Vision

Create an Environment to acquire skills through learning and practicing in the relevant domain to become effective and successful technician to augment the societal needs, upholding ethics and environmental concern.

Mission

M1: Identification of relevant courses and their content necessary for the skill Development in Electronics and Communication Engineering.

M2: Providing adequate emphasis for practical learning augmented by the relevant theoretical concepts.

M3: Facilitating continuous evaluation and outcome assessment.

M4: Opportunity to develop applications.

M5: Facilitating an environment for interactive and interdisciplinary learning.

M6: Exposure to industries, professional bodies and social activities.

Programme Educational Objectives (PEOs)

PEO1	Demonstrate, Update and adapt domain knowledge in the area of electronics and communication engineering and the allied fields to propose solutions for the core industry in the ever changing global enterprise with ethical practices.
PEO2	Assume leadership roles and succeed in their chosen career path, in industry or public service through engineering ability, life skills and multidisciplinary skill set acquired.
PEO3	Pursue higher education institutes of national level.

PROGRAM OUTCOMES (POs)

1. **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.

2. **Problem analysis:** Identify and analyze well-defined engineering problems using codified standard methods.

3. **Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

4. **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

5. **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.
6. **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
7. **Life-long learning:** Ability to analyze individual needs and engage in updating in the context oftechnological changes.

Syllabus For Electronics & Communication Engineering

Project Management Skills

RATIONALE

Project Management is a confluence of Management principles and Engineering subject area. This course enables the students to develop conceptualization of Engineering Management principles and apply the same for their engineering projects, in their domains, example, Software Development project or Construction Project and so on. The course integrates three core areas of Planning, Execution and Auditing of Projects.

1. COURSE SKILL SET

Student will be able to:

1. Understand what constitutes a project, Plan for the execution of the project by breaking into manageable work units, and Prepare necessary project artifacts
2. Track and control the Project while preparing verifiable records for Project Inspections and Audits
3. Inspect and Audit projects for Milestones or other project completion criteria and other metrics, Defects and remediation, Project learnings
4. Gain knowledge and develop curiosity on latest technology trends in Project management

2. COURSE OUT COMES

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

CO1	Apply the concepts of Project Management to real projects which are expressed in the form of the Project reports or Engineering drawings
CO2	Estimate Project resources needed Time, Material and Effort, and Plan for Execution
CO3	Understand, analyze and assess the risks involved in a project and plan for managing them
CO4	Use Project Management Software and processes to track and control Projects
CO5	Conduct inspection of Projects and audit progress and bills
CO6	Understand the Digital Technology trends in Project management and concepts like Smart cities

3. DETAILS OF COURSE CONTENT

The following topics/subtopics is to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets.

UNIT NO	Unit skill set (In cognitive domain)	Topics / Subtopics	Hours L-T-P
1. Introduction	Use Basic Science, Maths skills to understand Project management and project planning, execution and control.	Introduction and definition, Features of a Project, Types of Projects, Benefits and Obstacles in Project Management, Project Management Profession, Role of Project manager, Consultants, Project and Operation, Project Management Process, Project Scope	
2 Project Administration	Able to develop WBS, PEP and PM processes for Project with given inputs	Project Administration, Project Team, Project Design, Work Breakdown Structure (WBS), Project Execution Plan (PEP), Systems and Procedure Plan, Project Direction, Communication and Coordination, Project Success	
3. Project Lifecycle	Use project administration and project lifecycle knowledge to Assess and plan for project risk	Project Life Cycle, Phases - Project Planning, Project Execution, Project Closure, Project Risks, Project Cost Risk Analysis, Time and Cost overruns	
4. Project Planning, Project Scheduling and Project Monitoring and Implementation	Able to develop a detailed project plan given the inputs on manpower, funds availability and time availability	Project Planning Function, Structure, Project Scheduling, Project monitoring and Project evaluation	
5.Project Control, Review and Audit	Use Project Management lifecycle knowledge to Control project parameters, review and audit project performance	Project Control, Problems of Project Control, Gantt Charts, Milestone Charts, Critical Path Method (CPM), Network Technique in Project Scheduling, Crashing Project Duration through Network, Project Review, Initial Review, Performance Evaluation, Abandonment Analysis, Project Audit	

6.Digital Project Management	Understand latest trends of digital technologies impacting the domain of project management and application of the same in multiple scenario	Digital Technology trends in Project management, Cloud Technology, IoT, Smart cities, Data and analytics, case studies	

4. MAPPING OF CO WITH PO

CO	Course Outcome	PO Mapped	UNIT Linked	CL R/U/A	Sessions in Hrs	TOTAL - Marks
CO1	Understand the concepts of Project Management in relation to real projects which are expressed in the form of the Project reports or Engineering drawings					
CO2	Estimate Project resources needed Time, Material and Effort, and Plan for execution					
CO3	Evaluate the risks involved in a project and Plan for managing them					
CO4	Use Project Management methods with Software and/or processes to track and control Projects					
CO5	Conduct inspection of Projects and audit progress and bills					

CO6	Understand the Digital Technology trends in Project management, and Engineering Industries	1, 5, 7	6			

	CO's	Programme Outcomes (PO s)						
		1	2	3	4	5	6	7
Project Management	CO1							
	CO2							
	CO3							
	CO4							
	CO5							
	CO6							
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0-Not Mapped								

5. SUGGESTED LEARNING RESOURCES:

Sl No.	Author	Title of Books	Publication/Year
1	**Dr. Lalitha Balakrishnan & Dr. Gowri Ramachandran**	**Project Management**	**Himalaya Publishing, 2019**
2	Shailesh Kumar Shivakumar	Complete Guide to Digital Project Management	Apress, 2019
3	Prasanna Chandra	Project planning, analysis, selection, implementation and review	Tata McGraw Hill
4	Gopala Krishnan	Project Management	Mcmillan India Ltd.

STATISTICS AND ANALYTICS

RATIONALE

Statistics and analytics help the learner to use the proper methods to collect the data, employ the correct analyses, effectively present the results and conduct research, to be able to read and evaluate journal articles, to further develop critical thinking and analytic skills, to act as an informed consumer and to know when you need to hire outside statistical help. The python language is one of the most accessible programming languages available because it has simplified syntax and not complicated, which gives more emphasis on natural language.

COURSE OUT COMES

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

CO1	Understand the tools of data collection, classification and cleaning of data.
CO2	Able to summarize the given statistical data
CO3	Understand the measure of location and dispersion of data.
CO4	Learn the basics of Python programming.

DETAILS OF COURSE CONTENT

The following topics/subtopics is to be taught and assessed in order to develop Unit Skill Sets for achieving CO to attain identified skill sets.

UNIT NO	Unit skill set (In cognitive domain)	Topics/Subtopics	Hours L-T-P

UNIT-1 **STATISTICAL DATA COLLECTION AND TYPES**	➢ Able to collect statistical data.
	 ➢ Able to distinguish the data types.
	 ➢ Understands the usage of data collection tools
	 ➢ Able to specify problem statement for data collection
	 ➢ Able to collect data pointing the root cause of the problem statement.
		a Definition of data and classification (qualitative quantitative discrete and continuous data).
		 b Data collection tools
		   i) Questionnaires.
		   ii) Survey.
		   iii) Interviews.
		   iv) Focus group discussion.
		 1.3 Data cleaning.	

UNIT-2 **SUMMARIZATION OF DATA**	➢ Sketches bar, pie and histograms on Microsoft Excel spread sheet.
	 ➢ Sketches frequency curve and frequency polygon for the data set on Microsoft Excel spread sheet.
	 ➢ Sketches bar, pie and histograms on Microsoft Excel spread sheet.
	 ➢ Sketches frequency curve and frequency polygon for the data set on Microsoft Excel spread
		a Descriptive statistics
		   i. Data tabulation(frequency table
		   ii. Relative frequency table.
		 b Grouped data
		   i. Bar graph
		   ii. Pie chart
		   iii. Line graph
		   iv. Frequency polygon
		   v. Frequency curve
		   vi. Relative frequency polygon
		   vii. Histograms
		   viii. Box plot
		   ix. Leaf-stem plot
		 To be done in Microsoft excel.	

	sheet.		
UNIT-3 **MEASURE OF LOCATION AND DISPERSION**	➢ Able to determine the descriptive statistical variables using Microsoft Excel. ➢ Able to determine the absolute measures of dispersion of the given data set. ➢ Explain the symmetry and asymmetry of the distributed data.	a Determination of central tendencies Range, Mean, Mode and Median for the data in Microsoft excel. b Determination of absolute measures of dispersion for data like range quartile deviation, mean deviation, standard deviation and variance in Microsoft Excel. c Skewness and kurtosis graphs in Microsoft excel and interpretations of results.	

UNIT-4 **INTRODUCTION TO** **PYTHON** **PROGRAMMING**	➢ Able Install and run the Python interpreter. Create and execute Python programs. ➢ Understand the concepts of file I/O. ➢ Able to read data from a text file using Python. ➢ Learn variable declarations in Python. ➢ Learn control structures. ➢ Learn Loop Constructs.	4.1 Introduction to PYTHON. 4.2 Syntax of PYTHON. 4.3 Comments of PYTHON. 4.4 Data types of PYTHON. 4.5 Variables of PYTHON. 4.6 If-else in PYTHON. 4.6 Loops in PYTHON. 4.7 Arrays and functions in PYTHON.

STATISTICS AND ANALYTICS LAB

SL NO	Practical outcomes/Practical exercises	Unit no	PO	CO	L:T:P
	Learn loop constructs.				
1	Prepare a questionnaire (closed end) containing 25 questions for a specified problem statement: for example experience of an individual in a restaurant.	1			
2	Prepare a Google form for a specified problem statement to collect the dataset. (for example questionnaire to conduct online quiz)	1			
3	Send out a survey on your problem statement to number of 50 (By Google forms) and collect the data.	1			
4	Remove duplicate or irrelevant observations. Remove unwanted observations from the dataset provided, including duplicate observations or irrelevant observations.	1			
5	In Microsoft Excel spread sheet draw the frequency distribution table for the given data (data set should contain minimum 50 data).	2			
6	In Microsoft Excel spread sheet draw the relative frequency distribution table for the given data (data set should contain minimum 50 data).	2			
7	Using Microsoft Excel spread sheet plot bar graph for the data collected from 100 people(for example, conduct a survey on the favorite fruit of a person in your locality(restricting to 5 to 6 fruits). Explain the bar graph with minimum 30 words.	2			
8	Using Microsoft Excel spread sheet plot pie chart for the data collected from 50 people(for example, conduct a survey on the smokers with respect to their ages in your locality. Explain the pie chart with minimum 30 words.	2			
9	Using Microsoft Excel spread sheet draw a line graph for the given dataset.	2			
10	Using Microsoft Excel spread sheet draw frequency polygon and frequency curve for the data collected from 50 people. (For example, marks obtained by the students in your class in 5 subjects in previous examination). Explain your observations from the graph in minimum 30 words.	2			

11	Using Microsoft Excel spread sheet construct a box plot for the given dataset. (For example dataset can be the number of passengers in a flat form at different time in a day).	2			
12	Using Microsoft Excel spread sheet construct a leaf plot for the given dataset. Explain the graph with minimum 30 words.	2			
13	Using Microsoft Excel spread sheet find the Mean, Mode and Median for the data (univariate data) given and also represent them in a Histogram.	3			
14	Generate a 50 random data sample (even and odd number dataset) using Microsoft Excel spread sheet and determine the range and Quartiles.	3			
15	Collect the current yield of a crop from 50 different persons (problem statement can be changed according	3			
	to priorities of the tutor) in your locality and determine mean deviation and Quartile deviation in Microsoft excel spread sheet and brief your inference with less than 30 words.				
16	Collect the data of any 2 livestock population from 50 different houses in your locality (problem statement can be changed according to priorities of the tutor) and determine standard deviation for both the two separately in Microsoft excel spread sheet and brief your inference with less than 30 words.	3			
17	Collect the data of two wheeler (with a rider and a pillion) crossing a busy junction in your locality in the peak hours (problem statement can be changed according to priorities of the tutor) and determine the variance of the data in Microsoft excel spread sheet and brief your inference with less than 30 words.	3			
18	Using Microsoft Excel spread sheet draw a Skewness graph and kurtosis graph for randomly generated dataset.	3			
20	Write a python program to add 2 integers and 2 strings and print the result.	4			
21	Write a python program to find the sum of first 10 natural numbers.	4			
22	Write a python program to find whether the number is odd or even.	4			
23	Write a python program to find the variance and standard deviation for the given data..	4			
24	Write a python program to display student marks from the record.	4			
25	Write a python program to create a labeled bar graph using matpoltlib. pyplot.	4			

26	Write a python program to create a labeled pie chart using matpoltlib. pyplot.				
Total Hours					

MAPPING OF CO WITH PO

CO	Course Outcome	PO Mapped	Cognitive Level R/U/A	Tutorial & Practical Sessions in Hrs.	TOT AL
CO1	Understand the tools of data collection, classification and cleaning of data.	1,2,4,5,7			
CO2	Able to summarize the given statistical data	1,2,4,5,7			
CO3	Understand the measure of location and dispersion of data.	1,2,4,5,7			
CO4	Learn the basics of Python programming.	1,2,4,5,7			

Course	CO's	Programme Outcomes (PO's)						
		1	2	3	4	5	6	7
Statistics & Analytics	CO1	3	3	0	3	3	0	3
	CO2	3	3	0	3	3	0	3
	CO3	3	3	0	3	3	0	3
	CO4	3	3	0	3	3	0	3
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped								

SUGGESTED LEARNING RESOURCES:

1. Statistical Analysis with Excel For Dummies (For Dummies Series) Paperback Import, 9 April 2013 by Joseph Schmuller (Author)
2. https://www.brianheinold.net/python/A_Practical_Introduction_to_Python_Progra mmingHeinold.pdf
3. http://www.bikeprof.com/uploads/9/0/6/5/9065192/excel_stats_handout_npl.pdf
4. https://adminfinance.umw.edu/tess/files/2013/06/Excel-Manual1.pdf
5. https://www.brianheinold.net/python/A_Practical_Introduction_to_Python_Progra mmingHeinold.pdf
6. Introduction to Python programming for beginners by Vivian Baily Kindle edition.
7. PYTHON PROGRAMMING: Python programming: the ultimate guide from a beginner to expert by Clive Campbell.
8. Open source for python: https://hub.gke2.mybinder.org/user/jupyterlab- jupyterlab-demo-zfkdwy4y/lab

FUNDAMENTALS OF ELECTRICAL & ELECTRONICS ENGINEERING

1. RATIONALE

Fundamentals of Electrical and Electronics Engineering is essential for all streams of diploma engineering to work in any industry as it covers basic electrical safety, troubleshooting and repairing of simple electrical systems. Basic knowledge of electrical wiring circuits, protective devices, electrical machines and basic electronics devices is required to work in any engineering field.

2. COURSE SKILL SET

The aim of the course is to help the student to attain the following industry identified competency through various teaching –learning experiences

1. Perform and test domestic wiring
2. Can operate electrical machine
3. Test different electronics devices

3. INSTRUCTIONAL STRATEGY

1. Expose to different learning tools used in respective labs, Operational safety and Procedure to be followed in the laboratory.
2. Instructor should give examples from daily routine as well as, engineering/technology applications on various concepts and principles in each topic so that students are able to understand and grasp these concepts and principles. In all contents, SI units should be followed.
3. Activity- Theory - Demonstrate/practice approach may be followed throughout the course so that learning may be skill and employability based.

4.COURSE OUT COMES

On successful completion of the course, the students will be able to

CO1	Comply with the safety procedures
CO2	Apply the fundamentals of electricity.
CO3	Install and test electrical wiring system.
CO4	Identify and Operate electrical machines, Batteries and UPS.
CO5	Identify and test the different electronic devices.

5. COURSE TOPICS:

Unit No	Unit Name	Hours
1	Electrical Safety	
2	Electrical Fundamentals	
3	Protective Devices and Wiring circuits	
4	Electric Machines and Batteries and UPS	

SI No	Unit skill set			
5		Introduction to Electronic Devices and Digital Electronics		
		Total		

6. COURSE CONTENT

The following topics/subtopics is to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets

SI No	Unit skill set (In cognitive domain) *On successful completion of the class, the students will be able to*	Topics/Sub topics	Practical	Hours L-T-P
		UNIT-1 **Electrical Safety**		
1	Comply with the Electrical safety	1. Electrical Symbols 2. Electrical safety • Identify Various types of safety signs and what they mean • Demonstrate and practice use of PPE • Demonstrate how to free a person from electrocution • Administer appropriate first aid to victims, bandaging, heart attack, CPR, etc. • Fire safety, causes and precautionary activities. • Use of appropriate fire extinguishers on different types of fires. • Demonstrate rescue techniques applied during fire hazard, correct method to move injured people during emergency • Inform relevant authority about any abnormal situation http://nreeder.com/Flash/symbols.m http://bouteloup.pierre.free.fr/iufm/as/de/house/safety.html	1. Electrical symbols related to electrical engineering. 2. Electrical safety	
		UNIT-2 **Electrical Fundamentals**		

2	1. Identify and select the different measuring devices. 2. Identify different electrical supply systems 3. Identify open circuit, close circuit and short circuit conditions.	1. Describe the sources of electrical energy. 2. Electrical current, voltage, emf, potential difference, resistance with their SI units. 3. Mention the meters used to measure different electrical quantities. 4. Explain supply systems like AC, DC. 5. Describe open circuit, close circuit and short circuit http://nreeder.com/Flash/units.htm	1. Identification of measuring devices. 2. Measure current, voltage and analyses the effects of shorts and opens in series/parallel circuits.	
3	Calculate basic electrical quantities	• Behaviour of V, I in Series and Parallel DC circuits. • Relationship between V, I and R. http://nreeder.com/Fla sh/ohmsLaw.htm	1. Measure the voltage and current against individual resistance in electrical circuit. 2. Compare the theoretical values with actual in the circuit.	
4	Connect resistances in different combination	1. Equation to find the connected in Resistances series 2. Equation to find connected Resistances series in parallel and 3. Resistances connected parallel combinations 4. Simple problems.	1. Determine the equivalent Resistance of series connected resistances. 2. Determine the equivalent Resistance of parallel connected resistances.	
5	Calculate and measurement of different parameters of an AC quantity.	**Ac sinewave: S**inusoidal voltage, current, amplitude, time-period, cycle, frequency, phase, phase difference, and their units. http://nreeder.com/Flash/freqPe riod.htm http://nreeder.com/Flash/oscillo scope.htm	Demonstrate the measurement of frequency, time period and phase difference of AC quantity using CRO and function generator.	
6	1. Calculate and measure electric power and energy 2. Identify and differentiate Single phase and Three phase supply	1. Electrical work, energy, power and power factor • SI units • Mention the meters used to measure them 2. Single phase and Three phase supply http://nreeder.com/Flash/powerLaw.htm	• Measure the voltage, current, power and energy using relevant measuring	

		instruments in a single-phase load. • Compare the theoretical values with actual in the circuit. • Measure the voltages in Single phase and Three phase supply.	
UNIT-3 **Protective Devices and Wiring circuit s**		

7	Identify and select Protective Devices for given current and voltage rating	1. Necessity of Protective Devices
		2. Various Protective devices and their functions
		  • fuse wire,
		  • Glass cartridge fuse
		  • HRC fuse
		  • Kit-kat fuse
		  • MCB
		  • MCCB
		  • RCCB
		  • ELCB
		  • Relay
		3. Earthing
		  • Types
		  • Pipe earthing
		  • Plate earthing
			1. Identification and Selection of various prot ective devices
			2. Inspection of their instal lation in the college buil ding/public building.	

8	Identify and select the various electrician tools	1. Different types of electrician tools and their function. 2. Describe various wiring tools. 3. State procedure of care and maintenance of wiring tools.	Identification and selection of different tools.	

9	1. Identify and select Wiring systems for a given applications
	2. Identify and select the cables used for different current and voltage ratings.
	3. Draw the wiring diagram
		1. Describe different types of wiring systems.
		  • Surface conduit
		  • concealed conduit
		  • PVC casing capping
		2. Wiring systems and their applications.
		3. Describe the types of wires, cables used for different current and voltage ratings.
			1. Identification and selection of different Wiring systems.
			2. Wire up and test PVC Conduit wiring to control of 2 sockets and 2 lamps.
			3. Wire up and test PVC Conduit wiring to control one lamp from	

			two different places.	
10	Estimate and plan electrical wiring	Explain Plan and estimate the cost of electrical wiring for one 3m × 3m room consisting of 2 lamps, 1ceiling fan, 2 three pin sockets.	Prepare the estimation and plan	
		UNIT-4 **Electrical Machines and Batteries and UPS**		
11	1. Identify the types of transformer. 2. verify the transformation ratio.	**Transformer** • working principle • Transformation ratio • Types and applications with their ratings	Connect the Single-phase transformer as Step-Up, Step-Down transformer and verify the transformation ratio.	
12	1. Start and run the induction motor. 2. Troubleshoot DOL/Stardelta starter and induction motor	1. **Induction motor** • Types Induction motor and applications • Difference between single and three phase motors • Necessity of starters for AC motors • Describe different types of starters and applications 2. What are different causes and remedies for a failure of starter and induction motor.	1. Construct a suitable circuit to start and reverse the direction of three phase induction motor using DOL/ Stardelta starter. 2. Troubleshoot the DOL/S tar-delta starter and induction motor	
13	Select and test the battery for a given application	**Battery** • Types of batteries (Lead acid battery, lithium, sealed maintenance free (SMF) battery, Modular battery). • Selection criteria of batteries for different applications. • Ampere-Hour Capacity. • Efficiency	Testing Condition of a Lead-acid battery	

14	Select the size of the UPS for a given application	**UPS** • List the types and applications • Selection criteria of UPS • Sizing of UPS	Sizing of UPS	
		UNIT-5 **Introdu ction to Electronic Devices and Digital Electronics**		
15	Identify and differentiate Conductors, insulators and semiconductors.	Compare Conductors, insulators and semiconductors with examples http://nreeder.com/Flash/resistor. htm	Identification of types and values of resistors-color codes. Determine the value of resistance by color code and compare it with multimeter readings.	
16	Identify and test PN junction Diode	**PN junction diode** • Symbol • Characteristics • Diode as switch. • Types of diodes and ratings • Applications	Identify the terminals of a Diode and test the diode for its condition.	
17	Build and test bridge rectifier circuit	**Rectifier** • Need for AC to DC conversion • Bridge rectifier with and without C filter, • Rectifier IC.	Construct and test bridge rectifiers using semiconductor diode and rectifier IC. Compare the waveforms using CRO.	
18	1. Identify and test Transistor 2. Build and test transistor as an electronic switch	**Transistor (BJT)** • Symbol • Structure • Working principle	1. Identification of transistor terminals and test. 2. Construct and test the transistor as an electronic switch	

19	1. Identify and test various Sensors and actuators.	**1.Sensors** • Concept • Types: Temperature, Pressure, Water, Light, Sound, Smoke, proximity Sensors, Flow, humidity, voltage, vibration, IR (Principle/working, ratings/ specifications, cost, and applications) **2.Actuators** • Concept • Types and applications. • Relay as an actuator.	1. Connect and test an IR proximity sensor to a Digital circuit. 2. Connect and test a relay circuit using an Optocoupler. (Photo Diode & Transistor)
20	1. Identify and test different digital IC	• Comparison of analog and digital signal • Digital systems, examples. • Binary numbers, Boolean identities and laws. • Digital system building blocks: Basic logic gates, symbols and truth tables. • IC-Definition and advantages.	• Test a Digital IC. • Identification and selection of suitable ICs for basic gates. • Verify NOT, AND, OR, NOR, EXOR and NAND gate operations (two inputs).
21	Know the application of Microcontroller and PLC	• Microcontroller as a programmable device, and list of real-world applications. • PLC and Their applications.	• Identify different application microcontroller. • Identify commercially available PLC and their specifications
		TOTAL	
			Hours

FUNDAMENTAL OF ELE. & ELECTRONICS PRATICAL

Sl. No.	Practical Out Comes/Practical exercises	Unit No.	PO	CO	L: T:P Hrs.
1	1. Collect/draw standard prominent electrical symbols related to electrical engineering. 2. Identify Various types of safety signs and what they mean	1			
2	• Identify Various types of safety signs and what they mean • Demonstrate and practice use of PPE • Demonstrate how to free a person from electrocution • Administer appropriate first aid to victims, bandaging, heart attack, CPR, etc. • Fire safety, causes and precautionary activities. • Use of appropriate fire extinguishers on different types of fires. • Demonstrate rescue techniques applied during fire hazard, correct method to move injured people during emergency • Inform relevant authority about any abnormal situation	1			

3	1.Identification Measuring devices
	    • Ammeter
	    • Voltmeter
	    • Wattmeter
	    • Ohmmeter
	    • Digital Multimeter
	    • Megger
	    • Tong tester
	2. Measure current, voltage and analyses the effects of shorts and opens in series / parallel circuits.
		2			

4	Measure the voltage and current against individual resistance in electrical circuit. Compare the theoretical values with actual in the circuit.	2			
5	1. Determine the equivalent Resistance of series connected resistances. 2. Determine the equivalent Resistance of parallel connected resistances.	2			
6	Demonstrate the measurement of frequency, time period and phase difference of AC quantity using CRO and function generator.	2			

7	Measure the voltage, current, power and energy using relevant measuring instruments in a Single-phase load.Compare the theoretical values with actual in the circuit.	2			
	Measure the voltages in Single phase and Three phase supply.				
8	1.Identification and selection of various protective devices. • HRC fuse • Kit kat fuse • MCB • MCCB • RCCB • ELCB • Relay Videos/Presentations/Discussion on different protective devices. 2.Inspection of their installation in the college building/public building.	3			
9	Identification and selection of different tools. Handson use of the tools for appropriate applications. Combination plier, Cutting Plier, Nose plier, screw driver set, line tester, Poker, Hand Drill, Power Drill, Concrete Drill, Megger, Earth tester, Continuity tester, crimping tool, wire cutter, Wire splicer, wire stripper standard wire gauge, soldering iron, wooden mallet, ball pin hammer, testing board	3			
10	1.Identification and selection of different tools. Handson use of the tools for appropriate applications. Surface conduit • concealed conduit • PVC casing capping 2.Wire up and test PVC Conduit wiring and practice control of 2 sockets and 2 lamps.	3			
11	Wire up and test PVC Conduit wiring to control one lamp from two different places.	3			
12	Plan and estimate the cost of electrical wiring for one 3mx3m room consisting of 2 CFL 1ceiling fan, 2 three pin sockets.	3			
13	Connect the Single- phase transformer as Step-Up, Step-Down transformer and verify the transformation ratio.	4			
14	Construct a suitable circuit to start and reverse the direction of three phase induction motor using DOL/star-delta starter.	4			
15	Troubleshoot the DOL/Star-delta starter and induction motor	4			
16	Testing Condition of a Lead-acid battery	4			

17	Estimate the UPS rating for a computer lab with 50 computers/domestic.	4			
18	1.Identification of types and values of resistors-color codes. 2.Determine the value of resistance by color code and compare it with multimeter readings	5			
19	Identify the terminals of a Diode and test the diode for its condition.	5			
20	Construct and test bridge rectifiers using semiconductor diode and rectifier IC. Compare the waveforms using CRO.	5			
21	Identification of transistor terminals and test. Construct and test the transistor as an electronic switch.	5			
22	Connect and test anIR proximity sensor to a Digital circuit.	5			
23	Connect and test a relay circuit using an Optocoupler. (Photo Diode & Transistor)	5			
24	Test an IC. Verify the truth-table AND, OR, NOT logic gates.	5			
25	Verify the truth-table NAND, NOR, EX-OR, EX-NOR logic gates.	5			
26	1. Identify MCS-51 variants 2. Identify commercially available PLC and their specifications.	5			
Total					**Hrs**

7. MAPPING OF CO WITH PO

CO	Course Outcome	PO Mapped	Experiment	Cognitive Level R/U/A	Lecture & Practical Sessions in Hrs	TOTAL
CO1	Comply with the safety procedures	PO1, PO4	1-2	A	6	
CO2	Apply the fundamentals of electricity.	PO1, PO4	3-7	A	15	
CO3	Install and test electrical wiring system and protective devices.	PO1, PO4	8-12	A	15	
CO4	Identify and Operate electrical machines, Batteries and UPS.	PO1, PO4	13-17	A	15	
CO5	Identify and test the different electronic devices.	PO1, PO4	18-26	A	27	

Course	CO's	Programme Outcomes (PO's)						
		1	2	3	4	5	6	7
Fundamentals of Electrical and Electronics Engineering	CO1	3	0	0	3	0	0	0
	CO2	3	0	0	3	0	0	0
	CO3	3	0	0	3	0	0	0
	CO4	3	0	0	3	0	0	0
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0-Not Mapped								

8. SUGGESTED LEARNING RESOURCES:

Reference Books:

1. ABC of Electrical Engineering by B. L. Theraja and A. K. Theraja, S Chand Publishers, New Delhi, 2014 Edition.
2. Basic Electrical and Electronics Engineering by S. K. Bhattacharya, Pearson Education India, 2012 Edition.
3. Electronic Devices and Circuits by I. J. Nagrath, PHI Learning Pvt. Ltd., 2007 Edition.
4. Basic Electrical Engineering byV. Mittle and ArvindMittle, McGrawHill Companies, 2005 Edition.
5. The 8051 Microcontroller & Embedded systemsusinkbnnnjbbh bb vvvvg assembly and C (2ndEdition)–M.A.Mazidi , J.C. Mazidi&R.D.McKinlay ISBN: 81-317-1026-2
6. Programmable Logic controllers, W BOLTON

e-Resources

1. https://www.youtube.com/watch?v=mc979OhitAg&list=PLWv9VM947MKi_7yJ0 FCfzTBXpQU- Qd3K
2. https://www.youtube.com/watch?v=CWulQ1ZSE3c
3. en.wikipedia.org/wiki/Transformer
2. www.animations.physics.unsw.edu.au//jw/AC.html
3. www.alpharubicon.com/altenergy/understandingAC.htm
4. www.electronics-tutorials
5. learn.sparkfun.com/tutorials/transistors
6. www.pitt.edu/~qiw4/Academic/ME2082/Transistor%20Basics.pdf
7. www.technologystudent.com/elec1/transis1.htm
8. www.learningaboutelectronics.com
9. www.electrical4u.com
10. https://www.youtube.com/watch?v=zLW_7TPf310
11. https://www.youtube.com/watch?v=8PTNjw-hQIM

Digital Electronics

1. RATIONALE

Innumerable logical and complex problems prevail in the real world which need quick and accurate solutions at low cost. The examples include: Counting number of people entering cinema hall; digital clock; playing video; phone call; transmission of document from one place to other; searching your unique ID in Aadhaar database; withdrawing money from ATM; booking railway ticket; and to check if a 25-digit number is a prime-number or not.

Inherent mapping of real-world problems to digital domain, ability of electronic circuits to process digital signals/binary signals and the support of Boolean algebra/relevant mathematical theories for simplification of circuits and reduction of time-complexity have made digital electronics the most suitable option for solving real-world problems. In fact, digital electronics can provide solutions at electronic-speed and low-cost owing to the enhancements in circuit design, fabrication technology and mass production. And the fact that the hardware of computer is digital electronic circuits elucidates the relevance of digital electronics and it learning. In this context, it is very essential to learn the basics of digital electronics to be a competent electronics professional.

2. COURSE SKILL SET

The goal of the course is to help the student to attain the following industry-need competencies through various teaching-learning processes.

   i)   To understand the simple real-world logical problems and Learning to solve them through established methods.
   ii) Perform analysis, design and troubleshoot well-known simple digital circuits in practical environment.
   iii) To acquire the basic knowledge digital electronic integrated circuits andspecifications.

3. INSTRUCTIONAL STRATEGY

   1. Teachers are suggested to take measures to create interest and enhance learning confidencein students.
   2. Teachers should give examples from daily routine/realistic/real-world as well as relate to engineering/technology applications on various concepts and principles in each topic so that students are made to understand and grasp the concepts and principles. Wherever applicable SI units are followed.
   3. Demonstration can make the subject interesting and develop scientific temper in the students. Student activities should be planned on all the topics.
   4. Theory - Demonstrate/practice-Activity approach may be followed throughout the course sothat learning may be outcome and employability based.
   5. All demonstrations/Hand-on practices are under simulated environment (may be followed by real environment as far as possible).

4. COURSE OUTCOMES (COs)

On successful completion of the course, the students will be able to

CO1	Identify and apply arithmetic and conversion operations on different numbersystems
CO2	Formulate, simplify and implement simple logic functions
CO3	Build/design and analyze various combinational circuits
CO4	Identify and select digital integrated circuits (ICs) for simple applications

5. COURSE TOPICS

Unit No	Unit Name	Hours
1	Number Systems and Codes	
2	Basic Logic Circuits	
3	Arithmetic Circuits	
4	Multiplexers and Demultiplexer	
5	Encoders and Decoders	
6	Logic Families	
	Total	

6. COURSE CONTENTS

The following topics/sub topics is to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets

Course Content Delivery	Learning Method	Duration L:P (Hr)
UNIT –I: NUMBER SYSTEMS AND CODES (8Hr)		

1.1 Comparison between analog and digital signals with real-world examples. Number systems: Binary, Octal, Decimal and Hexadecimal. Relevance and examples.	Teaching, examples and exercises	
1.2 Conversion between number systems with examples	Teaching, examples and exercises	
1.3 Arithmetic operations-Addition, Subtraction, Multiplication and Division on binary numbers with examples.	Teaching, examples and exercises	
1.4 Addition and subtraction of Hexadecimal numbers. 1's & 2's complement of binary numbers with examples.	Teaching, examples and exercises	
1.5 Application of Complement numbers: Representation of signed binary numbers and Example for realizing subtraction using addition.	Teaching, examples and exercises	
1.6 Codes: Relevance, types (BCD, Gray, Excess-3, ASCII and EBCDIC) with examples and applications.	Teaching, examples and exercises	

1.7 BCD Addition, Conversion between BCD and Decimal, Binary and Gray Numbers, Decimal and Excess-3 with examples.	Teaching, examples and exercises	
UNIT –2: BASIC LOGIC CIRCUITS (14Hr)		
2.1 Boolean algebra: Constants, variables, functions, Logic-gates (NOT, OR, AND, NOR, NAND, EX-OR and EX-NOR): Symbol, function,expression and truth-table.	Teaching, examples and exercises. Hands-on demonstration/practice for all logic gates	
2.2. Boolean identities and laws with proof and examples.	Teaching, examples and exercises	
2.3 De Morgan's and Duality Theorem with proof and examples.	Teaching, examples and exercises Hands-on demonstration/practice for De Morgan's theorem	
2.4 Universal gates: Concept, examples, relevance and realization of all logic gates using NAND gate.	Teaching, examples and exercises	
2.5 Realization of all logic gates using NOR gate.	Teaching, examples and exercises	
2.6 Simplification of Boolean expressions using Boolean algebra and build the logic circuit.	Teaching, examples and exercises	
2.7 SOP and POS forms, Conversion into standard SOP and POS forms.	Teaching, examples and exercises	
2.8 Translate SOP and POS expressions into truth-table, Convert truth-table to SOP and POS expressions (maximum 4 variables).	Teaching, examples and exercises	
2.9 SOP to POS & POS to SOP conversion	Teaching, examples and exercises	

2.10 Karnaugh Map: Need, K-map for 2 variable, 3 variable and 4 variable Boolean expression.	Teaching, examples and exercises	
2.11 Simplification of Boolean expression using K- map and realization of logic circuit for 2 and 3 variable.	Teaching, examples and exercises	
2.12 Simplification of Boolean expression using K- map and realization of logic circuit for 4 variable	Teaching, examples and exercises	

UNIT –3: ARITHMETIC CIRCUITS (9Hr)

3.1 Features of combinational circuits and examples. Half adder (HA): Concept, truth-table, logical expression, gate-level implementation and application.	Teaching, examples and exercises	
3.2 Full adder (FA): Concept, truth-table, logical expression, gate-level implementation and application. List of FA ICs.	Teaching, examples and exercises. Hands-on demonstration/practice FA using gates	
3.3 Half Subtractor (HS): Concept, truth-table, logical expression, gate-level implementation and application.	Teaching, examples and exercises	
3.4 Full Subtractor (FS): Concept, truth-table, logical expression, gate-level implementation and application.	Teaching, examples and exercises	
3.5 Serial & Parallel adders: Concept, comparison & applications.	Teaching, examples and exercises.	
3.6 Three-bit parallel adder circuit: Given the circuit, analyze it's working.	Teaching, examples and exercises.	
3.7 Two-bit magnitude comparator: Concept, truth-table, logical expression, gate-level implementation and application. Identify ICs	Teaching, examples and exercises. Hands-on demonstration/practice of 2-bit Magnitude Comparator using IC or gate-levelcircuit.	

UNIT –4: MULTIPLEXERS AND DEMULTIPLXERS (8 Hr)		
4.1 Multiplexers (Mux): Concept, relevance and applications, 2:1 Mux: Symbol, truth-table, logical expression, gate-level implementation and application. Identify ICs	Teaching, examples and exercises	
4.2 High-order Mux: Concept, examples (4:1, 8:1, and 16:1), Relation between number of inputs and control lines.	Teaching, examples and exercises. Hands-on demonstration/practice: 4:1 using 2:1 Mux or 8:1 using 4:1 Mux, using ICs.	
4.3 Realization of high-order (4:1) Mux using low-order (2:1) Mux. List Mux ICs.	Teaching, examples and exercises	
4.4 Realization of logic gates and simple logic equations using multiplexers. (Max. 3variables)	Teaching, examples and exercises	
4.5 Demultiplexer (Demux): Concept, relevance and applications. 1:2 Demux: Symbol, truth-table, logical expression, gate-level implementation and application.	Teaching, examples and exercises	
4.6 High-order Demux: Concept and examples (1:4, 1:8, 1:16), relation between number of outputs and control lines. Analysis of Demux: Given 1:4 Demux, write logical expressions and truth table.	Teaching, examples and exercises Hands-on practice for 1:8 using 1:4 Demux, using ICs	
UNIT –5: ENCODERS AND DECODERS (7 Hr)		
5.1 Encoders and Decoders: Relevance and applications.	Teaching, examples and exercises	
5.2 Decimal-to-BCD encoder: Logic diagram, working, truth-table and applications. List ICs	Teaching, examples and exercises. Hands-on demonstration/practice of an Decimal to BCD encoder	

5.3 Priority Encoder: Relevance, Logic diagram, working and Truth Table. Identify IC	Teaching, examples and exercises	
5.4 BCD-to-Decimal decoder: Logic diagram, working and truth-table	Teaching, examples and exercises	
5.5 Seven-segment display: Principle and types. Identify ICs for 7-segment display and Decoder.	Teaching, examples and exercises.	
5.6 BCD-to-seven segment decoder: Logic diagram, working and truth table	Teaching, examples and exercises. Hands-on demonstration/ practice on BCD to Seven Segment decoder	
UNIT –6: LOGIC FAMILIES (6Hr)		
6.1 ICs: Concept, advantages and disadvantages. IC classification: Based on scale of integration. Concept, need and types of logic families	Teaching, examples and exercises	
6.2 Logic family specifications: Propagation delay, fan-out, fan-in, power dissipation, noise margin, speed and speed-power product. 6.3 IC data sheet: Identify the specifications in typical standard TTL IC	Teaching, examples and exercises. Demonstration of IC datasheet interpretation	
6.4 Features of Standard TTL, CMOS & ECL. Identify TTL/CMOS/ECL NAND gate ICs and compare their specifications.	Teaching, examples and exercises.	
6.5 Interfacing between TTL and CMOS: Need, concept and precautions. Handling of ICs and ESD.	Teaching, examples and exercises. Demonstration of ICs' handling / placement /removal on IC base/ sockets with anti-ESD gloves	

MAPPING OF COS, POS, COGNITIVE LEVELS, LECTURES AND PRACTICES.

CO No.	Course Outcome	POs Mapped	Units Linked	Cognitive Level R/U/A	Lecture Sessions in Hrs	Demonstration/ Hands-on practice in Hrs	TOTAL
CO1	Identify and apply arithmetic and conversion operations on different number systems						
CO2	Formulate, simplify and implement simple logic functions						
CO3	Build/design and analyze various combinational circuits						
CO4	Identify and select digital ICs for simple applications						
	Total						

UNIT SKILL-SETS

Unit	Unit Name	SkillSet
1	Number Systems and codes	Comprehend the number systems, operate (conversion,addition and subtraction) on different number systems, identify and select the codes for different applications
2	Boolean Algebra	Translate the problem to truth-table, simplify thelogical expressions using Boolean identities/ laws/K-maps, and implement the logical functions.
3	Arithmetic Circuits	Given simple arithmetic problems, solve using digital circuitsand vice-versa (analysis). Identify arithmetic circuits ICs for simple applications.
4	Multiplexers and Demultiplexer	Solve simple multiplexing and demultiplexing problems, vice-versa (analysis). Identify multiplexing ICs for simple multiplexing applications.
5	Encoders and Decoders.	Solve simple coding/decoding problems, and identify coding ICsfor simple coding applications.
6	Logic Families	Identify and select the ICs from different IC families based-on application specifications.

ii)   MAPPING BETWEEN COs AND POs

Course	COs	Programme Outcomes (POs)						
		1	2	3	4	5	6	7
Digital Electronics	CO1							
	CO2							
	CO3							
	CO4							
Legends: **Level 3-** Highly Mapped**, 2-**Moderately Mapped**, 1-**Low Mapped**, 0-** NotMapped								

Reference Books

i) Digital fundamentals   Thomas L. Floyd, PEARSON EDUCATION publication, Eleventh edition   Global Edition, ISBN 10: 1-292-07598-8, ISBN 13:978-1-292-07598-3.

ii) Digital   Electronics   principles and integrated circuits. Anil K. Maini. Wiley publications, first edition. ISBN:978-81-265-1466-3.

iii) Digital principles and applications. Donald P Leach, Albert Paul Malvino, GoutamSaha, McGraw Hill Publisher, 7th edition, ISBN:978-0-07-014170-4.

iv) Digital Systems-principles and applications. Ronald J. Tocci, Neal S.Widmer, Gregory L. Moss, Prentice Hall Publications, 8th edition, ISBN:0-13-085634-7.

v) Digital Computer Fundamentals,-Thomas C Bartee, McGraw-Hill Publisher,4thedition. ISBN 0-07-003892-9.

Web-based/onlineResources
1. https://www.electronics-tutorials.ws/
2. https://learn.sparkfun.com/
3. https://www.allaboutcircuits.com/textbook/digital/
4. http://electronicstheory.com/COURSES/ELECTRONICS/e101-1.htm
5. https://www.gadgetronicx.com/electronic-circuits-library/
6. https://www.electronics-lab.com/
7. https://learn.adafruit.com/

8. https://www.instructables.com/circuits/
9. https://www.digitalelectronicsdeeds.com/
10. https://www.electrical4u.com/digital-electronics/
11. https://www.tutorialspoint.com/digital_circuits/index.htm

Major Equipment/Instruments

1. Digital trainer kits.
2. Electronics simulation software's.
3. Computers.
4. IC tester, logic probes.

Residential Electrical Wiring Practice

1. RATIONALE

Residential electrical wiring involves the design, estimation and physical wiring of a residential building for voltages less than 650V by an Electrician. A diploma student who is willing to take Electrician as a profession must have good knowledge of different types of wiringthat is being carried out according to the budget of house owner. Studying this course enhances the skill of the student to utilize the resources-best design, latest technology and longevity of house wiring in best possible way that is also cost effective keeping the protection of wiring, house hold gadgets and property.

2. COURSESKILL SET

The aim of the course is to help the student to attain the following industry identified competency through various teaching –learning experiences

- Good Knowledge of different types of wiring that is being carried out according to the budget
- Skills to utilize the resources-best design, latest technology and longevity of house wiring in best possible way that is also cost effective keeping the protection of wiring, house hold gadgets and property.
- To carry out all sorts of troubleshooting in electrical circuits of domestic wiring, and fault repair

3. INSTRUCTIONAL STRATEGY

1. Instructor should expose students to different tools used in electrical wiring, Operational safety and Procedure to be followed in domestic wiring.
2. Focus should be on proper selection and sizing of wires, cables and use of protective devices as well as on testing and troubleshooting of electrical faults.

4. COURSE OUT COMES

On successful completion of the course, the students will be able to

CO1	Comply with the safety procedures and standards.
CO2	Select cables, wiring, optimize accessories and forecast.
CO3	Develop and test wiring installations as per standards and customer requirement.
CO4	Troubleshoot and repair the wiring installations for proper working.

5. COURSE TOPICS

Sl No.	Unit Name	Lecture Hours	Practical Hours	Total Hours
1	**Health & Safety practices at the work place**	01	02	03
2	**Planning & Design**	07	14	21
3	**Installation & Testing**	12	24	36
4	**Fault Location & Earthing**	06	12	18
	TOTAL	**26**	**52**	**78**

3. DETAILS OF COURSE CONTENT

Unit No.	Practical Outcomes / practical exercises)	Unit No.	Hours		
			L	**T**	**P**
1	1) Demonstrate and practice use of PPE 2) Demonstrate how to free a person from electrocution 3) Demonstrate rescue techniques applied during fire hazard, correct method to move injured people during emergency 4) Use of appropriate fire extinguishers on different types of fires	1			
2	Identify, specify, dismantle and assemble different types of Lighting accessories (Switches, Socket Outlets, Plugs and Lamp holders)	2			
3	Identify, Measure the wire sizes and find the Current rating of different types of Single core Copper and Aluminum cables.	2			
4	Identify, specify, dismantle and assemble different types of Conduits and its accessories, LT Switchgears and Protective devices. (Main Switch, Distribution Boards, Fuse, MCB, RCCB).	2			

5	• Interpret the various BIS symbols used in electrical wiring diagrams. • Interpret Manufactures Catalogue for Cables and wiring accessories. • B.I.S Regulations, Recommendations and the National Electrical Code of practice pertaining to wiring installations.	2			
6	• Identify the Phase wire, Neutral wire, Earth wire and Half wire in a switchboard. • Estimatethe permissible load in sub circuits and calculation of cable sizes.	2			
7	Prepare a layout diagram, circuit / schematic diagram, installation plan and wiring diagram for the following: a) A bed room with 2 Lamps, 1 fan and one 5A socket. b) A living room with 4 Lamps, 2 fans and three 5A socket. c) A Kitchen with one 15A socket, one 5A socket, one light point and one Exhaust fan. d) A bathroom with one 15A socket, one 5A socket and one light point.	2			
8	Practice conduits bending, drawing of cables through conduits. (**on a board** in **PVC Surface conduit wiring system**)	2			

9	Practice the different wirings methods and joints.
	      • Switch loop in
	      • Junction box Loop in
	      • Ceiling Rose Loop in
	      • Simple Twist Joint
	      • Married Joint in Stranded conductors
		3			

10	Identify the phase and neutral terminals of the supply and perform the following test on domestic wiring installation: • Continuity test (OC & SC Test) • Polarity test • Earth and ground test • Insulation and leakage test	3			
11	• Two lamps controlled independently. • Two lamps in series controlled by one switch.	3			
12	One lamp, one fan and one three pin socket controlled from one switchboard.	3			
13	One lamp controlled from three different places. **(Intermediate wiring)**	3			

14	Consumer main board with Energy meter, Double pole iron Clad Switch and Distribution Board.				
15	An electrical installation having one room having 2 light points, 1 fan point and one 5A socket. One light point and fan are controlled from two locations.**(One lighting sub circuit and multiple switchboards)**				
16	An electrical installation having • Two rooms with 1 light point, one fan point and one 5A socket. • One living room with two 5A sockets, 1 fan points and 2 light points. **(Two lighting sub-circuits and multiple switchboards)**				
17	An electrical installation having four 15A sockets and 4 light points. **(Two Power sub-circuits and one lighting sub-circuit)**				
18	Design a 2BHK residential installation scheme and estimate the materials required. Draw the layout diagram; installation plan and wiring diagram according to National electrical code for the following wiring installations. Also prepare the bill of materials.				
19	• Perform the basic electrical tests on the given wiring system and identify the problems such as bad connection, incorrect wiring and equipment failure if any. • Locate various faults in residential wiring and rectify them. • Check the function of each component for proper functioning.				
20	Prepare pipe earthing and **measure the earth resistance using earth tester / Megger.**				
21	Prepare plate earthing and **measure the earth resistance using earth tester / Megger.**				

MAPPING OF CO WITH PO

CO	Course Outcome	PO Mapped	Experiment Linked	Cognitive Level R/U/A	Tutorial & Practical Sessions in Hrs
CO1	Comply with the safety procedures and standards				
CO2	Select cables, wiring, optimize accessories and forecast.				
CO3	Develop and test wiring installations as per standards and customer requirement.				
CO4	Troubleshoot and repair the wiring installations for proper working.				
Total					

LEVEL OF MAPPING PO's with CO's

Course	CO's	Programme Outcomes (PO's)						
Residential Electrical Wiring Practice	CO1							
	CO2							
	CO3							
	CO4							
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0-Not Mapped								

SUGGESTED LEARNING RESOURCES:

1) A Course in Electrical Installation Estimating &Costing: J.B GUPTA, Katson Books.
2) Electrical Design Estimating & Costing: K.B.Raina & S.K.Bhattacharya, New Age International Publishers.
3) Electrician - Trade Practical &Trade Theory, Semester-2 (NSQF LEVEL 5),

National Instructional Media Institute (NIMI),Chennai

4) IS 732 (1989): Code of Practice for Electrical Wiring Installations

List of Software/Learning Websites

1. Electrical switch board wiring diagram !Diy house wiring
   https://www.youtube.com/watch?v=JmwL-3rhgwY

2. How to fit a flush double metal back box and double socket into a solid brick wall
   https://www.youtube.com/watch?v=1zMGbqJ7M64

3. single phase meter wiring diagram
   https://www.youtube.com/watch?v=5YNSiE7HWsY

4. Two Way Switching Explained - How to wire 2 way light switch
   https://www.youtube.com/watch?v=opoEswRp_jg

5. Three way light switching | Intermediate switch
   https://www.youtube.com/watch?v=SUlt4ouCYPU

6. Rcc Slab || Electrical Conduit Pipe || Working Process || House
   Wiringhttps://www.youtube.com/watch?v=5PtXIWjLpnc

7. What is Ground? Earth / Ground earthing
   https://www.youtube.com/watch?v=zLW_7TPf310

8. Pipe Earthing
   https://www.youtube.com/watch?v=8PTNjw-hQIM

4. *Suggested list of student Activities*

1) Troubleshoot a given wiring system and make a report on procedures followed to locate faults.

2) Estimate the materials required for wiring a domestic house, lab etc. and prepare a cost estimate.

3) Interact with an electrical contractor and involve in a physical wiring work and make a report of all activities.

4) Preparing extension box, switch box and wiring models, simple panel board, and distribution board, building wiring of a lab/ room, etc.

Environmental Sustainability

COURSE OBJECTIVES:

Technicians working in industries or elsewhere essentially require the knowledge of environmental science so as to enable them to work and produce most efficient, economical and eco-friendly finished products.

1. Solve various engineering problems applying ecosystem to produce eco – friendly products.
2. Use relevant air and noise control methods to solve domestic and industrial problems.
3. Use relevant water and soil control methods to solve domestic and industrial problems.
4. To recognize relevant energy sources required for domestic and industrial applications.
5. Solve local solid and e-waste problems.

COURSE OUTCOMES:

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

CO1	Importance of ecosystem and terminology.
CO2	The extent of air pollution, effects, control measures and acts.
CO3	The extent of noise pollution, effects, control measures and acts.
CO4	The water and soil pollution, effects, control measures and acts
CO5	Different renewable energy resources and efficient process of harvesting.
CO6	Solid Waste Management and Environmental acts.

Unit No & Name	Detailed Course Content	CO	PO	Contact Hrs
1. Ecosystem	Structure of ecosystem, Biotic & Abiotic components, Aquatic (Lentic and Lotic) and terrestrial ecosystem.	CO1		
	Global warming - Causes, effects.	CO1		
	Green House Effect, Ozone depletion - Causes, effects	CO1		
2. Air and Pollution	Air pollution, Natural sources of air pollution, Man Made sources of air pollution	CO2		
	Air pollutants and Types, Effects of Particulate Pollutants and control by Cyclone separator	CO2		
	Effects of Particulate Pollutants and control by Electrostatic Precipitator, Air (prevention and control of pollution) act 1981.	CO2		
3. Noise pollution	Noise pollution: sources of pollution, Measurement of Noise pollution level.	CO3		
	Effects and Control of Noise pollution. Noise pollution (Regulation and Control) Rules, 2000	CO3		

4. *Water and Soil Pollution:*	*Sources of water pollution. Types of water pollutants, Characteristics of water pollutants.*	*CO4*		
	Control measures of water pollution.	*CO4*		
	Definition and list unit operations in water and Waste Water Treatment process, Water (prevention and control of pollution) act 1974.	*CO4*		
	Water conservation – Importance of Rain Water Harvesting	*CO4*		
	Soil pollution, Causes and Effects due to Fertilizers, Pesticides and Insecticides	*CO4*		
	Preventive measures of Soil Pollution due to Excessive use of Fertilizers, Pesticides and Insecticides.	*CO4*		
5. *Renewable sources of Energy*	Solar Energy: Basics of Solar energy. Solar collectors and advantages of Advanced solar collectors.	CO5		
	Solar water heater, Solar stills and their uses.	CO5		
	Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel.			
	Wind energy: Current status and future prospects of wind energy. Wind energy in India.	CO5		
	Need of new Energy sources, Different type's new energy sources. Environmental benefits of New Energy Sources-Hydrogen energy	CO5		
	Environmental benefits of New Energy Sources- Ocean energy resources	CO5		
	Environmental benefits of New Energy Sources-Tidal energy conversion.	CO5		
6. Solid Waste Management And Environmental Acts	Solid waste generation, Sources, Characteristics of solid waste Solid Waste Management rules 2016	CO6		
	E- Waste generation Sources and characteristics, E waste management rules 2016	CO6		
	Plastic Waste generation Sources and characteristics, Plastic Waste Sources and characteristics	CO6		
	Recycled plastic rules 2016,Importance of Environment (protection) act 1986,	CO6		
	Occupational health and safety measures.	CO6		
			Total	

Mapping of Course Outcomes with Programme Outcomes

CO	Course Outcome	PO Mapped	Cognitive Level R/U/A	Theory Sessions In Hrs	Allotted marks for CIE on cognitive levels		TOTAL
					R	U	
CO1	Importance Of ecosystem and terminology	1,5,7	R, U				
CO2	The extent of air pollution, effects, control measures and acts.	1,5,7	R, U				
CO3	The extent of noise pollution, effects, control measures and acts.	1,5,7	R, U				
CO4	The water and soil pollution, effects, control measures and acts	1,5,7	R, U				
CO5	Different renewable energy resources and efficient process of harvesting.	1,5,7	R, U				
CO6	Solid Waste Management and Environmental acts.	1,5,7	R, U				
Total Hours of instruction							

R-Remember; U-Understanding.

Level of Mapping PO's with CO's

Course	CO's	Programme Outcomes (PO's)						
		1	**2**	**3**	**4**	**5**	**6**	**7**
Environmental Science	**CO1**	3	0	0	0	2	0	1
	CO2	3	0	0	0	2	0	1
	CO3	3	0	0	0	2	0	1
	CO4	3	0	0	0	2	0	1
	CO5	3	0	0	0	2	0	1
	CO6	3	0	0	0	2	0	1

Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped

Method is to relate the level of PO with the number of hours devoted to the CO s which maps the given PO.
If ≥50% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 3
If 30 to 50% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 2
If 5 to 30% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 1
If < 5% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is considered not mapped i.e. Level 0

Reference Books

1. S.C. Sharma & M.P. Poonia, Environmental Studies,Khanna Publishing House,New Delhi
2. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
3. Arceivala, Soli Asolekar, Shyam, Wastewater Treatment for Pollution Control and Reuse, Mc-Graw Hill Education India Pvt. Ltd., New York, 2007, ISBN:978-07-062099.
4. Nazaroff, William, Cohen, Lisa, Environmental Engineering Science, Willy, New York, 2000, ISBN 10: 0471144940.

5. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi
6. Rao, C. S., Environmental Pollution Control and Engineering, New Age International Publication, 2007, ISBN: 81-224-1835-X.
7. Rao, M. N.Rao, H.V.N, Air Pollution, Tata Mc-Graw Hill Publication, New Delhi, 1988, ISBN: 0- 07- 451871-8.
8. Frank Kreith, Jan F Kreider, Principles of Solar Engineering, McGraw-Hill, New York ; 1978, ISBN: 9780070354760.
9. Aldo Vieira, Da Rosa, Fundamentals of renewable energy processes, Academic Press Oxford, UK; 2013. ISBN: 9780123978257.
10. Patvardhan, A.D, Industrial Solid Waste, Teri Press, New Delhi, 2013, ISBN:978- 81-7993-502- 6
11. Metcalf & Eddy, Wastewater Engineering, Mc-Graw Hill, New York, 2013, ISBN: 077441206.
12. Keshav Kant, Air Pollution & Control, Khanna Publishing House, New Delhi (Edition 2018)