Faculty of Engineering & Technology
Radha Govind University
Sambhal (UP)

Evaluation Scheme & Syllabus for

B.Tech. First Year

(I & II SEM)

(Common for All Branches Except Agriculture Engineering)

(Effective from session 2025-26)

EVALUATION SCHEME
B.TECH ALL BRANCHES EXCEPT AGRICULTURE ENGINEERING

STUDY AND EVALUATION SCHEME FOR B.TECH ALL BRANCHES EXCEPT AGRICULTURE ENGG.

YEAR1st/SEMESTER-I

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	Tot	Th	Pr	Tot	
UENGIAL 101	ENGINEERING MATHEMATICS-I	3	1	0	4	30	-	30	70	-	70	100
UENGIAL 102	ENGINEERING PHYSICS-I	3	1	0	4	30	-	30	70	-	70	100
UENGIAL103	ENGINEERING CHEMISTRY	3	1	0	4	30	-	30	70	-	70	100
UBASICAL104	BASIC ELECTRICAL ENGINEERING	3	1	0	4	30	-	30	70	-	70	100
UCOMPAL105	COMPUTER SYSTEM & PROGRAMMING IN C	3	0	0	3	30	-	30	70	-	70	100
UENGIAL106	ENGINEERING PHYSICS-I LAB	0	0	2	1	-	25	25	-	25	25	50
UENGIAL107	ENGINEERING CHEMISTRY LAB	0	0	2	1	-	25	25	-	25	25	50
UBASIAL108	BASIC ELECTRICAL ENGINEERING LAB	0	0	2	1	-	25	25	-	25	25	50
UCOMPAL109	COMPUTER SYSTEM & PROGRAMMING IN C LAB	0	0	2	1	-	25	25	-	25	25	50
Total		15	4	8	23	150	100	250	350	100	450	700

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B.Tech. I Year I Semester

L	T	P
3	1	0

UENGIAL101: ENGINEERING MATHEMATICS – I

Unit - 1: Differential Calculus – I

Successive Differentiation, Leibnitz‟s theorem, Limit , Continuity and Differentiability of functions of several variables, Partial derivatives, Euler‟s theorem for homogeneous functions, Total derivatives, Change of variables, Curve tracing: Cartesian and Polar coordinates.

Unit - 2: Differential Calculus - II

Taylor‟s and Maclaurin‟s Theorem, Expansion of function of several variables, Jacobian, Approximation of errors, Extreme of functions of several variables, Lagrange‟s method of multipliers (Simple applications).

Unit - 3: Matrix Algebra

Types of Matrices, Inverse of a matrix by elementary transformations, Rank of a matrix (Echelon & Normal form), Linear dependence, Consistency of linear system of equations and their solution, Characteristic equation, Eigen values and Eigen vectors, Cayley-Hamilton Theorem, Diagonalization, Complex and Unitary Matrices and its properties

Unit - 4: Multiple Integrals

Double and triple integrals, Change of order of integration, Change of variables, Application of integration to lengths, Surface areas and Volumes – Cartesian and Polar coordinates. Beta and Gamma functions, Dirichlet‟s integral and its applications.

Unit - 5: Vector Calculus

Point function, Gradient, Divergence and Curl of a vector and their physical interpretations, Vector identities, Tangent and Normal, Directional derivatives. Line, Surface and Volume integrals, Applications of Green‟s, Stokes and Gauss divergence theorems (without proof).

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics,John-Wiley & Sons
2. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw- Hill Publishing Company Ltd.
3. R.K.Jain&S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publishing House.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Peter V. O‟ Neil, Advanced Engineering Mathematics, Thomas (Cengage) Learning.
3. Thomas & Finley, Calculus, Narosa Publishing House
4. Rukmanadachari, Engineering Mathematics – I, Pearson Education.

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L	T	P
3	1	0

UENGIAL102: ENGINEERING PHYSICS-I

Unit – I: Relativistic Mechanics

Inertial & non-inertial frames, Galilean transformations, Michelson-Morley experiment, Einstein‟s postulates, Lorentz transformation equations, Length contraction & Time dilation, Relativistic addition of velocities; Variation of mass with velocity, Mass energy equivalence, Concept of rest mass of photon.

Unit – II: Modern Physics: Black body radiation spectrum, Weins law and Rayleigh-Jeans law, Assumption of quantum theory of radiation, Planck‟s law. Wave-particle duality, de-Broglie matter waves, Bohr‟s quantization rule, Phase and Group velocities, Davisson-Germer experiment, Heisenberg uncertainty principle and its applications, Wave function and its significance, Schrödinger‟s wave equation (Time dependent and time independent) – particle in one dimensional potential box, Eigen values and Eigen function.

Unit – III: Wave Optics: Interference: Coherent sources, Interference in thin films (parallel and wedge shaped film), Newton‟s rings and its applications..

Diffraction: Single, double and N- Slit Diffraction, Diffraction grating, Grating spectra, dispersive power, Rayleigh‟s criterion and resolving power of grating.

Unit – IV: Polarization and Laser

Polarization: Phenomena of double refraction, Nicol prism, Production and analysis of plane, circular
and elliptical polarized light, Retardation Plate, Optical Activity, Fresnel‟s theory, Specific rotation. **Laser:** Spontaneous and stimulated emission of radiation, population inversion, Einstein‟s Coefficients, Concept of 3 and 4 level Laser, Construction and working of Ruby, He-Ne lasers and laser applications. **Unit – V: Fiber Optics and Holography : Fiber Optics:** Fundamental ideas about optical fiber, Propagation mechanism, Acceptance angle and cone, Numerical aperture, Single and Multi Mode Fibers, Dispersion and Attenuation.

Holography: Basic Principle of Holography, Construction and reconstruction of Image on hologram and applications of holography.

Reference Books:

1. Concepts of Modern Physics - AurthurBeiser (Mc-Graw Hill)
2. Introduction to Special Theory of Relativity- Robert Resnick (Wielly)
3. Optics –AjoyGhatak(Tata McGraw Hill Education Private Ltd. New Delhi)
4. Optics - Brijlal& Subramanian (S. Chand)
5. Engineering Physics- C. Mani Naidu(Pearson)
6. Lasers Principles, Types and Applications- K R Nambiar (New Age)

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L	T	P
3	1	0

UENGIAL103: ENGINEERING CHEMISTRY

Unit-1 Molecular orbital theory and its applications to homo-nuclear diatomic molecules. Band theory of solids. Liquid crystals and its applications. Point defects in Solids. Structure and applications of Graphite and Fullerenes. Concepts of nano-materials and its applications

Unit-2 Polymers: Basic concepts of polymer- blends and composites. Conducting and biodegradablepolymers. Preparations and applications of some industrially important polymers(Buna N, Buna S, Neoprene, Nylon 6, Nylon 6,6 , Terylene). General methods of synthesis of organometallic compound (Grignard Reagent) and their applications in polymerization.

Unit-3 Electrochemistry: Galvanic cell, electrode potential, Lead storage battery. Corrosion, causes and its prevention. Setting and hardening of cement, applications of cement. Plaster of paris. Lubricants- Classification, mechanism and applications..

Unit-4 Hardness of water. Disadvantage of hard water. Boiler troubles, Techniques for water softening; Lime-soda, Zeolite, Ion exchange resin, Reverse osmosis. Phase Rule and its application to water system.

Unit-5 Fuels; Classification of fuels. Analysis of Coal. Determination of Calorific values (bomb calorimeter &Dulong‟s method). Biogas. Elementary ideas and simple applications of UV, Visible, IR and H1NMR spectral Techniques.

Textbook

1. Chemistry for Engineers, by S. Vairam and Suba Ramesh; Wiley India

Reference Books

1. Textbook of Engineering Chemistry by Dr. Gopal Krishna Bhatt, Acme Publishers
2. Chemistry (9th ed), by Raymond Chang, Tata McGraw-Hill
3. Chemistry Concepts and Applications by Steven S. Zumdahl; Cengage Learning
4. Engineering Chemistry, Wiley India
5. Engineering Chemistry Author: AbhijitMallick, Viva Books
6. Text Book of Engineering Chemistry by Harsh Malhotra; Sonali Publications
7. Concise Inorganic Chemistry by J.D. Lee; Wiley India
8. Organic Chemistry (6 ed) by Morrison & Boyd; Pearson Education
9. Physical Chemistry by Gordon M. Barrow; Mc-Graw Hill
10. Organic Chemistry, Volume 1(6 ed)& 2 (5ed) by I. L. Finar; Pearson Education

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L	T	P
3	1	0

B.Tech. I Year I Semester

UBASIAL104:BASIC ELECTRICAL ENGINEERING

DETAILED SYLLABUS

Unit-I : Electrical Circuit Analysis:
Introduction, Circuit Concepts: Concepts of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements, Source transformation, Kirchhoff‟s laws, Loop and nodal methods of analysis, Star-delta transformation,
AC fundamentals: Sinusoidal, square and triangular waveforms – Average and effective values, Form and peak factors, Concept of phasors, phasor representation of sinusoidally varying voltage and current.

Unit-II: Steady- State Analysis of Single Phase AC Circuits:
Analysis of series and parallel RLC Circuits, Concept of Resonance in series & parallel circuits, bandwidth and quality factor; Apparent, active & reactive powers, Power factor, Concept of power factor improvement and its improvement (Simple numerical problems)
Network theorems (AC & DC with independent sources): Superposition theorem, Thevenin‟s theorem, Norton‟s theorem, Maximum Power Transfer theorem (Simple numerical problems)

Unit-III : Three Phase AC Circuits:
Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, Three-phase power and its measurement (simple numerical problems).
Measuring Instruments: Types of instruments, Construction and working principles of PMMC and moving iron type voltmeters & ammeters, Single phase dynamometer wattmeter, Use of shunts and multipliers (Simple numerical problems on shunts and multipliers)

Unit-IV: Magnetic Circuit:
Magnetic circuit concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis and eddy current losses, Magnetic circuit calculations (Series & Parallel).
Single Phase Transformer: Principle of operation, Construction, EMF equation, Equivalent circuit, Power losses, Efficiency (Simple numerical problems), Introduction to auto transformer.

Unit-V: Electrical Machines:

DC machines: Principle & Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems)

Three Phase Induction Motor: Principle & Construction, Types, Slip-torque characteristics, Applications (Numerical problems related to slip only)

Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications.

Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications.

Text Books:

1 ."Basic Electrical Engineering", S N Singh; Prentice Hall International

2. "Basic Electrical Engineering", KuldeepSahay, New Age International Publishers 3."Fundamentals of Electrical Engineering", B Dwivedi, A Tripathi; Wiley India 4."Principles of Electrical Engineering", V. Del Toro,; Prentice Hall International

5. "Electrical Engineering", J. B. Gupta, Kataria and Sons

Reference Books:

1."Electrical and Electronics Technology", Edward Hughes; Pearson

2."Engineering Circuit Analysis", W.H. Hayt&J.E. Kimerly; McGraw Hill

3."Basic Electrical Engineering", C L Wadhwa; New Age International

4."Basic Electrical Engineering", T.K. Nagsarkar,M.S. Shukhija; Oxford University Press

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3	0	0

B.Tech. I Year I Semester

UCOMPAL105: COMPUTER SYSTEM AND PROGRAMMING IN C

Unit1:
Basics of Computer: Introduction to digital computer, basic operations of computer, functional components of computer, Classification of computers.
Introduction to operating system: [DOS, Windows, Linux and Android] purpose, function, services and types.
Number system: Binary, octal and hexadecimal number systems, their mutual conversions, Binary arithmetic.
Basics of programming: Approaches to Problem Solving, Concept of algorithm and flow charts, Types of computer languages:- Machine Language, Assembly Language and High Level Language, Concept of Assembler, Compiler, Loader and Linker.

Unit2:
Standard I/O in "C", **Fundamental data types-** Character type, integer, short, long, unsigned, single and double floating point, Storage classes- automatic, register, static and external, Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bit operations, assignment operator, operator precedence and associatively.
Fundamentals of C programming: Structure of C program, writing and executing the first C program, Components of C language. Standard I/O in C.

Unit3:
Conditional program execution: Applying if and switch statements, nesting if and else, use of break and default with switch, program loops and iterations: use of while, do while and for loops, multiple loop variables, use of break and continue statements.
Functions: Introduction, types of functions, functions with array, passing values to functions, recursive functions.

Unit 4:
Arrays: Array notation and representation, manipulating array elements, using multi dimensional arrays. Structure, union, enumerated data types

Unit 5:
Pointers: Introduction, declaration, applications File handling, standard C preprocessors, defining and calling macros, conditional compilation, passing values to the compiler.

Reference:

1. The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education .
2. Computer Basics and C Programming by V.Rajaraman , PHI Learning Pvt. Limited – 2015.
3. Programming in C by Kochan Stephen G. Pearson Education – 2015.
4. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New Age International Publication .
5. Computer Concepts and Programming in C by Vikas Gupta, Wiley India Publication
6. Computer Fundamentals and Programming in C. ReemaThareja, Oxford Publication
7. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill
8. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning - 2007.
9. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson Addison- Wesley, 2006.
10. Computer Concepts and Programming by Anami, Angadi and Manvi, PHI Publication
11. Computer Fundamental and C programming by K K Gupta, Acme Learning Publication

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L	T	P
0	0	2

UENGIAL106:ENGINEERING PHYSICS LAB

List of Experiments

Any ten experiments, at least four from each group:

Group -A

1. To determine the wavelength of monochromatic light by Newton‟s ring.
2. To determine the wavelength of monochromatic light with the help of Fresnel‟s biprism.
3. To determine the focal length of two lenses by nodal slide and locate the position of cardinalpoints.
4. To determine the specific rotation of cane sugar solution using polarimeter.
5. To determine the wavelength of spectral lines using plane transmission grating.
6. To study the polarization of light by simple reflection using laser.
7. Measurement of Wavelength of a laser (He-Ne) light using single slit diffraction.

Group – B

8. To determine the specific resistance of a given wire using Carey Foster‟s bridge.
9. To study the variation of magnetic field along the axis of current carrying - Circular coil and then to estimate the radius of the coil.
10. To verify Stefan‟s Law by electrical method.
11. To calibrate the given ammeter and voltmeter by potentiometer.
12. To study the Hall effect and determine Hall coefficient, carrier density and - mobility of a given semiconductor using Hall effect set up.
13. To determine the energy band gap of a given semiconductor material.
14. To determine E.C.E. of copper using Tangent or Helmholtz galvanometer.
15. To draw hysteresis curve of a given sample of ferromagnetic material and from - this to determine magnetic susceptibility and permeability of the given specimen.
16. To determine the ballistic constant of a ballistic galvanometer.
17. To determine the coefficient of viscosity of a liquid.
18. Measurement of fiber attenuation and aperture of fiber.
19. High resistance by leakage method.
20. Magnetic Susceptibility of paramagnetic solution.

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0	0	2

UENGIAL107: ENGINEERING CHEMISTRY LAB

LIST OF EXPERIMENTS

1. Determination of alkalinity in the given water sample.
2. Determination of temporary and permanent hardness in water sample using EDTA .
3. Determination of available chlorine in bleaching powder.
4. Determination of chloride content in water sample.
5. Determination of iron content in the given solution by Mohr‟s method.
6. pH- metric titration.
7. Viscosity of an addition polymer like polyester by viscometer.
8. Determination of iron concentration in sample of water by colorimetric method.
   The method involves the use of KCN as a chelating agent and the measurements are carried out at 480nm.
9. Element detection and functional group identification in organic compounds.
10. Preparation of Bakelite and Urea formaldehyde resin.

Note: Institute can replace two experiments from the aforesaid experiments as per

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L	T	P
0	0	2

UBASIAL108:BASIC ELECTRICAL ENGINEERING LAB

LIST OF EXPERIMENTS

Note: A minimum of ten experiments from the following should be performed

1. Verification of Kirchhoff‟s laws
2. Verification of Superposition theorem
3. Verification of Thevenin‟s Theorem and Maximum Power Transfer Theorem.
4. Measurement of power and power factor in a single phase ac series inductive circuit and study improvement of power factor using capacitor
5. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
6. Connection and measurement of power consumption of a fluorescent lamp (tube light).
7. Measurement of power in 3- phase circuit by two wattmeter method and determination of its power factor for star as well as delta connected load.
8. Determination of parameters of ac single phase series RLC circuit
9. To observe the B-H loop of a ferromagnetic material in CRO.
10. Determination of (i) Voltage ratio (ii) polarity and (iii) efficiency by load test of a single phase transformer
11. Determination of efficiency of a dc shunt motor by load test
12. To study running and speed reversal of a three phase induction motor and record speed in both directions.

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L	T	P
0	0	2

UCOMPAL109:COMPUTER SYSTEM & PROGRAMMING IN C LAB

1. WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained by the student.
2. WAP that calculates the Simple Interest and Compound Interest. The Principal , Amount, Rate of Interest and Time are entered through the keyboard.
3. WAP to calculate the area and circumference of a circle.
4. WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formula C/5=(F-32)/9.
5. WAP that swaps values of two variables using a third variable.
6. WAP that checks whether the two numbers entered by the user are equal or not.
7. WAP to find the greatest of three numbers.
8. WAP that finds whether a given number is even or odd.
9. WAP that tells whether a given year is a leap year or not.
10. WAP that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:

    Between 90-100% ---------- Print „A"

    80-90%----------Print „B"

    60-80%----------Print „C"

    Below 60% ---------- Print „D"
11. WAP that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement.
12. WAP to print the sum of all numbers up to a given number.
13. WAP to find the factorial of a given number.
14. WAP to print sum of even and odd numbers from 1 to N numbers.
15. WAP to print the Fibonacci series.
16. WAP to check whether the entered number is prime or not.
17. WAP to find the sum of digits of the entered number.
18. WAP to find the reverse of a number.
19. WAP to print Armstrong numbers from 1 to 100.
20. WAP to convert binary number into decimal number and vice versa.

21. WAP that simply takes elements of the array from the user and finds the sum of these elements.
23. WAP to find the minimum and maximum element of the array.
24. WAP to search an element in a array using Linear Search.
25. WAP to sort the elements of the array inascending order using Bubble Sort technique.
26. WAP to add and multiply two matrices of order nxn.
27. WAP that finds the sum of diagonal elements of a mxn matrix.
28. WAP to implement strlen (), strcat (),strcpy () using the concept of Functions.
29. Define a structure data type TRAIN_INFO. The type contain Train No.: integer type Train name: string Departure Time: aggregate type TIME Arrival Time : aggregate type TIME Start station: string End station : string The structure type Time contains two integer members: hour and minute. Maintain a train timetable and implement the following operations:
(i) List all the trains (sorted according to train number) that depart from a particular section.
(ii) List all the trains that depart from a particular station at a particular time.
(iii) List all he trains that depart from a particular station within the next one hour of a given time.
(iv) List all the trains between a pair of start station and end station.

30. WAP to swap two elements using the concept of pointers.
31. WAP to compare the contents of two files and determine whether they are same or not.
32. WAP to check whether a given word exists in a file or not. If yes then find the number of times it occurs.

EVALUATION SCHEME
B.TECH ALL BRANCHES

STUDY AND EVALUATION SCHEME FOR B.TECH ALL BRANCHES

YEAR1st/SEMESTER-II

SUBJECTCODE	SUBJECTSNAME	STUDYSCHEME Periods/Week			Credits	MARKSINEVALUATIONSCHEME						Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	
UENGIAL201	ENGINEERING MATHEMATICS-II	3	1	0	4	30	-	30	70	-	70	100
UENGIAL202	ENGINEERING PHYSICS-II	3	1	0	4	30	-	30	70	-	70	100
UELEMAL203	ELEMENTS OF MECHANICAL ENGG	3	1	0	4	30	-	30	70	-	70	100
UPROFAL204	PROFESSIONAL COMMUNICATION	3	0	0	3	30	-	30	70	-	70	100
UBASIAL205	BASIC ELECTRONICS	3	0	0	3	30	-	30	70	-	70	100
UENGIAL206	ENGINEERING PHYSICS-II LAB	0	0	2	1	-	25	25	-	25	25	50
UELEMAL207	ELEMENTS OF MECHANICAL ENGG LAB	0	0	2	1	-	25	25	-	25	25	50
UPROFAL208	PROFESSIONAL COMMUNICATION LAB	0	0	2	1	-	25	25	-	25	25	50
Total		15	3	6	21	150	75	225	350	75	425	650

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L	T	P
3	1	0

UENGIAL201:ENGINEERING MATHEMATICS – II

Unit - 1: Ordinary Differential Equations

Linear differential equations of *n*th order with constant coefficients, Complementary function and Particular integral, Simultaneous linear differential equations, Solution of second order differential equations by changing dependent & independent variables, Method of variation of parameters, Applications to engineering problems (without derivation).

Unit - 2: Series Solution and Special Functions

Series solution of second order ordinary differential equations with variable coefficient (Frobenius method), Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials.

Unit - 3: Laplace Transform

Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac- delta function, Laplace transform of periodic function, Inverse Laplace transform, Convolution theorem, Application to solve simple linear and simultaneous differential equations.

Unit - 4: Fourier Series and Partial Differential Equations

Periodic functions, Dirichlet‟s Conditions, Fourier series of arbitrary periods, Euler‟s Formulae, Even and odd functions, Half range sine and cosine series, Gibbs Phenomena.

Solution of first order Lagrange‟s linear partial differential equations, Second order linear partial differential equations with constant coefficients.

Unit - 5: Applications of Partial Differential Equations

Classification of second order partial differential equations, Method of separation of variables for solving partial differential equations, Solution of one and two dimensional wave and heat conduction equations, Laplace equation in two dimension, Equation of transmission lines.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw- Hill Publishing Company Ltd.
3. R.K.Jain&S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publishing House.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Peter V. O‟ Neil, Advanced Engineering Mathematics, Thomas (Cengage) Learning.
3. Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudranalaya
4. A. C. Srivastava& P. K. Srivastava, Engineering Mathematics, Vol. – II, PHI Learning Pvt. Ltd.
5. Rukmangadachari, Engineering Mathematics – II, Pearson Education.

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L	T	P
3	1	0

UENGIAL202:ENGINEERING PHYSICS- II

Unit – I: Crystal Structures and X-ray Diffraction

Space lattice, basis, Unit cell, Lattice parameter, Seven crystal systems and Fourteen Bravais lattices, Co-ordination number, Atomic radius and Packing factor of different cubic structures, Crystal structure of NaCl and diamond, Lattice planes and Miller Indices, Diffraction of X-rays by crystal, Laue‟s experiment, Bragg‟s Law, Bragg‟s spectrometer. Compton Effect.

Unit – II: Dielectric and Magnetic Properties of Materials

Dielectric Properties: Dielectric constant and Polarization of dielectric materials, Relation between E, D and P, Types of Polarization (Polarizability). Equation of internal fields in liquid and solid (One-Dimensional), Claussius-Mossotti equation, Frequency dependence of dielectric constant, Dielectric Losses, Important applications of dielectric material, Ferroelectricity, Piezoelectricity.

Magnetic Properties: Magnetization, Origin of magnetic moment, Dia, para and ferro magnetism, Langevin‟s theory for diamagnetic material, Phenomena of hysteresis and its applications.

Unit – III: Electromagnetic Theory

Equation of continuity, Maxwell‟s Equations (Integral and Differential Forms) and its derivations, Displacement Current, Poynting vector and Poynting theorem, EM - Wave equation and its propagation characteristics in free space, non-conducting and conducting media, energy density of electromagnetic wave, Skin depth.

Unit – IV: Band Theory of Solids

Free electron Theory, Formation of bands in Solids, Classification of solids on band theory, Density of states, Fermi-Dirac distribution, Concept of effective mass, Charge carrier density (electrons and holes), Conductivity of semiconductors, carrier concentrations Fermi energy, Position of Fermi level in intrinsic and in extrinsic semiconductors. Temperature dependence of conductivity in semiconductors.

Unit – V: Physics of some technologically important Materials

Superconductors: Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Temperature dependence of critical field, London equations, Josephson theory, persistent currents, Type I and Type II superconductors, BCS theory (Qualitative), High temperature superconductors and Applications of Super-conductors.

Nano-Materials: Basic principle of nanoscience and technology, structure, properties and uses of Fullerene, Carbon nanotubes Single and double walled nanotubes, synthesis of nanotubes, Properties and Applications of nano tubes.

Reference books:

1. Concept of Modern Physics - by Beiser (Tata Mc-Graw Hill)
2. Solid State Physics - by C. Kittel, 7th edition (Wiley Eastern)
3. Materials Science and Engineering - by V. Raghavan (Prentice- Hall India)
4. Solid State Physics - by S.O. Pillai, 5th edition (New Age International)
5. Introduction to Electrodynamics - by David J. Griffith (PH I)
6. Engineering Physics- C. Mani Naidu(Pearson)
7. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New D

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L	T	P
3	1	0

UPROFAL203:ELEMENTS OF MECHANICAL ENGINEERING

UNIT-I:

Force System: Force, Parallelogram Law, Lami‟s theorem, Principle of Transmissibility of forces. Moment of a force, Couple, Varignon‟s theorem, Resolution of a force into a force and a couple. Resultant of coplanar force system. Equilibrium of coplanar force system, Free body diagrams, Determination of reactions.

Concept of Centre of Gravity and Centroid and Area Moment of Inertia, Perpendicular axis theorem and Parallel axis theorem

UNIT-II:

Plane Truss: Perfect and imperfect truss, Assumptions and Analysis of Plane Truss by Method of joints and Method of section.

Beams: Types of beams, Statically Determinate Beams, Shear force and bending moment in beams, Shear force and bending moment diagrams, Relationships between load, shear and bending moment.

UNIT-III:

Simple stress and strain: Normal and shear stresses. One Dimensional Loading; members of varying cross section, bars in series. Tensile Test diagram for ductile and brittle materials, Elastic constants, Strain energy.

Bending (Flexural) Stresses: theory of pure bending, neutral surface and neutral axis, stresses in beams of different cross sections.

Engineering Materials: Importance of engineering materials, classification, mechanical properties and applications of Ferrous, Nonferrous and composite materials.

UNI-IV:

Basic Concepts and Definitions of Thermodynamics: Introduction and definition of thermodynamics, Microscopic and Macroscopic approaches, System, surrounding and universe, Concept of continuum, Thermodynamic equilibrium, Thermodynamic properties, path, process and cycle, Quasi static process, Energy and its forms, Work and heat. Thermodynamic definition of work. **Zeroth law of thermodynamics:** Temperature and its‟ measurement.

First law of thermodynamics: First law of thermodynamics, Internal energy and enthalpy. First law analysis for non-flow processes. Non-flow work Steady flow energy equation; Boilers, Condensers, Turbine, Throttling process, Pumps etc.

UNIT-V:

Second law: Thermal reservoir, Kelvin Planck statement, Heat engines, Efficiency; Clausius‟ statement Heat pump, refrigerator, Coefficient of Performance. Carnot cycle, Carnot theorem and it‟s corollaries.Clausius inequality, Concept of Entropy.

Properties of pure substances: P-v, T-s and h-s diagram, dryness fraction and steam tables. Rankine Cycle.

Internal Combustion Engines: Classification of I.C. Engines and their parts, working principle and comparison between 2 Stroke and 4 stroke engine , difference between SI and CI engines. P-v and T-s diagrams of Otto and Diesel cycles, comparison of efficiency.

Books & References:

1. Engineering Mechanics: Statics by J.LMeriam , Wiley
2. Engineering Mechanics : Statics and Dynamics by R. C. Hibbler, Pearson
3. Strength of Materials by Thimoshenko& Young
4. Mechanics of Solid by R. C. Hibbler, Pearson
5. Engineering Thermodynamics by P.K.Nag, McGraw Hill
6. Thermodynamics An Engineering Approach by Cengel& Boles, McGraw Hill
7. Engineering Thermodynamics by P. Chattopadhyay, OXFORD Publication
8. Internal Combustion Engine by V Ganesan, McGraw Hill Pub .
9. An Introduction to Mechanical Engineering by Wickert& Lewis, Cengage Learning
10. Engineering Mechanics By S. S. Bhavikatti, K. G. Rajashekarappa, New Age International
11. Engineering Mechanics by R K Bansal, Laxmi Publications
12. Fundamentals of Mechanical Engineering by Sawhney, PHI
13. Basic Mechanical Engineering by Pravin Kumar, Pearson

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B.Tech. I Year II Semester

UPROFAL204:PROFESSIONAL COMMUNICATION

Unit-1 Fundamentals of Communications	Technical Communication: features: Distinction between General And Technical Communication; Language as a tool of communications; Levels of communication: Interpersonal, Organizational, Mass communication; The flow of communication: Downward, Upward, Lateral/Horizontal (Peer group) : Importance of technical communication; Barriers to Communication.
Unit-II Written Communication	Words and Phrases: Word formation, Synonyms and Antonyms; Homophones; Select vocabulary of about 500-1000 New words; correct Usage: all Parts of Speech; Modals; Concord; Articles; Infinitives; Transformation of sentences; Requisites f Sentence Construction: Paragraph Development: Techniques and Methods- Inductive, Deductive, Spatial , Linear, Chronological etc.
Unit-III Business Communication	Principles, Sales & Credit letters; Claim and Adjustment Letters; Job Application and Resumes. Reports: Types; Significance; Structure, Style & Writing of Reports. Technical Proposal; Parts; Types; Writing of Proposal; Significance; Negotiation skills.
Unit-IV Presentation Strategies and Soft Skills.	Nuances and Modes of Delivery; Body Language; Dimensions of Speech: Syllable; Accent; Pitch; Rhythm; Intonation; Paralinguistic features of voice; Interpersonal communication: Definition; Types; Team work; Attitude; Way to improve Attitude Listening Skills : Types; Methods for improving Listening Skills.
Unit –V Value- Based	Following essays from the prescribed text book with emphasis on Mechanics of writing.

Text Readings

(i) Humanistic and Scientific Approaches to Human Activity by Moody E. Prior
(ii) The Language of Literature and Science by A. Huxley
(iii) Man and Nature by J. Bronowski
(iv) Science and Survival by Barry Commoner
(v) The Mother of the Sciences by A.J. Bahm.

Text Book

1. Improve your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
2. Technical Communication- Principles and Practices by Meenakshi Raman &Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi.
3. Functional skills in Language and Literature, by R.P. Singh, Oxford Univ. Press, 2005, New Delhi.

Reference Books

1. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi.
2. Business Correspondence and Report Writing by Prof. R.C.,Sharma& Krishna Mohan, Tata McGraw Hill & Co. Ltd. , 2001, New Delhi.
3. Word Power Made Easy by Norman Lewis, W.R. Goyal Pub. & Distributors, 2009, Delhi.

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B.Tech. I Year II Semester

UBASIAL205:BASIC ELECTRONICS

Unit I PNP-N junction diode: Introduction of Semiconductor Materials Semiconductor Diode: Depletion layer, V-I characteristics, ideal and practical, diode resistance, capacitance, Diode Equivalent Circuits, Transition and Diffusion Capacitance, Zener Diodes breakdown mechanism (Zener and avalanche) Diode Application: Series , Parallel and Series, Parallel Diode Configuration, Half and Full Wave rectification, Clippers, Clampers, Zener diode as shunt regulator, Voltage-Multiplier Circuits Special Purpose two terminal Devices :Light-Emitting Diodes, Varactor (Varicap) Diodes, Tunnel Diodes, Liquid-Crystal Displays.

Unit-II Bipolar Junction Transistors and Field Effect Transistor: Bipolar Junction Transistor: Transistor Construction, Operation, Amplification action. Common Base, Common Emitter, Common Collector Configuration DC Biasing BJTs: Operating Point, Fixed-Bias, Emitter Bias, Voltage-Divider Bias Configuration. Collector Feedback, Emitter-Follower Configuration. Bias Stabilization. CE, CB, CC amplifiers and AC analysis of single stage CE amplifier (re Model). Field Effect Transistor: Construction and Characteristic of JFETs. AC analysis of CS amplifier, MOSFET (Depletion and Enhancement)Type, Transfer Characteristic,

Unit- III Operational Amplifiers : Introduction and Block diagram of Op Amp, Ideal & Practical characteristics of Op Amp, Differential amplifier circuits, Practical Op-Amp Circuits (Inverting Amplifier, Non inverting Amplifier, Unity Gain Amplifier, Summing Amplifier, Integrator, Differentiator).

OPAMP Parameters: Input offset voltage, Output offset voltage, Input biased current, Input offset current Differential and Common-Mode Operation

Unit- IV Electronic Instrumentation and Measurements: Digital Voltmeter : Introduction, RAMP Techniques Digital Multimeters: Introduction Oscilloscope: Introduction, Basic Principle, CRT , Block Diagram of Oscilloscope, Simple CRO, Measurement of voltage, current phase and frequency using CRO, Introduction of Digital Storage Oscilloscope and Comparison of DSO with Analog Oscilloscope.

Unit- V Fundamentals of Communication Engineering: Elements of a Communication System, Need of Modulation, Electromagnetic spectrum and typical applications. Basics of Signal Representation and Analysis, Introduction of various analog modulation techniques, Fundamentals of amplitude modulation, Modulation and Demodulation Techniques of AM.

Text Books:

1. Robert L. Boylestand / Louis Nashelsky*"Electronic Devices and Circuit Theory*", Latest Edition, Pearson Education.
2. H S Kalsi, "Electronic Instrumentation", Latest Edition, TMH Publication,.
3. George Kennedy, "Electronic Communication Systems", Latest Edition, TMH,

Reference Books:

1. David A. Bell, "*Electronic Devices and Circuits",* Latest Edition, Oxford University Press.
2. Jacob Millman, C.C. Halkias, StayabrataJit, "*Electronic Devices and Circuits*", Latest Edition ,TMH.
3. David A. Bell, Electronic Instrumentation and Measurements, Latest Edition, Oxford University Press India.

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B.Tech. I Year II Semester

L	T	P
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UENGIAL206
ENGINEERING PHYSICS- II LAB

1. To determine the energy band gap of a given semiconductor material.
2. To study Hall effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material using Hall effect setup.
3. To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
4. To verify Stefan's law by electric method.
5. To determine resistance per unit length and specific resistance of a given resistance using Carey Foster's Bridge.
6. To study the resonance condition of a series LCR circuit.
7. To determine the electrochemical equivalent (ECE) of copper.
8. To calibrate the given ammeter and voltmeter by potentiometer.
9. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.
10. To measure high resistance by leakage method.

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UELEMAL207:ELEMENTS OF MECHANICAL ENGINEERING LAB

Note: Any 10 experiments (Minimum of 3 from each module) are to be

conducted. Module 1:

1. To conduct the tensile test and determine the ultimate tensile strength, percentage elongation for a mild steel specimen.
2. To conduct the Impact-tests (Izod / Charpy) on Impact-testing machine to find the Impact Strength of the specimen.
3. To determine the hardness of the given specimen using Vicker/Brinell/Rockwell hardness testing machine.
4. To conduct experiment on Torsion of Rod/wire.

Module 2:

1. To Study the working of 2 stroke Diesel/Petrol engine.
2. To Study and working of 4 stroke Petrol/Diesel engine.
3. To Study the model of Babcock and Wilcox and Lancashire boiler.
4. To Study various types of Mounting and Accessories of Boilers.

Module 3:

1. To verify the parallelogram, and Triangle law.
2. To verify the polygon law of force.
3. To determine the coefficient of friction on inclined surface.
4. To determine the efficiency and Mechanical Advantage of Worm & Worm-wheel.
5. To conduct experiment on Force Analysis on simple truss and Jib-crane Apparatus.
6. To conduce friction experiment on screw-jack.

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UPROFAL208:PROFESSIONAL COMMUNICATION LAB :

LABORATORY PRACTICALS

Interactive and Communicative Practical with emphasis on Oral Presentation/Spoken Communication based on International Phonetic Alphabets (I.P.A)

LIST OF PRACTICAL'S

1. Group Discussion: Practical based on Accurate and Current Grammatical Patterns.
2. Conversational skills for Interviews under suitable Professional Communication Lab conditions with emphasis on Kinesics.
3. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistics / Kinesics.
4. Presentation Skills of Technical Paper/Project Reports/Professional Reports based on proper Stress and Intonation Mechanics.
5. Official /Public Speaking based on Rhythmic Patterns.
6. Theme-Presentation /Key-Note Presentation based on correct argumentation methodologies.
7. Individual Speech Delivery/Conferences with skills to defend Interjections/Quizzes.
8. Argumentative Skills/Role Play Presentation with Stress and Intonation.
9. Comprehensions Skills based on Reading and Listening Practical on a model Audio-Visual Usage.

Reference Books

1. BansalR.K.& Harrison: Phonetics in English, Orient Longman , New Delhi.
2. Sethi&Dhamija: A Course in Phonetics and Spoken English, Prentice Hall, New Delhi.
3. L.U.B. Pandey&R.P.Singh, A Manual of Practical Communication, A.I.T.B.S. Pub. India Ltd. Krishan Nagar, Delhi.
4. Joans Daniel, English Pronouncing Dictionary, Cambridge Univ. Press

Faculty of Engineering & Technology

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EVALUATION SCHEME & SYLLABUS

FOR

B. TECH.

ELECTRICAL ENGINEERING

(3rd year)

ON

CHOICE BASED CREDIT SYSTEM (CBCS)

[Effective from the Session: 2025-26]

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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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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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.

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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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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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Sambhal (UP)
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.

Department of Electrical Engineering
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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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2nd Year/3rd Semester

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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2nd Year/4th Semester

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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2nd Year/4th Semester

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.

Department of Electrical Engineering
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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
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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

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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.

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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.

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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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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.

Faculty of Engineering & Technology

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Sambhal (UP)

EVALUATION SCHEME & SYLLABUS

FOR

B. TECH.

ELECTRICAL ENGINEERING

ON

CHOICE BASED CREDIT SYSTEM (CBCS)

[Effective from the Session: 2025-26]

EVALUATION SCHEME (2022-23)
B.TECH ELECTRICAL ENGINEERING
3rd Year (5th & 6th Semester)

Study And Evaluation Scheme For B.Tech Electrical Engineering

Year- 3rd /Semester -5th

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
UMANAEE501	Managerial Economics	4	0	0	4	30	-	30	70	-	70	100
UELECEE502	Electrical Machines-II	4	0	0	4	30	-	30	70	-	70	100
UINDUEE503	Industrial Sociology	3	0	0	3	30	-	30	70	-	70	100
UPOWEEE504	Power Transmission & Distribution	4	0	0	4	30	-	30	70	-	70	100
UCONTEE505	Control System	4	0	0	4	30	-	30	70	-	70	100
UINTEEE506	Internet of Things	4	0	0	4	30	-	30	70	-	70	100
UELECEE507	Electrical Machines-II Lab	0	0	2	1	-	25	25	-	25	25	50
UCONTEE508	Control System Lab	0	0	2	1	-	25	25	-	25	25	50
USOFTEE509	Software Based Power System Lab	0	0	2	1	-	25	25	-	25	25	50
Total		23	0	6	26	180	75	255	420	75	495	750
For pass the candidate is required to obtain 40% marks in each paper and 50% marks in aggregate.												375

Study And Evaluation Scheme For B.Tech Electrical Engineering

Year- 3rd /Semester -6th

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
UINDUEE601	Industrial Management	3	0	0	3	30	-	30	70	-	70	100
UPOWEEE602	Power System Analysis	4	1	0	5	30	-	30	70	-	70	100
USPECEE603	Special Electrical Machines	3	0	0	3	30	-	30	70	-	70	100
UPOWEEE604	Power Electronics	4	1	0	5	30	-	30	70	-	70	100
UMICREE605	Microprocessor	4	0	0	4	30	-	30	70	-	70	100
UPOWEEE606	Power Electronics Lab	0	0	2	1	-	25	25	-	25	25	50
UMICREE607	Microprocessor Lab	0	0	2	1	-	25	25	-	25	25	50
UELECEE608	Electrical Design & Fabrication Lab	0	0	2	1	-	25	25	-	25	25	50
Total		19	2	6	23	150	75	225	350	75	425	650
For pass the candidate is required to obtain 40% marks in each paper and 50% marks in aggregate.												325

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UMANAEE501: Managerial Economics	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. To recognize the knowledge on concepts and principles of Managerial Economics.
2. To describe and relate to the market the concepts of Demand and Supply.
3. To identify and recognize the Production Function concept and Cost Analysis.
4. To recognize the knowledge on Market structures and Game theory.
5. To describe National Income concept and types of Business Cycles.

Unit	Contents	Hours
1	**Introduction of Engineering Economics and Demand Analysis:** Meaning and nature of Economics, Relation between science, engineering, technology and economics; Meaning of Demand, Determinants of Demand, Shifts in demand, Law of Demand, Price Elasticity of Demand &Types, Income Elasticity, Cross price Elasticity, Determinants of Elasticity, uses and importance of elasticity.	**06**
2	**Concept of Supply:** Law of Supply, Factors affecting Supply, Elasticity of supply. **Demand Forecasting:** Introduction, Meaning and Forecasting, Methods or Techniques of Demand Forecasting, Criteria for Good Demand Forecasting, Demand Forecasting for a New Product;	**06**
3	**Cost Analysis-** Introduction, Types of Costs, Cost-Output Relationship: Cost Function, Cost-Output Relationships in the Short Run, and Cost-Output Relationships in the Long Run; Short run and long run, Break- Even Analysis; Production functions: laws of variable proportions, law of returns; Economies of scale: Internal and external.	**06**

4	**Market Structure:** Market Structure Perfect Competition, Imperfect competition – Monopolistic, Oligopoly, duopoly sorbent features of price determination and various market conditions.	**06**
5	Nature and characteristics of Indian economy, concepts of LPG, elementary concepts of National Income, Inflation and Business Cycles ,Concept of N.I. and Measurement., Meaning of Inflation, Types and causes , Phases of business cycle .Investment decisions for boosting economy(National income and per capital income)	**06**

Suggested Readings / Books

1. D.M. Mithani, —Managerial Economics Theory & Applications‖ 2017, 8th Ed, Himalaya Publishing House.
2. Premvir Kapoor, Sociology and Economics for Engineers, Khanna Publishing House (Edition 2018)

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UELECEE502:Electrical Machines-II	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Demonstrate the constructional details and principle of operation of three phase Induction and Synchronous Machines.
2. Analyze the performance of the three phase Induction and Synchronous Machines K3 using the phasor diagrams and equivalent circuits.
3. Select appropriate three phase AC machine for any application and appraise its significance.
4. Start and observe the various characteristics of three phase Induction & Synchronous Machines
5. Explain the principle of operation and performance of Single-Phase Induction Motor & Universal Motor.

Unit	Contents	Hours
1	**Synchronous Machine-I** Constructional features, Armature winding, EMF Equation, Winding coefficients, Equivalent circuit and phasor diagram, Armature reaction, O.C.& S.C. tests, Voltage regulation using Synchronous Impedance method, MMF method, Potier's Triangle method, Parallel operation of synchronous generators, Operation on infinite bus, Synchronizing power and torque co-efficient.	**10**
2	**Synchronous Machine-II** Two reaction theory, Power flow equations of cylindrical and salient pole machines, operating characteristics. Synchronous Motor-Starting methods, Effect of varying field current at different loads, V- curves, Hunting & damping, Synchronous condenser.	**10**

3	**Three phase Induction Machine–I** Constructional features, Rotating magnetic field, Principle of operation, Phasor diagram, Equivalent circuit, Torque and power equations, Torque-slip characteristics, No-load & blocked rotor tests, Efficiency, Induction generator & its applications	**08**
4	**Three phase Induction Machine-II** Starting, Deep bar and double cage rotors, Cogging &Crawling, Speed control (with and without emf injection in rotor circuit)	**06**
5	**Single phase Induction Motor** Double revolving field theory, Equivalent circuit, No-load and blocked rotor tests, Starting methods, Repulsion motor, Universal motor, Brushless DC Motors.	**06**

Suggested Readings / Books

1. D.P. Kothari &I.J. Nagrath, "Electric Machines", Tata Mc GrawHill

2. Smarajit Ghosh, "Electric Machines", Pearson

3. Fitzerald, A.E., Kingsley and S.D. Umans, "Electric Machinery", McGraw Hill.

4.P.S.Bimbhra,"ElectricalMachinery",KhannaPublisher

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UELECEE507:Electrical Machines-II Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Perform various tests and demonstrate the various characteristics of three phase induction motor.
2. Demonstrate the working of three phase synchronous machine under different operating conditions.
3. Evaluate the performance of single-phase induction motor under different operating conditions.
4. Develop simulation models for Electrical Machines.

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. To perform no load and blocked rotor tests on a three phase squirrel cage induction motor And determine equivalent circuit.
2. To perform load test on a three phase induction motor and draw Torque -speed characteristics
3. To perform no load and blocked rotor tests on a single phase induction motor and determine equivalent circuit.
4. To study speed control of three phase induction motor by varying supply voltage and by keeping V/f ratio constant.
5. To perform open circuit and short circuit tests on a three phase alternator and determine.

   Voltage regulation at full load and at unity, 0.8 lagging and leading power factors by

(i) EMF method (ii) MMF method.

6. To determine V-curves and inverted V-curves of a three phase Synchronous motor.

7. To determine Xd and Xq of a three phase salient pole synchronous machine using the slip test and to draw the power-angle curve.

8. To study synchronization of an alternator with the infinite bus by using:

(i) Dark lamp method (ii) two bright and one dark lamp method.

9. To determine speed-torque characteristics of three phase slip ring induction motor and study the effect of including Resistance or capacitance in the rotor circuit.

10. To determine speed-torque characteristics of single phase induction motor and study the Effect of voltage variation.

11. To determine speed-torque characteristics of a three phase induction motor by

(i) Keeping v/f ratio constant (ii) increasing frequency at the rated voltage.

12. To draw O.C. and S.C. characteristics of a three phase alternator from the experimental Data and determine voltage regulation at full load, and Unity, 0.8 lagging and leading Power factors.

13. To determine steady state performance of a three phase induction motor using equivalent circuit.

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UINDUEE503: Industrial Sociology	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
3L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Ability to grasp the intellectual and social origins of the emergence of Sociological Theories.
2. Ability to cultivate sociological perspectives and apply those in understanding the social issues.
3. Understand the sociology for specific purpose.
4. Be able to understand the human needs and adjust accordingly the set goals.

Unit	Contents	Hours
1	Industrial Sociology: Nature, Scope and Importance of Industrial Sociology. Social Relations in Industry, Social Organization in Industry- Bureaucracy, Scientific Management and Human Relations.	**06**
2	Rise and Development of Industry: Early Industrialism – Types of Productive Systems – The Manorial or Feudal system. The Guild system, the domestic or putting-out system, and the Factory system. Characteristics of the factory system. Causes and Consequences of industrialization. Obstacles to and Limitations of Industrialization.	**06**
3	Industrialization in India. Industrial Policy Resolutions – 1956.Science. Technology and Innovation Policy of India 2013.	**06**

4	Contemporary Issues: Grievances and Grievance handling Procedure. Industrial Disputes: causes, Strikes and Lockouts. Preventive Machinery of Industrial Disputes: Schemes of Workers Participation in Management- Works Committee, Collective Bargaining, Bi-partite & Tri-partite Agreement, Code of Discipline, Standing Orders. Labour courts & Industrial Tribunals.	**06**
5	Visualizing the future: Models of industrialization- Collectivist, anarchist, free market, environmentalist, etc. Cultural issues, consumer society and sociological concerns.	**06**

References:

1. PREMVIR KAPOOOR, Sociology & Economics for Engineers, Khanna Publishing House (Edition 2018).
2. GISBERT PASCAL, Fundamentals of Industrial sociology, Tata McGraw Hill, New Delhi1972.
3. SCHNEIDER ENGNO V., Industrial Sociology 2nd Ed., McGraw Hill Publishing Co., New Delhi, 1979.
4. MAMORIA C.B. And MAMORIA S., Dynamics of Industrial Relations in India.
5. SINHA G.P. and P.R.N. SINHA, Industrial Relations and Labour Legislations, New Delhi, Oxford and IBH Publishing Co., 1977.

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UPOWEEE504: Power Transmission & Distribution	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Understand the general structure of power system, different supply system, rules and phenomena related to transmission line.
2. Be capable of calculating parameters of overhead transmission line.
3. Be capable of evaluating the performance of different types overhead transmission lines.
4. Be capable of analysis of mechanical and electrical design aspects of transmission system.
5. Impart the knowledge of insulated cables and neutral grounding.
6. Impart the knowledge of EHV AC and HVDC transmission.

Unit	Contents	Hours
1	**Power System Components:** Single line diagram of Power system, Brief description of power system Elements: Synchronous machine, transformer, transmission line, bus bar, circuit breaker and isolator. **Supply System:** Different kinds of supply system and their comparison, choice of Transmission Voltage. **Transmission Lines:** Configurations, types of conductors, resistance of line, skin effect, Kelvin's law, Proximity effect.	**08**
2	**Over Head Transmission Lines:** Calculation of inductance and capacitance of single phase, three phase, single circuit and double circuit transmission lines Representation and performance of short, medium and long transmission lines, Ferranti effect, and Surge impedance loading.	**10**
3	**Corona and Interference:** Phenomenon of corona, corona formation, calculation of potential gradient, corona loss, factors affecting corona, methods of reducing corona and interference Electrostatic	**06**

	and electromagnetic interference with communication lines. **Overhead line Insulators:** Type of insulators and their applications, potential distribution over a string of insulators, methods of equalizing the potential, string efficiency.	
4	**Mechanical Design of transmission line:** Catenary curve, calculation of sag & tension, effects of wind and ice loading, sag template, vibration dampers. **Insulated cables:** Type of cables and their construction, dielectric stress, grading of cables, insulation resistance, capacitance of single phase and three phase cables, dielectric loss, heating of cables.	**08**
5	**Neutral grounding:** Necessity of neutral grounding, various methods of neutral grounding, earthing transformer, grounding practices. **Distribution Systems:** Distribution system layout, Introduction of Distribution System, Primary & Secondary distribution, Design consideration, distribution system losses, Classification of Distributed system- Radial Ring interconnected systems, Stepped distribution	**08**

Text Books:

1. W.D. Stevenson, —Element of Power System Analysis‖, McGraw Hill

2. C.L. Wadhwa, —Electrical Power System‖, New age international Ltd. Third Edition

3. AsfaqHussain, —Power System‖, CBS Publishers and Distributors

4. B. R. Gupta, —Power System Analysis and Design‖, Third Edition, S. Chand & Co.

5. M. V. Deshpande, —Electrical Power System Design‖, Tata McGraw Hill

6. S. Sivanagaraju & S. Satyanarayana, —Electric Power Transmission and Distribution‖, Pearson Education

7. Kothari &Nagrath, —Power System Engineering‖,Tata McGraw-Hill Education

8. T.A. Short, —Electric Power Distribution Handbook‖, CRC Reference Books:

9. Soni, Gupta &Bhatnagar, —A Course in Electrical Power —, Dhanpat Rai & Sons

10. S.L. Uppal, —Electric Power‖, Khanna Publishers

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UCONTEE505: Control System	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Impart the knowledge of open loop and close loop control system, servomechanism.
2. Do modeling of mechanical, electrical and electro-mechanical systems by differential equations.
3. Learn about representation of the system by transfer function, block diagram reduction technique and signal flow graph.
4. Analyze the system response and stability in both time-domain and frequency domain.
5. Make students capable of designing of P, PI and PID controllers.
6. Impart the knowledge of Root Locus Technique and State variable Techniques.
7. Learn the features of different types of compensators and to design compensators using time-domain and frequency domain specifications.

Unit	Contents	Hours
1	**Control System Concepts:** Concept of Control system, Physical Systems and their Mathematical Modeling, Constructional and working of AC & DC servomotor, synchros, stepper motor and tachometer. Transfer function models, Block diagram algebra, Signal flow graph, Mason's gain formula, Open loop and closed loop systems and their sensitivity analysis.	**08**
2	**Time Response Analysis:** Standard test signals, time response of first and second order systems, time response specifications, steady state errors and error constants. Design specifications of second order systems, Proportional, Derivative, Integral and PID compensations, design considerations for higher order systems and performance indices.	**08**

3	**Stability and Algebraic Criteria:** Concept of stability and its necessary conditions, Routh-Hurwitz criteria and its limitations. **Root Locus Technique:** Root contour, Construction of root loci, Effect of transportation lag and Root locus of non-minimal phase system and Effect of pole-zero cancellation.	**08**
4	**Frequency Response Analysis:** Frequency Response analysis from transfer function model, Construction of polar and inverse polar plots. **Stability in Frequency Domain:** Nyquist stability criterion, Determination of gain and phase margin from Bode & Nyquist Plots, Nichol Charts, Correlation between time and Frequency Responses.	**08**
5	**Introduction to Design:** The design problems and preliminary considerations of lead lag and lead-lag compensation networks, design of closed loop systems using compensation techniques in time and frequency domains. **State Space Technique:** The concept of state & space, State-space model of physical system, conversion of state-space to transfer function model and vice-versa, Similarity transformation of the control system, Concept of controllability and observability and their testing.	**08**

Text Books:

1. Nagrath & Gopal, —Control System Engineering‖, new age International.
2. K. Ogata, —Modern Control Engineering‖, Pearson India.
3. B.C. Kuo & Farid Golnaraghi, —Automatic Control System‖ McGraw Hill, 2018.
4. D. Roy Choudhary, —Modern Control Engineering‖, Prentice Hall of India.
5. Ambikapathy, —Control Systems‖,Khanna Publishers.

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UCONTEE508: Control System Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Note: The minimum of 10 experiments are to be performed from the following, out of which at least three should be software based.

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 vs 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.
8. To study behavior of separately excited dc motor in open loop and closed loop conditions at various loads.
9. To study characteristics of positional error detector by angular displacement of two Servo potential- Meters.

Software based experiments (Use MATLAB, LABVIEW etc. or equivalent open source freeware software like Scilab using Spoken Tutorial MOOCs)

10. To simulate PID controller for transportation lag.
11. To determine time domain response of a second order system for Step input and obtain Performance Parameters.
13. To convert transfer function of a system into state space form And vice-versa.
14. To plot root locus diagram of an open loop transfer function and Determine range of gain _k' fir Stability.
15. To plot a Bode diagram of an open loop transfer function.
16. To draw a Nyquist plot of an open loop transfers functions and Examine the stability of the Closed loop system.

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UINTEEE506: Internet of Things	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Able to understand the application areas of IOT.
2. Able to realize the revolution of Internet in Mobile Devices, Cloud &Sensor Networks.
3. Able to understand building blocks of Internet of Things and characteristics.
4. Explain the function blocks, three-layer model and five-layer model of IoT
5. Describe privacy, security and design related challenges of IoT
6. Describe IoT applications in the field of Electrical Engineering

Unit	Contents	Hours
1	**IoT Web Technology** The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.	**08**
2	**IoT Applications for Value Creation Introduction** IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT for Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, e Health	**08**

3	**Internet of Things Privacy, Security and Governance** Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps towards a Secure Platform, Smarty Approach. Data Aggregation for the IoT in Smart Cities, Security.	**06**
4	**Architectural Approach for IoT Empowerment** Introduction, Defining a Common Architectural Ground, IoT Standardization,M2M Service Layer Standardization, OGC Sensor Web for IoT, IEEE, IETF and ITU-T Standardization activities, Interoperability , Physical vs. Virtual, Solve the Basic First, Data Interoperability, Semantic Interoperability, Organizational Interoperability, Eternal Interoperability, Importance of Standardization, Plan for Validation and testing, Important Economic Dimension, Research Roadmap for IoT Testing Methodologies. Semantic as an Interoperability Enabler and related work.	**08**
5	**Identity Management Models in IoT** Introduction, Vulnerabilities of IoT, Security requirements, Challenges for a secure Internet of Things, identity management, Identity portrayal, Different identity Management model: Local identity, Network identity, Federated identity, Global web identity, Identity management in Internet of Things, User-centric identity management, Device-centric identity management, Hybrid identity management.	**08**

Text Books/ Reference Books:

1. Olivier Hersent,DavidBoswarthick, Omar Elloumi, —The Internet of Things key applications and protocols‖,Wiley
2. Adrian McEwen,HakinCassimally, ‖Designing the Internet of Things‖ Wiley India

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UCONTEE09: Software Based Power System 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. Calculate the parameters of single phase transmission line.

2. Calculate the parameters of three phase single circuit transmission line.

3. Calculate the parameters of three phase double circuit transmission line.

4. Determine the ABCD constant for transmission line.

5. Simulate the Ferranti effect in transmission line.

6. Calculate the corona loss of transmission line.

7. Calculation of sag & tension of transmission line.

8. Calculation of string efficiency of insulator of transmission line.

9. Calculation for grading of underground cables.

10. Simulate the skin effect in the transmission line

11. Calculation of ground clearance of transmission line

12. Calculate the parameters for underground cable

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UINDUEE601:Industrial Management	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
3L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

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

1. Understand the basic concept of Industrial management and its types and ownership.
2. Know the functions of management with the help of scientific theory and human resource management.
3. Know the objective and measurement in work study and use the different model of inventory control.
4. Design the control chart for variable and attributes in statistical quality control and implementing sampling plan.
5. Analyze the project management scheme in project network analysis

Unit	Contents	Hours
1	Introduction: Concept and scope of Industrial Management. Productivity: Definition, measurement, productivity index, types of production system, Industrial Ownership.	**06**
2	Functions of Management, Taylor‘s Scientific Management Theory, Fayol‘s Principles of Management, Social responsibilities of Management, Introduction to Human resources management: Nature of HRM, functions and importance of HRM.	**06**

3	Work Study: Introduction, definition, objectives, steps in work study, Method study: definition, objectives, steps of method study, Work Measurement: purpose, types of study — stop watch methods — steps — allowances — standard time calculations — work sampling, Production Planning and Control Inventory Control: Inventory, Cost, Models of inventory control: EOQ, ABC, VED	**06**
4	**Quality Control:** statistical quality control, Control charts for variables and attributes, Acceptance Sampling- Single sampling- Double sampling plans, Introduction to TQM.	**06**
5	**Project Management:** Project network analysis, CPM, PERT and Project crashing and resource leveling.	**06**

Reference Books:

1. Engineering Management (Industrial Engineering & Management)/ S.C. Sharma & T.R. Banga, Khanna Book Publishing Co. (P) Ltd., Delhi (ISBN: 978-93-86173-072)
2. Industrial Engineering and Management/ P. Khanna, Dhanpatrai Publications Ltd.
3. Production & Operation Management /PaneerSelvam /PHI.
4. Industrial Engineering Management/NVS Raju/Cengage Learning.
5. Industrial Engineering Management I RaviShankar/ Galgotia.

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UPOWEEE602:Power System Analysis	
Credit:5	**Max Marks:100 (IA:30,ETE:70)**
4L+1T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Develop mathematical model of a given power system.
2. Analyze the steady state condition of Power System using Power Flow Analysis.
3. Analyze the behavior of the power system under faulted condition.
4. Illustrate the stability status of power system under transient condition.

Unit	Contents	Hours
1	**Representation of Power System Components:** Synchronous machines, Transformers, Transmission lines, One-line diagram, Impedance and reactance diagram, per unit system. Symmetrical Components: Symmetrical Components of unbalanced phasors, power in terms of symmetrical components, sequence impedances and sequence networks.	08
2	**Symmetrical Fault Analysis:** Transient if R-L series circuit, calculation of 3-phase short circuit current and reactance of Synchronous machine, internal voltage of loaded machines under transient conditions. **Unsymmetrical Faults:** Analysis of single line to ground fault, line-to-line fault and Double Line to ground fault on an unloaded generators and power system network with and without fault impedance. Formation of Z bus using singular transformation and algorithm, computer method for short circuit calculations.	08
3	**Load Flows:** Introduction, bus classifications, nodal admittance matrix (YBUS), development of load flow equations, load flow solution using Gauss Siedel and Newton-Raphson method, approximation to N-R method, line flow equation sand fast decoupled method.	08

4	**Power System Stability:** Stability and Stability limit, Steady state stability study, derivation of Swing equation, transient stability studies by equal area criterion and step-by-step method. Factors affecting steady state and transient stability and methods of improvement.	**08**
5	**Traveling Waves:** Wave Equation for uniform Transmission lines, velocity of propagation, surge impedance, reflection and transmission of traveling waves under different line loadings. Bewlay's lattice diagram, protection of equipment and line against traveling waves.	**08**

Text Books:

1. W.D. Stevenson, Jr. —Elements of Power System Analysis‖,McGraw Hill.

2. C.L. Wadhwa, —Electrical Power System‖, New Age International.

3. Chakraborthy, Soni, Gupta &Bhatnagar, —Power System Engineering‖, DhanpatRai&Co.

4. T.K. Nagsarkar& M.S. Sukhija, —Power System Analysis‖ Oxford University Press, 2007.

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USPECEE603: Special Electrical Machines	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Study the basic concept of poly phase induction machines.
2. Understand the basic principle and working of induction generator.
3. Explain the basic concept of poly phase Stepper Motors.
4. Analyses the basic principle and working of Permanent Magnet Machines.
5. Differentiate between different type poly phase Single Phase Commutator Motors.

Unit	Contents	Hours
1	**Poly-phase AC Machines:** Construction and performance of double cage and deep bar three phase induction motors; e.m.f. injection in rotor circuit of slip ring induction motor, concept of constant torque and constant power controls, static slip power recovery control schemes (constant torque and constant power)	08
2	**Induction Generator:** SEIG, DFIG: Operating Principle, Equivalent Circuit, Characteristics, and Application Two Phase AC Servomotors: Construction, torque-speed characteristics, performance and applications.	06
3	**Stepper Motors:** Principle of operation, variable reluctance, permanent magnet and hybrid stepper motors, characteristics, drive circuits and applications. Switched Reluctance Motors: Construction; principle of operation; torque production, modes of operation, drive circuits.	08

4	**Permanent Magnet Machines:** Types of permanent magnets and their magnetization characteristics, demagnetizing effect, permanent magnet dc motors, sinusoidal PM A C motors, brushless dc motors and their important features and applications, PCB motors. Single phase synchronous motor; construction, operating principle and characteristics of reluctance and hysteresis motors; introduction to permanent magnet generators and applications	**10**
5	**Single Phase Commutator Motors:** Construction, principle of operation, characteristics of universal and repulsion motors; Linear Induction Motors. Construction, principle of operation, linear force, and applications.	**06**

Text Books:

1. P.S. Bimbhra "Generalized Theory of Electrical Machines" Khanna Publishers.

2. P.C. Sen "Principles of Electrical Machines and Power Electronics" Johnwilley&Sons, 2001

3. Cyril G. Veinott "Fractional and Sub-fractional horse power electric motors" McGraw Hill International, 1987

4. M.G. Say "Alternating current Machines" Pitman & Sons.

Department of Electrical Engineering
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Radha Govind University
Sambhal (UP)
3rd Year/6th Semester

UPOWEEE604: Power Electronics	
Credit:5	**Max Marks:100 (IA:30,ETE:70)**
5L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Understand the characteristics as well as the operation of BJT, MOSFET, IGBT, SCR, TRIAC and GTO and identify their use in the power switching applications.
2. Ability to comprehend the non-isolated DC-DC converters and apply their use in different Power electronics applications.
3. Analyze the phase-controlled rectifiers and evaluate their performance parameters.
4. Ability to apprehend the working of single-phase ac voltage controllers, cyclo-converters and their various applications.
5. Ability to analyze a inverter for single and three phase system.

Unit	Contents	Hours
1	**Power semiconductor devices:** Introduction: Concept of Power Electronics, scope and applications, desired Characteristics of controllable switches **Power semiconductor switches and their characteristics:** Power Diode, Power BJT, Power MOSFET, IGBT, SCR, TRIAC, and GTO.	08
2	**Thyristor:** Rating & protection, Methods of SCR commutation, Gate Drive Circuit, Series and Parallel operation. **DC-DC Converters:** Introduction, Control Strategies, Buck converter, Boost Converter, Buck-Boost converter, Analysis of buck converter, Switched Mode power Supply (SMPS).	06

3	**Phase Controlled Converters:** Single phase half wave controlled rectifier with various loads, Effect of freewheeling diode. Single phase fully controlled and half controlled bridge converters with various loads. Performance Parameters of single phase uncontrolled and controlled converters. Three phase half wave converters, three phase fully controlled and half controlled bridge converters, Effect of source impedance, Single phase and three phase dual converters	**10**
4	**AC Voltage Controllers:** Principle of On-Off and phase controls, Single phase ac voltage controller with resistive and inductive loads, sequence control, Introduction to Matrix converter. **Cyclo Converters:** Basic principle of operation, single phase to single phase, three phase to single phase output voltage equation.	**10**
5	**Inverters:** Single phase and Three phase bridge inverters, VSI, CSI, Voltage control of single phase inverters, PWM Techniques, Introduction to Multi level inverter.	**06**

Text Books:

1. M.H. Rashid,—Power Electronics: Circuits, Devices & Applications‖, Pearson India,4th Edition, 2018.

2. Ned Mohan, T.M.Undeland and W.P.Robbins, —Power Electronics: Converters, Applications and Design‖, Wiley India Ltd,2008

3. P.C. Sen, —Power Electronics‖, McGraw Hill Education (India) Pvt. Ltd.

Department of Electrical Engineering
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Sambhal (UP)
3rd Year/6th Semester

UPOWEEE606: Power Electronics Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Note: The minimum of 10 experiments is to be performed out of which at least three should be software based.

1. To study triggering of (i) IGBT (ii) MOSFET (iii) power transistor
2. To study V-I characteristics of SCR and measure latching and holding Currents.
3. To compare the R, RC &UJT trigger circuit for SCR.
4. To study the commutation circuit for SCR.
5. To study single phase fully controlled bridge rectifiers with resistive and Inductive loads.
6. To study single phase fully controlled bridge rectifiers with DC motor load.
7. To study three-phase fully controlled bridge rectifier with resistive and Inductive loads.
8. To study single-phase ac voltage regulator with resistive and inductive loads.
9. To study single phase cyclo-converter
10. To study the four quadrant operation of chopper circuit
11. To study MOSFET/IGBT based single-phase bridge inverter.

Software based experiments (PSPICE/MATLAB or equivalent open source freeware Software like Scilab using Spoken Tutorial MOOCs)

12. To obtain the simulation of single phase half wave controlled rectifier with R and RL load and plot load voltage and load current waveforms.
13. To obtain simulation of single phase fully controlled bridge rectifier and Plot load voltage and load current waveform for inductive load.
14. To obtain simulation of single phase full wave ac voltage controller and draw load Voltage and load current waveforms for inductive load.
15. To obtain simulation of step down dc chopper with L-C output filter for Inductive load and Determine steady-state values of output voltage ripples in output voltage and load Current.

Department of Electrical Engineering
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3rd Year/6th Semester

UMICREE605: Microprocessor	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Study of microprocessor system
2. Development of flow chart for understanding the data flow.
3. Learning assembly language to program microprocessor-based system.
4. Interfacing different peripheral devices with microprocessor.
5. Building logic for microprocessor-based system

Unit	Contents	Hours
1	**Introduction to Microprocessor:** Introduction to Microprocessor and its applications, Microprocessor Evolution Tree, Microprocessor Architecture (Harward & Princeton), General Architecture of the Microprocessor and its operations, Component of Microprocessor system: Processor, Buses, Memory, Inputs-outputs (I/Os) and other Interfacing devices.	**08**
2	**8-bit Microprocessor:** **Intel 8085 microprocessor:**Pin Diagram, Internal architecture: ALU, Registers, Timing and control unit, interrupt: **Instruction Set of 8085:** Instruction format, op-codes, mnemonics, no. of bytes computation of the instruction, Machine cycles and Tstates and Execution time computation of an instruction. Classification of instruction with their examples. Writing of assembly Language programs.	**06**
3	**16-bit Microprocessor:** **Architecture of Intel 8086:** Pin Diagram, Bus Interface Unit, Execution unit, Register organization, Memory addressing, Memory Segmentation, Pipelining, Min &	**10**

	Max operating Modes **8086Instruction set**: Format, Addressing Modes, and Instruction Set Groups: Data transfer, Arithmetic, Logic, String, Branch control transfer and Processor control. Interrupts: Hardware and software interrupts.	
4	**Fundamental of Programming:** Program structure for microprocessors, Flowcharts of series, parallel, and controls structures. **Assembler Level Programming:** Memory space allocation for monitor and user program. Assembly language program using Debug or MASM assembler.	**10**
5	**Peripheral Interfacing:** Programmed I/O, Memory Mapped I/O, and Interrupt Driven I/O, DMA I/O interface, Serial and Parallel communications. **Peripheral Devices:** DMA controller (Intel 8237), Programmable peripheral interface (Intel 8255), Programmable timer/counter (Intl 8253/8254), Programmable Interrupt Controller (Intel 8259).	**06**

Text Books:

1. Gaonkar, Ramesh S, —Microprocessor Architecture, programming and applications with the 8085‖ Pen ram International Publishing 5th Ed.

2. Avtar Singh& Walter A. Triebel —8088 & 8086 Microprocessor‖ Pearson Education.

3. Ray, A.K. &Burchandi, K.M., —Advanced Microprocessors and Peripherals:Architecture, Programaming and Interfacing‖ Tata Mc. Graw Hill.

4. AK Gautam, —Advanced Microprocessors‖, Khanna Publishers.

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Sambhal (UP)
3rd Year/6th Semester

UMICREE607: Microprocessor Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

A. Study Experiments (any two):

1. To study 8085 based microprocessor system
2. To study 8086 and 8086A based microprocessor system
3. To study Pentium Processor B. Programming based Experiments (any four):
4. To develop and run a program for finding out the largest/smallest number from a given set of numbers.
5. To develop and run a program for arranging in ascending/descending order of a set of Numbers
6. To perform multiplication/division of given numbers
7. To perform conversion of temperature from 0F to 0C and vice-versa
8. To perform computation of square root of a given number
9. To perform floating point mathematical operations (addition, subtraction, multiplication and Division)

B. Interfacing based Experiments (any four):

10. To obtain interfacing of RAM chip to 8085/8086 based system
11. To obtain interfacing of keyboard controller
12. To obtain interfacing of DMA controller
13. To obtain interfacing of PPI
14. To obtain interfacing of UART/USART
15. To perform microprocessor based stepper motor operation through 8085 kit
16. To perform microprocessor based traffic light control
17. To perform microprocessor based temperature control of hot water.

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UELECEE608:Electrical Design & Fabrication 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. PCB Design & Fabrication.
2. Transformer design & Fabrication.
3. Small Power Supply design & Fabrication.
4. Filter design & Fabrication.
5. Controller design & Fabrication.
6. Inductor design and Fabrication.
7. Measurement of electrical parameters of AC & DC machine.
8. Design & Fabrication of High Power factor controlled rectifier.
9. Design & Fabrication of Microcontroller based digital energy meters / sensors.
10. Design & Fabrication of Power amplifier.
11. Design Fabrication of AC phase converter and its firing circuit.
12. IGBT based single phase inverter design and Fabrication.
13. Design & Fabrication of chopper.

Faculty of Engineering & Technology

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Sambhal (UP)

EVALUATION SCHEME & SYLLABUS FOR

B. TECH.

ELECTRICAL ENGINEERING
(4TH YEAR)

Effective from

Session: 2025-26

EVALUATION SCHEME

B.TECH ELECTRICAL ENGINEERING

4th Year (7th & 8th Semester)

Study And Evaluation Scheme For B.Tech Electrical Engineering

Year- 4th / Semester -7th

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
UENTREE701	Entrepreneurship Development	3	0	0	3	30	-	30	70	-	70	100
UELECEE702	Electric Drives	4	0	0	4	30	-	30	70	-	70	100
UPOWEEE703	Power Station Practice	3	0	0	3	30	-	30	70	-	70	100
UANALEE704	Analog & Digital Communication	3	0	0	3	30	-	30	70	-	70	100
UPOWEEE705	Power System Operation and Control	4	0	0	4	30	-	30	70	-	70	100
UELECEE706	Electric Drives Lab	0	0	2	1	-	25	25	-	25	25	50
UANALEE707	Analog & Digital Communication Lab	0	0	2	1	-	25	25	-	25	25	50
UMINIEE708	Minor project	0	0	2	1	-	25	25	-	25	25	50
UINDUEE709	Industrial Training	0	0	2	1	-	25	25	-	25	25	50
Total		19	0	8	21	150	100	250	350	100	450	700
For pass the candidate is required to obtain 40% marks in each paper and 50% marks in aggregate.												280

Study And Evaluation Scheme For B.Tech Electrical Engineering

Year- 4th /Semester -8th

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
UNONCEE801	Non-Conventional Energy Resources	3	0	0	3	30	-	30	70	-	70	100
UADVAEE802	Advanced Control System	4	0	0	4	30	-	30	70	-	70	100
UUTILEE803	Utilization of Electrical Energy and Traction	4	0	0	4	30	-	30	70	-	70	100
UPOWEEE804	Power Converters Applications	3	0	0	3	30	-	30	70	-	70	100
UMAJOEE805	Major project	0	0	14	7	-	100	100	-	200	200	300
Total		14	0	14	21	120	100	220	280	200	355	700
For pass the candidate is required to obtain 40% marks in each paper and 50% marks in aggregate.												280

Department of Electrical Engineering
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Sambhal (UP)
4th Year / 7th Semester

UENTREE701: Entrepreneurship Development	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
3L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. The purpose of this course is to expose the student to the basic concepts of entrepreneurship, functions of entrepreneurs and problems faced by them in the real world.
2. To provide insights to students in converting an Idea to an opportunity and develop understanding of various funding sources for a startup.
3. To understand the technological, human, economic, organizational, social and other dimensions of innovation.
4. To understand the role of innovation and technical change in enterprise and global level economic performance

Unit	Contents	Hours
1	**Entrepreneurship:** Definition. Growth of small scale industries in developing countries and their positions vis- a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control types. Government policy for small scale industry; stages in starting a small scale industry.	**08**
2	**Project identification:** Assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods,	**08**

	benefit cost analysis, discounted cash flow, internal rate of return and net present value methods.	
3	**Accountancy:** Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control, quality control, marketing, industrial relations, sales and purchases, advertisement, wages and incentive, inventory control, preparation of financial reports, accounts and stores studies.	**08**
4	**Project Planning and control:** The financial functions cost of capital in project planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. Profit planning and programming, planning cash flow, capital expenditure and operations. Control of financial flows, control and communication.	**08**
5	Laws concerning entrepreneur viz, partnership laws, business ownership, sales and income taxes and workman compensation act. Role of various national and state agencies which render assistance to small scale industries.	**08**

Text Books:

1. Forbat, John, —Entrepreneurship‖ New Age International.
2. Havinal, Veerbhadrappa, —Management and Entrepreneurship‖ New Age International
3. Joseph, L. Massod, —Essential of Management", Prentice Hall of Indi

Department of Electrical Engineering
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4th Year / 7th Semester

UELECEE702: Electric Drives	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Describe the operation of electric drives and its classification.
2. Explain the electric drive stability and selection of motor power rating.
3. Illustrate electric braking and its dynamics.
4. Describe the types of AC drives and its control.

Unit	Contents	Hours
1	**Fundamentals of Electric Drive:** Electric Drives and its parts, advantages of electric drives Classification of electric drives Speed-torque conventions and multi-quadrant operations Constant torque and constant power operation Types of load torque: components, nature and classification.	08
2	**Dynamics of Electric Drive:** Dynamics of motor-load combination Steady state stability of Electric Drive Transient stability of electric Drive. **Selection of Motor Power rating:** Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty. Load equalization.	08
3	**Electric Braking:** Purpose and types of electric braking, braking of DC, three phase induction and synchronous motors **Dynamics during Starting and Braking:** Calculation of acceleration time and energy loss during starting of DC shunt and three phase induction motors, methods of reducing energy loss during starting. Energy relations during braking, dynamics during braking.	08

4	**Power Electronic Control of DC Drives:** Single phase and three phase controlled converter fed separately excited DC motor drives (continuous conduction only), dual converter fed separately excited DC motor drive, rectifier control of DC series motor. Supply harmonics, power factor and ripples in motor current Chopper control of separately excited DC motor and DC series motor.	**08**
5	**Power Electronic Control of AC Drives:** **Three Phase induction Motor Drive:** Static Voltage control scheme, static frequency control scheme (VSI, CSI, and cyclo – converter based) static rotor resistance and slip power recovery control schemes. Three Phase Synchronous motor: Self-controlled scheme **Special Drives:** Switched Reluctance motor, Brushless dc motor. Selection of motor for particular applications.	**08**

Text Books:

1. G.K. Dubey, —Fundamentals of Electric Drives‖, Narosa publishing House.
2. S.K. Pillai, —A First Course on Electric Drives‖, New Age International.
3 V. Subrahmanyam, —Electric Drives: Concepts and Applications‖, Tata McGrawHill.

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UELECEE706: Electric Drives 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:

List of Experiments

1. Study of thyristor controlled DC Drives.
2. Study of Chopper fed DC Drives.
3. Study of AC Single phase motor –speed control using TRIAC.
4. PWM inverter fed 3-phase Induction motor control using PSPICE/MATLAB/PSIM Software.
5. VSI/CSI Induction motor Drive analysis using PSPICE/MATLAB/PSIM Software.
6. Study of V/F control operation of 3-phase Induction motor Drives.
7. Regenerative braking operation for DC motor-study using software.
8. Dynamic braking operation for DC motor-study using software.
9. PC/ PLC based forward/reverse motion control operation of Induction motor.
10. Dynamic braking operation for AC motor-study using software.
11. Regenerative braking operation for AC motor-study using software.

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UPOWEEE703: Power Station Practice	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Understand the awareness of electrical energy demand, growth and electrical energy sources in India.
2. Understand the general layout and operation of thermal and hydro power plant.
3. Understand the operation of nuclear power plant, Gas turbine plant and diesel plant.
4. Draw substation layout.
5. Describe the various terms related to power plant economics and power tariffs.
6. Impart the knowledge of generation of electricity based on non-conventional energy sources

Unit	Contents	Hours
1	**Introduction:** Electric energy demand and growth in India, electric energy sources. 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, brief description of impulse, reaction, Kaplan and Francis turbines, advantages & disadvantages, hydro-potential in India.	**08**
2	**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	**08**

	material, shielding. **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.	
3	**Sub-stations Layout:** Types of substations, bus-bar arrangements, and typical layout of substation. **Power Plant Economics and Tariffs:** Load curve, load duration curve, different factors related to plants and consumers, Cost of electrical energy, depreciation, generation cost, effect of Load factor on unit cost. Fixed and operating cost of different plants, role of load diversity in power system economy. Objectives and forms of Tariff; Causes and effects of low power factor, advantages of power factor improvement, different methods for power factor improvements.	**08**
4	**Economic Operation of Power Systems:** Characteristics of steam and hydro-plants, Constraints in operation, Economic load scheduling of thermal plants neglecting and considering transmission Losses, Penalty factor, loss coefficients, Incremental transmission loss. Hydrothermal Scheduling.	**08**
5	**Non-Conventional Energy Sources:** Power Crisis, future energy demand, role of Private sectors in energy management, concepts & principals of MHD generation, Solar power plant, Wind Energy, Geothermal Energy, Tidal energy, Ocean Thermal Energy.	**08**

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. Reference Books:

4. W. D. Stevenson, —Elements of Power System Analysis‖, McGraw Hill.

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4th Year / 7th Semester

UANALEE704: Analog & Digital Communication	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Understand the Amplitude Modulation in communication system.
2. Comprehend the Frequency & Phase modulation
3. Realize the Pulse Modulation Techniques.
4. Get the Digital Modulation Techniques and their use in communication system.
5. Apply the concept of Information Theory in Communication Engineering.

Unit	Contents	Hours
1	Elements of communication system and its limitations Amplitude Modulation: Amplitude modulation and detection, Generation and detection of DSB-SC, SSB and vestigial side band modulation, carrier acquisition AM transmitters and receivers, super heterodyne receiver, IF amplifiers, AGC circuits Frequency Division multiplexing	**08**
2	Angle Modulation: Basic definitions Narrow band and wideband frequency modulation, transmission bandwidth of FM signals Generation and detection of frequency modulation Noise: External noise, internal noise calculations, signal to noise ratio Noise in AM and FM systems.	**08**
3	**Pulse Modulation:** Introduction, sampling process Analog Pulse Modulation Systems-Pulse Amplitude Modulation, Pulse width modulation and Pulse Position Modulation. Waveform coding Techniques: Discretization	**08**

	in time and amplitude, Quantization process, quantization noise, Pulse code Modulation, Differential Pulse code Modulation, Delta Modulation and Adaptive Delta Modulation.	
4	**Digital Modulation Techniques:** Types of digital modulation, waveforms for amplitude, frequency and phase shift keying, methods of generation of coherent and non-coherent, ASK, FSK and PSK, comparison of above digital techniques.	**08**
5	**Time Division Multiplexing:** Fundamentals, Electronic Commutator, Bit/byte interleaving, TI carrier system, synchronization and signaling of TI, TDM and PCM hierarchy, synchronization techniques Introduction to Information Theory: Measure of information, Entropy & Information rate, channel capacity, Hartley Shannan law, Huffman coding, shannan Fano coding.	**08**

Text Books:

1. Simon Haykin,— Communication Systems‖ John Wiley & Sons 4th Edition
2. G.Kennedy and B. Davis,‖ Electronic Communication Systems‖ 4th Edition, Tata McGraw Hill
3. Simon Haykin, —Digital Communications‖ John Wiley & Sons
4. T.L. Singal, —Analog & Digital Communication‖, Tata Mc Graw Hill

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UANALEE707: Analog & Digital Communication Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Note: The minimum 10 experiments are to be performed from the following:

1. To study amplitude modulation using a transistor and determine depth of Modulation.
2. To study generation of DSB-SC signal using balanced modulator.
3. To study generation of SSB signal
4. To study envelope detector for demodulation of AM signal and observe Diagonal peak Clipping effect.
5. To study super heterodyne AM receiver and measurement of sensitivity, Selectivity and fidelity.
6. To study frequency modulation using voltage controlled oscillator.
7. To detect FM signal using Phase Locked Loop.
8. To measure noise figure using a noise generator.
9. To study PAM, PWM and PPM.
10. To realize PCM signal using ADC and reconstruction using DAC and 4 Bit/8bit system. Observe quantization noise in each case.
11. To study Delta Modulation and Adaptive Delta Modulation.
12. To study PSK-modulation system. 13. To study FSK-modulation system.
14. To study sampling through a Sample-Hold circuit and reconstruction of the Sampled signal and observe the effect of sampling rate & the width of the Sampling pulses.
14. To study functioning of color television
15. Fabricate and test a PRBS generator
16. Realization of data in different forms, such as MRZ-L, NRZ - M&N, NRZ-S.
17. Manchester coding & decoding (Bi phase L) of NRZ-L data.

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UPOWEEE705: Power System Operation and Control	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Analyze the various load characteristics with load curve and load duration curve.
2. Describe modeling of power-frequency dynamics and design power-frequency controller.
3. Explain the modeling of reactive power-voltage interaction and the control actions.
4. Solve economic dispatch problems and unit commitment problems in power systems.
5. Explain the need of State Estimation.

Unit	Contents	Hours
1	**Introduction:** Structure of power systems, Power system control center and real time computer control, SCADA system Level decomposition in power system Power system security various operational stages of power system Power system voltage stability.	**08**
2	**Economic Operation:** Concept and problems of unit commitment Input-output characteristics of thermal and hydro-plants System constraints Optimal operation of thermal units without and with transmission losses, Penalty factor, incremental transmission loss, transmission loss formula (without derivation) Hydrothermal scheduling long and short terms Concept of optimal power flow.	**08**

3	**Load Frequency Control:** Concept of load frequency control, Load frequency control of single area system: Turbine speed governing system and modeling, block diagram representation of single area system, steady state analysis, dynamic response, control area concept, P-I control, load frequency control and economic dispatch control. Load frequency control of two area system: Tie line power modeling, block diagram representation of two area system, static and dynamic response.	**10**
4	**Automatic Voltage Control:** Schematic diagram and block diagram representation, different types of Excitation systems & their controllers. **Voltage and Reactive Power control:** Concept of voltage control, methods of voltage control by tap changing transformer. Shunt Compensation, series compensation, phase angle compensation.	**08**
5	**State Estimation:** Detection and identification, Linear and Non-linear models. **Flexible AC Transmission Systems:** Concept and objectives FACTs controllers: Structures & Characteristics of following FACTs Controllers. TCR, FC-TCR, TSC, SVC, STATCOM, TSSC, TCSC, SSSC, TC-PAR, UPFC	**06**

Text Books:

1. D.P. Kothari & I.J. Nagrath, —Modern Power System Analysis‖ Tata Mc Graw Hill, 3rd Edition.
2. P.S.R. Murty, —Operation and control in Power Systems‖ B.S. Publications.
3. N. G. Hingorani & L. Gyugyi, —Understanding FACTs‖ Concepts and Technology of Flexible AC Transmission Systems‖
4. A. J. Wood & B.F. Wollenburg, —Power Generation, Operation and Control — John Wiley & Sons.

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4th Year / 7th Semester

UMINIEE708: Minor Project	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Investigate the emerging problems in electrical engineering and solve them by referring standard journals.
2. Illustrate the state-of-the-art technologies in the area of electrical engineering.
3. Analyze various technological advancements in the area of machines, control system through software or hardware implementation.
4. Understand and evaluate the area for future knowledge and skill development.
5. Formulate a research paper and write the project report.

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UINDUEE709: INDUSTRIAL TRAINING	
Credit:1	**Max Marks:50**
6 WEEKS / 45 DAYS - IDUSTRY WORK EXPERIENCE WITH TRAINING REPORT & CERTIFICATE	

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UNONCEE801: Non- Conventional Energy Resources	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
3L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able

1. Identify energy demand and relate with available energy resources
2. Analyze harnessing of solar energy.
3. Analyze harnessing of wind energy.
4. Analyze harnessing of Biomass energy.
5. Analyze harnessing of Geothermal and Ocean energies.
6. Analyze Magneto hydrodynamics and Fuel cell technology.

Unit	Contents	Hours
1	**Introduction:** Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.	**06**
2	**Solar Thermal Energy:** Solar radiation, flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.	**06**
3	**Geothermal Energy:** Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. **Magneto-hydrodynamics**	**06**

	(MHD): Principle of working of MHD Power plant, performance and limitations. Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.	
4	**Thermo-electrical and thermionic Conversions:** Principle of working, performance and limitations. **Wind Energy:** Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems.	**06**
5	**Bio-mass:** Availability of bio-mass and its conversion theory. **Ocean Thermal Energy Conversion (OTEC):** Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.	**06**

Text/References Books:

1. Raja etal, —Introduction to Non-Conventional Energy Resources‖ Scitech Publications.
2. John Twideu and Tony Weir, —Renewal Energy Resources‖ BSP Publications, 2006.
3. M.V.R. Koteswara Rao, —Energy Resources: Conventional & Non-Conventional —BSP Publications, 2006.
4. D.S.Chauhan,‖Non-conventional Energy Resources‖ New Age International.
5. C.S. Solanki, —Renewal Energy Technologies: A Practical Guide for Beginners‖ PHI Learning.
6. Peter Auer "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.

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UADVAEE802: Advanced Control System	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able

1. Do state space analysis of continuous system.
2. Describe the dynamics of a linear, time invariant and causal digital system through difference equations.
3. Determine the stability of discrete control system.
4. Analyze nonlinear system by using phase plane method.
5. Understand the concept of optimal and adaptive control system.

Unit	Contents	Hours
1	**State Space Analysis of Continuous System:** State space analysis, Solution of state equation, determination of state-transition matrix, using Laplace method, Similarity transformation method and Caley-Hamilton Method.	08
2	**Analysis of Discrete System:** Concept of state feedback design, Determination of controllability Matrix and test of controllability, State feedback controller design via pole placement method, Concept of state observer design, Determination of the observability matrix and test of observability condition, Design of the full state observer using pole placement.	08
3	**Nonlinear systems:** Nonlinear System Modeling Analysis of Nonlinear system (Inverted Pendulum) via Linearization, Describing function analysis of nonlinear system, Stability Analysis of Nonlinear system using Describing function Analysis.	08
4	**Phase Plan Analysis:** Construction of Phase portrait using Isoclines approach, Singular points, and Phase plane analysis of 2nd order linear system, Phase plane analysis of nonlinear control system.	08

5	**Liapunov Stability Analysis:** Concept of stability in the sense of Liapunov. Linear system analysis using Liapunov approach, Determination of Liapunov functions using variable gradient method, Stability analysis of nonlinear systems.	**08**

Text Books:

1. M. Gopal, —Digital Control and State variable Methods‖, Tata Mc Graw Hill.

2. Ajit K. Madal, —Introduction to Control Engineering: Modelling, Analysis and Design‖ New Age International.

3. K. Ogata, —Modern Control Engineering‖, PHI.

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UUTILEE803: Utilization of Electrical Energy and Traction	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able

1. Understand basic principles of electric heating and welding.
2. Design of indoor lighting and outdoor lighting systems.
3. Understand refrigeration and air conditioning.
4. Understand starting and speed control method of electric traction.
5. Evaluate speed time curves for traction.

Unit	Contents	Hours
1	**Electric Heating:** Advantages and methods of electric heating, Resistance heating, Electric arc heating, Induction heating, Dielectric heating.	08
2	**Electric Welding:** Electric Arc Welding Electric Resistance Welding Electronic welding control Electrolyte Process: Principles of electro deposition, Laws of electrolysis, and applications of electrolysis.	08
3	**Illumination:** Various definitions, Laws of illumination, requirements of good lighting Design of indoor lighting and outdoor lighting systems Refrigeration and Air Conditioning: Refrigeration systems, domestic refrigerator, water cooler Types of air conditioning, Window air conditioner.	08
4	**Electric Traction - I** Types of electric traction, systems of track electrification Traction mechanics- types of services, speed time curve and its simplification, average and schedule speeds Tractive effort, specific energy consumption, mechanics of train movement, coefficient of adhesion and its influence.	08

5	**Electric Traction – II** Salient features of traction drives Series – parallel control of dc traction drives (bridge transition) and energy saving Power Electronic control of dc and ac traction drives Diesel electric traction.	**08**

Text Books:

1. H. Partab, —Art and Science of Electrical Energy‖ Dhanpat Rai & Sons.
2. G.K. Dubey, —Fundamentals of Electric Drives‖ Narosa Publishing House
3. H. Partab, —Modern Electric Traction‖ Dhanpat Rai & Sons.
4. C.L. Wadhwa, —Generation, Distribution and Utilization of Electrical Energy‖ New Age international Publications.

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UPOWEEE804: Power Converter Applications	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able

1. Describe the characteristics, operation of power switching devices and identify their ratings and applications.
2. Categorize different phenomena occurring in HVDC system.
3. Identify the types of faults occurring in three phase generators.
4. Define and explain the basic concepts and theory of heating.

Unit	Contents	Hours
1	**HVDC Transmission:** Schematic diagram, modes of operation, twelve pulses line commutated converters, effect of source inductance, control of HVDC converters, converter faults and protection, harmonic filters.	**08**
2	**FACT Controllers:** Principle of power transmission, principles of shunt compensation and series compensation; Shunt compensators-TCR, TSC, SVC, STATCOM Series compensators-TSSC, FCSC, TCSC, SSVC; Phase angle compensator, Unified power flow controller (UPFC), comparison of compensators.	**08**
3	**Power Supplies:** Desirable specifications of power supplies, drawbacks of linear power supply. Switch-Mode Power supply (SMPS)-schematic diagram, fly back converter, forward converter, push- pull converter, half bridge and full bridge converters; Uninterruptible power supply (UPS)- configurations of off-line and on-line UPS,	**08**

	switch mode and resonant power supplies; air- craft power supply.	
4	**Industrial Applications:** High frequency inverters for induction and dielectric heating, ac voltage controllers for resistance heating and illumination control, high frequency fluorescent lighting, electricwelding control.	**08**
5	**Interconnection of Renewable Energy Sources to the Utility Grid:** Photovoltaic array interconnection, wind and small hydro interconnection, interconnection of energy storage systems; DC circuit breaker, single phase and three phase ac switches; Excitation control of synchronous generators.	**08**

Text Books:

1. Ned Mohan, T.M.Undeland and William P.Robins, —Power Electronics: Converters, Applications and Design‖, John Wiley & Sons.
2. M.H. Rashid, —Power Electronics: Circuits, Devices and Applications‖ Prentice Hall of India.

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UMAJOEE805: Major Project	
Credit:7	**Max Marks:100 (IA:50,EA:50)**
0L+0T+14P	**End Term Exams: 2 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Identify the particular problem in the field and demonstrate independent learning.
2. Plan, design and analyze the particular problem as project.
3. Demonstrate the usefulness of project in society and understanding of professional ethics and participate in a class or project team.