SARDAR PATEL UNIVERSITY, BALAGHAT (M.P.)

SCHOOL OF ENGINEERING AND TECHNOLOGY

SYLLABUS

COURSE – BACHELOR OF TECHNOLOGY BRANCH – ELECTRICAL ENGINEERING

SEMESTER – 3rd ACADMIC SESSION 2024-25

BOT031

Engineering Mathematics III

Course Objectives: To learn

• Methods of solving the differential equations of first and higher order.

• Evaluation of Partial Differential equations

• The physical quantities involved in engineering field related to vector valued functions

• The basic properties of vector valued functions and their applications to line, surface and volume integrals

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

• Identify whether the given differential equation of first order is exact or not

• Solve higher differential equation and apply the concept of differential equation to real world problems

• Evaluate the Application in Solution of Wave and Heat Conduction Equations.

• Evaluate the line, surface and volume integrals and converting them from one to another

UNIT-I:

First Order ODE

Exact, linear and Bernoulli's equations; Applications : Newton's law of cooling, Law of natural growth and decay; Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

UNIT-II:

Ordinary Differential Equations of Higher Order

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type , sin , cos , method of variation of parameters; Equations reducible to linear ODE with constant coefficients: Legendre's equation, Cauchy-Euler equation.

UNIT-III:

Partial Differential Equations

Partial Differential Equations of First Order, Partial Differential Equations with Constant Coefficients, Separation of Variable Method with Application in Solution of Wave and Heat Conduction Equations.

UNIT-IV:

Vector Differentiation

Vector point functions and scalar point functions. Gradient, Divergence and Curl. Directional derivatives, Tangent plane and normal line. Vector Identities. Scalar potential functions. Solenoidal and Irrotational vectors.

UNIT-V:

Vector Integration

Line, Surface and Volume Integrals. Theorems of Green, Gauss and Stokes (without proofs) and theirapplications.

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006
3. G.B. Thomas & R.L. Finney, Calculus & Analytic geometry, 9thEdition, Pearson, 2002.

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BEE 032

Electrical Measurements and Measuring Instruments

Course Outcomes :-The student will be able to

CO1- Understand different systems of units, various characteristics of measuring instruments, their classification and range extension methods, errors in measurement.

CO2- Classify resistance, apply measurement techniques for measurement of Resistance and understand the different methods to measure inductance, Capacitance

CO3- Explain construction, working principle and use of different electrical instrumentslike moving iron and moving coil instruments and

CO4- Explain construction , working principle dynamometer type wattmeter for measurement of power under balance and unbalance condition.

CO5- Understand balance and unbalance condition of load and comparison between different methods of power measurement

Unit –I

Introduction– Definition of analog & digital instruments, Classification of measuring instruments (primary & secondary instruments), their operating principle, Indicating, recording and integrating types of meters Operating forces in Indicating type measuring instruments (Deflecting Torque, Controlling torque, Damping torque) Elements of moving system in measuring instruments. Types of supports, Types of Damping, Static characteristics of measuring instruments. Error in measurement & types of error

Unit –II

Different types of Ammeter &Voltmeter– Theory, principle of operation and construction of ballistic galvanometer, D'arsonal galvanometer, Ballastic galvanometer. PMMC, MI, Electrodynamometer, Induction, Expression for control & deflection torque, their advantages, disadvantages & error, Extension of range of instruments using shunt & multiplier. Digital Voltmeter, Ammeter, Multimeter and Wattmeter.

Instrument transformers: Potential and current transformers, ratio and phase angle errors, testing of instrument transformers, Difference between CT and PT, error&reduction of errors.

Measurement of power using CTs &PTs.

Unit –III

Measurement of power: Power in AC and DC Circuit, Electrodynamometer type of wattmeter, Construction, theory, operation & error, Low power factor & UPF wattmeter, Double element and three element dynamometer wattmeter, Measurement of power in three phase circuit, one, two & three wattmeter method, Measurement of reactive power by single wattmeter,

Measurement of Energy: Single phase and three phasedigital / Electronic energy meter – construction & operation – Energy flow and power calculations, errors – Testing by phantom loading, Maximum demand meter, Ampere hour meter.

Unit –IV

Measurement of resistance –Classification of resistance, measurement of resistance. Ammeter-voltmeter method, wheat–stone bridge, Kelvin's double bridge, ohmmeter (series type & shunt type), digital multimeter, megger (construccction working & Applications). Importanceof earth resistance, Earth tester.

Unit –V

Measurement of Inductance & Capacitance –Basic operating principle of A.C bridges, null detectors, Measurement of inductance & capacitance by A.C. bridges Maxwell, Schering's Anderson, Hays, Desauty & Wien's bridge.

Power factor meter– Single & three phase Electro-dynamometer type & moving iron type.

Frequency meter – Vibrating reed, Resonance type & Weston type, Synchronoscope,

List Of Experiments

1. To study various types of meters such as ammeter, voltmeter, wattmeter & multimeter.
2. To measure the power by 3 voltmeter / 3 voltmeter method.
3. To measure the power in three phase system by Two wattmeter method.
4. Standardization of potentiometer &use the same for calibration of voltmeter & an ammeter.
5. To measure unknown resistance using Kelvin's Double Bridge.
6. To measure unknown resistance using Wheatstone Bridge.
7. To measure unknown inductance using Maxwell inductance Bridge.
8. To measure unknown capacitance using Schering's capacitance Bridge.
9. To measure unknown inductance using Hay's inductance Bridge.
10. To compare capacitance of two condenser by Desauty's bridge.
11. To calibrate the given single phase energy meter at unity & other power factor.
12. Measurement of three phase power and power factor.

Reference Books:-

1. G. K. Banerjee,' Electrical and Electronic Measurements'. PHI Learning Pvt. Ltd.
2. R. B. Northrop,' Introduction to Instrumentation and Measurement'; CRC press Taylor &Francis
3. Vijay Singh;' Fundamentals of Electrical & Electronic Measurements', New Age International Publishers.
4. A.K. Sawhney; 'A course in Electrical & Electronic Measurements & Instrumentation';Dhanpat Rai & co(p) Ltd , NewDelhi

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BEE 033

Network Analysis

Course Outcomes ;-The student will be able to

CO1- Develop strong basics of network theory.

CO2- Understand the concept of network topology and apply it for various formulations.

CO3-Develop the problem solving techniques for networks by application of theorem in AC & DC circuits.

CO4- Understand the behavior of networks by analyzing its output response for various ramp gate & sinusoidal functions.

CO5- understand Network functions & two port network parameters i.e. Z, Y, ABCD, Hybrid parameters

CONTENTS-

Unit –I

Introduction to circuit elements - R,L,C voltage & current sources KCL and KVL , Nodal & Mesh analysis, Network Topology, concept of Network graph, Tree, Tree branch & link, Incidence matrix, cut set and tie set matrices,

Unit –II

Network Theorems for DC circuits- Thevenin's & Norton's, Superpositions, Reciprocity, Compensation, Substitution, Maximum power transfer, and Millman's theorem, Tellegen's theorem, problems with dependent & independent sources.

Unit –III

Frequency domain analysis – Laplace transform solution of Integro-differential equations, transform of waveform synthesized with step ramp, Gate and sinusoidal functions, Initial & final value theorem,

Unit –IV

Network Theorems for AC circuits- Thevenin's & Norton's, Superpositions, Reciprocity, Compensation, Substitution, Maximum power transfer, and Millman's theorem, Tellegen's theorem, problems with dependent & independent sources.

Unit –V

Network function & Two port networks – concept of complex frequency, Network & Transfer functions for one port & two ports, poles and zeros, Necessary condition for driving point & transfer function. Two port parameters – Z, Y, ABCD, Hybrid parameters, their inverse & image parameters, relationship between parameters.

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List of Experiments

1. To Verify Kirchoff's voltage and Kirchoff's current law
2. To Verify Thevenin'sTheorem.
3. To Verify Norton's Theorem.
4. To Verify Superposition Theorem.
5. To Verify Maximum Power Transfer Theorem.
6. To measure the power drawn by a single phase AC circuit using three phase voltmeter.
7. To Determine ABCD parameters of a Two Port Network
8. To Determine h parameters of a Two Port Network
9. To Find Frequency Response of RLC Series Circuit.
10. To Find Frequency Response of RLC parallel Circuit**.**

Reference Books:-

1. M.E. Van Valkenburg, Network Analysis, Pearson
2. William H Hayt. & Jack E. Kemmerly, Steven M Durbin; Engineering Circuit Analysis; McGrawHill
3. Richard C Dorf, James A Svoboda, Introduction to Electric Circuits, Wiley India,2015
4. Charles K. Alexander & Matthew N.O. Sadiku: Electrical Circuits ; McGrawHill
5. J David Irwin, Robert M Nelms, Engineering Circuit Analysis, WileyIndia,2015
6. Robert L Boylestad, introductory circuit analysis, Pearson,2016
7. M S Sukhija, T K Nagsarkar; Circuits and Networks, Oxford University Press, 2015
8. Samarajit Ghosh, Network Theory Analysis and Synthesis

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BEE 034

Analog Electronics

Course Outcomes ;-The student will be able to

CO1- Illustrate working principle of different electronic circuit and their application in real life.

CO2- Define semiconductor device & different operating condition & their performance parameter.

CO3- Choose proper semiconductor devices depending upon application considering economic and technology up-gradation.

CO4- Employ mathematical and graphical analysis considering different practical issues modeling of semiconductor device; analyze the performance parameter of the system.

CO5- Recognize different signal processing circuit and the use in industrial, real life, modern control system application.

CONTENTS-

Unit –I

Semiconductor Diodes: Theory of P-N junction, temperature dependence and break down characteristics, junction capacitances, Zener diode, Varactor diode, Tunnel diode, PIN diode, LED, Photo diode, Schottky diode, Diode applications: series –parallel configurations, full wave and half wave rectification, voltage multiplier circuits, diodetesting

Unit –II

Transistors: BJT, types& configuration, working principal, characteristics, and region of operation, load line, biasing methods, Small signal analysis of transistor (low frequency) using h-parameters, thermal runaway and thermal stability. FET, MOSFET, Transistor as an amplifier, gain, bandwidth, frequency response,

Unit –III

Feedback amplifier and Oscillators: Feedback amplifier, negative feedback, voltage-series, voltage shunt, current series and current shunt feedback, Sinusoidal oscillators, L-C (Hartley-Colpitts) oscillators, RC phase shift, Wien bridge, and Crystal oscillators. Power amplifiers, class A, class B, class A B, C amplifiers, their efficiency and power Dissipation, Push-pull and complimentary symmetry push-pull amplifier.

Unit –IV

Wave Shaping circuits: Switching characteristics of diode and transistor, turn ON, OFF time, reverse recovery time, transistor as switch, Multivibrators, Bistable, Monostable, Astable multivibrators. Clipper and clamper circuit, Differential amplifier, calculation of differential, common mode gain and CMRR using h- parameters, Darlington pair, Boot strapping technique. Cascade and cascade amplifier.

Unit –V

Operational Amplifier: Operational amplifier basics, practical Op-amp circuits & characteristics, slew rate , bandwidth, offset voltage ,basic current, application, inverting, non- inverting amplifier, summer, average, differentiator, integrator, differential amplifier, instrumentation amplifier, log and antilog amplifier, voltage to current and current to voltage converters, comparators Schmitt trigger , active filters, 555 timer and its application.

List of Experiment

1. To study PN junction diode characteristics .
2. To study Zener diode characteristics and Zener voltage regulator.
3. To study Half wave rectifier with and without filter.
4. To study Full wave rectifier with and without filter.
5. To study Input and output characteristics of Transistor in CB configuration.
6. To study Input and output characteristics of Transistor in CE configuration.
7. To study FET characteristics.
8. To study H-parameters of CB configuration.
9. To study H-parameters of CE configuration.
10. To study Frequency response of CE amplifier.
11. To study Frequency response of CC amplifier.
12. To study Frequency response of common source FET amplifier.

Refrence Book:-

1. Robert L Boylestad, Louis Nashelsky; Electronic Devices and Circuits;Pearson
2. Jacob Millman, Cristos C Halkias, Satyabrata Jit; Electronic Devices and Circuits; McGraw-Hill
3. Anil K Maini, Electronic Devices and Circuits,Wiley
4. S Salivahanan, N Suresh Kumar; Electronic Devices and Circuits; McGraw-Hil

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BEE 035

Energy, Environment, Ecology & Society

Course Outcomes ;-The student will be able to

CO1-Describe various energy resources, their conversion to electrical power and role in technological & economic development, Update with national/international power status and renewable power development targets & mission.

CO2- Illustrates the concept of ecosystems and their conservation.

CO3 - Recognize the impact of pollution on the ecosystem and control policies adopted at national / international levels.

CO4 – To review and study control policies adopted at national / international levels.

CO5 - Solve practical problems of society in a sustainable and ethical manner.

CONTENTS-

Unit –I

Sources of Energy : Renewable & Non Renewable, Fossil fuel, Biomass Geothermal, Hydrogen, Solar, Wind, hydal, nuclear sources.

Unit –II

Ecosystem – Segments of Environment: Atmosphere, hydrosphere, Lithosphere, biosphere. Cycles in Ecosystem – Water, Carbon, Nitrogen. Biodiversity: Threats and conservation,

Unit –III

Air Pollution & Sound Pollution -Air Pollution: Air pollutants, classification, (Primary & secondary Pollutants) Adverse effects of pollutants. Causes of Air pollution chemical, photochemical, Green house effect, ozone layer depletion, acid Rain. Sound Pollution: Causes, controlling measures, measurement of sound pollution (deciblage), Industrial and non – industrial.

Unit –IV

Water Pollution– Water Pollution: Pollutants in water, adverse effects. Treatment of Domestic & Industrial water effluent. Soil Pollution – Soil Profile, Pollutants in soil, their adverse effects, controlling measures.

Unit –V

Society, Ethics & Human values– Impact of waste on society. Solid waste management Nuclear, Thermal, Plastic, medical, Agriculture, domestic &e-waste). Ethics & moral values, ethical situations, objectives of ethics & Preliminary studies regarding Environmental Protection Acts, introduction to value education, self exploration, sanyam & swasthya.

References Books:

1. Harris, CE, Prichard MS, Rabin's MJ, "Engineering Ethics"; Cengage Pub.
2. Rana SVS ; "Essentials of Ecology and Environment"; PHI Pub.
3.Raynold, GW "Ethics in information Technology"; Cengage.
4. Svakumar; Energy Environment & Ethics in society; TMH
5. AK De "Environmental Chemistry"; New Age Int. Publ.
6. BK Sharma, "Environmental Chemistry" ; Goel Publ. House.
7. Bala Krishnamoorthy; "Environmental management"; PHI 8. Gerard Kiely, "Environmental Engineering" ; TMH
9. Miller GT JR; living in the Environment Thomson/cengage
10. Cunninghan WP and MA; principles of Environment Sc; TMH
11. Pandey, S.N. & Mishra, S.P. Environment & Ecology, 2011, Ane Books , Pvt. Ltd, New Delhi
12. Joseph, B. Environmental Studies, 2009 Tata Mcgraw Hill, Edu India Ltd. New Delhi.
13. Gour R.R, Sangal, R &Bagaria, G.P. , Excel Books, A-45, Naraina Phase-I New Delhi.-110028

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BEE 036P

Electrical Workshop

Course Outcomes ;-The student will be able to

CO1-Integrate electrical/electronic circuits for useful applications, test and debug circuits.

CO2-Study and practice of AC/DC Machine Windings.

CO3-Read data manuals/data sheets of different items involved in the all Electrical Components current & voltage Ratings.

CO4-Produce the results of the testing in the form of report.

CO5-Study & perform of AC/DC Machine STARTERS.

(Suggested Exercise)

1. Introduction of tools, electrical materials, symbols and abbreviations.
2. To study stair case wiring
3. To study house wiring le, batten, cleat, casing-caping and conduit wirings
4. To study fluorescent tube light
5. To study circuit of SMPS
6. To study moving iron, moving coil, electrodynamic and induction type meter.
7. To study circuit and working of ups
8. To study circuit and working of home inverter
9. To study fuses MCBs and importance of earthing
10. To Study Single Phase Energy Meter and Power Measurement

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BEE 037P

GD/Seminar/Spoken English

Course Outcomes ;-The student will be able to

CO-1 Identify and analyze the real time system problems

CO-2 Acquire awareness on latest technology and current trends in the field of respective areas.

CO-3 Document and present technical reports.

CO-4 Participate in discussions for enhancement of knowledge.

CO-5 Adapt professional ethics

(Suggested Topics)

1. Different types of wires and determination of gauge of wirethrough SWG.
2. Different types of LT & HT cables
3. Wire joints.
4 Cable laying and joints of cable
5. Description of various insulators.
6. Various types of wirings.
7. Various types of LT and HT poles/Towers.
8. DC machine winding.
9. Development of tube light circuit using thermal/Bimetallic starter.
10. Development of series circuit band.
11. Development of circuit of two lamps operating with single switch.
12. DC/AC machine starters.

Students are Advised to present seminar individually with the help of PPT Presentation in above topics. Student can choose also their topics for Seminar/GD as per instruction of department faculties.

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SKILL BASED PROGRAME

EXPRESS PCB SOFTWARE

Express PCB is a PCB (Printed Circuit Board) design software that allows users to create schematics and design PCB layouts. Here is a five-unit syllabus for learning how to use Express PCB effectively: This syllabus provides a comprehensive pathway for students to learn and master PCB design using ExpressPCB software, from schematic creation to fabrication.

Unit 1:

Introduction to PCB Design and Express PCB Software

Overview of PCB Design and Its Importance, Understanding PCB layers, traces, pads, and vias Basic components: Resistors, capacitors, ICs, connectors, etc. Introduction to ExpressPCB Software, Installation and setup of Express PCB software, Overview of the interface, menus, and tools. Basics of Schematic Design in ExpressSCH (ExpressPCB Schematic Tool) Creating a new schematic project, Adding components from the library , onnecting components using wires and nets, Saving, Exporting, and Printing Schematic Designs, Exporting schematics for reference or documentation.

Unit 2:

Schematic Design and Circuit Simulation

Detailed Schematic Design in ExpressSCH, Creating multi-page schematics for complex circuits, Adding custom symbols and creating component libraries, Working with Advanced Schematic Components. Configuring component properties (values, labels, reference designators), Adding power sources, ground planes, and labels, Simulating Circuit Functionality (using third-party simulation tools), Exporting schematics to simulation software for testing, Understanding the simulation results and debugging schematic errors, Converting Schematic to PCB Layout, Preparing the schematic for PCB layout design.

Unit 3:

PCB Layout Design in Express PCB

Introduction to Express PCB Layout Tool, Creating a new PCB layout project, Understanding board outlines, layers, and units of measurement, Placing Components on the PCB Layout, Importing components from the schematic design, Positioning and orienting components for optimal layout, Routing Traces between Components, Manual routing techniques for signal, power, and ground traces, Using auto-routing features and their limitations, Creating Power and Ground Planes, Understanding plane layers for power distribution, Assigning net connections to power and ground planes.

Unit 4:

Advanced PCB Design Techniques

Design Rules and DRC (Design Rule Check), Setting up design rules (trace width, clearance, etc.), Running DRC to identify design errors and violations, Designing Multi-Layer PCBs, Working

with double-sided and multi-layer boards, Managing layer stacks and via placement, Designing for Manufacturability (DFM), Understanding manufacturing constraints and tolerances, Preparing Gerber files for manufacturing, Generating Bill of Materials (BOM) for component sourcing, Working with Custom PCB Shapes, Creating custom board outlines and non-rectangular PCB shapes

Unit 5:

Project Development and Fabrication

Preparing PCB for Fabrication, Generating Gerber files and drill files for manufacturing, Overview of PCB fabrication processes (etching, plating, etc.), Assembling and Soldering PCBs, Overview of through-hole and surface-mount soldering techniques, Using pick-and-place machines vs. manual soldering

Testing and Debugging PCB Designs

Performing continuity tests and power-on tests, Identifying and fixing common design and assembly issues

Final Project: Design and Fabricate a PCB

Examples: Simple power supply, microcontroller development board, sensor interface circuit
Documenting the design process and presenting the final project

LIST OF EXPERIMENTS

1. Introduction to circuit creation and simulation software TINAPRO.
2. Introduction to Layout Tool, and creating Layout board using TINAPRO .
3. Design a half wave rectifier using TINAPRO and observe its output on a virtual oscilloscope.
4. Design a full wave centre tapped rectifier using TINAPRO & its output on a virtual oscilloscope.
5. Design a clipper circuits using TINAPRO.
6. Design a clamper circuits using TINAPRO.
7. Design a RLC resonance circuit & verify the transient response for different values of R. L &C.
8. Convert the power supply circuit into PCB & simulates its 2D & 3D view.
9. Introduction of the materials required for the fabrication of PCB's.
10. Development of PCB in hardware lab.