P.K.UNIVERSITY, SHIVPURI (MP)
(FACULTY OF ENGINEERING & TECHNOLOGY)

EVALUATION SCHEME & SYLLABUS

FOR

B. TECH.

ELECTRICAL ENGINEERING

(3rd year)

ON

CHOICE BASED CREDIT SYSTEM (CBCS)

[Effective from the Session: 2025-26]

P.K.University,Vill-Thanra,Teh-Karera,Distt-Shivpuri (M.P.) 473665

EVALUATION SCHEME (2022-23)
B.TECH ELECTRICAL ENGINEERING
2nd Year (3rd & 4th Semester)

Study And Evaluation Scheme For B.Tech Electrical Engineering

Year-2nd /Semester -3rd

Subject Code	Subjects Name	Study Scheme Periods/Week			Credits	Marks in Evaluation Scheme						Total Marks of Internal & External
						Internal Assessment			External Assessment			
		L	T	P		Th	Pr	Total Internal	Th	Pr	Total External	Grand Total
UENGIEE301	Engineering Mathematics-III	3	1	0	4	30	-	30	70	-	70	100
UANALEE302	Analog & Digital Electronics	3	0	0	3	30	-	30	70	-	70	100
UELECEE303	Electrical & Electronics Engineering Material	3	0	0	3	30	-	30	70	-	70	100
UELECEE304	Electrical Measurements & Instrumentation	3	0	0	3	30	-	30	70	-	70	100
UBASIEE305	Basic Signals & Systems	3	1	0	4	30	-	30	70	-	70	100
UENVIEE306	Environment & Ecology	3	0	0	3	30	-	30	70	-	70	100
UELECEE307	Electrical Measurements & Instrumentation Lab	0	0	2	1	-	25	25	-	25	25	50
UELECEE308	Electrical Workshop Lab	0	0	2	1	-	25	25	-	25	25	50
USIMUEE309	Simulation-I Lab	0	0	2	1	-	25	25	-	25	25	50
UELECEE310	Electronics Lab	0	0	2	1	-	25	25	-	25	25	50
Total		18	2	8	24	180	100	280	420	100	520	800
For pass the candidate is required to obtain 40% marks in each paper and 50% marks in aggregate.												400

Study And Evaluation Scheme For B.Tech Electrical Engineering

Year-2nd /Semester -4th

Subject Code	Subjects Name	Study Scheme Periods/Week			Credits	Marks in Evaluation Scheme						Total Marks of Internal & External
						Internal Assessment			External Assessment			
		L	T	P		Th	Pr	Total Internal	Th	Pr	Total External	Grand Total
UNANOEE401	Nano Science	3	0	0	3	30	-	30	70	-	70	100
UPOWEEE402	Power Plant Engineering	3	0	0	3	30	-	30	70	-	70	100
UELECEE403	Electro Magnetic Field Theory	3	1	0	4	30	-	30	70	-	70	100
UELECEE404	Electrical Machine-I	3	1	0	4	30	-	30	70	-	70	100
UNETWEE405	Network Analysis & Synthesis	3	1	0	4	30	-	30	70	-	70	100
UUNIVEE406	Universal Human Value & Professional Ethics	3	0	0	3	30	-	30	70	-	70	100
UELECEE407	Electrical Machine-I Lab	0	0	2	1	-	25	25	-	25	25	50
UNETWEE408	Network Analysis & Synthesis Lab	0	0	2	1	-	25	25	-	25	25	50
USIMUEE409	Simulation –II Lab	0	0	2	1	-	25	25	-	25	25	50
UELECEE410	Electrical Instrumentation Lab	0	0	2	1	-	25	25	-	25	25	50
Total		18	2	8	25	180	100	280	420	100	520	800
For pass the candidate is required to obtain 40% marks in each paper and 50% marks in aggregate.												400

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2nd Year / 3rd Semester

UENGIEE301:Engineering Mathematics-III	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
3L+1T+0P	**End Term Exams: 3 hrs.**

Course Outcome: -

The objective of this course is to familiarize the students with partial differential equation, their application, statistical and numerical techniques. It aims to present the students with standard concepts and tools at an intermediate to superior level that will provide them well towards undertaking a variety of problems in the discipline.

The students will learn:

- The idea of partial differentiation, its types and their solution.
- The concept of Fourier transform and method of separation of variables to solve partial differential equations.
- To apply the basic ideas of statistics including measures of central tendency, correlation, regression and their properties.
- To apply numerical techniques in solving algebraic equations and data interpolation.
- To apply numerical techniques in solving linear equations, numerical differentiation and numerical integration.

Unit	Contents	Hours
1	**Numerical Techniques** – **I**: Zeroes of transcendental and polynomial equations, Bisection method, Regula-falsi method, Newton-Raphson method, Rate of convergence of above methods. **Interpolation**: Finite differences, Newton‘s forward and backward interpolation. Lagrange‘s and Newton‘s divided difference formula for unequal intervals**.**	**08**
2	**Numerical Techniques** –**II**: Solution of system of linear equations, Matrix Decomposition methods, Jacobi method, Gauss- Seidal method. **Numerical differentiation & Integration**: Trapezoidal rule, Simpson‘s one third and three- eight rules, Solution of ordinary differential equations (first order, second order and simultaneous) by Euler‘s, Picard‘s and fourth-order Runge- Kutta methods.	**08**

3	**Statistical Techniques**: Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, fitting of straight lines, Polynomials, Exponential curves, Correlation, Linear, none – Linear and multiple regression analysis, Binomial, Poisson and Normal distributions. Tests of significations: Chi-square test, t-test.	**08**
4	**Function of Complex variable**: Analytic function, C-R equations, Harmonic Functions, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions, Taylor's and Laurent's series, Singularities, Zeroes and Poles, Residue theorem.	**08**
5	**Integral Transforms**: Fourier integral, Complex Fourier transform, Inverse Transforms, Convolution Theorems, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations, wave equations and Laplace equations, Z-Transform and its application to solve difference equation.	**08**

Suggested Readings / Books

1. Peter V. O"Neil, Advance Engineering Mathematics Thomson (Cengage) Learning, 2007.
2. Jain, Iyenger Jain, Numerical Methods for Scientific and Engineering Computation, New AgeInternational, New Delhi
3. J.N. Kapur, Mathematical Statistics, S. Chand & company Ltd.
4. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers

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2nd Year/3rd Semester

UNALEE302:Analog and Digital Electronics	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
3L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: -

1. Know the characteristics of various components.
2. Understand the utilization of components.
3. Design and analyze small signal amplifier circuits.
4. Learn Postulates of Boolean algebra and to minimize combinational functions.
5. Design and analyze combinational and sequential circuits.
6. Know about the logic families and realization of logic gates.

Unit	Contents	Hours
1	**Analog Electronics** **Special Diodes:** LED, Photo diode, Schottky diode, Tunnel diode; their characteristics and applications. Introduction to Power devices- Characteristics of SCR, TRIAC, DIAC.	08
2	**Amplifier and Frequency Response**: Introduction to Amplifier, Transfer Function, Frequency Response of Common Emitter, Multistage amplifier. Frequency response of Common source MOSFET Amplifier. **Feedback-** General Feedback structure; properties of negative feedback; series-series, series-shunt, shunt-series and shunt-shunt feedback amplifiers.	08
3	**Oscillators**-Basic principle of sinusoidal oscillator, R-C Phase Shift , Wein Bridge oscillators, tuned oscillators- Colpitts and Hartley; Crystal oscillator, CLAP Oscillator.	08
4	**Digital Electronics** **Combinational Logic Circuits:** Multiplexers/Demultiplexures, Encoders/Decoders. **Sequential Logic Circuits:** latches, flip-flops- S-R, T, D, J-K. **Shift Registers:** Basic principle, serial and parallel data transfer, shift left/right registers, universal shift register. **Counters:** Mode N Counters, ripple counters, synchronous counters, ring/Johnson counters.	08

5	**OP-AMP applications:** Astable, Monostable and Bistable multivibrators, Schmitt trigger, IC555 Timer, A/D and D/A converters. **Voltage Regulators:** Series, shunt and switching regulator op-amp based configurations. **Memories:** Introduction to ROM, RAM; Sequential Memory, Memory organization.	**08**

Suggested Readings / Books

1. A.S. Sedra and K.C. Smith ―Microelectronics Circuits‖ Oxford University Press (India)
2. Malvino & Leach, ―Digital Principles and applications‖ Tata Mc. Graw Hill
3. R.A. Gayakwad ―Op amps and Linear Integrated Circuits‖ Prentice Hall of India.
4. Balbir Kumar and Shail B.Jain, ―Electronic Devices and Circuits‖ Prentice Hall of India,2007

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2nd Year/3rd Semester

UELECEE303:Electrical & Electronics Engineering Materials	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
3L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: -

1. Identify electrical and electronics engineering materials/component.
2. Select proper conducting material for a particular application.
3. Select a proper insulating material for a particular application.
4. Suggest an alternate material if proper material is not available.
5. Procure various electrical and electronics engineering material available in the market.
6. Select proper magnetic material for a particular application.
7. Make use of engineering material used for fabrication of particular electrical machine.
8. Select gaseous material for particular application.

Unit	Contents	Hours
1	**Dielectric Materials**: Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyro electric materials.	**08**
2	**Magnetic Materials**: Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and hysteresis.	**07**
3	**Semiconductor Materials**: Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale integration techniques (VLSI).	**06**

4	**Materials For Electrical Applications**: Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid Liquid and Gaseous insulating materials. Effect of moisture on insulation.	**10**
5	**Special Purpose Materials**: Refractory Materials, Structural Materials, Radioactive Materials, Galvanization and Impregnation of materials, Processing of electronic materials, Insulating varnishes and coolants, Properties and applications of mineral oils, Testing of Transformer oil as per ISI Reading.	**09**

Suggested Readings / Books

1. RK Rajput, A course in Electrical Engineering Materials, Laxmi Publications, 2009
2. TK Basak, A course in Electrical Engineering Materials, New Age Science Publications, 2009
3. Adrianus J. Dekker, Electrical Engineering Materials, Pearson, 2016.
4. A.J. Dekker,‖Electrical Engineering Materials‖ Prentice Hall of India
5. R.K. Rajput,‖ Electrical Engg. Materials,‖ Laxmi Publications.

Department of Electrical Engineering
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2nd Year/3rd Semester

UELECEE304:Electrical Measurements & Instrumentation	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
3L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: -

1. Evaluate errors in measurement as well as identify and use different types of instruments for the measurement of voltage, current, power and energy.
2. Display the knowledge of measurement of electrical quantities resistance, inductance and capacitance with the help of bridges.
3. Demonstrate the working of instrument transformers as well as calculate the errors in current and potential transformers.
4. Manifest the working of electronic instruments like voltmeter, multi-meter, frequency meter and CRO.
5. Display the knowledge of transducers, their classifications and their applications for the measurement of physical quantities like motion, force, pressure, temperature, flow and liquid level.

Unit	Contents	Hours
1	**Electrical Measurements**: Measurement system, Characteristics of instruments, Methods of measurement, Errors in Measurement & Measurement standards, Review of indicating and integrating instruments: Voltmeter, Ammeter, Three phase Wattmeter, Multimeter and Energy meter.	**08**
2	**Measurement of Resistance, Inductance and Capacitance**: Measurement of low, medium and high resistances, insulation resistance measurement, AC bridges for inductance and capacitance measurement	**08**
3	**Instrument Transformers**: Current and Potential transformer, ratio and phase angle errors, design considerations and testing.	**06**

4	**Electronic Measurements**: Electronic voltmeter, Multimeter, Wattmeter & energy meter. Time, Frequency and phase angle measurements using CRO; Spectrum & Wave analyzer. Digital counter, frequency meter, voltmeter, Multimeter and storage oscilloscope.	**10**
5	**Instrumentation:** Transducers, classification & selection of transducers, strain gauges, Thermistors, Thermocouples, LVDT, Inductive & capacitive transducers, Piezoelectric and Hall-effect transducers, Measurement of motion, force, pressure, temperature, flow and liquid level, basic concepts of smart sensors and application. Data Acquisition Systems.	**08**

Suggested Readings / Books

1. A K Sawhney, ―Electrical & Electronic Measurement & Instrument‖, Dhanpat Rai & Sons, India
2. BC Nakra & K. Chaudhary, ―Instrumentation, Measurement and Analysis,‖ Tata McGraw Hill 2nd Edition
3. Purkait, ―Electrical & Electronics Measurement & Instrumentation‖, TMH

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2nd Year/3rd Semester

UELECEE307:Electrical Measurements & Instrumentation Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Course Outcome: -

1. Understand the importance of calibration of measuring instruments
2. Demonstrate the construction and working of different measuring instruments.
3. Demonstrate the construction and working of different AC and DC bridges, along with their applications.
4. Ability to measure electrical engineering parameters like voltage, current, power & phase difference in industry as well as in power generation, transmission and distribution sectors.
5. Capability to analyze and solving the variety of problems in the field of electrical measurements.

Note: Minimum ten experiments are to be performed from the following list:

1. Calibration of AC voltmeter and AC ammeter.
2. Measurement of inductance by Maxwell‘s Bridge.
3. Measurement of inductance by Hay‘s Bridge.
4. Measurement of inductance by Anderson‘s Bridge.
5. Measurement of capacitance by Owen‘s Bridge.
6. Measurement of capacitance by De Sauty Bridge.
7. Measurement of capacitance by Schering Bridge.
8. Measurement of low resistance by using Kelvin‘s Double Bridge.
9. Measurement of phase difference and frequency of AC signal using CRO.
10. Measurement of Power using CT & PT.
11. Measurement of iron loss in a ring by using Maxwell‘s Bridge.
12. To measure high resistance by using loss of charge method.

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2nd Year/3rd Semester

UBASIEE305:Basic Signals & Systems	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
3L+1T+0P	**End Term Exams: 3 hrs.**

Course Outcome: -

1. Represent the various types of signals & systems and can perform mathematical operations on them.
2. Analyze the response of LTI system to Fourier series and Fourier transform and to evaluate their applications to network analysis.
3. Analyze the properties of continuous time signals and system using Laplace transform and determine the response of linear system to known inputs.
4. Implement the concepts of Z transform to solve complex engineering problems using difference equations.
5. Develop and analyze the concept of state-space models for SISO & MIMO system.

Unit	Contents	Hours
1	**Introduction To Continuous Time Signals And Systems**: Introduction to continuous time and discrete time signals, Classification of signals with their mathematical representation and characteristics. Transformation of independent variable, Introduction to various type of system, basic system properties. **Analogous System:** Linear mechanical elements, force-voltage and force-current analogy, modeling of mechanical and electro-mechanical systems: Analysis of first and second order Linear systems by classical method.	**09**
2	**Fourier Transform Analysis**: Exponential form and Compact trigonometric form of Fourier series, Fourier symmetry, Fourier transform: Properties, application to network analysis. Definition of DTFS, and DTFT, Sampling Theorem.	**08**

3	**Laplace Transform Analysis**: Review of Laplace Transform, Properties of Laplace Transform, Initial & Final value Theorems, Inverse Laplace Transform, Convolution Theorem, Impulse response, Application of Laplace Transform to analysis of networks, waveform synthesis and Laplace Transform to complex waveforms.	**08**
4	**State – Variable analysis**: Introduction, State Space representation of linear systems, Transfer function and state Variables, State Transition Matrix, Solution of state equations for homogeneous and non-homogeneous systems, Applications of State – Variable technique to the analysis of linear systems.	**08**
5	**Z – Transform Analysis**: Concept of Z – Transform, Z – Transform of common functions, Inverse Z – Transform, and Initial & Final value Theorems, Applications to solution of difference equations, Properties of Z- transform.	**07**

Suggested Readings / Books

1. Oppenhiem, Wilsky, Nawab, ―Signals & Systems‖, PHI
2. Anand Kumar, ― Signals & Systems‖, PHI
3. Choudhary D. Roy, ―Network & Systems‖, Wiley Eastern Ltd.
4. David K.Cheng; ―Analysis of Linear System‖, Narosa Publishing Co.
5. C.L.Wadhwa, ―Network Analysis and Synthesis‖, New Age International Publishers, 2007.

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2nd Year/3rd Semester

UENVIEE306:Environment & Ecology	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
3L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: -

1. Gain in-depth knowledge on natural processes that sustain life, and govern Bloom‘s economy.
2. Estimate and predict the consequences of human actions on the web of life, global economy and quality of human life.
3. Develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.
4. Acquire values and attitudes towards understanding complex environmental economic social challenges, and participate actively in solving current environmental problems and preventing the future ones.
5. Adopt sustainability as a practice in life, society and industry.

Unit	Contents	Hours
1	Definition, Scope & Importance, Need for Public Awareness• Environment definition, Eco system - Balanced ecosystem, Human activities - Food, Shelter, Economic and social Security. Effects or human activities on environment Agriculture, Housing, Industry, Mining and Transportation activities, Basics of Environmental Impact Assessment. Sustainable Development.	**08**
2	Natural Resources• Water Resources· Availability and Quality aspects. Water borne diseases, Water Induced diseases, Fluoride problem in drinking water. Mineral Resources, Forest Wealth, Material cycles-- Carbon, Nitrogen and Sulpher Cycles. **Energy** - Different types of energy, Electro-magnetic radiation. Conventional and Non-Conventional sources – Hydro-Electric, Fossil Fuel based Nuclear, Solar, Biomass and Biogas. Hydrogen as an alternative future source of Energy.	**08**

3	Environmental Pollution and their effects. Water pollution, Land Pollution. Noise pollution, Public Health aspects, Air Pollution, Solid waste management, e-waste management Current Environmental Issues of Importance: Population Growth, Climate Change and Global warming- Effects, Urbanization, Automobile pollution. Acid Rain Ozone Layer depletion, Animal Husbandry.	**08**
4	V Environmental Protection- Role of Government, Legal aspects, initiatives by Non-Governmental organizations (NGO), Environmental Education, Women Education	**08**

Suggested Readings / Books

1. Environmental Studies -Benny Joseph- Tata Mcgraw Hill-2005
2. Environmental Studies- Or. D.L. Manjunath, Pearson Education-2006.
3. Environmental studies - R, Rajagopalan -Oxford Publication • 2005.
4. Text book of Environmental Science & Technology- M. Anji Reddy- US Publication.

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2nd Year/3rd Semester

UELECEE308:Electrical Workshop Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Note: Minimum ten experiments are to be performed from the following list:

1. To study the working and Control of two lamps in series and in parallel
2. To perform the stair case working and its testing.
3. To study the working principle and wiring of fluorescent lamp.
4. To study and wiring of distribution board including power plug using isolator, MCB,ELCB.
5. To study and estimate a typical, BHK house wiring.
6. Familiarization, soldering, testing and observing the wave forms on CRO of a HW and FW uncontrolled rectifier (using diodes) with capacitor filter.
7. Visit your college substation and familiarize the supply system, Transformer, HT Panel and Distributionetc.
8. To study construction, working and application of workshop tools. Also study the Electrical andElectronics Symbols.
9. To study the wires, cables and their gauges, Domestic Electrical Accessories.
10. Mini Project on PCB.
11. To study fault, Remedies in Domestic Installation and Indian Electricity Rules.
12. To study the different types of earthing system and measure the earth resistance.

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2nd Year/3rd Semester

USIMUEE309:Simulation Lab-1	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Note: Minimum ten experiments are to be performed from the following list:

1. Introduction to MATLAB and its basic commands
2. Determine the root of a polynomial
3. Determination of polynomial using method for least square curve fitting
4. Solution of differential equation using 4th order runge - kutta method
5. Determination of time response of an RLC circuit
6. Single line Modeling of DC motor
7. Step, Ramp and impulse response of transfer function
8. Generation of single and three phase sinusoidal waveform
9. PWM based waveform generation
10. Single phase uncontrolled half wave rectifier using R and RL load
11. Single phase uncontrolled full wave rectifier using R and RL load
12. Three phase uncontrolled full wave rectifier using R and RL load

Institute may add any two software based experiments [Develop Computer Program in „C" language or use MATLAB or Electrical Domain Simulation Software: ―Virtual HIL Device‖ (Free, Unlimited Users, Full Version) from Typhoon HIL GmbH or Equivalent software] in the above list

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UELECEE310:Electronics Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Note: Select at least any five out of the following:

1. To Plot V-I characteristics of junction diode and zener diode.
2. To draw wave shape of the electrical signal at input and output points of the half wave, full wave and bridge Rectifiers.
3. To Plot input / output characteristics for common base transistor.
4. To Plot input /output characteristics of FET and determine FET parameters at a given operating point.
5. To determine voltage gain, current gain, input impedance and output impedance of common emitter amplifier.
6. To determine voltage gain, current gain, input impedance and output impedance and frequency response of R-C Coupled common Emitter amplifier.
7. To design R-C Phase shift / Wein Bridge oscillator and verify experimentally the frequency of oscillation.
8. To study transistor as a switch and determine load voltage and load current.

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UNANOEE401:Nano Science	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
3L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: -

1. Will acquire diverse feel about energy consumption, conservation and progress in multiple aspects of energy in terms of cost, viability and feasibility.
2. Will be educated on various energy related policies and their applications, practical difficulties, short comings in implementation and mass production.
3. Will be able to integrate functional materials of various scientific interests into energy engineering for the development of energy conversion and storage technologies.
4. Will be trained in various instrumentation techniques to produce materials of different nanostructures and device fabrication at lab and large scales.
5. Will be sensible on energy demands, energy policies and economics for the future developmental activities.
6. Will be able to contribute to the society in terms of energy via reach out activities to make the process sustainable and more attractive.

Unit	Contents	Hours
1	**Introduction**: Definition of Nano-Science and Nano Technology, Applications of Nano Technology. **Quantum Theory for Nano Science**: Particle in a box, Potential step: Reflection and tunneling (Quantum leak).Penetration of Barrier, Potential box (Trapped particle in 3D: Nano dot). **Physics of Solid State Structures**: Size dependence of properties, crystal structures, face centered cubic Nanoparticles; Tetrehedrally bounded Semiconductor structures; lattice vibrations. **Energy Bands**: Insulators, semiconductor and conductors; Reciprocal space; Energy Bands and gaps ofSemiconductors;	**08**

	Effective masses; Fermi Surfaces. **Localized Particles**: Acceptors and deep taps; mobility; Exactions.	
2	**Quantum Nanostructure**: Preparation of quantum wells, Wires and Dots, Size and Dimensionality effect, Fermi gas; Potential wells; Partial confinement; Single electron Tunneling, Infrared detectors; Quantum dot laser superconductivity. **Properties of Individual Nano Particles**: Metal Nano clusters; Magic numbers; Theoretical modeling of Nano particles; geometric structure; electronic structure; Reactivity, Fluctuations, Magnetic clusters; Bulk to nanostructure, semiconducting nanoparticles, Optical Properties, Photo fragmentation, Columbic Explosion. Rare Gas & Molecular clusters; Inert gas clusters; Superfluid clusters; Molecular clusters.	**08**
3	**Growth Techniques of Nano materials**: Litho and Nonlithograpahic techniques, RF Plasma, Chemical methods, Thermolysis, Pulsed laser method, Self-assembly, E-beam evaporation, Chemical Vapor Deposition, Pulsed Laser Deposition.	**08**
4	**Methods of Measuring Properties**: Structure: X-ray Diffraction Technique, Particle size determination, surface structure. Microscopy: Scanning Probe Microscopy (SPM), Atomic Force Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy (TEM). Spectroscopy: Infra-red and Raman Spectroscopy, X-ray Spectroscopy, Magnetic resonance, Optical and Vibrational Spectroscopy, Luminescence.	**08**
5	**Carbon Nano Materials:** Bucky Ball and Carbon Nano-Tubes: Nano structures of carbon (fullerene), Fabrication, Structure. Electrical, Mechanical and Vibrational properties and applications. Nano Diamond, Boron Nitride Nano-tubes, Single Electron Transistors, Molecular Machine, Nano-Biometrics, Nano Robots.	**08**

Suggested Readings / Books

1. CP Poole Jr, FJ Owens, ―Introduction to Nanotechnology‖.

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UPOWEEE402:Power Plant Engineering	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
3L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: -

1. Understand the different sources of power generation and their impact on environment.
2. Understand the elements of power generation using conventional and non-conventional energy sources.
3. Understand the concepts of electrical systems used in power plants.
4. Apply the basic concepts of thermodynamics to measure the performance of different power plants.
5. Determine the performance of power plants based on load variations.

Unit	Contents	Hours
1	**Hydro-electric power plants** – selection of site, elements of power plant, classification, water turbines, governor action, hydro-electric generator, plant layout, pumped storage plants.	**06**
2	**Thermal Steam power plants** – selection of site, elements and operational circuits of the power plant, turbo- alternators, plant layout, steam turbines, controls and auxiliaries.	**07**
3	**Nuclear power plants –** selection of site, nuclear reaction – fission process and chain reaction, constituents of power plant and layout, nuclear reactor – working, classification, control, shielding and waste disposal.	**07**
4	**Renewable power plants –** Solar power generation – Photo-voltaic and solar thermal generation – solar concentrators, Wind power generation – types of wind mills, wind generators, tidal, biomass, geothermal and magneto-hydro dynamic power generation, micro-hydel power plants, fuel cells and diesel and gas power plants.	**10**
5	**Combined operation of power plants –** plant selection, choice of size and number of generator units, interconnected systems, real and reactive power exchange among interconnected systems. Power plant economics: load curve, different terms and definitions, cost of electrical energy, tariffs methods of electrical energy, performance & operating characteristics of power plants, Economic Load Sharing.	**10**

Suggested Readings / Books

1. Chakrabarti A., Soni M.L., Gupta P.V., and Bhatnagar U.S., 'A text book on Power Systems Engg.', DhanpatRai and Sons, New Delhi, 2nd revised edition, 2010.
2. JB Gupta, „A course in Power Systems", S.K. Kataria and sons, reprint 2010-2011.
3. Power Plant Engineering by Hedge, Pearson India.
4. Power Plant Technology, by Wakil, McGraw Hill.
5. Power Plant Engineering by P.K. Nag, Tata McGraw Hill.

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(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
2nd Year/4thSemester

UELECEE403:Electromagnetic Field Theory	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
3L+1T+0P	**End Term Exams: 3 hrs.**

Course Outcome: -

1. Apply different coordinate systems and their application in electromagnetic field theory, establish a relation between any two systems and also understand the vector calculus.
2. Understand the concept of static electric field. Understand the concept of current and properties of conductors. Establish boundary conditions and to calculate capacitances of different types of capacitors.
3. Understand the concept of static magnetic field, magnetic scalar and vector potential.
4. Understand the forces due to magnetic field, magnetization, magnetic boundary conditions and inductors.
5. Understand displacement current, time varying fields, propagation and reflection of EM waves and transmission lines.

Unit	Contents	Hours
1	**Coordinate Systems and Transformation:** **Basics of Vectors:** Addition, subtraction and multiplications**;** Cartesian, Cylindrical, Spherical transformation. **Vector calculus:** Differential length, area and volume, line surface and volume integrals, Del operator, Gradient, Divergence of a vector, Divergence theorem, Curl of a vector, Stokes theorem, Laplacian of ascalar.	**06**
2	**Electrostatic fields:** Coulombs law and field intensity, Electric field due to charge distribution, Electric flux density, Gausses‟ Law- Maxwell‘s equation, Electric dipole and flux line, Energy density in electrostatic fields, Electric field in material space: Properties of materials, convection and conduction currents, conductors, polarization in dielectrics, Dielectric-constants, Continuity equation and relaxation time, boundary conditions, Electrostatic boundary value problems: Poisson‘s and Laplace‘s equations., Methods ofImages.	**08**

3	**Magneto statics :** Magneto-static fields, Biot – Savart‘s Law, Ampere‘s circuit law, Maxwell‘s equation, Application of ampere‘s law, Magnetic flux density-Maxwell‘s equation, Maxwell‘s equation for static fields, magnetic scalar and vector potential.	**06**
4	**Magnetic forces:** Materials and devices, Forces due to magnetic field, Magnetic torque and moment, a magnetic dipole. Magnetization in materials, Magnetic boundary conditions, Inductors and inductances,Magnetic energy.	**10**
5	**Waves and Applications:** Maxwell‘s equation, Faraday‘s Law, transformer and motional electromotive forces, Displacement current, Maxwell‘s equation in final form Electromagnetic wave propagation: Wave propagation in loss dielectrics, Plane waves in lossless dielectrics Plane wave in free space. Plain waves ingood conductors, Power and the pointing vector, Reflection of a plain wave in a normal incidence. Transmission Lines and Smith Chart.	**10**

Suggested Readings / Books

1. MNO Sadiku, ―Elements of Electromagnetic‟, Oxford University Press.

Department of Electrical Engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
2nd Year/4th Semester

UELECEE404:Electrical Machine-I	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
3L+1T+0P	**End Term Exams: 3 hrs.**

Course Outcome: -

1. Analyze the various principles & concepts involved in Electromechanical Energy conversion.
2. Demonstrate the constructional details of DC machines as well as transformers, and principle of operation of brushless DC motor, Stepper and DC Servo motors.
3. Evaluate the performance and characteristics of DC Machine as motor and as well as generator.
4. Evaluate the performance of transformers, individually and in parallel operation.
5. Demonstrate and perform various connections of three phase transformers.

Unit	Contents	Hours
1	**Principles of Electro-mechanical Energy Conversion**: Introduction, Review of magnetic system, Energy in Magnetic system, Force and torque in magnetic field system, Energy balance equation, Energy conversion via electrical field, Energy in a singly excited system, Determination of the Force and Torque from energy and co-energy, concept of Doubly excited system, Generation of EMF in Machines, Torque in machine with cylindrical air gap.	**08**
2	**DC Machines**: Construction, Classification and circuit model of DC Machines, Armature winding (Concentrated and Distributed), Winding Factor, EMF and torque equations, Armature reaction, Commutation, Inter poles and compensating windings, Performance characteristics of DC generators, Series and Parallel operation of the DC Generator, Applications.	**08**

3	**DC Machines (Contd.)**: Performance characteristics of DC motors, Starting of DC motors; 3 point and 4 point starters, Speed control of DC motors; Field control, Armature control and Voltage control (Ward Leonard method); Efficiency and Testing of DC machines (Hopkinson's and Swinburne's Test), Applications.	**06**
4	**Single Phase Transformer**: Construction, EMF Equation, Equivalent Circuit, Phasor diagram, Efficiency andvoltage regulation, all day efficiency. Testing of Transformers- O.C. and S.C. tests, Polarity test, Sumpner's test, Auto Transformer- Single phase and three phase autotransformers, Volt-amp relation Copper saving in autotransformer Efficiency, Merits & demerits and applications.	**10**
5	**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 of single phase and three phase transformers and load sharing, Three winding transformers, Excitation phenomenon and harmonics in transformers.	**08**

Suggested Readings / Books

1. IJ Nagrath & D.P. Kothari, "Electrical Machines", Tata McGraw Hill
2. Rajendra Prasad , "Electrical Machines", PHI
3. PS Bimbhra, "Electrical Machinery", Khanna Publisher

Department of Electrical Engineering
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2nd Year/4th Semester

UELECEE407:Electrical Machine-I Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Course Outcome: -

1. Analyze and conduct basic tests on DC Machines and single-phase Transformer
2. Obtain the performance indices using standard analytical aswell as graphical methods.
3. Determine the magnetization, Load and speed-torque characteristics of DC Machines.
4. Demonstrate procedures and analysis techniques to perform electromagnetic and electromechanical tests on electrical machines.

Note: Minimum ten experiments are to be performed from the Following list, out of which there shouldbe at least two Software based experiments.

1. To obtain magnetization characteristics of a DC shunt generator.
2. To obtain load characteristics of a DC shunt generator and compound generator
   (a) Cumulatively compounded (b) differentially compounded.
3. To obtain efficiency of a DC shunt machine using Swinburne‘s test.
4. To perform Hopkinson‘s test and determine losses and efficiency of DC machine.
5. To obtain speed-torque characteristics of a DC shunt motor.
6. To obtain speed control of DC shunt motor using (a) armature resistance control
   (b) Field control
7. To obtain speed control of DC separately excited motor using Ward-Leonard.
8. To obtain equivalent circuit, efficiency and voltage regulation of a single phasetransformer using O.C. and S.C. tests.
9. To obtain efficiency and voltage regulation of a single phase transformer by
   Sumpner‘s test.

10. To obtain 3-phase to 2-phase conversion by Scott connection.

11. To determine excitation phenomenon (B.H. loop) of single Phase Transformerusing C.R.O.

12. To demonstrate the parallel operation of three phase

13. Transformer and to obtainthe load sharing at a particular load.

Institute may add any two software based experiments [Develop Computer Program in „C‟ language or use MATLAB or Electrical Domain Simulation Software: ―Virtual HIL Device‖ (Free, Unlimited Users, Full Version) from Typhoon HIL GmbH or Equivalent software] in the above list.

Department of Electrical Engineering
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2nd Year/4th Semester

UNETWEE405:Network Analysis & Synthesis	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
3L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: -

1. Apply the knowledge of basic circuital law, nodal and mesh methods of circuit analysis and simplify the network using Graph Theory approach.
2. Analyze the AC and DC circuits using Kirchhoff's law and Network simplification theorems.
3. Analyze steady-state responses and transient response of DC and AC circuits using classical and Laplace transform methods.
4. Demonstrate the concept of complex frequency and analyze the structure and function of one and two port network. Also evaluate and analysis two-port network parameters.
5. Synthesize one port network and analyze different filters.

Unit	Contents	Hours
1	**Graph Theory**: Importance of Graph Theory in Network Analysis**,** Graph of a network, Definitions, planar & Non Planar Graphs, Isomorphism, Tree, Co Tree, Link, basic loop and basic cut set, Incidence matrix, Cut setmatrix, Tie set matrix, Duality, Loop and Nodal methods of analysis.	**06**
2	**Network Theorems (Applications to dependent & independent sources)**: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem. Millman's theorem, Compensation theorem, Tellegen's Theorem.	**08**
3	**Transient Circuit Analysis**: Natural response and forced response, Transient response and steady state response for arbitrary inputs (DC and AC), Evaluation of time response both through classical and Laplacemethods.	**06**

4	**Network Functions**: Concept of complex frequency, Transform impedances network functions of one port and two port networks, Concept of poles and zeros, Properties of driving point and transfer functions. **Two Port Networks-** Characterization of LTI two port networks; Z, Y, ABCD, A‟B‟C‟D‟, g and h parameters, Reciprocity and symmetry, Inter-relationships between the parameters, Inter-connections oftwo port networks, Ladder and Lattice networks: T & Π representation, terminated two Port networks, Image Impedance.	**10**
	Network Synthesis- Positive real function; definition and properties, Properties of LC, RC and RL driving point functions, Synthesis of LC, RC and RL driving point admittance functions using Foster and Cauer first and second forms. **Filters-** Image parameters and characteristics impedance, Passive and active filter fundamentals; Low pass filters, High pass (constant K type) filters, Introduction to active filters.	**10**

Suggested Readings / Books

1. ME Van Valkenburg, ―Network Analysis‖, Prentice Hall of India.
2. Alexander, Sadiku, ―Fundamentals of Electric Circuits‖, McGraw Hill.
3. D. Roy Choudhary, ―Networks and Systems‖, Wiley Eastern Ltd.
4. CL Wadhwa, ―Network Analysis and Synthesis‖, New Age International Publishers.
5. A. Chakrabarti, ―Circuit Theory‖, DhanpatRai& Co.

Department of Electrical Engineering
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2nd Year/4th Semester

UNETWEE408:Network Analysis & Synthesis Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Note: Minimum ten experiments are to be performed from the following list, out of which there should be at least two software based experiments.

1. Verification of principle of superposition with AC sources.
2. Verification of Thevenin, Norton and Maximum power transfer theorems in AC circuits.
3. Verification of Tellegen'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 damped, critically damped and over damped 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 ofY 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.
10. Verification of parameter properties in inter-connected two port Networks: series, Parallel and cascade. Also study loading effect in Cascade.
11. Determination of frequency response of a Twin – T notch filter.
12. To determine attenuation characteristics of a low pass / high pass active filters.

Department of Electrical Engineering
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2nd Year/4thSemester

UUNIVEE406: Universal Human Values and Professional Ethics	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
3L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: -

1. Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society
2. Distinguish between the Self and the Body; understand the meaning of Harmony in the Self the Co-existence of Self and Body.
3. Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.
4. Understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

Unit	Contents	Hours
1	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education :** Understanding the need, basic guidelines, and process for Value Education, Self-Exploration–what is it? - its content and process; _Natural Acceptance‘ and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.	**08**
2	**Understanding Harmony in the Human Being - Harmony in Myself :** Understanding human being as a co-existence of the sentient _I‘ and the material _Body‘, Understanding the needs of Self (_I‘) and _Body‘ - Sukh and Suvidha, Understanding the Body as an instrument of _I‘ (I being the doer, seer and enjoyer), Understanding the characteristics and activities of _I‘ and harmony in _I‘, Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs ensure Sanyam and Swasthya.	**06**
3	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship:** Understanding harmony in the Family- the basic unit of human interaction , Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal	**10**

	Order (SarvabhaumVyawastha)- from family to world family!.	
4	**Understanding Harmony in the Nature and Existence - Whole existence as Co-existence:** Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.	**06**
5	**Implications of the above Holistic Understanding of Harmony on Professional Ethics:** Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.	**10**

Suggested Readings / Books

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

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2nd Year/4th Semester

USIMUEE409:Simulation-II Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Note: Minimum ten experiments are to be performed from the following list:

1. Design of three phase inverter using R and RL Load.
2. Design of DC to DC converter using R and RL Load.
3. Simulate the response of DC machine using three phase rectifier.
4. Simulate the response of DC machine using PID controller.
5. Simulate the response of Induction machine using three phase inverter.
6. Simulate the response of synchronous machine using three phase inverter.
7. Introduction to fuzzy system toolbox.
8. Speed control of DC machine using fuzzy system.
9. Introduction to neural network toolbox.
10. Load forecasting of power system using neural network
11. Introduction to Genetic Algorithm.
12. Least square curve fitting using Genetic Algorithm.

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2nd Year/4th Semester

UELECEE410: Electrical Instrumentation Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Note: Minimum ten experiments are to be performed from the following list:

1. Measurement of displacement using LVDT.
2. Measurement of load using strain gauge based load cell.
3. Measurement of water level using strain gauge based water level transducer.
4. Measurement of temperature by RTD.
5. Design and Test a signal conditioning circuit for any transducer.
6. Simulate and analyze the frequency domain measurement of electrical signals using spectrum analyzer.
7. Study of PID controllers in flow measurement.
8. Measurement of flow rate by anemometer.
9. Measurement of solar energy using sensor.
10. Implementation of Color Sensor for differentiating frequencies.
11. Determine rotational speed and angle of a motor shaft using Encoder.
12. Range finding and object detection using detection sensor.
13. Measurement using various sensors and analyzing the output using Lab- VIEW software.Design a circuit for noise reduction in measurement system.