrepreneurship: Social enterprise-Need - Types - Characteristics and benefits of social enterprises, Rural entrepreneurship.

Total Periods: 30

Topics for self-study are provided in the lesson plan.

TEXT BOOKS:

1. Robert D. Hisrich, Mathew J. Manimala, Michael P. Peters, Dean A. Shepherd, *Entrepreneurship*, McGraw Hill Education (India) Private Limited, Eighth Edition, 2013.
2. Marc J Dollinger, Entrepreneurship: Strategies and Resources, Pearson, Third Edition, 2003.

REFERENCE BOOKS:

1. Vasant Desai, *Dynamics of Entrepreneurial Development and Management,* Himalaya Publ. House, 2004.
2. *Harvard Business Review on Entrepreneurship,* HBR Paper Back.
3. Thomas W. Zimmerer& Norman M. Scarborough, *Essential of Entrepreneurship and small business management,* PHI.

III B. Tech. – II Semester

(19BT60204) **HIGH VOLTAGE ENGINEERING**

(Professional Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Electromagnetic fields and Electrical circuits.

COURSE DESCRIPTION:

Electrostatic fields; Breakdown phenomena of insulation; Generation of high voltages; Measurement of HV and Testing of high voltage apparatus.

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

CO1. analyze the behaviour of dielectrics in the presence of high voltages using the principles of electric fields.

CO2. analyzethe generating circuits for generation of high voltages and currents.

CO3. analyze the measuring circuits and techniques for the measurement of high Voltages and currents.

CO4. realize the philosophy of sustainable testing and develop procedures for testing of various high voltage equipment by adhering relevant standards.

DETAILED SYLLABUS:

UNIT-I: ELECTROSTATIC FIELDS (6 periods)

Introduction to high voltage engineering — electrical field distribution; breakdown strength of insulating materials; field distortions by conducting particles; fields in multi-dielectric materials.

Over voltages — causes and protection against over voltages.

UNIT-II: BREAKDOWNPHENOMENA (11 periods)

Breakdown in gases — Townsend's theory, Streamer's theory, breakdown in electro negative gases, Paschen's law, time lags of breakdown; insulation co-ordination.

Breakdown in solid dielectrics — Thermal breakdown and electro mechanical breakdown, treeing and tracking, Internal discharges.

Breakdown in liquid dielectrics — Suspended particle theory and stressed oil volume theory.

UNIT-III: GENERATION OF HVAC, HVDC, IMPULSE VOLTAGE AND CURREN (12 periods)

Generation of HVAC and HVDC — cascade connection of transformers; series resonant circuit; tesla coil; voltage doubler circuit; Cock Croft Walton circuit — calculation of regulation, ripple and optimum number of stages for minimum voltage drop.

Generation of impulse voltage and current — introduction to standard lightning and switching impulse voltages; analysis of single stage impulse generator — expression for output impulse voltage; multi stage impulse generator — working principle, rating and

components of impulse generator; triggering of impulse generator; generation of high impulse current.

UNIT-IV: MEASUREMENT OF HIGH VOLTAGE AND CURRENT (8 periods)

HVAC measurement — Chubb and Fortescue method; HVDC measurements — generating voltmeter principle, construction; potential dividers — resistance dividers, capacitance dividers, mixed RC potential dividers; Standard sphere gap measurements of HVAC, HVDC and impulse voltages; factors affecting the measurements; Measurement of high impulse currents — Rogowsky coil and magnetic links.

UNIT-V: TESTING OF HIGH VOLTAGE APPARATUS (8 Periods)

Non-destructive testing — measurement of DC resistivity — Galvanometer method, loss of charge method; Dielectric loss and loss angle measurements using Schering bridge; Partial discharge measurements – straight discharge detection circuit.

Testing of high voltage apparatus — testing of insulators, bushings, power transformers, cables, surge arresters and circuit breaker.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. E. Kuffel, W.S. Zaengl and J. Kuffel, *High Voltage Engineering: Fundamentals*, 2nd edition, Newnes, Elsevier Press, 2000.
2. M. S. Naidu and V. Kamaraju, *High Voltage Engineering*, 4th edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2008.

REFERENCE BOOKS:

1. C.L. Wadhwa, *High Voltage Engineering*, 3rd revised edition New Age Science, 2010.
2. Mazen Abdel-Salam, Hussein Anis, Ahdab El-Morshedy, Roshdy Radwan, *High Voltage Engineering Theory and Practice*, 2nd edition, Revised & Expanded, Marcel-Dekker Publishers (Special Indian Edn.), 2000.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/104/108104048/#
2. http://vlabs.iitkgp.ernet.in/vhv/

IIIB.Tech.-IISemester
(16BT60208)**HIGHVOLTAGEENGINEERING**
(ProgramElective-2)

Int.MarksExt.MarksTotalMarksLTPC

307010031--3

PREREQUISITES: CoursesonEngineeringPhysics,Engineering Chemistry,ElectromagneticFieldsandElectricalMeasurements.

COURSEDESCRIPTION:

Typesofinsulationsystems;Breakdownprocessinsolid,liquid andgaseousdielectrics;GenerationofhighACandDCvoltages,Impulsevoltagesandcurrents;Measurementofhighvoltage,current,resistivity,dielectricconstantandlossfactor; Testing ofelectricalapparatus.

COURSEOUTCOMES:onsuccessfulcompletionofthecourse, studentswillbeableto

CO1.demonstrateknowledgeon

- •variousinsulationsystemsandtheirbehaviorunder voltagestress.
- •generationandmeasurementofhighvoltagesandcurrents.
- •testingofvarioushighvoltageelectricalapparatus.

CO2.analyze

•breakdownphenomenonindifferentinsulationsystems.
•circuitsforgenerationofhighvoltageandcurrents.
•methodsofmeasuringhighvoltagequantities.
CO3.designcircuitsforhighvoltagegeneration,measurementandtesting.

CO4.evaluatedifferentparametersinhighvoltageengineeringtoprovidevalidconclusions.

CO5.selectsuitabletestinganddiagnostictechniquesforthe highvoltageapparatus.

CO6.applycontextualknowledgeofhighvoltageengineering tosustainindustrialneeds.

CO7.followtheappropriatestandardfortestingofhighvoltageapparatus.

DETAILEDSYLLABUS:

UNIT-I:BREAKDOWNPHENOMENA(09periods)
IntroductiontoHighVoltageengineering,electricalfieldstresses.
Gaseousdielectrics:primaryand secondaryionizationprocesses,criteriaforgaseousinsulationbreakdownmechanism-Townsend'stheory,streamer'stheory,coronadischarges,breakdownin electronegative gases,Paschen'slawand itssignificance,timelagsofbreakdown.

Breakdowninsoliddielectrics:IntrinsicBreakdown,avalanche breakdown,thermalbreakdownandelectromechanicbreakdown.

Breakdownofliquiddielectrics:Suspendedparticletheory, electronicBreakdown,cavitybreakdown,electroconvection breakdown.

UNIT-II:GENERATIONOFHVACANDHVDC(08periods)
GenerationofHVAC:Needforcascadeconnectionandworking oftransformerunitsconnectedincascade;Seriesresonant circuit-principleofoperation,Teslacoil.

GenerationofHVDC: Voltagedoubler circuit,Cockroft-walton typehighvoltageDC set,Vande-graaffgenerator,calculation

ofhighvoltageregulation,rippleandoptimumnumberofstages forminimumvoltagedrop.

UNIT-III:GENERATIONOFIMPULSEVOLTAGEANDCURRENT (08periods)

Introductiontostandardlightningandswitchingimpulsevoltages,analysisofsinglestageimpulsegenerator-expressionfor outputimpulsevoltage.Multistageimpulsegenerator-working ofMarximpulse,ratingofimpulsegenerator,componentsof multistageimpulsegenerator,triggeringofimpulsegeneratorby threeelectrodegaparrangement,trigatrongapandoscillographtimesweepcircuits.Generationofswitchingimpulsevoltageandhighimpulsecurrent.

UNIT-IV:MEASUREMENTOFHIGHVOLTAGES(08periods)

ChubbandFortescuemethodforHVACmeasurement,generatingvoltmeter-Principle&construction.Seriesresistancemicro ammeterforHVDCmeasurements,standardspheregapmeasurementsofHVAC,HVDC,andimpulse voltages,factorsaffectingthemeasurements.Potentialdividers-resistive,capacitanceandmixedRC.Measurementofhighimpulsecurrents-rogowskycoilandmagneticLinks.

UNIT-V:HIGHVOLTAGETESTSONELECTRICALAPPARATUS (12periods)

MeasurementofDCresistivity,measurementofdielectricconstantandlossfactor,partialdischargemeasurements.Testing ofelectricalapparatus-insulators,bushings,isolators,circuit breakers,cables,transformersandsurgearresters;radiointerferencemeasurements.

TotalPeriods:45
TEXTBOOKS:

1. M.S.NaiduandV.Kamaraju,*HighVoltageEngineering*,5_{th} edition,TataMcGraw-HillPublications,2013.
2. E.Kuffel,W.S.ZaenglandJ.Kuffel,*HighVoltageEngineering*: Fundamentals,2_{nd}edition,2005.

III B. Tech. – II Semester
(19BT60206) **PIC MICROCONTROLLERS**
(Professional Elective – 2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Computer Architecture & Organization.

COURSE DESCRIPTION: Embedded systems concept, PIC Microcontroller Architecture, Peripherals, Programming, Interfacing and their applications.

COURSE OUTCOMES: After successful completion of this course, student will be able to:

CO1. develop optimized programs using PIC18 assembly instructions by applying the concepts of internal architecture and operation of PIC18 processor.
CO2. develop programs for specific applications using internal Timers, Serial port and I/O ports of PIC18 microcontroller.
CO3. develop programs for specific applications using Interrupts, CCP and ECCP of PIC18 microcontroller.
CO4. develop programs for interface and control of peripherals using PIC18 Microcontroller.

DETAILED SYLLABUS:

UNIT–I: INTRODUCTION TO EMBEDDED SYSTEMS (9 Periods)

Introduction – Characteristics - Von Neumann and Harvard Architecture - CISC and RISC - Instruction pipelining, Microcontrollers and Embedded processors: Microcontroller versus general-purpose microprocessor – History of the PIC microcontroller – PIC18 features, PIC18 Family.

UNIT-II: PIC18 ARCHITECTURE & BASIC PROGRAMMING (9 Periods)

PIC18 architecture and features - PIC18 Memory organization – program memory - data memory - PIC Register file – General Purpose registers - Special Function registers. PIC18 Data Format and Directives - Introduction to PIC18 Assembly Programming – PIC18 programming tools, Instruction set: Data transfer – Arithmetic – logical - bit manipulation - branch Instructions, Addressing modes: Immediate – Direct - Register Indirect Addressing Modes, Macros and Modules, PIC18 programming using MPLAB and PIC 'C' Compile.

UNNIT-III: TIMERS, SERIAL PORT AND I/O PORTS PROGRAMMING (9 Periods)

Timers: Programming Timers 0 and 1 in Assembly language - Programming Timers 2 and 3 in Assembly language, Serial Port: Basics of Serial Communication and PIC Serial Port programming in Assembly language, I/O Ports: Port A TRISA - Port B TRISB - Port C TRISC.

UNIT–IV: INTERRUPTS, CCP AND ECCP PROGRAMMING (9 Periods)

PIC18 Interrupts - Programming Timer Interrupts - Programming the Serial Communication Interrupts - Port-B Change Interrupt, Interrupt Priority in the PIC.

Standard and Enhanced CCP Modules - Compare Mode programming - Capture Mode programming - PWM Programming - ECCP Programming.

UNIT–V: PIC18 INTERFACING (9 Periods)

ADC Characteristics - ADC Programming in the PIC18 - DAC Interfacing - Sensor Interfacing and Signal Conditioning - Relays and Opto-isolators - Stepper Motor Interfacing - DC Motor Interfacing and PWM - PWM Motor Control with CCP - DC Motor Control with ECCP.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan.

TEXT BOOKS:

1. Muhammad Ali Mazidi, Rolin D. McKinlay, Danny Causey, PIC Microcontroller and Embedded Systems using assembly and C for PIC 18, Pearson Education, 2008.
2. John B. Peatman, Design with PIC Microcontrollers, Pearson Education, 2007.

REFERENCE BOOKS:

1. PIC18FXXX data sheet.
2. John B. Peatman, Embedded design with the PIC18F452 Microcontroller, Printice Hall, 2003.

ADDITIONAL LEARNING RESOURCES:

1. UDEMY:https://www.udemy.com/course/master-pic-microcontroller-using-mikroc-protuesprofessional/.
1. https://pic-microcontroller.com/online-courses-learn-pic-microcontroller-programming/
2. Coursera: https://www.coursera.org/learn/comparch

EDX : https://www.edx.org/learn/computer-architecture

IIIB.Tech.-IISemester

(16BT61001)**ARMPROCESSORS&PIC MICROCONTROLLERS** (CommontoEEE & EIE)

(Interdisciplinary Elective-2)

Int.Marks	Ext.Marks	TotalMarks	L	T	P	C
30	70	100	3	1	0	3

PREREQUISITES:CourseonSwitchingtheoryand logicdesign.

COURSEDESCRIPTION:

ARMProcessorsarchitecture,Programming,PICmicrocontroller architecture,InterruptsandtimersofPICmicrocontroller,Interfacing.

COURSEOUTCOMES:Onsuccessfulcompletionofthecourse, studentswillbeableto

CO1.demonstrateknowledgeinARMProcessorsarchitecture, PICarchitecture,Pinout,Instructionset.

CO2.analyzevariousdesignissuesregardingusageofonchip resourcesandLowpowermodes.

CO3.designembeddedsystemsusingARMProcessorsand PICmicrocontrollerstosuitmarketrequirements.

CO4.solveengineeringproblemsandarriveatsolutionsinde signingembeddedSystems.

CO5.useon-chipresourcestodesignembeddedsystemswith anunderstandingoflimitations.

CO6.practiceprofessionalengineeringtodeliverefficientand costeffectivemicrocontrollerbasedproducts.

DETAILEDSYLLABUS:

UNIT-I:PICMICROCONTROLLERARCHITECTURE(10Periods)

Microcontrollersvsgeneralpurposemicroprocessor,Overview ofPIC18family,WREGregisterinPIC,PICfileregister,Default accessbank,PICstatusregister,Dataformatsanddirectives, ProgramcounterandprogramROMspace,Arithmetic,Logic instructions,Branch,callandtimedelayinstructions,I/Oport programming,PIC18pindescription,Bitaddressabilityofdata RAM,bankswitching,Macrosandmodules.

UNIT-II:TIMERS,SERIALPORTANDINTERRUPTS (09Periods)

Programmingtimers0and1,Counterprogramming,Programmingtimers2and3,BasicsofserialcommunicationPIC18 connectiontoRS232,Serialportprogramminginassembly,PIC18

interrupts,Programmingtimerinterrupts,Programmingserialinterrupts.

UNIT-III:PERIPHERALSANDINTERFACING(07Periods)
7segmentLEDandLCDinterfacing,keyboardinterfacing,interfacingADC,DAC,Interfacingsteppermotor,DCmotorinterfacingandPWM.

UNIT-IV:INTRODUCTIONTOARMPROCESSORS(09Periods)
IntroductiontoARMCortexM3 processor,BackgroundofARM andARMarchitecture,CortexM3 Processorapplications,CortexM3fundamentals,registers,Operationmodes,Memorysystem,memorymap, Memorysystem attributes,ARMPipeline, Exceptiontypes.

UNIT-V:ARMPROGRAMMING(10Periods)
Datatransferinstructions,PseudoInstructions,DataProcessingInstructions,Call&unconditionalBranchInstructions,Decisions&conditionalBranchinstructions,SeveralusefulinstructionsinCortexM3,ARMAssemblyLanguageProgramming,Thumb InstructionSet,ARMMode&ThumbmodeProgramming,ARM ProgramminginC.

TotalPeriods:45

TEXTBOOKS:

1.MuhammadAliMazidi,RolinD.McKinlay,Dannycausey,*PIC MicrocontrollerandEmbeddedSystems*:UsingCandPIC18, PearsonEducation,2008.
2.JosephYiu,TheDefinitiveGuidetothe*ARMCortex-M3&M4*, Elsevier,3rdedition,2013.

REFERENCEBOOKS:

1.AndrewSloss,DominicSymes,ChrisWright,ARMSystem Developer'sGuide:*DesigningandOptimizingSystemSoftware(TheMorgan KaufmannSeriesinComputerArchitectureandDesign)*,2004.
2.John.B.Peatman, *DesignwithPICMicrocontroller*,Pearson education,1988.

III B. Tech. – II Semester

(19BT60208) **DISTRIBUTED GENERATION AND MICROGRID**
(Professional Elective – 3)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A Course on Transmission and Distribution.

COURSE DESCRIPTION: The course concerns with, the significance of distributed generation with centralized grid and microgrid, also the protection systems on various generation equipment and communication systems for the distribution generation and microgrids are discussed.

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

CO 1. understand the technical and economic aspects of distributed generations, and their impact on environment.
CO 2. understand various energy resource appropriate for distribution generation and their interfacing issues.
CO 3. plan the generation capacity to meet the thermal generation adequacy and appropriate protection system for distributed generation and networks.
CO 4. develop models of microgrid to assess energy management and coordination of protection system of the grid operating in different modes.
CO 5. understand the operational challenges and communication protocols of microgrid, and its impact on environment and society.

DETAILED SYLLABUS:

UNIT-I: OVER VIEW OF DISTRIBUTED GENERATION (9 Periods)
Distribution Generation - Introduction, Necessity, Benefits of integration. Distributed Generation – Technical aspects, Impacts on Environmental, Economics aspects, transmission system and central generation.

UNIT-2: ENERGY RESOURCES FOR DISTRIBUTED GENERATION (9 Periods)
Combined heat and power systems; Wind energy conversion systems; Solar photovoltaic systems; Small-scale hydroelectric power generation; Other renewable energy sources; Storage devices and Inverter interfaces.

UNIT-3: DG PLANNING AND PROTECTION (9 Periods)
Generation capacity, adequacy in conventional thermal generation systems; Impact of distributed generation on network design; Protection of distributed generation and distribution network.

UNIT-4: CONCEPT OF MICROGRID (9 Periods)
Microgrid - introduction and configuration; Functions of Micro source controller and central controller; Energy Management and Protection Co-ordination Module; Modes of Operation: Grid connected and islanded modes; Modelling of Microgrid : Micro-

turbine Model, PV Solar Cell Model, Wind Turbine Model; Role of Microgrid in power market competition.

UNIT-5: IMPACTS OF MICROGRID (9 Periods)

Technical and economical aspects of Microgrid ; Challenges of Microgrid development; Management and operational issues of a Microgrid ; Impacts of Microgrids on heat utilization, process optimization, energy market, environment, communication standards and protocols.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. Nick Jenkins, Janaka Ekanayake, Goran Strbac, *Distributed Generation*, Institution of Engineering and Technology, London, UK, 2010.
2. S. Chowdhury, S.P. Chowdhury and P. Crossley, *Microgrids and Active Distribution Networks*; The Institution of Engineering and Technology, London, United Kingdom, 2009.

REFERENCES:

1. Math H. Bollen, Fainan Hassan, *Integration of Distributed Generation in the Power System*, John Wiley &Sons, New Jersey, 2011.
2. Magdi S. Mahmoud, Fouad M. AL-Sunni, *Control and Optimization of Distributed Generation Systems*, Springer International Publishing, Switzerland, 2015.
3. Nadarajah Mithulananthan, Duong Quoc Hung, Kwang Y. Lee, *Intelligent Network Integration of Distributed Renewable Generation*, Springer International Publishing, Switzerland, 2017.

ADDITIONAL LEARNING RESOURCES:

1. NPTEL Videos : https://nptel.ac.in/courses/108/108/108108034/
2. IEEE Distributed generation and its impact on power grids and microgrids protection : https://ieeexplore.ieee.org/document/6201229

III B. Tech. – II Semester

(19BT50406) **FPGA ARCHITECTURES AND APPLICATIONS**

(Common to ECE, EEE & EIE)

(Inter Disciplinary Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Digital Electronics, and Linear and Digital IC Applications.

COURSE DESCRIPTION: Evolution of Programmable Devices, Design with PLDs, FPGA-Organization, Programming, Xilinx-XC2000, XC3000, XC4000 Architectures, Programming Technologies, Anti-Fuse Programmed FPGAs, Design Applications.

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1. Implement Boolean functions using programmable logic devices to develop a digital system.

CO2. Analyze FPGA's and its programmable technologies to assess the impact of digital functions in the development of digital system.

CO3. Analyze Xilinx & Actel based FPGA architectures, place and route designs for high speed digital Circuits.

CO4. Develop various sub systems using FPGA for specified applications.

DETAILED SYLLABUS:

UNIT-I: DESIGNING OF PROGRAMMABLE LOGIC DEVICES (Periods: 9)

Introduction, Simple Programmable Logic Devices – Read Only Memories, Programmable Logic Arrays, Programmable Array Logic, Sequential Programmable Logic Devices (22CEV10); Implementation of a serial Adder with Accumulation.

UNIT-II: FIELD PROGRAMMABLE GATE ARRAYS (Periods: 8)

Introduction to FPGAs, FPGA Programming Technologies, Programmable Logic Block Architectures, Programmable Interconnects, and Programmable I/O blocks in FPGAs, Dedicated Specialized Components of FPGAs, Applications of FPGAs.

UNIT–III: SRAM PROGRAMMABLE FPGAs (Periods: 8)

Introduction, Programming Technology, Device Architecture, the Xilinx XC2000, XC3000 and XC4000 Architectures.

UNIT-IV: ANTI-FUSE PROGRAMMED FPGAs (Periods: 10)

Introduction, Programming Technology, Device Architecture, The Actel ACT1, ACT2 and ACT3 Architectures.

UNIT–V: DESIGN APPLICATIONS (Periods: 10)

General Design Issues, A Fast Video Controller, A Position Tracker for a Robot Manipulator, A Fast DMA Controller, Designing Counters with ACT devices.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. Stephen M. Trimberger, *Field Programmable Gate Array Technology*, Springer International Edition, Eighth Indian Reprint 2015.
2. Charles H. Roth Jr, LizyKurian John, *Digital Systems Design using VHDL, 3rd edition,* Cengage Learning, 2017.

REFERENCE BOOKS:

1. John V. Oldfield, Richard C. Dorf, Field Programmable Gate Arrays, Wiley India, 2008.
2. Pak K. Chan/SamihaMourad , Wayne Wolf, Digital Design Using Field Programmable Gate Arrays, Pearson Low Price Edition,2009.

ADDITIONAL LEARNING RESOURCES

1. http://www2.eng.cam.ac.uk/~dmh/4b7/resource/section16.htm
2. https://nptel.ac.in/courses/106103016/21
3. https://nptel.ac.in/courses/106105161/54

III B. Tech. – II Semester

(19BT61003) **INDUSTRIAL DATA COMMUNICATIONS**

(Inter Disciplinary Elective-2)

(Common to EEE, EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: A course on Computer Networks

COURSE DESCRIPTION: Data networks, inter-networking and serial communications, HART and Field buses, MODBUS, PROFIBUS, Communication protocol, industrial Ethernet and wireless communication

COURSE OUTCOMES: After successful completion of this course, the students will be able to:

CO1: Demonstrate knowledge on fundamentals of data communication.
CO2: Analyze interfacing standards EIA-232 and EIA-485.
CO3: Selecta communication protocol for particular application.
CO4: Demonstrate knowledge on foundation fieldbus.

DETAILED SYLLABUS:

UNIT-1: Industrial Data Communication Methodology (9 periods)

Modern instrumentation and control systems, Open systems interconnection (OSI) model, Protocols, Standards Common problems and solutions, General comments on troubleshooting, a specific methodology, Grounding/shielding and noise, Sources of electrical noise, Electrical coupling of noise, Shielding, Cable ducting or raceways, Cable spacing, earthing and grounding requirements, Suppression techniques, Filtering.

UNIT-2: EIA-232 & EIA-485 Interface Standard (9 periods)

EIA-232 interface standard: the major elements of EIA-232, Half-duplex operation of the EIA-232 interface, EIA/TIA-232 revisions, Limitations of EIA-232, troubleshooting: Introduction, Typical approach, Test equipment, Typical EIA-232 problems.EIA-485 interface standard, Troubleshooting. Introduction, EIA-485 vs EIA-422, EIA-485 installation, Noise problems, Test equipment.

UNIT-3: HART Protocol & AS-interface (AS-i) (7 periods)

Introduction to HART and smart instrumentation, HART protocol: Physical layer, Data link layer, Application layer, troubleshooting. Introduction to AS-interface, Layer 1 – the physical layer, Layer 2 – the data link layer, Operating characteristics, Troubleshooting: Introduction, Tools of the trade.

Unit-4: ProfiBus PA/DP/FMS protocol (11 periods)

Introduction, ProfiBus protocol stack: Physical layer (layer 1), Data link layer (layer 2), Application layer, Fieldbus message specification (FMS), Lower layer interface (LLI), Fieldbus management layer (FMA 7), The ProfiBus communication model, Relationship between application process and communication, Communication objects, Performance, System operation: Configuration, Data transfer between DPM1 and the DP-slaves,

Synchronization and freeze modes, Safety and protection of stations, Mixed operation of FMS and DP stations, Troubleshooting: Introduction, Troubleshooting tools.

Unit-5: Foundation Fieldbus (9 periods)

Introduction to Foundation Fieldbus, The physical layer and wiring rules, The data link layer, The application layer, The user layer, Error detection and diagnostics, High-speed Ethernet (HSE), Good wiring and installation practice with Fieldbus: Termination preparation, Installation of the complete system, Troubleshooting: Introduction, Power problems, Communication problems, Foundation Fieldbus test equipment.

Total Periods: *45*

Topics for Self-Study are provided in the Lesson Plan

TEXT BOOKS:

1. Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, Practical Industrial Data Networks Design, Installation and Troubleshooting' Newnes Publication, Elsevier First Edition, 2004.

REFERENCE BOOKS:

1. Sunit Kumar Sen , Fieldbus and Networking in Process Automation, CRC Press.,1st edition, 2014.
2. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Prentice Hall of India Pvt. Ltd., 5th Edition. 2011.
3. Theodore S Rappaport, Wireless Communication: Principles and Practice, Prentice Hall of India 2nd Edition, 2001.
4. William Stallings, Wireless Communication & Networks, Prentice Hall of India, 2nd Edition, 2005.

ADDITIONAL LEARNING RESOURCES:

1. http://gtu-info.com/Subject/171703/IDC/Industrial_Data_Communication/Syllabus
2. https://www.gtu.ac.in/syllabus/NEW_Diploma/Sem6/3361704.pdf
3. https://rmd.ac.in/dept/eie/notes/7/IDN/syllabus.pdf
4. https://www.inspirenignite.com/anna-university/anna-university-b-tech-ic-r13-7th-sem-industrial-data-networks-syllabus/

III B. Tech. – II Semester
(19BT60231) **ELECTRICAL CAD LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A course on Computer Aided Engineering Drawing.

COURSE DESCRIPTION: Drafting standards for electrical engineering applications; Drafting of residential electrical layouts and electrical sub-station.

COURSE OUTCOMES: After successful completion of this course, student will be able to:

CO1. demonstrate preliminary design aspects of electrical design using CAD.
CO2. develop preliminary and detailed single line diagrams of complete electrical load distribution in a residential building.
CO3. develop wiring layouts for lighting, power and Air conditioning applications in residential accommodations.
CO4. develop a typical electrical layout of industrial blue prints and control appliances for industrial applications.
CO5. work independently or in teams to solve problems with effective communication.

Practical Exercises/List of Experiments:

Minimum Eight experiments are to be conducted.

PART-A: Electrical Design Concepts (Compulsory)

1. Review of preliminary electrical designing
2. Exercise on three phase load balancing

PART-B: Drafting Exercises (Minimum Six)

3. Typical residential floor plan
4. Lighting load wiring layouts for a residential accommodation
5. Power load wiring layouts for a residential accommodation.
6. AC load wiring layouts for a residential accommodation.
7. Typical house electrical wiring schematic circuit.
8. Preliminary single line diagram for a residential electrical system.
9. Detailed single line diagram for a residential electrical system.
10. Typical electrical wiring diagram for an industrial workshop.
11. Single line diagram of a typical electrical substation.
12. Schematic diagram of a motor control center.

TEXT BOOKS:

1. National Building Code of India 2005.
2. Gaurav Verma and Matt Weber, AUTOCAD Electrical 2016 Black Book, CADCAMCAE works, USA, 2015

(http://1.droppdf.com/files/YooGv/autocad-electrical-2016-black-book-by-gaurav-verma-2015.pdf)

ADDITIONAL LEARNING RESOURCES:

- https://www.youtube.com/watch?v=zTo8QL7A-wg
- https://www.youtube.com/watch?v=6VXybp4g4vU
- https://www.youtube.com/watch?v=fCJtarn6Jvg

- https://www.youtube.com/watch?v=B0x-OHR-1Pk

SOFTWARE/Tools used:

- Electrical CAD (AutoCAD for Electrical and Electronics Engineers)

III B. Tech. – II Semester

(19BT60233) **SOCIALLY RELEVANT PROJECT-II**

(Common to ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	-	1

PREREQUISITES: -

COURSE DESCRIPTION: Identification of topic for the socially relevant project; Literature survey; Collection of preliminary data; Identification of implementation tools and methodologies; Performing critical study and analysis of the topic identified; Time and cost analysis; Implementation of the socially relevant project; Preparation of thesis and presentation.

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

CO1. Create/Design engineering systems or processes to solve complex societal problems using appropriate tools and techniques following relevant standards, codes, policies, regulations and latest developments.

CO2. Consider environment, sustainability, economics and project management in addressing societal problems.

CO3. Perform individually or in a team besides communicating effectively in written, oral and graphical forms on socially relevant project.

III B. Tech. – II Semester
(19BT5MC01) **UNIVERSAL HUMAN VALUES**
(Common to All Branches)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	-	40	2	-	-	-

PRE-REQUISITES: --

COURSE DESCRIPTION: Process for Value Education; Harmony in the Human Being - Harmony in Myself!; Harmony in Family and Society- Human Relationship; Harmony in the Nature and Existence – Coexistence; Implications of Holistic Understanding of Harmony on Professional Ethics.

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

CO1. Understand Values and skills for sustained happiness and prosperity.
CO2. Analyse realistic implications of a Holistic understanding of ethical human conduct, trustful and mutually fulfilling human behaviour.
CO3. Apply holistic approach in personal life and profession through a positive understanding of the Human reality and existence.

DETAILED SYLLABUS:

UNIT-I: VALUE EDUCATION (6 Periods)
Human Values-Introduction; Self-Exploration - Natural Acceptance; Human Aspirations-Right understanding- the current scenario: understanding and living in harmony.

UNIT II: HUMAN BEING AND SELF (6 Periods)
Understanding human being - I' and the material 'Body'; needs of Self ('I') and 'Body'- happiness and physical facility; Body as an instrument of 'I' - characteristics and activities of 'I' and harmony in 'I'; harmony of I with the Body.

UNIT III: FAMILY, THE SOCIETY AND THE NATIONS (6 Periods)
Values in human relationship (nine universal values) - foundational values of relationship; Difference between intention and competence; Difference between respect and differentiation; harmony in the society; Universal harmonious order in society.

UNIT IV: HARMONY WITH THE NATURE (6 Periods)
Harmony in the Nature; Interconnectedness and mutual fulfilment - the four orders of nature - Recyclability and Self-regulation; Existence as Co-existence; Holistic perception of harmony and existence.

UNIT V: HARMONY WITH PROFESSIONAL ETHICS (6 Periods)
Acceptance of human values; Ethical Human Conduct; Basis for Humanistic Education; Competence in professional ethics; Case studies: Holistic

technologies, Management Models and Production Systems; Socially and ecologically responsible engineers, technologists and managers - enriching institutions and organizations.

Total Periods: 30

TEXT BOOK:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

REFERENCE BOOK:

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidya Prakashan, Amarkantak, 1999.

III B. Tech. – II Semester
(19BT60232) **ELECTRICAL POWER SYSTEMS LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A course on Electrical Machines-II

COURSE DESCRIPTION: Experimental investigations on behavior of insulators, performance of synchronous and asynchronous machines, relay testing and fault analysis.

COURSE OUTCOMES: On successful completion of the course, student will be able to:

CO1. analyze the behavior of various dielectric materials/insulators in the presence of high voltage and determine their withstand limits.
CO2. evaluate the operational parameters and characteristics of the transformers operating under different scenarios.
CO3. analyze the performance of synchronous and asynchronous machines operating under different scenarios.
CO4. evaluate various electrical parameters and interpret the experimental observations with underlying concepts.
CO5. Work independently or in teams to solve problems with effective communication.

Practical Exercises/List of Experiments: Minimum **Ten** experiments are to be conducted.

1. Determination of Corona inception characteristics.
2. Determination of efficiency of string insulator.
3. Determination of dielectric strength of liquid insulating material.
4. Determination of dielectric strength of gaseous dielectrics under uniform and non uniform electric fields.
5. Determination of equivalent circuit of a 3-winding transformer.
6. Determination of positive, negative and zero sequences of a 3-winding transformer.
7. Determination of sequence impedances of a cylindrical rotor Synchronous Machine.
8. Determination of sub-transient reactance of salient pole alternator.
9. Power Angle Characteristic of Three-Phase Salient Pole Synchronous Machine.
10. Performance of three phase induction motor under two phase supply.
11. Ascertain I-V and P-V Characteristics of PV module.
12. Three phase active power and energy measurement using two instrument transformers.

TEXT BOOKS:

1. C. L. Wadhwa, Electrical Power systems, New Age International (P) Limited, Publishers, New Delhi, 5th edition, 2009.
2. JB Gupta, *Theory and performance of Electrical Machines*(DC machines, Poly phase Circuits & AC machines) in SI Units, S.K. Kataria& Sons, New Delhi, 15th edition, 2015.

REFERENCE BOOKS:

1. John J. Grainger and William D. Stevenson, Jr., *Power System Analysis*, McGraw-Hill, 2003.
2. P.S. Bimbhra, *Electrical Machinery*, Khanna Publishers, 7th edition, Delhi, 2011.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/101/108101039/
2. http://www.ee.iitkgp.ac.in/faci_ps.php
3. https://www.youtube.com/watch?v=tgjayvDVW28
4. https://www.youtube.com/watch?v=_0T2Osgxdxs

IIIB.Tech.-IISemester

(16BT60232)**POWERSYSTEM-ILAB**

Int.MarksExt.MarksTotalMarksLTPC

5050100----32

PREREQUISITES:CourseonTransmission&Distributionand PowerSystemAnalysis.

COURSEDESCRIPTION:

ExperimentationonTransmissionanddistributionsystems;Load flow,FaultandStabilityanalysis.

COURSEOUTCOMES:Onsuccessfulcompletionofthecourse, studentswillbeableto

CO1.demonstrateknowledgeontransmission&distribution systemsandvarioustypesofpowersystemanalysisfor experimentalimplementation.

CO2.analyze,evaluateandrelateexperimentalobservations andmeasurementsforvalidation.

CO3.designasuitablemeasuringandtestingsetupforex perimentationonpowersystems.

CO4.interpretthedataobtainedfromexperimentationtopro videvalidconclusions

CO5.selectandapplyappropriatetechniqueforsolvingcom plexproblemsinthepowersystems.

CO6.applytheconceptualknowledgeofpowersystemsin relevancetoindustryandsociety

CO7.committoethicalprinciplesandstandardswhileexer cisingthepracticalinvestigationsonpowersystem.

CO8.workindividuallyorinagroupwhileexercisingpractical investigationsinthefieldofpowersystemanalysis.

CO9.communicateeffectivelyinverbalandwrittenformin relevancetopowersystem.

DETAILEDSYLLABUS:

Conductany**TEN**exercisesfromthefollowing

1.Determinationoftransmissionlineparameters.

2.Performanceof atransmissionlinefordifferentloadcondi- tions.

3.Coronacharacteristics.

4.Determinationofefficiencyofstringinsulator.

5.Poweranglecharacteristicofsalientpolesynchronous machine.

6.Performancecharacteristicsofdistributionsystem.

7.FormationofYbus. 8.FormationofZbus

9.Loadflowanalysis.

10.Faultanalysis.

11.Rotordynamicsusingswingequation.

12.Transientstabilityanalysis.

IV B. Tech. – I Semester
(19BT70201) **SOLID STATE DRIVES**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	--	--	3

PRE-REQUISITES: Courses on Electrical Machines–II, Control Systems and Power Electronics.

COURSE DESCRIPTION: DC drives — Controlled rectifier and chopper fed DC motors; AC drives — Inverter fed induction motor; Special motor fed drives — Synchronous and stepper motors.

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

CO1. evaluate the characteristics and operational aspects of drives operating in different modes.

CO2. analyze the operational aspects of various DC drives operating in different sustainable modes of operation.

CO3. analyze the operational aspects of various asynchronous motor drives operating in different sustainable modes of operation.

CO4. analyze the operational aspects of synchronous motor and stepper motor drives operating in different sustainable modes of operation.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO ELECTRIC DRIVES (10 Periods)

Electrical drives — block diagram, advantages of electric drive, parts of electric drives, choice of electrical drives, status of DC and AC drives. Dynamics of electrical drives — fundamental torque equations, speed-torque conventions and multi-quadrant operation; Equivalent values of drive parameters — loads with rotational and translational motion; Load torques — components, nature and classification. Concept of steady state stability. Electric braking methods — regenerative, dynamic and plugging. Modes of operation of electrical drives — steady state, acceleration including starting and deceleration including stopping. Speed control and drive classifications, closed loop control of drives — current limit control, torque control, speed control and position control (Block diagram only).

UNIT-II: SINGLE PHASE AND THREE PHASE CONVERTER FED DC DRIVES (10 Periods)

Control of DC separately excited motor by single-phase and three-phase half and full bridged converters — voltage and current waveforms for continuous and discontinuous conduction, speed-torque expressions and characteristics. Single phase half controlled rectifier fed DC series motor — voltage and current waveforms for continuous and discontinuous conduction, speed-torque expressions and characteristics. Multi-quadrant operation of DC separately excited DC motor fed from fully controlled rectifier — mechanical reversible switch in armature, dual converter and field current reversal.

UNIT-III: DC CHOPPER FED DRIVES (07 Periods)

Control of DC separately excited motor by one, two and four quadrant choppers — voltage and current waveforms for continuous conduction (motoring, regenerative and

dynamic braking), speed-torque expressions and characteristics. Chopper control of DC series motor — operation, speed-torque expressions and characteristics.Closed loop chopper control of separately excited DC motor (Block diagram only).

UNIT-IV: INDUCTION MOTOR DRIVES (12 Periods)

Three phase induction motors — Introduction, Stator variable voltage control — speed-torque characteristics,AC voltage controllers and efficiency of induction motor under voltage control. Stator variable voltage and variable frequency control — slip speed control, torque-power limitations and modes of operation. Voltage Source Inverters (VSIs) and Current Source Inverters (CSIs) fed induction motor and closed loop operation of induction motor drives (Block diagram only). Comparison of VSI and CSI fed drives. Static rotor resistance control, slip power recovery schemes — static scherbius and kramer drive, speed-torque characteristics.

UNIT-V: SYNCHRONOUS AND STEPPER MOTOR DRIVES (06 Periods)

Synchronous Motor Drives: Separate control and self control of synchronous motors — operations of self controlled synchronous motors by VSI and CSI. Load commutated CSI fed Synchronous motor — operation and speed torque characteristics. Closed loop control operation of synchronous motor drives (Block diagram only).

Stepper Motor Drives: Variable reluctance and permanent magnet operation — features of stepper motor — torques Vs stepping rate characteristics and drive circuits.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. Gopal K. Dubey, *Fundamentals of Electric Drives*, Narosa Publications, Alpha Science International Ltd, 2nd Edition, 2002.
2. Krishnan, Ramu. *Electric motor drives: modeling, analysis, and control*, Ist edition, Pearson, 2015.

REFERENCE BOOKS:

1. Gopal K. Dubey, *Power Semiconductor Controlled Drives*, Prentice-Hall International, 1989.
2. P. C. Sen, *Principles of Electrical Machines and Power Electronics*, Wiley, 3rd Edition, 2013.
3. M.D. Singh, K.B. Khanchandani, *Power Electronics*, Tata McGraw-Hill, 2nd Edition, 2013.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/104/108104140/
2. https://nptel.ac.in/courses/108/102/108102046/
3. https://swayam.gov.in/nd1_noc19_ee65/preview

IIIB.Tech-IISemester

(16BT60201)**POWERSEMICONDUCTOR DRIVES**

Int.Marks	Ext.Marks	TotalMarks	L	T	P	C
30	70	100	3	1	0	3

PREREQUISITES:CoursesonPowerElectronics,Synchronous MachinesandControlSystems.

COURSEDESCRIPTION:

DCdrives:RectifierfedandChopperfeddrives;ACDrives: Inductionmotordrives,SynchronousandSteppermotordrives.

COURSEOUTCOMES:Onsuccessfulcompletionofthecourse, studentswillbeableto

CO1.demonstrateknowledgeon

- dynamicsofelectricaldrives.
- operationandspeedcontrolofvariousDC&ACdrives.
- openloopandclosedloopcontrolofDC&ACdrives.

CO2.analyzesingleandmulti-quadrantoperationsofDC&AC driveswithspeed-torquecharacteristics.

CO3.designanddevelopvariousconfigurationsofpowerelec tronicconvertersforAC&DCdrives.

CO4.investigateopenandclosedloopoperationsofvarious drivesusingdifferentspeedcontroltechniquestoenha- ncethedriveperformance.

CO5.applyappropriatepowerconvertersforcontrollingthe drivesinrealtimeapplications.

CO6.applytheconceptualknowledgeofpowersemiconduc tordrivesinrelevancetoindustryandsociety.

DETAILEDSYLLABUS:

UNIT-I:INTRODUCTIONTOELECTRICALDRIVES (08periods)

Conceptofelectricaldrives.Dynamicsofelectricaldrives-fun- damentaltorqueequations,speed-torqueconventionsandmulti- quadrantoperation;Loadtorques-components,natureand classification.Steadystatestability.Electricbrakingmethods- regenerativedynamicandplugging.Modesofoperationofelec- tricaldrive.Speedcontrolanddriveclassifications,closedloop controlofdrives.

UNIT-II:SINGLEPHASEANDTHREEPHASECONVERTERFED DCDRIVES(11periods)

IntroductiontoDCdrives,controlofDCseparatelyexcitedmo- torbysingle-phaseandthree-phasehalfandfullconverters- voltageandcurrentwaveformsforcontinuousanddiscontinu- ousmotor currents,speed-torqueequations and characteris- tics.DualconvertercontrolofDCseparatelyexcitedmotor.

UNIT-III:DCCHOPPERFEDDRIVES(08periods)

ControlofDCseparatelyexcitedmotorbyone,twoandfour quadrantchoppers,voltageandcurrentwaveformsforcon- tinuousconductionmode.Closedloopmodelofseparatelyex- citedDCmotor,closedloopspeedcontrolscheme.

UNIT-IV:INDUCTIONMOTORDRIVES(10periods)

Introduction,statorvoltagecontrolbyACvoltage controllers.Statorfrequencycontrol-slipspeedcontrol,torque andpowerlimitations,modesof operation.Variablefrequency controlbyvoltagesourceinverters(VSI),currentsourcein- verters(CSI).Staticrotorresistancecontrol.Slippowerrecov- eryschemes-staticScherbiusdrive,staticKramerdrive.

UNIT-V:SYNCHRONOUSANDSTEPPERMOTORDRIVES (08periods)

Modesofvariablefrequencycontrol.Operationofself-controlledsynchronousmotorsbyVSI,CSI.LoadcommutatedCSIfedsynchronousmotordrive-operationandwaveforms.Steppermotordrives-torqueVssteppingratecharacteristics,drivecircuits.

TotalPeriods:45

TEXTBOOKS:

1.GopalK.Dubey,*FundamentalsofElectricDrives*,Narosa Publications,2nd edition,2004.

2.VedamSubramaniam,*Electricdrives(conceptsand applications)*,TataMcGraw-HillEducation,2011.

REFERENCEBOOKS:

1.GopalK.Dubey,*PowerSemiconductorControlledDrives*, Prentice-HallInternational,1989.

2.PareshC.Sen,*ThyristorDCDrives*,Wiley-Interscience,1981.

IV B. Tech. – I Semester

(19BT70204) **ELECTRIC VEHICLES**

(Professional Elective–4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	--	--	3

PRE-REQUISITES: Courses on Electrical Machines-II and Power Electronics.

COURSE DESCRIPTION: Transportation vehicles and their impact in society; Concept, configurations, principle, types and operation of Electric Vehicles (EV); Power Electronic converters in EVs; Different motor drives & energy storage technologies in EVs.

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

CO1. understand the principle of operation of electric, hybrid-electric vehicles and various emerging technological challenges while confronting the issues during transportation.

CO2. analyze the performance characteristics of various power converters operating in different modes, and assess a suitable convertor and its control strategies for sustainability of electric vehicle.

CO3. analyze various propulsion motor drives operating in different modes for sustainability and determine the performance/operational parameters of electric vehicle.

CO4. analyze various battery energy storage systems and assess their adaptability for sustainable performance of electric vehicle.

CO5. understand the various types of magnetic gears for electric vehicles and apply them for sustainable mobility of vehicles.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO EVS AND HEVS (08 Periods)

Environmental impact and history of modern transportation, history of transportation electrification, Electric Vehicles (EVs) — introduction, configurations and traction motor characteristics; Hybrid Electric Vehicles (HEVs) — concept and architectures; series and parallel HEVs — configuration, operation, advantages and disadvantages; HEVs — interdisciplinary nature, challenges and key technologies.

UNIT-II: POWER CONVERTERS IN EVS (10 Periods)

Introduction, isolated DC-DC converter — advantages, forward converter, CCM currents in forward converter, CCM voltages in forward converter and sizing the transformer. Isolated full-bridge converter, operation, CCM currents in full-bridge converter and CCM voltages in the full-bridge converter. Resonant power conversion — LCLC series-parallel resonant converter, desirable converter characteristics for inductive charging and fly-back converter. Bi-directional battery chargers and contactless charging.

UNIT-III: ELECTRIC PROPULSION SYSTEMS (09 Periods)

Stator-PM versus rotor-PM, system configurations, doubly salient PM motor drives, flux-reversal PM motor drives, flux-switching PM motor drives, hybrid-excited PM motor

drives, flux-mnemonic PM motor drives, magnet less flux switching motor drives and design criteria for EVs.

UNIT-IV: ENERGY STORAGE TECHNOLOGIES (09 Periods)

Battery — basic theory and characterization, battery technologies, types — lead acid batteries, nickel-based batteries and lithium-based batteries. Ultra-capacitors — features, basic principles, performance, battery modeling based on electric equivalent circuit, modeling of ultra-capacitors, battery charging control and flywheel energy storage system. Fuel cells — modeling and block diagrams of hybrid fuel cell energy storage systems.

UNIT-V: MAGNETIC GEAR FOR EV TRANSMISSION SYSTEMS (09 Periods)

Introduction, system configurations, types, Magnetic Gear (MG) machines — principle, modelling, control and design criteria for MG motor drives. Magnetic Gear Electric Variable Transmission (MG EVT) systems — multiport magnetic gears, magnetic planetary-geared EVT system, magnetic concentric-geared EVT system and applications.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. K. T. Chau, *Electric Vehicle Machines and Drives, Design, Analysis and Application,* Wiley, 2015.
2. John G. Hayes*, Electric Powertrain*, Wiley, 2018.

REFERENCE BOOKS:

1. Iqbal Husain, *Electric and Hybrid Vehicles Design Fundamentals,* 2nd Edition, CRC Press, 2011.
2. Jack Erjavec, *Hybrid, Electric & Fuel-Cell Vehicles*, 2nd Edition, Delmar Cengage learning, 2013.
3. Mehrdad Ehsani, Yimin Gao and Ali Emadi, Modern Electric, *Hybrid Electric and Fuel Cell Vehicles*, 2nd Edition, CRC Press, 2015.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/102/108102121/
2. https://swayam.gov.in/nd1_noc20_ee18/preview
3. https://www.coursera.org/learn/electric-vehicles-mobility?#syllabus

IV B.Tech. – I Semester

(19BT70205) Flexible AC Transmission System

(Program Elective – 4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES:

Courses on Power Electronics and Power System Analysis.

Course Description: Need for flexible AC transmission systems; objectives of shunt and series compensations, phase angle regulators; FACTS controllers: shunt, series and combined; coordination of various FACTS controllers.

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

CO1. understand the power flow aspects in AC transmission system and realize the need of compensation and philosophy of FACTS controllers.

CO2. realize the principle of static shunt compensation techniques and apply an appropriate shunt controller for sustainable operation of AC transmission system.

CO3. realize the principle of static series compensation techniques and apply an appropriate series controller for sustainable operation of AC transmission system.

CO4. realize the philosophy of various power flow controllers operating in various modes to control the active and reactive power and foster sustainable operation of AC transmission system.

CO5. realize the principle of multiple FACTS controllers in AC transmission system and techniques to coordinate them for sustainable operation.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO AC TRANSMISSION SYSTEMS (7 Periods)

Overview of interconnected power system. Power flow in AC systems – Expression for real and reactive power flow between two nodes of a power system, controllable parameters. Power flow in parallel and meshed system. Overview of compensated transmission lines – shunt and series compensation. Conventional controllers for real and reactive power flows – merits and demerits. FACTS – benefits, types of FACTS controllers.

UNIT-II: STATIC SHUNT COMPENSATION (10 Periods)

Expression for real and reactive power flow with mid-point voltage regulation. Variable impedance type static VAR generators - V-I characteristics and control schemes of TCR, TSR, TSC. QD-QO characteristic and control scheme of TSC-TCR. Switching converter

type VAR generators – V-I characteristics and control schemes of STATCOM. Hybrid VAR generators – V-I characteristics of SVC and STATCOM, regulation of V-I slope. Applications of static shunt compensators – Voltage regulation, improvement in transient stability, prevention of voltage instability, power oscillation damping. Comparison of static shunt compensators.

UNIT-III: STATIC SERIES COMPENSATION (10 Periods)

Expression for real and reactive power flow with series line compensation. Variable impedance type series compensators: V-I characteristics and control schemes of GCSC, TSSC, TCSC- modes of operation. Sub-synchronous resonance. Switching converter type series compensator – V-I characteristics, internal and external control schemes of SSSC. Applications of static series compensators – improvement in transient stability, power oscillation damping. Comparison of static series compensators.

UNIT-IV: STATIC PHASE ANGLE REGULATORS AND COMBINEDCOMPENSATORS (10 Periods)

Power flow control by phase angle regulators - Concept of voltage and phase angle regulation. Operation and control of TCVR and TCPAR. Switching converter type phase angle regulators. Objectives of TCPAR - improvement of transient stability, power oscillation damping. UPFC – Principle, expression for real and reactive power between two nodes of UPFC, independent real and reactive power flow control using UPFC, control schemes of UPFC - operating principle and characteristics of IPFC.

UNIT-V: CO-ORDINATION OF FACTS CONTROLLERS (8 Periods)

FACTS controller interactions – interaction between multiple SVC's – interaction between multiple TCSC's – SVC-TCSC interaction – Coordination of multiple controllers using linear control techniques. Comparative evaluation of different FACTS controllers: performance comparison and cost comparison, Control coordination using Genetic Algorithm, Future direction of FACTS technology.

Total periods: 45

Topics for Self-study are provided in the Lesson Plan.

TEXT BOOKS:

1. Narain G. Hingorani, Laszi Gyugyi, *Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems*, Wiley-IEEE Press, 1999.
2. R. Mohan Mathur and Rajiv k. Varma, *Thyristor based FACTS Controllers for Electrical Transmission Systems*, Wiley-IEEE Press, 2002.

REFERENCE BOOKS:

1. Xiao-Ping, Rehtanz, Christian, Pal, Bikash, *Flexible AC Transmission Systems: Modeling and Control*, Springer Power Systems Series, 2006.
2. T.J.E. Miller, *Reactive Power Control in Electric Systems*, Wiley, 1982.

IVB.Tech.-ISemester

(16BT70204)**FLEXIBLEACTRANSMISSION SYSTEMS**

(ProgramElective-3)

Int.MarksExt.MarksTotalMarksLTPC

307010031--3

PREREQUISITES:CoursesonPowerElectronicsandTransmission&Distribution.

COURSEDESCRIPTION:

ConventionalAC Power TransmissionSystem;RealandReactivePowerTransmission;loadandlinecompensation;Concepts ofFACTS;CompensationusingFACTSDevicesandControllers; ShuntCompensation,SeriesCompensation,PhaseangleRegulationandCombinedcompensation.

COURSEOUTCOMES:Onsuccessfulcompletionofthecourse, studentswillbeableto

CO1.demonstrateknowledgeon

•realandreactivepowerflowinconventionalsystem.
•conceptofFACTS devicesand controllers.
•shuntandseriescompensationusingFACTSdevices.
•phaseangleregulationandcombinedcompensation.
CO2.analyze

•stabilityandvoltageprofileofacompensatedandun compensatedtransmissionlines.

•Voltageregulation,improvementoftransientstability, preventionofvoltageinstability,poweroscillationdamp ingwithvariousFACTSdevicesandcontrollers.
CO3.designsuitablecompensationstrategyforbettervolt ageprofileandsecuredoperationofpowersystem.
CO4.solveproblemsoftransmissionsystemtoprovidefea siblesolutions.
CO5.selectandapplyappropriatedevices,schemesandtech niquesforrealtimeapplicationsinACpowertransmission.

DETAILEDSYLLABUS:

UNIT-I:INTRODUCTIONTOACTRANSMISSIONSYSTEMS (10Periods)

Overviewofinterconnectedpowersystem.PowerflowinAC systems-Expressionforrealandreactivepowerflowbetween twonodesofapowersystem,controllableparameters,conventionalcontrollersforrealandreactivepowerflows-merits anddemerits.

FACTS- benefits-types ofFACTScontrollers.

UNIT-II:REACTIVEPOWERCONTROL(09Periods)

Reactivepower-it'ssignificanceandcontrolinElectricalPower Transmission-Differenttypesofreactivepowercompensation equipmentfortransmissionsystems.Loadcompensation-specificationofloadcompensator.Uncompensatedandcompensated transmissionlines:shuntandseriescompensation.

UNIT-III:STATICSHUNTCOMPENSATION(11Periods)

OperatingcharacteristicsandcontrolschemesofstaticVAR generators-variableimpedancetype:TCR,TSR,TSC,Switchingconvertertype-STATCOM;HybridVARgenerators.Applicationsofstaticshuntcompensators-Voltageregulation,improvementintransientstability,preventionofvoltageinstability,poweroscillationdamping.Comparisonofstaticshuntcompensators.

UNIT-IV:STATICSERIESCOMPENSATION(08Periods)
Operatingcharacteristicsandcontrolschemesofstatic VAR generators-variableimpedancetype:GCSC,TSSC,TCSC, Switchingconvertertype:SSSC.Applicationsofstaticseries compensators-improvementintransientstability,poweroscillationdamping.Comparisonofstaticseriescompensators.

UNIT-V:STATICPHASEANGLEREGULATORSANDCOMBINED COMPENSATORS(07Periods)
Powerflowcontrolbyphaseangle regulators-operationand controlofTCPAR,objectivesofTCPAR: improvementoftransientstability,poweroscillationdamping.PrincipleofUPFC-comparisonofUPFCto seriescompensatorsandphaseangle regulators,controlschemesofUPFC,operatingprincipleand characteristics ofIPFC.

TotalPeriods:45
TEXTBOOKS:

1.T.J.E.Miller,*ReactivePowercontrolinelectricsystems*,Wiley, 1982.
2.NarainG.Hingorani,LasziGyugyi,*UnderstandingFACTS:ConceptsandTechnologyofFlexibleACTransmissionSystems*, Wiley-IEEEPress,1999.

REFERENCEBOOKS:

1.Xiao-Ping,Rehtanz,Christian,Pal,Bikash,*FlexibleACTransmissionSystems:ModelingandControl,SpringerPowerSystemsSeries*,2006.
2.R.MohanMathurandRajivK.Varma,*ThyristorbasedFACTS controllersforElectricalTransmissionSystems*,Wiley-IEEE Press,2002.

IV B.Tech. I Semester

(19BT70207) **SOFT COMPUTING TECHNIQUES**

(Professional Elective–5)

Int.	Ext.	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: Courses on Basic Mathematics.

COURSE DESCRIPTION: Fundamentals of Artificial Neural Networks, back propogation Neural Networks, Deep Neural Networks, Fuzzy Logic Systems, Adaptive Neuro Fuzzy Inference Systems, evolutionary and swarm algorithms.

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

CO1. develop an architecture of a neural network, its training/learning algorithms and apply them to solve various real world problems.

CO2. develop a rule base fuzzy system and apply the control strategy to control various real world appliances.

CO3. develop an algorithm based on evolutionary principles and model an objective function to optimize the given problem.

CO4. develop an algorithm, mimicking the swarm behaviour of a school and model the objective function to optimize the given problem.

DETAILED SYLLABUS:

UNIT-I: ARTIFICIAL NEURAL NETWORKS (12 Periods)

Biological neural network, architectures of artificial neural networks; Activation functions, learning strategies- supervised, un supervised, reinforced; learning rules; Single layer perceptron network, linear separability with AND & XOR examples; Back propagation neural network- architecture, training algorithm; Kohonen self-organizing maps- competitive process, training algorithm.

UNIT – II: DEEP NEURAL NETWORKS (8 Periods)

Introduction to deep learning, architecture of recurrent neural networks; Back propagation through time; multilayer recurrent networks; Long short-term memory; Regression (load forecasting) and classification (object classification) using neural network.

UNIT – III: FUZZY LOGIC SYSTEMS (10 Periods)

Fuzzy Logic Systems: Classical Vs fuzzy sets, fuzzy relations & operations; Membership functions; Fuzzification; Rule base; Inference mechanism; Defuzzification; Development of fuzzy control system; speed control of DC motors using fuzzy logic.

UNIT IV – EVOLUTIONARY ALGORITHMS (08 Periods)

Genetic Algorithms: Introduction to evolutionary computation, Genetic algorithms - (GA)biological background, traditional optimization and search techniques, basic terminologies, simple GA, flow chart; Operators in GA - encoding, selection, crossover, mutation, constraints in GA, fitness function; Advantages and limitations of GA.

Differential Evaluation: Overview, initialization, base vector selection, differential mutation, recombination, selection and termination criteria; Optimal allocation of DG.

UNIT V – PARTICLE SWARM OPTIMIZATION (07 Periods)

Introduction to swarm intelligence, the basic PSO method, characteristic features of PSO, PSO algorithm, optimum parameter setting for the best performance of PSO, comparison with other Evolutionary computing techniques; MPPT for PV system.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. S.N. Sivanandam, S.N.Deepa, *Principles of Soft computing*, Wiley India private Ltd., 2nd edition, 2013.
2. Charu C. Aggarwal, *Neural Networks and Deep Learning***,** Springer International Publishing AG, part of Springer Nature, 2018

REFERENCE BOOKS:

1. Jacek M. Zurada, *Introduction to Artificial Neural Networks*, Jaico Publishing House.
2. Simon Haykin, *Neural Networks – A Comprehensive Foundation*, Prentice-Hall Inc, 1999.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/117/101/117101055/
2. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/

IVB.Tech.-ISemester

(16BT70210)**SOFTCOMPUTINGTECHNIQUES**

(ProgramElective-4)

Int.MarksExt.MarksTotalMarksLTPC

307010031--3

PREREQUISITES: CoursesonDCMachinesandTransmission andDistribution.

COURSEDESCRIPTION:

Architecturesofartificialneuralnetworks;Learningstrategies; Fuzzysettheory;Fuzzysystemsdesign;Applicationsofneural networksandfuzzysystems;Geneticalgorithmsanditsappli-cations.

COURSEOUTCOMES: Onsuccessfulcompletionofthecourse, studentswillbeableto

CO1.demonstrateknowledgeon

- •learningrules,strategiesandalgorithmsofartificial neuralnetwork.
- •fuzzylogicsystem.
- •geneticalgorithms.

CO2.analyze

- •learningmethodsandalgorithmsofneuralnetworks.
- •fuzzy&classicalsets.
- •operatorsofgeneticalgorithms.

CO3.designfuzzysystems,neuralnetworksandgenetical gorithmsfordesiredspecifications.

CO4.evaluateelectricalengineeringproblemsusingsoftcom putingtechniquestoprovidefeasiblesolutions.

CO5.selectandapplysuitablesoftcomputingtechniquesto solveelectricalengineeringproblems.

CO6.applytheconceptualknowledgeofsoftcomputingtech niquesinrelevancetoindustryandsociety.

DETAILEDSYLLABUS:

UNIT-I:FUNDAMENTALSOFARTIFICIALNEURALNETWORKS (09periods)

Neuralnetworks-introduction,biologicalneuralnetwork.Arti-ficialneuralnetwork-advantages,architectures,activation functions,importantterminologiesofANN.Mcculloch-pitsneu-ronmodel.Learningstrategies-supervised,unsupervisedand reinforced.Hebbianlearningrule,Perceptronlearningrule,delta learningrule,Widrow-hofflearningrule,correlationlearningrule, winner-take-alllearningrule,outstarlearningrule,conceptof linearseparability.

UNIT-II:FEEDFORWARDANDFEEDBACKNETWORKS (11periods)

Supervisednetworks:Backpropagationneuralnetwork-ar-chitecture,trainingalgorithm,learningfactors,initialweights, steepnessoftheactivationfunction,learningconstant,mo-mentummethodandnecessarynumberofhiddenneurons. Un-supervisednetworks:Kohonenself-organizingmap-competi-tiveprocess,cooperationprocess,adaptiveprocess,training algorithm.

Associativememories:Concepts,BidirectionalAssociative Memory(BAM)-architecture,discreteBAM-algorithm,analysis ofhammingdistance,energyfunctionandstoragecapacity.

DiscreteHopfieldnetwork-architectureandtrainingalgorithm. Electricalloadforecasting-Artificialneuralnetworksforshort-termelectricalloadforecasting.

UNIT-III:CLASSICALANDFUZZYSETS(09periods)

Introductiontofuzzylogic.Classicalsets-operations,properties.Fuzzysets-operations,properties.Crisprelations-cardinality,operations,properties,cartesianproduct,composition. Fuzzyrelations-cardinality,operations,properties,fuzzy cartesianproduct,composition.Linguistichedges,membership functions-features,methodsofmembershipvalueassignments -intuition,inference,rankordering,neuralnetworks,inductive reasoning.

UNIT-IV:FUZZYLOGICSYSTEMS(08periods)

Defuzzification-Lambda-cutsforfuzzysetsandfuzzyrelations.Defuzzificationmethods-maxmembershipprinciple, weightedaverage,centroid,centerofsums.Fuzzyrulebaseformationofrules,decompositionofrules,aggregationofrules -designprocedure.

SpeedcontrolofDCmotor-needoffuzzylogic,selectionof membershipfunctions,designofrulebaseforspeedcontrol.

UNIT-V:GENETICALGORITHM(08periods)

Introduction toevolutionary computing-GA,biologicalbackgroundofGA.TerminologiesandoperatorsofGA-searchspace, individuals,genes,fitnessfunction,population,encoding-binaryencoding,breading.Selection-roulettewheel,rank,tournament.Crossover-singlepointandtwopointcrossovers. Mutation-flipping,interchangingandreversing.Probabilitiesof crossoverandmutation.Replacement-random,weakparent replacement.Terminationcriteria,flowchart,advantages,limitationsandapplications.Applicationofgeneticalgorithmfor optimalallocationofcapacitorsindistributionsystem.

TotalPeriods:45

TEXTBOOKS:

1.S.N.Sivanandam,S.N.Deepa,*PrinciplesofSoftcomputing*, WileyIndiaprivateLtd.,2nd edition,2013.

2.TimothyJRoss,FuzzyLogicwithEngineeringApplication,Mc GrawHillInc.,3rd edition,2014.

REFERENCES:

1.JacekM.Zurada,I*ntroductiontoArtificialNeuralNetworks*, JaicoPublishingHouse.

2.SimonHaykin,*NeuralNetworks-AComprehensiveFoundation*,Prentice-HallInc,1999.

IV B. Tech. – I Semester

(19BT70209) **POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS**

(Professional Elective–5)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	--	--	3

PRE-REQUISITES: Courses on Electrical Machines-II and Power Electronics.

COURSE DESCRIPTION: Solar Energy Conversion System: Types of Photovoltaic Systems – Stand-alone, Hybrid and Grid Connected Systems; Wind Energy Conversion Systems: Types of WECS — Stand-alone and Grid Connected Systems; Generators in WECS; Power Quality: Issues, standards and problems in distributed generation.

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

CO1. analyze the solar PV system operating in different modes, assess a suitable convertor and control strategies for sustainability of PV system.

CO2. analyze the operation of various electrical machines and review their suitability for wind energy conversion system.

CO3. analyze the operation of various power converters for wind energy conversion system.

CO4. understand various power quality issues and their relevant standards, while mitigating the issues using custom power devices.

DETAILED SYLLABUS:

UNIT-I: POWER CONVERTERS FOR SOLAR APPLICATIONS (9 Periods)

Introduction to solar photovoltaic system; I-V and P-V characteristics; Block diagram of solar photo voltaic system. Principle of operation — line commutated converters (inversion-mode). Selection of inverter. Multilevel inverters and its classification. Battery sizing and array sizing.

UNIT-II: PHOTOVOLTAIC SYSTEMS (11 Periods)

PV Systems — Stand-alone PV system: Charge controllers — series and shunt charge regulators. Maximum power point tracking algorithm. Solar pumping application.

Grid Connected PV Systems: Inverter types — line, self-commutated inverters, PV inverter with high frequency transformer and grid-tied inverter characteristics. Grid connection issues.

UNIT-III: WIND ENERGY CONVERSION SYSTEMS (8 Periods)

Introduction to wind energy system, Components of Wind Energy Conversion System (WECS), classification of WECS, performance of induction generators for WECS; Principle of operation and analysis of induction generator, permanent magnet synchronous generator, squirrel cage and doubly fed induction generators.

UNIT-IV: POWER CONVERTERS FOR WIND APPLICATIONS (9 Periods)

Power converters: Three phase AC voltage controllers, AC-DC-AC converters — uncontrolled rectifiers, PWM inverters, grid interactive inverters, matrix converters. Stand alone operation of fixed and variable speed WECS. Grid connection issues. Grid integrated PMSG and SCIG based WECS.

UNIT-V: POWER QUALITY ISSUES IN RENEWABLE ENERGY INTEGRATION

(8 Periods)

Power quality — Definition, Power quality issues, Sources and Effects; International standards of Power quality and Electro Magnetic Compatibility (EMC); Impact of power quality problems in grid integration of renewable energy sources. Power quality enhancement using custom Power devices-STATCOM and DVR.

Total Periods: 45

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. Mukund R Patel, *Wind and Solar Power Systems*, CRC Press, 2005.
2. Arindam Ghosh, Gerard Ledwich, *Power Quality Enhancement Using Custom Power Devices*, Springer, 2002.

REFERENCE BOOKS:

1. Ion Boldea, *Variable speed generators*, Taylor & Francis group, 2015.
2. Andrzej M. Trzynnadlowski, *Introduction to Modern Power Electronics*, 3rd edition, wiley India Pvt. Ltd, 2016.
3. Roger C. Dugan, Mark E. Mc. Granaghan, Surya Santosoh and H. Wayne Beaty, *Electrical Power Systems Quality*, Tata McGraw Hill, 3rd edition, 2012.

ADDITIONAL LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108108078/
2. https://swayam.gov.in/nd1_noc19_ee37/preview
3. https://nptel.ac.in/courses/121/106/121106014/
4. https://nptel.ac.in/courses/103107157/

IV B. Tech. – I Semester
(19BT70233) INTERNSHIP

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	100	100	-	-	-	2

PREREQUISITES: -

COURSE DESCRIPTION: Expose students to the industrial environment; Create competent professionals for the industry; sharpen the real time technical / managerial skills required at the job; Gain professional experience and understand engineer's responsibilities and ethics; Familiarize with latest equipment, materials and technologies; Gain exposure to technical report writing; Gain exposure to corporate working culture.

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

CO1. Analyze latest equipment, materials and technologies that are used in industry to solve complex engineering problems following relevant standards, codes, policies and regulations.

CO2. Analyze safety, health, societal, environmental, sustainability, economical and managerial factors considered in industry in solvingcomplex engineering problems.

CO3. Perform individually or in a team besides communicating effectively in written, oral and graphical forms on practicing engineering.

IV B. Tech. – I Semester

(19BT702AC) **ELECTRICAL SAFETY AND SAFETY MANAGEMENT**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
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PRE-REQUISITES: A course on Basic Electrical and Electronics Engineering.

COURSE DESCRIPTION: The course deals with the various aspects of potential risk due to electrical shock; safety precautions to be followed while working in hazardous zones; safe practices while handling various electrical equipment and during maintenance; and relevant electrical safety standards and Indian rules and acts.

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

CO1. understand the Indian electricity rules, regulations and various standards to be maintained for safety of life and equipment.

CO2. understand the potential effects of electrical shock and safety measures to protect against such risk.

CO3. understand the safety aspects and safe practices to be followed while installing residential, commercial and agricultural appliances.

CO4. identify various hazardous working zones and take necessary precautionary measures while working in such areas.

CO5. follow safety measures during installation, testing and commissioning and maintenance of electrical equipment/plant.

DETAILED SYLLABUS:

UNIT-I: INDIAN ELECTRICITY RULES AND ACTS, AND THEIR SIGNIFICANCE (06 PERIODS)

OSHA standards of electrical safety, Basic electrical safety rules as per OSHA; Objectives and scope of IE acts and IE rules, Ground clearance and Section Clearances, Clearance in transmission and distribution lines, Significance of Equipment earthing, Earthing of equipment bodies, structures and non-current carrying metallic parts, earthing of system neutral; Rules regarding first aid and firefighting facility, Electrical safety general requirements as per IE rules.

UNIT-II: INTRODUCTION TO ELECTRICAL SAFETY AND SAFETY MANAGEMEN (07 PERIODS)

Electric Safety: Terms and definitions, objectives of safety and security measures, Hazards associated with electric current and voltage, Protection against electrical hazards and types, Effect of current on human body, Principles of electrical safety and approach to prevent accidents.

Electric shocks and its prevention: Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, Safety precautions in LV installations and electric plant.

UNIT-III: ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND AGRICULTURAL INSTALLATIONS (05 PERIODS)

Introduction—Wiring and fitting; Domestic appliances—water tap giving shock, shock from wet wall, fan firing shock; Multi-storied building, Temporary installations, Agricultural pump installation; Do's and Don'ts for safety in the use of domestic electrical appliances; Principles of safety management in electrical plants, safety auditing and economic aspects.

UNIT-IV: ELECTRICAL SAFETY IN HAZARDOUS AREAS (05 PERIODS)

Hazardous zones—class 0, 1 and 2; Sparks, flashovers and corona discharge in electrical plants; equipment for hazardous locations; scope for live line work, principles of live line maintenance, special tools for live line maintenance, safety instructions for working on HV lines/apparatus.

UNIT-V: SAFETY DURING INSTALLATION, TESTING AND MAINTENANCE (07 PERIODS)

Safety during installations: Preliminary preparations, preconditions for start of installation work and safe sequence, safety aspects during installations of Transformers and Rotating machines.

Safety during testing: Purpose of commissioning checks and tests, equipment tests, high voltage energization tests, performance and acceptance tests, safety aspects during commissioning.

Safety during maintenance: Operators safety, Types of safety maintenance, Safety procedures, safety precautions during maintenance, planning of maintenance.

Total Periods: 30

Topics for Self-study are provided in the Lesson Plan

TEXT BOOKS:

1. S.Rao, Prof. H.L.Saluja, "*Electrical Safety, Fire Safety Engineering and Safety Management"*, 2nd edition, Khanna Publishers. New Delhi, 2018 Reprint.

REFERENCE BOOKS:

1. Cadick, John, Mary Capelli-Schellpfeffer, and Dennis K. Neitzel. *Electrical safety handbook.* McGraw-Hill Education, 2012.

ADDITIONAL LEARNING RESOURCES:

Indian Electricity acts:

1. https://cercind.gov.in/Act-with-amendment.pdf
2. https://www.indiacode.nic.in/handle/123456789/2058?view_type=browse&sam_handle=123456789/1362

IV B. Tech. – I Semester
(19BT70232) **POWER SYSTEM SIMULATION LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	2	1

PRE-REQUISITES: A course on Power systems analysis.

COURSE DESCRIPTION: Investigations on various operational aspects of power system; power flow studies; faults and stability analysis; Power quality issues and its control aspects using simulation tools; FACTS controllers and grid connected PV system.

COURSE OUTCOMES: On successful completion of the course, student will be able to:

CO1. develop an appropriate simulation program/model to estimate the load profile, schedule the generators and analyze the dynamics of automatic generation control for various operating scenarios.

CO2. develop an appropriate simulation program/model, to model the transmission network and investigate the power flow, fault levels and stability limits for various operating scenarios.

CO3. develop an appropriate simulation/model to simulate various power quality issues and design appropriate filters to mitigate the harmonics.

CO4. develop an appropriate simulation/model to analyze operational aspects of the FACTS controllers for reactive power support and grid connected PV system.

CO5. Work independently or in teams to solve problems with effective communication.

Practical Exercises/List of Experiments:

Minimum Ten experiments are to be conducted.

1. Load forecasting using statistical methods.
2. Solving economic load dispatch problem with transmission losses.
3. Simulation of AVR and load frequency control with and without integral controller.
4. Develop bus admittance matrix of a transmission network.
5. Develop bus impedance matrix of a transmission network.
6. Analyze Load flows for a given transmission network.
7. Symmetrical fault analysis using bus impedance matrix.
8. Analysis of rotor dynamics using swing equation.
9. Simulation of power quality problems (Sag/Swell, interruption, transients, harmonics, flickers).
10. Harmonic analysis and Single tuned filter design to mitigate harmonics.
11. Simulation of FACTS controllers (TCR and TCSC).
12. Simulation of single phase grid connected PV system.

REFERENCE BOOKS/LABORATORY MANUALS:

1. Haadi A. Sadat, *Power System Analysis*, McGraw Hill Co. Ltd., India, 2000.
2. Dr. Shailendra Jain, *Modeling and simulation using Matlabsimulink*, 2nd edition Wiley, 2017.
3. *Randall Shaffer, Fundamentals of Power Electronics with Matlab,1st Edition, Da Vinci Engineering Series, 2007.*
4. https://in.mathworks.com/help/documentation

IVB.Tech.-ISemester

(16BT70231)**POWER SYSTEM-IILAB**

Int.MarksExt.MarksTotalMarksLTPC
5050100----32

PREREQUISITES: CoursesonMatricesandNumericalMethods, ElectricCircuitsandTransmission&Distribution.

COURSEOUTCOMES:onsuccessfulcompletionofthecourse, studentswillbeableto

CO1.demonstrateknowledgeon

••formationofnetworkmatricesandparametersof powersystem.

•variousloadflowmethodsandfaults.
•loadfrequencycontrolandstabilityofpower system.

CO2.analyze

•theformationofpowersystemnetworkmatrices.
•thepowerflowsolutionsusingvariousloadflow techniques.
•varioustypesofpowersystemfaults.
•loadfrequencyproblem.
•stabilityforthestableoperationofpower system.

CO3.designasuitableoperatingandcontrolstrategytomeet therequiredspecificationsofpowersystem.

CO4.developprogrammingskillstosolveandsimulatepower systemproblemstoprovideviablesolution.

CO5.selectandapplyappropriatetechniqueforsolvingcomplex problemsinthepowersystems.

CO6.applytheconceptualknowledgeofpowersystemsin relevancetoindustry andsociety.

CO7.committoethicalprinciplesandstandardswhile exercisingthepracticalinvestigationsonpowersystem.

CO8.workindividuallyorinagroupinthefieldofpower systems.

CO9.communicateeffectivelyin verbalandwrittenformin powersystemdomain.

LISTOFEXPERIMENTS:

Conductany**TEN**experimentsusingMATLAB/SIMULINK/PSCAD/ MiPower/PSIM.

1.Determinationofloadparametersfromloadcurve.
2.Determinationoftransmissionlineparameters.
3.FormationofYbus.
4.FormationofZbus.
5.Loadflowanalysis.
6.Faultanalysis.
7.Rotordynamicsusingswingequation.
8.Transientstabilityanalysis.
9.Economicdispatchproblem.
10.Modeling,simulationandanalysisofAVR.
11.Modeling,simulationandanalysisofLFCinan interconnectedpowersystem.
12.Powerqualityproblems.
13.Determinationoftransformerinrushcurrent.
14.Simulationofcapacitorswitchingtransients.
15.Demonstrationofsoftcomputingtechniquestoolboxes(ANN,FUZZY,GA