

Electrical Measurements & Instrumentation

[3rd Semester, Second Year]



Course Description

Offered by Department	Credits	Status	Code
Electrical Engineering	3-1-0, (4)	Program Core	EL103101EL
[Pre-requisites: Basic Electrical Engineering EL101022EL]			

Course Outcomes (COs)

On completion of this course, the students will be able to:

1. Classify various measuring instruments used to measure electrical quantities.
2. Apply methods for the measurement of resistance, capacitance and inductance
3. Choose the suitable current and potential transformers
4. Measure and analyze the currents and voltages of electronics and digital levels.
5. Measure and analyze the physical quantities using transducers at industry level.

Course Content

UNIT-I

Electrical Measurements: Measurement And Error: Sensitivity, Resolution, Accuracy and precision, Absolute and Relative types of errors, Statistical analysis, Probability of and Limiting errors, Linearity. Review of indicating and integrating instruments: Voltmeter, Ammeter, Wattmeter, and Energy meter.

UNIT-II

Measurement of Resistance, Inductance and Capacitance: Measurement of low, medium and high resistances, insulation resistance measurement, AC bridges for inductance and capacitance measurement.

UNIT-III

Instrument Transformers: Current and Potential transformers, ratio and phase angle errors, design considerations and testing.

UNIT-IV

Electronic Measurements: Electronic voltmeter, multi-meter, wattmeter & energy meter. Time, Frequency and phase angle measurements using CRO; Spectrum & Wave analyzer. Digital counter, frequency meter, voltmeter, multi-meter and storage oscilloscope.

UNIT-V

Instrumentation: Transducers, classification & selection of transducers, strain gauges, inductive & capacitive transducers, piezoelectric and Hall-effect transducers, thermostats, thermocouples, photo-diodes & photo-transistors, encoder type digital transducers, signal conditioning and telemetry, basic concepts of smart sensors and application, data acquisition systems.

Course Materials

Text Books:

1. Golding, E.W., "Electrical Measurement and Measuring Instruments", 15th Edition, Wheeler Publishing, 1998.

2. Helfrick and Cooper, “Modern Electronic Instrumentation and Measurement Techniques”, Dorling Kindersley (India) Pvt Limited, 2005.
3. A. K. Sawhney, Puneet Sawhney “A Course in Electrical and Electronic Measurements and Instrumentation” Dhanpat Rai & Company, 2016.
4. Kalsi H.S, ‘Electronic Instrumentation’, Tata McGraw-Hill Education, 3rd Edition, 2010.
5. Deobelin, ‘Measurements Systems’, Tata McGraw Hill Publications, 2nd Edition, 2010.

Mapping of course outcomes with program outcomes

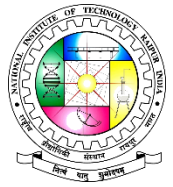
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3		2	3	2	3	2	2			3
CO2	3	2		3			2	3	2			3
CO3	3	3		3		2	3	2	2			3
CO4	3	3	2	3	3	2	3	3	2			3
CO5	3	3	3	2	3	2	3	3	2			3

Mapping of course outcomes with program specific outcomes

	PSO1	PSO2	PSO3
CO1	3	2	2
CO2	2	2	2
CO3	2	2	2
CO4	3	2	2
CO5	3	2	2

Analog Electronics

[3rd Semester, Second Year]



Course Description

Offered by Department	Credits	Status	Code
Electrical Engineering [Pre-requisites: Basic Electrical Engineering EL101022EL]	3-1-0, (4)	Program Core	EL103102EL

Course Outcomes (COs)

On completion of this course, the students will be able to:

1. Analyze and design the electronic system having BJT and FET operating at high frequencies.
2. Interpret different configurations of power amplifiers, transistors (low & high frequency) and can relate their applications.
3. Develop, evaluate and design the feedback amplifiers for their different applications.
4. Analyze various characteristics of op-amp and design different op-amp circuits.

Course Content

UNIT-I

Bipolar Junction Transistors: Review of transistor fundamentals, Transistor Biasing Techniques and Thermal stabilization

UNIT-II

Field Effect Transistors: Introduction, Construction, Operation, V-I Characteristics, Transfer Characteristics, Drain Characteristics. Metal Oxide Semiconductor Field Effect Transistor (MOSFET): Introduction, Construction, Operation and characteristics, Depletion MOSFET, Enhancement MOSFET.

UNIT-III

Frequency Analysis of Transistor Circuits: Graphical Analysis of CE amplifier, h-parameter Models for CB, CE, CC configurations Biasing techniques, Linear analysis of Transistor Circuits, Miller's Theorem, Modeling and design of CE and CC Amplifiers, High frequency modeling and analysis

UNIT-IV

Multi Stage Amplifier Operation: Feedback amplifier, Class A, class B, class AB and push pull amplifiers, Multistage Amplifiers, Frequency response of cascade amplifier.

UNIT-V

Operational Amplifier: Basics and configurations, measurement of amplifier parameters, CMRR, slewing rate. Basic operational amplifier applications, differential DC bridge amplifier.

Course Materials

Text Books:

1. Donald L. Schilling, Charles Belove, "Electronic Circuits: Discrete and Integrated", Tata McGraw-Hill Education, 3rd Edition, 2002.
2. Jacob Milliman, Christos C. Halkias, "Integrated Electronics: Analog and Digital Circuits and Systems", Tata McGraw-Hill Education, 3rd Edition, 2002.
3. David A Bell, "Electronic Devices", Oxford University Press, 5th Edition
4. A.P. Malvino, David Bates, "Electronics Principles", McGraw-Hill Education 8th Edition

Reference Books:

1. Jacob Milliman, Arvin Grabel, "Microelectronics", Tata McGraw-Hill Education, 2nd Edition, 1999.
2. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", Pearson Education, 3rd Edition, 2007.
3. Robert L. Boyleston and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education India, 11th Edition.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	3	1					1	3
CO2	2	3	3	2	3	1					1	3
CO3	3	3	3	2	3	1					1	3
CO4	3	3	3	2	3	1					1	3

Mapping of course outcomes with program specific outcomes

	PSO1	PSO2	PSO3
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1



Generation of Electrical Energy (Conventional & Non-Conventional)

[3rd Semester, Second Year]

Course Description

Offered by Department

Electrical Engineering

Credits

3-1-0,(4)

Status

Program Core

Code

EL103103EL

[Pre-requisites: Basic Electrical Engineering EL10I022EL]

Course Outcomes (COs)

On completion of this course, the students will be able to:

1. Explain the basic requirements for the design and development of modern power plant.
2. Explain how economically power can be generated and distributed among the load centres.
3. Demonstrate the cheapest ways of electric power generation.
4. Explain the operation of different accessories associated with conventional and nonconventional power plants.
5. Develop new renewable power devices for socioeconomic application.

Course Content

UNIT-I

(A) Introduction to Generating station & Loads: Choice of Power station and units: Types of power station, choice of type of generation, choice of size of generator units and number of units. Definition of connected load, maximum load, maximum demand, demand factor, load factor, diversity factor, plant capacity factor, plant utilization factor, load duration curve, mass curve

(B) Economic operation of power systems: Economic load scheduling, Load sharing between two and multiple generators neglecting transmission loss

UNIT-II

(A) Coal Fired Based Thermal Power Plant: Schematic diagram, operation, super thermal power plant, steam turbines, characteristics,

(B) Nuclear Power Plant: Schematic diagram, operation, classification, nuclear reactors, concept of MHD generation

UNIT-III

Hydro power stations: Hydrology, hydrographs, flow duration curve, mass curve, types of dam, principle of working of a hydroelectric plant, classification, types of turbine, characteristics, tidal power generation

UNIT-IV

(A) Solar energy: Solar radiation - Review. Models for radiation analysis and beam radiation calculations. Solar concentrators: Parabolic trough, paraboloidic dish: continuous type and Fresnel type.

(B) Wind energy: Characteristics and measurement, wind energy conversion principles, types and classification of WECS.

UNIT-V

Solar PV Systems: Principle of photovoltaic conversion of solar energy. Solar PV technologies overview. Techno-economic analysis of solar thermal and solar PV power plants.

Course Materials

Text Books/Reference Books:

1. B. R. Gupta, "Generation of Electrical Energy", S Chand and Company Ltd., 7th Edition, 2017.
2. T. H. Car, "Electric Power Stations", Vol. I and II, Chapman and Hall, 1944.
3. C. S. Solanki, "Solar Photovoltaics – Fundamentals, Technologies and Applications", PHI Learning Pvt Ltd, 3rd Edition, 2015.
4. S. P. Sukhatme and J. K. Nayak, "Solar Energy: Principles of Thermal Collection and Storage", Tata McGraw-Hill Publishing Company Ltd, 3rd Edition, 2008.
5. J. B. Gupta, "A Course in Electrical Power", S. K. Kataria & Sons, 2009.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		3	3	3	3			3	1	3	3
CO2	2	3							1	2	3	2
CO3	2	2							1	2	3	3
CO4	3		1	2					1	2	3	3
CO5	3	3	3	3	3	3			3	3	3	3

Mapping of course outcomes with program specific outcomes

	PSO1	PSO2	PSO3
CO1	3	2	2
CO2	2	1	2
CO3	2	2	2
CO4	2	2	2
CO5	3	3	2



Electromagnetic Field Theory

[3rd Semester, Second Year]

Course Description

Offered by Department

Electrical Engineering

Credits

3-1-0,(4)

Status

Program Core

Code

EL103104EL

[Pre-requisites: Basic Electrical Engineering EL101022EL]

Course Outcomes (COs)

On successful completion of this course, students will be able to:

1. Estimate electric field intensity and potential for different charge distributions'
2. Determine line parameters for transmission line configurations
3. Solve Laplace and Poisson's equations
4. Determine magnetic field intensity and magnetic flux density for various current configurations.
5. Understand the concept of electromagnetic force, electromagnetic wave propagation and torque development along with appreciating its applications.

Course Content

UNIT-I

Basics of Vector algebra and Electric fields: Scalars and vectors, vector algebra, the Cartesian, circular cylindrical and spherical coordinate systems, transformations between coordinate systems, Coulomb's law, electric field intensity, electric field due to several charges, Gauss law and its application, divergence and divergence theorem, Maxwell's first equation, the vector operator and divergence theorem.

UNIT-II

Electrostatics: Electric potential, potential at any point due to discrete and distributed charges, principle of superposition potential and field between two coaxial cylinders, potential between two conducting spherical shells, conservative property, potential gradient, electric dipole, current and current density, continuity of current, metallic conductors, conductor properties and boundary conditions for dielectric materials, boundary conditions for perfect dielectric materials, capacitance Poisson and Laplace equation, uniqueness theorem, examples of the solution of Laplace and Poisson's equations.

UNIT-III

Magnetostatics: The steady state magnetic field, Biot Savart Law, Ampere's circuital Law, Curl, Stokes theorem, magnetic flux and magnetic flux density, scalar and vector magnetic potentials.

UNIT-IV

Magnetic Force And Inductance :Force on a moving charge, force on a differential current element, force between differential current elements, force and torque on a closed circuit, magnetic materials, magnetization and permeability, magnetic boundary conditions.

UNIT-V

Time Varying Field And Maxwell's Equations :Modification of Maxwell's equations under time varying conditions, displacement current, source free wave equation, power flow and energy, sinusoidal time varying field, Helmholtz equation, complex Poynting vector, Boundary condition, relation between field theory and current theory

Course Materials

Text Books:

1. William H. Hayt, Jr. and John A. Buck, "Engineering Electromagnetics", Tata McGraw-Hill Publishing Company Ltd, 7th Edition, 2006.
2. G. S. N. Raju, "Electromagnetic Field theory and transmission lines", Pearson Education, 2006.

Reference Books

1. Matthew N. O. Sadiku, "Elements of Electromagnetics", Oxford University Press, 7th Edition, 2018.
2. Robert Plonsey and Robert E. Collin, "Principles and Applications of Electromagnetic Fields", McGraw-Hill, 1961.
3. David K. Cheng, "Field and Wave Electromagnetics", Pearson Education Limited, 2nd Edition, 2013.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3		2						3
CO2	3	3	2	3								3
CO3	3	3	2	2								3
CO4	3	3	2	3		2						3
CO5	3	3	3	2		2	2		2			3

Mapping of course outcomes with program specific outcomes

	PSO1	PSO2	PSO3
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	2

Electrical Power System

[3rd Semester, Second Year]



Course Description

Offered by Department

Electrical Engineering

Credits

3-1-0,(4)

Status

Program Core

Code

EL103105EL

[Pre-requisites: Basic Electrical Engineering EL101022EL]

Course Outcomes (COs)

On successful completion of this course, students will be able to:

1. Outline the structure and operation of power system and appreciate its role in our society.
2. Appraise the influence of different parameters on the performance of transmission lines.
3. Develop knowledge about different phenomena effecting transmission line performance
4. Interpret the significance of voltage control in transmission line.
5. Infer the concept, advantages and practical applications of underground cables.

Course Content

UNIT-I

Overhead lines: General structure of electrical power system; power transmission & voltage levels; power distribution through overhead lines, single line diagram, Type of overhead conductors, solid conductors, stranded conductors, bundled conductors, conductor configurations, spacing & clearance, skin effect, proximity effects, principle of corona, Types of Insulator, String Efficiency, Improvement of String Efficiency, Line Supports, Types of Steel Towers, Cross Arms, Sag and Tension calculation, Factors affecting sag.

UNIT-II

Transmission Lines: Inductance and capacitance of single-phase, three-phase single circuit and double circuit lines, concept of GMD, transposition of lines, effect of earth on capacitance of transmission lines.

UNIT-III

Transmission Lines (cont.): Characteristics and performance of transmission lines, transmission lines as four terminal networks, nominal-T, nominal- π , equivalent-T, and equivalent- π representation of transmission lines, A, B, C, D constants, distributed parameters of long lines, hyperbolic solutions, Ferranti effect, surge impedance loadings.

UNIT-IV

Voltage Control Methods: Compensation of transmission lines, Voltage regulation, Power flow through a line, power flow equations, Methods of voltage control, on-load tap changing transformer, control of reactive power, basis of selection for line voltage, AC and DC distribution systems.

UNIT-V

Underground Cable and Travelling waves: Types of cables, insulation resistance of cables, capacitance of cables dielectric stress, capacitance grading of cables, use of inter-sheaths. Travelling waves: wave equation, traveling wave phenomenon in open circuited and short-circuited lines, repeated reflections.

Course Materials

Text Books:

1. Ashfaq Husain, "Electrical power systems", CBS Publishers & Distributors, 5th Edition, 2014.
2. D. P. Kothari and I. J. Nagrath, "Power System Engineering", McGraw Hill Education, 3rd Edition, 2019.

3. C. L. Wadhwa, “Electrical Power Systems”, New Age International (P) Ltd Publishers, 2017.

Reference Books:

1. William D. Stevenson, “Elements of Power System Analysis”, McGraw-Hill, 4th Edition, 1982.
2. Turan Gonen “Electrical Power Transmission System Engineering: Analysis and Design” CRC Press, 3rd Edition, 2015.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	3	3	3	3		3			3
CO2	3	3	3	3	2	3						3
CO3	3		2	3		3			2			3
CO4	3	3	3	1		3						3
CO5	3	3	3	3	3	3	2		2			3

Mapping of course outcomes with program specific outcomes

	PSO1	PSO2	PSO3
CO1	3	3	2
CO2	3	2	1
CO3	2	2	1
CO4	3	2	1
CO5	3	2	2

Mathematics-III

[3rd Semester, Second Year]



Course Description

Offered by Department

Electrical Engineering

Credits

3-1-0,(4)

Status

Program Core

Code

EL103105EL

[Pre-requisites:Mathematics-I, Mathematics-II]

Course Outcomes (COs)

On successful completion of this course, students will be able to

1. Express functions in Fourier Series and to find Fourier Transform and Inverse Fourier transform.
2. Apply concepts of Laplace Transform and inverse Laplace Transform to solve differential equations and to Evaluate improper integral.
3. Construct and solve the partial differential equation using different analytical techniques with application in solution of wave and Laplace equations.
4. Solve problems using basic graph theory.

Course Content

UNIT-I Fourier Series and Fourier Transform

Expansive of function as Fourier series, Functions having points of discontinuity, Change of interval, Even & Odd functions, Half-range series, Harmonic analysis, Fourier Transformation, Inverse transformation, Finite cosine and sine transform.

UNIT-II Laplace Transform

Definition, Transform of elementary functions, Properties of Laplace transform, Transform of derivatives and integrals, Multiplication by t, Division by t, Evaluation of Integrals, periodic functions, inverse Laplace transform, Convolution theorem, Application of Laplace transform to find the solution of ordinary differential equations.

UNIT-III Partial Differential Equations

Formations, Solutions by direct integration method, Linear equation of first order, Homogeneous linear equations with constant coefficients, Non-homogeneous linear equation, Method of separation of variable with application in finding the solution of wave, heat and Laplace equations.

UNIT-IV Graph Theory

Basic concepts of graph theory, types of graphs, subgraphs, path, circuit, directed and undirected graph, Shortest path problems, Matrix representation of graphs, planar graphs, Trees and fundamental circuit, spanning tree, binary trees, Network flows.

Course Materials

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons.

Reference Books:

1. R. K. Jain and S.R. K. Iyengar, "Advanced Engg. Mathematics", Narosa Publishing House.
2. VeeraRajan, "Discrete Mathematics with Graph Theory and Combinatorics", McGraw Hill Education.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1									1
CO2	3	2	1									1
CO3	3	2	1									1
CO4	3	2	1									1

Mapping of course outcomes with program specific outcomes

	PSO1	PSO2	PSO3
CO1	2	1	1
CO2	2	1	1
CO3	2	1	1
CO4	2	1	1