Invertis Institute of Engineering & Technology

Invertis Village Bareilly-Lucknow NH-24, Bareilly

DEPARTMENT OF ELECTRICAL ENGINEERING

Vision

To promote specialized knowledge in the field of electrical engineering along with interdisciplinary awareness and to develop a framework to support the communicative and ethical needs of industry and society at global level.

Mission

To impart quality education in the field of electrical engineering and to facilitate and develop students for their superior employability, to pursue research and higher studies.

PROGRAM EDUCATIONAL OBJECTIVES

PEO1	To prepare students for a professional career in Electrical Engineering.
PE02	To develop the capability in students to solve engineering problems, carry out higher studies in core areas.
PEO3	To train students with a solid foundation in engineering, problem-solving skills for flourishing professional careers in industry, academia, and public service.
PEO4	To encourage the students to practice the profession with social responsibility and responsibility by taking the ownership for their projects.
PEO5	To train the students in basic human and technical communication skills so that they may be both good team-members, leaders and responsible citizen.

PROGRAM OUTCOMES:

At the end of the program the student will be able to:

PO1	Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Electrical engineering problems.
PO2	Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
PO3	Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
PO4	Apply relevant Electrical technologies and tools with an understanding of the limitations.
PO5	Supervise and manage electrical engineering project related activities effectively.
PO6	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO7	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO8	Communicate effectively in oral and written form.

Scheme of Instruction

of

Diploma in Electrical Engineering

(Three Year Diploma Course)

II and III Year

(Effective Session 2017-2018)

Invertis Institute of Engineering &Technology
INVERTIS UNIVERSITY
Invertis Village, Bareilly-Lucknow NH-24, Bareilly

Study and Evaluation Scheme, Diploma (Electrical Engineering)
Effective from session 2017-18
(Year-II, Semester-III)

S.NO.	CODE	SUBJECT	PERIODS			EVALUATION SCHEME					TOTAL	CREDIT
						SESSIONAL				END SEMESTER		
			L	T	P	CT	TA	AT	Total	E-Sem		
1	DEE-301	Electrical Circuits	3	1	0	20	10	10	40	60	100	4
2	DEE-302	DC Machines and Transformer	3	1	0	20	10	10	40	60	100	4
3	DEE-303	Electrical & Electronics Measurements	3	1	0	20	10	10	40	60	100	4
4	DEE-304	Solid state Electronics Engg.	3	1	0	20	10	10	40	60	100	4
5	DEE-305	Basic Signal and system	3	1	0	20	10	10	40	60	100	4
PRACTICAL/TRAINING/PROJECT												
6	DEE-351	Electrical Wiring Lab	0	0	4	0	0	0	50	50	100	2
7	DEE-352	Electrical Machines Lab	0	0	4	0	0	0	50	50	100	2
8	DEE-353	Electrical Measurement Lab	0	0	4	0	0	0	50	50	100	2
9	DEE-354	Electrical Network Lab	0	0	4	0	0	0	50	50	100	2
10	GP-301	General Proficiency	-	-	-	-	-	-	50	-	50	1
			15	05	16				450	500	950	29

Study and Evaluation Scheme (Year-II, Semester-IV)
Diploma (Electrical Engineering) Effective from session 2017-18

S.NO.	CODE	SUBJECT	PERIODS			EVALUATION SCHEME					TOTAL	CREDIT
						SESSIONAL				END SEMESTER		
			L	T	P	CT	TA	AT	Total	E-Sem		
1	DEE-401	AC Machines	3	1	0	20	10	10	40	60	100	4
2	DEE-402	Power System –I	3	1	0	20	10	10	40	60	100	4
3	DEE-403	Electrical Installation & Estimation	3	1	0	20	10	10	40	60	100	4
4	DEE-404	Digital Electronics	3	1	0	20	10	10	40	60	100	4
5	DEE-405	Electrical Engineering Material	3	1	0	20	10	10	40	60	100	4
PRACTICAL/TRAINING/PROJECT												
6	DEE-451	AC Machines Lab	0	0	4	0	0	0	50	50	100	2
7	DCS-459	Programming in C Lab	0	0	4	0	0	0	50	50	100	2
8	DEE-453	Electrical Workshop Lab	0	0	4	0	0	0	50	50	100	2
9	DEE-454	Digital Electronics Lab	0	0	4	0	0	0	50	50	100	2
10	GP-401	General Proficiency	-	-	-	-	-	-	50	-	50	1
			15	5	16				450	500	950	29

Study and Evaluation Scheme (Year-III, Semester-V)
Diploma (Electrical Engineering) Effective from session 2017-18

S.NO.	CODE	SUBJECT	PERIODS			EVALUATION SCHEME					TOTAL	CREDIT
						SESSIONAL				END SEMESTER		
			L	T	P	CT	TA	AT	Total	E-Sem		
1	DEE-501	Power System –II	3	1	0	20	10	10	40	60	100	4
2	DEE-502/DEC-501	Basics of Microprocessor	3	1	0	20	10	10	40	60	100	4
3	DEE-503	Control System	3	1	0	20	10	10	40	60	100	4
4	DEE-504	Power Electronics	3	1	0	20	10	10	40	60	100	4
5	DEE-505	Modern electric traction system	3	1	0	20	10	10	40	60	100	4
PRACTICAL/TRAINING/PROJECT												
6	DEE-551	Control system lab	0	0	4	0	0	0	50	50	100	2
7	DEE-552	Power Electronics Lab	0	0	4	0	0	0	50	50	100	2
8	DEE-553	Industrial Training Viva	0	0	4	0	0	0	100	-	100	2
9	DEE-554	Mini Project work	0	0	4	0	0	0	50	50	100	2
10	GP-501	General Proficiency	-	-	-	-	-	-	50	-	50	1
			15	5	16				500	450	950	29

Study and Evaluation Scheme (Year-III, Semester-VI)
Diploma (Electrical Engineering) Effective from session 2017-18

S.NO.	CODE	SUBJECT	PERIODS			EVALUATION SCHEME					TOTAL	CREDIT
						SESSIONAL				END SEMESTER		
			L	T	P	CT	TA	AT	Total	E-Sem		
1	DEE-601	Utilization of electrical energy and drive	3	1	0	20	10	10	40	60	100	4
2	DAS-604	Environment & Ecology	2	0	0	8	03	04	15	35	50	2
3	DEE-603	Power system protection	3	1	0	20	10	10	40	60	100	4
4	DEE-604	Power Station Practice	3	1	0	20	10	10	40	60	100	4
PRACTICAL/TRAINING/PROJECT												
5	DEE-651	Power system lab	0	0	4	0	0	0	50	50	100	2
6	DEE-652	Major Project	0	0	8	0	0	0	150	200	350	8
7	DEE-654	Instrumentation Lab	0	0	4	0	0	0	50	50	100	2
8	GP-601	General Proficiency	-	-	-	-	-	-	50	-	50	1
			11	3	16				435	515	950	27

DEE-301	**Electrical circuit**	**3-1-0**	**4 credits**

Pre-requisites: None

Course Objectives:

CEO1	To provide a methodical approach to problem solving.
CEO2	To learn a number of powerful engineering circuit analysis techniques such as nodal analysis, mesh analysis, theorems, source transformation and several methods of simplifying networks.
CEO3	Different types of two-port network analysis using network parameters, with different types of connections.
CEO4	To develop a clear understanding of the important parameters of a magnetic circuit.
CEO5	To analyze various types of filters and attenuators.

Course outcomes: At the end of the course, the student will be able to:

CO1	Match concepts in trigonometry, complex algebra, and matrix algebra to utilize techniques, skills, and modern engineering tools necessary for electrical engineering practices.
CO2	Select proper network reduction techniques, circuital laws and theorems for magnetic / electric circuit solution considering economic, performance, efficiency and availability constraints.
CO3	Apply computer mathematical and simulation programs to solve various real life multi- disciplinary topics through circuit solution.
CO4	Analyze circuits and systems by their standard parameters to identify their characteristics in general form, applicable for generation, transmission and distribution considering economical, ethical and practical limitation.
CO5	Estimate parameters for different types of attenuators and filters used in signal modulation for power systems and communication systems.

DEE-301 ELECTRICAL CIRCUIT

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Unit-I

Circuit elements and laws:

Voltage, current, power and energy, Resistance, Inductance & capacitance as parameters, Active, Passive, Bilateral & Unilateral, Linear & Nonlinear elements,KVL and KCL, Voltage division & current division.

Unit -II

Magnetic circuits:

Introduction on Magnetizing force, Intensity, MMF, flux and their relations Permeability, reluctance and permeance , Analogy between electric and Magnetic Circuits ,B-H Curve Series & parallel magnetic circuit ,Hysteresis loop.

Unit -III

Network analysis:

Mesh Analysis, Mesh Equations by inspection, Super mesh Analysis, Nodal Analysis Nodal Equations by inspection, Super node Analysis, and Source Transformation Technique

Unit-IV

Network theorems:

Star – delta transformation, Super position Theorem, Thevenin's Theorem, Norton's Theorem, Reciprocity Theorem, Compensation Theorem, Maximum power Transfer theorem, Milliman'sTheorem.

Unit –V

Two-port network:

Open circuit impedance (z) parameters, Short circuit admittance (y) parameters, Transmission (ABCD) parameters, Hybrid (n) parameters.

Filters:

Classification of filters ,Filter networks , Equations of filter networks , Classification of pass Band and stop Band , Characteristic impedance in the pass and stop bands Band pass filter.

Text book:

1. CIRCUIT & NETWORKS By: A. Sudhakar & Shyam Mohan S Palli Publisher Tata Mc Graw Hill.

2. Electrical Technology Volume – I, By- B. L. Thereja Publisher: S. Chand.

DEE302	DC machines and transformer	3-1-0	4 Credits

COURSE OUTCOMES:

CO1	To describe DC machine construction, their emf, torque, commutation, interpoles, compensating winding and transformer's construction efficiency, voltage regulation, all day efficiency.
CO2	To classify DC machines, transformers, their testing, control methods, connections and operations.
CO3	To determine the performance characteristics of DC generator and motor, efficiency of DC generators, DC motors, single phase and three phase transformers, auto transformer, voltage regulation of transformers.
CO4	To compare tests for finding performance characteristics of DC machines and transformers and compare their control scheme.
CO5	To judge the best suitable performance test for different DC machines and transformers, best suitable connection of multiple phase transformer for a particular operation.
CO6	To predict the best suitable DC motor and transformer for a particular application.

DEE-302: D.C. MACHINES & TRANSFORMER

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Unit-I

D.C. Machines:- Construction of DC Machines, Armature winding, Emf and torque equation , Armature Reaction ,Commutation , Interpoles and Compensating Windings, Performance Characteristics of D.C. generators, Performance Characteristics of D.C. motors.

Unit-II

D.C. Machines (Contd.):- Starting of D.C. motors; 3 point and 4 point starters, Speed control of D.C. motors: Field Control, armature control and Voltage Control (Ward Leonard method); Efficiency and Testing of D.C. machines (Hopkinson's and Swinburne's Test).

Unit-III

Single Phase Transformer: Phasor diagram, efficiency and voltage regulation, all day efficiency.

Unit-IV

Testing of Transformers: O.C. and S.C. tests, Sumpner's test, polarity test.

Auto Transformer: Single phase and three phase auto transformers, volt-amp, relation, efficiency, merits & demerits and applications.

Unit-V

Three Phase Transformers: Construction, three phase transformer phasor groups and their connections, open delta connection, three phase to 2 phase, 6 phase or 12 phase connections, and their applications, parallel operation and load sharing of single phase and three phase transformers.

Test Books:-

1. I.J. Nagrath & D.P.Kotahri," Electrical Machines", Tata McGraw Hill.
2. Husain Ashfaq," Electrical Machines", Dhanpat Rai & Sons.
3. A.E. Fitzgerald, C.Kingsley Jr and Umans,"Electric Machinery" 6th Edition.

DEE 303	ELECTRICAL & ELECTRONICS MEASUREMENT	3-1-0	4 Credits

COURSE OUTCOMES:

CO1	To describe the methods of Measurement, Measurement System, instrument transformer, measurement of inductance & capacitance with the help of AC Bridges, Q Meter, Polar type & Co-ordinate type AC potentiometers, application of AC Potentiometers in electrical measurement, digital voltmeter, CRO, CRT, Lissajous Pattern.; Dual Trace & Dual Beam Oscilloscopes.
CO2	To classify the measurement system, instrument systems, Characteristics of instruments & measurement system**,** Errors in measurement, Standards.
CO3	To analyse the errors in measurement.
CO4	To compare between analog and digital instruments, methods of measuring low, medium and high resistances.
CO5	To judge the different readings from different type of instruments and find out the efficiency of each instrument.
CO6	To design simple LCR circuits and measure the currents and voltages with variations.

DEE-303 ELECTRICAL & ELECTRONICS MEASUREMENT

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3 1 0

Unit-I

Analog Measurement of Electrical Quantities: Electrodynamic,Thermocouple, Electrostatic& Rectifier type Ammeters &Voltmeters , Electrodynamic Wattmeter, Three Phase Wattmeter, Power in three phase system , errors & remedies in wattmeter and energy meter.

Unit-II

Instrument Transformer: Instrument Transformer and their applications in the extension of instrument range, Introduction to measurement of speed, frequency and power factor.

Unit-III

Measurement of Parameters: Different methods of measuring low, medium and high resistances, measurement of inductance & capacitance with the help of AC Bridges, Q Meter.
AC Potentiometer: Polar type & Co-ordinate type AC potentiometers.

Unit-IV

Digital Measurement of Electrical Quantities: Concept of digital measurement, block diagram, Study of digital voltmeter.

Unit-V

Cathode Ray Oscilloscope: Basic CRO circuit (Block Diagram), Cathode ray tube (CRT) & its components, application of CRO in measurement, Lissajous Pattern; Dual Trace & Dual Beam Oscilloscopes.

Test Books:-

1. E.W. Golding & F.C. Widdis, "Electrical Measurement &Measuring Instrument", A.W. Wheeler& Co. Pvt. Ltd. India.
2. A.K. Sawhney, "Electrical & Electronic Measurement & Instrument", Dhanpat Rai & Sons, India.

DEE 304	SOLID STATE ELECTRONICS ENGINEERING	3-1-0	4 Credits

COURSE OUTCOMES:

CO1	To describe Photo diode, Zener Diode, Tunnel Diode, LED
CO2	To classify rectifiers, Different modes of operation of transistor, Current components in a transistor ,Transistor as an amplifier , Transistor circuit configuration & its characteristics , CB Configuration , CE Configuration ,CC Configuration
CO3	To analyse half wave, full wave centre tapped and Bridge rectifiers.
CO4	To compare General circuit simple of OP-AMP and IC – CA – 741 OP AMP Operational amplifier stages, Equivalent circuit of operational amplifier
CO5	To judge Open loop OP-AMP configuration ,OPAMP with feedback , Inverting OP-AMP , Non inverting OP-AMP ,Voltage follower & buffer ,Differential amplifier
CO6	To design Adder or summing amplifier, Subtractor, Integrator, Differentiator , Comparator.

DEE-304: SOLID STATE ELECTRONICS ENGINEERING

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3 1 0

Unit I

Special semiconductor devices:
Photo diode, Zener Diode, Tunnel Diode, LED.

Unit II

Rectifier circuits & filters:
Classification of rectifiers , Analysis of half wave, full wave centre tapped and Bridge rectifiers and calculate , DC output current and voltage , RMS output current and voltage, Rectifier efficiency , Ripple factor , Regulation, Transformer utilization factor ,Peak inverse voltage, Filters: T filter, π filter.

Unit III

Transistors:
Principle of Bipolar junction transistor ,Different modes of operation of transistor, Current components in a transistor ,Transistor as an amplifier , Transistor circuit configuration & its characteristics , CB Configuration , CE Configuration ,CC Configuration.

Unit IV

Operational amplifiers:
General circuit simple of OP-AMP and IC – CA – 741 OP AMP Operational amplifier stages, Equivalent circuit of operational amplifier.

Unit V

Open loop OP-AMP configuration ,OPAMP with feedback , Inverting OP-AMP , Non inverting OP-AMP ,Voltage follower & buffer ,Differential amplifier ,Adder or summing amplifier ,Subtractor, Integrator, Differentiator , Comparator.

Text Book:

1. Electronic Devices and Circuits. By: Sanjeev Gupta Publisher: Dhanpat Rai Publications.

DEE 305	BASIC SIGNALS AND SYSTEM	3-1-0	4 Credits

COURSE OUTCOMES:

CO1	To describe Basic continuous time signals, unit step, unit ramp, unit impulse and periodic signals with their mathematical representation and characteristics.
CO2	To classify Exponential form and Trigonometric form of Fourier series, Fourier symmetry, Fourier Integral and Fourier Transform. Transform of common functions and periodic wave forms.
CO3	To analyse Laplace Transform of periodic functions and complex waveforms, Initial and Final Value Theorems, Inverse Laplace Transform, Convolution Theorem, Superposition Integral.
CO4	To compare Laplace and Z transform, various types of systems: Linear, casual, time-varying.
CO5	To judge the concept of Z-Transform, Inverse Z-Transform, Initial and Final Value theorems
CO6	To design applications to solution of difference equations, Pulse Transfer Function.

DEE-305: Basic Signal and system

L T P
3 1 0

Unit I

Introduction to continuous time signals and systems: Basic continuous time signals, unit step, unit ramp, unit impulse and periodic signals with their mathematical representation and Characteristics. Various types of systems: Linear, casual, time-varying.

Unit II

Fourier Transform Analysis: Exponential form and Trigonometric form of Fourier series, Fourier symmetry, Fourier Integral and Fourier Transform. Transform of common functions and periodic wave forms.

Unit III & IV

Laplace Transform Analysis: Review of Laplace Transform, Laplace Transform of periodic functions and complex waveforms, Initial and Final Value Theorems, Inverse Laplace Transform, Convolution Theorem, Superposition Integral.

Unit V

Z-Transform Analysis : Concept of Z-Transform, Inverse Z-Transform, Initial and Final Value theorems , Applications to solution of difference equations, Pulse Transfer Function.

Text Book:

1. B.P. Lathi, “Linear Systems & Signals” Oxford University Press, 2008.
2. A.K. Chakrabarti, “Circuit Theory” Danpat Rai publication.

DEE 351	**Electrical wiring lab**	**0-0-4**	**2 credits**

Pre-requisites: basic knowledge of electrical wiring.

Course Objectives:

CEO1	Ability to apply knowledge of electrical wiring.

Course outcomes: At the end of the course, the student will be able to:

CO1	Apply and prepare the joints.
CO2	Apply and make the positions of switches and appliances in switch board.
CO3	To understand assembling, dismantling and fault investigation in the domestic appliances.
CO4	Learn to draw wiring diagrams.

DEE-351: Electrical Wiring Lab

LIST OF PRACTICALS:

1. Preparations of joints on multistrand insulated wire: Twisted joint, Married joint, plain cross joint, duplex cross joint.
2. Preparation of wiring diagram and wiring of the following: Sodium vapour lamp, Mercury vapour lamp, Corridor wiring, Row of lamps (decorative light)
3. To make the positions, fix and complete the internal wiring of the fitting of a switch board, containing at least four switches, one plug and one regulator.
4. Assembling, dismantling and fault investigation in the following domestic appliances: Electric heater, Electric immersion heater, Room heater, Electric kettle, Electric soldering iron.
5. Dismantling, identifying of various parts, finding fault, removing the fault, assembling and testing of: Table fan, Ceiling fan, Electric washing machine, and Room cooler, electric toaster and sandwich maker.

6. Study the construction of telephone and its circuit.
7. To make connection of supply and consumer board.
8. Study of contactors and time delay relays.
9. Soldering practice and lugs jointing.
10. Rewinding of a ceiling fan.

DEE 352	**Electrical machines lab**	**0-0-4**	**2 credits**

Pre-requisites: basic knowledge of electrical machines.

Course Objectives:

CEO1	Ability to apply knowledge of electrical machine.

Course outcomes: At the end of the course, the student will be able to:

CO1	Apply the basic principles of energy conservation..
CO2	Apply and study of DC machines..
CO3	To understand efficiency and regulations.
CO4	Learn to draw phasor diagram.

DEE-352: Electrical Machines Lab

LIST OF PRACTICALS:

1. Speed control of dc shunt motor (i) Armature control method (ii) Field control method
2. Study and connection of dc series motor with starter (to operate the motor on no load for a moment)
3. Study and connection of 3 point starter for starting D.C. shunt motor and change its direction of rotation. Also draw load characteristics
4. To perform open circuit and short circuit test for determining: (i) equivalent circuit (ii)the regulation and (iii) efficiency of a transformer from the data obtained from open circuit and short circuit test at full load.
5. To find the efficiency and regulation of single phase transformer by actually loading it.
6. Checking the polarity of the windings of a three phase transformer and connecting the windings in various configurations.
7. Finding the voltage and current relationships of primary and secondary of a three phase transformer under balanced load in various configurations conditions such as (a) Star-star (b) Star delta (c) Delta star (d) Delta - Delta configuring conditions
8. To test primary/ secondary windings of a transformer.

DEE 353	**Electrical measurement lab**	**0-0-4**	**2 credits**

Pre-requisites: basic knowledge of the measurement of electrical quantities.

Course Objectives:

CEO1	Ability to apply knowledge of electrical measurements..

Course outcomes: At the end of the course, the student will be able to:

CO1	Apply and use of analog and digital multimeters..
CO2	To measure the value of power, power factor, voltage, current, resistance, impedance and capacitance.
CO3	To understand CRO..
CO4	Learn to draw circuit diagrams of measurement devices.

DEE-353: Electrical Measurement Lab

LIST OF PRACTICALS:

1. Use of analog and digital multimeter for measurement of voltage, current (a.c/d.c) and resistance.
2. To calibrate 1-phase energy meter by direct loading method.
3. To measure the value of earth resistance using earth tester.
4. To measure power, power factor in a single-phase circuit, using wattmeter and power factor meter and to verify results with calculations.
5. Measurement of power and power factor of a three-phase balanced load by two wattmeter method.
6. Measurement of voltage and frequency of a sinusoidal signal using CRO time base as well as Lissajous pattern and draw wave shape of signal.
7. Measurement of power in a 3 phase circuit using CT, PT and 3-phase wattmeter.
8. Use of LCR meter, digital LCR meter for measuring inductance, capacitance and Resistance.
9. To record all electrical quantities from the meters installed in the institution premises.
10. To measure Energy at different Loads using Single phase Digital Energy meter.

DEE 354	**Electrical Network lab**	**0-0-4**	**2 credits**

Pre-requisites: basic knowledge of electrical circuits.

Course Objectives:

CEO1	Ability to apply knowledge of electrical engineering fundamentals to design complex electrical systems.

Course outcomes: At the end of the course, the student will be able to:

CO1	Apply KCL, KVL and ohms law to Simple circuits.
CO2	Apply Network theorems to Simple and Complex circuits.
CO3	To understand and demonstrate logic gates in electronics devices
CO4	Learn to draw characteristics of P-N junction diode.

DEE-354: Electrical Network Lab

LIST OF PRACTICALS:

1. Verification of principle of superposition with dc and ac sources.
2. Verification of Thevenin, Norton and Maximum power transfer theorems in ac circuits.
3. Verification of Tellegin's theorem for two networks of the same topology.
4. Determination of transient response of current in RL and RC circuits with step voltage Input.
5. Determination of transient response of current in RLC circuit with step voltage input for under damp, critically damp and over damp cases.
6. Determination of frequency response of current in RLC circuit with sinusoidal ac input.
7. Determination of z and h parameters (dc only) for a network and computation of Y and ABCD parameters.
8. Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values.

9. Determination of image impedance and characteristic impedance of T and Π networks, using O.C. and S.C. tests Write Demo for the following (in Ms-Power point).

10. Verification of parameter properties in inter-connected two port network: series, parallel and cascade also study loading effect in cascade.

DEE-401	AC Machines		3-1-0	4 credits

Pre-requisites: None

Course Educational Objectives:

CEO1	To make the students capable of understanding concepts of parallel operation of alternators & determine various sequence reactances of synchronous machines.
CEO2	To make the student gain knowledge on the nature of Analyze the behavior of synchronous machine connected to infinite bus.

Course Outcomes: **At the end of the course, the student will be able to:**

CO1	Acquire knowledge about the constructional details and principle of operation of alternators.
CO2	Acquire knowledge about the working of synchronous machines as generators and motors.
CO3	Acquire knowledge about testing and applications of synchronous machines.
CO4	Acquire knowledge about the constructional details and principle of operation of three phase and single phase induction motors.
CO5	Acquire knowledge about the starting and speed control of induction motors.
CO6	Acquire knowledge about testing and applications of induction motors.

DEE-401 AC Machines

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3 1 0

Unit-I

Synchronous Machines: Main constructional features of commutator and brushless excitation system Generation of three phase emf, Production of rotating magnetic field in a three phase winding, Concept of distribution factor and coil span factor and emf equation, Armature reaction on unity, lag and lead power factor, Operation of single synchronous machine independently supplying a load -Voltage regulation by synch-impedance method.

Unit-II

Need and necessary conditions of parallel operation of alternators, Synchronizing an alternator with the bus bars, Operation of synchronous machine as a motor –its starting methods, Effect of change in excitation of a synchronous motor, Cause of hunting and prevention.

Unit-III & IV

Induction Motors: Salient constructional features of squirrel cage and slip ring 3-phase induction Motors, Principle of operation, slip and its significance and connection of submersible motor (mono block),Locking of rotor and stator fields, Rotor resistance, inductance, emf and current, Relationship between copper loss and the motor slip, Power flow diagram of an induction motor, Factors determining the torque, Torque-slip curve, stable and unstable zones, Effect of rotor resistance upon the torque slip relationship.

Unit-V

Fractional Kilo Watt (FKW) Motors: Single phase induction motors; Construction characteristics and applications, Nature of field produced in single phase induction motor, Split phase induction motor, Capacitors start and run motor, Shaded pole motor, Reluctance start motor, Alternating current series motor and universal motors, Single phase synchronous motor, Reluctance motor, Hysteresis motor .

Test Books:-

1. Electrical Machines by SK Bhattacharya, Tata Mc Graw Hill, New Delhi
2. Electrical Machines by SK Sahdev, Unique International Publications, Jalandhar
3. Electrical Machines by Nagrath and Kothari, Tata Mc Graw Hill.

DEE-402	Power Systems 1		3-1-0	4 credits

Pre-requisites: None

Course Educational Objectives:

CEO1	To make the students capable of understanding concepts of the basic concepts of co-generation ,captive power generation & sustainable development of energy.
CEO2	To make the student gain knowledge on the nature of details about generation, transmission & distribution of electrical power.

Course Outcomes: **At the end of the course, the student will be able to:**

CO1	Awareness of general structure of power systems.
CO2	Impart the knowledge of generation of electricity based on conventional and nonconventional energy sources.
CO3	Awareness of the concept of microgrid and distributed generation.
CO4	To make students capable of analysis of mechanical and electrical design aspects of transmission system.
CO5	Enable the students to do analysis of different types of distribution systems and its design.
CO6	Impart the knowledge of protective relays and circuit breakers.

DEE-402 Power System –I

L T P
3 1 0

Unit-I

Power Generation: Main resources of energy, conventional and non-conventional, Different types of power stations, thermal, hydro, gas, diesel and nuclear power stations.

Unit-II

Transmission Systems:
Layout of transmission system, selection of voltage for H.T and L.T lines, advantages of high voltage for Transmission both AC and DC, Comparison of different system, Types of supports, types of insulators, Selection of insulators, conductors, earth wire and their accessories, Transposition and string efficiency of lines, Mechanical features of line: Importance of sag,

calculation of sag, effects of wind and ice and related problems, voltage regulation concept of corona.

Unit-III

Distribution System: Layout of HT and LT distribution system, constructional feature of distribution lines and their erection. LT feeders and service mains; Simple problems on AC radial distribution system, determination of size of conductor, Construction of LT and HT power cables advantages/disadvantages ,Calculation of line losses in distribution system.

Unit-IV

Substations:

Brief idea about substations; outdoor grid sub-station 220/132 KV, 66/33 KV outdoor substations, pole mounted substations and indoor substation, Layout of 33/11 KV distribution substation and various auxiliaries and equipment associated with it, Preparation of estimates for 11 KV/0.4 KV substations (pole mounted)

Unit-V

Various Types of Tariffs: Tariffs Block rate, flat rate, maximum demand and two part tariffs, Simple problems.

Power Factor: Concept of power factor, Reasons and disadvantages of low power factor, Methods for improvement of power factor using capacitor banks, VAR Static Compensator (SVC)

Test Books:-

1. Electrical Power System and Analysis by CL Wadhwa, 3rd edition, New Age International Publishers, New Delhi

2. Substation Design and Equipment by Satnam and PV Gupta, Dhanpat Rai & Sons, New Delhi

DEE-403	Electrical Installation and Estimation		3-1-0	4 credits

Pre-requisites: None

Course Educational Objectives:

CEO1	To make the students capable of understanding concepts of estimation and costing of power systems.
CEO2	To make the student gain knowledge on the IE rules and wiring.

Course Outcomes: **At the end of the course, the student will be able to:**

CO1	Study and understand the working of substation.
CO2	Understand various safety devices and earthing used in electrical system.
CO3	Study the maintenance and testing of transformer and induction motor.
CO4	Organize reports based on performed experiments with effective demonstration of diagram.
CO5	Study and understand the wiring diagram of star-delta starter of three phase induction motor.

DEE-403 Electrical Installation & Estimation

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Unit-I

Introduction:

Purpose of estimating and costing, preparation of materials schedule, costing, price list, preparation of tender document, net price list, market survey, overhead charges, labour charges, electrical point method and fixed percentage method, contingency, profit, purchase system, enquiries, comparative statements, orders for supply, payment of bills.

Unit-II

Types of wiring:

IE rules and safety codes, Cleat, batten, casing capping and conduit wiring, comparison of different wiring systems, selection and design of wiring schemes for particular situation Selection of wires and cables, wiring accessories and use of protective devices i.e. MCB, ELCB etc.

Unit-III

Estimating and Costing: Domestic installations; standard practice as per IS and IE rules. Planning of circuits, sub-circuits and position of different accessories, electrical layout, preparing estimates including cost as per schedule rate pattern and actual market rate (for house of two room set along with layout sketch), single storey building, auditorium hospital, cinema hall, computer networking.

Unit-IV & V

Industrial installations: relevant IE rules and IS standard practices, planning, designing and estimation of installation for single phase motors of different ratings, electrical circuit diagram, starters, preparation of list of materials, estimating and costing exercises on workshop with singe-phase, 3-phase motor load and the light load.

Text Books:

1. Electrical Installation, Estimating and Costing by JB Gupta, SK Kataria and Sons, New Delhi.
2. Estimating and Costing by SK Bhattacharya, Tata McGraw Hill, and New Delhi.
3. Estimating and Costing by Surjeet Singh, Dhanpat Rai & Co., New Delhi.
4. Estimating and Costing by Qurashi.

DEE-404	Digital Electronics		3-1-0	4 credits

Pre-requisites: None

Course Educational Objectives:

CEO1	To perform decimal, octal, hexadecimal, and binary conversions.
CEO2	To analyze digital decoding & multiplexing circuits.

Course Outcomes: **At the end of the course, the student will be able to:**

CO1	Acquired knowledge about solving problems related to number systems conversions and Boolean algebra and design logic circuits using logic gates to their simplest forms using De Morgan'sTheorems; Karnaugh Maps.
CO2	Design of combinational circuits.
CO3	Design of various synchronous and asynchronous sequential circuits using State Diagrams & Tables.
CO4	Understand DAC & ADC technique and corresponding circuits.
CO5	Understand counters and shift registers.

DEE-404 Digital Electronics

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Unit-I

Number Systems:
Decimal, binary, octal and hexa-decimal number systems. Binary addition, subtraction and multiplication, 1's and 2's complement methods of addition/subtraction.

Unit-II

Logic Gates: Definition, symbol and truth tables for inverter, OR, AND, NAND, NOR and X-OR gates

Unit-III

Boolean algebra: Boolean Relations, DeMorgan's Law, K-Map up to four variables.

Combinational Circuits: Half adder, Full adder, Encoder, Decoder, Multiplexer/Demultiplexer, Display Devices (LED, LCD and 7-segment display)

Unit-IV

Flip-Flops: J-K Flip-Flop, R-S Flip-Flop, D-Type Flip-Flop, T-Type Flip-Flop.

Unit-V

A/D and D/A Converter: D/A converters (Binary weighted, R-2R D/A Converter),A/D converter (Counter ramp, successive approximation method of A/D Conversion).

Test Books:-

1. Modern Digital Electronics by RP Jain.
2. Digital Principles and Electronics by Malvino & Leach.
3. Digital Electronics by RL Rokheine.
4. Digital Electronics by SN Ali.

DEE-405	Electrical Engineering Materials		3-1-0	4 credits

Pre-requisites: None

Course Educational Objectives:

CEO1	To make the students capable of understanding concepts of engineering materials and their use in various research organizations and industry.
CEO2	To make the student gain knowledge on the nature of electrical engineering materials (ceramics, polymers, permanent magnets).

Course Outcomes: **At the end of the course, the student will be able to:**

CO1	To provide students with a thorough understanding of the electrical properties and characteristics of various materials, used in the electrical appliances, devices, instruments.
CO2	An understanding of the electrical engineering material science essential for them to work in different industries.
CO3	To provide students with a moderate level understanding of the physics behind the electrical engineering materials.
CO4	To motivate them to do innovative research while going for higher studies and also to work in R & D with scientific enthusiasm.
CO5	To provide students knowledge about dielectrics and their properties.
CO6	Knowledge of contemporary issues within and outside the electrical engineering profession.

DEE-405 Electrical Engineering Material

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Unit-I

Dielectric Materials: Static dielectric constant, Polarization, atomic interpretation of the dielectric constant of mono-atomic and poly atomic gases, internal fields in the solids and liquids, static dielectric constants of solids, ferroelectric materials and spontaneous polarization, piezo- electricity. Frequency dependence of electronics, ionic and orientation polarization, complex dielectric constant and dielectric losses.

Unit-II

Conductivity of Metals: Ohm's Law and relaxation time of electrons, collision time and mean free path. Electron scattering and resistivity of metals. Heat developed in current carrying conductor, thermal conductivity of metals, superconductivity.

Unit-III

Magnetic Materials: Magnetization from microscopic view point, orbital magnetic dipole movement and angular momentum materials, diamagnetism, origin of permanent magnetic dipoles in material. Paramagnetic spin systems.

Unit-IV & V

Properties of ferromagnetic materials: Spontaneous magnetization and the curie-Weils Law. Ferromagnetic Domains and coercive force, anti ferromagnetic and ferromagnetic materials. Magnetic materials for electrical devices, introduction to permanent magnets

Test Books:-

1. Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi.
2. Electronic Components and Materials by Grover and Jamwal, Dhanpat Rai and Co., New Delhi.
3. Electrical Engineering Materials by Sahdev, Unique International Publications.

DEE-451	AC machines lab		0-0-2	2 credits

Pre-requisites: None

Course Objectives:

CEO1	Acquire hands on experience of conducting various tests on alternators and obtaining their performance indices using standard analytical as well as graphical methods

Course outcomes: At the end of the course, the student will be able to:

CO1	Acquire hands on experience of conducting various tests on induction machines and obtaining their performance indices using standard analytical as well as graphical methods.
CO2	Develop phasor diagram & examine steady state performance of synchronous machines, determine voltage regulation of an alternator.
CO3	Interpret parallel operation of alternators & determine various sequence reactances of synchronous machines.
CO4	Explain transient behavior of synchronous machines & determination of time constant and equivalent circuit parameters under transient conditions.

DEE-451: AC Machines Lab

LIST OF PRACTICALS:

1. Demonstration of revolving field set up by a 3-phase wound stator of Synchronous machines.
2. Determination of excitation of Synchronous machines.
3. Determination of the relationship between the voltage and load current of an alternator, keeping excitation and speed constant.
4. Determination of the regulation and efficiency of alternator from the open circuit and short circuit test.
5. Parallel operation of poly phase alternators and load sharing.
6. Determination of the effect of variation of excitation on performance of a synchronous motor.

7. Induction Machines: Determination of efficiency by (a) no load test and blocked rotor test on an induction motor (b) direct loading of an induction motor.
8. Determination of effect of rotor resistance on torque speed curve of an induction motor.

DEE-459	C Programming lab		0-0-2	2 credits

Pre-requisites: None

Course Objectives:

CEO1	Students will demonstrate basic knowledge in fundamentals of programming, algorithms and programming technologies and fundamentals of Computer Science

Course outcomes: At the end of the course, the student will be able to:

CO1	Develops basic understanding of computers, the concept of algorithm and algorithmic thinking.
CO2	Develops the ability to analyze a problem, develop an algorithm to solve it.
CO3	Introduces the more advanced features of the C language.
CO4	Develops the use of the C programming language to implement various algorithms, and develops the basic concepts and terminology of programming in general.

DCS-459: Programming in C Lab

1. To do exercise on data type conversion, use of variable of different types.
2. To write simple program using expression, assignment statements and different types of operators.
3. To write simple programs using controls statements: if, switch, conditional operator, for, while, do-while, break and continue statements.
4. Familiarity with formatted and unformatted console I / O with simple programs.
5. To write program using 1D and 2D arrays, sorting and matrix manipulation.
6. Write programs on function, using function prototype declaration, function definition, with or without arguments, returning value or no value, call by value and call by reference, recursive functions.

7. To write program using pointer (int, float and character type) using malloc and calloc functions, pointer to pointer, pointer to function.
8. To write program using different file function.
9. To write program using different macro definition, file inclusion and conditional compilation.
10. To write program using string function and math function.
11. To write program to find base memory use, to make caps lock on and to control the different keys on the keyboard.

DEE-453	Electrical workshop lab		0-0-2	2 credits

Pre-requisites: None

Course Objectives:

CEO1	To develop students with skill to analyze of load survey of electrical energy consumption

Course outcomes: At the end of the course, the student will be able to:

CO1	Analyze of load survey of electrical energy consumption and calculation of KVA rating of transformer.
CO2	Examine and come to the valid conclusion for the experiment by proper connection of given circuit.
CO3	Summerise and explain the prepared report based on substation or industrial visit.
CO4	Estimate various designing parameters of three phase induction motor.

DEE-453: Electrical Workshop Lab

LIST OF PRACTICALS:

1. Study of electrical safety measures as mentioned in the Electricity Rules and shock treatment including first aid.
2. Types of wiring and to make different light control circuits in the following types wiring Casing and capping, (PVC) conduct, baten wiring.
3. Study of ISI standard for MCBs and ELCBs Conduct one test on MCB on above basis.
4. Wiring of main distribution board with four outgoing circuits for light and fan loads including main switch and MCBs Types of wiring and to make different light control circuits in the following types of wiring. (i) Casing and Capping (PVC) wiring (ii) Conduit wiring (surface/concealed)
5. Construction of distribution and extension board with two 5A sockets and two I5A Sockets, a fuse and indicator with series test lamp provision controlled by their respective Switches.

6. Testing of domestic wiring installation using meggar.
7. Fault finding and repair of a tube light circuit.
8. Carry out pipe/ plate earthing for a small house and 3 phase induction motor. Testing the earthing using earth tester.
9. Connection of single phase and three phase motors through an appropriate starter.
10. Winding/ rewinding of a fan (ceiling and table) and choke.
11. Repair of domestic electric appliances such as electric iron, geyser, fan, heat convector, desert cooler, room heater, electric kettle, electric oven, electric furnace and weighing machine.

DEE-454	Digital Electronics lab		0-0-2	2 credits

Pre-requisites: None

Course Objectives:

CEO1	Ability to apply knowledge of digital electronics fundamentals to design combinational and sequential circuits.

Course outcomes: At the end of the course, the student will be able to:

CO1	Ability to understand and analyze various types of logic gates.
CO2	The ability to understand, analyze and design various combinational and sequential circuits
CO3	Apply the design Procedures to design basic sequential circuits
CO4	Ability to understand and analyze operation of D/A convertor.

DEE-454: Digital Electronics Lab

LIST OF PRACTICALS:

1. Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, X-OR gates.
2. Construction of Half Adder using gates.
3. Construction of Full Adder using gates.
4. Verification of operation of an 8-bit D/A Converter.
5. Verify the truth table of R-S, J-K, D,T, flip flops
6. Writing assembly language programme using numemoanics and test them on microprocessor Kit:
   (i) Addition of two 8-bit numbers
   (ii) Subtraction of two 8-bit numbers
   (iii) Multiplication of two 8-bit numbers
   (iv) Division of two 8-bit numbers

DEE-501	Power System II		3-1-0	4 credits

Pre-requisites:

Course Educational Objectives:

CEO1	To Understand various types of faults and their effects on the system.
CEO2	To familiarize with the concept of load flow study.

Course Outcomes: **At the end of the course, the student will be able to:**

CO1	Able to detect the different types of faults in the network.
CO2	Able to select proper methodologies of load flow studies for the power network.
CO3	Able to solve problems on load flow studies.
CO4	Able to develop programs for power system studies.

DEE-501 Power System –II

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Unit-I

Power System Faults:
Types of faults, single line to ground, double line to ground, three phase to ground, open conductors, severity of faults and their effects on system.

Unit-II & III

Load flow solution:
Introduction, bus classifications, nodal admittance matrix (BUS Y), development of load flow equations, load flow solution using Gauss Siedel and Newton-Raphson method, approximation to N-R method, line flow equations and fast decoupled method

Unit-IV & V

Wave equation:
Wave equation for uniform Transmission lines, velocity of propagation, surge impedance, reflection and transmission of traveling waves under different line loading

Test Books:-

1. Electrical Power System and Analysis by CL Wadhwa, 3rd edition, New Age International Publishers, New Delhi.
2. Electrical Power System by VK Mehta, S Chand & CO., New Delhi
3. Electrical Power System by JB Gupta, Kataria and Sons, New Delhi

DEE-502	Basics of Microprocessors	3-1-0	4 credits

Pre-requisites:

Course Educational Objectives:

CEO1	To introduce students with the architecture and operation of typical microprocessors.
CEO2	To familiarize the students with the programming and interfacing of microprocessors.
CEO3	To provide strong foundation for designing real world applications using microprocessors.

Course Outcomes: **At the end of the course, the student will be able to:**

CO1	Able to assess and solve basic binary math operations using the microprocessor and explain the microprocessor's internal architecture and its operation within the area of manufacturing and performance.
CO2	Able to apply knowledge and demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor
CO3	Able to Compare accepted standards and guidelines to select appropriate Microprocessor (8085 & 8086) and Microcontroller to meet specified performance requirements.
CO4	Able to analyse assembly language programs; select appropriate assemble into machine a cross assembler utility of a microprocessor and microcontroller.
CO5	Able to Design electrical circuitry to the Microprocessor I/O ports in order to interface the processor to external devices.
CO6	Able to Evaluate assembly language programs and download the machine code that will provide solutions real-world control problems.

DEC -501/DEE-502- BASICS OF MICROPROCESSORS

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UNIT-I

Introduction to Digital Computer: Digital Computers: General architecture and brief description of elements, instruction execution, instruction format, and instruction set, addressing modes, programming system, higher level languages. Buses and CPU Timings: Bus size and signals, machine cycle timing diagram, instruction timing, processor timing.

UNIT-II

Microprocessors: Evolution of Microprocessors, its importance and applications.
Memory chips: Types of ROM, RAM, EPROM, PROM. Read/Write inputs, Chip enable/select input. Other control input/output signals- Address latching, Read output, Address strobes. Power supply inputs. Extension of memory-In terms of word length and depth.

UNIT-III

Architecture of 8085 microprocessor: Pin configuration, Illustration using functional block diagram, Concept of Bus and bus organization, Memory mapping and extension, De-multiplexing of data or and address buses.

UNIT-IV

Addressing Modes: Register addressing, direct addressing; register indirect addressing, immediate addressing, and implicit addressing.
Instruction Set of 8085 microprocessor: Instruction format, op-codes, mnemonics, no. of bytes, RTL, variants, no. of machine cycles and T states, status flags, use of stacks and subordinates. Timing diagrams of instructions.

UNIT-V

Interfacing and Data Transfer Schemes of 8085 microprocessor: Memory mapped Input and input mapped I/O schemes, Interrupts of 8085, Programmable data transfer, Interrupt and DMA data transfer schemes and related applications.

Peripheral Devices: 8255 PPI, 8253 PIT, 8257 DMA Controller, 8259 PIC.

REFERENCE BOOKS:

1. Gaonkar, Ramesh S, "Microprocessor Architecture, programming and applications with the 8085" Pen ram International Publishing 5th Ed.
2. Uffenbeck, John, "Microcomputers and Microprocessors" PHI/ 3rd Edition.
3. Ray, A.K. & Burchandi, K.M., "Advanced Microprocessors and Peripherals: Architecture, Programming and Interfacing" Tata Mc. Graw Hill.
4. Krishna Kant, "Microprocessors and Microcontrollers" PHI Learning.

DEE-503	Control System	3-1-0	4 credits

Pre-requisites:

Course Educational Objectives:

CEO1	To understand different types of system and identify a set of algebraic equations to represent and model a complicated system into a more simplified form to interpret different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis.
CEO2	To employ time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions and identify the needs of different types of controllers and compensator to ascertain the required dynamic response from the system.
CEO3	Formulate different types of analysis in frequency domain to explain the nature of stability of the system.

Course Outcomes: **At the end of the course, the student will be able to:**

CO1	Able to categorize different types of system and identify a set of algebraic equations to represent and model a complicated system into a more simplified form.
CO2	Able to characterize any system in Laplace domain to illustrate different specification of the system using transfer function concept.
CO3	Able to interpret different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis.
CO4	Able to employ time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions.
CO5	Able to formulate different types of analysis in frequency domain to explain the nature of stability of the system.

DEE-503 Control System

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Unit-1

Systems & Representation: Basic elements in control systems, Open and closed loop systems, Electrical analogy of mechanical and thermal systems, Transfer function, Synchros , AC and DC servomotors, Block diagram reduction techniques , Signal flow graphs.

Unit-2

Time Response: Time response, Time domain specifications, Types of test input, I and II order system response, Error coefficients, Generalized error series, Steady state error, P, PI, PID modes of feedback control

Unit-3

Frequency Response: Bode plot, Polar plot, Determination of closed loop response from open loop response.

Unit-4 & 5

Stability of Control System: Characteristics equation, Location of roots in S plane for stability, Routh Hurwitz criterion, Effect of pole-zero addition, Gain margin and phase margin.

Text Books:

1) I.J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International Publishers, 2003.
2) Benjamin C. Kuo," Automatic Control systems, Pearson Education", New Delhi, 2003.

DEE-504	Power Electronics	3-1-0	4 credits

Pre-requisites:

Course Educational Objectives:

CEO1	To make the students capable of understanding the basic theory of power semiconductor devices and passive components, their practical applications in power electronics.
CEO2	To make the students learn how the principle of operation, design and synthesis of different power conversion circuits and their applications.

Course Outcomes: **At the end of the course, the student will be able to:**

CO1	Relate basic semiconductor physics to properties of power devices, and combine circuit mathematics and characteristics of linear and non-linear devices.
CO2	Describe basic operation and compare performance of various power semiconductor devices, passive components and switching circuits.
CO3	Design and Analyse power converter circuits and learn to select suitable power electronic devices by assessing the requirements of application fields.
CO4	Formulate and analyse a power electronic design at the system level and assess the performance.
CO5	Identify the critical areas in application levels and derive typical alternative solutions, select suitable power converters to control Electrical Motors and other industry grade apparatus.

DEE-504 Power Electronics

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3 1 0

Unit-I & II

Introduction to SCR:

Construction and working principles of an SCR, two transistor analogy circuit and characteristics of SCR ,SCR specifications and rating ,Construction, working principles and V-I characteristics of DIAC and TRIAC, Methods of triggering a Thyristor. Study of triggering circuits, UJT, its Construction, working principles and VI characteristics, UJT laxation oscillator, Commutation of Thyristors, Series and paralled operation of Thyristor.

Unit-III & IV

Controlled Rectifiers:

Three phase full wave fully controlled bridge rectifier Single phase half wave controlled rectifier with resistive load and inductive load**,** Single phase half controlled full wave rectifier**,** Fully

controlled full wave rectifier bridge**,** Single phase full wave centre lap rectifier**,** Three phase full wave half controlled bridge rectifier

Unit-V

Inverters, choppers, dual converters and cyclo convertors:

Inverter-introduction, working principles, voltage and current driven in series and parallel invertors and applications, Choppers introduction, types of choppers and their working principles and applications, Dual Convertors-introduction, types of cyclo-convertors, working principles and applications, Cyclo-convertors-introduction, types, working principles and applications

Text Books:

1. Power Electronics, Circuits Devices and Applications by Mohammad H. Rashid
2. Power Electronics by PC Sen
3. Power Electronics by Dr. PS Bhimbra, Khanna Publishers, New Delhi

DEE-505	Modern electric traction system	3-1-0	4 credits

Course Educational Objectives:

CEO1	To expose students to the operation, application and control of power conversion systems employing electric drive to cater to industrial needs.
CEO2	To familiarize the operation principles, and design of starting, braking, and speed control arrangements for electric motors and their applications.
CEO3	To provide strong foundation to asses performance of different industrial drives considering issues such as, energy efficiency, power quality, economic justification, environmental issues, and practical viabilities.

Course Outcomes: **At the end of the course, the student will be able to:**

CO1	Able to examine various applications in industrial and domestic areas where use of electric drives is essential.
CO2	Able to Classify types of electric drives systems based on nature of loads, control objectives, performance and reliability.
CO3	Able to combine concepts of previously learnt courses such as, electrical machines, Control and power electronics to cater to the need of automations in industries.
CO4	Able to select most suitable type and specification of motor drive combination for efficient conversion and control of electric power.
CO5	Able to design and justify new control and power conversion schemes for implementing alternative solutions considering the critical and contemporary issues.

DEE-505 Modern electric traction system

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3 1 0

Unit-I

Introduction:

Electric Traction System, Advantages over other system, Types of electric traction systems, Choice of traction system in India.

Unit-II

System of Tract Electrification:

Single phase low frequency D.C. System, Three phase low frequency system, Composite System, Disadvantages of Single phase to D.C. System, Comparison between pure A.C. and D.C system.

Unit-III

Track Mechanics:

Types of services (Urban, Suburban and Mainline), Speed time curve, Tractive effort & traction effort speed characteristics, Power of traction motor, Specific energy consumption, Mechanics of train movement.

Unit-IV

Power Supply arrangement:

Constituents of Power supply system i.e. substation, Sectioning and paralleling post. Subsection and post, Sub-sectioning post and elementary sections, Major control posts or switching substations.

Unit-V

Traction Motors and Traction Motor Control:

Desirable characteristic of traction motors. Comparative study of characteristic of Induction motor. Linear induction motor and their suitability for traction applications. Series parallel control of traction motors. Advantages of series parallel control.

Text Books:

1. Art and Science of utilization of electrical energy by H. Partab, Dhanpat Rai and Sons, Delhi.
2. Modern Electric Traction by Partab, Dhanpat Rai and Sons, Delhi.

BIC-551	Control System Lab-I	BIC-551	0-0-2	2 credit

Pre-requisites:

Course Educational Objectives:

CEO1	They get the basic knowledge on practical control system and PLC applications
CEO2	They get the knowledge on applications of machines & electronic devices with control systems

Course Outcomes: **At the end of the course, the student will be able to:**

CO1	Will be able to do various engineering projects.
CO2	Ability to formulate transfer function for given control system problems.
CO3	Ability to design Lead, Lag, Lead-Lag systems in control systems
CO4	Plot Root Locus and Bode plots for given control system model
CO5	Ability to find time response of given control system model.
CO6	Ability to design PID controllers for given control system model

DEE-551: Control system lab

LIST OF PRACTICALS:

1. To determine response of first order and second order systems for step input for various values of constant 'K' using linear simulator unit and compare theoretical and practical results.
2. To study P, PI and PID temperature controller for an oven and compare their performance.
3. To study and calibrate temperature using resistance temperature detector (RTD)
4. To design Lag, Lead and Lag-Lead compensators using Bode plot.
5. To study DC position control system
6. To study synchro-transmitter and receiver and obtain output V/S input characteristics
7. To determine speed-torque characteristics of an ac servomotor.
8. To study performance of servo voltage stabilizer at various loads using load bank.

9. To study behavior of separately excited dc motor in open loop and closed loop conditions at various loads.
10. To study PID Controller for simulation proves like transportation lag.

DEE-552	Power Electronics Lab	2 credit	0-0-2	BEE-652

Pre-requisites:

Course Educational Objectives:

CEO1	To make students Understand, Examine and design the working of various power electronic converter circuits.

Course outcomes: At the end of the course, the student will be able to:

CO1	Apply and deduce the concepts of Power Electronics through laboratory experimental work.
CO2	Connect the circuit to perform experiments, measure, analyze the observed data to come to a conclusion.
CO3	Organize reports based on performed experiments with effective demonstration of diagrams and characteristics/graphs.
CO4	Estimate and Interpret the V-I characteristics of various Power Electronic Devices.

DEE-552: Power Electronics Lab

LIST OF PRACTICALS:

1. To draw firing characteristics of an SCR.
2. To draw firing characteristics of a TRIAC.
3. To draw firing characteristics of a DIAC.
4. To draw uni-junction transistor characteristics.
5. Observe the output wave of an UJT relaxation oscillator.
6. Observe the wave shape across SCR and load of an illumination control circuit.
7. Fan speed regulator using TRIAC (fabrication of this circuit)
8. Speed-control of a universal motor.
9. Single phase 1 halt controlled full wave rectifier.
10. Single phase controlled rectifier.
11. Three phase controlled rectifier.
12. Single phase inverter circuit (fabrication of this circuit)

DEE-601	**Utilization of electrical energy and Drive**	4 credits	3-1-0	**DEE-601**

Prerequisite: - Utilization of electrical energy and Drive

Course Educational Objectives:

CEO1	To make the students capable of analysing the problem of Electric heating and welding.
CEO2	To make the students learn how to synthesize the problems of illumination, electric traction.

Course Objectives:

COURSE OUTCOMES:

CO1	To define the electric heating, Electric arc heating, Induction heating, Dielectric heating, Electric Arc Welding.
CO2	To summarize the Principles of electro deposition, Laws of electrolysis, applications of electrolysis.
CO3	To determine the Laws of illumination, requirements of good lighting Design of indoor lighting and outdoor lighting systems.
CO4	To compare the Types of electric drive with advantages.
CO5	To judge the Salient features of traction drives, speed time curve and its simplification.
CO6	To create a Series – parallel control of dc traction drives (bridge transition) and energy saving, Power Electronic control of dc and ac traction drives, Diesel electric traction.

DEE-601 Utilization of electrical energy and Drive

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31 0

Unit-I

Electric Drives: Advantages of electric drives**,** Characteristics of different mechanical loads**,** Types of motors used in electric drive**,** Electric braking**,** Plugging**,** Rheostat braking**,** Regenerative

braking**,** Methods of power transfer by direct coupling by using devices like belt drive, gears, pulley drives etc.

Unit- II & III

Illumination: Definition: Luminous flux, solid angle, luminous intensity, illumination, luminous efficiency, depreciation factor, coefficient of utilization, space to height ratio, reflection factor, glare, shadow, lux. Laws of illumination–simple numerical, Different type of lamps, construction and working of incandescent and discharge lamps – their characteristics, fittings required for filament lamp, mercury vapor lamp, fluorescent lamp, metal halide lamp, neon lamp.

Unit-IV & V

Electric Heating:

Advantages of electrical heating, heating methods: Resistance heating – direct and indirect resistance heating, domestic water heaters and other heating appliances and thermostat control circuit, Induction heating; principle of core type and coreless induction furnace, Electric arc heating; direct and indirect arc heating, construction, working and applications of arc furnace, Dielectric heating, applications in various industrial fields, Infra-red heating and its applications.

Text Books:

1. Art and Science of Utilization of Electrical Energy by H Partap, Dhanpat Rai & Sons, Delhi.
2. Utilization of Electrical Energy by JB Gupta, Kataria Publications, Ludhiana.
3. A.Text Book. of Electrical Power by Dr. SL Uppal, Khanna Publications, Delhi.

DEE-603	Power system protection	4 credits	3-1-0	DEE-603

Pre-requisites: None

Course Educational Objectives:

CEO1	To make the students capable of analysing any given electrical transmission system and different electrical protective device.
CEO2	To make the students learn different circuit breakers.

COURSE OUTCOMES:

CO1	To summarize different protective equipment's of power systems.
CO2	To Know about various protective systems- how it works and where it works?
CO3	To identify DMT and IDMT type relays.
CO4	To analyse the different applications of the relays, circuit breakers and lightning arrestor.
CO5	To describe about Oil circuit Breaker, Air Blast circuit Breakers, SF6 Circuit Breaker etc.

DEE-603: Power system protection

L T P
3 1 0

Unit-I & II

Switch gears: Purpose of protective gear. Difference between switch, isolator and circuit breakers. Function of isolator and circuit breaker. Making and breaking capacity of circuit breaker (only definition), Principles of Arc extinction by OCB and ACB, Constructional features of OCB, ACB, and their working, Circuit breakers. Types of circuit breakers, bulk and minimum oil circuit breakers, air blast circuit breakers, SF6 circuit breakers, Miniature circuit breakers ACB, ELCB, MCB, for distribution and transmission system.

Unit-III

Protection Devices:

Fuses; function of fuse. Types of fuses, HV and LV fuses, rewire-able, cartridge, HRC, Earthing, purpose of earthing: Equipment earthing, Substation earthing, system earthing as per Indian Electricity rules. Relays: (a) Introduction, types of relays. Electromagnetic and thermal relays, their construction and working (b) Induction type over-current, earth fault relays, instantaneous over current relay(c) Directional over-current, differential relays, and their functions

Unit-IV

Protection Scheme:

Relays for generator protection, Relays for transformer, protection including Buchholtz relay protection, Protection of feeders and bus bars. Over current and earth fault protection, distance protection.

Unit-V

Over-voltage Protection: Protection of system against over voltage; causes of over voltage, function of ground wire**,** Lightning arrestors, Rod gap, horn gap, metal oxide type. Line protection.

Text Books:

1. Testing, Commissioning , Operation and Maintenance of Electrical Equipment by S Rao,Khanna Technical Publication, New Delhi
2. Electrical Power Systems by CL Wadhwa, Wiley Eastern Ltd., New Delhi
3. Textbook of Electrical Technology by BL Theraja, S Chand and Co., New Delhi
4. Electrical Power by Dr. SL Uppal, Khanna Publications, Delhi
5. A Course in Electrical Power by ML Soni, PV Gupta and Bhatnagar, Dhanpat Rai.

DEE-604	Power Station Practice	3-1-0	4 Credits

Course Educational Objectives:

CEO1	To learn basic concepts of power plant
CEO2	To make the students learn about non-conventional energy resources.

COURSE OUTCOMES:

CO1	To describe Electric energy demand and growth in India, electric energy sources,thermal power plant, hydroelectric power plant, nuclear power plant, gas turbine plant, diesel plant, solar power plant, wind energy, geothermal energy, MHD generation, ocean thermal energy and tidal energy.
CO2	To classify thermal power plant, hydro power plant, different type of turbines, non-conventional energy sources, different type of reactors.
CO3	To compare the efficiency, cost, advantages and disadvantages of different type of plants, different type of turbines, energy sources. .
CO4	To judge the efficiency and cost of power plants.

DEE-604: Power Station Practice

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Unit-I

Thermal Power Plant: Site selection, general layout and operation of plant, detailed description and use of different parts.

Hydro Electric Plants: Classifications, location and site selection, detailed description of various components, general layout and operation of Plants.

Unit-II

Nuclear Power Plant: Location, site selection, general layout and operation of plant. Brief description of different types of reactors Moderator material, fissile materials, control of nuclear reactors, disposal of nuclear waste material, shielding.

Unit-III

Gas Turbine Plant: Operational principle of gas turbine plant & its efficiency, fuels, open and closed-cycle plants, regeneration, inter-cooling and reheating, role and applications.

Diesel Plants: Diesel plant layout, components & their functions, its performance, role and applications.
Non Conventional Energy Sources: Power Crisis, future energy demand, role of Private sectors in energy management.

Unit-IV

MHD generation: Working principle, open and closed cycles, MHD systems, advantages, parameters governing power output.
Solar power plant: Conversion of solar heat to electricity, solar energy collectors, Photovoltaic cell, power generation, future prospects of solar energy use.

Unit-V

Wind Energy: Windmills, power output with combined operation of wind turbine generation and isolated generating system, technical choices& economic size.
Geothermal Energy: Earth energy, heat extraction, vapor turbine cycle, difficulties & disadvantages.

Text Books:

1. B.R. Gupta, "Generation of Electrical Energy", S. Chand Publication.
2. Soni, Gupta & Bhatnagar, "A text book on Power System Engg.", Dhanpat Rai & Co.
3. P.S.R. Murthy, "Operation and control of Power System" BS Publications, Hyderabad.

DAS604	**Environment and Ecology**	2 credits	2-0-0	DAS-604

Pre-requisites: None

Course Educational Objectives:

CEO1	To learn basic concepts.
CEO2	To make the students learn Functional Characteristics of Ecosystems.

COURSE OUTCOMES:

CO1	Students will demonstrate broad-based knowledge of the fundamentals of Ecology, Behavior, Evolution and Physiology and the relationships among these disciplines.
CO2	Students will demonstrate skills in the observation and experimental study of organisms, using both field-based and laboratory-based approaches.
CO3	Students will demonstrate skills in identifying, accessing, comprehending and synthesizing scientific information, including interpretation of the primary scientific literature.
CO4	Students will demonstrate the ability to conceive and execute independent scientific research.

ENVIRONMENT AND ECOLOGY (DAS604)

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Unit-1

Introduction to Environmental Science - Definition and scope and need for public awareness Ecosystems, Concept, structure and functions, restoration of damaged ecosystems

Biodiversity – Definition, description at national and global level, threats and conservation

Unit-2

Natural Resources - Renewable and non-renewable and their equitable use for sustainability, Material cycles – carbon, nitrogen and sulphur cycle. Conventional and Non-conventional Energy Sources – fossil fuel-based, hydroelectric, wind, -nuclear and solar energy, biomass, biodiesel, hydrogen as an alternative fuel.

Unit-3

Transportation and industrial growth Social Issues Related to Environment–Sustainable development, reset lement and rehabilitation Environmental ethics.

Unit-4

Environmental Changes and Human Health Environmental Pollution–Definition, causes and effects, control measures for water, air, soil, noise, thermal pollution.

Textbook:

1. Environmental Studies, J Krishna wamy , R J Ranjit Daniels, Wiley India.

Reference Books:

2. Environmental Science, Bernard J. Nebel, Richard T. Right, 9780132854467, Prentice Hall Professional 1993.
3. Environment and Ecology, R K Khandal, 978-81-265-4277-2, Wiley India.

DEE-651	**Power System Lab**	2 Credit	0-0-2	DEE-651

Pre-requisites:

Course Educational Objectives:

CEO01	To make the students capable of analyzing any given electrical transmission system.
CEO02	To make the students learn different circuit breakers.

Course Outcome: after the completion of the course the student will be able to:

CO01	Understand the operation & performance of various relays such as over-current, differential.
CO02	Understand the concept of sequence components for analysis of unbalanced three phase power systems
CO03	Understand the concepts of different-different effect HV transmission line, grid substation.

DEE-651: Power system lab

LIST OF PRACTICALS:

1. To determine direct axis reactance (X_d) and quadrature axis reactance (X_q) of a salient pole alternator.
2. To determine negative and zero sequence reactances of an alternator.
3. To determine sub transient direct axis reactance (xd) and sub transient quadrature axis reactance (xq) of an alternator.
4. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation
5. To study the IDMT over current relay and determine the time current characteristics
6. To study percentage differential relay
7. To study Impedance, MHO and Reactance type distance relays
8. To determine location of fault in a cable using cable fault locator
9. To study Ferranti effect and voltage distribution in H.V. long transmission line using transmission line model.
11. To study operation of oil testing set.

DEE-654	**Instrumentation Lab**	2 credit	0-0-2	**DEE-654**

Pre-requisites:

Course objectives:

CE01	Apply and deduce the principles of Electrical Measurements and Instrumentation Engineering through laboratory experimental work.

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the working of LVDT
CO2	Measure three phase power and energy.
CO3	Measure resistance, inductance and capacitance using bridges.
CO4	Organize reports based on performed experiments with effective demonstration of diagrams and characteristics/graphs.

DEE-654: Instrumentation Lab

Note: Minimum Eight experiments should be performed from the following

1. Measurement of displacement using LVDT.
2. Measurement of displacement using strain gauge based displacement transducer.
3. Measurement of displacement using magnetic pickup.
4. Measurement of load using strain gauge based load cell.
5. Measurement of water level using strain gauge based water level transducer
6. Measurement of flow rate by anemometer
7. Measurement of temperature by RTD.
8. Measurement of temperature by thermocouple
9. Study of P,PI and PID controllers
10. Study of storage oscilloscope and determination of transient response of RLC circuit.
11. Determination of characteristics of a solid state sensor/fibre-optic sensor
12. Design and test a signal conditioning circuit for any transducer