ANDHRA UNIVERSITY: : VISAKHAPATNAM

DEPARTMENT OF ELECTRICAL ENGINEERING

SCHEME OF INSTRUCTION & EXAMINATION

I/IV B.TECH

Common with SIX YEAR DUAL DEGREE COURSE II/VI (B.TECH.+ M.TECH.)

(With effect from **2019-2020** admitted batch onwards)

B.TECH. (EEE) I YEAR I-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

SUB. REF	NAME OF THE SUBJECT	PERIODS			MAXIMUM MARKS			CREDITS
		THEORY	TUTORIAL	LAB	SESSIONALS	EXAM	TOTAL	
ENG1101	English	2	--	--	30	70	100	2
ENG1102	Mathematics -1	3	--	--	30	70	100	3
ENG1103	Mathematics -2	3	--	--	30	70	100	3
ENG1105	Physics	3	1	--	30	70	100	4
ENG1107	Engineering Graphics	2	--	3	30	70	100	3.5
ENG1109	Physics Lab	--	--	3	50	50	100	1.5
ENG1111	Workshop	--	--	3	50	50	100	1.5
ENG1113	Professional Ethics & Moral Values	2	--	--	30	70	100	0
	TOTAL	**15**	**1**	**9**	**280**	**520**	**800**	**18.5**

ENG1101	English	2L:0T:0P	2 Credits

Course Outcomes:

At the end of the course the student will be able to

- Infer explicit and implicit meaning of a text
- Construct clear, grammatically correct sentences using a variety of sentence structures
- Analyse and Produce various types & formats of emails, letters in formal & informal ways to meet particular purposes.
- Select and apply appropriate words and phrases in different contexts.
- Formulate and present ideas effectively in spoken form.
- Discuss social issues with concern and imagine possible solutions

The emphasis on English Language is enormously increasing as an effective medium of communication in all sectors the World over. As a consequence of this, the acquisition of effective communication skills in English has become most important to the students to flourish in their careers. In this connection there is a need to train the students to equip themselves with the necessary skills required for effective communication in English thereby enabling them to get a good placement immediately after the completion of their undergraduate courses. To meet the objectives of developing proficiency in English communication skills and developing Listening, Speaking, Reading and Writing (LSRW) skills. The following curriculum is designed for favorable consideration.

CURRICULUM: THEORY AND PRACTICE (LANGUAGE LAB)

1. **A TEXT WITH FOCUS ON SKILLS APPROACH**

Intended to develop the language skills of Listening. Speaking, Reading and Writing.

2. **VOCABULARY :**

a) One – Word Substitutes.
b) Words often Confused – Pairs of Words.
c) Synonyms and Antonyms.
d) Foreign Phrases.
e) Phrasal verbs derived from the following dynamic verbs_Go, Get, Run, Take, Look, Hold, Put, Stand Etc.
f) Idioms and phrases.

3. **GRAMMAR :**

a) Error Analysis
   - Correction of Errors in a given sentence – errors in the use of words – errors of indianisms – use of slang – errors in punctuation

b) Concord
c) Articles, Prepositions and words followed by prepositions.
d) Tenses.

4. **Writing skills :**

a) Précis writing
b) Note Making

c) Letter writing.
d) Technical Report Writing.
e) Preparation of C.V and Resume writing.
f) Reading Comprehension.
g) Memo.
h) Notices/Circulars Agenda and Minutes of a Meeting.
i) E-Mail etiquette
j) Essay writing.

Text Books:
In order to improve the proficiency of the student in the acquisition of the above mention skills, the following texts and course content is prescribed.

- **LEARNING ENGLISH:** A Communicative Approach, Hyderabad: Orient Long man. (selected lessons)

The following lessons are prescribed from the above Text:
i) Astronomy (1)
ii) Travel and Transport (3)
iii) Humour (4)
iv) Environment (6)
v) Inspiration (7)
vi) Human Interest (8)

Reference Books Prescribed:

1. Sharma, G.V.L.N., **English for Engineering Students**.
2. Margaret M Maison, **Examine your English**, Orient Longman
3. Krishnaswami,N and Sriraman, T., **Current English for Colleges**, Macmillan.
4. Krishnaswami, N. and Sriraman, T., **Creative English for Communication**, Macmillan.
5. Rizvi, M Ashraf. **Effective Technical Communication.** McGraw – Hill.
6. English for Technical Communication K.R Lakshminarayana, SCITECH.

ENG1102	Mathematics - I	3L:0T:0P	3 Credits

Course Outcome:

At the end of the course the student will learn

- Classify and solve analytically a wide range of first and higher order ordinary differential equations with constant coefficients
- Explain the concept of Convergence and divergence of series.
- Adapt methods for measuring lengths, volumes, surface area of an object and transformation of coordinates in practical situations
- Utilize basic knowledge of conservative field, potential function and work done in engineering problems
- Identify the relationships between line, surface and volume integrals
- Formulate and solve some of the physical problems of engineering using partial differential equations

UNIT: I

Partial Differentiation and its applications: Functions of Two or More Variables, Partial Derivatives, Homogeneous Functions- Euler's Theorem, Total Derivative. Differentiation of Implicit Functions, Geometrical Interpretation- Tangent Plane and Normal to a surface. Change of Variables, Jacobians, Taylor's Theorem for functions of two variables. Jacobians, Taylor's Theorem for functions of two variables. Errors and approximations. Total Differential, Maxima and Minima of functions two variables. Lagrange's method of undetermined multiples, Differentiation under the integral sign – Leibnitz Rule. Involutes and evolutes.

UNIT: II

Multiple integrals and their applications: Double integrals. Change of order of integration. Double integrals in Polar Co-ordinates, Areas enclosed by plane curves. Triple integrals. Volume of solids. Change of variables. Area of a curve of a curved surface. Calculation of Mass, Center of gravity, Center of pressure, Moment of inertia. Product of inertia. Principle Axes. Beta function, Gamma function. Relation between Beta and Gamma functions. Error function or Probability integral.

UNIT: III

Solid geometry (Vector Treatment): Equation of a plane. Equations of Straight line. Condition for a line to lie in a plane. Coplanar lines. Shortest distance between two lines. Interaction of three planes. Equation of Sphere, Tangent plane to a sphere. Cone, cylinder, Quadric surfaces.

UNIT: IV

Infinite series: Definitions. Convergence, Divergence and oscillation of a series, General properties, series of Positive terms, comparison tests, Integral test. D'Alembert's ratio test. Raabe's test. Logarithmic test. Cauchy's Root test. Alternating series- Leibnitz's rule, Series of positive or negative terms. Power series. Convergence of exponential. Logerithmic and Bionomial series. Uniform convergence. Weirstrass M-test. Properties of uniformly convergent series.

UNIT: V

Fourier series: Euler's formulae, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval, Odd and even functions – Expansions of odd or even periodic function. Half range series. Parsevel formula, Practical Harmonic analysis.

Text Books:

1. Higher Engineering Mathematics by B.S.Grewal
2. Mathematics for Engineering by Chandrica Prasad.

Reference Books:

1. Higher Engineering Mathematics by M.K.Venkatraman.
2. Advanced Engineering Mathematics by Erwin Kreyszig.

ENG1103	Mathematics – II	3L:0T:0P	3 Credits

Course Outcomes:

At the end of this course student will be able to

- Apply matrix knowledge to Engineering problems
- Solve problems related to engineering applications using Bernoulis Equation.
- Make use of Laplace transforms in solving the differential equations with the initial and boundary conditions
- Explain the concept of solving Legender's equations

UNIT: I

Linear Algebra: Rank of a Matrix. Eigen values Eigen vectors of a Matrix. Cayley Hamilton Theorem. Consistency of equations. Matrix Invertion, Gaussian Elimination Scheme. Cholesky factorization. Jacobi and Gauss-Seidal Iterative Methods for solving simultaneous equations. Eigen Value solution using forward iteration. Inverse itrration. Hermitian and skew Hermitian forms. Unitary Matrix, Functions of a Matrix. Quadratic forms and Conical forms.

UNIT: II

Differential Equations of First Order And Its Applications: Formation of differential equation. Solution of a differential equation. Geometrical meaning. Equations the first order and first degree. Variables separable, Homogeneous equations. Linear equations. Bernoulli's equation. Exact equations. Equation reducible to exact equations. Equations of the first order and higher degree. Calirut's equation. Geometric applications. Orthogonal trajectories, Physical applications. Simple Electric circuits. Heat flow, Chemical applications. Newton's law of cooling.

UNIT: III

Linear Differential Equations: Higher order linear differential equations with constant Coefficients. Deflection of beams. Simple harmonic motion. Oscillatory Electric circuits.

UNIT: IV

Series solutions of differential equations: Frobenis method, Special function as solution from series. Bessel equation, Bessel functions of first and second kind. Equation reducible to Bessel's equations. Legender's equations, Legender Polynomial, Rodrigues formula, Generating functions. Recurrence relation. Orthonogolity relation for Bessel functions and Legendre Polynomial.

UNIT: V

Laplace transforms: Transforms of elementary functions. Properties of Laplace Transforms, Existence conditions, Inverse transforms, Transform of derivatives, Transform of Integrals. Multiplication's by 't'- division by 't'. Convolution theorem. Application to ordinary differential equations and simultaneous linear equations with constant coefficients. Unit step function, Impulse functions and periodic functions.

Text Books:

1. Theory of Matrices by Shantinarayanan.
2. Higher Engineering Mathematics by B.S. Grewal
3. Adv. Math for Engg students, vol. 2 by Narayana, Manieavachgon Pillay, Ramanaiah

Reference Books:

1. Higher Engineering Mathematics by M.K.Venkataraman.
2. Advanced Engineering Mathematics by Erwin Kreyozig.
3. Engineering Mathematics by P.P. Gupta.
4. A text book on Engg Mathematics by N.P.Bali.

ENG1105	Physics	3L:1T:0P	4 Credits

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

- Illustrate the concepts of Interference, Diffraction, Polarization and their applications
- Summarize the concepts of electric fields, magnetic fields and
- superconductivity and make out the scope of applications in various engineering fields
- Outline the quantum mechanics to infer conductivity nature of metals
- Explain the properties and application of dielectric, magnetic and Nano - materials
- Demonstrate the emission of laser light, optical fibers and their applications in various Engineering fields
- Analyse the engineering Applications based on Fundamental concepts

UNIT: I
Thermodynamics: Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Entropy, Second law of thermodynamics, Entropy and disorder, Entropy and Probability, Third law of thermodynamics. Thermography and its Applications.

UNIT: II
Electromagnetism: Concept of electric field – Point charge in electric field, dipole in an electric field. Gauss law, some applications, electric potential and field strength, potential due to a point charge and dipole.
Magnetic field – magnetic force on current, torque on current loop, Hall effect, Ampere's law, B near a long wire, B for a solenoid and Toroid. The Biot-Savart,s Law. B for a circular Current loop.

Faraday's law of induction. Lenz's law, Calculation of Inductance. L-R Circuit. Energy stored in Magnetic field. Induced magnetic fields, Displacement current. Energy density in Electric and Magnetic fields, Poynting Vector S.

Maxwells equations and Electromagnetic waves (Both differential and Integral forms). Magnetic properties of materials. Paramagnetism, Diamagnetism, Ferromagnetism, Ferrites and its applications.

UNIT: III
Optics: Interference – Principles of superposition – Young's Experiment – Coherence – Interference of thin films, Wedge shaped film, Newtons Rings, Michelson Interferometer and its applications.
Diffraction – Single slit (Qualitative and quantitative treatment).

Polarisation – Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization and detection.

UNIT: IV

Lasers and Fibre Optics: Spontaneous and stimulated emissions, population inversions, Ruby laser, Gas laser, Semiconductor laser, Applications of lasers.

Fibre Optics, Optical Fibre and Total Internal Reflection, Acceptance Angle and cone of a fibre, Fibre optics in communications, Optical parts in Fibre. Fibre Optic Sensors.

UNIT: V

Ultrasonics: Production of Ultrasonics by Magnetostriction and Piezoelectric effects – Ultrasonics and diffraction pattern, Applications of Ultrasonics.

UNIT: VI

Modern Physics: The quantization of energy, Photoelectric effect, De Broglie concept of matter waves, uncertainty principle, Schrodinger wave equation, application to a particle in a box.

Elementary concepts of Maxwell-Boltzman, Bose-Einstein's and Fermi Dirac Statistics. Fermi Dirac Distribution function (no derivations).

Free electron theory of metals, Band theory of solids, Kronig Penny Model, Metals, Insulators and Semiconductors. Ferroelectrics and their applications

Super conductivity, Meisner Effect, Types of Superconductors and Applications of Superconductors.

Nanophase materials – Synthesis, characterization of nanostructured materials, properties and applications.

Renewable energies – Solar, wind and tidal – Applications

TEXT BOOKS:

1. Engineering Physics by R.K. Gaur and S.D. Gupta
2. Physics by David Halliday and Robert Resnick – Part I and Part II
3. Modern Engineering Physics by A.S. Vadudeva
4. University Physics by Young and Freedman
5. Materials Science by V. Rajendra and A. Marikani
6. Nonconventional Energy by Ashoke V. Desai

ENG1107	Engineering Graphics	2L:0T:3P	3.5 Credits

Course Outcomes:

At the end of this course student will be able to

- Understand Principles of engineering drawing
- Construct Conic sections using general methods and other methods
- Construct Orthographic projections of Points, Lines and Planes
- Construct Orthographic projections of Solids using basic drafting software
- Construct Isometric projections using basic drafting software
- Construct Orthographic projections from given isometric projections of an object and vice versa

UNIT: I

Introduction: Drawing Instruments and uses. Lettering scales in common use.

UNIT: II

Curves: Curves used in Engineering Practice, conic sections, construction of conics by different methods, rectangular-hyperbola, cycloidal curves, trochoids, epi and hypo-cycloids. involutes and Archemedian spiral.

UNIT: III

Orthographic Projections: Projection of points, projection of straight lines, traces of a line, projection of planes and projection on auxiliary planes.

UNIT: IV

Solids and Developments: Projection of solids in simple positions, projection of solids with axis inclined to one of the reference planes and parallel to the other, projection of solids with axis inclined to both the reference planes. Projection of spheres. Development of surfaces of solids. Development of transition piece connecting a square and circular pipe. Helices and screw threads.

UNIT: V

Sections and Intersections: Sections of different solids and true shape of sections. Intersection of surfaces-simple problems with cylinders, prisms and cones.

UNIT: VI

Isometric and Perspective Projections: Isometric projection and conversion of orthographic projection into isometric projection. Perspective projection. Theory of visual ray method and vanishing point method. Simple problems involving regular geometrical solids.

Textbook:

1. Elements of Engineering Drawing by N.D. Bhatt

Reference:

1. Engineering Graphics by K.L. Narayana and P. Kannaiah

ENG1109	**Physics Lab**	**0L:0T:3P**	**1.5 Credits**

*** Common with all branches

ENG1111	Workshop	0L:0T:3P	1.5 Credits

Course Outcomes:

At the end of this course student will be able to

- Utilize basic carpentry tools for the preparation of wooden joints
- Make use of basic hand tools for the preparation of mild steel joints
- Build simple house hold items with GI sheet using tin smithy tools
- Make use of house wiring accessories to build simple electrical circuits
- Build simple components with hand tools for making experimental setups
- Build simple components with hand tools as per the drawing specifications

UNIT: I

Carpentry: Bench work, tools used in carpentry.

Jobs for class work – half lap joint, mortise and tenon joint, half –lap dovetail joint, corner dovetail joint, bridle joint.

UNIT: II

Sheet Metal: Tools used in sheet metal work. Laying developments of sheet metal jobs, soldering.

Jobs for class work – square tray, taper side tray, funnel, elbow pipe.

UNIT: III

Fitting: Tools used in fitting work. Different files, chisels, hammers and bench vice.

Jobs for class work – hexagon, rectangular, circular and triangular fits. External and internal threads with dies and taps.

Reference:

1. Elements of Workshop technology, Vol.1 by S.K. and H.K. Hajra Choudary

ENG1113	Professional Ethics & Moral Values	2L:0T:0P	0 Credits

Course Outcomes:

At the end of this course student will be able to

- Interpret the core values and awareness on professional ethics and human values
- Interpret engineering as social experimentation
- Identify the responsibilities of an engineer for safety, risk benefit analysis and professional rights
- Summarize the role of electrical engineers in assessing industrial safety
- Outline the operational issues of Electrical Apparatus
- Outline the operational issues of power grid

UNIT: I

Human Values and Engineering Ethics - Morals, Values and Ethics, Integrity, Work ethic, Service learning, Civic virtue, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing time, Cooperation, Commitment, Empathy, Self- confidence, Character, Spirituality. Senses of Engineering Ethics, Variety of moral issues, Types of inquiry, Kohlberg's theory, Gilligan's theory, Consensus and Controversy, Models of professional roles, Theories about right action, Self - interest, Customs and Religion, Uses of Ethical Theories. Moral dilemmas, Moral Autonomy

UNIT: II

Safety, Responsibilities and Rights in Social Experimentation - Engineering as Experimentation, Engineers as responsible Experimenters, Codes of Ethics, Balanced Outlook on Law, Safety and Risk, Assessment of Safety and Risk, Risk Benefit Analysis and Reducing Risk, Respect for Authority, Collective Bargaining, Confidentiality, Conflicts of Interest, Occupational Crime, Professional Rights, Employee Rights. Intellectual Property Rights

UNIT: III

Operational Issues of Electrical Apparatus - Code of practice for construction, installation, protection, operation and maintenance of electric supply lines and apparatus, Installation and Testing of Generating Units, Meters, maximum demand indicators and other apparatus on consumer's premises, Point of commencement of supply, Test for resistance of insulation, Earth leakage protective device, Use of energy at high and extra - high voltages Maximum stresses; Factors of safety, clearances in overhead lines Role, qualification and licensing of electrical inspector

UNIT: IV

Operational Issues of Power Grid - Terminology, Objective, Scope and Structure of Indian Electricity Grid Code (IEGC), Role of various agencies under IEGC, Functioning of interstate transmission, Operating code, Scheduling and dispatch
Connection code

Text books:

1. R.S.Naagarazan, “Professional Ethics and Human Values”, New Age International Ltd Publishers, 2006

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B.TECH. (EEE) I YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

SUB. REF	NAME OF THE SUBJECT	PERIODS			MAXIMUM MARKS			CREDITS
		THEORY	TUTORIAL	LAB	SESSIONALS	EXAM	TOTAL	
ENG1201	Mathematics -3	3	1	--	30	70	100	4
ENG1202	Chemistry	3	1	--	30	70	100	4
ENG1204	Computer Programming using C &Numerical Methods	3	--	--	30	70	100	3
ENG1206	Fundamentals of Electrical Engineering	3	1	--	30	70	100	4
ENG1207	Chemistry Lab	--	--	3	50	50	100	1.5
ENG1209	CPNM Lab	--	--	3	50	50	100	1.5
ENG1211	English Lab	--	--	3	50	50	100	1.5
ENG1213	Essence of Indian Traditional Knowledge	2	--	--	30	70	100	0
	TOTAL	**14**	**3**	**9**	**300**	**500**	**800**	**19.5**

ENG1201	Mathematics – III	3L:1T:0P	4 Credits

Course Outcomes:

At the end of this course student will be able to

- Utilize numerical techniques to find approximate solutions of Complex Variables.
- Make use of method of least squares to fit a best curve for the given data
- Find approximate values of derivatives and finite integrals using numerical techniques
- Comprehend basic probability axioms and apply Baye's theorem related to engineering problems

UNIT: I

Functions of a Complex Variables Continuity concept of f(z), Derivative of f(z), Cauchy - Riemann Equations, Analytic Functions, Harmonic Functions, Orthogonal Systems, Applications to Flow Problems, Integration of Complex Functions, Cauchy's Theorem, Cauchy's Integral Formula, Statements of Taylor's and Laurent's Series without Proofs, Singular Points, Residues and Residue Theorem, Calculations of Residues, Evaluation of Real Definite Integrals, Geometric Representation of f(z), Conformal Transformation, Some Standard Transformations:- (1) $w = z+c$, (2) $w = 1/z$, (3) $w = (az+b)$ (4) $w = z^2$, (6) $w = e^2$.

UNIT: II

Statistical Methods - Review of Probability theory (not be examined), Addition law of probability, Independent events, Multiplication law of probability, Bay's theorem, Random variable, Discrete probability distribution, Expectation, Moment generation function, repeated trails, Binomial distribution, Poission distribution, Normal distribution, Prabable error, Normal approximation to binomial distribution.

UNIT: III

Sampling Theory: Sampling Distribution, Standard Error, Testing of Hypothesis, Level of Significance, Confidence Limits, Simple Sampling of Attributes, Sampling of Variables - Large Samples and Small Samples, Student's T-distribution, x2 - Distribution, F – Distribution , Fisher's Z - Distribution.

UNIT: IV

Difference Equations and Z-Transforms Z - transforms - Definition, Some Standard Z-transforms, Linear Property, Sampling Rule, Some Standard Results, Shifting Rules, Initial and Final Value Theorems, Convolution theorem, Evaluation of inverse transforms, definition, Order and Solution of Difference Equations, Formation of Difference Equations, Linear Difference Equations, Rules for finding C.F., Rule for finding P.L., Difference Equation Reducible to Linear Form, Simultaneous Difference Equations with Constant Coefficients, Application to Deflection of a Loaded String, Applications of Z-transform to Difference Equations.

Text Books:

1. Higher Engineering Mathematics, Dr. B.S. Grewal, Khanna Publisher - N. Delhi, 34th Edition, 1998.

Reference Books:

1. Higher Engineering Mathematics, Dr. M. K. Venkataraman, National Pub. and Co. - Madras.

ENG1202	Chemistry	3L:1T:0P	4 Credits

Course Outcomes:

At the end of this course student will be able to

- Outline the fundamental chemistry with an applied perspective as future engineers with a focus on engineering and industry.
- Analyse the quality of water and its treatment methods for domestic and industrial applications
- Utilize the polymers, plastics, elastomers and advanced materials (Nano materials) as engineering materials and apply them in domestic and industrial life
- Infer the concepts of renewable & non - renewable energy sources, quality of fuels and apply a suitable fuel as an energy source
- Outline the corrosion factors and implement the prevention measures
- Interpret the Nernst equation for electrode potentials and construction and working of various types of energy storage devices

UNIT: I

Water Chemistry and pollution:

Water Chemistry: Sources of water - impurities – Hardness and its determination – W.H.O. limits. Boiler troubles and their removal. Water softening methods – Lime Soda, Zeolite and Ion exchange. Municipal water treatment – Break point chlorination. Desalination of Sea Water - Electrodialysis and Reverse osmosis methods.

Water pollution: Source – BOD – COD – Sewage treatment - preliminary, primary, secondary and tertiary.

Air Pollution: Source – Air pollutants – CO , SOx , NOx , Hydrocarbons and particulates. Acid rain – Green House effect – control of Air pollution (General).

UNIT: II

Solid State Chemistry: Classification of Solids – Types of Crystals – Properties - imperfections in crystals. Band theory of solids. Chemistry of Semiconductors - Intrinsic, extrinsic, compound and defect. Organic semiconductors and superconductivity. Purification of solids by zone refining - Single crystal growth – epitaxial growth. Elementary ideas on liquid crystals.

UNIT: III

Energy Sources: (a) Thermal Energy: Coal- Ranking of coal - analysis (proximate and ultimate) Calorific value and determination (Bomb calorimeter method) – COKE – Manufacture – Otto Hoffmann's process – Applications.

(b) Chemical Energy: Electrode potential – Calomel electrode – Galvanic cells – primary secondary – Acid and alkaline cells – fuel cells.

(c) Nuclear Energy : Fission and fusion – power rectors – Atomic pile applications .

(d) Solar Energy : Methods of utilization – thermal conversion – Liquid Flat – Plate collector – Photovoltaic conversion - solar cell - Applications.

UNIT: IV

Corrosion Chemistry : Origin and theories of corrosion – Types of corrosion - Factors affecting corrosion – corrosion control methods . Protective coatings –Metallic coatings –

Chemical conversion coatings - phosphate , chromate , Anodized . Organic Coating – paints – special paints – Varnishes and lacquers.

UNIT: V

Fuels and Lubricants: Petroleum – refining - Motor fuels – Petrol and Diesel Oil - Knocking – Octane number - Cetane number. Synthetic petrol – Fisher - Tropsch and Bergius methods. LPG and CNG - Applications. Rocket fuels -Propellants - Classification.

Lubricants: Classification - mechanism - properties of lubricating oils - Selection of lubricants for Engineering applications.

UNIT: VI

Polymers and Plastics: Definition – Types of polymerization – Mechanism of addition polymerization. Effect of polymer sructure on properties. Plastics – Thermoplastic resins and Thermosetting resins - Compounding of plastics – Fabrication of plastics. Preparation and properties of cellulose derivatives - Vinyl resins-Nylon(6,6)- bakelites – polycarbonates - epoxy resins. Reinforced plastics. Conducting polymers. Engineering applications of polymers.

Building Materials: (a) Portland Cement: Manufacture - Dry and Wet process. Setting and hardening of cement - Cement concrete - RCC - Decay of concrete - special cements.

(b) Refractories: Classifications - properties - Engineering applications.

(c) Ceramics: Classification - Properties - uses.

Prescribed Text Books:

1. Engineering Chemistry, P.C. Jain and M. Jain - Dhanapathi Rai & Sons, Delhi
2. A text book of Engineering Chemistry, S.S. Dara - S. Chand & Co. New Delhi
3. Engineering Chemistry, B.K. Sharma - Krishna Prakashan, Meerut
4. A text book of Engineering Chemistry, - Allied Publishers Balasubramanian et.al.,
5. Material Science and Engineering V. Raghavan - Prentice-Hall India Ltd.,

ENG1204	Computer Programming using C & Numerical Methods	3L:0T:0P	3 Credits

Course Outcomes:

At the end of this course student will be able to

- Develop the flow charts and algorithms, and then implement, compile and debug programs in C language for solving a problem
- Design programs involving decision structures, loops for problem solving
- Design programs to develop applications using array data structure
- Solve scientific problems using function
- Make use of pointers to design applications for efficient and dynamic memory allocation
- Design programs to create/update basic data files

Section A

Computer Programming in C

UNIT: I

Basics: Variables – Constants – Expressions – Operators and their precedence and associativity. Basic input and output statements. Control structures. Simple programs in C using all the operators and control structure.

UNIT: II

Functions: Concept of a function – Parameters and how they are passed – Automatic Variables – Recursion – Scope and extent of variables. Writing programs using recursive and non-recursive functions.

UNIT: III

Arrays and Strings: Single and multidimensional arrays-Character array as a string-Functions on strings. Writing C Programmes using arrays and for string manipulation.

UNIT: IV

Structures: Declaring and using structures-Operations on structures – Arrays of structures-User defined data types-Pointers to using files.

UNIT: V

Files: Introduction –file structure- File handing functions- file types- Files- Error handing- C Programming examples for using files.

Section B

Computer Oriented Numerical Methods

1. Basic Concepts: Preliminary Concepts of Algorithms-Flow Charts and their execution traces- A Simplified Model of a Computer.
2. Representation for Characters and Numbers: Representation for integer and real numbers. Effect of finite representation on arthimatic operations for example overflow, underflow, associativity and normalization. Some elementary methods for overcoming these limitations.

3. Numerical Methods: Notation of round-off and truncation errors, numerical methods of finding roots of an algebraic equation of one variable. Successive bisection method, False position method, Newton Raphson method and Secant method.
4. Solutions of simultaneous Algebraic Equations; Gauss elimination method and Gauss Seidal methods.
5. Interpolation: Lagrange's Interpolation and difference table methods.
6. Numerical integration: Simpson's rule, Gaussian Quadrature Formula.
7. Numerical Solution of Differential Equation: Euler's method, Taylor's seriesmethod and Runge-Kutta method.

Books:

1. Section A: Programming with C by K.R.Venugopal& Sudeep R Prasad
2. Section B: Introduction to Numerical Methods by S.S Sastry
3. Elementary Numerical Methods by S.D.Conte

Reference:

1. C Programming Language by Kerningham & Ritchie

ENG1206	Fundamentals of Electrical Engineering	3L:1T:0P	4 Credits

Course Out Comes:

At the end of this course student will be able to

- Demonstrate the basic principles of electrical components.
- Outline electric circuits using network laws and reduction techniques.
- Illustrate the behavior of basic circuit elements for an AC excitation.
- Outline the working principle and construction of the measuring instruments.
- Choose appropriate wiring schemes.

UNIT: 1

Electrical Engineering Fundamentals: Electrical circuit elements and sources, Ohm's law, effect of temperature on resistance, resistance temperature coefficient, insulation resistance, Series-parallel connection of inductors, rise and decay of current in inductive circuit, Concepts of mutual inductance, Concept of Potential difference. Charging and discharging of capacitor, Concepts of induced emfs, comparison between electric and magnetic circuit, Kirchhoff's laws, star-delta conversion.

UNIT: 2

Fundamental Laws of Electrical Engineering: Coulombs law of Electrostatics (1^{st} law and 2^{nd}), Faradays laws of Electromagnetic induction, Fleming Left hand and Right hand rules, Lenz's law, Biot-Savart's law, Ampere circuital law, Maxwell's corkscrew rule.

UNIT: 3

Alternating Current Fundamentals: Sinusoidal voltage and currents, their mathematical and graphical representation, concept of cycle, period, frequency, instantaneous value, peak value, average value, RMS value, Peak factor and Form factor; Phase difference, lagging, leading and in phase quantities; and phasor representation, Rectangular and polar representation of phasors, study of A.C circuits (RL, RC and RLC series circuits), Phasor diagrams, voltage, current, powers and power factor, Introduction to poly-phase systems.

UNIT: 4

Fundamentals of Electrical Measurements: (no need to explain errors and compensations) Classification of instruments, various forces in indicating instruments (deflection, control and damping), construction and operation of MI and MC type instruments for voltage and current measurement, Construction and operation of dynamometer type wattmeter, Construction and operation of single phase induction type energy meter.

UNIT: 5

Electrical Wiring: Symbols for various electrical equipment, Service mains, meter board and distribution board, Types of wirings and their Installations, Various types of conductors, conductor sizes and current ratings, Examples of house wiring (one lamp-one switch, Stair case, Corridor wiring, Power wiring), Elementary discussion on Circuit protective devices: fuse and Miniature Circuit Breaker (MCB's), significance of various parameters on name plates of equipment.

Note: The syllabus is prepared to given basic concepts of Electrical Engineering to First year students. Hence, in the evaluation, problems need to be avoided.

Text Books:

1. Basic Electrical Engineering D. C. Kulshreshtha TMH 1st Edition.
2. S L Uppal and G C Garg, "Electrical Wiring, Estimating & Costing", Khanna Publishers, 2015.

Reference Books:

1. Fundamentals of Electrical Engineering Rajendra Prasad PHI Third Edition 2014.
2. V. N. Mittal and Arvind Mittal;, " Basic Electrical Engineering" McGraw Hill.
3. A.K.Sawhney, A Course in Electrical and Electronics Measurements and Instruments- Dhanpat Rai and Sons,Delhi, 2005.

ENG1207	**Chemistry Lab**	**0L:0T:3P**	**1.5 Credits**

*** Common with all branches

ENG1209	**CPNM Lab**	**0L:0T:3P**	**1.5 Credits**

*** Common with all branches

ENG1211	**English Lab**	**0L:0T:3P**	**1.5 Credits**

*** Common with all branches

ENG1213	**Essence of Indian Traditional Knowledge**	**2L:0T:0P**	**0 Credits**

*** Common with all branches

ANDHRA UNIVERSITY: : VISAKHAPATNAM

DEPARTMENT OF ELECTRICAL ENGINEERING

SCHEME OF INSTRUCTION & EXAMINATION

II/IV B.TECH

Common with SIX YEAR DUAL DEGREE COURSE II/VI (**B.TECH.+ M.TECH.**)

(With effect from **2019-2020** admitted batch onwards)

B.TECH. (EEE) II YEAR I-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

SUB. REF	NAME OF THE SUBJECT	PERIODS			MAXIMUM MARKS			CREDITS
		THEORY	TUTORIAL	LAB	EXAM	SESSIONALS	TOTAL	
EEB2101	BSC-5: Mathematics-IV	3	1	--	70	30	100	3
EEO21xx	OEC-1:	3	1	--	70	30	100	3
EEO21xx	OEC-2:	3	1	--	70	30	100	3
EEC2102	PCC-2:Network Theory	3	1	--	70	30	100	3
EEC2103	PCC-3: Electronic Circuits	3	1	--	70	30	100	3
EES2105	ESC-5 : Engineering Mechanics & Strength of Materials	3	1	--	70	30	100	3
EEL2101	Laboratory – I: Electrical Networks Lab	--	--	3	50	50	100	1.5
EEL2102	Laboratory – II: FM & HM Lab	--	--	3	50	50	100	1.5
	TOTAL	**18**	**6**	**6**	**520**	**280**	**800**	**21**

Open Electives Courses (OEC) (Semester-III)		
S.No.	**Subject Code**	**Subject Name**
1	EEO2101	Fluid Mechanics & Hydraulic Machines
2	EEO2102	Thermal Prime Movers
3	EEO2103	Data Structures & Algorithms
4	EEO2104	Electrical Engineering Materials
5	EEO2105	Probability and Stochastic Process
6	EEO2106	Solid State Electronic Devices

BSC-5:EEB2101	Mathematics - IV	3L:1T:0P	3 Credits

Course Outcomes:

After going through this course, the students would be able to:

- Operate the differential operator 'del' to the scalar and vector point functions, Calculate the Gradient, Divergence and Curl, Vector normal to a surface, maximum rate of change of a scalar field, test whether two surfaces are to cut orthogonally or not .
- Find the rate per unit volume at which the physical quantity is issuing from a point, the rate of inflow minus out flow using the Divergence and the angular velocity of rotation at any point of the vector field using the Curl.
- Test whether the given motion is irrotational or rotational, whether a vector force acting on a particle is conservative or not
- Apply the vector integral theorems (Green's theorem in the plane, Stoke's and Divergence theorems) for evaluating the double and triple integrals as these are used to find areas and volumes.
- Solve the Linear Partial Differential Equations with constant coefficients (homogeneous and non homogeneous) and know the procedure for finding the complementary function and particular integrals
- Apply and extend the knowledge of Fourier transform techniques in solving several Initial and Boundary value problems of Engineering, such as in Conduction of heat **/** Thermodynamics, Hydraulics transverse vibrations of a string, oscillations of an elastic beam, bending of beams, electrical circuits, free and forced vibrations of a membrane and transmission lines , etc.

UNIT: I

VECTOR CALCULUS-1: Differentiation of vectors, curves in space, velocity and acceleration, relative velocity and relative acceleration, scalar and vector point functions, vector operator ∇ applied to scalar point functions- gradient, ∇ applied to vector point functions- divergence and curl. Physical interpretation of ∇f, $\nabla.\overline{F}$, $\nabla \times \overline{F}$, ∇ applied twice to point functions, ∇ applied to products of two functions; Irrotational and Solenoidal fields.

UNIT: II

VECTOR CALCULUS-2: Integration of vectors, line integral, circulation, work done, surface integral-flux, Green's theorem in the plane, Stoke's theorem, volume integral, Gauss Divergence theorem. Introduction of orthogonal curvilinear coordinates, cylindrical and spherical polar coordinates.

UNIT: III

INTRODUCTION OF PARTIAL DIFFERENTIAL EQUATIONS: Formation of partial differential equations, solutions of partial differential equations- equations solvable by direct integration, linear equations of first order: Lagrange's Linear equation, non-linear equations of first order, Charpit's method.

Homogeneous linear equations with constant coefficients- rules for finding the complementary function, rules for finding the particular integral (working procedure), non-homogeneous linear equations.

UNIT: IV

APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS: Method of separation of variables, One dimensional wave equation-vibrations of a stretched string, one dimensional Heat equation, Two dimensional heat flow in steady state - solution of Laplace's equation in Cartesian and polar coordinates (two dimensional).

UNIT: V

INTEGRAL TRANSFORMS: Introduction, definition, Fourier integral, Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier Sine and Cosine transforms, Finite Fourier Sine and Cosine transforms, properties of Fourier transforms, Convolution theorem for Fourier transforms, Parseval's identity for Fourier transforms, Fourier transforms of the derivatives of a function, simple applications to Boundary value problems.

TEXT BOOKS:

1. Scope and treatment as in "Higher Engineering Mathematics", by Dr. B.S.Grewal, 43rd Edition, Khanna Publishers.

REFERENCE BOOKS:

1. A text book of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
2. Mathematical Methods of Science & Engineering aided with MATLAB by Kanti B.Dutta, Cengage Learning India Pvt. Ltd.
3. Advanced Engineering Mathematics by Erwin Kreyszig.
4. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw Hill Company.
5. Advanced Engineering Mathematics by H.K.Dass. S.Chand Company.
6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

OEC-1:EEO2101	Fluid Mechanics & Hydraulic Machines	3L:1T:0P	3 Credits

Course Outcomes:

At the end of this course student will be able to,

- Develop to gain knowledge on fluid statics, fluid dynamics, and closed conduit flow and hydro-electric power stations.
- Design various components of pumps and turbines and study their characteristics.
- Apply conservation laws to derive governing equations of fluid flows.
- Analyze and design simple pipe systems.
- Describe the functioning of various turbines and analyze the performance characteristics of various turbines.

UNIT: I

Introduction To Fluid Mechanics: Principle Of Continuum–Fluid Properties–Mass Density, Specific Weight, Specific Gravity, Viscosity, Surface Tension, Capillarity, Compressibility & Bulk Modulus Of Electricity, Vapour Pressure.

UNIT: II

Fluid Statics: Fluid Pressure and Its Measurement, Pascal's Law, Hydrostatic Pressure Distribution, Manometers-Micro manometers-Mechanical Gauges, Hydrostatic Forces On Plane Surfaces.

UNIT: III

Fluid Kinematics: Definition Of Steady and Unsteady, Uniform and Non Uniform, Compressible and Incompressible, Rotational and Irrotational, 1-D, 2-D and 3-D, Laminar and Turbulent Flows, Stream Line, Path Line, Streak Line, Stream Function, Velocity Potential Function, Local And Convective Accelerations-Flow Nets, Principle Of Conservation Of Mass, 3-D Continuity Equation In Cartesian Coordinates, Continuity Equation For Stream Tube.

UNIT: IV

Fluid Dynamics: Derivation Of Bernoulli's Equation From The Concepts Of Work Done, Total Head, Limitations Of Bernoulli's Principle, Application Of Bernoulli's Equation, Venturi Meter, Orifice Meter, Flow Nozzle, Pitot Tube, Momentum Principle-Impulse Momentum Equation And Its Application To Pipe Bends And Reducers, Impact Of Jets On Single Stationary Plates.

UNIT: V

Flow Through Pipes: Laws Of Friction, Reynolds Experiment, Darcy-Weichbach Equation, Major And Minor Losses, Pipes In Series, Pipes In Parallel, Pipes Connecting Two Reservoirs, Siphon, Power Transmission Through Pipes And Nozzles, Water Hammer (Concept only) .

Hydraulic Machines: Impact Of Jets On Series Of Stationary And Moving Vanes, Velocity Triangles, Work done-Turbines-Hydraulic, Mechanical And Overall Efficiency, Classification, Component Parts And Working Principles Of Pelton, Francis And Kaplan Turbines, Unit Quantities, Specific Speed, Characteristic Curves.

UNIT: VI

Pumps: Classification of Pumps, Positive Displacement and Rotodynamic Pumps, Centrifugal Pumps-Components Parts, Working Principles, Manometric, Static And Overall Efficiency, Work Done- Pumps In Parallel And Series, Specific Speed And Pump Characteristic Curves.

TEXT BOOKS:

1. Fluid Mechanics and Hydraulic Machinery by P.N. MODI & SM SETHI
2. Fluid Mechanics and Hydraulic Machinery by A.K.Jain.

OEC-1:EEO2102	Thermal Prime Movers	3L:1T:0P	3 Credits

Course Outcomes:

Upon completion of this course the student will be able to:

- Describe the basic components of steam power plants and working principles of different types of steam turbines.
- Explain the working principle of different types of gas turbines.
- Identify the main components of diesel power plant and explain the working principle of diesel engines.
- Discuss the working principle of different types of hydraulic turbines.
- Illustrate the working principle of centrifugal and reciprocating pumps.

UNIT: I

Laws Of Thermodynamics: Laws of thermodynamics (Statements Only), Gas Laws, Relation between Gas Constant and Specific Heat at Constant Pressure and Constant Volume, Thermodynamics Processes of Perfect Gases and Entropy, Properties of Steam and Use of Steam Tables, Extent Work and Internal Energy, Thermodynamic Processes of Vapor and Entropy of Steam.

UNIT: II

Boilers: Classification, Simple Vertical, Cochron, Lancashire, and Babcock & Wilcox Boilers.

UNIT: III

I C Engines: Classification, Otto Cycle, Diesel Cycle and Duel Combustion Cycle. Working Of 2-Stroke and 4-Stroke Engines, Petrol Engines and Diesel Engines, Power and Efficiency of IC Engines.

UNIT: IV

Steam Nozzles: Flow through Steam Nozzles Critical Pressure Ratio, Effect of Friction and Super Saturation.

UNIT: V

Steam Turbines: Impulse And Reaction Turbines, Velocity diagrams, Methods of Reduction of Rotor Speed.

UNIT: VI

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.

Text Books:

1. Thermal Engineering by R.S. Khurmi And J.K. Gupta, S.Chand & Co Ltd.
2. Elements of Heat Engines, Vols. I & Ii by R.C. Patel And C.J. Karam Chandani, Acharya Book Depot, Baroda.

OEC-1:EEO2103	Data Structures & Algorithms	3L:1T:0P	3 Credits

Course Outcomes:

At the end of this course student will be able to

- Explain basic operations of stacks, queues, and linked – lists
- Understand various sorting and searching techniques
- Choose an appropriate hashing techniques for a given problem
- Understand the basic operations of trees and its types
- Explain the concept of height balancing in AVL and B trees
- Demonstrate graph traversal algorithms

UNIT: I

Introduction to Data Structures: Information and Meaning – Representation of Multi-Dimensional Arrays _ Review of C Programming.

The Stack: Primitive operations – As an Abstract Data Type – Implementing the Stack operations in C.

Infix, Postfix and Prefix: Definitions, Evaluation and Conversions using C.

UNIT: II

Recursion: Recursive Definition and Processes, Recursion in C and Recursive Implementation of Applications. Simulation of Recursion – Efficiency of Recursion.

Queues and Lists: The Queue as Abstract Data Type – Sequential Representation _Types of Queues – Operations – Implementation in C.

UNIT: III

Linked List: Operations – Implementation of Stacks, Queues and priority Queues in C.

Circular Lists: Insertion, Deletion and Concatenation Operations _ Stacks and Queues as Circular Lists _ Doubly Linked Lists _Applications.

UNIT: IV

Trees: Binary Trees Operations and Applications.

Binary Tree Representation: Node Representation – Implicit array Representation – Choice of Representation – Binary Tree Traversal – Threaded Binary Trees and their Traversal – Trees and their Applications

UNIT: V

Sorting: General Background: Efficiency – The big 0 Notation – Efficiency of Sorting. Bubble Sort and Quick Sort and their Efficiency – Selection Sorting – Binary Tree Sort – Heap Sort – Insertion Sorts – Shell Sort – Address calculation Sort – Merge and Radix Sorts.

Searching: Basic Searching Techniques: Dictionary as an Abstract Data Type – Algorithmic Notation – Sequential Searching and its Efficiency – Binary Search – Interpolation Search.

Tree Searching: Insertion into a Binary Search Tree – Deleting from a Binary Search Tree – Efficiency of Binary Search Tree operation

UNIT: VI

Graphs and Their Application: Graphs: Application of Graphs – Representation of Graphs in C – Transitive closure – Warshall's Algorithm – Shortest Path Algorithm.

Linked Representation of Graphs: Dijikstra's Algorithm – O rganizing the set of Graph Nodes – Application to Scheduling and its implication. Graph Traversal and Spanning Forests – Undirected Graph and their Traversals, Applications and Efficiency – Minimal Spanning Trees –Prim's and Kruskal's Algorithms.

Textbooks:

1. Data Structures Using C and C++ Yddish Langsam, Moshe J. Augenstein and Aaron M. Tanenbaum, Prentice Hall Of India (2nd Edition) (Chapters 1 to 8)
2. Data Structures, Algorithms and Applications with C++, Sahani Mc-Graw Hill.

OEC-2:EEO2104	Electrical Engineering Materials	3L:1T:0P	3 Credits

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.

UNIT: I

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.

UNIT: II

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**.**

UNIT: III

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

UNIT: IV

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.

UNIT: V

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.

Text Books:

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. S. P. Seth, P. V. Gupta “A course in Electrical Engineering Materials”, Dhanpat Rai & Sons, 2011.

OEC-2:EEO2105	Probability and Stochastic Process	3L:1T:0P	3 Credits

Course Outcomes:

Upon completion of the subject, students will be able to compute:

- Simple probabilities using an appropriate sample space.
- Simple probabilities and expectations from probability density functions (pdfs)
- Likelihood ratio tests from pdfs for statistical engineering problems.
- Least -square & maximum likelihood estimators for engineering problems.

UNIT: I

Probability: Probability introduced through Sets and Relative Frequency, Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem, Independent Events.

UNIT: II

Random Variable: Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables

Distribution & Density Functions: Distribution and Density functions and their Properties - Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh and Conditional Distribution, Methods of defining Conditional Event, Conditional Density, Properties.

UNIT: III

Operation on One Random Variable – Expectations: Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function.

UNIT: IV

Stochastic Processes-I: The Stochastic Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence, First-Order Stationary Processes, Second-Order and Wide-Sense Stationarity, Nth Order and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes.

UNIT: V

Stochastic Processes-II: Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance and its Properties, Linear System Response of Mean and Mean-squared Value, Autocorrelation Function, Cross-Correlation Functions, Gaussian Random Processes, Poisson Random Process.

UNIT: VI

Spectral Characteristics: Power Spectrum, Properties, Relationship between Power Spectrum and Autocorrelation Function, Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function, Spectral

Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Spectral Density of Input and Output of a Linear System.

TEXT BOOKS:

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, 4Ed., 2001, TMH.
2. Probability and Random Processes – Scott Miller, Donald Childers, 2 Ed, Elsevier, 2012.

REFERENCE BOOKS:

1. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, 4 Ed., TMH.
2. Theory of Probability and Stochastic Processes- Pradip Kumar Gosh, University Press
3. Probability and Random Processes with Application to Signal Processing – Henry Stark and John W. Woods, 3 Ed., PE
4. Probability Methods of Signal and System Analysis - George R. Cooper, Clave D. MC Gillem, 3 Ed., 1999, Oxford.

OEC-2:EEO2106	Solid State Electronic Devices	3L:1T:0P	3 Credits

Course Outcomes:

On successful completion the student should be able to:

- Demonstrate an understanding of the key concepts involved in semiconductor device operation and their characteristics.
- Perform simple analysis of semiconductor devices to derive basic V-I characteristics.
- Predict the effect of device design variations on device performance.
- Assess the relative advantages/disadvantages of different classes of electronic and optoelectronic devices for particular applications.

UNIT: I

Elemental and compound semiconductors, Fermi-Dirac distribution, Equilibrium and steady state conditions, Equilibrium concentration of electrons and holes, Temperature dependence of carrier concentration, Carrier transport in semiconductors, drift, conductivity and mobility, variation of mobility with temperature and doping, High Field effects, Hall effect.

UNIT: II

Excess carriers in semiconductors: Generation and recombination mechanisms of excess carriers, quasi Fermi levels, diffusion, Einstein relations, Continuity equations, Diffusion length, Gradient of quasi Fermi level.

UNIT: III

PN junctions : Contact potential, Electrical Field, Potential and Charge density at the junction, Energy band diagram, Minority carrier distribution, Ideal diode equation, Electron and hole component of current in forward biased p-n junction, piecewise linear model of a diode effect of temperature on V-I characteristics

UNIT: IV

Diode capacitances, switching transients, Electrical Breakdown in PN junctions, Zener and avalanche break down (abrupt PN junctions only), Tunnel Diode basics only, Metal Semiconductor contacts, Ohmic and Rectifying Contacts, current voltage characteristics

UNIT: V

Bipolar junction transistor, current components, Minority carrier distributions, basic parameters, Evaluation of terminal currents
(based on physical dimensions),Transistor action, Base width modulation

Text Books:

1. Ben G. Streetman and Sanjay Kumar Banerjee, Solid State Electronic Devices, Pearson, 6/e, 2010
2. Achuthan, K N Bhat, Fundamentals of Semiconductor Devices, 1e, McGraw Hill ,2015.
3. Electronic Devices & Circuits, K Venkata Rao and K Rama Sudha, McGraw Hill Education, 1986.

PCC-2:EEC2102	Network Theory	3L:1T:0P	3 Credits

Course Outcomes:

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

- Apply network theorems for the analysis of electrical circuits.
- Obtain the transient and steady-state response of electrical circuits.
- Analyze circuits in the sinusoidal steady-state.
- Analyze two port circuit behavior.

UNIT: I

Network Elements: Charge, Voltage, Current, Power, Energy, Circuit concept, Active and Passive circuit elements, Ideal, Practical and dependent sources and their V-I characteristics, Energy stored in Inductors and Capacitors , Kirchoffs Laws, Voltage and Current division, Nodal Analysis, Mesh Analysis, Star-Delta transformation and Source Transformation.

UNIT: II

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

UNIT: III

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.

UNIT: IV

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 waveform, 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.

UNIT: V

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.

UNIT: VI

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.

Text Books:

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)

Reference Books:

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

PCC-3:EEC2103	Electronic Circuits	3L:1T:0P	3 Credits

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.

UNIT: I

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.

UNIT: II

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.

UNIT: III

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.

UNIT: IV

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.

UNIT: V

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

UNIT: VI

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 Venkata Rao and K Rama Sudha, McGraw Hill Education, 1986.

References:

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.

ESC-5:EES2105	Engineering Mechanics & Strength of Materials	3L:1T:0P	3 Credits

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

- Understand the concepts of co-ordinate systems.
- Analyze the three-dimensional motion.
- Understand the concepts of rigid bodies.
- Analyze the free-body diagrams of different arrangements.
- Analyze torsional motion and bending moment.

UNIT: I

Introduction to vectors and tensors and co-ordinate systems: Introduction to vectors and tensors and coordinate systems; Vector and tensor algebra; Indical notation; Symmetric and anti-symmetric tensors; Eigenvalues and Principal axes.

UNIT: II

Three-dimensional Rotation: Three-dimensional rotation: Euler's theorem, Axis-angle formulation and Euler angles; Coordinate transformation of vectors and tensors.

UNIT: III

Kinematics of Rigid Body: Kinematics of rigid bodies: Dentition and motion of a rigid body; Rigid bodies as coordinate systems; Angular velocity of a rigid body, and its rate of change; Distinction between two and three-dimensional rotational motion; Integration of angular velocity to find orientation; Motion relative to a rotating rigid body: Five term acceleration formula.

UNIT: IV

Kinetics of Rigid Bodies: Kinetics of rigid bodies: Angular momentum about a point; Inertia tensor: Dentition and computation, Principal moments and axes of inertia, Parallel and perpendicular axes theorems; Mass moment of inertia of symmetrical bodies, cylinder, sphere, cone etc., Area moment of inertia and Polar moment of inertia, Forces and moments; Newton-Euler's laws of rigid body motion.

UNIT: V

Free Body Diagram: Free body diagrams; Examples on modeling of typical supports and joints and discussion on the kinematic and kinetic constraints that they impose.

General Motion: Examples and problems. General planar motions. General 3-D motions. Free precession, Gyroscopes, Rolling coin.

UNIT: VI

Bending Moment: Transverse loading on beams, shear force and bending moment in beams, analysis of cantilevers, simply supported beams and overhanging beams, relationships between loading, shear force and bending moment, shear force and bending moment diagrams.

Torsional Motion: Torsion of circular shafts, derivation of torsion equation, stress and deformation in circular and hollow shafts.

Friction: Concept of Friction; Laws of Coulomb friction; Angle of Repose; Coefficient of friction.

Text / References:

1. J. L. Meriam and L. G. Kraige, “Engineering Mechanics: Dynamics”, Wiley, 2011.
2. M. F. Beatty, “Principles of Engineering Mechanics”, Springer Science & Business Media, 1986.

EEL2101	**Laboratory-I: Electrical Networks Lab**	**0L:0T:3P**	**1.5 Credits**

EEL2102	**Laboratory-II: FM & HM Lab**	**0L:0T:3P**	**1.5 Credits**

ANDHRA UNIVERSITY: : VISAKHAPATNAM

DEPARTMENT OF ELECTRICAL ENGINEERING

SCHEME OF INSTRUCTION & EXAMINATION

II/IV B.TECH

Common with SIX YEAR DUAL DEGREE COURSE II/VI (**B.TECH.+ M.TECH.**)

(With effect from **2019-2020** admitted batch onwards)

B.TECH. (EEE) II YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

SUB. REF	NAME OF THE SUBJECT	PERIODS			MAXIMUM MARKS			CREDITS
		THEORY	TUTORIAL	LAB	EXAM	SESSIONALS	TOTAL	
EEO22xx	OEC-3:	3	1	--	70	30	100	3
EEO22xx	OEC-4:	3	1	--	70	30	100	3
EEC2201	PCC-4:Electrical Machines-I	3	1	--	70	30	100	3
EEC2202	PCC-5:Electromagnetic Fields	3	1	--	70	30	100	3
EEC2203	PCC-6: Pulse and Digital Circuits	3	1	--	70	30	100	3
EEH2201	HSMC-2/MC-5: Environmental Science	3	1	--	70	30	100	3
EEL2201	Laboratory – III: Electrical Machines Lab – I	--	--	3	50	50	100	1.5
EEL2202	Laboratory – IV: Electronic Circuits Lab	--	--	3	50	50	100	1.5
	TOTAL	**18**	**6**	**6**	**520**	**280**	**800**	**21**

Open Electives Courses (OEC) (Semester-IV)		
S.No.	**Subject Code**	**Subject Name**
1	EEO2201	Signals, Systems & Synthesis
2	EEO2202	Digital Logic Design
3	EEO2203	Computer Networks
4	EEO2204	Wavelet Transforms
5	EEO2205	Optical FiberCommunications
6.	EEO2206	Engineering Geology

OEC-3:EEO2201	Signals, Systems & Synthesis	3L:1T:0P	3 Credits

Course Outcomes:

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

- Evaluate the Fourier Series of periodic signals.
- Make use of Fourier Transform Properties.
- Use z-transform for analyzing discrete time signals and systems.
- Convert a continuous time signal to the discrete time domain and reconstruct using the sampling theorem

UNIT: I

Signals, Transformations of Independent Variables, Basic Continuous Time Signals, Basic Discrete Time Signals, Signal Energy and Power Systems, Properties of Systems, Linear Time – invariant Systems. Continuous Time and Discrete time.

UNIT: II

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.

UNIT: III

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

UNIT: IV

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.

UNIT: V

Positive Real Function and Other Properties, Herwitz Polynomials, Computation of Residues, Even and Odd Functions, Test for Positive Real Functions. Network Synthesis Elementary Synthesis Operation, LC Network Synthesis, Properties of RC Network Functions, Foster and Cauer Forms of RC and RL Networks.

Text Books:

1. A.V. Oppenheim et al.,(1997) Signals & Systems (2nd Edition), Prentice Hall., ISBN 0-13-814757-4
2. P.Rama Krishna Rao, “Signals & Systems”, 1st Edition, TMH, 2008..
3. Modern Network Synthesis, M. E. Van Valkenburg, Wiley Eastern

OEC-3:EEO2202	Digital Logic Design	3L:1T:0P	3 Credits

Course Outcomes:

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

- Understand working of logic families and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- Use PLDs to implement the given logical problem.

UNIT: I

Numbering Systems: Basic structure and brief description of Digital computers and Digital systems - Binary, Octal, Decimal and Hex numbering systems – Number base Conversions – (n-1)'s and n's complements of the various numbering systems – Binary arithmetic – Various methods to represent signed binary numbers.

UNIT: II

Binary Codes: BCD, Excess-3 codes – Binary arithmetic using BCD and Excess-3 codes – Gray code – Error detecting codes: parity checking and Hamming code – Error correcting codes: Hamming code – Basic idea of 2421, 84-2-1, ASCII codes.

UNIT: III

Boolean Algebra and Boolean Functions: Boolean theorems and postulates – Logic gates – Truth table - Boolean functions – Dual of a function – Complement of a function – Canonical and standard forms – Simplification of Boolean functions using Boolean theorems and postulated, Karnaugh map (K-map) with maximum of 5 variables – Quine-McCluskey Tabular method.

UNIT: IV

Combinational Logic Circuits- I: Boolean function implementation using AND-OR logic, multilevel NAND and multilevel NOR implementation – Transformation of multilevel NAND and NOR circuits to AND-OR diagram – Combinational logic design - Half adder – Full adder – Half subtractor – Full subtractor – Parallel adder – Parallel adder/subtractor –Carry look ahead adder – BCD adder – Magnitude comparator – Even an odd functions – Parity generator and checker – code converters.

UNIT: V

Combinational Logic Circuits- II: Decoders – Encoders – Demultiplexer – Multiplexer – Read Only Memory (ROM) – PLA – PAL – implementation of the Boolean functions using decoders, multiplexers, ROMs, PLA, and PAL.

Sequential Logic Circuits: Differences between combinational logic and sequential logic – Flip-flops (R-S, J-K, D, T, Master-slave J-K flip) – Truth tables and excitation tables of the flip-flops, Conversions of flip-flops – state diagram – Mealy and Moore models – Design of sequential circuits with various flip-flops – Design of synchronous counters – Serial adder.

UNIT: VI

Micro Computer Components Design with Flip-flops: Register – Register with parallel load – Shift register – Bidirectional shift register with parallel load – Ripple counters (Binary and BCD) – Binary counters with parallel load.

Text Book:

1. M. Morris Mano, Digital Design, Prentice-Hall of India Pvt. Limited, New Delhi, 2nd Edition. 2000.

Reference Books:

1. Zvi Kohavi, Switching and Finite Automata Theory, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2nd Edition, 2008.
2. Frederick J. Hill and Gerald R. Peterson, Introduction to Switching Theory and Logic Design, John Wiley & sons, Inc. New York, 3rd edition, 1981.

OEC-3:EEO2203	Computer Networks	3L:1T:0P	3 Credits

Course Outcomes:

At the end of the course students are able to:

- Suggest appropriate network model for data communication.
- Know how reliable data communication is achieved through data link layer.
- Propose appropriate routing algorithm for data routing.
- Connect internet to the system and knowledge of trouble shooting.

UNIT: I

INTRODUCTION: Network Hardware, Network Software, and Reference Models: OSI, TCP/IP, The ARPANET, Network Topologies, Physical Layer: Transmission media: Magnetic Media, Twisted pair, Base band Coaxial Cable, Fiber optics, Wireless Transmission: Electromagnetic Spectrum, Radio Transmission, Microwave Transmission.

UNIT: II

Data link layer: Design issues: framing, error detection and correction, CRC, Elementary Data link Protocols: Stop and wait, Sliding Window protocols: Go-back-n, Selective Repeat,

UNIT: III

Medium Access sub layer: Channel allocation methods, Multiple Access protocols: ALOHA, CSMA, IEEE Standard 802.3 and Ethernet, IEEE Standard 802.4: Token bus.

UNIT: IV

Network Layer: Network Layer design issues, Virtual circuit and Datagram subnets, Routing algorithms: Shortest path routing, Flooding, Hierarchical routing, Distance vector routing. Broad cast and Multi cast routing, Congestion Control: Congestion prevention policies.

UNIT: V

The Network layer in the internet: The IP Protocol, IP Addresses, and Internet Control Protocols.

UNIT: VI

Transport Layer: Transport Services, Connection management, Elements of Transport Protocols, Internet Transport Protocols: UDP and TCP.
Application Layer -Domain name system, Electronic Mail, WWW

TEXT BOOK:

1. Computer Networks—Andrew S Tanenbaum, 4th Edition. Pearson Education /PHI

REFERENCES:

1. Data Communications and Networking - Behrouz A. Forouzan. Third Edition TMH
2. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson

OEC-4:EEO2204	Wavelet Transforms	3L:1T:0P	3 Credits

Course Outcomes:

At the end of this course student will be able to

- Interpret fundamental concepts of Time-Frequency Resolution
- Explain Multi resolution analysis
- Implement continuous wavelet transform with various wavelets
- exemplify discrete wavelet transform with its properties
- Demonstrate various applications of wavelet transform

UNIT: I

Continuous Wavelet Transform: Introduction, Continuous-time wavelets, Definition of the CWT, the VWT as a Correlation, Constant-Factor Filtering Interpretation and Time-Frequency Resolution, the VWT as an Operator, Inverse CWT, Problems.

UNIT: II

Discrete Wavelet Transform and Orthogonal Wavelet Decomposition: Introduction, Approximation of Vectors in Nested Linear Vector Subspaces, Examples of an MRA,Problems.

UNIT: III

MRA, Orthonormal Wavelets, and their relationship to filter banks: Introduction, Formal Definition of an MRA, Construction of General Orthonormal MRA, a wavelet Basic for the MRA, Digital Filtering Interpretation, Examples of Orthogonal Basic Generating Wavelets, Interpreting Orthonormal MRAs for Discrete-Time signals, Miscellaneous Issues Related to PRQME Filter Banks, generating Scaling Functions and wavelets from Filter Coefficient, Problems.

Unit-IV

Wavelet Transform And Data Compression: Introduction, Transform Coding, DTWT for Image Compression, Audio Compression, And Video Coding Using Multiresolution Techniques: a Brief Introduction.

UNIT: V

Other Application of Wavelet Transforms: Introduction, Wavelet denoising speckles Removal, Edge Detection and Object Isolation, Image Fusion, Object Detection by Wavelet Transform of Projections, Communication application.

Textbooks:

1. James S. Walker, “A Primer on Wavelets and their Scientific Applications”, CRC Press, (1999).
2. Rao, “Wavelet Transforms”, Pearson Education, Asia.
3. C. Sidney Burrus, Ramesh A. Gopinath, “Introduction to Wavelets and Wavelets Transforms”, Prentice Hall, (1997).

References:

1. J. C. Goswami and A. K. Chan, “Fundamentals of wavelets: Theory, Algorithms and Applications "Wiley Inter science Publication, John Wiley & Sons Inc.,1999.
2. M. Vetterli, J. Kovacevic, “Wavelets and subband coding" Prentice Hall Inc, 1995.

OEC-4:EEO2205	Optical Fiber Communications	3L:1T:0P	3 Credits

Course Outcomes:

At the end of this course student will be able to

- Explain about optical fiber communication system and fiber optic devices.
- Illustrate the significance of various components involved in optical fiber communication system design.
- Attribute the various optical communication networks.
- Assess various Optical switching and Access Networks.
- Illustrate the multicasting and optical network simulators.
- Explain various Optical Metro Networks and Network Routing.

UNIT: I

Basic Optical Communication Network:

Overview of basic fiber optic communication system: optical fibers, optical sources & optical detectors, Wave propagation through optical fibers, optical link design & calculation of various loses, Optical receiver design, Modulation formats for optical communication system.

UNIT: II

Wavelength Division Multiplexing Network: Advantages of optical network, telecom network overview and architecture, WDM optical networks, WDM network evolution, WDM network construction, broadcast and select optical WDM network, wavelength routed optical WDM network, Challenges of optical WDM network. Optical connectors

UNIT: III

Optical Networking Components and Networks Optical Networking Components: Optical transmitters, semiconductor laser diode, tunable and fixed laser, laser characteristics, photodectors, tunable and fixed optical filters, channel equalizers, optical amplifiers and its characteristics, semiconductor laser amplifier, Raman amplifier, doped fiber amplifier, Direction Couplers, beam splitters, switches, connectors, Star couplers, OADM, OXC, CLOS architecture, MEMS, wavelength convertors, polarizer, polarization controllers.

UNIT: IV

Single and Multi-hop Networks: Introduction to single and multi-hop networks, Characteristics of single and multi-hop networks, experimental single hop networks: LAMBDANET, STARNET, SONATA, Rainbow, experimental multi-hop networks: Shufflenet, De Bruijn Graph, Hypercube. Adhoc Networks

UNIT: V

Optical switching and Access Networks:

Optical packet switching basics, slotted and unslotted networks, header and packet format, contention resolution in OPS networks, self-routing, examples on OPS node architecture, optical burst switching, signaling and routing protocols for OBS networks, contention resolution in OPS networks, multicasting, implementation and application.

MEMs based switching, switching with SOAs. Introduction to access network, PON, EPON and WDN EPON: overview, principal of operation, architecture; dynamic wavelength allocation, STARGATE: overview, need, architecture, operation and application, gigabit Ethernet, radio over fiber network. Network applications

UNIT: VI

Optical Metro Networks and Routing: Introduction to metro network, overview of traffic grooming in SONET ring, traffic grooming in WDM ring, Interconnected WDM networks, packet communication using tunable WADM, RINGOSTAR: architecture, proxy stripping, protect oration and network lifetime Routing and wavelength assignment: Problem formulation, routing sub-problem: routing types, wavelength assignment sub-problem, algorithms: simulated annealing, flow deviation algorithm. Introduction to multicasting, Multicast-capable switch architecture, unicast, broadcast and multicast traffic, multicast tree protection, static and dynamic traffic grooming, Introduction to Optical Network simulators (NS-2, NS-3, OMNeT++, and OPNET) Optical Networks Budget

Textbooks:

1. Gerd Keiser, Fibre Optic communication, TMH 4th Edition, 2000.
2. Behrouz A Forouzan, Data Communications and Networking, McGraw Hill, 4thEdition, 2007.
3. Tarek S. El. Bawab, Optical Switching, Springer, 2006.

References:

1. 1.John M Senior, Optical Fiber Communications -Principles and Practice, Pearson, 3rd Edition,2009
2. Biswanath Mukherjee, Optical Network Series, Springer, 2006.
3. R.Ramaswami and K.Sivarajan, Optical Networks, Morgan Kaufmann Publishers, 2nd Edition, 2002.
4. Mayer & Martin, Optical Switching Networks, Cambridge University Press, 2008

OEC-4:EEO2206	Engineering Geology	3L:1T:0P	3 Credits

Course Outcomes:

At the end of this course student will be able to

- Identify the different minerals and rocks using physical properties
- Construct cross sections of geological maps showing tilted beds, faults, folds, joints and unconformities
- Analyse the seismic hazard potential and practical implementation of earthquake response spectra
- Assess the suitability of materials in the project site by interpreting data from different site investigation techniques
- Apply the investigation techniques to decide the suitability of project site for different structures

UNIT: I

Physical Geology: Geology in civil engineering – branches of geology – structure of earth and its composition - weathering of rocks – scale of weathering – Earth processes – Work of wind, rivers and sea and their engineering importance. Plate tectonics – Earthquakes – Seismic zones in India.

UNIT: II

Mineralogy: Definition of mineral, Importance of study of minerals, Physical properties of minerals - Role of study of physical properties in their identification, Study of physical properties of different rock forming mineral groups.

UNIT: III

Petrology: Geological classification of rocks - igneous, sedimentary and metamorphic rocks, Different methods of formation of igneous, sedimentary and metamorphic rocks. Description, occurrence, engineering properties, distribution and use of following rocks Granite, Syenite, Diorite, Basalt, Sandstone, Limestone, Conglomerate, shale, Quartizite, Marble, Slate, Gniess.

UNIT: IV

Structural Geology and Geophysical Methods: Attitude of beds – out crop - geological maps – study of structures – folds, faults and joints their bearing on engineering construction. Geophysical methods – Seismic and electrical methods for subsurface investigations

UNIT: V

Application of Geological Investigations: Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings – Hydrogeological investigations and mining – Coastal protection structures. Investigation of Landslides, causes and mitigation.

Textbooks:

1. Subinoy Gangopadhyay, Engineering Geology, 1st Edition, Oxford University Press, New Delhi, 2013

2. A.Parthasaradhy, V.Panchapakesan, R.Nagarajan, Engineering Geology, 1st Edition, Wiley Private India Limited, New Delhi, 2013

References:

1. N Chenna Kesavalu, Text Book of Engineering Geology, 2nd Edition, Trinity Press, Hyderabad, 2014.
2. HalukSucuoglu, SinanAkkar, Basic Earthquake Engineering, 1st Edition, Springer International Publishing, 2014.
3. David George Price, Engineering Geology: Principles and Practice, 2nd Edition, Springer International Publishing, 2009

PCC-4 : EEC2201	Electrical Machines-I	3L:1T:0P	3 credits

Course Outcomes:

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

- Understand the operation of dc machines.
- Understand the testing of dc motors
- Analyze the differences in operation of different dc machine configurations.
- Analyze single phase and three phase transformers circuits.

UNIT: I

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.

UNIT: II

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, Losses occur in DC Generator, Power Stages in D.C. Generator, Efficiency, Condition for Maximum Efficiency of a dc generator and Applications.

UNIT: III

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.

UNIT: IV

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

UNIT: V

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.

UNIT: VI

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.

TEXT BOOKS:

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

PCC-5 : EEC2202	Electromagnetic Fields	3L:1T:0P	3 credits

Course Outcomes:

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

- Understand the concepts of electric and magnetic fields.
- Understand the electromagnetic wave behaviour.
- Estimate the effect of electric and magnetic fields on the materials used in electrical equipments.
- Understand the various principles used to estimate the effects of electric and magnetic fields.

UNIT: I

Introduction: Rectangular, Cylindrical and Spherical Coordinate Systems.

UNIT: II

Electrostatics: Superposition, Coulomb's Law, Electric Field of Different Charge Configurations using Coulomb's Law and Superposition, Flux of a Vector, 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, Electrostatic Energy, Method of Images.

UNIT: III

Electric Dipoles: Electric dipoles, Polarization of Dielectrics, Bound Charges and Their Physical Interpretation, the Displacement Vector D, Comments about the Curl of D in Electrostatics, Linear Dielectrics, Determination of Electric fields in the Presence of Linear Dielectrics by finding D, Electrostatic Boundary Conditions at a Charged Surface(Assuming no Dielectric Polarization), Continuity Equation, Basic Properties of Conductors in Electrostatic Fields, Capacitance, Poisson's and Laplace's Equations, Properties of the Solutions of Laplace's Equations, Uniqueness Theorem, Examples on Laplace's and Poisson's equations.

UNIT: IV

Magnetic Fields and Lorentz force Law: Magnetic field intensity H, Magnetic flux Φ, flux density B, Biot-Savart's law, Determination of Magnetic Field using Biot-Savart's Law, Divergence and Curl of B, Ampere's Law in Integral and Differential Form, Applications, The Scalar and Vector Magnetic Potential, Calculation of Magnetic Field through the Vector Magnetic Potential for given Steady Current Configurations, Comparison of Electrostatics and Magnetostatics, Magnetostatic Boundary Conditions(assuming no magnetic polarizations)

UNIT: V

The Magnetic Dipole: Diamagnetism, Paramagnetism & Ferro Magnetism, Torques and Forces on Magnetic dipoles, Magnetization, Bound current, Physical Interpretation of Bound Currents, the H Vector, the Divergence and Curl of H, Linear Magnetic Materials, Determination of Magnetic Fields in the Presence of Magnetic Materials by Finding H, EMF, Ohm's Law, Motional EMF, Faraday's Laws, Lenz's law, Quasistatic Fields, Inductance and Energy in Magnetic Fields.

UNIT: VI

Time Varying fields and Maxwell's Equations: Maxwell's modification of Ampere's Law, Maxwell's Equations in any medium in terms of E & B and in terms of D,E,B & H, General Boundary Conditions, The Uniform Plane Wave, Maxwell's Equations in Free Space, Plane Wave Propogation, Phase Velocity and Wave length, Intrinsic Impedance, Perfect Dielectrics, Attenuation, Phase and Propagation Constants, the Poyinting Vector and Power Considerations.

Text Books:

1. Introduction to Electrodynamics by David J. Griffiths, 3rd Edition, Prentice Hall, New Jersey, 1999.
2. Engineering Electromagnetics by William H. Hayt Jr. and John A. Buck, Sixth Edition, Mc Graw Hill, New Delhi, 2001.

Reference Books:

1. Principles of Electromagnetics by Mathew N.O. Sadiku, Oxford International Student edition, 2009.
2. Electromagnetics by John D Kraus, Mc Graw-Hill International Edition, 1999.
3. Engineering Electromagentics by J. P. Tewari, Khanna Publishers, 2nd edition.

PCC-6 : EEC2203	Pulse and Digital Circuits	3L:1T:0P	3 Credits

Course Outcomes:

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

- Understand working of logic families and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- Be able to use PLDs to implement the given logical problem.

UNIT: I

LINEAR WAVE SHAPING: High pass and Low pass RC circuits, Response of High pass and Low pass RC circuits to sinusoidal, step, pulse, square, exponential and Ramp inputs, High pass RC circuit as a differentiator, Low pass RC circuit as an integrator. Attenuators and its application as CRO probe, RL and RLC Circuits and their response for step input, Ringing Circuit.

UNIT: II

NONLINEAR WAVE SHAPING: Diode clippers, Transistor Clippers, Clipping at two independent levels, Comparator, Applications of voltage Comparators, Diode Comparator, Clamping Operation, Clamping Circuits using Diode with Different Inputs, Clamping Circuit Theorem, Practical Clamping circuits, Effect of diode Characteristics on Clamping Voltage.

UNIT: III

BISTABLE MULTIVIBRATORS: Transistor as a switch, Switching times of a transistor, Design and Analysis of Fixed-bias and self-bias transistor binary, Commutating capacitors, Triggering schemes of Binary, Transistor Schmitt trigger and its applications.

UNIT: IV

MONOSTABLE AND ASTABLE MULTIVIBRATORS: Design and analysis of Collector coupled Monostable Multivibrator, Expression for the gate width and its waveforms. Design and analysis of Collector coupled Astable Multivibrator, expression for the Time period and its waveforms, The Astable Multivibrator as a voltage to frequency convertor.

UNIT: V

TIME BASE GENERATORS: General features of a time-base signal, Methods of Generating time base waveform, Exponential voltage sweep circuit, Basic principles of Miller and Bootstrap time base generators, transistor Miller sweep generator, transistor Bootstrap sweep generator, Current Sweep circuit, Linearity correction through adjustment of driving Waveform.

UNIT: VI

LOGIC GATES: Realization of gates using diodes and Transistors, RTL, DTL.

Text Books:

1. Pulse Digital and Switching Waveforms, J. Millman and H. Taub, McGraw-Hill, 2nd Edition 1991.
2. Pulse and Digital Circuits, K.VenkatRao, Pearson Education India, 2nd Edition, 2010.

Reference Books:

1. Pulse and Digital Circuits, A. Anand Kumar, PHI, second edition, 2005.
2. Pulse switching and digital circuits – David A.Bell, PHI ,5th Edn., oxford university press.

HSMC-2/MC-5 : EEH2201	Environmental Science	3L:1T:0P	3 Credits

Course Outcomes:

At the end of this course, student will be able to

- Motivate environmental organizations to create a concern about our present state of Environment.
- Find solutions for conservation of natural resources
- Illustrate social issues of environmental protection and adopt sustainable developmental practices
- Perceives the basic structure of environmental policy and law pertaining to specific environmental issues (water quality, air quality, biodiversity protection, Forest, etc.)

UNIT: 1

Introduction To Environmental Sciences – Importance - Types of Ecosystems – Lake – River – Marine – Forest – Desert – Bio-Diversity.

UNIT: 2

Resources Natural – Water – Mineral – Food – Forest – Energy – Land – Use And Exploitation - Environmental Degradation - Remedial Measures.

UNIT: 3

Environmental Pollution Causes, Effects, Standards And Control Of (A) Air Pollution; (B) Water Pollution; (C) Soil Pollution; (D) Marine Pollution; (E) Noise Pollution.

UNIT: 4

Legal Aspects Of Pollution (A) Air (Prevention and Control of Pollution) Act. (B) Water (Prevention and Control of Pollution) Act. (C) Environmental Protection Act. (D) Forest Conservation Act.

UNIT: 5

Role of People To Protect Environment – Role of NGOs.

(i) A. Global Issues. B. Green House effect C. Global Warming D. Nuclear Accidents

(ii) A. Local Issues: Causes and Action B. Air Pollution due to Industries C. Automobiles

(iii) Public Interest Litigation Case Studies – Success Stories Leather Industries Taaj & Mathura Refinery Silent Valley

Text Books:

1. Introduction To Environmental Sciences – Turk & Turk And Witties &Witties.
2. Environmental Sciences – P.D.Sarma

Reference Books:

1. Cunningham, W.P., Cunningham, M.A.,Principles of Environmental Science, TMH.
2. Kaushik, A., Kaushik, C.P., Perspectives in Environmental Studies, 3rded., New Age International Publishers.

EEL2201	**Laboratory-III: Electrical Machines Lab-I**	**0L:0T:3P**	**1.5 Credits**

EEL2202	**Laboratory-IV: Electronic Circuits Lab**	**0L:0T:3P**	**1.5 Credits**

ANDHRA UNIVERSITY: : VISAKHAPATNAM

DEPARTMENT OF ELECTRICAL ENGINEERING

SCHEME OF INSTRUCTION & EXAMINATION

III/IV B.TECH

Common with SIX YEAR DUAL DEGREE COURSE II/VI (B.TECH.+ M.TECH.)

(With effect from **2019-2020** admitted batch onwards)

B.TECH. (EEE) III YEAR I-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

SUB. REF	NAME OF THE SUBJECT	PERIODS			MAXIMUM MARKS			CREDITS
		THEORY	TUTORIAL	LAB	EXAM	SESSIONALS	TOTAL	
EEO31xx	OEC-5:	3	1	--	70	30	100	3
EEC3101	PCC-7: Power Electronics	3	1	--	70	30	100	3
EEC3102	PCC-8: Electrical Measurements	3	1	--	70	30	100	3
EEC3103	PCC-9:ElectricalMachines-II	3	1	--	70	30	100	3
EEC3104	PCC-10: Power Systems - I	3	1	--	70	30	100	3
EEE31XX	PEC-1:	3	1	--	70	30	100	3
EEL3101	Laboratory – V: Electrical Measurements Lab	--	--	3	50	50	100	1.5
EEL3102	Laboratory – VI: Electrical Machines Lab – II	--	--	3	50	50	100	1.5
EEM3101	MC-6: Indian Constitution	--	--	--	--	--	--	--
	TOTAL	**18**	**6**	**6**	**520**	**280**	**800**	**21**

Open Electives Courses (OEC) (Semester-V)		
S.No.	**Subject Code**	**Subject Name**
1	EEO3101	Linear ICs and Applications
2	EEO3102	Communication Systems
3	EEO3103	Internet of Things (IoT)

Professional Electives Courses (PEC) (Semester-V)		
S.No.	**Subject Code**	**Subject Name**
1	EEE3101	Computer Architecture and Organisation
2	EEE3102	Digital Signal Processing
3	EEE3103	Information Technology

OEC-5 : EEO3101	Linear IC's and Applications	3L:1T:0P	3 Credits

Course Outcomes:

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

- Design different RC differentiator and integrator circuits.
- Analyze the various multi-vibrator circuits.
- Infer the DC and AC characteristics of operational amplifiers and its effect on output and their compensation techniques.
- Elucidate and design linear and non-linear applications using op-amps.
- Describe the concepts of filters, Timers and VCO.
- Apply the concepts of A/D and D/A convertors in various applications.

UNIT: I

Operational Amplifiers: Design Aspects of Monolithic Op-Amps, Ideal Characteristics, AC and DC Characteristics, Data sheet Specifications, Offset Voltages and Currents, Frequency Compensation Techniques, Measurement of Op-Amp Parameters.

UNIT: II

Applications of Op-Amps: Inverting and Non-inverting Amplifiers, Integrator, Differentiator, Comparator, Logarithmic Amplifiers, Instrumentation Amplifiers, Op-Amp Phase Shift, Wein-bridge and Qudrature Oscillator, Voltage Controlled Oscillators, Voltage to Current and Current to Voltage Converters., Analog Multiplexers.

UNIT: III

Signal Conditioning Circuits: Rectifiers, Peak Detection and, Wave form Generators, Sample and Hold Circuits, Multivibrators, Square Wave Generators, Schmittrigger.

UNIT: IV

Active Filters: LPF, HPF, BPF, BEF, All-pass Filters, Higher Order Filters and their Comparison, Switched Capacitance Filters.

UNIT: V

Special ICs: 555 Timers, 556 Function Generator ICs and their Applications, Three Terminal IC Regulators, IC 1496 (Balanced Modulator), IC 565 PLL and its Applications, Function Generators, Voltage to Frequency and Frequency to Voltage Converters.

UNIT: VI

Digital to Analog and Analog to Digital Converters: DAC techniques, Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Different types of ADCs-parallel Comparator type ADC, Counter type ADC, Successive approximation ADC and dual type ADC, DAC and ADC specifications, Integrated ADC and DACs.

Text Books:

1. Op-Amps and Linear ICs- Ramakanth Gayakwad, PHI, 1987.

2. Linear Integrated Circuits- D.Roy Chowdhury, New Age International(p) Ltd, 2nd Edition ,2003.

Reference Books:

1. Integrated Circuits- Botkar, Khanna Publications.
2. Applications of Linear ICs- Clayton.
3. Microelectronics- Jacob Millman.

OEC-5 : EEO3102	Communication Systems	3L:1T:0P	3 Credits

Course Outcomes:

At the end of this course, student will be able to

- Explain the need of modulation.
- Describe various types of modulation.
- Describe the sampling theorem and spectra of pulse modulation.

Unit-I

Communication System: Elements of communication System and its Fundamental limitations Need of Modulation.

Random Processes: Random Process, Stationary Processes, Ergodic Processes, Transmission through LTI, Power spectral density, Gaussian process.

UNIT: II

Noise: External and internal sources of noise, Thermal noise, Calculation of thermal noise, Shot noise, Noise figure, Noise temperature, Equivalent noise bandwidth.

Unit-III

Amplitude (Linear Modulation): Generation and detection of DSB, SSB, VSB, Carrier Acquisition, Concept of FDM, AM transmitter and Receiver.

Unit-IV

Angle (Exponential Modulation): Types of Angle Modulation, Concepts of Instantaneous frequency, Wideband and Narrowband FM, Generation and detection of FM, Generation and detection of PM, FDM.

Unit-V

Noise performance of CW Modulation Systems, Noise in DSB-SC, SSB-SC and AM system, Noise in FM and PM FM threshold and its extension, Pre-emphasis and De-emphasis in FM.

Unit-VI

Sampling theory & pulse modulation Sampling process, sampling theorem, signal reconstruction, flat top sampling of band pass signals.

Analog Pulse Modulation: Types of analog pulse modulation, Method of generation and detection of PAM, PWM, PPM, Spectra of pulse modulation, concept of time division multiplexing.

Text books:

1. Communication Systems S. Haykin, John Willy & Sons.
2. Communication Systems: A.B. Carlson, Mc-Graw-HW.
3. Modem Analog & Digital Communication Systems: B.P. Lathi; Oxford Univ. Press.
4. Analog Communication Systems: PchakrabartiDhanpatRai.

Reference Books:

1. Carlson, A. Bruce, Crilly, Paul B. & Rutledge, Janet C. / “Communication Systems an Introduction to Signals & Noise in Electrical Communication”/ Tata McGraw-Hill.
2. Kennedy, George & Davis, Bernard / “Electronic Communication Systems” / Tata McGraw-Hill / 4th Ed.

OEC-5 : EEO3103	Internet of Things	3L:1T:0P	3 credits

Course Outcomes:

At the end of this course, student will be able to

- Analyze structural aspects of IoT.
- Describe the different applications of IoT.
- Explain the concept of Raspberry - pi Interface.
- Particular application of IoT for Smart Grid.

UNIT: I

Introduction and Fundamental IoT Mechanisms, History of IoT, Overview and Motivations, Examples of Applications, Internet of Things Definitions and Frameworks : IoT Definitions, IoT Architecture, Identification of IoT Objects and Services, Structural Aspects of the IoT, Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy. IOT paradigm - smart objects - Bits an atom - goal orientation - RTLS+ GPS - agents+ Multi agent system

UNIT: II

M2M to IoT A Market Perspective – Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT - An Architectural Overview – Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

UNIT: III

Introduction to Atmega 8 /16 microcontroller - Architecture of the AVR Microcontroller - Pin description of the microcontroller - I/O of the microcontroller - IR Sensors.

UNIT: IV

IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real - World Design Constraints - Introduction, Technical Design constraints hardware is popular again, Interaction and remote control.

UNIT: V

Industrial realizing the enterprise integrated Web of Things, IMC - AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation -Introduction, Case study: phase one - commercial building automation today, Case study. Specification - Domain Model Specification - Information Model Specification - Service Specifications - IoT Level Specification - Functional View

UNIT: VI

IoT for Business Applications Internet of Things Application: IoT for Smart Grid ,City Automation, Automotive Applications, Home Automation, Smart Cards , Process Monitoring / Automation, Sensor Technology, Raspberry - pi Interface, Smart Healthcare, Smart

Transportation, M2M Communication, Smart Metering, Systems and Services Integration, Hands - on training, Smart Waste management System.

Text Books:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine to - Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.
2. Daniel Minoli, Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications, ISBN: 9781 – 118 – 47347 - 4, Willy Publications, 2014

PCC-7 : EEC3101	Power Electronics	3L:1T:0P	3 credits

Course Outcomes:

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

- Understand the differences between signal level and power level devices.
- Analyse controlled rectifier circuits.
- Analyse the operation of DC-DC choppers.
- Analyse the operation of voltage source inverters, Choppers & Cyclo Converters.

UNIT: I

Thyristors: Introduction, Principle of Operation, Two Transistor Model, Gate Characteristics, Turn On Methods, Turn Off Methods, Thyristor Ratings, Measurement of Thyristor Parameters, Protection Circuits.

UNIT: II

Gate Triggering Circuits: Firing of Thyristors, Pulse Transformers, Opto Isolators, Gate Triggering Circuits, Resistance Firing, Resistance-Capacitance Firing, UJT, Programmable UJT (PUT), UJT as an SCR Trigger, Synchronized UJT Triggering.

Series And Parallel Operation of Thyristors: Equalizing Networks, Triggering, String Efficiency, De-rating.

UNIT: III

Phase Controlled Rectifiers: Single Phase-Half wave Rectifier with R, RL & RLE Circuits, Single Phase Full wave & Bridge Controlled Rectifiers, Three-Phase Half Wave and Fully Controlled Rectifiers, Three-Phase Fully Controlled Bridge Rectifier.

UNIT: IV

Inverters: Classification, Series and Parallel Inverters, Self Commutated Inverters, The Mc Murray Inverter, The Mc Murray Bedford Inverter, Harmonic Reduction, Current Source Inverters, Voltage Source Inverters.

UNIT: V

Choppers: Principle of Operation, Step up, Step down Choppers, Jones Chopper, Morgan Chopper.

Cyclo-converters: Principle of Operation, Single Phase To Single Phase Cyclo-converters, Cyclo-converter Circuits for Three-Phase Output, Control Circuits

UNIT: VI

Modern Power Semiconductor Devices: Basic Structure and Characteristics of Diode, Transistor, MOSFET, IGBT, GTO, DIAC, TRIAC

Text Books:

1. Power Electronics by M.D.Singh, K.B.Khanchandani, Tata Mc Graw Hill Education (India) Private Limited.

Reference Books:

1. Power Electronic Circuits Devices and Applications by M.H.Rashid, Pearson India
2. Power Electronics by Dr. P S Bhimbra, Khanna Publishers.

PCC-8:EEC3102	Electrical Measurements	3L:1T:0P	3 Credits

Course Outcomes:

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.

UNIT: I

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

UNIT: II

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

UNIT: III

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.

UNIT: IV

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.

UNIT: V

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.

UNIT: VI

Potentiometers & Instrument Transformers: Crompton's D.C. Potentiometer, A.C. Polar and Co-Ordinate Type Potentio Meters. Applications measurement 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, Dhanpat Rai & Sons, Delhi, 11th Edition, 1995.

References:

1. Electrical & Electronic Instrumentation by Umesh Sinha, Satya Prakashan, Newdelhi,1998
2. Electrical Measurements by E.W.Golding. & Widdis, 5th Edition, Wheeler Publishing.

PCC-9: EEC3103	Electrical Machines – II	3L:1T:0P	3 Credits

Course Outcomes:

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

- Understand the concepts of rotating magnetic fields.
- Understand the operation of ac machines.
- Analyze performance characteristics of ac machines.

UNIT: I

Induction Motors - I: Principle of operation, Constructional details, Rotating Magnetic field, Types of rotors, Slip, Stator and Rotor current frequencies, Development of torque and torque calculations, Torque-Speed Characteristics, Power flow and performance calculations, Equivalent circuit, Calculation of equivalent circuit parameters from No-load and Rotor-blocked tests.

UNIT: II

Induction Motors - II: Predetermination of performance characteristics using circle diagram and load test, Starting of Induction motors using Rheostat/reactor starter, Auto-transformer starter, Star-Delta starter, and Rotor Resistance starter, Crawling and cogging, Brief description of the induction motor speed control using Voltage control, frequency control, pole changing, rotor resistance control, cascading, and rotor emf injection, Induction generator and principle of operation, Double-cage rotors.

UNIT: III

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.

UNIT: IV

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.

UNIT: V

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.

UNIT: VI

Special Machines: Single phase Induction motors: Double-field revolving theory, Principle of operation of Split-phase, capacitor start, capacitor start and run, shaded pole machines.
Principle of operation of hysteresis motor, Reluctance motor, BLDC motor and Doubly-fed Induction generator.

Text books:

1. M G Say, The performance and Design of Alternating Current Machines, 3rd edition, CBS Publishers & Distributors, New Delhi, 2002.
2. P S Bhimbhra, Electrical Machinery, 7th edition, Khanna Publishers, New Delhi, 2011.

References:

1. A E Fitzferald, Chrles Kingsley, Jr., and Stephen D Umans, Electric Machinery, 6th edition, Mc. Graw-Hill, New Delhi, 2003.
2. B L Theraja, and A K Theraja, A textbook of Electrical Technology, Vol. 2, AC & DC Machines, S Chand Publications.
3. Gonzalo Abad, *et al*, Doubly Fed Induction Machine: Modelling and Control for Wind Energy Generation, John. Wiley & Sons, Inc., USA, 2011.

PCC-10:EEC3104	Power Systems-I	3L:1T:0P	3 Credits

Course Outcomes:

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

- Identify different components of a thermal power station.
- Describe the operation of various components of a nuclear power station.
- Distinguish between the operation of hydro and gas power plants.
- Analyze the significance of various factors for economic analysis of power generation.
- Select the suitable tariff method for various consumers.

UNIT: I

Introduction: Basic Structure of power system, Power Generation, Comparison of different Sources of Energy.

Hydro Electric Plants: Choice of Site, Hydrology, Classification of Plants, General Arrangement, Functions of Different Components of a Hydro Plant, Advantages & Disadvantages

UNIT: II

Thermal Power Stations(TPS): Line Diagram and location of thermal power plant, TPS components, Boilers – Fire tube and Water tube, Super heaters, Economizers, Condensers, Draught, Cooling Water Systems.

Nuclear Power Plants: Schematic Arrangement, Components of Nuclear Reactor, Classification and working of Nuclear reactors, Different Power Reactors.

UNIT: III

Diesel Power Plant: Understand the Working Principle, Site Selection, Plant Layout, Components, Merits and Demerits.

Gas Turbine Plants: Layout, Components of a Gas Turbine Plant, Open Cycle and Closed Cycle Plants.

UNIT: IV

Magneto Hydro Dynamic (MHD) Power Generation: Basic Concepts, Principle, Classification, Coal Burning MHD Steam Power Plant, Gas Cooled Nuclear MHD Power, Liquid Metal MHD Generator.

UNIT: V

Operational Aspects of Generating Stations: Load Curves and Associated Definitions – Connected load, Maximum demand, Demand factor, Load factor, Diversity factor, Capacity factor, Utilization factor, Capacity, utilization and plant use factors-Numerical Problems, Selection of Units, and Load Duration Curves.

UNIT: VI

Economic Considerations: Capital and Running Costs of Generating Stations, Different Tariffs - Simple Rate Tariff, Flat Rate Tariff, Block-Rate Tariff, Two-part Tariff, Three-part tariff and power factor tariff, Comparison of Costs.

Text Book:

1. A Text Book on Power System Engineering by Soni, Gupta, Bhatnagar & Chakrabarti, Dhanpat rai & Co.

Reference Books:

1. Generation & Utilization by C.L.Wadhwa
2. Electrical Power by S. L. Uppal, Khanna Publishers

PEC-1:EEE3101	Computer Architecture and Organisation	3L:1T:0P	3 Credits

Course Outcomes:

At the end of this course, student will be able to

- Explain about the concept of arithmetic micro operations.
- Describe the vector and pipeline processing.
- Explain the addressing modes of CPU.

UNIT: I

Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit.

UNIT: II

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input- Output and Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

UNIT: III

Micro programmed Control: Control Memory, Address Sequencing, Micro program Example, Design of Control Unit.

UNIT: IV

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer(RISC)

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISK Pipeline, Vector Processing, Array Processors.

UNIT: V

Input/output Organization: Peripheral Devices, I/O interface, Asynchronous data transfer, Modes of transfer, priority Interrupt, Direct memory access, Input-Output Processor (IOP), Serial Communication.

UNIT: VI

Memory Organization: Memory Hierarchy, Main memory, Auxiliary memory, Associate Memory, Cache Memory, and Virtual memory, Memory Management Hardware.

Text Book:

1. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd., Third Edition, Sept. 2008.

References:

1. Computer Architecture and Organization, William Stallings, PHI Pvt. Ltd., Eastern Economy Edition, Sixth Edition, 2003.

2. Computer Organization and Architecture, Linda Null, Julia Lobur, Narosa Publications ISBN 81- 7319-609-5
3. Computer System Architecture", John. P. Hayes.

PEC-1:EEE3102	Digital Signal Processing	3L:1T:0P	3 Credits

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

- Represent signals mathematically in continuous and discrete-time, and in the frequency domain.
- Analyse discrete-time systems using z-transform.
- Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.
- Design digital filters for various applications.
- Apply digital signal processing for the analysis of real-life signals.

Unit-I:
Discrete - Time Signals and Systems: Discrete - Time Signals – Sequences, Linear Shift – Invariant Systems, Stability and Casuality, Linear Constants – Coefficient Difference Equations, Frequency Domain Representation of Discrete – Time Signals and Systems.

Unit- II
Applications of Z – Transforms: System Functions H(z) of Digital Systems, Stability Analysis, Structure and Realization of Digital Filters, Finite Word Length Effects.

Unit- III
Discrete Fourier Transform (DFT): Properties of the DFS, DFS Representation of Periodic Sequences, Properties of DFT, Convolution of Sequences.

Unit -IV
Fast – Fourier Transforms (FFT): Radix – 2 Decimation – In – Time (DIT) and Decimation – In – Frequency (DIF), FFT Algorithms, Inverse FFT.

Unit-V
IIR Digital Filter Design Techniques: Design of IIR Filters from Analog Filters, Analog Filters Approximations (Butterworth and Chebyshev Approximations), Frequency Transformations, General Considerations in Digital Filter Design, Bilinear Transformation Method, Step and Impulse Invariance Technique.

Unit-VI
Design of FIR Filters: Fourier Series Method, Window Function Techniques, Comparison of IIR and FIR Filters.

Text Book:

1. Alan V. Oppenheim and Ronald W. Schafer: Digital Signal Processing, PHI.

References:

1. Sanjit K. Mitra, Digital Signal Processing "A – Computer Based Approach", Tata McGraw Hill.
2. Raddar and Rabiner, Application of Digital Signal Processing.
3. S. P. Eugene Xavier, Signals, Systems and Signal Processing, S. Chand and Co. Ltd.
4. Antonio, Analysis and Design of Digital Filters, Tata McGraw Hill.

PEC-1:EEE3103	Information Technology	3L:1T:0P	3 Credits

Course Outcomes:

At the end of this course student will be able to

- Understand the concept of different data transmission modes.
- Explain the concept of internetworking protocol and wireless networking.
- Describe Security system of computer.

UNIT: I

Introduction to Computer and Computer System Hardware: Characteristics of Computer, History and generations of computers, micro, mini, mainframe and computers, applications, CPU, Instruction execution, microprocessors, interconnecting the units of Computer system, components of computer cabinet

UNIT: II

Memory, Storage Devices and I/O devices: Memory hierarchy, Primary memory, secondary memories, types of storage devices and technologies, role of I/O devices, Manual and automatic Data entry devices, output devices, I.O ports

UNIT: III

Data Representation: Number systems, conversion of Binary, Octal, Hexadecimal, Decimal numbers from one form to the other, Binary arithmetic, signed number representation, fixed and floating point numbers, coding schemes.

Operating systems: Objectives of OS, types of OS, Functions of OS, Process management, memory management, file management, device management, protection and security, User interface, case studies

UNIT: IV

Data communication and Computer Networking: Importance of networking, Various Data transmission media, transmission modes, analog and digital signals, modulation and demodulation, multiplexing, asynchrounous and synchronous transmission, types of switching, Types of networks, LAN technologies, communication protocols, Network devices, wireless networking.

UNIT: V

Internet and Internet Services: History of Internet, Internetworking Protocol, Internet Architecture, Managing the Internet, types of internet connections, Internet services - www, e- mail, FTP, Telnet, IRC, News etc.

UNIT: VI

Computer Security: Security Threat and Attack, Malicious software, Hacking, Security services, security mechanisms, cryptography, digital signatures, firewalls, user identification and authentication, security awareness, security policy.

Text book:

1. "Computer Fundamentals", Anita Goel, Pearson Education India.

References:

1. "Fundamentals of Computers", V.Raja Raman and Neeharika Adabala, Prentice Hall India Publishers.
2. "Fundamentals of Information Technology", V.Rajaraman, Prentice Hall India publishers.

EEL3101	**Laboratory-V: Electrical Measurements Lab**	**0L:0T:3P**	**1.5 Credits**

EEL3102	**Laboratory-VI: Electrical Machines Lab-II**	**0L:0T:3P**	**1.5 Credits**

MC-6: EEM3101	Indian Constitution

*** Common to all Branches

ANDHRA UNIVERSITY: : VISAKHAPATNAM

DEPARTMENT OF ELECTRICAL ENGINEERING

SCHEME OF INSTRUCTION & EXAMINATION

III/IV B.TECH

Common with SIX YEAR DUAL DEGREE COURSE II/VI (B.TECH.+ M.TECH.)

(With effect from **2019-2020** admitted batch onwards)

B.TECH. (EEE) III YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

SUB. REF	NAME OF THE SUBJECT	PERIODS			MAXIMUM MARKS			CREDITS
		THEORY	TUTORIAL	LAB	EXAM	SESSIONALS	TOTAL	
EEC3201	PCC-11: Power Systems - II	3	1	--	70	30	100	3
EEC3202	PCC-12: Control Systems	3	1	--	70	30	100	3
EEC3203	PCC-13: Microprocessors & Micro-controllers	3	1	--	70	30	100	3
EEC3204	PCC-14: Power System Analysis & Stability	3	1	--	70	30	100	3
EEE32XX	PEC-2:	3	1	--	70	30	100	3
EEE32XX	PEC-3:	3	1	--	70	30	100	3
EEL3201	Laboratory – VII: Power Electronics Laboratory	--	--	3	50	50	100	1.5
EEL3202	Laboratory – VIII: Microprocessor and Microcontroller Laboratory	--	--	3	50	50	100	1.5
	TOTAL	**18**	**6**	**06**	**520**	**280**	**800**	**21**

Professional Electives Courses (PEC) (Semester-VI)		
S.No.	**Subject Code**	**Subject Name**
1	EEE3201	Utilization of Electrical Energy
2	EEE3202	Renewable Energy Sources
3	EEE3203	Energy Management and Auditing
4	EEE3204	Power Station Practice
5	EEE3205	Digital Control Systems
6	EEE3206	High Voltage Engineering

PCC-11: EEC3201	Power Systems – II	3L:1T:0P	3 Credits

Course Outcomes:

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

- Estimate the inductance and capacitance for different conductor configurations.
- Analyze the performance of short, medium & long transmission lines.
- Select a suitable insulator for a particular operating voltage, configuration and best method to improve string efficiency.
- Analyze the effect of various factors on corona.
- Evaluate the sag and tension of transmission line for various configurations under the effect of wind and ice.

UNIT: I

Transmission Line Constants: Transmission line components, Types of conductors, Inductance and Capacitance of Single Phase and Three Phase Lines, Concept of GMDR Mutual GMD Double Circuit Line, Inductance of Composite Conductors, Transposition, Skin Effect and Proximity Effect.

UNIT: II

Transmission Line Modeling: Generalized Network Constants, Modeling of Short Transmission line, Modeling of Medium transmission line: Nominal-T and Nominal-π methods and Long Transmission Lines, Rigorous Line Modeling, Circle Diagrams.

UNIT: III

Mechanical Design of Transmission Lines: Sag and Tension Calculations with equal and unequal heights of towers, effect of Wind and Ice on weight of conductor. Line Supports, Conductor Materials, Overhead Lines Vs Underground Cables.

UNIT: IV

Over Head Line Insulators: Types of Insulators, String efficiency and Methods for improvement–Numerical Problems, Voltage distribution, Calculation of string efficiency, Capacitance grading and Static Shielding.

UNIT: V

Under-Ground Cables: Types of Cables, Insulation in Cables, Armonning & Covering of Cable, Insulation Resistance OFR Cables, Stress in Insulation, Sheathing in Cable, Use of Inter Sheaths, Capacitance Grading, Capacitance in 3-Core Cables.

UNIT: VI

Corona: Phenomenon of Corona, Critical Voltages, Power Loss due to Corona, Factors Affecting Corona Loss, Radio Interference.

Text Books:

1. A Text Book on Power Systems Engineering by Sony, Gupta, Bhatnagar and Chakrabarti, Dhanapatrai & Co.
2. Electrical Power Systems by C. L. Wadhwa.

References:

1. Electrical Power by S. L. Uppal.
2. A Course in Power Systems by J. B. Gupta.
3. Electrical Power Transmission and Distribution by S. Siva Nagaraju and S. Satyanarayana.

PCC-12:EEC3202	Control Systems	3L:1T:0P	3 Credits

Course Outcomes:

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

- Understand the modeling of linear-time-invariant systems using transfer function and state-space representations.
- Develop mathematical models for physical systems.
- Employ the time domain analysis to quantify the performance of linear control systems and specify suitable controllers.
- Understand the concept of stability and its assessment for linear-time invariant systems.
- Quantify time and frequency domain specifications to determine stability margins.
- Apply state variable theory to determine the dynamic behavior of linear control systems.

UNIT: I

Basic Structure of a Feedback Control System: Introduction to Mathematical Modeling of Physical Systems – Equations of Electrical Networks – Modeling of Mechanical Systems – Equations of Mechanical Systems, Analogous Systems.

UNIT: II

Transfer Functions of Linear Systems: Impulse Response of Linear Systems – Block Diagrams of Control Systems – Signal Flow Graphs (Simple Problems) – Reduction Techniques for Complex Block Diagrams and Signal Flow Graphs (Simple Examples). Feedback Characteristics of Control Systems.

UNIT: III

Time Domain Analysis of Control Systems: Time Response of First and Second Order Systems with Standard Input Signals – Steady State Error Constants – Effect of Derivative and Integral Control on Transient and Steady State Performance of Feedback Control Systems.

UNIT: IV

Stability: Concept of Stability and Necessary Conditions for Stability – Routh-Hurwitz Criterion, Relative Stability Analysis, the Concept and Construction of Root Loci, Analysis of Control Systems with Root Locus (Simple Problems to understand theory).

UNIT: V

Frequency Domain Analysis of Control Systems: Correlation between Time and Frequency Responses – Polar Plots – Bode Plots – Log Magnitude versus Phase Plots – All Pass and Minimum Phase Systems – Nyquist Stability Criterion – Assessment of Relative Stability – Constant M and N Circles-The Nichols Chart.

Text Books:

1. Automatic Control Systems, Benjamin C. Kuo, PHI Publication (5^{th} Edition).

Reference Books:

1. Modern Control Engineering, Ogata, PHI.
2. Control Systems Engineering, I. J. Nagrath and M. Gopal, Wiley Eastern Ltd.
3. Control Systems Principles and Design M.Gopal, McGrawHill

PCC-13: EEC3203	Microprocessors & Micro-controllers	3L:1T:0P	3 Credits

Course Outcomes:

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

- Do assembly language programming.
- Do interfacing design of peripherals like I/O, A/D, D/A, timer etc.
- Develop systems using different microcontrollers.

UNIT: I

8085 Microprocessor: Introduction to microprocessors, microcomputers – Architecture of 8085 microprocessor – pin-out diagram of 8085 – Detailed description of the 8085 pins – addressing modes – Memory structure and its requirements – Basic concepts in memory interfacing – Address decoding – Memory mapping – Machine cycles and bus timings for memory read, memory write, I/O read, I/O write operations – Memory mapped I/O and I/O mapped I/O.

UNIT: II

8085 Instructions and programming: Difference between Machine language, Assembly language and High level language – Brief description of the 8085 instruction set – 8085 programming using data transfer group, arithmetic group, logical group, branch transfer group, stack and subroutines – counters and delay - code conversions.

UNIT: III

Interfacing peripherals to 8085: Function of D/A and A/D converters – Interfacing D/A and A/D converters and necessary programming – Detailed description and interfacing of 8251 USART, 8253/8254 programmable timer, 8255 PPI, 8257 DMA controller, 8259 programmable interrupt controller, 8279 programmable keyboard/display interface

UNIT: IV

8051 Microcontroller: Introduction to microcontrollers – Comparison between microprocessors and microcontrollers – Functional block diagram of 8051 microcontroller and its description – 8051 pin-out diagram and description of 8051 pins – Interfacing external memory to 8051 – implementing counters and timers in 8051 – Serial data transfer using 8051 – Various interrupts and its programming in 8051.

UNIT: V

Advanced topics in Microprocessors: Architecture of 8086 microprocessor – Addressing modes – RS232 communication standard – Interfacing Stepper motor, elevator, traffic controller to 8085 microprocessor.

Text books:

1. Ramesh S. Gaonkar, Microprocessor Architecture, Programming, and Applications, New Age International Publishers, New Delhi, 2nd edition, 1996.
2. Kenneth J. Ayala, The 8051 Microcontroller : Architecture, Programming, & Applications, Penram International Publishing (I) Pvt. Ltd., Mumbai, 2nd edition, 2006.

3. Douglas V. Hall, Microprocessor and Interfacing : Programming and hardware, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1997.

Reference Books:

1. B. Ram, Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai & sons, New Delhi, 4^{th} edition, 1998.
2. Muhammad Ali Mazidi and Janice Gillispie Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education (Singapore) Pte. Ltd., New Delhi, 2003.
3. A K Ray and K M Bhurchandi, Advanced Microprocessors and Peripherals : Architecture, Programming and Interfacing, Tata McGraw Hill Publishing Company Limited, New Delhi, 2002.

PCC-14:EEC3204	Power System Analysis & Stability	3L:1T:0P	3 Credits

Course Outcomes:

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

- Describe the per unit system of power system.
- Apply the concepts of addition or removal of element in the power system for determining the impedance matrix.
- Formulate and solve the power flow problem of power system.
- Develop and solve the positive, negative, and zero sequence networks for systems consisting of machines, transmission lines and transformers.
- Determine the fault voltages and currents for various faults.
- Analyze the stability of power system under various disturbances.

UNIT: I

Per Unit Representation & Topology: Per Unit Quantities–Single line diagram– Impedance diagram of a power system – Graph theory definition – Formation of element node incidence and bus incidence matrices – Primitive network representation – Formation of Y–bus matrix by singular transformation and direct inspection methods.

UNIT: II

Power Flow Studies: Necessity of power flow studies – Derivation of static power flow equations – Power flow solution using Gauss-Seidel Method – Newton Raphson Method (Rectangular and polar coordinates form) –Decoupled and Fast Decoupled methods

UNIT: III

Symmetrical Fault Analysis: Formation of Z_{Bus}: Partial network– Algorithm for the Modification of Z_{bus} Matrix for addition element for the following cases: Addition of element from a new bus to reference– Addition of element from a new bus to an old bus– Addition of element between an old bus to reference and Addition of element between two old busses (Derivations and Numerical Problems) – Modification of Z_{Bus} for the changes in network (Problems). 3–Phase short circuit currents and reactances of synchronous machine–Short circuit MVA calculations.

UNIT: IV

Symmetrical Components: Synthesis of unsymmetrical phasor from their symmetrical components– Symmetrical components of unsymmetrical phasor–Phase–shift of symmetrical components in Y–Δ–Power in terms of symmetrical components – Sequence networks – Positive, negative and zero sequence networks

UNIT: V

Unsymmetrical Faults: Various types of faults LG– LL– LLG and LLL on unloaded alternator–unsymmetrical faults on power system.

UNIT: VI

Power System Stability Analysis: Elementary concepts of Steady state– Dynamic and Transient Stabilities– Description of Steady State Stability Power Limit–Transfer Reactance Synchronizing Power Coefficient –Power Angle Curve and Determination of Steady State Stability –Derivation of Swing Equation–Determination of Transient Stability by Equal Area Criterion–Application of Equal Area Criterion–Methods to improve steady state and transient stability.

Text Books:

1. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
2. Modern Power system Analysis – by I.J.Nagrath & D.P.Kothari: Tata Mc Graw–Hill Publishing Company, 2nd edition.

Reference Books:

1. Power System Analysis by Hadi Saadat – TMH Edition.

PEC-2:EEE3201	Utilization of Electrical Energy	3L:1T:0P	3 Credits

Course Outcomes:

At the end of this course, student will be able to,

- Describe various electric heating and welding methods.
- Design illumination systems for residential, commercial and industrial environments.
- Design an illumination system.
- Calculate the required tonnage capacity for a given air-conditioning system.
- Evaluate domestic wiring connection and debug any faults occured.

UNIT: I

Electric Heating & Welding: Electric Heating: Advantages and methods of electric heating, resistance heating induction heating and dielectric heating. Electric welding: resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.

UNIT: II

Illumination-I: Introduction terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light.

UNIT: III

Illumination-II: Discharge lamps, MV and SV lamps - comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of lighting and flood lighting.

UNIT: IV

Electrical Circuits used in Refrigeration Air Conditioning and Water Coolers: Principle of air conditioning, vapour pressure, refrigeration cycle, eco-friendly refrigerants Description of Electrical circuit used in refrigerator, air conditioner, Lift wiring and Automobile wiring.

UNIT: V

Electrolytic Processes: Need of electro-deposition, Laws of electrolysis, process of electrode position – clearing, operation, deposition of metals, polishing, buffing, Equipment and accessories for electroplating, Factors affecting electrode position, Principle of galvanizing and its applications, Principle of anodising and its applications, Electroplating on non-conducting materials, Manufacture of chemicals by electrolytic process and electrolysis process.

UNIT: VI

Electrical Safety, Wiring & Introduction to Power System: Safety measures in electrical system- types of wiring- wiring accessories- staircase, fluorescent lamps & corridor wiring- Basic principles of earthing-Types of earthing- Simple layout of generation, transmission & distribution of power.

Text Books:

1. C.L. Wadhwa, 'Generation, Distribution and Utilization of Electrical Energy', New Age International Pvt. Ltd, 2003.

2. B.R. Gupta, ‘Generation of Electrical Energy’, Eurasia Publishing House (P) Ltd, New Delhi, 2003.

Reference Books:

1. H. Partab, ‘Art and Science of Utilization of Electrical Energy’, Dhanpat Rai and Co, New Delhi, 2004.
2. E. Openshaw Taylor, ‘Utilization of Electrical Energy in SI Units’, Orient Longman Pvt. Ltd, 2003
3. Dash.S.S, Subramani.C,Vijayakumar.K,”BasicElectrical Engineering”, First edition, Vijay Nicole Imprints Pvt.Ltd,2013

PEC-2:EEE3202	Renewable Energy Sources	3L:1T:0P	3 Credits

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

- Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.
- Understand the basic physics of wind and solar power generation.
- Understand the power electronic interfaces for wind and solar generation.
- Understand the issues related to the grid-integration of solar and wind energy systems.

UNIT: I

Energy Sources: Classification, Indian energy scenario, prediction regarding fossil fuels, generation of non-conventional and renewable energy resources, Description of renewable energy sources, Achievements of renewable energy in India, Use of renewable energy in agriculture in India.

UNIT: II

Solar Energy: Environmental impact of solar power, principles of solar radiation, solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surfaces, solar radiation data, instruments for measuring solar radiation, sun shine.

Solar Energy Collectors: Principles of solar energy conversion, Flat plate and Concentrating type collectors, energy balance and collector efficiency, solar thermal plants, thermal energy storage for solar heating and cooling, limitations and applications.

UNIT: III

Photovoltaic Technology: Present status, solar cells, cell technology, characteristics of PV systems, equivalent circuit, array design, Integrated PV systems, components, sizing and economics, peak power operation, MPPT, Standalone and grid integrated systems.

UNIT: IV Wind Energy: Wind power sources, wind characteristics, site selection, criterion, momentum theory, Components of wind energy systems, performance and limitations, classification of wind energy collectors, aerodynamic forces acting on blades, applications and environmental impacts.

UNIT: V Nonconventional Energy: Detailed description of nonconventional energy sources of bio energy, chemical energy, MHD, geothermal energy, ocean energy systems, General features, Basic principles of operation, classification, applications and environmental impacts.

UNIT: VI Renewable Energy Generation in Power Systems: Distributed Generation, Renewable energy penetration, Point of common coupling (PCC), Connection voltage, Voltage Effects, Steady state voltage rise, Thermal Limits, Other Embedded Generation Issues, Islanding.

Text Books:

1. Non-Conventional Energy Sources by GD Rai, Khanna Publishers.
2. Renewable Energy in Power Systems by Leon Freris and David Infield, John Wiley & Sons, Ltd.

References:

1. Advanced renewable energy systems; Part 1 by S. C. Bhatia, Woodhead Publishing India Pvt Ltd.
2. Renewable Energy Sources and Methods by Anne Maczulak, Green technology info print publication.

PEC-2:EEE3203	Energy Management and Auditing	3L:1T:0P	3 Credits

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

- Understand the current energy scenario and importance of energy conservation.
- Understand the concepts of energy management.
- Understand the methods of improving energy efficiency in different electrical systems.
- Understand the concepts of different energy efficient devices.

UNIT-I:

Basic Principles of Energy Audit: Energy audit- definitions, concept , types of audit, energy index, cost index ,pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit.

UNIT-II:

Energy Management: Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting- Energy manger, Qualities and functions, language.

UNIT-III:

Energy Efficient Motors: Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed , variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit.

UNIT-IV:

Power Factor Improvement, Lighting and Energy Instruments: Power factor – methods of improvement, location of capacitors, Pf with non-linear loads, effect of harmonics on power factor, power factor motor controllers - Good lighting system design and practice, lighting control ,lighting energy audit - Energy Instruments- wattmeter, data loggers, thermocouples, pyrometers, lux meters, tongue testers ,application of PLC's.

UNIT-V:

Economic Aspects and Analysis: Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method , replacement analysis, life cycle costing analysis- Energy efficient motors- calculation of simple payback method, net present worth method- Power factor correction, lighting - Applications of life cycle costing analysis, return on investment .

Text Books:

1. Energy Management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications. 2012
2. Energy Efficient Electric Motors by John. C. Andres, Marcel Dekker Inc. Ltd – 2nd Edition, 1995

3. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill Publishing Company Ltd, New Delhi.

Reference Books:

1. Energy management by Paulo' Callaghan, Mc – Graw Hill Book company – 1st edition, 1998
2. Energy management hand book by W.C. Turner, John wiley and son, 2001.
3. Energy management and good lighting practice: fuel efficiency booklet12 – EEO.

PEC-3:EEE3204	Power Station Practice	3L:1T:0P	3 Credits

Course Outcomes:

At the end of this course student will be able to

- Selection of locating generating stations
- Explain the concept of Lightning Arrestor
- Describe the Operation and control of HVDC Transmission system.
- Applications of HVDC System.

UNIT: I

Design of Power Station: Introduction, selection of sizes and location of generating stations, interconnections issues with wind and Solar PV.

UNIT: II

Substation Design: Determination of voltage regulation and losses in power system, shifting of distribution transformer centre, Substation layout, sizes and locations of sub stations, Substation equipments specifications ratings and its operation from design view point, Cathodic Protection, Gas Insulated Substation (GIS).

UNIT: III

Power System Earthing – Power Station and Sub Station Earthing: Objectives, definitions, tolerable limits of body currents, soil resistivity, measurement of soil resistivity, earth resistance, measurement of earth resistance, tolerable step and touch voltage, actual step and touch voltage, design of earthing grid, impulse behaviour of earthing system.

UNIT: IV

Insulation Coordination and Location of Lightning Arrestor: Introduction, definitions, insulation-co-ordination curves, determination of line insulation, Basic Insulation level (BIL), Insulation levels of substation equipments, Lightning arrestor selection and location, Selection of arrestor voltage rating, arrestor discharge voltage and arrestor discharge current, protective margin.

UNIT: V

HVDC Transmission: Merits and demerits of HVDC transmission, one line diagram, types of DC link, necessary equipments, operation and control, applications, recent advances of HVDC in India.

UNIT: VI

EHV Transmission: Introduction, Need of EHV Transmission Lines, Advantages and Disadvantages of EHV Lines

Note: It is suggested that based on the above syllabus, visits for LT/HT Electrification and 220KV/ 400 KV substations should be carried out.

Text Books:

1. Electrical Power System Design – M. V. Deshpande, TMH publication

2. Electrical Power System Design – B. R. Gupta, S. CHAND
3. Electrical Power System Planning – A. S. Pabla, TMH publication
4. Substation Design – Satnam & Gupta, Dhanpat Rai and Co.
5. A course in Electrical Power- Soni, Gupta and Bhatnagar, Dhanpat Rai & Sons

PEC-3:EEE3205	Digital Control Systems	3L:1T:0P	3 Credits

Course Outcomes:

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

- Obtain discrete representation of LTI systems.
- Analyze stability of open loop and closed loop discrete-time systems.
- Design and analyze digital controllers.
- Design state feedback and output feedback controllers.

UNIT: I

Discrete –Time Systems: The Structure of a Digital Control System, Analog Systems with Piecewise Constant Inputs, Difference Equations, The Z-Transform, Z-Transform Solution of Difference Equation, The Time Response of a Discrete-Time System, Frequency Response of Discrete-Time Systems.

UNIT: II

Modeling of Digital Control Systems: ADC Model, DAC Model, Transfer Function of the ZOH, Effect of Sampler on Transfer Function of a Cascade, Transfer Function for the DAC, Analog Subsystem, ADC Combination, Closed-Loop Transfer Function, Analog Disturbances in a Digital System, Steady-State Error and Error Constants.

UNIT: III

Stability of Digital Control Systems: Definitions of Stability, Stable Z-Domain Pole Locations, Stability Conditions, Stability Determination, Jury Test.

UNIT: IV

State Space Representation: Discrete-Time State Space Equations, Solution of Discrete-Time State Space Equations, Z-Transfer from State Space Equations, Similarity Transformation, Stability of State Space Realizations, Controllability and Stabilizability, Observability and Detectability.

UNIT: V

State Feedback Control: On State and Output Feedback, Pole Placement, Servo Problem, Principles of Observer, State Feedback and Pole Assignment Using Transfer Functions.

Text Book:

1. Digital control systems by B.C.Kuo, Oxford University Press.

Reference Books:

1. Digital Control Engineering: Analysis and Design**,** By M. Sami Fadali, Antonio Visioli, Academic Press; 1edition (February 16, 2009)
2. Digital control systems by K.Ogata

PEC-3:EEE3206	High Voltage Engineering	3L:1T:0P	3 Credits

Course Outcomes:

At the end of the course, the student will demonstrate

- Understand the basic physics related to various breakdown processes in solid, liquid and gaseous insulating materials.
- Knowledge of generation and measurement of D. C., A.C., & Impulse voltages.
- Knowledge of tests on H. V. equipment and on insulating materials, as per the standards.
- Knowledge of how over-voltages arise in a power system, and protection against these over-voltages.

UNIT: I

Breakdown in Gases: Ionization processes and de-ionization processes, Types of Discharge, Gases as insulating materials, Breakdown in Uniform gap, non-uniform gaps, Townsend's theory, Streamer mechanism, Corona discharge

UNIT: II

Breakdown in liquid and solid Insulating materials: Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, applications of insulating materials.

UNIT: III

Generation of High Voltages: Generation of high voltages, generation of high D. C. and A.C. voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

UNIT: IV

Measurements of High Voltages and Current: Peak voltage, impulse voltage and high direct current measurement method, cathode ray oscillographs for impulse voltage and current measurement, measurement of dielectric constant and loss factor, partial discharge measurements.

UNIT: V

Lightning and Switching Over-voltages: Charge formation in clouds, Stepped leader, Dart leader, Lightning Surges. Switching over voltages, Protection against over-voltages, Surge diverters, Surge modifiers.

UNIT: VI

High Voltage Testing of Electrical Apparatus and High Voltage Laboratories: Various standards for HV Testing of electrical apparatus, IS, IEC standards, Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers and some high voltage equipment, High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H. V. Labs.

Text/Reference Books:

1. M. S. Naidu and V. Kamaraju, “High Voltage Engineering”, McGraw Hill Education, 2013.
2. C. L. Wadhwa, “High Voltage Engineering”, New Age International Publishers, 2007.

EEL3201	**Laboratory-VII: Power Electronics Lab**	**0L:0T:3P**	**1.5 Credits**

EEL3202	**Laboratory-VIII: Microprocessor and Microcontroller Laboratory**	**0L:0T:3P**	**1.5 Credits**

ANDHRA UNIVERSITY: : VISAKHAPATNAM

DEPARTMENT OF ELECTRICAL ENGINEERING

SCHEME OF INSTRUCTION & EXAMINATION

IV/IV B.TECH

Common with SIX YEAR DUAL DEGREE COURSE II/VI (B.TECH.+ M.TECH.)

(With effect from **2019-2020** admitted batch onwards)

B.TECH. (EEE) IV YEAR I-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

SUB. REF	NAME OF THE SUBJECT	PERIODS			MAXIMUM MARKS			CREDITS
		THEORY	TUTORIAL	LAB	EXAM	SESSIONALS	TOTAL	
EEH4101	HSMC-3: Managerial Economics	3	1	--	70	30	100	3
EEC4101	PCC-15: Electrical Drives & Traction	3	1	--	70	30	100	3
EEC4102	PCC-16: Power System Operation & Control	3	1	--	70	30	100	3
EEE41XX	PEC-4:	3	1	--	70	30	100	3
EEE41XX	PEC-5:	3	1	--	50	50	100	3
EEL4101	Laboratory – IX: Control Systems Laboratory	--	--	3	50	50	100	1.5
EEL4102	Laboratory – X: Power System Simulation Lab	--	--	3	50	50	100	1.5
EEL4103	Seminar(basedonInternship experiences)	--	--	4	50	50	100	1.5
EEL4104	Project Work (Part-I: Mini Project)	--	--	8	25	25	50	4
	TOTAL	**15**	**5**	**18**	**505**	**345**	**850**	**23.5**

Professional Electives Courses (PEC) (Semester-VII)		
S.No.	**Subject Code**	**Subject Name**
1	EEE4101	Operations Research
2	EEE4102	Electrical Machine Design
3	EEE4103	Flexible AC Transmission Systems
4	EEE4104	Electrical Distribution Systems
5	EEE4105	Advanced ControlSystems
6	EEE4106	Advanced PowerElectronics

HSMC-3: EEH4101	Managerial Economics	3L:1T:0P	3 Credits

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

Unit: I

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

UNIT: II

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.

Unit: III

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.

UNIT: IV

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 of Liquidity 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.

Unit: V

Introduction to Management & Strategic Management: Introduction to management: Nature – Importance – Classical Theories of Management: F.W.Taylor's and Henri Fayol's Theory – 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.

Unit: VI

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

References:

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

PCC-15:EEC4101	Electrical Drives & Traction	3L:1T:0P	3 Credits

Course Outcomes:

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

- Analyze the appropriate type of traction system.
- Select a suitable drive for speed control of AC motors.
- Select a suitable drive for speed control of DC motors.
- Determine the tractive effort, power and specific energy consumption of electric traction.

UNIT: I

Electric Drive: Definition, Components of electric drive system, Advantages and applications of drives, factors governing the selection of motors, classification of drives, Drive characteristics and nature of load conditions, selection of motor for particular drive, Dynamics of motor load combination, Multi quadrant operation, Nature, classification and components of load torques.

UNIT: II

Speed Control of DC Motor Drives: Speed Control methods, Single phase rectifier fed uncontrolled and controlled drives, chopper fed drives, closed loop control and Phase locked loop control of DC drives.

UNIT: III

Speed Control of AC Motor Drives: Speed control methods of induction motors, phase controlled drives; frequency controlled drives, slip power recovery schemes, voltage current and frequency control and closed loop control. Variable frequency control of synchronous motor drives, self-controlled synchronous motor drives.

UNIT: IV

Electric Traction I: Definition and features of traction, Classification of traction systems, Types and choice of track electrification systems, Review of characteristics and suitability of traction motors. Transmission of drive and auxiliary equipment, Loco wheel arrangement and riding qualities, Train lighting system.

UNIT: V

Electric Traction II: Speed time curves and speed distance curves, Tractive effort, specific energy consumption, mechanics of train movement, coefficient of adhesion.

UNIT: VI

Control of Traction Motors: Control of traction motors, rheostatic control, series parallel control, drum controllers, constant current systems, multiple unit control, thyristor and feedback controls. Magnetic levitation suspension systems.

Text Books:

1. Fundamentals of Electrical Drives by GK Dubey
2. Power Electronics: Circuits, Systems and Applications by MH Rashid
3. A First Course on Electric Drives by SK Pillai
4. Utilization of Electrical Energy by E. Open Shaw Taylor and VVL Rao

Reference Books:

1. Electrical Drives and Traction by N. Prema Kumar
2. Electrical Drives by Vedam Subramanyam
3. Modern Elecric Traction by H. Partab

PCC-16:EEC4102	Power System Operation & Control	3L:1T:0P	3 Credits

Course Outcomes:

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

- Evaluate optimal generation schedule with and without losses.
- Compute loss coefficients and transmission losses.
- Find the solution for short term hydrothermal scheduling problems.
- Determine the steady state changes in frequency in single area and two area load frequency control.
- Suggest suitable voltage control method for different applications.

UNIT: I

Optimal System Operation: Characteristics of various steam units, combined cycle plants, cogeneration plants, Hydro-electric units, Steam units economic dispatch problem with and without considering losses and solution using Legrange multiplier method only.

Hydro-Thermal Coordination: Hydro-electric plant models, Scheduling energy, Short-term hydrothermal scheduling.

UNIT: II

Unit Commitment: Constraints in unit commitment, Generation of state, optimizing the states using Priority-list method, Unit commitment problem solution using Priority-list method and Dynamic Programming.

Optimal Power Flow: Optimal power flow problem formulation for loss and cost minimization, Solution of optimal power flow problem using Newton's method and Linear Programming technique.

UNIT: III

Automatic Generation Control: Control System structure, Automatic Load–frequency control of single area system with and without control, Steady state and dynamic responses of single area ALFC loop, Automatic Load-frequency control of two area system, Tie-line bias control of two area and multi-area system.

Voltage Control: Automatic voltage regulator, Exciter types, Exciter modelling, Generator modelling, Static and Dynamic response of AVR loop.

UNIT: IV

Power System Security: Introduction, Factors affecting the power system security, Contingency analysis procedure, Linear sensitivity factors: Line outage distribution factors and Generation shift factors, and its derivation; AC power flow method, contingency selection.

UNIT: V

State Estimation: Weighted Least Square State Estimation, Basic concepts about network observability, Pseudo-measurements, Bad data detection and identification.

Text Books:

1. Power Generation, Operation and Control, Allen J. Wood and Bruce F. Wollenberg, John Wiley & Sons, Inc., New York, 2nd edition, 1996.
2. Electric Energy Systems Theory: An Introduction, Olle I. Elgerd, TMH Publishing Company Ltd., New Delhi, 2nd edition, 1983.

PEC-4:EEE4101	Operations Research	3L:1T:0P	3 Credits

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.

UNIT-I

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

UNIT-II

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.

UNIT-III

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).

UNIT-IV

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

UNIT-V

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.

UNIT-VI

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.

TEXT BOOKS:

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.

PEC-4:EEE4102	Electrical Machine Design	3L:1T:0P	3 Credits

Course Outcomes:

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

- Understand the construction and performance characteristics of electrical machines.
- Understand the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines.
- Understand the principles of electrical machine design and carry out a basic design of an ac machine.
- Use software tools to do design calculations.

UNIT: I

Introduction to Design: Introduction, Design factors, Limitations in Design.

Electrical Engineering Materials: (a) Conducting Materials – High conductivity materials (Copper, Aluminum, Copper alloys only); High resistivity materials, Carbon materials, Super-conductivity; (b) Magnetic Materials – types of magnetic materials; (c) Insulating Materials – Electrical characteristics, temperature characteristics, and classification of insulating materials.

UNIT: II

Heating and Cooling: Theory of solid body heating, Heating time constant and estimation, Selection of motor power rating, types of duties and ratings (Description only), Selection of motor capacity for continuous, short-time and Intermittent periodic duty ratings, Concept of the methods used for determination of motor rating for variable load drives.

UNIT: III

Design of Transformers: Output of transformer, Design of core, Selection of type of winding, Design of insulation, Overall design, No-load current estimation, Design of tank with tubes.

Design of DC machines: Output equation and main dimensions, choice of flux density, choice of ampere-conductors, Selection of number of poles, Length of air gap, Design of field winding.

UNIT: IV

Design of AC machines (Induction motor): Output equation and main dimensions, Selection of stator and rotor slots, Length of air gap, Reduction of harmonic torques.

UNIT: V

Design of AC machines (Synchronous machines): Output equation, Main dimensions for cylindrical and salient pole machines, Choice of specific magnetic and electric loadings, Effect of SCR on machine performance, Length of air gap, Selection of stator slots, Elimination of harmonics.

UNIT: VI

Windings: DC machines: Simplex Lap and Wave windings. AC machines: Hemitropic, whole coil and Mush windings.

Text books:

1. A K Sawhney and Chakrabarti, A course on Electrical Machine Design, 6th edition, Dhanpat Rai & Co Pvt. Ltd., 2014.
2. M G Say, The performance and Design of Alternating Current Machines, 3rd edition, CBS Publishers & Distributors, New Delhi, 2002.
3. A E Clayton and N N Hancock, Performance and Design of Direct Current Machines, 3rd edition, CBS Publication, 2004.

PEC-4:EEE4103	Flexible AC Transmission Systems	3L:1T:0P	3 Credits

Course Outcomes:

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

- Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation.
- Understand the working principles of FACTS devices and their operating characteristics.
- Understand the basic concepts of power quality.
- Understand the working principles of devices to improve power quality.

UNIT: I

Introduction: Electrical Transmission Networks, Conventional Control Mechanisms-Automatic Generation Control, Excitation Control, Transformer Tap-Changer Control, Phase-Shifting Transformers; Advances in Power-Electronic Switching Devices, Principles and Applications of Semiconductor Switches; Limitations of Conventional Transmission Systems, Emerging Transmission Networks, HVDC and FACTS options.

UNIT: II

Flexible AC Transmission Systems (FACTS): Transmission Interconnections, Power Flow in AC System, Factors Limiting the Loading Capability of Transmission Lines, Power Flow and Dynamic Stability Considerations, Importance of Controllable Parameters, Types of FACTS Controllers.

UNIT: III

FACTS Converters: Types of converter, Concept and operation of Voltage sourced converters, Current Sourced converters, Operation of Single-Phase and Three-Phase Bridge Converters, Description of Three-Level VSC and PWM Converters, Transformer Connections for 12-pulse, 24-pulse and 48-pulse operation.

UNIT: IV

Shunt, Series Type FACTS Controllers (Operation and Theoretical Descriptions only): Objective of Shunt Compensation, Methods of Controllable Shunt VAR Generation (Variable Impedance type, Switching Converter type and Hybrid type), Objective of Series Compensation, Methods of Controllable Series VAR Generation (Variable Impedance type, Switching Converter type and Hybrid type).

UNIT: V

UPFC and IPFC : Unified Power Flow Controller (UPFC) – Principle of operation, Transmission Control Capabilities, Independent Real and Reactive Power Flow Control; Principle of operation and Characteristics of Interline Power Flow Controller (IPFC), UPFC and IPFC control structures (only block diagram description).

Text Books:

1. Narain G. Hingorani and Laszlo Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2000.
2. R Mohan Mathur and Rajiv K Varma, Thyristor-Based FACTS Controllers for Electrical Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2002.

Reference Books:

1. K R Padiyar, FACTS Controllers in Power Transmission and Distribution, New Age International Publishers, New Delhi, 2007.
2. Anrique Acha, Claudio R. Fuerte-Esquivel, Hugo Ambriz-Pérez and César Angeles-Camacho, FACTS: Modelling and Simulation in Power Networks, John Wiley & Sons, West Sussex, 2004.

PEC-5:EEE4104	Electrical Distribution Systems	3L:1T:0P	3 Credits

Course Outcomes:

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

- Distinguish various load models in the distribution system
- Describe the primary feeder ratings and voltage levels.
- Design an optimum location of the substation.
- Analyze the distribution system and its associated coordination procedures
- Select appropriate voltage control method in the distribution systems

UNIT: I

Distribution System Basics: Brief description about electrical power transmission and distribution systems, Factors effecting the system planning, Distribution system planning methods, Planning models, Factors for future planning, Distribution system loading characteristics – demand, demand interval, Maximum demand, diversified demand, Non-coincident demand, demand factor, connected load, utilization factor, plant factor, load factor, diversity factor, coincidence factor, load diversity, contribution factor, loss factor; relation between load and loss factors, Tariff structures (As per text book and practically existing at the institution location are to be covered).

UNIT: II

Distribution Systems: Types of distribution sub-transmission, Substation bus schemes and comparison, Factors effecting the substation location, Rating of a distribution substation for square and hexagonal shaped distribution substation service area, Factors effecting the primary feeder rating, types of primary feeders, Factors affecting the primary feeder voltage level, Factors affecting the primary feeder loading, Tie-lines, Radial feeder with uniformly and non-uniformly distributed loading.

UNIT: III

Distribution System Components: Approximate line segment model, Various types of loads, Definitions of various terms related to system loading, Detailed description of distribution transformer loading, feeder loading, Modelling of star and delta connected loads, two-phase and single-phase loads, shunt capacitors, Voltage regulators, Line-drop compensator.

UNIT: IV

Modern Distribution Systems: Distribution system automation, Architecture and implementation strategies for distribution automation, Distribution management system functions, Real-time control system, Outage management, Decision support applications, Concepts of distributed generation, Various types of distributed generators.

UNIT: V

Advanced topics in Distribution Systems: Basic reliability indices, Calculation of SAIDI, SAIFI and MAIFI, Distribution automation communication protocols: MODBUS, DNP 3.0, IEC 60870-5-101, UCA 2.0, IEC 61850; Brief description of Smart-grid, Micro-grid, and Nano-grid with simple examples.

Text Books:

1. Distribution System Modelling and Analysis, William H. Kersting, CRC Press, Newyork, 2002.
2. Electric Power Distribution System Engineering, Turan Gonen, McGraw-Hill Inc., New Delhi, 1986.
3. Control and Automation of Electrical Power Distribution Systems, James Northcote-Green and Robert Wilson, CRC Taylor & Francis, New York, 2007.

PEC-5:EEE4105	Advanced Control System	3L:1T:0P	3 Credits

Course Outcomes:

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

- Understand various design specifications.
- Design controllers using the state-space approach.
- Design a compensator for continuous time systems.
- Apply the concepts of controllability and observability in evaluating the performance of control system.
- Design an appropriate feedback controller and/or observer for physical plants.

UNIT: I

Control Systems Components: DC & AC Tachometers - Synchros, AC AND DC Servo Motors - Stepper Motors and its use in Control Systems, Amplidyne Metadyne - Magnetic Amplifier – Principle, Operation and Characteristics Ward - Leonard Systems.

UNIT: II

State Variable Analysis: concept of State Variables & State Models, State model for Linear Continuous Time Systems, State-Space Representation Using Physical Variables, State-Space Representation Using Phase Variables.

UNIT: III

Diagonalization, Jordan Canonical Form, Solution of State Equations, Properties of State Transition Matrix, Computation of State-Transition Matrix (Using Laplace Transformation, Cayley-Hamilton Theorem).

UNIT: IV

Controllability & Observability: Concept of Controllability & Observability, Controllable Companion Form, Observable Companion Form (For SISO and MIMO Systems), Pole Placement By State Feedback.

UNIT: V

Introduction to Design: Introduction-Preliminary Considerations of Classical Design - Lead Compensation, Lag Compensation, Realization of Compensating Networks, Cascade Compensation in Time Domain and Frequency Domain (Root Locus And Bode Plot Techniques).

Text Books:

1. Control Systems Engineering, Ij Nagrath, M.Gopal, New Age International Publishers.
2. Modern Control System Theory, M. Gopal, New Age International Publishers.

References:

1. R. T. Stefani and G. H. Hostetter, “Design of feedback Control Systems”, Saunders College Pub, 1994.

PEC-5:EEE4106	Advanced Power Electronics	3L:1T:0P	3 Credits

Course outcomes:

At the end of this course, student will be able to

- Employ suitable switching converter for a particular industrial applications.
- Realize various compensators for power quality issues.
- Select suitable drive for electric vehicle.

UNIT: I

Static Switches: Single Phase AC Switches, Three Phase AC Switches, Three Phase Reversing Switches, AC Switches for Bus Transfer, DC Switches and Solid State Relays.

UNIT: II

Soft Switching and resonant converters: Switching mechanism of semiconductor devices, resonant switch topologies, concepts of Zero Voltage Switching (ZVS) and Zero Current Switching (ZCS), L – type and M – type ZCS resonant converters, ZVS resonant converters.

UNIT: III

Power Quality Mitigation Devices: Passive Filters, Active Filters, Hybrid Filters. Distribution Static Compensator (DSTATCOM), Dynamic Voltage Restorer (DVR) and Unified Power Quality Conditioner (UPQC). (Theoretical Approach Only)

UNIT: IV

Power Supplies: Power Line Disturbances – Types And Sources, Effect on Sensitive Equipment, Power Conditioners, Uninterruptible Power Supplies (UPS), DC Power Supplies – Switched Mode, Resonant and Bidirectional DC Power Supplies, AC Power Supplies – Switched Mode, Resonant and Bidirectional AC Power Supplies.

UNIT: V

Power Electronics Application: Residential Applications, Industrial Applications, Solar and Battery Powered Drives, Motors Suitable for Pump Drives, Solar Power Pump Drives, Battery Powered Vehicles, Solar Powered Electric Vehicles and Boats.

Text Books:

1. MH Rashid, “Power Electronics: Circuits, Systems and Applications”, 2nd edition. Prentice Hall, Eaglewood Cliffs, NJ, 1996.
2. R. W. Erickson, “Fundamentals of Power Electronics”, First Edition. Chapman and Hall, New York, 1997.
3. Ned Mohan, Tore M. Undeland and William P. Robbins, “Power Electronics – Converters, Applications, and Design”, Third Edition. John Wiley & Sons, Inc. 2003.

Reference Books:

1. Narain G. Hingorani and Laszlo Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2000.
2. Gopal K Dubey, "Fundamentals of Electrical Drives".1st edition, Narosa Publishing House, New Delhi, 1995.
3. R.S. Ramshaw, "Power Electronics Semiconductor Switches", 2nd edition, Chapman & Hall, UK. 1993.

EEL4101	**Laboratory- IX: Control Systems Laboratory**	**0L:0T:3P**	**1.5 Credits**

EEL4102	**Laboratory X: Power System Simulation Lab**	**0L:0T:3P**	**1.5 Credits**

EEL4103	**Seminar (based on Internship experiences)**	**0L:0T:4P**	**1.5 Credits**

EEL4104	**Project Work (Part-I: Mini Project)**	**0L:0T:8P**	**4 Credits**

ANDHRA UNIVERSITY: : VISAKHAPATNAM

DEPARTMENT OF ELECTRICAL ENGINEERING

SCHEME OF INSTRUCTION & EXAMINATION

IV/IV B.TECH

Common with SIX YEAR DUAL DEGREE COURSE II/VI (B.TECH.+ M.TECH.)

(With effect from **2019-2020** admitted batch onwards)

B.TECH. (EEE) IV YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

SUB. REF	NAME OF THE SUBJECT	PERIODS			MAXIMUM MARKS			CREDITS
		THEORY	TUTORIAL	LAB	EXAM	SESSIONALS	TOTAL	
EEE42XX	PEC-6:	3	1	--	70	30	100	3
EEO42XX	OEC-6:	3	1	--	70	30	100	3
EEL4201	Laboratory–XI: Power System Protection Lab	--	--	3	50	50	100	1.5
EEL4202	Project Work (Part-II)	--	--	14	50	50	100	7
	TOTAL	**6**	**2**	**17**	**240**	**160**	**400**	**14.5**

Professional Electives Courses (PEC) (Semester-VIII)		
S.No.	**Subject Code**	**Subject Name**
1	EEE4201	HVDC Transmission
2	EEE4202	Power System Protection
3	EEE4203	Electrical GIS

Open Electives Courses (OEC) (Semester-VIII)		
S.No.	**Subject Code**	**Subject Name**
1	EEO4201	Industrial Management and Entrepreneurship
2	EEO4202	Organisational Behaviour
3	EEO4203	Financial Accounting

PEC-6:EEE4201	HVDC Transmission	3L:1T:0P	3 Credits

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

- Understand the advantages of dc transmission over ac transmission.
- Understand the operation of Line Commutated Converters and Voltage Source Converters.
- Understand the control strategies used in HVDC transmission system.
- Understand the improvement of power system stability using an HVDC system.

UNIT: I

General aspects of DC transmission and comparison of it with AC transmission: Introduction, General aspects of transmission, Transmission links, types - Monopolar, Homopolar, Bipolar and Back-to-Back, Constitution of dc and ac links. Technical aspects, Economic aspects, Reliability aspects and Environmental aspects of HVDC Transmission (HVDCT), Advantages and disadvantages of HVDCT, Applications of DC Transmission, HVDC light.

UNIT: II

Converters: Definition, Thury system, Valves, Valve characteristics, Components of circuits, Properties of converter circuits, Pulse number, Single phase and three phase converters, Assumptions in converter circuit, Greatz circuit, Bridge converter with grid control without overlap, Bridge converter with grid control with overlap less than 60^0

UNIT: III

HVDC Links and Converters: Characteristics of converter circuits – Rectifier and inverter characteristics, complete characteristics of rectifier and inverter, Equivalent circuit of HVDC Link, Brief description of 12-pulse, 24-pulse and 48-pulse converters transformer configurations, Choice of converter circuit for HVDC transmission.

UNIT: IV

HVDC Converter control: Desired features and means of control, control of the direct current transmission link, Constant current control, Constant ignition angle control, Constant extinction angle control, Converter firing-angle control-IPC and EPC, frequency control and Tap changer control, Starting, Stopping and Reversal of power flow in HVDC links.

UNIT: V

Misoperation and Protection of DC links: Malfunction of converter valves, Arc-back, Arc-through, Misfire, Quenching, Commutation failure, Valve blocking and bypass, Short circuits within the converter station. DC reactors, valve dampers, line dampers, circuit breakers.

Text Books:

1. E.W. Kimbark, Direct current transmission, Vol. I, Wiley Interscience, New York, 1971.
2. P Kundur, Power System Stability and Control, McGraw Hill Inc., New York, 1994.

Reference Books:

1. K. R. Padiyar, HVDC Power Transmission Systems: Theory and System Interactions, New Age International Publishers, New Delhi, 2009.
2. Erich Uhlmann, Power Transmission by Direct Current, Springer-Verlag, Berlin/Heidelberg, 1975.

PEC-6:EEE4202	Power System Protection	3L:1T:0P	3 Credits

Course Outcomes:

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

- Understand the different components of a protection system.
- Evaluate fault current due to different types of fault in a network.
- Understand the protection schemes for different power system components.
- Understand the basic principles of digital protection.
- Understand system protection schemes, and the use of wide-area measurements.

UNIT: I

Introduction to Protection Scheme: Need for Protective systems - Nature and causes of Faults -Types of faults - Effect of faults - fault statistics - Evolution of protective relays - Zones of protection - Primary and Back -up Protection - Essential qualities of Protection - Classification of Protective schemes -Automatic reclosing - current transformer for Protection - potential transformer - basic relay terminology.

UNIT: II

Relays: General considerations - sensing of faults - construction of electro-magnetic attraction and induction types relays - Buchholz and negative sequence relay -concept of reset, pick up, inverse time and definite time characteristics, over current, over voltage, directional, differential and distance relays on R-X diagram

UNIT: III

Static Relays: Introduction, advantage and limitation of static relays, static over current, directional, distance and differential relays. Electronic relays - static relays functional circuits: comparators, level detectors, logic and training circuits, microprocessor and computer based protection schemes.

UNIT: IV

Protection: Types & detection of faults and their effects, alternator protection scheme - Power transformer protection , generator-transformer unit protection scheme, bus bar protection - Transmission line protection, Pilot relaying schemes, power line carrier protection.

UNIT: V

Switchgear: Theory of current interruption- energy balance and recovery rate theory, arc quenching, recovery and restriking voltages - Types of circuit breakers - Rating selection and testing of circuit breakers/operating mechanisms - LT switchgear, HRC fuses, types construction and applications.

Text Books:

1. Badriram & Vishwakarma, “Power System Protection”, Tata McGraw-Hill Education, 2011.
2. Paithankar Y. G., S. R. Bhide., “Fundamentals of power system protection”, PHI Learning Pvt. Ltd., 2004.

Reference Books:

1. Ravindra Nath.B, and Chandar.M, “Power systems protection and switchgear”, New age international (P) Ltd. 2005.
2. Rao Sunil.S, “Switchgear and protection”. Khanna Publishers, 1999.
3. Paithankar.Y.G,” Transmission Network Protection: Theory and Practice”, Marcel Deicker, Inc.1998.

PEC-6:EEE4203	Electrical GIS	3L:1T:0P	3 Credits

Course outcomes:

At the end of this course student will be able to,

- Distinguish between the operation of air and gas insulated sub-stations.
- Develop the layout of a GIS sub-station.
- Analyze the significance of various factors like fast transient phenomenon, insulation diagnostics & problems in GIS sub-station.

UNIT-I

Introduction to GIS, Properties of SF_6 and Layout of GIS Stations: Characteristics of GIS - Introduction to SF_6 - Properties of SF_6 Gas - Specifications of SF_6 Gas for GIS applications - Handling of SF_6 Gas before use - Safe handling of SF_6 Gas in Electrical Equipment - Equipment for handling the SF_6 Gas - SF_6 and Environment, advantage of GIS Stations - Comparison with Air Insulated Substations - Economics of GIS - User Requirements for GIS - Main features of a GIS - Planning and Installation - Components of a GIS Station.

UNIT-II

Design and Construction of GIS Station: Introduction - Rating of GIS components - Design Features - Estimation of different types of Electrical Stresses -Design Aspects of GIS components - Insulation Design for Components - Insulation Design for GIS - Thermal Considerations in the Design of GIS - Effect of very Fast Transient Over-voltages (VFTO) on the GIS design - Insulation Coordination systems - Gas handling and Monitoring System Design.

UNIT-III

Testing of GIS and Special Problems in GIS: Introduction – Various Tests on GIS – Design Approach for manufacturing and Type Tests – Quality Assurance in Manufacturing, Shipping and Erection – On-site Testing of GIS – Dielectric Tests – Commonly Used On-site Test Methods - Experience during On-site Testing – Condition Monitoring and Diagnostic Methods. Introduction - particles their effects and their control- Insulating Spacers and their Reliability - SF6 Gas Decomposition.

UNIT-IV

GIS Diagnostics, GIS Service Experience and Maintenance Procedures: Introduction - Characteristics of imperfections in insulation - Insulation Diagnostic methods - PD Measurement and UHF Method.

UNIT-V

Fast Transient Phenomena in GIS and Future Trends in GIS Technology: Introduction - Disconnector Switching in Relation to Very fast Transients - Origin of VFTO Propagation and Mechanism of VFTO - VFTO Characteristics - Effects of VFTO - Testing of GIS for VFTO.

TEXT BOOK:

1. M. S. Naidu," Gas Insulated Substations"- IK International Publishing House.

References:

1. G.F. Montillet, E. Mikes et al. "Underground transmission and distribution GIS solutions" IEEE/PES T&D Exposition and Conference, Dallas USA, 2003.
2. E. Mikes, Ch. Tschannen, et al. "GIS substation extensions and upgrades" CEPSI Paper T1-068, 2000, Manila, Philippines.
3. CIGRE WG 23.10; Paper 23-102, 1998, Report on the Second International Survey on High-Voltage Gas Insulated Substations (GIS) Service Experience, Paris, France 1998.
4. E. Mikes, H. Aeschbach et al. "Innovative GIS based solutions for substations" CIGRE SC23 Colloquium Venezuela, Paper 3.1, 2001.
5. D. Dufournet, C. Lindner et al. "Technical Trends in Circuit Breaker Switching Technologies" CIGRE SC A3 Colloquium paper, Sarajevo, Bosnia, 2003.

OEC-6:EEO4201	Industrial Management and Entrepreneurship	3L:1T:0P	3 Credits

COURSE OUTCOMES:

At the end of the course the student should be able to

- Differentiate between Micro and Macro Economics and apprise the nitty gritty of demand function.
- Identify various kinds of markets, the pricing methods used and solve the basic problems using BEP analysis.
- Comprehend the basic concepts of Management and Human Resource Management.
- Apply the basic concepts of Production Management and Marketing Management in planning the production and distribution of products.
- Evaluate the basic forms of organization best suited for entrepreneurship and appreciate the importance of Financial Management in a firm.

UNIT I:

Introduction to Economics: Concept, Nature & Scope of Economics-Macro and Micro Economics Demand Analysis: Demand Determinants- Law of Demand& its exceptions-Elasticity of Demand Types –Demand Forecasting-Methods.

UNIT II:

Market Structures: Types of Markets-Price output determination in Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly - Pricing methods - Break – Even Analysis (simple problems).

UNIT III:

Introduction to Management: Concept - Functions of Management - Scientific Management Principles of Management- Leadership Styles - Functional areas of Management. Human Resource Management: Definition, Significance and Functions - PM Vs HRM –Recruitment, Selection, Training and Development -Job Analysis - Role and position of HR department – Performance Appraisal.

UNIT IV:

Marketing Management : Needs- Wants - Products - Market- Marketing- Production Concept, Product Concept, Sales Concept, Marketing Concept, Societal Marketing Concept-Organizing the Marketing Department - Marketing Mix: Product, Price, Place, Promotion (in brief)Production Management: Concept of production management-Types of Production processes Plant Location & Layout, Statistical Quality Control.

UNIT V:

Financial Management: Financial Statements – Contents of Trading Account, Profit and Loss Account – Balance Sheet (Theory only) - Analysis of Financial statements : Ratio analysis (simple problems) -Concept of Finance - Objectives of Finance-Wealth Maximization Vs.

Profit Maximization - Functions of Finance - Role of financial manager - Organization of finance function.

UNIT VI:

Forms of Business Organizations: Sole Proprietorship, Partnership, Joint Stock Company – Private limited and Public limited Companies, Public enterprises and their types, Business Cycles .Entrepreneur ship- Entrepreneur – Qualities of good entrepreneur - Entrepreneurial Functions ,Entrepreneurial Development: Objectives, Training, Benefits - Phases of Installing a Project.

Text/Reference Books:

1. M.Y.Khan & P.K.Jain, Financial Management, TATA McGraw-Hill, New Delhi.
2. Koontz O Donnel, Management, TATA McGraw-Hill, New Delhi.
3. K. Aswathappa, Production Mangement, Himalaya Publishing House, Mumbai.
4. P.Subba Rao, Human Resource Management, Himalaya Publishing House, Mumbai.
5. Philip Kotler, Marketing Management, Pearson Prentice Hall, New Delhi.
6. Vasant Desai, Entreprenuership, Himalaya Publishing House, Mumbai.
7. Varshini &Maheswari, Managerial Economics, SChand & Co, New Delhi.

OEC-6:EEO4202	Organizational Behavior	3L:1T:0P	3 Credits

Course Outcomes:

At the end of this course student will be able to

- Explain the role of entrepreneur in economic development
- Demonstrate methods of generating ideas
- Develop the business plan to start their own enterprise
- Manage various production aspects such as manufacturing costs control, marketing management and waste reduction
- Make financial plan for enterprise
- Find the institutional support entrepreneurship

UNIT: I

Planning and Decision Making: Planning and goal setting – Organizational planning – Vision, Mission and goals, Types of plans, steps in planning process, Approaches to planning, Planning in Dynamic Environment. Decision making process, types of decisions, decision making styles, Vroom's Participative decision making model.

UNIT: II

Organizing: Organizational Structure, Principles of Organizing, Authority, Power and Influence, designing organizational structure, Mechanistic and organic structures, contemporary organizational design and its challenges.

UNIT: III

Controlling: The control process, controlling for organizational performance, types of control, financial controls, Balanced Scorecard, Bench Marking, Contemporary issues in controlling.

UNIT: IV

Organizational Behavior: Individual and Group Behavior, Importance of organizational Behavior, Culture and diversity, personality theories, perception, formation of group behavior, classification of groups, group properties, group cohesiveness.

UNIT: V

Leadership: Leadership traits, Leadership styles, Leadership theories, Power and Politics.

UNIT: VI

Motivation: Approaches to Motivation, Maslow's needs hierarchy theory, two factor theory of motivation, McGregor's theory, ERG theory, McClelland's needs theory, Valance Theory.

TEXTBOOKS:

1. Richard L.Daft, New Era of Management, Cengage Learning, 11e, 2017.
2. Afsaneh Nahavandi, Robert B.Denhardt, Janet V. Denhardt, Maris P. Aristigueta, Organizational Behaviour, Sage Publications, 2015.
3. Laurie J. Mullins, Management,and Organizational Behaviour, Pearson publications, 9e.

4. Stephen P. Robbins, Timothy A.Judge, NeharikaVohra, Organizational Behaviour, Pearson, 16e, 2017.
5. Ramesh B.Rudani, Management and Organizational Behaviour Tata McGraw hill, 2011.

OEC-6:EEO4203	Financial Accounting	3L:1T:0P	3 Credits

Course Outcomes:

At the end of this course student will be able to

- Explain basic principles of Financial Accounts.
- Apply cost – volume - profit (CVP) analysis in their business decision making.
- Evaluate investment proposals through various Accounting transactions.
- Apply the knowledge to prepare the simple financial statements for measuring performance of business firm.
- Analyse key issues of organization, management and administration

Unit: I

Meaning and Scope of Accounting: Need, development, and definition of accounting; Bookkeeping and accounting; Persons interested in accounting; Disclosures; Branches of accounting; Objectives of accounting.

Unit: II

Accounting Principles: International Accounting Standards (only outlines); Accounting principles; Accounting Standards in India.

Unit: III

Accounting transactions: Accounting Cycle; Journal; Rules of debit and credit; Compound journal entry; Opening entry; Relationships between Journal and Ledger; Rules regarding posting; Trial balance; Sub divisions of journal**.**

Unit: IV

Capital and Revenue: Classification of income; Classification of expenditure; Classification of receipts Accounting concepts of income; Accounting concepts and income measurement; Expired costs and income measurement Final Accounts; Manufacturing account; Trading account ;Profit and loss account; Balance Sheet; Adjustment entries, Rectification of errors; Classification of errors; Location of errors; Suspense accounts; Effects on profit.

Unit: V

Depreciation Provisions and Reserves: Concept of depreciation; Causes of depreciation ; Depreciation, depletion, amortization, and dilapidation ;Depreciation accounting; Methods of recording depreciation; Methods for providing depreciation; Depreciation of different assets; Depreciation of replacement cost ;Depreciation accounting as per accounting standard; Depreciation accounting.

Text Books:

1. Anthony, RN. and Reece. J.S.: Accounting Principles: Richard Irwin Inc.
2. Gupta. R.L.and Radhaswamy. M: Financial Accounting; Sultan Chand and Sons, New Delhi.
3. Monga J.R., Ahuja Girish, and Sehgal Ashok: Financial Accounting; Mayur Paper Back.Nokia.

4. Shukla. M.C., Grewal T.S., and Gupta, S.C.: Advanced Accounts: S. Chand & Co. New Delhi.
5. Compendium of Statement and Standards of Accounting : The Institute of Chartered Accountants of India, New Delhi.

EEL4201	**Laboratory XI: Power System Protection Lab**	**0L:0T:3P**	**1.5 Credits**

EEL4202	**Project Work (Part - II)**	**7 Credits**