National Institute of Technology Raipur													
Course of Study and Scheme of Examination							B. Tech. 3rd Semester				Branch:Electrical		
S. No.	Subject Code	Subject Name	Periods per Week			TA	Examination Scheme				Total Marks	Credits
			L	T	P		MSE/MTR		ESE/ESVE			
							Theory	Prac.	Theory	Prac.		
1	EL103101EL	Electrical Measurement and Instrumentation	3	1	0	20	30		50		100	4
2	EL103102EL	Analog Electronics	3	1	0	20	30		50		100	4
3	EL103103EL	Generation of Electrical Energy(Conventional & Non-Conventional)	3	1	0	20	30		50		100	4
4	EL103104EL	Electromagentic Field Theory	3	1	0	20	30		50		100	4
5	EL103105EL	Electrical Power System	3	1	0	20	30		50		100	4
6	MA103006MA	Mathematics-III	3	1	0	20	30		50		100	4
7	EL103401EL	Electrical Measurement and Instrumentation Laboratory	0	0	2	40		20		40	100	1
8	EL103402EL	Analog Electronics Laboratory	0	0	2	40		20		40	100	1

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 EL10I022EL]

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 Bublishing, 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

Analog Electronics

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electrical Engineering	3-1-0, (4)	Program Core	EL103102EL

[Pre-requisites: Basic Electrical Engineering EL10I022EL]

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-l Characteristics, Transfer, Characteristics, Drain Characteristics. Metal Oxide Semiconductor Field Effect Transistor (MOSFET): Introduction, Construction, Operationand 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 MaterialsText 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. Boylston 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

Generation of Electrical Energy (Conventional & Non-Conventional)

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electrical Engineering	3-1-0,(4)	Program Core	EL103103EL

[Pre-requisites: Basic Electrical Engineering EL101022EL]

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

Part 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

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

UNIT-II

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-III

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

UNIT-IV

Nuclear Power Plant: Schematic diagram, operation, classification, nuclear reactors, concept of MHD generation.

UNIT-V

Part A: Solar Power Generation: Description and principle of working, performance characteristics of solar cell, types of solar cell.

Part B: Wind power generation, classification of wind turbine, components of wind turbine, operating characteristics of wind turbine.

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 Photovotaics – Fundamentals, Technologies and Applications", PHILearning 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

Electromagnetic Field Theory

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electrical Engineering	3-1-0,(4)	Program Core	EL103104EL

[Pre-requisites: Basic Electrical Engineering EL10I022EL]

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, magnetizalion 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 Electro magnetics", 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 Electro magnetics”, 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 Electro magnetics", 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		2	2	1	3							
CO2	3	2	2	1	3							2
CO3	3	2	2	1	3							2
CO4	3	1	1	1	3							2
CO5	3	1	1	1	3							2

Electrical Power System

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electrical Engineering	3-1-0,(4)	Program Core	EL103105EL

[Pre-requisites: Basic Electrical Engineering EL10I022EL]

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; single line diagram, power transmission & voltage levels; power distribution through overhead lines, Type of overhead conductors, solid conductors, stranded conductors, bundled conductors, conductor configurations, spacing & clearance, skin effect, proximity effects, principle of corona, Types of Insulators, String Efficiency, Improvement of String Efficiency, Types of Steel Towers, Cross Arms, Sag and Tension.

UNIT-II

Transmission Parameter Calculation: 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 Line Performance: 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, 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

Insulated cables: Insulation, extra high voltage cables, grading of cables, types of cables, insulation resistance, capacitance of single core cable, current rating, types of cable.

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

Mathematics-III

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electrical Engineering	3-1-0,(4)	Program Core	MA103006MA

[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 Fouriertransform.
2. Apply concepts of Laplace Transform and inverse Laplace Transform to solvedifferential equations and to Evaluate improper integral.
3. Construct and solve the partial differential equation using different analytical techniqueswith 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

Electrical Measurement & Instrumentation laboratory

[3th Semester, Third Year]

Course Description

Offered by Department	Credits	Status	Code
Electrical Engineering	0-0-2 (1)	Program Core	EL103401EL

[Pre-requisites: Electrical measurement and instrumentation]

Course objectives:

- To study the importance of Electrical Measurement and Instrumentation.
- To identify the all kinds of Electrical parameter measurements.
- To know the various sensors for measurement of electro-mechanical quantities etc.

Course Outcomes: After Completion of this laboratory the student is able to

	Course outcome
CO1	Study and Analyze measurement method of resistance, capacitance, inductance etc. by using various AC bridges and other methods
CO2	Identify and analyze measurements applying different transducers
CO3	Study and analyze high resistance measurement using the megger and earth tester
CO4	Identify and analyze the methods of energy, torque and temperature measurement using electrical and electronics instruments

List of experiment

1. To measure energy using a given single phase induction type Energy Meter.
2. Measurement of high resistance by using Megger.
3. To determine unknown resistance by Wheatstone Bridge Method.
4. To determine unknown inductance and Q-factor of a given coil by Maxwell's Inductance capacitance Bridge Method.
5. To determine unknown capacitance of a given capacitor by Deasauty's Bridge Method.
6. To measure the speed using Magnetic pick-up.
7. To measure temperature using thermocouple.
8. Measurement of an unknown self-inductance using Owens's bridge.
9. To determine unknown capacitance of a given capacitor by Schering Bridge Method.
10. To determine unknown inductance of a given coil by Maxwell's Inductance Bridge Method.
11. Measurement earth electrode resistance and soil resistivity by fall of terminal method.

Reference Books:

1. Helfrick and Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice-Hall of India, Reprint 1988.
2. Buckingham, H. and Price, E.N., "Principles of Electrical Measurements", 1961.
3. A. K. Sawhney "Electrical Measurement and Measuring Instruments" Dhanpat Rai & Sons

Course outcome and program outcome correlation matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	2	-	-	-	-	2	2	-
CO2	2	3	3	3	2	-	-	-	-	2	2	-
CO3	2	3	3	3	2	-	-	-	-	2	2	-
CO4	2	3	3	3	2	-	-	-	-	2	2	-

Analog Electronics Laboratory

[3rd Semester, Second Year]

Course Description

Offered by Department
Electrical Engineering

Credits
0-0-2 (1)

Code
EL103402EL

[Pre-requisites: Basic Electrical Engineering EL101022EL]

Course Outcomes (COs)

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

After the completion of the course the student will be able to:

1. Interpret the characteristics of diode and zener diode
2. Interpret the characteristics of BJT, FET and MOSFET.
3. Understand the operation of various electronics circuits.

List of Experiments

1) Study and verification of V-I characteristics of a p-n junction diode.
2) Study and verification of V-I characteristics of a Zener diode.
3) To draw the input and output characteristics of common base configuration of BJT.
4) To draw the input and output characteristics of common emitter configuration of BJT.
5) To draw the input and output characteristics of common collector configuration of BJT.
6) To draw the input and output characteristics of common emitter configuration of BJT.
7) Study and verification of drain characteristics and transfer characteristics of a JFET.
8) Study and verification of drain characteristics and transfer characteristics of a MOSFET.
9) To design an inverting amplifier using op-amp.
10) To design a non-inverting amplifier using op amp.
11) To design a summing amplifier using op-amp.

Mapping of course outcomes with program outcomes

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