Department of Electrical Engineering
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UG Scheme-2023 (NEP-2020)

B. Tech. Electrical Engineering

(With Multidisciplinary Minor)

Syllabus III Semester

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-III													
23BTEEL201 23BTEEP201	Sensors and Transducers	PCC2	3	-	2	5	4	10	15	50	25	25	125
23BTEEL202 23BTEEP202	Network Theory	PCC3	3	-	2	5	4	10	15	50	25	-	100
23BTXXLXXX	Multidisciplinary Minor I	MDM1	2	-	-	2	2	10	15	50		-	75
23BTISL2XX	Open Elective-I	OE1	4		-	-	4	10	15	50	-	-	75
23BTHUL201	Engineering Economics and Industrial Management	EEMC 1	2	-		2	2	10	15	50		-	75
23BTHUL2XX	Humanities Elective	VEC1	2	-	-	2	2	10	15	50	-	-	75
23BTEEP203	Minor Project	CEP			4	4	2	-	-	-	50	-	50
TOTAL			**16**	**-**	**08**	**24**	**20**	**60**	**90**	**300**	**100**	**25**	**575**

Offered From Department of Electrical Engineering

Course Code	Name of Course	Course Category
23BTEEL210	Open Elective-I	OE1
23BTEEL203	Multidisciplinary Minor I	MDM1

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Course Title: Sensors & Transducer

Semester	III	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	EE	3Hrs.	.	02Hrs.	04	10	15	50	25	25
Course Code	23BTEEL201 23BTEEP201									
Teaching Mode	Conventional	5 Hrs			Total	75			50	
Duration of ESE	02.30					125				

Course Objectives	1. To understand the different electrical instrument used for electrical measurement and Instrumentation
	2. To study the different types of Bridges.
	3. To know basics knowledge of transducer & sensors used in electrical system.
	4. To study digital signals conditioning.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: To understand the basic principles of different electromagnetic instruments
	CO2: To Analysis various bridges like Wheatstone bridge, Hay's bridge, Maxwell & Schering bridge to find unknown values of R, L & C
	CO3: To understand various type of transducer used in electrical engineering system.
	CO4: To impart knowledge in measuring physical phenomenon & analyze the working principle of different sensors.
	CO5: To understand the concept of digital signal conditioning.

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**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	3	--	--	--	--	--	--	--	--	--	3	2	1
CO2	3	1	2	1	--	--	--	--	--	--	--	--	3	2	1

CO3	3	1	2	--	--	--	--	--	--	--	--	--	3	2	1
CO4	3	--	1	--	--	--	--	--	--	--	--	--	3	2	1
CO5	3	--	2	--	--	--	--	--	--	--	--	--	3	2	1

Unit	Contents	Hours
I	**Unit-I:- Basics of Instrumentation** Introduction to digital instruments, Advantages of Digital instruments over Analog instruments, Block diagram, principle of operation, Accuracy of digital instruments, Need of ADC, ADC types like Flash, Counter, SAR and Dual-Slope, ADC Specifications, ADC Need of DAC, DAC types like Weighted-Resistor and R-2R ladder, DAC Specifications, Its applications in digital instruments like Digital Multimeter, Digital Kilo Watt Hour meter, Digital Clamp meter	8
II	**Unit – II:- Measuring Instruments** Wheatstone Bridge. Low resistance: Kelvin's Double Bridge, High resistance: Megger and loss of charge method. Earth resistance: - Earth tester, Measurement of inductance using Maxwell's inductance-capacitance bridge& Hays bridge, Measurement of Capacitance using Schering's Bridge.	6
III	**Unit III:- Introduction to Transducers** Introduction, Classification of Transducers, Advantages and Disadvantages of Electrical Transducers, Transducers Resistance Transducers, Variable Inductance Transducers (LVDT & RVDT),Capacitive Transducers, Piezoelectric Transducers, Hall Effect Transducers, Thermoelectric Transducers, Photoelectric Transducers, Strain Gages, Load Cells, Torque Transducer	**8**
IV	**Unit IV Introduction to different type of Sensors** Introduction, Resistance Temperature Detectors (RTD) and their characteristics, Piezo resistive pressure sensor, McLeod gauge, thermal conductivity gauges, Electromagnetic Flow meters, Ultrasonic Flow Meters thermistor, Thermocouples, law of thermocouple, Proximity Sensors, Light Sensors.	6

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Course

V	**Unit V:- Digital Signal Conditioning** Introduction to smart energy meters (principle and block diagram) ,Digital measuring techniques, Sample and Hold Circuits, D/A Conversion and A/D Conversion, Methods & Error in A to D conversion, digital voltmeter, electronic frequency and time period measurement , Data Acquisition System (DAS). Function generator , Applications of IOT in sensing and transducing system Virtual instrumentation	8

Contents:

Text Books	1.	1 A. K. Sawhney., A course in Electrical & Electronics measurement and instrumentation, 11th Edition, Dhanpat Rai And Son Publication, 1996
	2.	Rajput, Electrical Measurements, 1 st Edition, S.Chand , 2009
E--Books	1.	
	2.	
Reference Books	1.	W.D. Cooper, Prentice Hall, Electronic Instrumentation and measurement Technique, 2nd Edition, P.H.I. Publication, 2007
	2.	Rangan, Instrumentation Devices and System, 2 nd Edition, Tata Mcgraw Hill, 2008
	3.	Doebelin, Ernest, Measurement System application & Design, 5th Edition, Mc Graw Hill, 2004
	4.	A.K.Ghosh , Introduction To Measurements and Instrumentation, Fourth Edition
Online TL Material	1.	https://nptel.ac.in/courses/108105153
	2.	

Sr. No.	Name of Experiments
1	To determine medium resistance by using Wheatstone Bridge.
2	To measure unknown inductance by Maxwell's inductance-capacitance bridge
3	To measure unknown inductance by Hay's bridge
4	To measure power factor of series R-L circuit using power factor meter.
5	To measure the 3ph power by using two wattmeter method
6	To measure unknown capacitance by Schering bridge.
7	To measure unknown value of low resistance by balancing the Kelvin's double bridge.
8	To characterize the Temperature Sensor (Thermocouple) using Virtual

	Lab
9	To get the characteristics of Hall Effect transducer.
Open Ended Experiments / New Experiments	
1	To characterize the LVDT using Virtual Lab
2	To study pressure measurement using Bourdon tube gauge using Virtual Lab
3	
Details of Online Laboratory Resource Material Instruction / Operating Manuals	
1.	Virtual Lab

Course Title: Network Theory

Semester	III	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	EE	3Hrs.	.	02Hrs.	04	10	15	50	25	-
Course Code	23BTEEL202 23BTEEP202									
Teaching Mode	Conventional	5 Hrs			Total	75			25	
Duration of ESE	02.30					100				

Course Objectives	1. To study behavior of basic circuit elements.
	2. To understand the various mathematical tools/transformations used in circuit analysis.
	3. To study Fundamental concepts and methods used for analysis of dc, single-phase and three phase circuits.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Apply the knowledge of basic circuital law and simplify the network using node analysis and loop analysis & network reduction techniques.
	CO2: Analyze the circuit using Kirchhoff's law and Network simplification theorems.
	CO3: Apply Laplace Transform for steady state and transient analysis.
	CO4: Apply transient behavior for pole zero analysis & graph theory.
	CO5: Evaluate two-port network parameters and derive different network filters.

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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**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	-	2	--	--	--	--	--	--	--	--	3	3	1
CO2	3	3	2	1	--	--	--	--	--	--	--	--	3	3	1
CO3	3	3	2	2	--	--	--	--	--	--	--	--	3	3	1
CO4	3	3	2	1	--	--	--	--	--	--	--	--	3	2	1
CO5	3	3	2	2	--	--	--	--	--	--	--	--	3	2	1

Unit	Contents	Hours
I	**Unit-I:- Nodal and Mesh analysis** Nodal and Mesh analysis basic equilibrium equations, matrix approach for Complicated network, containing voltage, current sources, Mutual Inductances, source transformations, Duality.	8
II	**Unit – II:- Network Theorems:** Superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, Reciprocity theorem as applied to A.C. & DC circuits.	6
III	**Unit III:- Laplace transformation for Analysing Electric Circuits** Laplace transformation and its properties, partial fractions, singularity functions, waveform synthesis. Analysis of RC & RL network with and without initial conditions with Laplace transformation, evaluation of initial& final conditions.	8

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IV	**Unit IV Transient Behaviors & Pole zero systems** Transient behaviors, concept of complex frequency, Driving points and transfer functions, poles, zeros of admittance function, their properties, sinusoidal response from Pole-zero locations, Graph theory , Tree & Co-tree, Incidence Matrix, Tie Set & Cut Set Matrix,	6
V	**Unit V:- Two Port Network & Passive Filters** Two port network parameters, Z parameter, Y parameter, ABCD parameter & their numerical, Introduction of Basic filters, Design of High pass, Low pass, Band pass and Band Reject filters & associated numerical.	8

Contents:

Text Books	1.	Van Valkenburg, Network Analysis, 3rd Edition, Prentice Hall of India, 2001
	2.	Sudhakar and S.P. Shyam Mohan, Circuit and Network, 2nd Edition, Tata McGraw Hill, 2002.
E--Books	1.	
	2.	
Reference Books	1.	D. Roy Choudhary, Network and System, 1st Edition, New Age International Publication, 1998.
	2.	Charles K. Alexander, Matthew N. O. Sadiku, Fundamentals of electrical circuits, 5th Edition, Tata McGraw Hill Education, 2012
	3.	N. T. Khobragade, S. D. Naik, A textbook of Network Analysis, 1ST Edition, Professional Publishing House PVT.LTD., 2009
Online TL Material	1.	https://nptel.ac.in/courses/108/105/108105153/
	2.	

Sr. No.	**Name of Experiments** [23BTEEP202]
1	To verify Superposition Theorem
2	To verify Reciprocity Theorem.
3	To verify Thevenin's Theorem.
4	To verify Norton's Theorem.
5	To verify Maximum Power Transfer Theorem.
6	To determine open circuit impedance parameters of a two port network.
7	To Study of 3-phase star & delta connected unbalanced circuit
8	To study resonance condition in R-L-C series circuit.

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Open Ended Experiments / New Experiments	
1	To study the variation in current and voltage in a parallel LCR circuit by using Virtual Lab.
2	To Design Parallel LC Circuit and find out the current flowing through each Component by using virtual lab.
3	To Design Parallel RL Circuit and find out Current flowing through each Component.
Details of Online Laboratory Resource Material Instruction / Operating Manuals	
1.	Virtual Lab

Course Title: Solar Photovoltaic and its Application [Multidisciplinary Minor I]

Semester	III	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	EE	2Hrs.	.		02	10	15	50	-	-
Course Code	23BTEEXX									
Teaching Mode	Conventional	5Hrs			Total	75			-	
Duration of ESE	02.30					75				

Course Objectives	1. Understand the fundamentals of energy conversion in solar photovoltaics
	2. Understanding various technologies in structures of solar photovoltaic cells
	3. Developing the skills in basic calculations in solar PV systems design
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Understand basic of Solar Energy system
	CO2: Understand Solar Photovoltaic energy conversion and utilization
	CO3: Understand the fabrication of solar cell
	CO4: Understand use of various equipments associated with safety measures
	CO5: Understand the application of solar PV system in various electricity consumer.

Mapping of Course Outcomes with Program Outcomes:

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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	PSO 1	PSO 2	PSO 3
CO1	3	3	-	2	--	--	--	--	--	--	--	--	3	3	1
CO2	3	3	2	1	--	--	--	--	--	--	--	--	3	3	1
CO3	3	3	2	2	--	--	--	--	--	--	--	--	3	3	1
CO4	3	3	2	1	--	--	--	--	--	--	--	--	3	2	1
CO5	3	3	2	2	--	--	--	--	--	--	--	--	3	2	1

Unit	Contents	Hours
I	**Unit-I:- Basic of Solar Energy** Sun, Earth, solar radiation, losses, radiation reaching the Earth, rotation of Earth, seasons and variations in solar radiation, solar angles and nomenclature, solar radiation spectrum, basics of heat transfer, conduction, convection, radiation of heat, absorption, reflection and transmission of radiation	8
II	**Unit – II:- Introduction to solar Thermal System** Introduction to solar thermal systems, non-concentrating and concentrating type systems, flat plate collectors, properties of flat plate collectors, systems using flat plate collectors, Evacuated tube collectors, various types of solar concentrating systems, viz. parabolic trough, dish type, linear Fresnel,Heliostat, non-imaging type.	6
III	**Unit III:- Fabrication of Solar cell** Overview of Semiconductor Processing (Conductor, Insulator & Semiconductor),Type of Dopped Silicon (P & N Type semiconductor), Energy Band Structure for n- and p-Type Semiconductors, Cell Fabrication(Surface Texturing, Adding the n-Type Layer, Screen Printing), PV Module Fabrication and Construction(Encapsulant, Glass and Backsheet Layers, Frame, PV Module Label)	8

IV	**Unit IV :- Energy storage technology & grid system** Different energy storage technologies, Inverter, equipment used in solar installation, Concept of off-On grid system, Introduction to net metering & its aspects	6
V	**Unit V :- Safety equipment's & PV Calculation** Introduction system protection & safety equipment's, Economics of PV system & payback period of calculation, Operation & maintenance of PV system, PV Commissioning, application of PV system.	8

Course Contents:

Text Books	1.	Solar Photovoltaics: Fundamentals, Technologies And Applications, BookAuthor: Dr. Chetan Singh Solanki, Publisher- PHI learning
	2.	The Solar Electricity Handbook - 2017 Edition, by Michael Boxwell
E--Books	1.	
	2.	
Reference Books	1.	Solar Photovoltaic Technology And Systems: A Manual for Technicians, Trainers and Engineers, by Dr. Chetan Singh Solanki, Publisher- PHIlearning
	2.	Solar Energy: The physics and engineering of photovoltaic conversion, technologies and systems Kindle Edition by Arno Smet
	3.	
Online TL Material	1.	https://nptel.ac.in/courses/115107116
	2.	

Course Title: Non-Conventional Energy Sources
[Open Elective-I]

Semester	III	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	EE	4Hrs.	.		04	10	15	50	-	-
Course Code	23BTXXXX									
Teaching Mode	Conventional					75			-	

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Duration of ESE	02.30	4Hrs	Total	75

Course Objectives	1. To understand the basic principles of solar photovoltaic Technology.
	2. To understand the basic principles of Wind Energy Conversion System.
	3. To understand the basic knowledge of other Nonconventional Energy Sources.
	4. To understand the basic concept of Hybrid Technology.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: To understand the basic principles of Solar Photovoltaic Technology
	CO2: To understand the basic principles of Solar Energy collectors.
	CO3: To understand the basic principles of Wind Energy Conversion System.
	CO4: To understand the basic knowledge of other Nonconventional Energy Sources.
	CO5: To understand the basic concept of Hybrid Technology.

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**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	-	2	--	--	--	--	--	--	--	--	3	3	1
CO2	3	3	2	1	--	--	--	--	--	--	--	--	3	3	1
CO3	3	3	2	2	--	--	--	--	--	--	--	--	3	3	1

CO4	3	3	2	1	--	--	--	--	--	--	--	--	3	2	1
CO5	3	3	2	2	--	--	--	--	--	--	--	--	3	2	1

Unit	Contents	Hours
I	**Unit-I:- Basic concept of Solar Energy** Basics of Sun, Solar Constant, Solar radiation at earth's surface, solar radiation geometry, solar radiation measurement, estimation of average solar radiation, solar radiation on tilted surfaces, why south facing?, comparison of true south & Magnetic south.	8
II	**Unit – II:- Solar Thermal System** Physical Principles of the conversion of solar radiation into heat, flat plate Collectors, transitivity of cover systems, energy balance equation and collector efficiency, concentrating collectors, comparison of concentrating and flat plate collectors, selective absorber coatings. Solar Energy Storage: Solar Energy Storage system (Thermal, Electrical, Chemical, Mechanical), Solar ponds. Application of Solar Energy: Solar water heating, space heating, space cooling, solar thermal heat conversion, solar photovoltaic energy conversion, solar pumping, solar cooking, online grid connected, solar photovoltaic generation system.	6
III	**Unit III:- Wind Energy** Basic principles of wind energy conversion, wind energy conversion system, wind data & energy estimation, site selection consideration, basic components of wind energy conversion system (WECS), classification of WEC system,generating system, energy storage, application of wind energy.	8
IV	**Unit IV Nonconventional Energy Source** **ENERGY from OCEANS:** Ocean thermal electric conversation (OTEC), Claude & Anderson cycles, evaporators, Bio-fouling, Hybrid cycle, components of OTEC for power generation. **Energy from Tides:** Introduction, basic principles of Tidal power, components of Tidal Power Plants, operation methods of utilization of Tidal Energy; Estimation of Energy & Power in simple single basin. Tidal system: Advantages & limitations of Tidal Power Generations, energy & power from wares, wave energy conversions devices. Introduction to Bioenergy, Bioenergy Products, Feedstocks, Co-Products & By-Products, Economic, Social and Ecological Impacts of Bioenergy at Local, National and Global Levels, Current and Emerging Challenges to Bioenergy	6

	Development	
V	**Unit V:- Basic concept of Hybrid Technology** Types of Hybrid Technology systems, solar-wind hybrid technology concept, Basic Optimizing techniques to improve the efficiency of Hybrid system.	8

Course Contents:

Text Books	1.	D Non Conventional Energy Sources, G.D. Rai, Khanna publishers
	2.	C Non Conventional Energy Resources, B. H. Khan, 2nd , The McGraw Hill Companies
	3.	Energy Technology : Nonconventional, Renewable and Conventional, S. Rao & B. B. Parulekar, 1st, Khanna Publisher
E--Books	1.	
	2.	
Reference Books	1.	Solar Energy: Principles of thermal collection and storage, S. P. Sukhatme, 2nd edition, Tata McGraw Hill Publishing Company Ltd.
	2.	Solar Photovoltaics : Fundamental, Technologies and Applications, Chetan Singh Solanki, PHI Learning Pvt. Ltd.
	3.	Biomass Energy Systems, Venkata Ramana P and Srinivas S.N
Online TL Material	1.	https://www.youtube.com/watch?v=BTyJrRy8DUE&list=PLwdnzlV3ogoUtaGiqlVJc4CC6x_czs9D
	2.	

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Course Title: Minor Project [23BTEEPXX]

Semester	III	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	EE	-.	.	04Hrs.	04	-	-	-	50	-
Course Code	23BTEEPXX									
Teaching Mode	Conventional	4Hrs			Total	-			50	
Duration of ESE	--					50				

Course Objectives	To promote community engagement and social responsibility.
	To develop hands-on technical skills in maintenance, fabrication, and documentation.
	To enhance innovative thinking for project readiness.
	To encourage self-maintenance practices for optimal use of resources.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: To create a Community engagement culture within the institution.
	CO2: To provide students hands on experience on, troubleshooting, maintenance, fabrication, innovation, record keeping, documentation etc thereby enhancing the skill and competency part of technical education
	CO3: To inculcate innovative thinking and thereby preparing students for main project.
	CO4: To set up self-maintenance cell within departments to ensure optimal usage of infrastructure facilities.
	CO5: To promote the concept of entrepreneurship.