Department of Electrical Engineering

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B. Tech.in Electrical Engineering with Multidisciplinary Minor

Course Code	Name of Course	Course Category	Teaching Scheme				Credits	Evaluation Scheme					
								Theory			Practical		Total Marks
			L	T	P	Total Hours		TAE	CAE	ESE	INT	EXT	
SEMESTER-IV													
23BTEEL204 23BTEEP204	Basic Electrical Machines	PCC4	3	-	2	5	4	10	15	50	25	-	100
23BTEEL205	Electromagnetic Fields	PCC5	3	1	-	4	4	10	15	50	-	-	75
23BTXXLXXX	Multidisciplinary Minor II	MDM2	2	-		2	2	10	15	50		-	75
23BTISL2XX	Open Elective-II	OE2	2	-	-	2	2	10	15	50	-	-	75
23BTEEL2XX 23BTEEP2XX	Vocational & Skill Enhancement Elective-III	VSEC3	1	-	2	3	2	10	15	-	25	-	50
23BTHUL202EE 23BTHUP202EE	Aptitude &Employability Skills	AEC2	1	-	2	3	2	10	15	-	25	-	50
23BTHUL204EE	Universal Human Values 2 : Understanding Harmony	VEC2	2	-		2	2	10	15	50	-	-	75
23BTHUL203EE	Entrepreneurship Development Practices	EEMC 2	2	-		2	2	10	15	50		-	75
TOTAL			**16**	**1**	**06**	**23**	**20**	**80**	**120**	**300**	**75**	**-**	**575**

Course Title: Basic Electrical Machines

Semester	IV	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PCC4	3 Hrs.	-	2 Hrs	4	10	15	50	25	-
Course Code	23BTEEL204 23BTEEP204									
Teaching Mode	Offline	5Hrs			Total	75			25	
Duration of ESE	2 Hrs.					100				

Course Objectives	1. Understand the basic of Electromagnetic circuit.
	2. Understand three phase Transformers.
	3. Learn the basic of electromechanical conversion in Electrical machines.
	4. Understand construction and working principle of DC machine.
	5. Learn to connect, run and control DC machines.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO 1. Demonstrate the theoretical knowledge of Electromagnetic circuits used in Electrical Machines.
	CO 2. Understand the construction, principle, performance, and applications of 3-phase

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	transformers
	CO 3. Demonstrate the theoretical knowledge of rotating machines to connect, run, control and test them for practical experimentation.
	CO 4. Understand the construction, principle, performance, control and applications of DC Machines.
	CO 5. Acquaintance with latest trends in machine advancement and their characteristics and behavior under steady state conditions.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	1	0	0	0	0	0	0	0	0	3	2	3
CO2	3	2	3	1	0	0	0	0	0	0	0	0	3	2	3
CO3	3	2	3	1	0	0	0	0	0	0	0	0	3	2	3
CO4	3	2	3	1	0	0	0	0	0	0	0	0	3	2	3
CO5	3	2	3	1	0	0	0	0	0	0	0	0	3	2	3

Course Contents:

Unit	Contents	Hours
I	**Magnetic Circuits and Magnetic Materials**: Magnetic circuits, Laws governing magnetic circuits, Flux linkage, Inductance and energy, Statically and Dynamically induced EMF, Torque, and Properties of magnetic materials, Hysteresis and Eddy Current losses - AC excitation, introduction to permanent magnets-Transformer as a magnetically coupled circuit.	6
II	**Electromechanical Energy Conversion Concepts:** Energy in magnetic system, Field energy and co energy, force and torque equations, singly and multiply excited magnetic field systems, mmf of distributed windings, winding inductances, magnetic fields in rotating machines, rotating mmf waves, and magnetic saturation and leakage fluxes.	7
III	**Transformers**: Construction, principle of operation, equivalent circuit parameters, phasor diagrams, losses, testing, efficiency and voltage regulation-all day efficiency, Sumner's test, inrush current, three phase transformers, connections, Scott Connection, parallel operation of three phase transformers, auto transformer, tap changing transformers- tertiary winding.	7
IV	**DC Generators**: Construction and components of DC Machine, Principle of operation, Lap and wave windings, EMF equations, circuit model, armature reaction, methods of excitation-commutation and inter poles, compensating winding, characteristics of DC generators, Parallel operations and applications	7
V	**DC Motors**: Principle and operations - types of DC Motors, Speed Torque Characteristics of DC Motors, starting and speed control of DC motors, Plugging, dynamic and regenerative braking- testing and efficiency, Retardation test-Swinburne's test and Hopkinson's test, Permanent magnet dc motor.	8

Sr. No.	Name of Experiments
1	Verification of additive and subtractive polarity on two winding transformer.
2	Conversion of two-winding transformer into auto transformer.
3	Determination of efficiency and voltage regulation of a three-phase transformer by direct loading.
4	To perform the sumpners test on single phase transformers.
5	Speed control of DC shunt motor by field current and armature voltage control methods.

6	Connection of transformer for the conversion of three phases to two phases
7	To perform load test on DC shunt generator
8	To perform load test on DC shunt motor.
9	To perform load test on DC series motor.
10	To draw characteristics of DC separately excited motor.
Open Ended Experiments / New Experiments	
1	http://vp-dei.vlabs.ac.in/Dreamweaver/exp6.html

Text Books	1.	1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
	2.	2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
	3	3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
Reference Books	1.	I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
	2.	Ashfaq Husain &HaroonAshfaq"ElectricMachines",Third edition (1 January 2016),DhanpatRai Publishers.
	3.	3. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons,

Course Title: Electromagnetic Fields

Semester	IV	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PCC5	3 Hrs.	1 Hrs	-	4	10	15	50	-	-
Course Code	UNEEL205									
Teaching Mode	Offline	4 Hrs			Total	75			-	
Duration of ESE	2 Hrs.					75				

Course Objectives	1. To introduce the electric & magnetic fields in detail.
	2.To study the laws related to electric and magnetic fields
	3.To know applications of Electromagnetic in electrical engineering applications
Course Outcomes	Up on successful completion of this course, student will be able to:
	CO1: Represent the electromagnetic phenomena &fields mathematically in different coordinate systems and to predict their output.
	CO2: Apply Knowledge of mathematics to the analysis of electrical systems involving electric field.
	CO3: Apply Knowledge of science to design of electrical systems involving electric fields
	CO4: Apply Knowledge of engineering to design of electrical systems involving electric fields
	CO5: Understand the design of electrical system involving magnetic field

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	0	3	2	0	0	0	0	0	0	0	1	0	2	3
CO2	1	0	3	2	0	0	0	0	0	0	0	1	0	2	3
CO3	1	0	3	2	0	0	0	0	0	0	0	1	0	2	3

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CO4	1	0	3	2	0	0	0	0	0	0	0	1	0	2	3
CO5	1	0	3	2	0	0	0	0	0	0	0	1	0	2	3

Course Contents:

Unit	Contents	Hours
I	**Vector Calculus:-** Vector Analysis Idea of Field, Vector & Scalars, Vector Algebra, Introduction to Scalar and Vector Fields, Space Field Operators (Gradient, Divergence Curl), , Vector addition, vector subtraction, Dot product, Cross Product, conversion of variables from Cartesian to cylindrical and vice-versa, Spherical co-ordinates system, Transformation of Cartesian to spherical and vice versa.	(07Hrs)
II	**Electrostatics** :- Coulomb's law, electric field intensity, field of point charges, field of line charge, field of sheet charges, Faraday's Law of Electrostatic Field, concept of flux density.	(07 Hrs)
III	**Gauss's law** :-Gauss's law, Application of Gauss's law, divergence theorem, definition of potential difference and potential, potential due to point, line, plane and spherical charge distributions,	(06Hrs)
IV	**Poisson's and Laplace's Equations:-**Current and current density, continuity of current, metallic conductors, conductor properties and Boundary conditions, Nature of Dielectric materials capacitance and capacitances, Capacitance of parallel plate capacitor and coaxial capacitors, Poisson and Laplace equations.	(10Hrs)
V	**Electrodynamics:-**Biot-Savarts Law Statement for different current configurations, Ampere's Circuital Law, Strokes theorem, Curl, Magnetic flux density, Self And Mutual Inductance of Simple Configurations, Lorentz Force, Inductance, Faraday's Law, Magneto motive Force, Magnetic Circuits, Reluctance, Maxwell Equations for steady and time varying fields.	(10Hrs)

Text Books	1.	William H. Hayt, Jr., John A. Buck, Engineering Electromagnetic, 7th Edition, Tata McGraw-Hill Publishing Company Limited, 2006
E--Books	1.	William H. Hayt, Jr., John A. Buck, Engineering Electromagnetic, 7th Edition, Tata McGraw-Hill Publishing Company Limited, 2006
	2.	Matthew N. O. Sadiku, Elements of Electromagnetic, 5th Edition, Oxford University Press, 2010
Reference Books	1.	A Tinguria, Fundamentals Of Electromagnetic Fields, 2nd Edition, Denett& Co, 2006
	2.	Rajeev Bansal, Handbook of Engineering Electromagnetic, 1st Edition, CRC Press, 2004

Course Code	Name of Course	Course Category	Teaching Scheme				Credits	Evaluation Scheme					
								Theory			Practical		Total Marks
			L	T	P	Total Hours		TAE	CAE	ESE	INT	EXT	
Vocational and Skill Enhancement Elective III													
UNEEL206 UNEEP206	Estimation & Costing of Electrical Systems	SEE	1	-	2	3	2	10	15	-	25	-	50
UNEEL207 UNEEP207	Introduction to Renewable Energy and Power station Practice	SEE	1	-	2	3	2	10	15	-	25	-	50
TOTAL			**4**	**1**	**08**	**12**	**08**	**40**	**60**	**-**	**100**	**-**	**200**

Course Title: Estimation & Costing of Electrical Systems											
Semester	I/II	Teaching Scheme				Evaluation Scheme					
						Theory			Practical		
Term	Odd/ Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT	
Course	SEE	1	--	2	2	10	15	--	25	--	

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Category		Hr		Hrs.						
Course Code	UNEEL206 UNEEP206									
Teaching Mode	Offline	3 Hrs			Total	25			25	
Duration of ESE	NA					50				

Course Objectives	To demonstrate Estimation & Costing of Solar lights for domestic application.
	To understand Estimation & Costing of Domestic Earthing system.
	To Estimation & Costing of Domestic Appliances
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1:Recognize and describe the solar system
	CO2: Essenes of domestic earthing systems with Estimation & costing of domestic appliances
	CO3: Implement and design the residential circuits

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	--	2	--	--	--	--	--	2	--	2	1
CO2	3	--	2	--	--	--	--	--	2	--	2	1
CO3	3	--	2	--	--	--	--	--	2	--	2	1

Course Contents:

Unit	Contents	Hours
I	Introduction to Solar System: Power scenario of india, Load pattern, Solar PV cell, Types of PV, Components of solar system design procedures and steps, domestic's application case study.	5
II	Earthing system: Need of earthing, types of earthing design aspect of domestic earthing systems. Case study of domestic appliances.	5
III	General rules guidelines for wiring of residential installation and positioning of equipment's, Principles of circuit design in lighting and power circuits, Procedures for designing the circuits and deciding the number of circuits, Method of drawing single line diagram, Selection of type of wiring and rating of wires Panel Wiring	4
Text Books	1. Electrical Design Estimating and Costing, By K. B. Raina	
	2. Electrical Wiring - Estimating & Costing, Book by S L and S. L. Uppal	

Sr. No.	Name of Experiments / Mini Project
1	Estimation of Solar Based Solar lights for domestic application.
2	Estimation of Solar Based Solar Pump for domestic application
3	Estimation & Costing of Light Illumination
4	Estimation & Costing of Smart appliances like mobile charger
5	Estimation & Costing of solar water heater.
6	Estimation & Costing of Earthing
7	Estimation & Costing of Power Factor Correction in Industries
8	Estimation & Costing of load of Domestic Appliances
9	Estimation & Costing of solar cooking

10	Estimation of costing of session wise electric bills.

Course Title: Introduction to Renewable Energy and Power station Practice										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/ Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	SEE	1 Hr	--	2 Hrs.	2	10	15	--	25	--
Course Code	UNEEL207 UNEEP207									
Teaching Mode	Offline	3 Hrs			Total	25			25	
Duration of ESE	NA					50				

Course Objectives	To Understand Solar assembly using different parts.
	To Demonstrate Solar Cell operation
	To design the application of Solar cell
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Recognize and describe the role of Solar in present, past and future society
	CO2: Comprehend basic components of Solar cell
	CO3: Explain the impact of its operation
	CO4: Implement and design application oriented Solar cell
	CO5: Interpret the aspects of legal issues

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	--	2	--	--	--	--	--	2	--	2	1
CO2	3	--	2	--	--	--	--	--	2	--	2	1
CO3	3	--	2	--	--	--	--	--	2	--	2	1
CO4	3	--	2	--	--	--	--	--	2	--	2	1
CO5	3	--	2	--	--	--	--	--	2	--	2	1

Course Contents:

Unit	Contents	Hours
I	**Introduction to Solar PV:** Understand the role of Solar PV Installer Job opportunities. Understand the advantages of doing this course,	4
	Wind Energy Conversion system	
II	**Basics of Solar energy and Electrical concepts:** Understand Ohm's Law; Understand the basics of electricity and electrical concepts; Perform simple calculations to derive power and energy, Explain and understand DNI, GHI and Diffused Irradiance & Irradiation; Assess the movement of the sun and its effect on the performance of the plant.	4
III	**Basics of Solar Photovoltaic systems and its components.** Understand Terminology used in the Solar Industry; Identify the different components of a Solar PV system and its basic operation; Identify and understand the working of different types of Solar PV systems Understand and acquire know-how of different	4

	Types, sizes and specifications of Modules, Solar Inverters, Charge Controllers, Cables, Conduits, Junction Boxes, Solar Batteries and allied accessories Read and Interpret the manufacturing data specification sheets of different Types, sizes and specifications of Modules, Solar Inverters, Charge Controllers, Cables, Conduits, Junction Boxes, Solar Batteries and allied accessories.	
	Introduction to power generation through Thermal Hydro and Nuclear	
IV	**Identification and Use of different tools and tackles used for installation of solar PV system:** Understand and acquire know-how of different Types, sizes and specifications of foundations/ footings; Select the right footing/foundation as per site location including suitability of roof condition or suitability of soil Identify and acquire the know-how of the different tools & tackles used for specific purpose in an installation of Solar PV system	3

Text Books	1.	Fundamentals of Solar Cell Design, Inamuddin, Mohd Imran Ahamed, RajenderBoddula, MashallahRezakazemi First published:5 August 2021 Print ISBN:9781119724704 |Online ISBN:9781119725022 © 2021 Scrivener Publishing LLC
	2.	Solar Cells and their Applications Lewis Fraas, Larry Partain Print ISBN:9780470446331 |Online ISBN:9780470636886 Copyright © 2010 John Wiley & Sons, Inc.
E--Books	1.	https://es.b-ok.as/book/3317604/c31002
Reference Books	1.	Build a Drone: A Step-by-Step Guide to Designing, Constructing, and Flying Your Very Own Drone Barry Davies
	2.	Drones: An Illustrated Guide to the Unmanned Aircraft that are Filling our Skies
Online TL Material	1.	https://nptel.ac.in/courses/101/104/101104073/
	2.	https://nptel.ac.in/courses/101/104/101104083/
	3.	https://nptel.ac.in/courses/101/104/101104017/

Sr. No.	Name of Experiments / Mini Project
1	Learn to measure and understand the characteristics of solar cells, such as voltage, current, and power output under different light conditions.
2	Assemble a small solar panel by connecting individual solar cells. Understand the series and parallel connections to achieve the desired voltage and current.
3	Use a solar irradiance meter to measure the intensity of sunlight at different times of the day and under various weather conditions.
4	Conduct a shadow analysis to understand how shading can affect the performance of a solar PV system. This can involve setting up temporary obstacles and observing the impact on energy production.
5	Set up a small-scale solar battery charging system. Learn about charge controllers, battery types, and safety considerations.
6	Understand the basics of inverters in converting DC power from solar panels to AC power. Connect an inverter to your solar panel setup.
7	Use a power meter to measure the actual power output of your solar panel system under different conditions.
8	IV and PV characteristics of solar cell
9	Design a small-scale solar PV system considering factors like panel orientation, tilt angle, and location.
10	Differentiate between grid-tied and off-grid solar PV systems. Understand the advantages and challenges of each.
Open Ended Experiments / New Experiments	

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1	Develop a project proposal for a small solar PV installation. Include system specifications, cost estimates, and potential energy savings.
2	Learn to identify common issues in solar PV systems and troubleshoot problems. This includes checking connections, measuring voltages, and ensuring proper system operation.
3	Understand local regulations and standards related to solar PV installations. Consider safety codes, building permits, and interconnection requirements.
Details of Laboratory Resource Material Instruction / Operating Manuals	
1.	PV syst
2.	P-Sim
3.	MATLAB