DEPARTMENT OF
ELECTRICAL AND ELECTRONICS ENGINEERING

SYLLABI (R-25)

B. Tech II Year

(Electrical and Electronics Engineering)

w.e.f. the Academic Year 2026-2027

Vidya Jyothi Institute of Technology
(An Autonomous Institution)

(Accredited by NAAC A+ Approved by AICTE New Delhi & Permanently Affiliated to JNTUH)

Aziz Nagar Gate, C.B. Post, Hyderabad-500 075

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
B. TECH II YEAR COURSE STRUCTURE
(Electrical and Electronics Engineering)

Semester – I

S. No	Course Code	Course Title	L	T	P	Credits
1	A253201	Electromagnetic fields	3	0	0	3
2	A253202	Electrical Machines – I	3	0	0	3
3	A253401	Electronic Devices and Circuits	3	0	0	3
4	A253203	Power Systems – I	3	0	0	3
5	A253204	Electrical Measurements and Sensors	2	0	0	2
6	A253005	Innovation and Entrepreneurship	2	0	0	2
7	A253281	Electrical Machines - I Lab	0	0	2	1
8	A253282	Electrical Measurements and Sensors Lab	0	0	2	1
9	A253481	Electronic Devices and Circuits Lab	0	0	2	1
10	A253283	Design of Electrical Systems using Auto CAD	0	0	2	1
11	A253105	Environmental Science	1	0	0	1
		Total Credits	**17**	**0**	**8**	**21**

Semester – II

S. No	Course Code	Course Title	L	T	P	Credits
1	A254002	Numerical Methods and Complex Variables	3	0	0	3
2	A254201	Electrical Machines – II	3	0	0	3
3	A254202	Power Systems – II	3	0	0	3
4	A254401	Digital Electronics	3	0	0	3
5	A254203	Control Systems	3	0	0	3
6	A254081	Computational Mathematics Lab	0	0	2	1
7	A254281	Electrical Machines - II Lab	0	0	2	1
8	A254282	Control Systems Lab	0	0	2	1
9	A254481	Digital Electronics Lab	0	0	2	1
10	A254482	PCB Design	0	0	2	1
		Total Credits	**15**	**0**	**10**	**20**

ELECTROMAGNETIC FIELDS

Department of Electrical and Electronics Engineering					II B. Tech I Semester		
Course Code	Hours/Week			Credits	Marks		
A253201	L	T	P	C	CIE	SEE	Total
	3	0	0	3	40	60	100

Prerequisites: Mathematics & Physics

Course Objectives:

- To introduce the concepts of electric field and magnetic field.
- To know Applications of electric and magnetic fields in the development of the theory for power transmission lines and electrical machines.
- To know about electromagnetic waves.

Course outcomes: After learning the contents of this course, the student must be able to

CO1. Explain static electric field concepts including charge distributions, Gauss's law, electric potential, electric dipole, and electrostatic energy for different field configurations.

CO2. Apply field equations and boundary conditions to analyze conductors, dielectrics, and capacitance using Poisson's and Laplace's equations.

CO3. Analyze static magnetic fields produced by current-carrying conductors using Biot–Savart law, Ampere's circuital law, and magnetic potential formulations.

CO4. Evaluate magnetic force interactions, inductive effects, and magnetic circuits by examining forces on charges and current elements, and self and mutual inductances.

CO5. Formulate electromagnetic field relationships using Maxwell's equations to interpret time-varying fields, electromagnetic induction, and wave propagation.

UNIT-I: Static Electric Field

Review of conversion of a vector from one coordinate system to another coordinate system, Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

UNIT-II: Conductors, Dielectrics and Capacitance

Current and current density, Ohms Law in Point form, Continuity equation, Boundary conditions of conductors and dielectric materials. Capacitance, Capacitance of a two-wire line, Poisson's equation, Laplace's equation.

UNIT-III: Static Magnetic Fields

Biot-Savart Law, Ampere Circuital Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.

UNIT-IV: Magnetic Forces

Force on a moving charge, Force on a differential current element, Force between differential current elements, Magnetic boundary conditions, Magnetic circuits, Self-inductances and mutual inductances.

UNIT-V: Time Varying Fields and Maxwell's Equations

Faraday's laws of Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Introduction to Electromagnetic Waves.

TEXT BOOKS:

1. M.N.O. Sadiku, "Elements of Electromagnetics", 7th edition, Oxford University Publication, 2018.
2. William H. Hayt, John A. Buck, Jaleel M. Akhtar, "Engineering Electromagnetics", 9th edition, McGraw Hill Education, 2020.

REFERENCEBOOKS:

1. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
2. G.W.Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.
3. W.J.Duffin, "ElectricityandMagnetism", McGraw Hill Publication, 1980.

ELECTRICAL MACHINES-I

Department of Electrical and Electronics Engineering					II B. Tech I Semester		
Course Code	Hours/Week			Credits	Marks		
A253202	L	T	P	C	CIE	SEE	Total
	3	0	0	3	40	60	100

Prerequisites: Electrical Circuits-I&II

Course Objectives:

- To study and understand different types of DC machines and their performance evaluation through various testing methods.
- To understand the operation of single-phase and Three-phase Transformers
- To analyze the performance of transformers through various testing methods

Course outcomes: After learning the contents of this course, the student must be able to

CO1. Explain the construction, operating principles, armature reaction, commutation, excitation methods, and performance characteristics of DC generators.

CO2. Apply DC motor principles to determine torque, speed control, losses, efficiency, and to conduct standard performance tests of DC machines.

CO3. Analyze the operation, equivalent circuit, losses, efficiency, and regulation of single-phase transformers under no-load and load conditions.

CO4. Evaluate transformer performance by interpreting results of open-circuit, short-circuit, and Sumpner's tests for loss separation and efficiency prediction.

CO5. Design transformer configurations for parallel operation and poly-phase applications by selecting appropriate connections and transformer types

UNIT-I: D.C. Generators

Principle of operation – Action of commutator – constructional features – armature windings– lap and wave windings – simplex and multiplex windings (elementary treatment only) – EMF Equation. Concept of Armature reaction and commutation – Cross magnetizing and de-magnetizing AT/pole. Methods of Excitation – separately excited and self-excited generators – build-up of EMF - critical field resistance and critical speed. Performance Characteristics of shunt, series and compound generators and applications.

UNIT-II: D.C. Motors

Principle of operation–Back EMF.-Torque equation–characteristics and application of shunt, series and compound motors. 3-pointstarter, Speed control of DC shunt and series motors-Armature voltage and field flux control methods. Losses–Constant & Variable losses–calculation of efficiency–condition for maximum efficiency.

Testing of DC Machines: Methods of Testing – Direct, Indirect, and Regenerative Testing – Brake Test– Swinburne's Test – Hopkinson's Test.

UNIT-III: Single Phase Transformers

Types – constructional details – minimization of hysteresis and eddy current losses – EMF equation - operation on no-load and onload - phasor diagrams and Applications. Equivalent circuit-losses and efficiency–regulation-All day efficiency – effect of variations of frequency & supply voltage on iron losses

UNIT-IV: Testing of Transformers

Principle of operation – Action of commutator – constructional features – armature windings– lap and wave windings – simplex and multiplex windings (elementary treatment only) – EMF Equation. Concept of Armature reaction and commutation – Cross magnetizing and de-magnetizing AT/pole. Methods of Excitation – separately excited and self-excited generators – build-up of EMF - critical field resistance and critical speed. Performance Characteristics of shunt, series and compound generators and applications

UNIT-V: Transformers

Parallel operation with equal and unequal voltage ratios – auto transformers – equivalent circuit – comparison with two winding transformers.

Poly – phase transformers – Poly – phase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ, Scott connection and Applications

TEXT BOOKS:

1. P.S. Bimbhra, “ElectricalMachinery”, Khanna Publishers, Revised Edition, 2021.
2. I.J. Nagrath and D.P.Kothari, “ElectricMachines”, McGraw Hill Education, 2010.

REFERENCEBOOKS:

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, “Electrical Machines”, Oxford, 2017.
2. M.G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. A.E. Fitzgerald and C. Kingsley, "ElectricMachinery”, New York, McGraw Hill Education, 2013.

ELECTRONIC DEVICES AND CIRCUITS

<table>
<tr><th colspan="5">Department of Electrical and Electronics Engineering</th><th colspan="3">II B. Tech I Semester</th></tr>
<tr><th>Course Code</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Marks</th></tr>
<tr><td rowspan="2">A253401</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIE</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
</table>

Course Overview:

- This course introduces fundamental semiconductor devices and their behavior, including diodes, BJTs, and FETs. It covers their characteristics, applications, and the analysis of basic electronic circuits.
- The course also explores rectifiers, voltage regulation, amplifier design, and advanced semiconductor technologies like FinFETs and CNTFETs.
- Emphasis is placed on developing a strong foundation for analog circuit design and understanding modern device technologies in electronics

Course outcomes: After learning the contents of this course, the student must be able to

CO1. Analyze the electrical characteristics and models of semiconductor diodes and apply the min rectifier and clipping circuits.

CO2. Evaluate the operation and configurations of Bipolar Junction Transistors (BJTs) & Field Effect Transistors and analyze their input and output characteristics.

CO3. Design appropriate biasing networks for BJTs and determine the operating point for amplifier applications.

CO4. Analyze transistor amplifier circuits using small signal models and assess performance for various configurations.

CO5. Analyze the structure and working of Special purpose diodes and advanced devices like FinFETs and CNTFETs

UNIT-I: Diode Characteristics and Applications

PN junction diode – V-I characteristics, Diode resistance and capacitance, Diode models (Ideal, Simplified, Piecewise Linear), Rectifiers –Half-wave, Full- wave (Center-tap and bridge), Capacitor filter for rectifiers.- Clippers and clampers, Zener diode – V-I characteristics and voltage regulation.

UNIT-II: Transistors

Bipolar Junction Transistor (BJT): Structure and working principle of BJT, Current components and transistor action, Configurations: Common Base (CB), Common Emitter (CE), Common Collector(CC), Input and output characteristics, Determination of h-parameters from transistor characteristics.

Field Effect Transistors (FET): JFET: Structure, operation, and characteristics, MOSFET: Enhancement and Depletion modes –Structure, operation and characteristics.

UNIT-III: BJT Biasing

Need for biasing and stabilization, Load line and operating point, Biasing techniques: Fixed bias, Collector-to-base bias, Voltage divider bias, Stability factors and thermal runaway

UNIT-IV: Amplifiers

Transistor Amplifiers: Transistor as a small-signal amplifier, h-parameter equivalent circuit, CE, CB, CC amplifier analysis using h-parameters, Approximate h parameter model for CE amplifier.

FET Amplifiers: FET Small Signal Model, Analysis of CS, CD, CG JFET Amplifiers

UNIT-V: Special Purpose Diodes & Advanced Devices

Special Purpose Diodes: Principle of Operation of - SCR, Tunnel Diode, Varactor Diode, Photo Diode, Solar Cell, LED and Schottky Diode.

Advanced Devices: FinFETs – 3D structure, Scaling advantages, CNTFETs – Structure, ballistic transport, fabrication, Comparison: CMOS vs. FinFET vs. CNTFET.

TEXT BOOKS:

1. Boylestad, Robert L., and Louis Nashelsky., “Electronic Devices and Circuit Theory”, Pearson, 11th ed., 2013.
2. Millman, Jacob, and Christos C. Halkias., “Electronic Devices and Circuits”, Tata McGraw-Hill, 1991.
3. Sedra, Adel S., and Kenneth C. Smith., “Microelectronic Circuits”, Oxford University Press, 7th ed., 2014.

REFERENCEBOOKS:

1. Bell, David A. “Electronic Devices and Circuits”, Oxford University Press, 5thed.,2008.
2. Neamen, Donald A., “Electronic Circuit Analysis and Design”, McGraw-Hill, 2nded., 2001.
3. Salivahanan, S,and N.Suresh Kumar, “Electronic Devices and Circuits”, McGraw-Hill Education, 4th ed., 2017.
4. Razavi, Behzad, “Fundamentals of Microelectronics”, Wiley, 2nded., 2013.
5. Taur, Yuan, and Tak H. Ning, “Fundamentals of Modern VLSI Devices”, Cambridge University Press, 2nd ed., 2009.

POWER SYSTEMS–I

Department of Electrical and Electronics Engineering					II B. Tech I Semester		
Course Code	Hours/Week			Credits	Marks		
A253203	L	T	P	C	CIE	SEE	Total
	3	0	0	3	40	60	100

Prerequisites: Electrical Circuits-I&II

Course Objectives:

- To understand the power generation through conventional and non-conventional sources
- To illustrate the economic aspects of power generation and tariff methods
- To know about substations and distributions systems

Course outcomes: After learning the contents of this course, the student must be able to

CO1. Explain the operation, layout, components, site selection, advantages, and limitations of conventional and renewable electric power generation plants.

CO2. Apply economic principles of power generation to evaluate load characteristics, plant capacity, and energy tariffs.

CO3. Analyze the layout and bus-bar arrangements of air-insulated substations and GIS to assess their suitability for power system applications.

CO4. Evaluate DC distribution systems by performing voltage drop calculations for various distributor configurations and comparing distribution alternatives.

CO5. Design AC distribution systems by selecting appropriate configurations and computing voltage drops under different loading and power factor conditions

UNIT-I: Generation of Electric Power

Operation of Hydel, Thermal, Nuclear and Gas Power plant with layouts – Description of components- Choice of site – advantages and disadvantages, Introduction and description of components – renewable energy sources and plants (solar and wind)

UNIT-II: Economics of Power Generation

Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, Load curve, Load duration curve, number and size of generator units. Base load and peak load plants. Cost of electrical energy – fixed cost, running cost, Tariffs.

UNIT-III: Substations

Air Insulated Substations (AIS): Indoor & Outdoor substations – Substations layout showing the location of all the substation equipment. Busbar arrangements in the substations. Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams.

GIS: Single line diagram, Advantages

UNIT-IV: DC Distribution

Classification of Distribution Systems – Comparison of DC vs AC and Under Ground vs Over – Head Distribution Systems – Requirements and Design features of Distribution Systems – Voltage Drop Calculations (Numerical Problems) in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends (equal/unequal Voltages) and Ring Main Distributor.

UNIT-V: AC Distribution

Introduction, AC distribution, Single phase, 3-phase3 wire, 3-phase4 wire system, busbar arrangement, Selection of site for substation. Voltage Drop Calculations (Numerical Problems) in AC Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

TEXT BOOKS:

1. C. L. Wadhwa, "Generation, Distribution and Utilization of Electrical Energy", 2nd Edition, New Age International, 2009.
2. A.Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar, "ATextbook on Power System Engineering", Dhanpat Rai Publishing Company (P) Ltd, 2008.

REFERENCEBOOKS:

1. J.B.Gupta, "A Course in Power Systems", Katson Books, 11th Edition, 2016.
2. C.L.Wadhwa, "Electrical Power Systems", 5th Edition, NewAge International, 2009.
3. W.D.Stevenson, "Elements of Power System Analysis", 4th Edition, McGraw Hill, 1984.

ELECTRICAL MEASUREMENTS AND SENSORS

Department of Electrical and Electronics Engineering					II B. Tech I Semester		
Course Code	Hours/Week			Credits	Marks		
A253204	L	T	P	C	CIE	SEE	Total
	2	0	0	2	40	60	100

Prerequisites: Electrical Circuits-I&II

Course Objectives:

- To introduce the basic principles of all measuring instruments.
- To deal with the measurement of voltage, current, Power factor, power, energy and magnetic measurements.
- To understand the basic concepts of smart and digital metering

Course outcomes: After learning the contents of this course, the student must be able to

CO1. Explain the principles, construction, operating torques, errors, and range extension methods of analog measuring instruments including PMMC, moving iron, and electrostatic voltmeters.

CO2. Apply DC and AC potentiometers and instrument transformers for accurate measurement of electrical quantities and qualitative analysis of ratio and phase angle errors.

CO3. Analyze the measurement of power and energy in single-phase and three-phase systems using dynamometer wattmeters and induction energy meters, including error sources and compensation techniques.

CO4. Evaluate DC and AC bridge measurement techniques for resistance, inductance, and capacitance, considering sensitivity, accuracy, and suitability for different ranges.

CO5. Design measurement solutions using sensors and smart instruments by integrating appropriate transducers, signal conditioning, communication technologies, and intelligent features for modern metering applications

UNIT-I: Introduction to Measuring Instruments

Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type instruments – expression for the deflecting torque and control torque –Errors and compensations, extension of range using shunts and series resistance.Electrostatic Voltmeters-electrometer type and attracted disc type – extension of range of Electrostatic Voltmeters

UNIT-II: Potentiometers & Instrument Transformers

Principle and operation of DC Crompton’s potentiometer – standardization – Measurement of unknown resistance, current, voltage. AC Potentiometers: polar and coordinate type’s standardization – applications. CT and PT – Ratioand phase angle errors (Qualitative approach).

UNIT-III: Measurement of Power & Energy

Single phase dynamometer wattmeter, LPF and UPF, Double element and three element dynamo meter wattmeter, expression for deflecting and control torques – Extension of range of wattmeter using instrument transformers – Measurement of active and reactive powers in balanced and unbalanced systems.

Single phase induction type energy meter – driving and braking torques – errors and compensations – testing by phantom loading using RSS meter. Three phase energy meter – trivector meter, maximum demand meters (Qualitative approach)

UNIT-IV: DC & AC Bridges

Method of measuring low, medium and high resistance – sensitivity of Wheat-stone's bridge –Kelvin's double bridge for measuring low resistance, measurement of high resistance – loss of charge method. Measurement of inductance - Maxwell's bridge, Hay's bridge, Anderson's bridge.Measurement of capacitance and loss angle –De Sauty's Bridge - Wien's bridge – Schering Bridge. (Qualitative approach).

UNIT-V: Sensors & Smart instruments

Sensors: Classification of transducers – Temperature sensors – Proximity sensor – Pressure sensor – IR sensors – Motion detection sensors – Ultrasonic sensors – Rotor Position Sensors, Operation of Strain Gauge – Thermocouples, construction and working of LVDT, Piezoelectric transducers, photo voltaic, photo conductive cells, and photo diodes – Applications.

Smart instruments: Intelligent transducer, self – diagnosis and remote calibration features, HART communication, MEMS, non-linearity compensation; smart energy meter components, working principle; Automatic Meter Reading (AMR), Advanced Metering Infrastructure (AMI) environments.

TEXT BOOKS:

1. A.K.Sawhney, "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Co. Publications, 2005.
2. Dr.Rajendra Prasad, "Electrical Measurements & Measuring Instruments", Khanna Publishers 1989.

REFERENCEBOOKS:

1. G.K.Banerjee, "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd.,2nd Edition, 2016.
2. R.K.Rajput, "Electrical & Electronic Measurement & Instrumentation", S.Chand and Company Ltd.,2007.
3. S.C.Bhargava, "Electrical Measuring Instruments and Measurements", BS Publications, 2012.

INNOVATION AND ENTREPRENEURSHIP

<table>
<tr><th colspan="4">Department of Electrical and Electronics Engineering</th><th colspan="3">II B. Tech I Semester</th></tr>
<tr><th>Course Code</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="2">Marks</th></tr>
<tr><td rowspan="2">A253005</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIE</td><td>SEE</td><td>Total</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>2</td><td>40</td><td>60</td><td>100</td></tr>
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Course Objectives:

- To familiarize on the basic concepts of innovation, entrepreneurship and its importance.
- To Identify and analyze the process of problem-opportunity identification, market segmentation, and idea generation techniques.
- To initiate prototype development and understand minimum viable product.
- To develop initial Business and financial planning and Go-to-Market strategies
- To impart knowledge on establishing startups, venture pitching and IPR

Course outcomes: After learning the contents of this course, the student must be able to

CO1. Understand the entrepreneurship and the entrepreneurial process and its significance in economic development.

CO2. Assess the problem from an industry perspective and generate solutions using the design thinking principles.

CO3. Assess market competition, estimate market size, and develop a prototype.

CO4. Analyze Business and financial planning models and Go-to-Market strategies.

CO5. Able to build a start-up, register IP and identify funding opportunities.

UNIT-I: Fundamentals of Innovation and Entrepreneurship Innovation

Introduction, need for innovation, Features, Types of innovations, fostering a culture of innovation, planning for innovation.

Entrepreneurship: Introduction, types of entrepreneurship attributes, mindset of entrepreneurial and intrapreneurial leadership, Role of entrepreneurs in economic development. Woman Entrepreneurship, Importance of on-campus startups, attributes and networks individuals while on campus.

Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity

UNIT-II: Problem and Customer Identification

Identification of gap, problem, analyzing the problem from a industry perspective, market and customer segmentation, validation of customer problem fit, Iterating problem-customer fit, Porter's Five Force Model. Idea generation, Ideation techniques: Brainstorming, SCAMPER, Design thinking principles.

Core Teaching Tool: Several types of activities including: Class, game, Gen AI, 'Get out of the Building' and Venture Activity.

UNIT-III: Opportunity assessment and Prototype development

Identify and map global competitors, review industry trends, and understand market sizing: TAM, SAM, and SOM. Understanding prototyping and Minimum Viable Product (MVP). Developing a prototype: Testing, and validation.

Core Teaching Tool: Venture Activity, Class activity

UNIT-IV: Business & Financial Models

Introduction to Business Model and types, Business planning: components of Business plan- Sales plan, People plan and financial plan, Financial Planning: Types of costs, preparing a financial plan for profitability using a financial template, analyzing financial performance. Go-To-Market (GTM) approach,

Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

UNIT-V: Startups and IPR

Startup requirements, building founding team members and mentors, pitch preparation, start-up registration process, funding opportunities and schemes, startup lifecycle, documentation, legal aspects in startup, venture pitching readiness, National Innovation Startup Policy (NISP) and its features. Patents, Designs, Patentability, Procedure for grants of patents. Indian Scenario of Patenting, International Scenario: International cooperation on Intellectual Property. Patent Rights, Copyright, trademark, and GI. Licensing and transfer of technology.

Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.

TEXT BOOKS:

1. John R Bessant, Joe Tidd, Innovation and Entrepreneurship, 4E, Wiley, Latest Edition.
2. Ajay Batra, The Stratup Launch Book, A Practical Guide for Launching Customer Centric Ventures, Wiley, 2020.

REFERENCEBOOKS:

1. Entrepreneurship Development and Small Business Enterprises, Poornima M Charantimath, 3E, Pearson, 2018.
2. D.F. Kuratko and T.V. Rao, Entrepreneurship: A South-Asian Perspective, Cengage Learning, 2013.
3. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha, Entrepreneurship, McGraw Hill, 11^{th} Edition, 2020.

ELECTRICAL MACHINES-I LAB

Department of Electrical and Electronics Engineering					II B. Tech I Semester		
Course Code	Hours/Week			Credits	Marks		
A253281	L	T	P	C	CIE	SEE	Total
	0	0	2	1	40	60	100

Prerequisites: Electrical machines – I

Course Objectives:

- To uncover the students to the operation of DC Generators.
- To know the operation of various types of DC Motors.
- To examine the performance of Single and Three Phase Transformers

Course Outcomes: After learning the contents of this course, the student must be able to

CO1. Set up and conduct standard tests on DC generators, DC motors, and single-phase transformers by following correct laboratory procedures and safety practices.

CO2. Measure electrical and mechanical parameters such as voltage, current, power, speed, torque, and losses during load and no-load tests on DC machines and transformers.

CO3. Plot and interpret characteristic curves and performance graphs of DC generators, DC motors, and transformers from experimentally obtained data.

CO4. Analyze test results to determine efficiency, regulation, speed control characteristics, critical field resistance, and critical speed of electrical machines.

CO5. Demonstrate proficiency in evaluating the performance and operational behavior of DC machines and single-phase transformers for practical electrical engineering applications

Any 10 out of the following experiments required to be conducted

1. Magnetization characteristics of DC shunt generator (Determination of critical field resistance and critical speed)
2. Load test on DC shunt generator (Determination of characteristics)
3. Load test on DC series generator (Determination of characteristics)
4. Hopkinson’s test on DC shunt machines (Predetermination of efficiency)
5. Swinburne’s test (Predetermination of efficiency)
6. Brake test on DC compound motor (Determination of performance curves)
7. OC and SC Test on Single Phase Transformer
8. Brake Test on DC shunt motor (Determination of performance curves)
9. Load Test on DC compound generator (Determination of characteristics).
10. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
11. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
12. Speed control of DC shunt motor

TEXTBOOKS:

1. P.S. Bimbhra, “ElectricalMachinery”, Khanna Publishers, 2011.
2. I.J.Nagrath and D.P.Kothari, “ElectricMachines”, McGraw Hill Education,2010.

REFERENCEBOOKS:

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, “ElectricalMachines”, Oxford, 2017.
2. M.G.Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. A.E.Fitzgerald and C.Kingsley, "Electric Machinery”, NewYork, McGraw Hill Education, 2013.

ELECTRICAL MEASUREMENTS AND SENSORS LAB

Department of Electrical and Electronics Engineering					II B. Tech I Semester		
Course Code	**Hours/Week**			**Credits**	**Marks**		
A253282	L	T	P	C	CIE	SEE	Total
	0	0	2	1	40	60	100

Prerequisites: Electrical Circuits–I & II

Course Objectives:

- To calibrate Watt, Energy and PF Meter and determination of three phase active & reactive powers.
- To determine unknown inductance, resistance, capacitance by performing experiments on DC Bridges & AC Bridges.
- To determine the ratio and phase angle errors of Instrument transformers

Course Outcomes: After learning the contents of this course, the student must be able to

CO1. Set up standard measurement and calibration circuits for electrical instruments such as energy meters, power factor meters, and PMMC instruments following laboratory safety practices.

CO2. Calibrate electrical measuring instruments including energy meters, dynamometer meters, potentiometers, and bridges by accurately adjusting, connecting, and recording experimental parameters.

CO3. Measure electrical quantities such as power, reactive power, resistance, displacement, strain and transformer turns ratio using bridges, watt meters, LVDT and strain gauges with improved accuracy.

CO4. Analyze experimental results by computing errors, tolerance, and calibration characteristics and correlating observed behavior with theoretical expectations.

CO5. Demonstrate proficiency in selecting, integrating, and testing sensors and high-voltage equipment to perform reliable measurements and interpret results for practical engineering applications

Any 10 out of the following experiments required to be conducted

1. Calibration and testing of single-phase energy Meter.
2. Calibration of dynamo meter power factor meter.
3. Crompton DC Potentiometer–Calibration of PMMC ammeter and PMMC voltmeter.
4. Kelvin’s double Bridge–Measurement of resistance–Determination of Tolerance.
5. Dielectric testing of oil using HT Testing Kit.
6. Schering Bridge & Anderson Bridge.
7. Measurement of 3-Phase reactive power with single-phase wattmeter.
8. Measurement of displacement with the help of LVDT.
9. Measurement of 3-phase power with single wattmeter and two CTs.
10. Resistance strain gauge–strain measurements and Calibration.
11. Transformer turns ratio measurement using AC bridges.
12. Demonstration of different sensors using trainer kit

TEXTBOOKS:

1. A.K.Sawhney, “Electrical & Electronic Measurement & Instruments”, Dhanpat Rai & Co. Publications, 2005.
2. Dr.RajendraPrasad, “Electrical Measurements & Measuring Instruments”, Khanna Publishers, 1989.

REFERENCEBOOKS:

1. G.K.Banerjee, “Electrical and Electronic Measurements”, PHI Learning Pvt. Ltd., 2nd Edition, 2016.
2. R.K.Rajput, “Electrical & Electronic Measurement & Instrumentation”, S.Chandand Company Ltd.,2007.
3. S.C.Bhargava, “Electrical Measuring Instruments and Measurements”, BS Publications, 2012

ELECTRONIC DEVICES AND CIRCUITS LAB

Department of Electrical and Electronics Engineering					II B. Tech I Semester		
Course Code	Hours/Week			Credits	Marks		
A253481	L	T	P	C	CIE	SEE	Total
	0	0	2	1	40	60	100

Prerequisites: Electrical Circuits–I & II

Course Overview:

- This laboratory course aims to provide hands-on experience and simulation-based learning of semiconductor devices and basic electronic circuits.
- Students will analyze the characteristics and applications of diodes, BJTs, and FETs, design rectifiers and amplifiers, and simulate modern electronic circuits using software tools.
- The course bridges theoretical concepts with practical implementation, developing foundational skills essential for analog electronics and circuit analysis.

Course Outcomes: After learning the contents of this course, the student must be able to

CO1. Analyze the V–I characteristics of semiconductor devices such as diodes, BJTs, and FETs.

CO2. Design and evaluate basic rectifier circuits.

CO3. Demonstrate biasing techniques for BJT and determine their operating point using DC load line analysis.

CO4. Design and analyze transistor amplifier circuits in various configurations using small signal models.

CO5. Simulate and interpret electronic circuits using appropriate simulation tools

List of Experiments

A. Hardware-Based Experiments:

1. Plot the V–I characteristics of a PN junction diode in forward and reverse bias to determine cut-in voltage and dynamic resistance.
2. Plot the V–I characteristics of a Zener in forward and reverse bias to determine cut-in voltage and break down voltage.
3. Implement clipper and clamper circuits to observe waveform shaping through positive, negative, and biased configurations.
4. Design and analyze half-wave with and without capacitor filters to evaluate ripple factor and output voltage.
5. Design and analyze full-wave rectifiers (center-tap) with and without capacitor filters to evaluate ripple factor and output voltage.
6. Plot the input and output characteristics of a BJT in common emitter configuration to determine the value of h-parameters.
7. Design and test voltage divider bias circuit to establish a stable operating point for a BJT amplifier and draw the DC load line behavior.

B. Software-Based Simulation Experiments:

1. Simulate a full-wave bridge rectifier with capacitor filter to analyze wave form smoothing and ripple reduction in DC power supply design.
2. Simulate a Zener diode-based voltage regulator to study voltage stabilization against varying supply voltages and load resistances.

3. Simulate the output and transfer characteristics of a JFET to determine parameters such as pinch-off voltage, drain resistance, and trans conductance.
4. Simulate a common emitter amplifier to analyze the effect on voltage gain and signal amplification.
5. Simulate a common source amplifier to analyze the effect on voltage gain and signal amplification.
6. Simulate BJT operation as a switch and small-signal amplifier to understand its dual functionality in digital and analog applications.
7. Design and simulate a CMOS inverter to study digital switching behavior and low-power logic design.

Hardware Requirements:

1. Regulated DC Power Supply (0-30 V)
2. Function Generators
3. Digital Multimeter
4. Cathode Ray oscilloscope or DSO
5. Breadboards and connecting wires
6. Resistors, Capacitors Diodes
7. BJTs, JFETs, and MOSFETS
8. Trainer kits (optional)

Software Requirements (any one of the listed tools or equivalent)

1. LT Spice (Free from Analog Devices)
2. NI Multisim (Academic License or Student version)
3. Proteus Design Suite (Simulation and PCB design)
4. TINA-TI (Free from Texas Instruments)
5. PSICE for TI or OrCAD Lite
6. Windows PC

DESIGN OF ELECTRICAL SYSTEMS USING AUTOCAD

Department of Electrical and Electronics Engineering					II B. Tech I Semester		
Course Code	Hours/Week			Credits	Marks		
A253283	L	T	P	C	CIE	SEE	Total
	0	0	2	1	40	60	100

Course Objectives:

- To provide hands-on training in using Auto CAD for electrical design and drafting.
- To understand the principles of preparing electrical wiring diagrams and panel layouts.
- To enable students to design residential, commercial, and industrial electrical systems.
- To introduce students to symbols, standards, and practices in electrical CAD

Course Outcomes: After learning the contents of this course, the student must be able to

CO1. Apply Auto CAD tools to create electrical schematics and layouts.
CO2. Design residential and commercial wiring systems as per standards.
CO3. Develop and document substation and panel wiring drawings.
CO4. Interpret electrical diagrams and create professional CAD documentation.
CO5. Work on real-time electrical design problems using CAD tools

Module I: Introduction to Auto CAD for Electrical Design Overview of Auto CAD interface and tools

- Layers, blocks, and annotation in AutoCAD
- Electrical symbols: IEC/ ANSI/ IS standards
- Drawing and modifying basic electrical elements

Lab Experiments:

- Creating simple electrical circuit diagrams using Auto CAD
- Use of layers and blocks for electrical layouts

Module II: House Wiring and Lighting System Design

- Design of single-line diagrams (SLDs)
- Layout of internal wiring for residential buildings
- Load calculation and cable selection
- Earthing and protection system basics

Lab Experiments:

- Preparation of residential wiring layout
- Switch board and lighting plan for 1BHK/ 2BHK house

Module III: Commercial and Industrial Electrical Layouts

- Design of power circuits and lighting for commercial buildings
- Distribution board design and component placement
- Panel board and bus bar layout

Lab Experiments:

- Design and drafting of distribution system for a small commercial building
- Electrical room layout with control panels

Module IV: Substation and Control Circuit Design

- Single-line diagram of substations
- Control circuits schematics
- Relay control and contactor wiring diagrams
- Cable routing and tray layout

Lab Experiments:

- Drawing of 11kV/440V substation SLD
- Panel wiring diagram for DOL/ Star-Delta motor starter

Module V: Mini Project and Professional Practice

- Project planning, drawing standards, title block, and BOM
- Design and documentation of a small-scale electrical system
- Printing, plotting, and exporting drawings

Lab Activity:

- Mini-project: Design and documentation of electrical system for a small apartment, lab,or factory setup

Software Requirements:

- Auto CAD Electrical (Student or Institutional License)
- Optional: E-Plan, DraftSight, or similar tools for advanced users

TEXT BOOKS:

1. K.B. Raina and S.K. Bhattacharya, "Electrical Design Estimating and Costing", New Age International.
2. Prof. Sham Tickoo, "Auto CAD Electrical 2023 for Electrical Control Designers", CADCIM Technologies.

REFERENCE BOOKS:

1. Frederic P. Hartwell and Herbert P.Richter, "Practical Electrical Wiring", Park Publishing.
2. James A. Leachand Shawna Lockhart, "AutoCAD2023 Instructor", SDC Publications.
3. Ray C. Mullin and Phil Simmons, "Electrical Wiring Residential", Cengage Learning.

ENVIRONMENTAL SCIENCE

Department of Electrical and Electronics Engineering					II B. Tech I Semester		
Course Code	Hours/Week			Credits	Marks		
A253105	L	T	P	C	CIE	SEE	Total
	1	0	0	1	40	60	100

Course Objectives: This course is expected to enable the student

- Describe eco system components, functions, and their societal relevance.
- Explain natural resource classification, management, and challenges.
- Analyze pollution types, impacts, and control measures.
- Evaluate global environmental issues, policies, and EIA‘s role in sustainability

Course outcomes: After learning the contents of this course, the student must be able to

CO1. Describe eco system structure, functions, and bio diversity conservation.
CO2. Analyze natural resource management and alternative energy options.
CO3. Evaluate biodiversity threats and conservation frameworks.
CO4. Identify pollution sources, impacts, and control technologies.
CO5. Apply environmental policies and EIA for sustainable management.

UNIT-I: Ecosystems

Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Bioaccumulation, Bio magnification, ecosystem value, services and carrying capacity

UNIT-II: Resources

Natural Resources: Classification of Resources: Living and Non-Living resources, water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, Land resources: Forest resources, Energy resources: growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

UNIT-III: Biodiversity and Biotic Resources

Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act

UNIT-IV: Environmental Pollution and Control Technologies: Environmental Pollution

Classification of pollution, Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. Water pollution: Sources and types of pollution, drinking water quality standards. Soil Pollution: Sources and types, Impacts of modern agriculture, degradation of soil. Noise Pollution: Sources and Health hazards, standards, Pollution control technologies; Overview of air pollution control technologies, Concepts of bioremediation. Global Environmental Issues and Global Efforts: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification.

UNIT-V: Environmental Policy, Legislation & EIA

Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). Contemporary Environmental Issues, Climate change; Sustainable development goals (SDGs); Global environmental challenges; Environmental policies and international agreements.

TEXT BOOKS:

1. Anjaneyulu, Y., Introduction to Environmental Science, BS Publications, 2nd Edition, 2017.
2. Bharucha,E., Text book of Environmental Studies for Undergraduate Courses, University Grants Commission, 3rd Edition, 2021.
3. Rajagopalan,R., Environmental Studies, Oxford University Press, 3rd Edition, 2023.

REFERENCE BOOKS:

1. Wright, R.T., Environmental Science: Towards a Sustainable Future, PHI Learning Pvt. Ltd., Revised Edition, 2008.
2. Masters, G.M., & Ela, W.P., Environmental Engineering and Science, PHI Learning Pvt. Ltd., 1st Edition, 2008.
3. Botkin, D.B., & Keller, E.A., Environmental Science: Earth as a Living Planet, Wiley India,8th Edition, 2012.
4. Kaushik, A., & Kaushik, C.P., Perspectives in Environmental Studies, New Age International Publishers, 7th Edition, 2021.
5. Reddy, M.A., Text book of Environmental Science and Technology, BS Publications, 2nd Edition, 2007.

NUMERICAL METHODS AND COMPLEX VARIABLES

Department of Electrical and Electronics Engineering				II B. Tech II Semester		
Course Code	Hours/Week			Credits	Marks	
A254002	L	T	P	C	CIE	SEE	Total
	3	0	0	3	40	60	100

Prerequisites: Mathematics courses of first year of study

Course Objectives: To learn

- Various numerical methods to find roots of polynomial and transcendental equations.
- Concept of finite differences and to estimate the value for the given data using interpolation.
- Evaluation of integrals using numerical techniques
- Solving ordinary differential equations of first order using numerical techniques.
- Differentiation and integration of complex valued functions.
- Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
- Expansion of complex functions using Taylor's and Laurent's series.

Course outcomes: After learning the contents of this course, the student must be able to

CO1. Apply the Knowledge to find the root of a given polynomial and transcendental equations.

CO2. Estimate the value for the given data using interpolation

CO3. Solve the given first order ODE's using Numerical Techniques

CO4. Analyze the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems

CO5. Expand the complex functions using Taylor's and Laurent's series expansions.

UNIT-I: Algebraic and Transcendental Equations

Solution of polynomial and transcendental equations: Bisection method, Iteration Method, Newton-Raphson method and Regula-Falsi method. Jacobi and Gauss-Seidal iteration methods for solving linear systems of equations.

UNIT-II: Interpolation & Numerical Integration

Finite differences: forward differences, backward differences, central differences, symbolic relations and separation of symbols, Interpolation using Newton's forward and backward difference formulae. Central difference interpolation: Gauss's forward and backward formulae, Lagrange's method of interpolation.

Numerical integration: Trapezoidal ruleandSimpson's$1/3^{rd}$ and$3/8^{th}$ rules.

UNIT-III: Solutions of Initial Value Problems

Solutions of Ordinary differential equations: Taylor's series, Picard's method, Euler and modified Euler's methods, Runge-Kutta method of second and fourth order for first order

UNIT-IV: Function of Complex Variables and Differentiation

Introduction, Complex functions - limits and Continuity-Differentiability, Analytic functions and Properties, Cauchy-Riemann Equations (Cartesian and Polar), Harmonic functions, Construction of analytic functions.(All theorems without Proofs).

UNIT-V: Complex Integration

Introduction, Complex integration-Line integral, Cauchy's integral theorem, Cauchy's integral formula, Generalized Cauchy's integral formula, Power series: Taylor's series, Laurent series, Singular points, Types of Singularities, Residue, Cauchy's Residue theorem.(All theorems without Proofs)

TEXT BOOKS:

1. Higher Engineering Mathematics by Dr. B. S. Grewal, Khanna Publishers.
2. Introductory methods of numerical analysis 2005. By S. S. Sastry, , PHI, 4th Edition.

REFERENCEBOOKS:

1. Advanced Engineering Mathematics by Kreyszig, John Wiley & sons
2. Numerical methods for Scientific and Engineering Computations, by M. K. Jain, S. R. K. Iyengar, R. K. Jain, New Age International publishers.
3. Functions of Complex Variables by J.N.Sharma, Krishna Prakashan Media.

ELECTRICAL MACHINES – II

Department of Electrical and Electronics Engineering					II B. Tech II Semester		
Course Code	Hours/Week			Credits	Marks		
A254201	L	T	P	C	CIE	SEE	Total
	3	0	0	3	40	60	100

Prerequisites: Electrical Circuits – I & II and Electrical Machines – I

Course Objectives:

- To deal with the detailed analysis of three phase induction motors & Alternators.
- To understand operation, construction and types of single – phase motors and their applications.
- To introduce the concept of parallel operation of alternators.

Course outcomes: After learning the contents of this course, the student must be able to

CO1. Explain the construction, operating principles, and torque–slip characteristics of three-phase induction machines including rotor behaviour and power flow relations.

CO2. Apply equivalent circuits and testing methods to determine the performance, starting characteristics, and speed control of induction machines and induction generators.

CO3. Analyze the construction, winding schemes, EMF generation, harmonics, armature reaction, and load characteristics of synchronous generators.

CO4. Evaluate the voltage regulation and parallel operation of synchronous generators using standard methods and phasor relationships under varying excitation and load conditions.

CO5. Assess synchronous motor and single-phase machine applications by analyzing their operating principles, performance characteristics, and starting methods for practical engineering use.

UNIT-I: Three Phase Induction Machines

Constructional details of cage and wound rotor machines – production of a rotating magnetic field - principle of operation – rotor EMF and rotor frequency - rotor reactance, rotor current and Power factor at stand still and during operation. Rotor power input, rotor copper loss and mechanical power developed and their interrelation. Torque equation – expressions for maximum torque and starting torque – torque-slip characteristics.

UNIT-II: Characteristics and Speed Control

Characteristics of Induction Machines: Equivalent circuit – phasor diagram – crawling and cogging, No-load Test and Blocked rotor test –Predetermination of performance-Methods of starting and starting current and Torque calculations, Applications.

Speed Control Methods: Change of voltage, change of frequency, voltage/frequency, injection of an EMF into rotor circuit (qualitative treatment only)-induction generator-principle of operation.

UNIT-III: Synchronous Generator (Alternator)

Constructional Features of round rotor and salient pole machines – Armature windings–Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors–EMF Equation. Harmonics ingenerated EMF–suppression of harmonics–armature reaction-leakage reactance–synchronous reactance and impedance–phasor diagram–load characteristics.

UNIT-IV: Regulation and Parallel operation

Regulation of Synchronous Generator: Synchronous impedance method, MMF method and ZPF method–two reaction theory–Determination of Xd and Xq (Slip test)Phasor diagrams–Regulation of salient pole alternators.

Parallel Operation of Synchronous Generator: Synchronizing Alternators with infinite bus bars – synchronizing power torque –parallel operation and load sharing -Effect of change of excitation and mechanical power input.

UNIT-V: Synchronous Motors and Single Phase Machines

Synchronous Motors:

Theory of operation – phasor diagram – Variation of current and power factor with excitation –synchronous condenser –Mathematical analysis for power developed. Hunting and its suppression–Methods of starting.

Single Phase Machines: Single phase induction motor – Constructional Features-Double revolving field theory – split-phase motors – Universal Motor- BLDC Motor – principle of operation, PMSM principle of operation and reluctance motor principle of operation and their applications.

TEXT BOOKS:

1. P.S.Bimbhra,“ElectricalMachinery”, Khanna Publishers,2011.
2. I.J.Nagrath and D.P.Kothari, “ElectricMachines”, McGraw Hill Education,2010.

REFERENCE BOOKS:

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, “Electrical Machines”, Oxford, 2017.
2. M.G.Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. A.E.Fitzgerald and C.Kingsley, “ElectricMachinery”, New York, McGraw Hill Education, 2013.

POWER SYSTEMS – II

<table>
<tr><th colspan="4">Department of Electrical and Electronics Engineering</th><th colspan="3">II B. Tech II Semester</th></tr>
<tr><th>Course Code</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Marks</th></tr>
<tr><td rowspan="2">A254202</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIE</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
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Prerequisites: Electrical Circuits – I & II and Power Systems – I

Course Objectives:

- To study the performance of transmission lines and travelling waves.
- To understand the concept of voltage control, compensation methods and per unit representation of power systems.
- To know the Symmetrical components and fault calculation analysis

Course outcomes: After learning the contents of this course, the student must be able to

CO1. Explain the constructional features and electrical characteristics of overhead transmission lines, including inductance, capacitance, and the effects of earth, skin, and proximity.

CO2. Apply transmission line models to evaluate the performance of short, medium, and long lines using appropriate equivalent circuits and ABCD constants.

CO3. Analyze the performance of overhead line insulators and transmission systems by examining sag–tension relations, corona effects, voltage control, and power factor improvement methods.

CO4. Evaluate power system behaviour using per-unit representation and travelling wave theory to interpret system response under switching and transient conditions.

CO5. Investigate power system fault scenarios using symmetrical components to compute fault currents, sequence networks, and short-circuit capacity.

UNIT-I: Overhead Transmission Lines

Line conductors, Composite conductors transposition, bundled conductors, Inductance and capacitance of single phase and three phase lines with symmetrical spacing, and effect of earth on capacitance, skin and proximity effects.

UNIT-II: Performance of Lines

Representation of lines, short transmission lines, medium length lines, nominal T and PI- representations, long transmission lines. The equivalent circuit representation of along Line, A, B, C, and D constants, Ferranti Effect.

UNIT-III: Overhead Line Insulators, Corona, Voltage Control & Power Factor Improvement

Overhead Line Insulators: Introduction, types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, testing of insulators, Sag and Tension calculations.

Corona: Introduction, disruptive critical voltage, corona loss, Factors affecting corona loss and methods of reducing corona loss, Advantages and Disadvantages of corona, interference between power and Communication lines.

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

UNIT IV: Per Unit and Travelling Waves

Per Unit Representation of Power Systems: The one-line diagram, impedance and reactance diagrams, per unit quantities, changing the base of per unit quantities, advantages of per unit system.

Travelling Waves on Transmission Lines: Production of travelling waves, open circuited line, short-circuited line, line terminated through a resistance, line connected to a cable, Reflection and Refraction coefficients.

UNIT-V: Symmetrical Components and Fault Calculations:

Significance of positive, negative and zero sequence components, Average 3-phase power in terms of symmetrical components, sequence impedances and sequence networks, fault calculations, sequence network equations, single line to ground fault, line to line fault, double line to ground fault, three phase fault, faults on power systems, faults with fault impedance, reactors and their location, short circuit capacity of a bus.

TEXT BOOKS:

1. C.L. Wadhwa, “Generation, Distribution and Utilization of Electrical Energy”, 3rd Edition, New Age International, 2009.
2. D.P. Kothari and I.J. Nagrath, “Modern Power System Analysis”, Tata McGraw Hill Pub.Co.,New Delhi, Fourth edition, 2011.

REFERENCE BOOKS:

1. A. Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar, “A Textbook on Power System Engineering”, Dhanpat Rai Publishing Company (P) Ltd, 2008.
2. W.D. Stevenson, “Elements of Power System Analysis”, 4th Edition, McGraw Hill, 1984.
3. John J.Grainger & W.D. Stevenson, “Power System Analysis”, McGraw Hill International,1994.

DIGITAL ELECTRONICS

Department of Electrical and Electronics Engineering					II B. Tech II Semester		
Course Code	Hours/Week			Credits	Marks		
A254401	L	T	P	C	CIE	SEE	Total
	3	0	0	3	40	60	100

Prerequisites: Electronic Devices and Circuits

Course Objectives:

- To learn fundamental concepts of digital system design and common forms of number representations and their conversions.
- To implement and design logical operations using combinational logic circuits and sequential logic circuits.
- To understand the semiconductor memories and programmable logic devices

Course outcomes: After learning the contents of this course, the student must be able to

CO1. Explain the fundamentals of digital systems, logic families, Boolean algebra, and number systems used in digital circuit analysis.

CO2. Apply Karnaugh map techniques to simplify and minimize combinational logic functions including multiplexers and demultiplexers.

CO3. Analyze combinational circuits such as adders, subtractors, comparators, encoders, decoders, and code converters for functional correctness.

CO4. Evaluate the behavior and performance of sequential circuits including flip-flops, shift registers, and synchronous and asynchronous counters.

CO5. Design digital systems using semiconductor memories and programmable logic devices such as ROM, RAM, PLA, PAL, and FPGA.

UNIT-I: Fundamentals of Digital Systems and Logic Families

Digital signals, Digital circuits, AND, OR, NOT, NAND, NOR and Exclusive – OR operations, Boolean algebra, Examples of IC gates, Number systems-binary, Signed binary, Octal hexadecimal number, Binary arithmetic, One’s and Two’s complements arithmetic.

UNIT-II: Combinational Circuits-I

Standard representation for logic functions, K-map representation and simplification of logic functions using K- map, Minimization of logical functions, Don’t care conditions, Multiplexer, De-Multiplexer

UNIT-III: Combinational Circuits-II

Adders, Subtractors, Carry look ahead adder, Digital comparator, Parity checker/generator, Code converters, Priority encoders, Decoders/Drivers for display devices.

UNIT-IV: Sequential Circuits

Introduction to flip-flops, SR, JK, T and D type’s flip-flops, Shift registers, Conversion of flip-flops, Ring counter, Ripple (Asynchronous) counters, Synchronous counters.

UNIT-V: Semiconductor Memories and Programmable Logic Devices

Memory organization and operation, expanding memorysize, classification and characteristics of memories, sequential memory, read-only memory (ROM), ROM types, Read and write memory (RAM) types, Programmable logic array, Programmable array logic, Field Programmable Gate Array (FPGA).

TEXT BOOKS:

1. A. Kumar, “Fundamentals of Digital Circuits”, Prentice Hall India, 2016.
2. M.M. Mano, “Digital logic and Computer design”, Pearson Education India, 2016.

REFERENCE BOOKS:

1. R.S. Sedha, “A Text book of Digital Electronics”, S.Chand, 2005
2. R.P. Jain, “Modern Digital Electronics”, McGraw Hill Education, 2009.

CONTROL SYSTEMS

Department of Electrical and Electronics Engineering					II B. Tech II Semester		
Course Code	Hours/Week			Credits	Marks		
A254203	L	T	P	C	CIE	SEE	Total
	3	0	0	3	40	60	100

Prerequisites: Electrical Circuits – I & II and Electrical Machines – I

Course Objectives:

- Understand the mathematical modelling of physical systems.
- Comprehend the representation of dynamical systems through input-output models, including transfer functions and state-space models.
- Understand the design of controllers and compensators to enhance the performance and stability of dynamical systems

Course outcomes: After learning the contents of this course, the student must be able to

CO1. Explain the mathematical modeling of physical systems and feedback control concepts using transfer functions, block diagrams, signal flow graphs, and controller components.

CO2. Examine the time-domain response and stability of linear time-invariant systems using standard test signals, Routh–Hurwitz criterion, and root-locus technique.

CO3. Analyze system behavior in the frequency domain using Bode plots, polar plots, and Nyquist stability criterion to assess stability.

CO4. Apply classical control strategies by designing and tuning P, PI, PD, PID controllers and lead, lag, and lead–lag compensators.

CO5. Evaluate dynamic system performance using state-space models by analyzing state equations, system response, controllability, and observability.

UNIT-I: Mathematical modelling of physical systems

Open–loop and Closed loop Systems, Concept of Feedback Control, Benefits of Feedback and Effects of feedback, Linear, Non-Linear, Time Variant and Time Invariant systems, Mechanical and Electrical Systems, Transfer function, Block-Diagram Techniques, Signal flow graph, Controller Components: DC Servo motors, AC Servomotors, Synchro's.

UNIT-II: Time-Domain Analysis with Input-Output Models

Standard Test signals, Time response of first and second order systems for step input, Time Domain Specifications, Types of System, Steady state response, Error Analysis for Linear time Invariant Systems.

Concept of Stability: Routh-Hurwitz Criteria. Relative Stability analysis, Root-Locus technique: Construction of Root-loci.

UNIT-III: Frequency Domain Analysis

Introduction to frequency response, Relationship between time and frequency response, Concept of Bode plots and construction. Polar plots, Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin

UNIT -IV: Classical Controllers and Compensators

Proportional, Integral and Derivative Controllers-PI, PD and PID controllers, Lead, Lag and Lead-Lag compensators (elementary treatment only).

UNIT -V: State Variable Analysis

Concept of State, State variables and State model. State Representation, Transformation of State variables, Solution of state equations and Complete response of the Systems. Concept of controllability and observability.

TEXT BOOKS:

1. I.J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.
2. B.C. Kuo, "Automatic Control System", Prentice Hall, 1995.

REFERENCE BOOKS:

1. Norman S Nise, "Control Systems Engineering", Wiley, 8th Edition, 2019
2. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
3. K.R. Varmah, "Control Systems", McGraw Hill Education, 2010.

COMPUTATIONAL MATHEMATICS LAB

Department of Electrical and Electronics Engineering				II B. Tech II Semester		
Course Code	Hours/Week			Credits	Marks	
A254081	L	T	P	C	CIE	SEE	Total
	0	0	2	1	40	60	100

Course Objectives: Learn to

- Solve problems of Eigen values and Eigen Vectors using Python/MATLAB.
- Solution of Algebraic and Transcendental Equations using Python/MATLAB
- Solve problems of Linear system of equations
- Solve problems of First-Order ODEs Higher order linear differential equations with constant coefficients

Course Outcomes: After learning the contents of this course, the student must be able to

CO1. Develop the code to find the Eigen values and Eigen Vectors using Python/MATLAB.
CO2. Develop the code find solution of Algebraic and Transcendental Equations and Linear system of equations using Python/MATLAB
CO3. Write the code to solve problems of First-Order ODEs Higher order linear differential equations with constant coefficients

UNIT-I: Eigen values and Eigen vectors:

Programs:

- Finding real and complex Eigen values.
- Finding Eigen vectors.

UNIT-II: Solution of Algebraic and Transcendental Equations

Bisection method, Newton Raphson Method

Programs:

- Root of a given equation using Bisection method.
- Root of a given equation Newton Raphson Method.

UNIT-III: Linear system of equations

Jacobi's iteration method and Gauss-Seidal iteration method

Programs:

- Solution of given system of linear equations using Jacobi's method
- Solution of given system of linear equations using Gauss-Seidal method

UNIT-IV: First-OrderODEs

Exact and non-exact equations, Applications: exponential growth/ decay, Newton's law of cooling.

Programs:

- Solving exact and non-exact equations
- Solving exponential growth/ decay and Newton's law of cooling problems

UNIT-V: Higher order linear differential equations with constant coefficients

Programs:

- Solving homogeneous ODEs
- Solving non-homogeneous ODEs

TEXT BOOKS:

1. MATLAB and its Applications in Engineering, Rajkumar Basal, Ashok Kumar Geo,Manoj Kumar Sharma, Pearson publication.
2. Kenneth A. Lambert, The fundamentals of Python: First Programs, 2011, Cengage Learnings.
3. Think Python First Edition, by Allen B. Downey, Orielly publishing.
4. Introduction to Python Programming, William Mitchell, Povel Solin, Martin Novaketal., NC Lab Public Computing, 2012.
5. Introduction to Python Programming, ©Jacob Fredslund, 2007.

REFERENCE BOOKS:

1. An Introduction to Python, John C.Lusth, The University of Alabama, 2011.
2. Introduction to Python, ©Dave Kuhlman, 2008.

ELECTRICAL MACHINES-II LAB

<table>
<tr><th colspan="5">Department of Electrical and Electronics Engineering</th><th colspan="3">II B. Tech II Semester</th></tr>
<tr><th>Course Code</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Marks</th></tr>
<tr><td rowspan="2">A254281</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIE</td><td>SEE</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td><td>40</td><td>60</td><td>100</td></tr>
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Prerequisites: Electrical machines – I

Course Objectives:

- To understand the operation of Induction, Synchronous Machines and Transformers.
- To study the performance analysis of Induction and Synchronous Machines through various Testing methods.
- To analyze the performance of single and three-phase transformers

Course Outcomes: After learning the contents of this course, the student must be able to

CO1. Set up and conduct standard no-load, blocked-rotor, Sumpner's, and brake tests on electrical machines and transformers by following correct experimental and safety procedures.
CO2. Measure machine and transformer parameters such as regulation, losses, reactance, and sequence impedances using appropriate test methods and instrumentation.
CO3. Plot and interpret characteristic curves and equivalent circuits of induction motors, synchronous machines, alternators, and transformers from experimental observations.
CO4. Analyze test results to determine performance indices including efficiency, voltage regulation, power losses, and operating characteristics under different conditions.
CO5. Demonstrate proficiency in configuring advanced transformer and machine operations such as parallel operation, Scott connection, and salient-pole parameter determination for practical power system applications

Any 10 out of the following experiments required to be conducted

1. Sumpner's test on a pair of single-phase transformers
2. No-load & Blocked rotor tests on three phase Induction motor
3. Regulation of a three–phase alternator by synchronous impedance & MMF methods
4. 'V' and 'Inverted V' curves of a three—phase synchronous motor.
5. Equivalent Circuit of a single-phase induction motor
6. Determination of Xd and Xq of a salient pole synchronous machine
7. Brake Test on three phase Induction Motor
8. Regulation of three-phase alternator by ZPF method
9. Separation of core losses of a single-phase transformer
10. Parallel operation of Single-phase Transformers
11. Measurement of sequence impedance of a three-phase alternator.
12. Scott Connection of transformer

TEXT BOOKS:

1. P.S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I.J.Nagrath and D.P.Kothari, "Electric Machines", McGraw Hill Education,2010.

REFERENCE BOOKS:

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, "Electrical Machines", Oxford, 2017.
2. M.G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. A.E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.

CONTROL SYSTEMS LAB

Department of Electrical and Electronics Engineering					II B. Tech II Semester		
Course Code	Hours/Week			Credits	Marks		
A254282	L	T	P	C	CIE	SEE	Total
	0	0	2	1	40	60	100

Prerequisites: Electrical machines – I

Course Objectives:

- Understand system representations like transfer function and state space, and assess system dynamic response.
- Evaluate system performance using both time and frequency domain analyses, identifying methods to enhance performance.
- Study controllers and compensators to improve system performance based on the assessments from time and frequency domain analyses

Course Outcomes: After learning the contents of this course, the student must be able to

CO1. Obtain the time response and transfer function models of second-order systems, DC motors, and DC generators using experimental and simulation tools.
CO2. Analyse the characteristics of synchros, AC servo motors, and the effect of feedback on DC servo motor performance through controlled laboratory experiments.
CO3. Evaluate the stability characteristics of Linear Time Invariant (LTI) systems using Bode plots, Root Locus, and Nyquist criteria with suitable simulation software.
CO4. Asses the performance of P, PI, PD, and PID controllers on second-order systems by conducting time-domain, steady-state error, and dynamic response analysis using simulation tools.
CO5. Validate lead, lag, and lead-lag compensators to meet given system specifications by developing state-space and transfer-function-based models using appropriate software platforms

Any 10 out of the following experiments required to be conducted

1. Time response of Second order system
2. Characteristics of Synchro's
3. Effect of feedback on DC servomotor
4. Transfer function of DC motor
5. Transfer function of DC generator
6. Lag and lead compensation–Magnitude and phase plot
7. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using simulation tools.
8. States pace model for classical transfer function using simulation tools.
9. Characteristics of AC servo motor
10. (a) Simulation of P, PI, PID Controller.
    (b)Linear system analysis (Time domain analysis, Error analysis) using suitable software
11. Programmable Logic Controller – Study and Verification of truth tables of logic gates and simple Boolean expressions
12. Design of Lead-Lag compensator for the given system and with specification using suitable software

TEXT BOOKS:

1. M. Gopal, ,"Control Systems: Principles and Design", McGraw Hill Education,1997..
2. B.C. Kuo, "Automatic Control System", Prentice Hall, 1995.

REFERENCE BOOKS:

1. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
2. I.J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.

DIGITAL ELECTRONICS LAB

Department of Electrical and Electronics Engineering					II B. Tech II Semester		
Course Code	**Hours/Week**			**Credits**	**Marks**		
A254481	L	T	P	C	CIE	SEE	Total
	0	0	2	1	40	60	100

Prerequisites: Analog Electronics & Digital Electronics

Course Objectives:

- To learn basic techniques for the design of digital circuits and number conversion systems.
- To implement simple logical operations using combinational logic circuits.
- To design combinational logic circuits, sequential logic circuits

Course Outcomes: After learning the contents of this course, the student must be able to

CO1. Set up and verify basic digital logic functions by realizing Boolean expressions, logic gates, and truth/excitation tables using standard logic families.

CO2. Implement combinational logic circuits such as adders/ subtractors, code converters, multiplexers, and comparators using logic gates and universal gates.

CO3. Generate and test timing and sequencing circuits including clock generators, pseudo-random sequence generators, and shift registers using logic gates and flip-flops.

CO4. Analyze sequential circuits such as synchronous and asynchronous counters by correctly interconnecting and triggering flip-flops.

CO5. Realize integrated digital subsystems by selecting appropriate logic families and validating their functional performance through experimental verification

Any 10 out of the following experiments required to be conducted

1. Realization of Boolean Expressions using Gates
2. Design and realization logic gates using universal gates
3. Generation of clock using NAND/ NOR gates
4. Design a 4–bit Adder/Subtractor
5. Design and realization a 4–bit gray to Binary and Binary to Gray Converter
6. Design and realization of a 4-bit pseudo random sequence generator using logic gates.
7. Design and realization of an 8-bit parallel load and serial out shift register using flip-flops.
8. Design and realization A synchronous and Synchronous counters using flip-flops
9. Design and realization 8x1using 2x1 mux
10. Design and realization 2-bit comparator
11. Verification of truth tables and excitation tables
12. Realization of logic gates using DTL, TTL, ECL

TEXT BOOKS:

1. A. Kumar, “Fundamentals of Digital Circuits”, Prentice Hall India, 2016.
2. M.M. Mano, “Digital logic and Computer design”, Pearson Education India, 2016.

REFERENCE BOOKS:

1. R.S. Sedha, “A Text book of Digital Electronics”, S. Chand, 2005
2. R.P. Jain, “Modern Digital Electronics” , McGraw Hill Education, 2009.

PCB DESIGN

Department of Electrical and Electronics Engineering				II B. Tech II Semester		
Course Code	Hours/Week			Credits	Marks		
A254482	L	T	P	C	CIE	SEE	Total
	0	0	2	1	40	60	100

Course Objectives:

- To understand the basics of PCB types, materials, and design standards.
- To gain hands-on experience with PCB layout software tools.
- To develop skills in schematic capture, component placement, routing, and Gerber generation.
- To fabricate and test a simple single-layer PCB

Course Outcomes: After learning the contents of this course, the student must be able to

CO1. Explain the design and fabrication process of PCBs.
CO2. Design schematic diagrams and convert them to PCB layouts.
CO3. Apply routing and layout techniques using EDA tools.
CO4. Generate Gerber files and perform DRC/ ERC effectively.
CO5. Trouble shoot the errors of the circuits and correct them

Module I: Fundamentals of PCB Design

- Types of PCBs: Single-layer, Double-layer, Multilayer
- PCB materials and manufacturing process
- PCB design rules and standards (IPC standards)
- Introduction to EDA tools, (e.g., KiCad, Eagle, Altium, EasyEDA)

Lab Activity:

- Exploring the user interface of PCB design software
- Setting up design rules

Module II: Schematic Design

- Creating circuit schematics using PCB CAD tools
- Component library management
- Electrical rule checking (ERC)
- Net list generation

Lab Activity:

- Designing a basic power supply or LED flasher circuit
- Performing ERC and generating net list

Module III: PCB Layout and Routing

- Importing netlist to layout editor
- Foot print assignment and component placement
- Manual vsauto-routing
- Design Rule Check (DRC)

Lab Activity:

- Placing components and routing for the schematic designed earlier
- Performing DRC and correcting errors

Module IV: PCB Output Files

- Generating Gerber files, drill files, and BOM

Lab Activity:

- Generate Gerber files and preview using Gerber viewer

Module V: Mini Project and Testing

- Design for PCB Boards"

TEXT BOOKS:

1. Walter C. Boss hart, "Printed Circuit Board Design and Technology", Tata McGraw Hill
2. Clyde F.Coombs, "Printed Circuit Boards: Design and Technology", McGraw-Hill

REFERENCE BOOKS:

1. Peter Dalmaris, "PCB Design Using KiCad6"
2. Kraig Mitzner, "Complete PCB Design Using OrCAD Capture and PCB Editor"
3. James Angus, "Electronic Product Design"

IPC Standards:

1. IPC-2221: Generic Standard on Printed Board Design
2. IPC-7351: Generic Requirements for Surface Mount Design