ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES :: KADAPA
(AUTONOMOUS)

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu

Accredited by NBA (B.Tech. - EEE, ECE & CSE) & NAAC with 'A' Grade

Utukur (Post), C.K.Dinne (V&M), Kadapa, Kadapa (Dist), Andhra Pradesh - 516003

B.TECH. – ELECTRICAL & ELECTRONICS ENGINEERING (EEE)
COURSE STRUCTURE & SYLLABUS

III Year I Semester

S.No.	Course Code	Title	L	T	P	Credits
1	23HPC0214	Power Electronics	3	0	0	3
2	23HES0404	Digital Circuits	3	0	0	3
3	23HPC0215	Power Systems - II	3	0	0	3
4	23HES0505	Introduction to Quantum Technologies and Applications	3	0	0	3
5	23HPE021a 23HPE021b 23HPE021c	**Professional Elective - I** Signals & Systems Electrical Safety and Risk Management Utilization of Electrical Energy	3	0	0	3
6		Open Elective - I	3	0	0	3
7	23HPC0216	Power Electronics Lab	0	0	3	1.5
8	23HES0405	Analog and Digital Circuits Lab	0	0	3	1.5
9	23HSC1E01	**Skill Enhancement Course:** Soft Skills	0	1	2	2
10	23HSC0402	Tinkering Lab	0	0	2	1
11	23HCSP02I	Evaluation of Community Service Internship	-	-	-	2
Total			**18**	**1**	**10**	**26**

Open Elective - I

S.No.	Course Code	Course Name	Offered by the Dept.
1	23HOE011a	Green Buildings	CIVIL
2	23HOE011b	Construction Technology and Management	
3	23HOE0301	Sustainable Energy Technologies	ME
4	23HOE0401	Electronic Circuits	ECE
5	23HOE051a	Java Programming	CSE & Allied / IT
6	23HOE051b	Introduction to Artificial Intelligence	
7	23HOE051c	Quantum Technologies and Applications	
8	23HOE991a	Mathematics for Machine Learning and AI	Mathematics
9	23HOE991b	Materials Characterization Techniques	Physics
10	23HOE991c	Chemistry of Energy Systems	Chemistry
11	23HOE991d	English for Competitive Examinations	Humanities
12	23HOE991e	Entrepreneurship and New Venture Creation	

Note:

1. A student is permitted to register for Honors or a Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to their Minor from V Semester onwards.
2. A student shall not be permitted to take courses as Open Electives/Minor/Honors with content substantially equivalent to the courses pursued in the student's primary major.
3. A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline.

III Year II Semester

S.No.	Course Code	Title	L	T	P	Credits
1	23HPC0217	Electrical Measurements and Instrumentation	3	0	0	3
2	23HPC0414	Microprocessors and Microcontrollers	3	0	0	3
3	23HPC0218	Power System Analysis	3	0	0	3
4	23HPE022a 23HPE022b 23HPE022c	**Professional Elective – II** AI&ML for Electrical Engineers Programmable Logic Controllers Switchgear and Protection	3	0	0	3
5	23HPE023a 23HPE023b 23HPE023c	**Professional Elective – III** Communication systems Electric Drives Renewable and Distributed Energy Technologies	3	0	0	3
6		Open Elective - II	3	0	0	3
7	23HPC0219	Electrical Measurements and Instrumentation Lab	0	0	3	1.5
8	23HPC0416	Microprocessors and Microcontrollers Lab	0	0	3	1.5
8	23HSC0201	**Skill Enhancement course** Applications of Soft Computing Tools in Electrical Engineering	0	1	2	2
10	23HAC9902	**Audit Course** Technical Paper Writing & IPR	2	0	0	-
Total			**20**	**1**	**8**	**23**
Mandatory Industry Internship of 08 weeks duration during summer vacation						

Open Elective - II

S.No.	Course Code	Course Name	Offered by the Dept.
1	23HOE012a	Disaster Management	CIVIL
2	23HOE012b	Sustainability In Engineering Practices	
3	23HOE0302	Automation and Robotics	ME
4	23HOE0402	Digital Electronics	ECE
5	23HOE052a	Operating Systems	CSE & Allied / IT
6	23HOE052b	Introduction to Machine Learning	
7	23HOE992a	Optimization Techniques for Engineers	Mathematics
8	23HOE992b	Mathematical Foundation of Quantum Technologies	
9	23HOE992c	Physics Of Electronic Materials And Devices	Physics
10	23HOE992d	Chemistry Of Polymers And Applications	Chemistry
11	23HOE992e	Academic Writing and Public Speaking	Humanities

B.Tech. (EEE) III Year - I Semester **B.Tech. R23 Regulations**

Course Code	POWER ELECTRONICS (Professional Core)	L	T	P	C
23HPC0214		3	0	0	3

Course Outcomes:

CO	Statements	Blooms Level
CO1	Understand the V-I Characteristics and Gate Drive Requirements of Power Devices Including Diodes, Thyristors, MOSFETs and IGBTs.	L2
CO2	Design Single Phase and Three Phase Rectifiers with Different Load Conditions and Evaluate Power Factor and Source Inductance Effects	L5
CO3	Apply Duty Ratio Control and Analyze Steady-State Waveforms of Buck, Boost and Buck-Boost Converters	L3
CO4	Analyze the Operation of Single Phase and Three Phase Inverters with Various Load Conditions and Commutation Techniques	L4
CO5	Explore the Operation of AC Voltage Controllers, and Cyclo Converters with Various Load Conditions	L3

UNIT-I Power Switching Devices

V-I Characteristics of Thyristor – Firing circuits for Thyristor – Voltage and Current commutation of Thyristor.

V-I Characteristics of Diode, MOSFET and IGBT – Gate drive circuits for MOSFET, IGBT and GTO – Introduction to Gallium Nitride and Silicon Carbide Devices.

UNIT-II Rectifiers

Single Phase Half Wave and Full Wave Rectifiers – Single Phase Full Bridge Thyristor Rectifier with Resistive Load (R Load) and highly Inductive Load (RL Load)

Three Phase Full Bridge Thyristor Rectifier with Resistive Load (R Load) and highly Inductive Load (RL Load) – Input current wave shape, power factor and effect of source inductance – Analysis of Rectifiers with filter capacitance – Dual Converter – Numerical problems.

UNIT-III DC-DC Converters

Elementary chopper with an active switch and diode – Concepts of duty ratio, control strategies and average output voltage.

Buck Converter, Boost Converter and Buck-Boost Converter (Power circuit, analysis and waveforms at steady state, duty ratio control and average output voltage)

UNIT-IV Inverters

Single Phase Voltage Source Inverter (VSI): Operating principle, steady state analysis – Voltage control techniques for Inverters and Pulse Width Modulation techniques.

Simple forced commutation circuits for Bridge Inverters – Single Phase Current Source Inverter (CSI) with ideal switches – Basic principle of operation of basic series inverter and single phase parallel inverter – Numerical problems.

Three Phase Bridge Inverter (VSI): 180 degree conduction mode – 120 degree conduction mode.

UNIT-V AC Voltage Controllers & Cyclo Converters

AC Voltage Controllers: Principle of Phase Control – Principle of Integral Cycle Control – RMS load voltage, load current, power factor and wave forms of Single Phase AC Voltage Controller with two SCRs in anti-parallel with R Load and RL Load – Modes of operation of TRIAC – TRIAC with R Load and RL Load – Numerical problems.

Cyclo Converters: Mid Point and Bridge connections - Principle of operation, waveforms, output voltage equation of Single Phase to Single Phase Step-up Cyclo Converter and Step-down Cyclo Converter with Resistive Load (R Load) and Inductive Load (RL Load).

Textbooks:

1. M. H. Rashid “Power Electronics: Circuits, Devices and Applications”, 2nd edition, Prentice Hall of India, 1998.
2. P.S. Bimbhra “Power Electronics”, 4th Edition, Khanna Publishers, 2010.
3. M. D. Singh & K. B. Kanchandhani “Power Electronics”, Tata Mc Graw Hill Publishing Company, 1998.

Reference Books:

1. Ned Mohan “Power Electronics”, Wiley, 2011.
2. Robert W. Erickson and Dragan Maksimovic “Fundamentals of Power Electronics” 2nd Edition, Kluwer Academic Publishers, 2004.
3. Vedam Subramanyam “Power Electronics”, New Age International (P) Limited, 1996.
4. V. R. Murthy “Power Electronics”, 1st Edition, Oxford University Press, 2005.
5. P. C. Sen”Power Electronics”, Tata Mc Graw-Hill Education, 1987.
6. J.M.D.Murphy “Power Electronic Control of Alternating Current Motors”

B.Tech. (EEE) III Year - I Semester **B.Tech. R23 Regulations**

Course Code	POWER SYSTEMS - II (Professional Core)	L	T	P	C
23HPC0215		3	0	0	3

Course Outcomes:

CO	Statements	Blooms Level
CO1	Analyze the transmission lines to determine their electrical parameters and constants under various loading conditions.	**L4**
CO2	Apply performance equations to assess transmission line efficiency, voltage regulation and losses.	**L3**
CO3	Design an efficient transmission line system that meets daily power requirements considering technical , economic and environmental factors	**L6**
CO4	Explain the concept of per unit system and its role in simplifying fault calculations.	**L2**
CO5	Apply appropriate load compensation techniques to manage reactive power	**L3**

UNIT-I Transmission Line Parameters

Types of Conductors - Calculation of Resistance for Solid Conductors, Bundle Conductors, Skin effect, Proximity effect, Concept of GMR & GMD- Transposition of Power lines- Calculation of inductance for single phase and three phase, Single and Double circuit lines, Symmetrical and asymmetrical conductor configurations with and without transposition.

Calculation of Capacitance for 2 wire and 3 wire systems, effect of ground on Capacitance, Capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

UNIT-II Performance of Transmission Lines

Classification of Transmission Lines-Short, medium and long line and their models representation - Nominal-T, Nominal-π and A, B, C, D Constants for symmetrical networks, Numerical Problems and solutions for estimating regulation and efficiency of all types of lines. Ferranti effect and Charging Current.

UNIT-III

Overhead Line Insulators: Types of Insulators, String efficiency and Methods for improvement, – Voltage Distribution, Calculation of String efficiency, Capacitance Grading and Static Shielding., Numerical Problems.

Sag and Tension: Sag and Tension Calculations with equal and unequal heights of towers, Effect of wind and ice on weight of conductor, Stringing chart, Sag template and its applications Numerical Problems

Corona: factors affecting corona, critical voltages and Power loss due to Corona. Radio Interference.

UNIT-IV

Short Circuit Analysis: Per-Unit System, Per-Unit equivalent reactance network of a three phase power system. Short circuit current and MVA calculations, fault levels, application of Series Reactors. Numerical problems.

Symmetrical Components and Fault Analysis: Symmetrical component theory, symmetrical component transformation. Positive, negative and zero sequence components of voltages, currents and impedances Positive, negative and zero sequence networks LG, LL, LLG faults with and without fault impedance and LLL fault. Numerical Problems.

UNIT-V

Voltage Control and Power Factor Improvement: Methods of voltage control, shunt and series capacitors / Inductors, tap changing transformers, synchronous phase modifiers, power factor improvement methods.

Compensation in Power Systems: Concepts of Load compensation Load ability characteristics of overhead lines – Uncompensated transmission line – Symmetrical line – Radial line with asynchronous load – Compensation of lines.

Textbooks:

1. C.L. Wadhwa "Electrical Power Systems", New Age International Pub. Co, Third Edition, 2001.
2. D.P. Kothari and I.J. Nagrath "Modern Power System Analysis", Tata Mc Graw Hill Pub. Co., New Delhi, Fourth edition, 2011.
3. B.R.Gupta "Power System Analysis and Design", S.ChandPublishing.1998.

Reference Books:

1. A. Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar "A Text book on Power System Engineering", Dhanpat Rai Publishing Company (P) Ltd, 2008.
2. John J. Grainger & W.D. Stevenson "Power System Analysis", Mc Graw Hill International,1994.
3. Hadi Sadat "Power System Analysis", Tata Mc Graw Hill Pub. Co. 2002.
4. W.D. Stevenson "Elements of Power system Analysis", McGraw Hill International Student Edition.

Online Learning Resource: https://onlinecourses.nptel.ac.in/noc22_ee17/preview

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B.Tech. (EEE) III Year - I Semester **B.Tech. R23 Regulations**

Course Code	SIGNALS & SYSTEMS	L	T	P	C
23HPE021a	(Professional Elective - I)	3	0	0	3

Course Outcomes:

CO	Statements	Blooms Level
CO1	Explain the basic properties of signal & systems and LTI systems	**L2**
CO2	Apply Fourier series to represent periodic signals	**L3**
CO3	Represent signals in continuous and discrete time Fourier transform	**L2**
CO4	Analyze the sampling theorem and characterize signals & systems in time & frequency domain	**L3**
CO5	Analyse the stability of systems by applying Laplace transform and Z transform	**L3**

UNIT-I

Signals and Systems : Continuous and Discrete Time Signals, Transformations of the Independent Variable, Elementary Signals-Unit Impulse, Unit Step Functions, Ramp Signal, Rectangular function, Signum Function, Sinc & Sa Function, Exponential and Sinusoidal Signals, Classification of Signals & Systems, Continuous and Discrete Time Systems, Basic System Properties, Linear Time Invariant (LTI) Systems, Discrete-Time LTI Systems, Convolution Sum, Continuous Time LTI Systems, Convolution Integral, Properties of LTI Systems, Causal LTI Systems described by Differential and Difference Equations, Singularity Functions.

UNIT-II

Fourier series representation of periodic signals: Response of LTI Systems to Complex Exponentials. Fourier Series Representation of Continuous Time Periodic Signals, Trigonometric, Polar, Exponential fourier Series & related problems, Convergence of the Fourier Series, Properties of Continuous Time Fourier Series, Fourier Series Representation of Discrete Time Periodic Signals, Properties of Discrete Time Fourier Series, Fourier Series and LTI Systems,

UNIT-III

The Continuous-Time Fourier Transform: Representation of aperiodic Signals, Continuous Time Fourier Transform, Fourier Transform for Periodic Signals, Properties of the Continuous Time Fourier Transform, Systems characterized by Linear constant coefficient differential equations, Discrete Time Fourier Transform - Representation of Aperiodic Signals, Discrete Time Fourier Transform, Frequency Response, Systems Characterized by Linear Constant-Coefficient Difference Equations.

UNIT-IV

Time & Frequency Characterization of Signals and Systems : The Magnitude Phase Representation of the Fourier Transform, Magnitude Phase Representation of the Frequency Response of LTI Systems, Time-Domain Properties of Ideal Frequency Selective Filters, Time Domain and Frequency Domain Aspects of Non-ideal Filters, Examples of Continuous time filters and Discrete time filters described by differential equations, First-Order and Second-Order Continuous and Discrete-Time Systems, Examples of Time and Frequency Domain Analysis of Systems.

Sampling: Representation of a Continuous Time Signal by Its Samples, Sampling Theorem, Reconstruction of a Signal from Its Samples Using Interpolation, Effect of under sampling: Aliasing, Discrete Time Processing of Continuous-Time Signals.

UNIT-V

Laplace and z-Transforms : The Laplace Transform, Region of Convergence for Laplace Transforms, Inverse Laplace Transform, Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot, Properties of the Laplace Transform, Some Laplace Transform Pairs, Analysis and Characterization of LTI Systems Using the Laplace Transform, System Function Algebra and Block Diagram Representations, Unilateral Laplace Transform, Z-Transform - Region of Convergence for the z-Transform, Inverse z-Transform, Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot, Properties of the z-Transform, Some Common z-Transform Pairs, Analysis and Characterization of LTI Systems Using z-Transforms, System Function Algebra and Block Diagram Representations, Unilateral z-Transforms.

Textbooks:

1. Signals and Systems, Alan V. Oppenheim, Alan S. Willsky, & S. Hamid, 2nd Edition, Pearson Higher Education, 1997.
2. Principles of Linear Systems and Signals, B.P. Lathi, 2nd Edition, Oxford University Press, 2011.

Reference Books:

1. Signals & Systems, Simon Haykin and B. Van Veen, 2nd Edition, John Wiley, 2003.
2. Signals and systems, Narayana Iyer and K Satya Prasad, 1st Edition, CENGAGE Learning, 2011.
3. Signals, Systems and Transforms, C. L. Philips, J. M. Parr and Eve A. Riskin, 4th Edition, Pearson education, 2008

Online Learning Resource: https://onlinecourses.nptel.ac.in/noc22_ee17/preview

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B.Tech. (EEE) III Year - I Semester **B.Tech. R23 Regulations**

Course Code	ELECTRICAL SAFETY AND RISK MANAGEMENT (Professional Elective - I)	L	T	P	C
23HPE021b		3	0	0	3

Course Outcomes:

CO	Statements	Blooms Level
CO1	Explain the objectives and precautions of Electrical Safety, effects of Shocks and their Prevention	**L2**
CO2	Summarize the Safety aspects during Installation of Plant and Equipment	**L3**
CO3	Apply the electrical safety in residential, commercial and agricultural installations	**L3**
CO4	Illustrate various Electrical Safety in Hazardous Areas, Equipment Earthing and System Neutral Earthing	**L3**
CO5	Interpret various electrical systems safety management and IE rules	**L2**

UNIT-I

Introduction to Electrical Safety, Shocks and Their Prevention:

Terms and definitions, objectives of safety and security measures, Hazards associated with electric current and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents, scope of subject electrical safety. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shops

UNIT-II

Safety During Installation of Plant and Equipment:

Introduction, preliminary preparations, preconditions for start of installation work, during, risks during installation of electrical plant and equipment, safety aspects during installation, field quality and safety during erection, personal protective equipment for erection personnel, installation of a large oil immersed power transformer, installation of outdoor switchyard equipment, safety during installation of electrical rotating machines, drying out and insulation resistance measurement of rotating machines.

UNIT-III

Electrical Safety In Residential, Commercial and Agricultural Installations:

Wiring and fitting – Domestic appliances – water tap giving shock – shock from wet wall – fan firing shock – multi-storied building – Temporary installations – Agricultural pump installation – Do's and Don'ts for safety in the use of domestic electrical appliances.

UNIT-IV

Electrical Safety in Hazardous Areas: Hazardous zones – class 0,1 and 2 – spark, flashovers and corona discharge and functional requirements – Specifications of electrical plants, equipments for hazardous locations – Classification of equipment enclosure for various hazardous gases and vapours – classification of equipment/enclosure for hazardous locations.

Equipment Earthing and System Neutral Earthing: Introduction, Distinction between system grounding and Equipment Grounding, Equipment Earthing, Functional Requirement of earthing system, description of a earthing system, , neutral grounding(System Grounding), Types of Grounding, Methods of Earthing Generators Neutrals

UNIT-V

Safety Management of Electrical Systems: Principles of Safety Management, Management Safety Policy, Safety organization, safety auditing, Motivation to managers, supervisors, employees.

Review of IE Rules and Acts and Their Significance: Objective and scope – ground clearances and section clearances – standards on electrical safety - safe limits of current, voltage –Rules regarding first aid and fire fighting facility. The Electricity Act, 2003, (Part1, 2, 3,4 & 5)

Textbooks:

1. S. Rao, Prof. H.L. Saluja "Electrical safety, fire safety Engineering and safety management", Khanna Publishers. New Delhi, 1988. (units-I to V)
2. www.apeasternpower.com/downloads/elecact2003.pdf (Part of unit-V)

Reference Books:

Pradeep Chaturvedi "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997.

B.Tech. (EEE) III Year - I Semester **B.Tech. R23 Regulations**

Course Code	UTILIZATION OF ELECTRICAL ENERGY	L	T	P	C
23HPE021c	(Professional Elective - I)	3	0	0	3

Course Outcomes:

CO	Statements	Blooms Level
CO1	To apply the appropriate electric drives for various industrial applications	L3
CO2	Ability to understand the various heating and welding techniques	L2
CO3	To apply the various electrical lamps for different electrical environment	L3
CO4	To understand the principles and various braking techniques of electric traction	L2
CO5	To understand the basic principles and applications of the electrolytic process	L2

UNIT-I

Electric Drives: Type of electric drives - rating and choice of motor - starting and running characteristics - particular applications of electric drives - types of industrial loads - Continuous - intermittent and variable loads.

UNIT-II

Electric Heating: Introduction - Advantages and methods of electric heating - resistance heating - induction heating and dielectric heating.

Electric Welding: Classification - resistance and arc welding - electric welding equipment - comparison between AC and DC Welding.

UNIT-III

Illumination: Introduction - terms used in illumination - laws of illumination - sources of light. Discharge lamps - mercury vapor and sodium vapor lamps - comparison between tungsten filament lamps and fluorescent tubes - compact fluorescent lamp – LED - Basic principles of light control - Types and design of good lighting system and practice - flood lighting.

UNIT-IV

Electric Traction: System of electric traction and track electrification - Review of existing electric traction systems in India - Special features of traction motor - Speed-time curves for different services - methods of electric braking - plugging - rheostatic braking - regenerative braking - Introduction to Magnetic Levitation vehicles.

UNIT-V

Electrolytic Process: Introduction - Basic principles - Faradays laws of electrolysis - Energy efficiency - Electro deposition - Factors governing deposition Processes - Deposition of Alloys - Extraction and refining of metals - Fuel Cells.

Textbooks:

1. C.L.Wadhwa "Generation Distribution and Utilization of Electrical Energy", New age International Publishers.
2. J.B.Gupta "Utilization of Electrical Power and Electric Traction", S.K.Kataria & sons Publishers, 2002.
3. G.C.Garg "Utilization of Electrical Power & Electric traction, 8th edition, Khanna publishers, New Delhi.
4. N.V.Suryanarayana "Utilization of Electrical Power including Electric drives and Electric traction, New Age International (P) Limited Publishers, 1996.

Reference Books:

1. Partab (2007), Art & Science of Utilization of electrical Energy, 2nd edition, Dhanpat Rai & Sons, New Delhi.
2. Alan. V. Oppenheim, Ronald. W. Schafer, John R Buck, Discrete Time Signal Processing, Prentice Hall, 2ndedition, 2006.
3. E.Openshaw Taylor "Utilization of Electric Energy", Orient Longman, 1971.

Online Learning Resources:

1. https://nptel.ac.in/courses/108105060
2. https://nptel.ac.in/courses/112105221
3. https://vssut.ac.in/lecture_notes/lecture1426861925.pdf
4. https://vpmpee.wordpress.com/uee-3340903/

B.Tech. (EEE) III Year - I Semester **B.Tech. R23 Regulations**

Course Code	POWER ELECTRONICS LAB (Professional Core)	L	T	P	C
23HPC0216		0	0	3	1.5

Course Outcomes:

CO	Statements	Blooms Level
CO1	Analyze the Characteristics of Power Semiconductor Devices (SCR, MOSFET, IGBT) and their Role in Power Converters	L4
CO2	Design and Implement Gate Firing Circuits for SCR-based Power Converters	L4
CO3	Evaluate the Performance of Single-phase and Three-phase Power Converters with R and RL Loads	L5
CO4	Apply Different Commutation Techniques to Analyze Inverter for Efficient Power Control	L3
CO5	Apply Different Commutation Techniques to Analyze Chopper Circuits for Efficient Power Control	L3

List of Experiments: (Any 10 experiments are to be conducted)

1. Study of Characteristics of SCR, MOSFET & IGBT
2. Gate firing circuits for SCR (a) R triggering (b) RC triggering
3. Single Phase AC Voltage Controller with R Load and RL Load
4. Single Phase Fully Controlled Bridge Converter with R Load and RL Load
5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E)
6. DC Jones chopper with R and RL Loads.
7. Single Phase Parallel inverter with R Load and RL Load
8. Single Phase Cyclo converter with R Load and RL Load
9. Single Phase Half controlled converter with R and RL load.
10. Single Phase Fully controlled converter with R and RL load.
11. Three Phase half controlled bridge converter with R, RL-load.
12. Three Phase fully controlled bridge converter with R, RL-load.
13. Single Phase series inverter with R and RL loads.
14. Single Phase Bridge converter with R and RL loads.
15. Single Phase dual converter with RL loads.
16. Single Phase Half Wave Rectifier with R Load and RL Load
17. Single Phase McMurray Bedford Inverter

Reference Books:

1. O.P. Arora "Power Electronics Laboratory: Theory, Practice and Organization" Narosa series in Power and Energy Systems, Alpha Science International Ltd., 2007.
2. M. H. Rashid "Simulation of Electric and Electronic circuits using PSPICE", M/s PHI Publications.
3. PSPICE A/D user's manual and reference guide - Microsim, USA.
4. MATLAB and its Tool Books user's manual and Math works, USA.
5. http://vlabs.iitb.ac.in/vlabs-ev/labs/mit_bootcamp/power_electronics/labs/index.php

B.Tech. (EEE) III Year - II Semester **B.Tech. R23 Regulations**

Course Code	ELECTRICAL MEASUREMENTS AND INSTRUMENTATION (Professional Core)	L	T	P	C
23HPC0217		3	0	0	3

Course Outcomes:

CO	Statements	Blooms Level
CO1	Understand principle and working of electrical measuring instruments	L2
CO2	Understand the principle of operation of instrument transformers, energy meters and analog instruments	L5
CO3	Understand the principle and working of various DC and AC bridges for the measurement of Resistance, Inductance and Capacitance	L3
CO4	Understand the principle and working of different digital voltmeters and transducers.	L4
CO5	Understand the working of various sensors and data acquisition systems	L3

UNIT-I Measuring instruments & Digital Meters

Fundamentals: True Value, Errors (Gross, Systematic, Random); Static Characteristic of Instruments (Accuracy, Precision, Sensitivity, Resolution & threshold); Error Analysis- Simple problems; Statistical treatment of data-Simple problems.

Indicating Instruments: Three forces in Electromechanical indicating instrument (Deflecting, controlling & damping forces); Moving iron type (attraction and repulsion), PMMC, Electrodynamometer Type instruments: Torque equation (Expression only, no derivation), shape of scale – simple problems on torque equations; Measurement of voltage and current - Extension of Range of ammeter and voltmeter – problems on extension of range of ammeter and voltmeter.

UNIT-II Measurement Of Power, Power Factor And Energy

Instrument transformers: Types, CT & PT Ratio and phase angle errors (Expression only, no derivation)

Measurement of Power: Principle and Operation of Single-phase dynamometer wattmeter, expression (Expression only no derivation) for deflecting and control torques, errors and compensations.

Measurement of power factor: Principle and operation of Single-phase Electrodynamometer Power factor meter.

Measurement of Frequency: Principle and Operation of single phase frequency meter- vibrating reed type, - ferro dynamic type meter.

Measurement of Energy: Principle and Operation of Single phase induction type energy meter, driving and braking torques (expression only no derivation), errors and compensations, testing by phantom loading.

UNIT-III DC & AC Bridges

Measurement of Resistance: Methods of measuring low, medium and high resistances –Sensitivity of Whetstone's bridge– Kelvin's double bridge for Measuring low resistance, Megger for measurement of high resistance.

Measurement of Inductance: Maxwell's bridge, Anderson's bridge.

Measurement of Capacitance: De Sauty bridge. Wien's bridge–Scheringbridge–Numerical problems

UNIT-IV Digital Volt Meters And Transducers

Digital Voltmeters: Ramp type, Dual Slope integrating type, successive approximation, Potentiometric type DVMs.

Classification of transducers: Active/passive, analog/digital- Strain Gauge-gauge factor (Elementary treatment only)-applications of strain gauge, Q-Meter

UNIT-V Transducers, Sensors and Data Acquistion:

Transducers: Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle Operation of Resistor, Inductor and Capacitive Transducers; LVDT and its Applications, Strain Gauge and Its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Piezo Electric Transducers, Photo electric Transducers, Hall effect, Photo Diodes, Optocoupler.

Silicon based micro sensors: Pressure sensor, Gyro sensor, Accelerometer, Flow sensor, Proximity sensor, Temperature sensor, Humidity sensor. (Elementary treatment only)

Introduction to PLC and SCADA Systems: Data acquisition systems (DAS) and interfacing techniques.

Textbooks:

1. A.K. Sawhney "Electrical & Electronic Measurement & Instruments" Dhanpat Rai & Co. Publications
2. E.W.Golding and F.C. Widdis "Electrical Measurements and measuring Instruments", Reem Publications
3. Buckingham and Price "Electrical Measurements", Prentice Hall Publications

Reference Books:

1. H.S.Kalsi "Electronic Instrumentation" Tata Mc Graw Hill Publications
2. Martin U Reissland "Electrical Measurements: Fundamentals, Concepts, Applications" New Age Publications
3. R.K.Rajput "Electrical & Electronic Measurement & Instrumentation" S. Chand & Co Publications
4. Jon S Wilson "Sensor Technology Hand Book" ELSEVIER Publications

Online Learning Resource:

https://onlinecourses.nptel.ac.in/noc22_ee112/preview

B.Tech. (EEE) III Year - II Semester **B.Tech. R23 Regulations**

Course Code	POWER SYSTEM ANALYSIS (Professional Core)	L	T	P	C
23HPC0218		3	0	0	3

Course Outcomes:

CO	Statements	Blooms Level
CO1	Calculate the Pu quantities of various elements in power system network & Y_{BUS} formation of a system using Graph theory.	**L3**
CO2	Write the program for Z_{BUS} of a system using Building Algorithm method.	**L6**
CO3	Write the program of a system to know the power losses using various traditional power flow methods.	**L6**
CO4	Analyze the fault current of Symmetrical & unsymmetrical faults under different conditions.	**L4**
CO5	Analyze the Stability of a system using Swing equation & Equal Area Criterion.	**L4**

UNIT-I PER UNIT System and Ybus Formation

Per Unit representation of Power system elements – Per Unit equivalent reactance network of a three phase Power System - Graph Theory: Definitions, Bus Incidence Matrix, YBus formation by Direct and Singular Transformation Methods, Numerical Problems

UNIT-II Formation of Zbus

Partial network, Algorithm for the Modification of Zbus Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses - Modification of Zbus for the changes in network

UNIT-III Power Flow Analysis

Static load flow equations – Load flow solutions using Gauss Seidel Method: Algorithm and Flowchart. Acceleration Factor, Load flow Solution for Simple Power Systems (Max. 3-Buses): Newton Raphson Method in Polar Co-Ordinates Form: Load Flow Solution- Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods

UNIT-IV Short Circuit Studies

Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors. Symmetrical Component Theory: Positive, Negative and Zero sequence components, Positive, Negative and Zero sequence Networks. Symmetrical Fault Analysis: LLLG faults with and without fault impedance, Unsymmetrical Fault Analysis: LG, LL and LLG faults with and without fault impedance, Numerical Problems.

UNIT-V Stability Analysis

Elementary concepts of Steady State, Dynamic and Transient Stabilities. Derivation of Swing Equation, Power Angle Curve and Determination of Steady State Stability. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Numerical methods for solution of swing equation - Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.

Textbooks:

1. G.W.Stagg & A.H.El-Abiad "Computer Methods in Power System Analysis", Mc Graw Hill Publications
2. I.J.Nagrath & D.P.Kothari "Modern Power system Analysis", Tata Mc Graw Hill Publications

Reference Books:

1. Grainger and Stevenson "Power System Analysis", Mc Graw Hill Publications
2. Hadi Saadat "Power System Analysis", Mc Graw Hill Publications
3. B.R.Gupta "Power System Analysis and Design" S. Chand Publications

Online Learning Resource:

https://onlinecourses.nptel.ac.in/noc22_ee120/preview

B.Tech. (EEE) III Year - II Semester **B.Tech. R23 Regulations**

Course Code	AI & ML for ELECTRICAL ENGINEERS (Professional Elective - II)	L	T	P	C
23HPE022a		3	0	0	3

Course Outcomes:

CO	Statements	Blooms Level
CO1	Understanding the Basics and Architecture of Artificial Intelligence	**L1**
CO2	Analyzing and Applying Artificial Neural Networks (ANN) Concepts	**L3**
CO3	Implementing ANN Applications in Real-World Problems	**L5**
CO4	Understanding and Applying Fuzzy Logic Concepts	**L2**
CO5	Designing and Implementing Fuzzy Logic Applications	**L5**

UNIT-I Introduction to Artificial Intelligence

Introduction and motivation - Approaches to AI - Architectures of AI - Symbolic Reasoning System - Rule based Systems - Knowledge Representation - Expert Systems

UNIT-II Overview of Machine Learning

The Motivation & Applications of Machine Learning: Learning Associations, Classification, Regression; Supervised Learning; Unsupervised Learning; Reinforcement Learning; Gradient Descent: Batch Gradient Descent, Stochastic Gradient Descent; Data pre processing; Under fitting and Overfitting issues

UNIT-III Artificial Neural Networks

Basics of ANN - Comparison between Artificial and Biological Neural Networks - Basic Building Blocks of ANN - Artificial Neural Network Terminologies - McCulloch Pitts Neuron Model - Learning Rules - ADALINE and MADALINE Models - Perceptron Networks (Continuous and Discrete) – Perceptron Convergence Theorem - Back Propagation Neural Networks - Associative Memories – BAM and Hopfield networks

UNIT-IV Fuzzy Logic

Classical Sets - Fuzzy Sets - Fuzzy Properties, Operations and relations - Fuzzy Logic System - Fuzzification - Defuzzification - Membership Functions - Fuzzy Rule base - Fuzzy Logic Controller Design

UNIT-V Applications of AI Techniques

Load forecasting, Load flow studies, Economic load dispatch, Speed control of DC Motor, Speed Control of Induction Motors

Textbooks:

1. S. N. Sivanandam, S. Sumathi and S. N. Deepa “Introduction to Neural Networks using MATLAB", Mc Graw Hill Publications, 2006
2. Timothy J. Ross “Fuzzy Logic with Engineering Applications", WILEY India Publications, 2012
3. Ethem Alpaydin “Introduction to Machine Learning”, MIT Press, 2014
4. Russell. S and Norvig. P “Artificial Intelligence - A Modern Approach”, Pearson Publications, 2022

Reference Books:

1. S. N. Sivanandam, S. Sumathi and S. N. Deepa “Introduction to Fuzzy Logic using MATLAB", Springer International Edition, 2013
2. Yung C. Shin and Chengying Xu “Intelligent System - Modeling, Optimization & Control”, CRC Press, 2009.
3. Kevin P. Murphy “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012

Online Learning Resource:

https://onlinecourses.nptel.ac.in/noc22_ee120/preview

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Utukur (Post), C.K.Dinne (V&M), Kadapa, Kadapa (Dist), Andhra Pradesh - 516003

B.Tech. (EEE) III Year - II Semester **B.Tech. R23 Regulations**

Course Code	PROGRAMMABLE LOGIC CONTROLLERS (Professional Elective - II)	L	T	P	C
23HPE022b		3	0	0	3

Course Outcomes:

CO	Statements	Blooms Level
CO1	Explain the Purpose of PLCs and Easy Veep	**L2**
CO2	Demonstrate how to configure and connect Allen- Bradely PLC hardware for a basic control task	**L3**
CO3	Evaluate different PLC program structures for efficiency and reliability in specific applications	**L5**
CO4	Analyze the role of PLCs in improving efficiency and precision in scientific and technological applications	**L4**
CO5	Evaluate the efficiency and accuracy of using ADD,SUB,AND counters in different logic scenarios.	**L5**

UNIT-I Introduction to PLCs

Basic functions of PLCs, Mechanical relays versus PLC, Different types of PLCs – Allen-Bradley – Micrologix: ML1000, ML1100, SLC500, Compact Logix, Mitsubishi FX series, HMIs, Processor and I/O cards

UNIT-II PLC Computational Tool

Introduction to Easy Veep software, Link between mechanical, electrical and programming documentation, Logic diagrams, Flip-Flop Logic, M8000, M8001 internal bits interpretation, Binary code, data table, manipulation and search engine in Mitsubishi environment Communication between PC and PLC, Communication between PC and HMI, PLC and HMI Serial Local network, Introduction to SLC500

UNIT-III PLC Development

PLC software and applications, Boolean algebra – understanding binary code, ADD and SUB functions, UP and Down Counters, Introduction to k1Y0, MOV function, CPR and ZCP functions, SHWT and SHRD instructions, Introduction to Absolutely Drum Instruction.Allen Bradley PLC: Introduction to Rockwell Software, Hardware focus, Hardware considerations (Field wiring, Master Control Relay, VFD), Basic programming and applications, Cascade control – subroutine, Different programs

UNIT-IV PLC Programming

Programming instructions: Instructions and binary interpretation, Bit Instruction, Timers and counters, Comparison instructions, Programming Instructions - Math instructions, Move and Logical Instructions, Discussions of programming, communications for PLC-Robotic arm, Exercise of setup and monitoring

UNIT-V Applications

Analog and Digital parameters by using SLC5/03-VFD-Panel Mate series 1700, Practical Troubleshooting, troubleshooting technique, Control system stability and tuning basics. Applications: Process to rewind, test, and integrate with extrusion process for wiring and fibre optic industries, Food industry – yeast, flour distribution and control. Process Medical equipment Industry – Gas analyzer, Leak tester (using CO2), plastic wrapping machines etc

Textbooks:

1. Automating manufacturing systems with PLCs by Hugh Jack, 2010.
2. PLC Hand Book (Automation direct Siemens)

Reference Books:

1. Programmable Logic Controllers
2. by R. Bliesener, F Ebel, Festo. Didactic publishers, 2002.

2. Programmable Logic Controllers by W. Bolton, 4th Edition, Newnes, 2006.
3. Introduction to PLCs by Jay F. Hooper, 2nd Edition, Carolina Academic Press, 2006.

Online Learning Resource:

https://nptel.ac.in/courses/108105088

B.Tech. (EEE) III Year - II Semester **B.Tech. R23 Regulations**

Course Code	SWITCH GEAR AND PROTECTION (Professional Elective - II)	L	T	P	C
23HPE022c		3	0	0	3

Course Outcomes:

CO	Statements	Blooms Level
CO1	Analyze the use of different circuit breakers based on their specifications.	**L4**
CO2	Understand the application of different types of relays in real time power system scenario	**L3**
CO3	Analyze the performance of different protection schemes for transformers and rotating machines based on specific operational requirements.	**L4**
CO4	Apply appropriate protective schemes to safeguard bus bars and feeders in a power system	**L3**
CO5	Analyze the impact of different over voltage protection strategies and grounding methods on system reliability and safety.	**L4**

UNIT-I

Circuit Breakers:

Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages - Restriking Phenomenon, Average, Max. RRRV, Current Chopping and Resistance Switching - CB ratings and Specifications, Selection of CB: Types and Numerical Problems

Auto reclosures - Description and Operation of Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers

UNIT-II

Electromagnetic, Static and Numerical Relays:

Basic Requirements of Relays - Primary and Backup protection - Construction details of Attracted armature, balanced beam, inductor type and differential relays - Universal Torque equation - Characteristics of over current, Direction and distance relays - Static Relays - Advantages and Disadvantages - Definite time, Inverse and IDMT static relays

Comparators - Amplitude and Phase comparators - Microprocessor based relays - Advantages and Disadvantages - Block diagram for over current (Definite, Inverse and IDMT), Distance Relays, Impedance Relays and Reactance Relays with their Flow Charts

UNIT-III

Protection of Generators and Transformers:

Protection of generators: Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on percentage winding unprotected.

Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CTs Ratio, Buchholtz relay Protection

UNIT-IV

Protection of Feeders, Transmission Lines and Busbars:

Protection of Feeders (Radial & Ring main) using over current Relays. Protection of Transmission lines - 3 Zone protection using Distance Relays.

Carrier current protection. Protection of Bus bars Differential protection, Differential Pilot wire protection

UNIT-V

Protection Against Over Voltages:

Generation of Over Voltages in Power Systems - Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lighting Arresters - Insulation Coordination - BIL

Neutral Grounding, Grounded and Ungrounded Neutral Systems - Effects of Ungrounded Neutral on system performance - Methods of Neutral Grounding: Solid, Resistance, Reactance - Arcing Grounds and Grounding Practices

Textbooks:

1. Sunil S Rao “Switchgear and Protection” Khanna Publications
2. Badari Ram, D.N Viswakarma “Power System Protection and Switchgear” TMH Publications

Reference Books:

1. J Lewis Blackburn “Protective Relaying Principles and Applications” CRC Press
2. Numerical Protective Relays, Final Report 2004 - 1009704 EPRI, USA
3. Walter A Elmore “Protective Relaying Theory and Applications”, Marcel Dekker Publications
4. Y.G. Paithankar “Transmission network Protection” Taylor and Francis Publications
5. P. M. Anderson “Power System Protection”, Wiley Publications

Online Learning Resource:

https://onlinecourses.nptel.ac.in/noc22_ee101/preview

B.Tech. (EEE) III Year - II Semester **B.Tech. R23 Regulations**

Course Code	ELECTRIC DRIVES (Professional Elective - III)	L	T	P	C
23HPE023b		3	0	0	3

Course Outcomes:

CO	Statements	Blooms Level
CO1	Evaluate the characteristics and operational aspects of drives operating in different modes	L3
CO2	Analyze the operational aspects of various controlled Rectifiers fed DC Drives operating in different sustainable modes of operation	L3
CO3	Analyze the operational aspects of various controlled Chopper fed DC Drives operating in different sustainable modes of operation	L3
CO4	Analyze the operational aspects of various Induction Motor Drives operating in different sustainable modes of operation	L3
CO5	Analyze the operational aspects of Synchronous Motor Drives and other Motor Drives operating in different sustainable modes of operation	L3

UNIT-I Introduction to Electric Drives

Electric Drive: Block diagram of Electrical Drive – Advantages of Electric Drives – Parts of Electric Drives – Choice of Electric Drives – Status of DC and AC Drives.

Dynamics of Electric Drives: Fundamental torque equations – Speed Torque conventions and Multi Quadrant operation – Equivalent values of drive parameters (Loads with rotational motion and Loads with translational motion) – Components of Load Torque – Nature and Classification of Load Torque – Steady State Stability.

Electric Braking methods: Regenerative Braking, Dynamic Braking and Plugging.

Control of Electric Drives: Modes of operation of Electrical Drives (Steady State, Acceleration including starting and Deceleration including stopping – Closed Loop Control of Electric Drives (Block diagram only): Current Limit Control, Closed Loop Torque Control, Closed Loop Speed Control and Closed Loop Position Control.

UNIT-II Single Phase and Three Phase Converter Fed DC Drives

Control of Separately Excited DC Motor by 1Ø Half Controlled Bridge Rectifier, 1Ø Fully Controlled Bridge Rectifier, 3Ø Half Controlled Bridge Rectifier, 3Ø Fully Controlled Bridge Rectifier (Voltage and Current waveforms for continuous and discontinuous conduction, Speed Torque expressions and characteristics).

1Ø Half Controlled Bridge Rectifier fed DC Series Motor (Voltage and Current waveforms for continuous and discontinuous conduction, Speed Torque expressions and characteristics) – Multi Quadrant operation of Separately Excited DC Motor: (a) with Fully Controlled Bridge Rectifier and mechanical reversible switch (b) with Dual Converter (c) with Field Current Reversal.

UNIT-III Chopper Fed DC Drives

Control of Separately Excited DC Motor by One Quadrant Chopper, Two Quadrant Chopper, Four Quadrant Chopper (Voltage and Current waveforms with continuous conduction, Speed Torque expressions and characteristics for motoring, regenerative braking and dynamic braking).

Chopper control of DC Series Motor (Operation, Speed Torque expressions and characteristics) – Closed Loop Speed Control of Chopper fed Separately Excited DC Motor (Block diagram only).

UNIT-IV Induction Motor Drives

Stator Side: Stator Voltage control by AC Voltage Controller (Speed Torque characteristics and efficiency) – Stator Variable Voltage and Variable Frequency Control (Speed Torque characteristics, Slip speed controlling, torque-power limitations and modes of operation) – Voltage Source Inverter (VSI) fed Induction Motor Drive – Current Source Inverter (CSI) fed Induction Motor Drive – Comparison of VSI and CSI fed Induction Motor Drives – Closed Loop Slip Control of Induction Motor Drives (Block diagram only).

Rotor Side: Static Rotor Resistance control – Slip Power Recovery Schemes: Static Scherbius Drive, Static Kramer Drive (Circuit Diagram, Operation, Speed Torque characteristics).

UNIT-V Synchronous and Stepper Motor Drives

Synchronous Motor Drives: Separate Control of Synchronous Motor Drive – Self Control of Synchronous Motor Drive by VSI, CSI, Load commutated CSI (Operation and speed torque characteristics) – Closed Loop Speed Control of Synchronous Motor Drive (Block diagram only).

Stepper Motor Drives: Introduction – Variable Reluctance Stepper Motor – Permanent Magnet Stepper Motor – Important Features of Stepper Motor – Torque (vs) Stepping Rate Characteristics of Stepper Motor – Drive Circuits for Stepper Motor.

BLDC Motor Drives: Operation and Control of BLDC Motor Drives.

Textbooks:

1. Gopal K. Dubey "Fundamentals of Electric Drives", Narosa Publications
2. M. H. Rashid "Power Electronic Circuits, Devices and applications", Prentice Hall of India Publications
3. R. Krishnan "Electric motor drives: modeling, analysis, and control" Pearson Education Publications

Reference Books:

1. M. D. Singh, K. B. Khanchandani "Power Electronics", Tata Mc Graw Hill Publications
2. Vedam Subramanyam "Thyristor Control of Electric drives", Tata Mc Graw Hill Publications
3. S. K. Pillai "A First course on Electrical Drives, 2nd Edition, New Age International Publications
4. P.C. Sen "Principles of Electrical Machines and Power Electronics", Wiley Publications

Online Learning Resource:

1.https://web.iitd.ac.in/~amitjain/Drives_VTR.pdf
2. https://sde.uoc.ac.in/sites/default/files/sde_videos/Electrical%20Drives%20and%20Controls_0.pdf
3. https://nptel.ac.in/courses/108/104/108104140/
4. https://nptel.ac.in/courses/108/102/108102046/
5. https://swayam.gov.in/nd1_noc19_ee65/preview

B.Tech. (EEE) III Year - II Semester **B.Tech. R23 Regulations**

Course Code	RENEWABLE and DISTRIBUTED ENERGY TECHNOLOGIES (Professional Elective - III)	L	T	P	C
23HPE023c		3	0	0	3

Course Outcomes:

CO	Statements	Blooms Level
CO1	Apply knowledge of solar energy systems to explain real- world energy production.	**L3**
CO2	Explain the abstraction (conversion) process of electrical energy from wind, bio-mass and Tidal energy sources	**L2**
CO3	Explain how electrical energy is stored and how Green Energy system operates.	**L2**
CO4	Demonstrate how distributed Generation can be integrated into local energy systems.	**L3**
CO5	Analyze the effects of distributed generation on grid performance, control complexity and operational cost.	**L4**

UNIT-I Energy Scenario and Solar Energy

Introduction: Fundamentals of renewable energy sources, Types of energy, Renewable and Non-renewable energy, SWOT analysis, Global warming and climate change, World energy transformation by 2050, Prospects of renewable energy in the world, Renewable energy availability in India.

Solar Energy Fundamentals: Solar Spectrum, propagation of solar radiation from the sun to earth; solar radiation geometry: sun-earth geometry, extra-terrestrial and terrestrial radiation.

Solar Thermal: Solar Collectors, Solar parabolic trough, Solar tower, Solar cooker, Solar water heater, Solar dryer, Solar Pond.

Solar Electric Power Generation: A Generic PV Cell, PV Materials, Equivalent Circuits for PV Cells, Modules and Arrays; I-V Curve under Standard Testing Conditions; Impact of Temperature and Insolation on I-V curves; Shading Impacts on I-V curves; Maximum Power Point Trackers (MPPT).

UNIT-II Wind and Other Energy Systems

Wind Energy: Air, Wind, Global and Local Wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Classification of wind energy conversion system (WECS)- Horizontal axis- single, double and multiblade system. Vertical axis- Savonius and darrieus types

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies-fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft).

Tidal Power: fundamental characteristics of tidal power, harnessing tidal energy, advantages, and limitations

UNIT-III Energy Storage and Green Energy

Energy Storage: Stationary Battery Storage – Basics of Lead-Acid batteries, Battery Storage Capacity, Coulomb efficiency instead of energy efficiency, Battery Sizing. Different Battery storage technologies and comparison of their performance. Introduction to Super capacitors.

Green Energy: Historical Development, Basic Operation of a Fuel Cell, Fuel Cell Thermodynamics, Entropy and the theoretical efficiency of Fuel Cells, Gibbs Free Energy and Fuel Cell efficiency, Electrical output of an Ideal Cell, Electrical Characteristics of Real Fuel Cells, Types of Fuel Cells, H2: Operating principles, Zero energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy.

UNIT-IV Introduction to DG and its Grid Integration

Introduction: Need for Distributed generation, renewable sources in distributed generation, current scenario in Distributed Generation, Planning of DGs – Siting and sizing of DGs – optimal placement of DG sources in distribution systems.

Grid integration of DGs: Different types of interfaces - Inverter based DGs and rotating machine-based interfaces - Aggregation of multiple DG units. Energy storage elements: Batteries, ultracapacitors, flywheels.

UNIT-V Technical Impact, Economic and Control aspects of DG

Technical impacts of DGs: Transmission systems, Distribution systems, De-regulation – Impact of DGs upon protective relaying – Impact of DGs upon transient and dynamic stability of existing distribution systems

Economic and control aspects of DGs: Market facts, issues, and challenges - Limitations of DGs. Voltage control techniques, Reactive power control, Harmonics, Power quality issues. Reliability of DG based systems – Steady-state and Dynamic analysis.

Textbooks:

1. Muhammad Kamran, Muhammad Rayyan Fazal, "Renewable Energy Conversion Systems", First Edition, Elsevier Academic Press, 2021.
2. G. D. Rai, Non-Conventional Sources of Energy, Khanna Publisher, 2004

Reference Books:

1. G N Tiwari, Solar Energy: Fundamentals, Design, Modeling and Applications, Narosa, 2002.
2. Mukund R Patel, Wind and Solar Power Systems: Design, Analysis, and Operation, 2nd Edition, Taylor & Francis, 2006. .
3. H. Lee Willis, Walter G. Scott, ―Distributed Power Generation – Planning and Evaluation‖, Marcel Decker Press, 2000.
4. Gilbert M. Masters, ―Renewable and Efficient Electric Power Systems‖, 2nd Edn., IEEE Press, Wiley, 2013.
5. N. Jenkins, J.B. Ekanayake and G. Strbac, ―Distributed Generation‖, 1st Edn, The Institution of Engineering and Technology, London, 2010

Online Learning Resource:

1. https://archive.nptel.ac.in/courses/121/106/121106014/#
2. https://onlinecourses.nptel.ac.in/noc22_ch27/preview
3. https://www.nptelvideos.com/lecture.php?id=8517

B.Tech. (EEE) III Year - II Semester **B.Tech. R23 Regulations**

Course Code	ELECTRICAL MEASUREMENTS & INSTRUMENTATION LAB (Professional Core)	L	T	P	C
23HPC0219		0	0	3	1.5

Course Outcomes:

CO	Statements	Blooms Level
CO1	Determine the unknown Resistance, Inductance and Capacitance using AC and DC bridges	**L3**
CO2	Understand the calibration of single phase energy meter	**L2**
CO3	Understand the measurement of power, power factor in a single phase circuit and real, reactive Power in a three phase circuit	**L2**
CO4	Extend the range of Ammeter and Voltmeter	**L5**
CO5	Understand the working of Transducers, Measure distance, temperature, current, voltage and humidity using sensors	**L2**

List of Experiments: (Any 10 experiments are to be conducted)

1. Measurement of resistance using Wheatstone bridge and Kelvin's Double Bridge.
2. Measurement of inductance using Maxwell's bridge, Anderson bridge.
3. Measurement of capacitance using De-Sauty's bridge, Schering bridge.
4. Calibration of single phase energy meter using direct loading method.
5. Calibration of energy meter using Phantom load kit.
6. Measurement of Power using 3-Voltmeter and 3-Ammeter methods in a single phase Circuit.
7. Measurement to Real and Reactive Power in a three phase circuit.
8. Extension of range of given Ammeter and Voltmeter.
9. Measurement of displacement using LVDT.
10. Study of CRO: Measurement of voltage, current, frequency using lissajous patterns.
11. Measurement of different ranges of temperatures using i)RTD ii)Thermocouple
12. Measurement of strain with the help of strain gauge transducers

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B.Tech. (EEE) III Year - II Semester **B.Tech. R23 Regulations**

Course Code	APPLICATIONS OF SOFT COMPUTING TOOLS IN ELECTRICAL ENGINEERING (Skill Enhancement Course)	L	T	P	C
23HSC0201		0	1	2	2

Course Outcomes:

CO	Statements	Blooms Level
CO1	Understand the basic concepts of Electrical Engineering	**L2**
CO2	Apply the concepts to design MATLAB models	**L4**
CO3	Analyze various Electrical engineering applications through MATLAB	**L3**
CO4	Develop real time models using MATLAB	**L5**
CO5	Design virtual PMU	**L5**

List of Experiments: (Any 10 experiments are to be conducted)

1. Transient analysis of given electrical network
2. Simulation of 1-phase and 3-phase transformers
3. Study of the dynamics of second order system
4. Implementation of buck and boost dc-dc converters
5. Study on the design of PI controllers and stability analysis for a DC-DC buck Converter
6. Sine-PWM techniques for single-phase half-bridge, full-bridge and three-phase inverters
7. Economic Load Dispatch of (i) Thermal Units and (ii) Thermal Plants using Conventional method
8. Transient Stability Analysis of Power Systems using Equal Area Criterion (EAC)
9. Reactive Power Control in a transmission system (Ferranti effect, Effect of shunt Inductor)
10. Fault studies using Zbus matrix
11. Design of virtual PMU
12. Wide area control of Two area Kundur system

Online Learning Resources/Virtual Labs:

1. http://vem-iitg.vlabs.ac.in/
2. https://vp-dei.vlabs.ac.in/Dreamweaver/

Gmail Rama Mohan P <rammohan.kadapa@gmail.com>

Request for approval of AITS Kadapa R23 B.Tech. III Year Course Structure and Syllabus

2 messages

Rama Mohan P <rammohan.kadapa@gmail.com> Wed, Jul 23, 2025 at 2:27 PM
To: "kiranmayi0109@gmail.com" <kiranmayi0109@gmail.com>

From
Dr. P. Rama Mohan
Associate Professor
EEE Department
Annamacharya Institute of Technology and Sciences (Autonomous)
Kadapa
Andhra Pradesh

Phone: 9849809510
e-mail: rammohan.kadapa@gmail.com

Madam,

We have discussed R23 B.Tech. (EEE) III Year I Sem and II Sem Course Structure and also, Syllabus of EEE related Subjects for EEE students and other branch students in the BOS Meeting which was held on 21.07.2025 at our college premises. You attended the meeting through online.

Herewith I am sending the syllabus copy of R23 B.Tech. (EEE) III Year I Sem and II Sem Course Structure and also, Syllabus of EEE related Subjects for EEE students and other branch students. We have not done any changes in the syllabus given by JNTUA.

I request you to please approve the course structure and syllabus.

Thank You Madam.

2 attachments

R23 B.Tech. (EEE) III Year AITSK EEE Syllabus.pdf
1012K

R23 B.Tech. III Year AITSK EEE related OE Subjects Syllabus.pdf
445K

Kiranmayi R <kiranmayi0109@gmail.com> Wed, Jul 23, 2025 at 3:21 PM
To: Rama Mohan P <rammohan.kadapa@gmail.com>

Approved sir.

[Quoted text hidden]

--
Thanks&Regards
Prof. R. Kiranmayi
EEE Department
Director IR&P & SCDE
JNTUA

Gmail Rama Mohan P <rammohan.kadapa@gmail.com>

Request for approval of AITS Kadapa R23 B.Tech. III Year Course Structure and Syllabus

2 messages

Rama Mohan P <rammohan.kadapa@gmail.com> Wed, Jul 23, 2025 at 4:08 PM
To: electricalprofessor@gmail.com

From
Dr. P. Rama Mohan
Associate Professor
EEE Department
Annamacharya Institute of Technology and Sciences (Autonomous)
Kadapa
Andhra Pradesh

Phone: 9849809510
e-mail: rammohan.kadapa@gmail.com

Sir,

We have discussed R23 B.Tech. (EEE) III Year I Sem and II Sem Course Structure and also, Syllabus of EEE related Subjects for EEE students and other branch students in the BOS Meeting which was held on 21.07.2025 at our college premises. You attended the meeting through online.

Herewith I am sending the syllabus copy of R23 B.Tech. (EEE) III Year I Sem and II Sem Course Structure and also, Syllabus of EEE related Subjects for EEE students and other branch students. We have not done any changes in the syllabus given by JNTUA.

I request you to please approve the course structure and syllabus.

Thank You Sir.

2 attachments

R23 B.Tech. (EEE) III Year AITSK EEE Syllabus.pdf
1012K

R23 B.Tech. III Year AITSK EEE related OE Subjects Syllabus.pdf
445K

mallikarjuna rao <electricalprofessor@gmail.com> Wed, Jul 23, 2025 at 4:34 PM
To: Rama Mohan P <rammohan.kadapa@gmail.com>

Sir,

The minutes of the meeting are in line with the discussion of the BoS meeting

Thank you very much

Mallikarjuna Rao
[Quoted text hidden]

Gmail Rama Mohan P <rammohan.kadapa@gmail.com>

Request for approval of AITS Kadapa R23 B.Tech. III Year Course Structure and Syllabus

2 messages

Rama Mohan P <rammohan.kadapa@gmail.com> Wed, Jul 23, 2025 at 4:06 PM
To: nnmurty@iittp.ac.in

From
Dr. P. Rama Mohan
Associate Professor
EEE Department
Annamacharya Institute of Technology and Sciences (Autonomous)
Kadapa
Andhra Pradesh

Phone: 9849809510
e-mail: rammohan.kadapa@gmail.com

Sir,

We have discussed R23 B.Tech. (EEE) III Year I Sem and II Sem Course Structure and also, Syllabus of EEE related Subjects for EEE students and other branch students in the BOS Meeting which was held on 21.07.2025 at our college premises. You attended the meeting through online.

Herewith I am sending the syllabus copy of R23 B.Tech. (EEE) III Year I Sem and II Sem Course Structure and also, Syllabus of EEE related Subjects for EEE students and other branch students. We have not done any changes in the syllabus given by JNTUA.

I request you to please approve the course structure and syllabus.

Thank You Sir.

2 attachments

R23 B.Tech. (EEE) III Year AITSK EEE Syllabus.pdf
1012K

R23 B.Tech. III Year AITSK EEE related OE Subjects Syllabus.pdf
445K

Murty N <nnmurty@iittp.ac.in> Wed, Jul 23, 2025 at 4:17 PM
To: Rama Mohan P <rammohan.kadapa@gmail.com>

Approved. Please go ahead.

Thanks & Regards,
Murty

N V L Narasimha Murty
Professor
Electrical Engg
IIT Tirupati
Yerpedu - Venkatagiri Road, Yerpedu Post,
Yerpedu - 517619, Dist. - Tirupati,
Andhra Pradesh, INDIA.
Ph: +91-9439429709
E-mail: nnmurty@iittp.ac.in
Web: http://www.iittp.ac.in/dr-n-n-murty

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