ANDHRA UNIVERSITY: : VISAKHAPATNAM
DEPARTMENT OF ELECTRICAL ENGINEERING
SCHEME OF INSTRUCTION & EXAMINATION
II/IV B.Tech

Common with SIX YEAR DUAL DEGREE COURSE II/IV(B.Tech+M.Tech)

(With effect from 2020-21admitted batch onwards)

B.Tech II Year - I Semester(Academic Year - 2020-21 onwards)

Course code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	Credits
			L	T	P				
EE2101	BS	Operations Research	3	0	0	30	70	100	3
EE2102	PC	Network Theory	3	0	0	30	70	100	3
EE2103	PC	Electronic Circuits	3	0	0	30	70	100	3
EE2104	PC	Electrical machines-I	3	0	0	30	70	100	3
EE2105	HSS	Managerial Economics	3	0	0	30	70	100	3
EE2106	PC	Electrical Networks LAB	0	0	3	50	50	100	1.5
EE2107	PC	Electrical Machines-I LAB	0	0	3	50	50	100	1.5
EE2108	PC	Electronic Circuits LAB	0	0	3	50	50	100	1.5
EE2109	SC	MATLAB &Interfacing	1	0	2	50	50	100	2
EE2110	MC	Professional Ethics and Universal Human Values	0	0	0	--	100	100	0
EE2111	MC	NCC/NSS	0	0	2				0
Total credits									**21.5**

ANDHRA UNIVERSITY: : VISAKHAPATNAM
DEPARTMENT OF ELECTRICAL ENGINEERING
SCHEME OF INSTRUCTION & EXAMINATION

B.Tech II Year - II Semester (Academic Year - 2020-21 onwards)

Course code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	Credits
			L	T	P				
EE2201	ES	Signals& Systems	3	0	0	30	70	100	3
EE2202	BS/PC	Electrical Measurements	3	0	0	30	70	100	3
EE2203	PC	Electrical Machines-II	3	0	0	30	70	100	3
EE2204	PC	E M F Theory	3	0	0	30	70	100	3
EE2205	PC	Electrical Engineering Materials	3	0	0	30	70	100	3
EE2206	PC	Electrical Machines–II LAB	0	0	3	50	50	100	1.5
EE2207	PC	Electrical Measurements lab	0	0	3	50	50	100	1.5
EE2208	SC	Electrical CAD	1	0	2	50	50	100	2
EE2209	MC	Environmental science	0	0	0		100	100	0
Total credits									**20**
Summer Internship(Community Service)									

EE2101	Operations Research	3L:0T:0P	3 .0 Credits

Prerequisite: None

Course Objectives:

- To introduce optimization techniques to students.
- To explain linear programming, transportation problem, assignment problem, pert network with few computations.
- To discuss few inventory models.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Analyse any real life system with limited constraints and depict it in a model form.
- Convert the problem into a mathematical model.
- Solve the mathematical model manually as well as using soft resources/software such as solver, TORA etc.
- Understand variety of problems such as assignment, transportation, travelling salesman etc.
- Solve the problems mentioned in point 4 using linear programming approach using software.
- Understand different queuing situations and find the optimal solutions using models for different situations.

Introduction to Optimization: Engineering Applications of Optimization, Statement of Problem, Classification of Optimization Problem Techniques.

Linear Programming: Introduction, Requirements For a LP Problem, Examples on The Application of LP, Graphical Solution of 2-Variable LP Problems, Some Exceptional Cases, General Mathematical Formulation For LPP, Canonical And Standard Forms of LP Problem, Simplex Method, Examples on The Application of Simplex Techniques.

Artificial Variable Techniques: Big-M Method and Two Phase Techniques.

Transportation Problem: Matrix Terminology, Definition and Mathematical Representation of Transportation Model, Formulation and Solution of Transportation Models (Basic Feasible Solution by North-West Corner Method, Inspection Method. Vogell's Approximation Method).

Assignment Problem: Matrix Terminology, Definition of Assignment Model, Comparison with Transportation Model, Mathematical Representation of Assignment Model, Formulation and Solution of Assignment Models.

Pert Network: Introduction, Phases of Project Scheduling, Network Logic, Numbering the Events (Fulkerson's Rule), Measure of Activity.

Pert Network Computations: Forward Pass And Backward Pass Computations, Slack Critical Path, Probability of Meeting the Scheduled Dates.

Inventory Models: Introduction, Necessity For Maintaining Inventory, Classification of Inventory Models, Inventory Models With Deterministic Demand, Demand Rate Uniform Production Rate Infinite, Demand Rate Non-Uniform Production Rate Finite, Demand Rate Uniform-Production Rate Finite. Game Theory: Useful Terminology, Rules For Game Theory, Saddle Point, Pure Strategy, Reduce Game By Dominance, Mixed Strategies, 2x2 Games Without Saddle Point.

Textbooks:

1. "Operations Research-An Introduction' By H.Taha, Prentice Hall Of India Pvt. Ltd.
2. "Engineering Optimization-Theory & Practice" By S.S. Rao, New Age International (P) Ltd.
3. "Operations Research – An Introduction" By P.K.Gupta&D.S.Hira, S. Chand & Co. Ltd

EE2102	Networktheory	3L:0T:0P	3.0 Credits

Prerequisite: None

Course Objectives:

- To enrich the students to acquire knowledge about the basics of circuit analysis, network theorems, concepts of AC circuits, coupled & three phase circuits, transient analysis.
- Explain the basic laws and theorems of DC circuits.
- Discuss the DC transients for RL, RC & RLC circuits and explain about Magnetic Circuits.
- Explain different types of Laplace Transforms of different signals and their response when applied to simple circuits.

Course Outcomes:

At the end of this course, a student

- Will be able to articulate in working of various components of a circuit.
- Will be familiar with ac and dc circuits solving.
- Will be ready with the most important concepts like mesh and nodal analysis.
- Ability to measure three phase voltages and current, active, reactive powers
- Ability to convert Three phase Star to Three phase Delta circuits and Vice-Versa.
- Ability to Express given Electrical Circuit in terms of A,B,C,D and Z,Y Parameter Model and Solve the circuits.

Introduction of Network Elements: Basic definition of the unit of Charge, Voltage, Current, Power and Energy, Circuit concept, Active and Passive circuit elements; Ideal, Practical and dependent sources and their V-I characteristics, , Reference Directions for current and voltage, Energy stored in Inductors and Capacitors ,Kirchhoff's Laws, Voltage and Current Division Nodal Analysis, Mesh Analysis, Star-Delta transformation, Source Transformation.

Network Theorems: Linearity and superposition, Thevenin's and Norton's Theorem, Reciprocity, Compensation, Maximum power transfer theorems, Tellegan's and Millman's theorems, Application of theorems to DC circuits.

DC Transients: Inductor, Capacitor, Source free RL, RC and RLC Response, Evaluation of Initial conditions, application of Unit-step Function to RL, RC and RLC Circuits, Concepts of Natural, Forced and Complete Response.

Introduction of Alternating Circuits: The Sinusoidal Forcing Function Instantaneous, Peak, Average and RMS values of Voltage and Current,; Crest factor, Form factor; Concept of phase and phase difference in sinusoidal waveforms; Phase relation in pure resistor, Inductor and capacitor; Impedance diagram, phasor diagram, series and parallel circuits, compound Circuits, Instantaneous and Average Power, Complex Power Computation of active, reactive and complex powers; power triangle, power factor.

Sinusoidal Steady State Analysis: Steady State Analysis Using Mesh and Nodal Analysis, Application of Network Theorems to AC Circuits, Series resonance, Impedance and phase angle, voltages and currents, bandwidth and Q factor and its effect on bandwidth, parallel resonance, resonant frequency, variation of impedance with frequency, Q factor and its effect on bandwidth, Balanced 3-phase circuits, Resonance, Concept of Duality. Magnetically Coupled Circuits, Dot Convention, Y, Z, H, T – Parameters of Two – Port Networks.

Laplace Transform Techniques: Transforms of Typical Signals, Response of Simple Circuits to Unit – Step, Ramp and Impulse Functions, Initial and Final Value Theorem, Convolution Integral, Time Shift and Periodic Functions, Transfer Function.

Textbooks:

1. Engineering Circuit Analysis, Willam H. Hayt Jr., and Jack E. Kemmerly, 5th Edition, McGraw Hill.
2. Electric circuits by J.A Edminister (Schaum outline series)

Referencebooks:

1. Franklin F. Kuo, Network Analysis and Synthesis, 2nd Edition, John Wiley & Sons
2. Network Analysis, M. E. Vanvalkenburg, 3rd Edition, PHI.

EE2103	Electronic circuits	3L:0T:0P	3.0 Credits

Prerequisite: Network Theory, Electronic Devices

Course Objectives:

- To familiarize the students with theory of various kinds of amplifiers and oscillators.
- To explain concepts of gain, band-width and gain band-width product.
- To analyse all kinds of feedback amplifiers.
- To deal with various aspects of power amplifiers and tuned voltage amplifiers.
- To introduce operational amplifiers and their applications.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the characteristics of transistors.
- Design and analyze various rectifier and amplifier circuits.
- Design sinusoidal and non-sinusoidal oscillators.
- Understand the functioning of OP-AMP and design OP-AMP based circuits.

Multistage Amplifiers:BJT and FET RC Coupled Amplifiers – Frequency Response. Cascaded Amplifiers. Calculation of Band Width of Single and Multistage Amplifiers. Concept of Gain Bandwidth Product.

Feedback Amplifiers: Concept of Feedback Amplifiers – Effect of Negative feedback on the amplifier Characteristics. Four Feedback Amplifier Topologies. Method of Analysis of Voltage Series, Current Series, Voltage Shunt and Current Shunt feedback Amplifiers.

Sinusoidal Oscillators: Condition for oscillations –LC Oscillators – Hartley, Colpitts, Clapp and Tuned Collector Oscillators – Frequency and amplitude Stability of Oscillators – Crystal Oscillators – RC Oscillators -- RC Phase Shift and Weinbridge Oscillators.

Power Amplifiers: Classification of Power Amplifiers – Class A, Class B and Class AB power Amplifiers. Series Fed, Single Ended Transformer Coupled and Push Pull Class A and Class B Power Amplifiers. Cross-over Distortion in Pure Class B Power Amplifier, Class AB Power Amplifier – Complementary Push Pull Amplifier, Derating Factor – Heat Sinks.

Tuned Voltage Amplifiers: Single Tuned and Stagger Tuned Amplifiers – Analysis – Double Tuned Amplifier – Bandwidth Calculation.

Operational Amplifiers: Concept of Direct coupled amplifiers, Ideal Characteristics, Differential amplifier, normalized transfer characteristics, Measurement of Op-Amp Parameters.

Applications of Op-Amps: Inverting and Non-inverting Amplifiers, Integrator, Differentiator, Comparator, Logarithmic Amplifiers, Instrumentation Amplifiers.

Text Books:

1. Integrated Electronics, Analog Digital Circuits and systems, Jacob Millman and D. Halkias, McGraw Hill, 1972
2. OP-Amps and Linear Integrated Circuits, Gayakwad, 4th ed. PHI publications, 1993.
3. Electronic Devices & Circuits, K VenkataRao and K Rama Sudha, McGraw Hill Education, 1986.

Reference books:

1. Linear Integrated Circuits, D Choudhury Roy, New Age International Pvt Ltd, publishers, New Delhi, 2004
2. Electronic Devices and Circuits – G.K.Mithal, Khanna Publishers, 23rd Edition, 2004.

EE2104	Electrical machines – I	3L:0T:0P	3.0 Credits

Prerequisite: Basic Physics

Course Objectives:

- To understand the concepts ofThermal Prime Movers.
- To understand the concepts of Hydraulic turbines
- To familiarize the concepts of electro-mechanical energy conversion principles.
- To explain the theory of dc machines, and their testing.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Discuss the working principle of different types of thermal & hydraulic turbines.
- Understand the operation of dc machines.
- Understand the testing of dc motors
- Analyze the differences in operation of different dc machine configurations.

Gas Turbines: Introduction, Classification of Gas Turbines. Analysis of Constant Pressure Closed Cycle Gas Turbines, Open Cycle Gas Turbines. Methods to Improve the Thermal Efficiency of Gas Turbines.

Hydraulic turbines: Layout of a typical hydro power installation, heads and efficiencies – classification of turbines – pelton wheel, francis turbine, Kaplan turbine working – velocity diagram, work done and efficiency.

Electro-mechanical Energy Conversion: Principles, Forces and Torques in Magnetic Field Systems, Energy Balance, Energy and Force in Singly Excited Magnetic Field System, Co-energy, Multiply Excited Magnetic Field Systems.

D.C. Generators: Principle of Operation, Constructional Features, EMF Equation of a D.C.Generator, Collection and Flow of Current from Armature, Armature Reaction, Methods to reduce Effects of Armature Reaction and Commutation Process, Armature Winding Diagram(Lap and Wave), Methods of Excitation, Generator Characteristics, Parallel Operation, Lossesoccur in DC Generator, Power Stages in D.C. Generator, Efficiency, Condition for Maximum, Efficiency of a dc generator and Applications.

D.C. Motors: Principle of operation, Types of DC Motors, Significance of Back Emf, condition for maximum power, Torque and Speed Equations, Starting and necessity of Starters, Types of Starters, DC Motor characteristics, Speed Control Methods of a D.C. Motors, Losses occur in DC Motors, Power Stages in D.C. Motor, Condition for Maximum Efficiency and Applications.

Testing of D.C. Motors: Brake Test, Swinburne's Test, Hopkinson's Test, Retardation Test, Field's Test and Separation of Losses.

Text books:

1. Thermal Engineering by R.S. KhurmiAnd J.K. Gupta, S.Chand& Co Ltd.
2. Elements of Heat Engines, Vols. I & Ii by R.C. Patel And C.J. KaramChandani, Acharya Book Depot, Baroda.
3. Electrical Machinery by DR.P.S.BIMBHRA, KHANNA PUBLISHER.
4. Electrical Machines by D P KOTHARI and I J NAGRATH, Mc Graw Hill Education (India)

   Private Limited.

Reference books:

1. Electrical Machines, by J B Gupta, S K Kataria& Sons.
2. Electrical Machines by U A Bakshi and M V Bakshi, Technical Publications.

EE2105	Managerial Economics	3L:0T:0P	3.0 Credits

Prerequisite: None

Course Objectives:

- To introduce the managerial economics to students.
- To explain the concepts of demand forecasting and cost analysis.
- To discuss concepts of investmentdecisions&marketstructures.
- To understand financial statements.
- To describe marketing.

Course Outcomes:

At the end of this course student will be able to

- Explain basic principles of engineering economics
- Apply cost – volume -profit (CVP) analysis in their business decision making
- Evaluate investment proposals through various capital budgeting methods
- Apply the knowledge to prepare the simple financial statements for measuring performance of business firm
- Analyse key issues of organization, management and administration
- Evaluate project for accurate cost estimates and plan future activities

Introduction to Engineering Economics: Concept of Engineering Economics – Types of efficiency – Managerial Economics - Nature and Scope – Law of Demand – Types of Elasticity of demand.

Demand Forecasting & Cost Analysis:Demand Forecasting: Meaning, Factors Governing Demand Forecasting, Methods of Demand Forecasting (Survey and Statistical Methods) – **Cost Analysis:** Basic Cost Concepts, Break Even Analysis.Factors affecting the elasticity of demand – Supply and law of Supply.

Investment Decisions & Market Structures: Financial Statements & Ratio Analysis Time Value of Money – Capital Budgeting: Meaning, Need and Techniques of Capital Budgeting – Types of Markets Structures – Features – Price Out - put determination under Perfect Competition and Monopoly.

Financial Statements & Ratio Analysis: Introduction to Financial Accounting –Double entry system – Journal - Ledger – Trail Balance – Final Accounts (with simple adjustments) – Financial Analysis through Ratios: Interpretation ofLiquidity Ratios (Current Ratio and quick ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio, Creditors Turnover Ratio, Capital Turnover Ratio), Solvency Ratios (Debt - Equity ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit

ratio, Operating Ratio, P/E Ratio and EPS).Price output determination under Monopolistic markets, Accounting concepts and conventions.

Introduction to Management & Strategic Management: Introduction to management: Nature – Importance – Classical Theories of Management: F.W.Taylor's and Henri Fayol'sTheory – Functions and Levels of Management – Decision Making Process. Methods of Production (Job, Batch and Mass production) - Inventory Control, Objectives, Functions – Analysis of Inventory –EOQ.Maslow& Douglas Mc.Gregor theories of Management, ABC Analysis.

Project Management: Introduction – Project Life Cycle and its Phases – Project Selection Methods and Criteria – Technical Feasibility – Project Control and Scheduling through Networks – Probabilistic Models of Networks – Time - Cost Relationship (Crashing) –Human Aspects in Project Management: Form of Project Organization – Role & Traits of Project Manager.

Textbooks:

1. Chan S. Park, "Fundamentals of Engineering Economics", Pearson, 2013, 3 Edition,New Delhi, 2015
2. Rajeev M Gupta, "Project Management", 2nd Ed., PHI Learning Pvt. Ltd. New Delhi, 2014

Reference books:

1. PanneerSelvam. R, "Engineering economics", 3rdEdision., Prentice Hall of India, New Delhi, 2013
2. R.B.Khanna, "Project Management", PHI Learning Pvt. Ltd. New Delhi, 2011

EE2106	Networks laboratory	0L:0T:3P	1.5 CREDITS

Prerequisite: Network Theory

Course Objectives

- To enhance student learning by applying knowledge and skills to provide solutions to Electrical and Electronics Engineering problems in industry and governmental organizations
- To identify, formulate, design and investigate complex engineering problems of electric circuits.
- Work as a team with a sense of ethics and professionalism, and communicate effectively with a practical orientation.

Course Outcomes:

After completion of this course, a student will be

- Able to analyze and design DC and AC circuits.
- Able to apply concepts of electrical circuits throughout engineering.
- Able to evaluate response in any given network using theorems
- Able to analyze a given network by applying various Network Theorems

1. Verification of ohm's law and to measure filament lamp resistance.
2. Verification of Kirchhoff's law
3. Verification of Thevenin's theorem
4. Verification of Norton's theorem
5. Verification of superposition theorem.
6. Verification of Maximum Power Transfer theorem.
7. Verification of Reciprocity theorem.
8. Two Port Network Parameters
9. Time response of first order RC / RL network for periodic non – sinusoidal inputs – Time constant and Steady state error determination
10. Series and Parallel Resonance
11. Measurement of Active Power for Star and Delta connected balanced loads
12. Measurement of reactive Power for Star and Delta connected balanced loads

EE2107	Electrical Machines – I lab	0L:0T:3P	1.5 CREDITS

Prerequisite: Electrical Machines-I

Course Objective:

- To understand design and each part of dc electrical machines.
- To gain expertise in controlling dc electrical machines.
- Also to perform tests on dc electrical machines and transformers and determine their characteristics.
- To inculcate team spirit and cooperative behaviour.

Course Outcome:

After completion of course, a student will be able to

- Analyse dc electrical machines and transformers.
- To define characteristics of dc machines and transformers.
- To test them in various methods.

Experiments can be drafted basing on the theory course#

EE2108	Electronic Circuits lab	0L:0T:3P	1.5 CREDITS

Prerequisite: Electronic Devices and Electronic Circuits

Course Objectives:

- To gain practical knowledge on electronic circuits.
- To understand the functioning of electronic devices.
- To draw the characteristics of the devices.
- To develop team spirit.

Course Outcomes:

After completion of this course, a student will be able to

- Analyse electronic components.
- Design rectifier, filter circuits.
- Design electronic circuits for small applications.

#experiments can be drafted basing on the theory course#

EE2109	MATLAB & Interfacing	0L:1T:2P	2 CREDITS

Prerequisite: Basics of Electrical Engineering

Course Objectives:

- To understand the MATLAB software
- To write program for electrical applications
- To simulate an electric and electronic circuit.

Course Outcome:

After completion of this course, a student

- Can use the software effectively.
- Can simulate and program an electrical and electronic application.

#the programs/experiments can be drafted to make the student acquainted with the latest concepts

Related to Electrical Engineering#

EE2110	Professional ethics and Universal human values	0L:0T:0P	0 CREDITS

Course Objectives:

The objective of the course is Six fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- This course will illuminate the students in the concepts of laws and its applicability to engineers
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection, Development of commitment and courage to act and also enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and professional lives
- To enable the students to imbibe the Values and Ethical Behavior in the personal and Professional lives
- The students will learn the rights and responsibilities Individual, employee, team member and a global citizen

Course Outcomes:

By the end of the course Student will be able to:

- Grasp the meaning of the concept – Law and also Get an overview of the laws relating to Engineers and also Apprehend the importance of being a law abiding person and They would have better critical ability
- Self-explore by using different techniques to live in harmony at various levels
- Analyze themselves and understand their position with respect to the moral and ethical character needed for a successful and satisfactory work life
- Students are expected to become more aware of themselves and their surroundings (family, society, nature)
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society

SYLLABUS

Need, Basic Guidelines, Content and Process for Value Education

- ,Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation - as the process for self-exploration, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility - 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. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking, Include practice sessions and case studies.

Understanding Harmony in the Human Being - Harmony in Myself!

- Understanding human being as: a co-existence of the sentient 'I' and the material 'Body', the needs of Self ('I') and 'Body' - happiness and physical facility, the Body as an instrument of 'I' (I being the doer,

seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I', the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, P to ensure Sanyam and Health, Include practice sessions and case studies.

Understanding Harmony in the Family and Society - Harmony in Human – Human Relationship

- Understanding values in human-human relationship: meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, the meaning of Trust; Difference between intention and competence, the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, the harmony in the society (society being an extension of family), Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family, Include practice sessions and case studies.

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

- 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 of mutually interacting units in all – pervasive space, Holistic perception of harmony at all levels of existence, Include practice sessions and case studies.

Concept of Law and Law of Torts

- Understanding Essentials of a Valid Contract and the basics of contract law protecting rights and obligations, Introduction to the Law of Torts and the basics to protect oneself and the company Law affecting the Workplace Employers Responsibilities/Duties Hiring Practices, Introduction to Intellectual Property Law, Professional Code of Conduct for Engineers, Relationship between Law and Ethics, Include practice sessions and case studies.

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, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, 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, Include practice sessions and case studies.

Text Books

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
3. R. Subramanian, "Professional Ethics", Oxford University Press.
4. S.B. Srivasthva, "Professional Ethics & Human Values", SciTech Publications (India) Pvt. Ltd. New Delhi.
5. D.R. Kiran, "Professional Ethics & Human Values", TATA Mc Graw Hill Education.
6. Saroj Kumar, "Business Law" and Avtar Singh, "Law of Contract"

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book), Mohandas Karamchand Gandhi "The Story of My Experiments with Truth", E. FSchumacher. "Small is Beautiful", Slow is Beautiful –Cecile Andrews, J C Kumarappa "Economy of Permanence", Pandit Sunderlal "Bharat Mein Angreji Raj" and Dharampal, "Rediscovering India
4. G K Kapoor, "Business Law" and Sen & Mitra, "Business & Commercial Laws" and Calvin Frank Allen, "Business law for Engineers"
5. Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). *Introduction to Psychology*. 6th Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.
6. Govindarajan, M; Natarajan, G. M. & Senthilkumar, V.S. (2013). *Professional Ethics & Human Values*. Prentice Hall: New Delhi
7. Gogate, S. B. (2011). Human Values & Professional Ethics. Vikas Publishing: New Delhi.
8. Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, "Engineering Ethics, Concepts Cases: 4e, Cengage learning, 2015.
9. Caroline Whitbec, " Ethics in Engineering Practice & Research: 2e, Cambridge University Press 2015.

EE2111	**NCC/NSS**	**0L:0T:2P**	**0 CREDITS**

2ND YEAR 2ND SEM

EE2201	Signals& Systems	3L:0T:0P	3 CREDITS

Prerequisite: None

Course objectives:

- To understand the fundamental properties of linear systems
- Use linear systems tools, especially transform analysis and convolution, to analyse and predict the behaviour of linear systems
- Apply properties of the Fourier Transforms and Z-transforms .

Course Outcome:A student be

- Ableto describe signals mathematically and to perform mathematical operations on signals
- Able to classify the signals.
- Able to compute the output of an LTI system for a given input.
- Able to find Fourier series coefficients of a periodic signal.
- Able to find Z transform of a discrete-time signal.

Size of a Signal, Signal Energy, Signal Power, Some Useful Signal Operations , Time Shifting, Time Scaling , Time Reversal , Combined Operations.

Classification of Signals, Continuous-Time and Discrete-Time Signals, Analog and Digital Signals, Periodic and Aperiodic Signals, Energy and Power Signals, Deterministic and Random Signals.

Some Useful Signal Models, Unit Step Function u(t) , The Unit Impulse Function, The Exponential Function , Even and Odd Functions, Some Properties of Even and Odd Functions, Even and Odd Components of a Signal.

Systems, Classification of Systems , Linear and Nonlinear Systems , Time-Invariant and Time-Varying Systems , Instantaneous and Dynamic Systems , Causal and Noncausal Systems , Continuous-Time and Discrete-Time Systems , Analog and Digital Systems , Invertible and Noninvertible Systems, Stable and Unstable Systems.

Properties of Systems, Linear Time – invariant Systems. Continuous Time and Discrete time.

Fourier series, Convergence of Fourier series, Fourier Transform. Periodic Signals and Continuous and discrete Fourier Transform. Z-transform of a Discrete Sequence, Region of Convergence for the Z-transform. Inverse Z-transform, Properties of Z-transform, Relation Between Z and Fourier Transform.

Linear Time – Invariant (LTI) Systems, Representation of Signals in terms of Impulses, Discrete Time LTI Systems, the Convolution Sum, Continuous Time LTI Systems, the Convolution Integral. Properties of LTI

Systems, Systems described by Differential and Difference Equations. Block Diagram Representation of LTI Systems described by Differential Equations and, Singularity Functions.

Frequency Response Characterized by Linear Constant Coefficient Differential Equations. First-order and Second-order Systems. Representation of DTFT, First-order and Second-order Systems.

Sampling Theorem, Reconstruction of a Signal from Samples, the Effect of under sampling, Discrete Time Processing of Continuous Time Signals. Sampling in Frequency Domain, Sampling of Discrete Time Signals.

Textbooks:

1. V. Oppenheim et al.,(1997) Signals & Systems (2nd Edition), Prentice Hall.,
2. Principles Of Linear Systems And Signals, B.P. Lathi, Oxford University Press
3. Open Course Ware material Signals and Systems, Massachusetts Institute of Technology
4. Theory and Problems of Signals and Systems, Hwei P. Hsu, Schaums Outline Series.
5. Signals and Systems ,P.Ramakrishna Rao, Shankar Prakriya, Mc Graw Hill Education India.

EE2202	Electrical Measurements	3L:0T:0P	3CREDITS

Prerequisite: none

Course objectives:

- Gain knowledge between different types analog and digital measurements.
- Study the characteristics of moving element measurements
- Study the concepts of measuring various electrical parameters/quantities
- Knowledge regarding the magnetic measurement & devices.
- To study various bridges and their applications.
- To study various potentiometers configurations.

Course Outcome:

Upon successful completion of the course, the students will be able to

- Describe operation of electrical measuring instruments.
- Select suitable instrument for measuring power and energy of electrical systems.
- Determine the parameters of electrical circuits using suitable measuring instruments.

Instruments: Objectives of Measurements, Analog versus Digital Measurements, Accuracy, Precision and Uncertainty, Sources of Measurement Error, Standard Cell And Standard Resistance.

Characteristics of measuring instruments with a moving element instruments: Ammeter, Voltmeter, Expression for Torque of Moving Coil, Moving Iron, Dynamometer, Induction and Electrostatic Instruments.

Extension of Range Of Instruments: Wattmeters, Torque Expression for Dynamometer Instruments. Reactive Power Measurement, Energy Meters Single Phase And Poly Phase, Driving Torque And Braking Torque Equations, Errors And Testing, Compensation, Maximum Demand Indicator, Power Factor Meters, Frequency Meters, Electrical Resonance And Weston Type of Synchro-Scope.

Bridge Methods: Measurement of Inductance, Capacitance & Resistance Using Bridges. Maxwell's, Anderson's, Wein's Heave-Side & Campbell's, Desauty's, Schering's Bridges, Kelvin's Double Bridge, Price Guard Wire Bridge, Loss Of Charge Method, Megger, Wagner's Earthing Device.

Magnetic Measurements: Ballastic Galvanometer, Calibration of Hibbert's Magnetic Standard Flux Meter, loydfischer Square for Measuring Iron Loss. Testing Of Ring and Bar Specimens, Determination Of B-H Curve And Hysteresis Loop Using CRO, Determination Of Leakage Factor.

Potentiometers & Instrument Transformers: Crompton's D.C. Potentiometer, A.C. Polar and Co-Ordinate Type PotentioMeters.Applicationsmeasurement Of Impedance, Calibration of Ammeters, Voltmeters and Wattmeters.Use of Oscilloscope in Frequency, Phase and Amplitude Measurements,

Indian Standard Specifications for Voltmeters, Ammeters, Energy Meters, Insturmnet Transformers – Ration and Phase Angle Errors and Their Reduction.

Text Book:

1. Electric and Electronic Instrumentation By A.K. Sawhney, DhanpatRai& Sons, Delhi, 11th Edition, 1995.

References:

1. Electrical & Electronic Instrumentation by UmeshSinha, SatyaPrakashan, Newdelhi,1998
2. Electrical Measurements byE.W.Golding. &Widdis, 5th Edition, Wheeler Publishing.

EE2203	Electric machines – II	3L:0T:0P	3.0 CREDITS

Prerequisite: Network Theory

Course Objectives:

- To introduce the concept of transformers.
- To introduce the concepts of Induction motors
- To introduce the concepts of Synchronous machines

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Analyze single phase and three phase transformers circuits.
- Analyze the operation of different configurations of Induction motors
- Analyse the operation of synchronous machines

Transformers: Principle of operation, Constructional features, Types of Transformers, emf equation of a Transformer, Idea Transformer, Practical Transformer on No-Load and Load and its vector diagrams, Equivalent Circuit of a Transformers, Losses in a Transformer, Voltage Regulation and Efficiency, Testing of a Transformers, All Day Efficiency, Condition for Maximum Efficiency of a Transformer, auto transformers, tap changers on transformers, Parallel Operation of single phase transformers.

Three Phase Transformers: Three-phase Transformers, Three-phase Transformer Connections, Star/Star or Y/Y Connection, Delta-Delta or Connection, Wye/Delta or Y/ Connection, Delta/Wye or /Y Connection, Open-Delta or Y-Y Connection, Power supplied by Y-Y Bank, Three-phase to Two-Phase conversion and vice-versa, Parallel operation of 3- phase Transformers.

Synchronous Generators: Basic requirements, Constructional details, EMF equation, Effect of chording and distribution of winding, Armature reaction, Phasor diagram, Regulation of Synchronous Generators using EMF, MMF and ZPF method.

Synchronization of alternators, Parallel operation of two-alternators, Parallel operation of Synchronous Generator to infinite bus, Sharing of real and reactive powers, Capability curve, Salient-pole synchronous machine, Two-reaction theory, Determination of direct axis and quadrature axis reactances of salient-pole machines, Power-Angle characteristics of cylindrical and salient-pole machines.

Synchronous Motors: Principle of operation, starting methods, phasor diagram, effect of changing load and changing excitation on machine performance, V and Inverter 'V' curves, Hunting, Damper winding, power developed by synchronous motor.

Textbooks:

1. Electrical Machinery by DR.P.S.BIMBHRA, KHANNA PUBLISHER.

2. Electrical Machines by D P KOTHARI and I J NAGRATH, Mc Graw Hill Education (India) Private Limited.

Reference books:

1. M G Say, The performance and Design of Alternating Current Machines, 3rd edition, CBS Publishers & Distributors, New Delhi, 2002.
2. Electrical Machines, by J B Gupta, S K Kataria& Sons.
3. Electrical Machines by U A Bakshi and M V Bakshi, Technical Publications.

EE2204	EMF Theory	3L:0T:0P	3.0 CREDITS

Prerequisite: Basic Physics, Differential Calculus

Course Objectives:

- To familiarize the students with different coordinate systems.
- To impart knowledge on the concepts of electrostatics, electric potential, energy density and their applications.
- To impart knowledge on the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.
- To impart knowledge on the concepts of Faraday‘s law, induced emf and Maxwell‘s equations.

Course Outcomes:

At the end of the course, the student could able to

- Understand the basic mathematical concepts related to electric and magnetic vector fields.
- Apply the principles of electrostatics to the problems relating to electric field and electric potential, boundary conditions and electric energy density.
- Apply the principles of magnetostatics to the problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density.

Introduction: Rectangular, Cylindrical and Spherical Coordinate Systems.

Electrostatics: Coulomb’s Law, Electric Field of Different Charge Configurations using Coulomb’s Law, Electric Flux, Field Lines, Gauss’s Law in terms of E (Integral Form and Point Form), Applications of Gauss’s Law, Curl of the Electric Field, Electric Potential, Calculation of Electric Field Through Electric Potential for given Charge Configuration, Potential Gradient, The Dipole, Energy density in the Electric field.

Conductors, Dielectrics, and Capacitance: Current and Current Density, Continuity of current, Metallic conductors, Conductor properties and Boundary Conditions, The Method of Images, Semiconductors , The Nature of Dielectric materials, Boundary conditions for Perfect Dielectric Materials, Capacitance, Several Capacitance Examples, Continuity Equation, Basic Properties of Conductors in Electrostatic Fields, Capacitance, Poisson’s and Laplace’s Equations, Examples of the Solution of Laplace’s Equations, Uniqueness Theorem, Examples Of The Solution Of Poisson’s equations.

The Steady Magnetic Field: Biot-Savart’s Law , Amperes Circuital Law, Curl, Stokes Theorem, Magnetic Flux and Magnetic Flux Density , The Scalar and Vector Magnetic Potentials , Derivation of Steady Magnetic Field Laws.

Magnetic Forces, Materials and Inductance: Force on Moving Charge, Force on a Differential Current Element, Force Between Differential Current Elements, Force and Torque on a Closed Circuit, The Nature of Magnetic Materials, Magnetization and Permeability, Magnetic Boundary Conditions, The Magnetic Circuit, Potential Energy and Forces On Magnetic Materials.

Self-Inductance, Internal Inductance and Mutual Inductance, Magnetic circuits , BH Curve , Cores with Air Gaps, Parallel Magnetic Circuits (Chapter 11 Joseph. A. Edminster)

Time Varying Fields and Maxwell's Equations: Faraday's Law, Transformer and Motional EMFs, Displacement Current, Maxwell's Equations in Point Form, Maxwell's Equations in Integral Form, Time - Varying Potentials Time-Harmonic Fields.

Textbooks:

1. Elements of Electromagnetics by Matthew N.O. Sadiku, Oxford University Press.
2. Engineering Electromagnetics by William H. Hayt Jr. and John A. Buck, Sixth Edition, Mc Graw Hill, New Delhi, 2001.
3. Electromagnetics, Joseph A. Edminister, Schaum's Outline Series, McGrawHill International Editions.

Referencebooks:

1. Introduction to Electrodynamics by David J. Griffiths, 3rd Edition, Prentice Hall, New Jersey, 1999.
2. Electromagnetics by John D Kraus, Mc Graw-Hill International Edition, 1999.

Engineering Electromagentics by J. P. Tewari, Khanna Publishers, 2nd edition.

EE2205	Electrical Engineering Materials	3L:0T:0P	3.0 Credits

Prerequisite: Basic Physics

Course Objectives:

- To explain students about dielectric materials and their properties.
- To detail about magnetic materials and their properties.
- To familiarize with semiconductor materials and their applications.
- To introduce various kinds of special purpose materials.

Course Outcomes:

After completion of this course, the student will be able to

- Understand various types of dielectric materials, their properties in various conditions.
- Evaluate magnetic materials and their behavior.
- Evaluate semiconductor materials and technologies.
- Acquire Knowledge on Materials used in electrical engineering and applications.

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, pyroelectric materials.

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.

Semiconductor Materials: Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale integration techniques (VLSI)

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.

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.

Textbooks:

1. “R K Rajput”, “ A course in Electrical Engineering Materials”, Laxmi Publications, 2009

2. “T K Basak”, “ A course in Electrical Engineering Materials”, New Age Science Publications 2009

Reference books:

1. TTTI Madras, “Electrical Engineering Materials”, McGraw Hill Education, 2004.

2. “AdrianusJ.Dekker”, Electrical Engineering Materials, PHI Publication, 2006.

3. P. Seth, P. V. Gupta “A course in Electrical Engineering Materials”, DhanpatRai& Sons, 2011.

EE2206	Electrical Machines – II lab	0L:0T:3P	1.5 CREDITS

Prerequisite: Electrical Machines-II

Course Objective:

- To understand design and each part of ac electrical machines.
- To gain expertise in controlling dc electrical machines.
- Also to perform tests on ac electrical machines and transformers and determine their characteristics.
- To inculcate team spirit and cooperative behaviour.

Course Outcome:

After completion of course, a student will be able to

- Analyse dc electrical machines.
- To define characteristics of ac machines.
- To test them in various methods.

#experiments can be drafted basing on the theory course#

EE2207	Electrical Measurements lab	0L:0T:3P	1.5 CREDITS

Prerequisite: Electrical measurements & measuring devices

Course Objectives:

- To gain practical knowledge on measuring electrical quantities.
- To understand the functioning of measuring devices
- To understand the circuits of electrical measuring devices.
- To develop team spirit.

Course Outcomes:

After completion of this course, a student will be able to

- Analysevarious measured electrical quantities.
- Developing circuits for small applications.

#experiments can be drafted basing on the theory course#

EE2208	Electrical CAD	0L:1T:2P	2.0 credits

Prerequisite: Network theory, Electric Machines

Course objectives:

- To understand the software.
- To design electrical networks.

Course Outcome:

- After completion of this course, a student
- Can design a CAD model of an electrical network

#experiments/programs can be drafted to suit the technical needs of the students#

EE2209	Environmental studies	0L:0T:0P	0 credits

Course Objectives

The objectives of the Environmental Science course are to

- Familiarize the fundamental aspects of environment and the environmental management'
- Provide information of some of the important international conventions which will be useful during the future endeavors after graduation.
- Make realize the importance of natural resources management for the sustenance of the life and the society.
- Apprise the impact of pollution getting generated through the anthropogenic activities on the environment
- Provide the concept of Sustainable Development, energy and environmental management
- Impart knowledge on the new generation waste like e-waste and plastic waste.

Course Outcomes

After completion of the course the students will have

- Knowledge on the fundamental aspects of environment and the environmental management
- The knowledge on the salient features of the important international conventions
- Understanding of the importance of natural resources management for the sustenance of the life and the society.
- Familiarity on various forms of pollution and its impact on the environment.
- Understand the elements of Sustainable Development, energy and environmental management
- Knowledge on the new generation waste like e-waste and plastic waste.

SYLLABUS

Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems.
Salient features of International conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC),

Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide-watershed management.

Forest resources: Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings.

Water resources: Exploitation of surface and groundwater, Floods, droughts, Dams:benefits and costs.

Mineral Resources: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals.
Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution.

Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986.

Sustainable Development: Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.

Energy and Environment: Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Solar Energy: process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

Management of plastic waste and E-waste: Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Bharucha,Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India
3. Masters, G. M., &Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.
4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)
4. Jadhav, H & Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
5. MoEF&CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018.
6. MoEF&CC, Govt. of India, CPCB: Plastic waste management rules, 2016.