**RG22 Regulations**

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
(AUTONOMOUS)
NELLORE – 524137 (A.P) INDIA

## B.TECH Electrical and Electronics Engineering
## Course Structure (RG22)

| Semester-3 (Theory-5, Lab-3, SC -1, MC-1) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sl. No.** | **Category** | **Course Code** | **Course Title** | **Hours per week** | | | **Credits** |
| | | | | **L** | **T** | **P** | **C** |
| 1 | BSC | 22A0015T | Complex Variables & Numerical methods | 2 | 1 | 0 | 3 |
| 2 | HSC | 22A0021T | Universal Human Values | 3 | 0 | 0 | 3 |
| 3 | PCC | 22A0207T | Electrical Circuit Analysis & Synthesis | 2 | 1 | 0 | 3 |
| 4 | ESC | 22A0412T | Analog & Digital Electronics | 2 | 1 | 0 | 3 |
| 5 | PCC | 22A0208T | DC Machines & Transformers | 2 | 1 | 0 | 3 |
| 6 | PCC | 22A0209T | Electrical Power Generating Systems | 2 | 1 | 0 | 3 |
| 7 | PCC (Lab) | 22A0210P | Electrical Circuits &Simulation Lab | 0 | 0 | 3 | 1.5 |
| 8 | ESC (Lab) | 22A0413P | Analog & Digital Electronics Lab | 0 | 0 | 3 | 1.5 |
| 9 | PCC (Lab) | 22A0211P | DC Machines & Transformers Lab | 0 | 0 | 3 | 1.5 |
| 10 | SC | 22A0212P | **Skill Oriented Course:** Electrical work shop | 1 | 0 | 2 | 2 |
| 11 | MC | 22A0028T | **Mandatory Course:** Environmental Studies | 2 | 0 | 0 | 0 |
| | | | **Total credits** | | | | **27.5** |

| **Category** | **Credits** |
|---|---|
| Basic Science Course (BSC) | 3 |
| Engineering Science Course (ESC) | 4.5 |
| Professional Core Courses(PCC) | 15 |
| Humanities & Social Sciences Elective (HSSC) | 3 |
| Skill oriented Course (SC) | 2 |
| **Total** | **27.5** |

**HoD** **Dean of Academics** **Principal**

**COMPLEX VARIABLES AND NUMERICAL METHODS**
**(EEE, ECE, ME)**

| Course Code | L:T:P:S | Credits | Exam Marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 22A0015T | 2: 1:0:0 | 3 | CIE: 30 & SEE:70 | 3 Hours | BSC |

**Course Objectives:**

This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables, various numerical methods for interpolating the polynomials, evaluation of integral equations and solution of differential equations,.

| Unit -I | ANALYTIC FUNCTIONS AND CONFORMAL MAPPING | 9Hrs |
|---|---|---|

Differentiation, Analytic functions, Cauchy-Riemann equations (both Cartesian and polar), Harmonic functions, and Harmonic conjugate, Potential functions.

| Unit -II | COMPLEX INTEGRATION | 10Hrs |
|---|---|---|

Line integrals, Cauchy's theorem (without proof), Cauchy's integral formula (without proof), Generalized Cauchy's integral formula (without proof), Complex Power Series: Taylor's series and Laurent's series (without proof), zeros of an analytic functions, Singularities: Types of singularities, pole of order

| Unit -III | RESIDUE THEOREM | 10Hrs |
|---|---|---|

Residues and evaluation of residues at poles, Cauchy's Residue theorem (without proof), Evaluation of integrals using residue theorem, Evaluation of improper and real integrals of the type:

(i) $\int_{c}^{c+2\pi} f(\cos\theta, \sin\theta)\, d\theta$ (ii) $\int_{-\infty}^{\infty} f(x)dx$

| Unit-IV | INTERPOLATION-NUMERICAL DIFFERENTIATION & INTEGRATION | 9Hrs |
|---|---|---|

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Numerical Differentiation & Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule.

| Unit-V | NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS | 10Hrs |
|---|---|---|

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.

**Course Outcomes(CO):**

**On completion of this course, student will be able to**

- Understand functions of Complex variable and its properties, analyticity &conformal mappings of complex functions.
- Understand the integration of complex functions; apply Cauchy's integral theorem and Cauchy's integral formula, singularities of complex functions.
- Evaluate improper integrals of complex functions using Residue theorem.
- Derive interpolating polynomials using interpolation formulae and evaluate the differentiation and integration numerically.
- Solve differential and integral equations numerically.

**Textbooks:**


1. Higher Engineering Mathematics, B.S. Grewal, Khanna publishers.
2. Engineering Mathematics Volume III by T.K.V. Iyengar, B. Krishna Gandhi, S. Ranganatham and M.V.S.S.N.Prasad, S.Chand Publications.
3. Introductory Methods of Numerical Analysis by S. S. Sastry, PHI Learning Pvt. Ltd., New Delhi.

| **ReferenceBooks:** |
| --- |
| 1. Engineering Mathematics, Volume - III, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher.<br>2. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad, S. Chand Publications.<br>3. Erwin Kreyszig, “Advanced Engineering Mathematics”, Wiley India |

| UNIVERSAL HUMAN VALUES<br>(Common to all branches of Engineering) | | | | | |
|---|---|---|---|---|---|
| **Course Code** | **L:T:P:S** | **Credits** | **Exam marks** | **Exam Duration** | **Course Type** |
| **22A0021T** | **3:0:0:0** | **3** | **CIE:30 & SEE:70** | **3 Hours** | **HSC** |

**Course Objectives:**

Student will be able to,

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature /existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

| UNIT-I | COURSE INTRODUCTION-NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION | 10Hrs |
|---|---|---|

Purpose and motivation for the course, recapitulation from Universal Human Values-I Self-Exploration–what is it?- Its content and process; 'Natural Acceptance' and Experiential Validation – as the process for self-exploration Continuous Happiness and Prosperity – A look at basic Human Aspirations

Right understanding, Relationship and Physical Facility-the basic requirements for fulfillment of aspirations of every human being with the incorrect priority

Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

| UNIT-II | UNDERSTANDING HARMONY IN THE HUMAN BEING- HARMONY IN MYSELF! | 9Hrs |
|---|---|---|

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'

Understanding the needs of Self ('I') and 'Body'- happiness and physical facility Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) Understanding the characteristics and activities of 'I' and harmony in 'I'

Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me.

Identifying from one' sown life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

| UNIT-III | UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN – HUMAN RELATIONSHIP | 10Hrs |
|---|---|---|

Understanding values in human – human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

Understanding the meaning of Trust; Difference between intention and competence

Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

Visualizing a universal harmonious order in society – Undivided Society, Universal Order-from family to world family.

Include practice sessions to reflection relationships in family, hostel and institute as extended family, real life examples, teacher – student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

| UNIT-IV | UNDER THE NATURE AND EXISTENCE HOLE EXISTENCE AS COEXISTS | 9Hrs |
|---|---|---|

Understanding the harmony in the Nature Inter connectedness and mutual fulfillment among the four order so nature – recyclability and self-regulation in nature
Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
Holistic perception of harmony at all level so existence.
Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resource sand role of technology etc.

| UNIT-V | IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS | 10Hrs |
|---|---|---|

Natural acceptance of human values Definitiveness of Ethical Human Conduct
Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
Competence in professional ethics :
a. Ability to utilize the professional competence for augmenting universal human order
b. Ability to identify the scope and characteristics of people friendly and eco – friendly production systems,
c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
Case studies of typical holistic technologies, management models and production systems Strategy for transition from the present state to Universal Human Order:
a. At the level of individual : as socially and ecologically responsible engineers, technologists and managers
b. At the level of society: as mutually enriching institutions and organizations
Sump.
Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

**Course Outcomes (CO):**

**On completion of this course, student will be able to**

- Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to the recommitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

**Textbooks:**

1. RR Gaur, R Asthana, GP Bagaria, "A Foundation Course in Human Values and Professional Ethics",
2. Revised Edition, Excel Books, NewDelhi, 2019. ISBN978-93-87034-47-1
3. R R Gaur, R Asthana, GP Bagaria,"Teachers' Manual for A Foundation Course in Human Values and Professional Ethics",2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN978-93-87034-53-2

**ReferenceBooks:.**

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak,1999.
2. A.N.Tripathi, "HumanValues", New Age Intl.Publishers, NewDelhi, 2004. The Story of Stuff (Book).
3. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
4. E.FSchumacher. "SmallisBeautiful" Slowis Beautiful – Cecile Andrews
J C Kumarappa "Economy of Permanence" Pandit Sunderlal "Bharat Mein Angreji Raj"
Dharampal, "Rediscovering India"
Mohandas K.Gandhi, "Hind Swaraj or Indian Home Rule"
India Wins Freedom-Maulana Abdul Kalam Azad
Vivekananda – Romain Rolland (English)
Gandhi – Romain Rolland (English)

| ELECTRICAL CIRCUIT ANALYSIS & SYNTHESIS | | | | | |
|---|---|---|---|---|---|
| **Course Code** | **L:T:P:S** | **Credits** | **Exam Marks** | **Exam Duration** | **Course Type** |
| **22A0207T** | **2: 1:0:0** | **3** | **CIE: 30 & SEE:70** | **3Hours** | **PCC** |

**Course Objectives :**

**Student will be able to**

1. To know the current locus diagrams for electrical circuits
2. To know the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.
3. Knowing how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations
4. Identify the properties and characteristics of network functions
5. To know the analysis & design of two-port networks
6. Synthesize passive one-port networks using standard Foster and Causer forms

| **UNIT-** I | **THREE PHASE A.C. CIRCUITS** | **10Hrs** |
|---|---|---|

Introduction - Analysis of Balanced Three Phase Circuits – Phase Sequence- Star and Delta Connection - Relation between Line and Phase Voltages and Currents in Balanced Systems - Measurement of Active and Reactive Power in Balanced and Unbalanced Three Phase Systems. Analysis of Three Phase Unbalanced Circuits - Loop Method - Star Delta Transformation Technique – for balanced and unbalanced circuits - Measurement of Active and reactive Power – Advantages of Three Phase System.

| **UNIT-II** | **LOCUS DIAGRAMS AND NETWORKS FUNCTIONS** | **8Hrs** |
|---|---|---|

**Locus diagrams**: Locus diagrams of RL, RC, RLC circuits.

**Network Functions**: The concept of complex frequency, physical interpretation, transform impedance, series and parallel combination of elements, terminal ports, network functions for one port and two port networks, poles and zeros of network functions, significance of poles and zeros, properties of driving point functions and transfer functions, necessary conditions for driving point functions and transfer functions, time domain response from pole zero plot.

| **UNIT-III** | **NETWORK SYNTHESIS** | **10Hrs** |
|---|---|---|

Identification of network synthesis, Brune's positive and real function (PRF), properties of PRF, testing of driving point functions, even and odd function, one terminal pair network driving point synthesis with LC elements, RC elements, Foster and Cauer form.

| **UNIT-IV** | **TRANSIENT ANALYSIS** | **10Hrs** |
|---|---|---|

**D.C Transient Analysis**: Transient Response of R-L, R-C, R-L-C Series Circuits for D.C Excitation - Initial Conditions in network - Initial Conditions in elements - Solution Method Using Differential Equation and Laplace Transforms - Response of R-L & R-C Networks to Pulse Excitation

**A.C Transient Analysis**: Transient Response of R-L, R-C, R-L-C Series Circuits for Sinusoidal Excitations - Solution Method Using Differential Equations and Laplace Transforms.

| **UNIT-V** | **TWO PORT NETWORKS** | **10Hrs** |
|---|---|---|

Two Port Network Parameters – Impedance – Admittance - Transmission and Hybrid Parameters and their Relations - Concept of Transformed Network - Two Port Network Parameters Using Transformed Variables.

**Course Outcomes (CO):** After completion of the course, students will be able to

- Illustrate the locus diagram for series and parallel circuits
- Understand the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.
- To get knowledge about how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations
- Apply two-port network analysis in the design and analysis of filter and attenuator networks
- Describe the properties and characteristics of network functions and verify the mathematical constraints for their physical realization.
- Synthesize passive one-port networks using standard Foster and Causer forms

**Text books:**

1. Fundamentals of Electric Circuits Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th Edition, 2013.
2. Engineering circuit analysis William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 7th Edition, 2006.
3. Circuit Theory Analysis & Synthesis A. Chakrabarti, Dhanpat Rai & Sons, 7th Revised Edition, 2018

**Reference Books:**

1. Network Analysis M.E Van Valkenberg, Prentice Hall (India), 3rd Edition, 1999.
2. Electrical Engineering Fundamentals V. Del Toro, Prentice Hall International, 2nd Edition, 2019.
3. Electric Circuits- Schaum's Series, Mc Graw Hill, 5th Edition, 2010.
4. Electrical Circuit Theory and Technology John Bird, Routledge, Taylor & Francis, 5th Edition, 2014.

## ANALOG AND DIGITAL CIRCUITS

| Course Code | L: T:P | Credits | Exam. Marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 22A0412T | 2:1:0 | 3 | CIE:30 & SEE:70 | 3 Hours | ESC |

**Course Objectives:**

- To familiarize various types of feedback amplifiers and oscillators.
- To introduce the basic building blocks of linear integrated circuits.
- To teach the linear and non-linear applications of operational amplifiers.
- To understand and implement the working of basic digital circuits.

| UNIT –I | AMPLIFIERS | 10Hrs |
|---|---|---|

**Multistage Amplifiers:** Classification of amplifiers, different coupling schemes used in amplifiers, frequency response and analysis of two stage RC coupled Amplifier, principles of Darlington amplifier, Cascode amplifier

**Feedback Amplifiers:** Concepts of Feedback, Classification of Feedback Amplifiers, General Characteristics of Negative-Feedback Amplifiers, Analysis of a feedback Amplifiers - Voltage – Series, Current-Series, Current-shunt and Voltage – shunt.

**Oscillators:** Conditions for oscillations, Phase - shift Oscillator, Wien Bridge Oscillator, L-C Oscillators (Hartley and Colpitts).

| UNIT –II | 741 OP-AMP | 10Hrs |
|---|---|---|

**Operational Amplifier**: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, features of 741 Op-Amp, Block diagram of Op-Amp, Modes of Operation - Inverting, Non-Inverting, and Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Sample and hold circuits, Comparator and its applications, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

| UNIT-III | IC-555 & IC 565 APPLICATIONS | 8Hrs |
|---|---|---|

**IC-555 & IC 565 Applicati**ons: Introduction To Active Filters, Characteristics Of Band Pass, Band Reject And All Pass Filters, Analysis Of 1st Order LPF& HPF Butterworth Filters, Waveform Generators - Triangular, Saw-Tooth, Square Wave, IC555 Timer - Functional Diagram, Monostable And Astable Operations, Applications, IC565 PLL - Block Schematic, Description of Individual Blocks, Applications.

| UNIT –IV | DATA CONVERTERS | 10Hrs |
|---|---|---|

Introduction, Basic DAC techniques, Different types of DACs-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 Slope ADC, DAC and ADC Specifications.

| UNIT –V | DIGITAL ELECTRONICS | 10Hrs |
|---|---|---|

Classification of Integrated Circuits, Combinational Logic ICs - Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoder, Encoder, Priority Encoder, Multiplexer, De-multiplexer, Parallel Binary Adder/ Subtractor, Magnitude Comparator.

**Sequential:** Familiarity with commonly available 74XX & CMOS 40XX Series ICs - All Types of Flip-flops, conversion of Flip-flops, Synchronous Counter, Decade Counter, Shift Register.

**Text Books:**


1. Millman, Halkias and Jit, "Electronic Devices and Circuits", 4 th Edition, Mc Graw Hill Education (India) Private Ltd., 2015.
2. Salivahanan and N. Suresh Kumar, "Electronic Devices and Circuits", 4th Edition, Mc Graw Hill Education (India) Private Ltd., 2017
3. Linear Integrated Circuits – D. Roy Chowdhury, New Age International (p) Ltd, 2nd Edition,2003.
4. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 2003.
5. Digital fundamentals – Floyd and Jain, Pearson Education,8th Edition ,2005.

**References:**


1. J. Milliman, C. C. Halkias and Chetan Parikh, "Integrated Electronics", 2nd Edition, Mc Graw Hill, 2010.
2. Op Amps & Linear Integrated circuits-Concepts and Applications James M.Fiore,Cengage Learning/Jaico,2009.
3. Operational Amplifiers with linear integrated circuits by K.Lal kishore-Pearson,2009.
4. Digital design principles and practices-John.F.Wakerly 3/e,2005.


**Course Outcomes:**

After the completion of the course students will able to

1. List various types of feedback amplifiers and oscillators.
2. List out the characteristics of Linear and Digital ICs.
3. Discuss the various applications of linear & Digital ICs.
4. Solve the application-based problems related to linear and digital ICs.
5. Design the circuits using either linear ICs or Digital ICs from the given specifications.
6. Able to design and implement digital logic circuits.

| DC MACHINES & TRANSFORMERS | | | | | |
|---|---|---|---|---|---|
| **Course Code** | **L:T:P:S** | **Credits** | **Exam Marks** | **Exam Duration** | **Course Type** |
| **22A0208T** | **2: 1:0:0** | **3** | **CIE: 30 & SEE:70** | **3Hours** | **PCC** |

**Course Objectives :**

**Student will be able to**

1. Study the magnetic materials, electromechanical energy conversions, principle and operation of DC machines and transformers and starters.
2. Understand the constructional details of DC machines and Transformers
3. Analyze the performance characteristics of DC machines and transformer
4. Identify the properties and characteristics of network functions
5. To know the analysis & design of two-port networks
6. Classify and design different types of filters and study their characteristics

| **UNIT-** I | **INTRODUCTION TO MACHINES.** | **10Hrs** |
|---|---|---|

Principles of electromechanical energy conversion: Energy in magnetic system, field energy and mechanical force, multiply-excited magnetic field systems. Constructional details of DC machine, principle of operation of DC generator, armature windings and its types, emf equation,

| **UNIT-II** | **DC GENERATORS CHARACTERISTICS** | **9Hrs** |
|---|---|---|

armature reaction, effect of brush lead, demagnetizing and cross magnetizing ampere turns, compensating windings, commutation: emf induced in a coil undergoing commutation, methods of improving commutation OCC and load characteristics of different types of generators. Parallel operation of DC Generators: DC shunt and series generators in parallel, equalizing connections.

| **UNIT-III** | **DC MOTORS** | **10Hrs** |
|---|---|---|

Force on conductor carrying current, back emf, Torque and power developed by armature, speed
Control of DC motors, Necessity of starters, constructional details of starters, characteristics of DC motors, Losses in DC machines, condition for maximum efficiency, Testing of DC machines: Brake test, Swinburne's test, Hopkinson's test, Fields test.

| **UNIT-IV** | **SINGLE PHASE TRANSFORMERS** | **10Hrs** |
|---|---|---|

Principle, construction and operation of single- emf equation -phase transformers, equivalent circuit, phasor diagrams , Magnetizing current, harmonics in magnetization current, losses and efficiency Testing - open circuit and short circuit tests, voltage regulation, Sumpner's test, separation of hysteresis and eddy current losses. Parallel operation of single-phase transformers.

| **UNIT-V** | **THREE PHASE TRANSFORMERS** | **9Hrs** |
|---|---|---|

Three-phase transformer – construction, types of connection and their comparative features, Phase conversion - Scott connection, Tap-changing transformers - No-load and on-load tap changing of
Transformers, Three-winding transformers- Cooling of transformers.
Autotransformers - construction, principle, applications and comparison with two winding transformer.

**Course Outcomes (CO):** After completion of the course, students will be able to

- Understand the concepts of magnetic circuits.
- Understand the construction, operation and armature windings of a DC generator
- Understand the operation of a DC motors.
- Analyze speed control of DC motors, testing methods and parallel operation of DC machines
- Analyse single phase transformers circuits.
- Analyse three phase transformers circuits.

| **Text books:** |
|---|
| 1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.<br>2. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education,2010. |
| **Reference Books:** |
| 1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education,2013.<br>2. A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers,2004.<br>3. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.Online Learning Resources: |
| **Online Learning Resources:** |
| _ https://onlinecourses.nptel.ac.in/noc21_ee71/preview<br>_ https://onlinecourses.nptel.ac.in/noc21_ee24/preview |

| ELECTRICAL POWER GENERATING SYSTEMS | | | | | |
|---|---|---|---|---|---|
| **Course Code** | **L:T:P:S** | **Credits** | **Exam Marks** | **Exam Duration** | **Course Type** |
| **22A0209T** | **2: 1:0:0** | **3** | **CIE: 30 & SEE:70** | **3Hours** | **PCC** |

**Course Objectives :**

**Student will be able to**

1. Structure, essential components and their layout in thermal power station
2. Selection of site for thermal power station
3. Selection of site for hydro power generation
4. Various aspects and issues involved in Nuclear power generation
5. Electric power generation from renewable energy sources as sun, wind and ocean
6. Cost of generation and tariff methods

| **UNIT**- I | **THERMAL POWER GENERATING SYSTEMS** | **10Hrs** |
|---|---|---|

Block Diagram of Thermal Power Station (TPS) showing paths of Coal, Steam, Water, Air, Ash and Flue Gasses - Brief Description of TPS Components: Economizers, Boilers, Super Heaters, Turbines, Condensers, Chimney and Cooling Towers

| **UNIT-II** | **HYDRO & NUCLEAR POWER GENERATING SYSTEMS** | **9Hrs** |
|---|---|---|

**Hydro Power**: Selection of Site, Classification, Layout, Description of Main Components.
**Nuclear Power:** Nuclear Fission and Chain Reaction.- Nuclear Fuels.- Principle of Operation of Nuclear Reactor.-Reactor Components: Moderators, Control Rods, Reflectors and Coolants.- Radiation Hazards: Shielding and Safety Precautions.- Types of Nuclear Reactors and Brief Description of PWR, BWR and FBR.

| **UNIT-III** | **SOLAR & WIND POWER GENERATING SYSTEMS** | **10Hrs** |
|---|---|---|

**Solar Power Generation**: Role and Potential of Solar Energy Options, Principles of Solar Radiation, Flat Plate and Concentrating Solar Energy Collectors, Different Methods of Energy Storage – PV Cell- V-I Characteristics.
**Wind Power Generation:** Role and potential of Wind Energy Option, Horizontal and Vertical Axis Wind Mills- Performance Characteristics- Power- Speed & Torque- Speed Characteristics-Pitch & Yaw Controls – Power Electronics Application – EconomicAspects.

| **UNIT-IV** | **BIOGAS & GEOTHERMAL POWER GENERATING SYSTEMS** | **10Hrs** |
|---|---|---|

**Biogas Power Generation**: Principles of Bioconversion, Types of Biogas Digesters – Characteristics of Bio-Gas- Utilization- Economic and Environmental Aspects.
**Geothermal and Ocean Power Generation:** Principle of Geothermal Energy Methods of Harnessing- Principle of Ocean Energy-Tidal and Wave Energy- Mini Hydel Plants Economic Aspects.

| **UNIT-V** | **ECONOMIC ASPECTS OF POWER GENERATION** | **9Hrs** |
|---|---|---|

Load Curve, Load Duration and Integrated Load Duration Curves-Load Demand, Diversity, Capacity, Utilization and Plant Use Factors- Numerical Problems. Costs Of Generation and their Division Into Fixed, Semi-Fixed and Running Costs. Tariff Methods: Desirable Characteristics of a Tariff Method.- Flat Rate, Block-Rate, Two-Part, Three –Part, and Power Factor Tariff Methods and Numerical Problems.

**Course Outcomes (CO):** After completion of the course, students will be able to

- Estimate the coal requirement, cost per kWh generation and number of units generated for thermal power station
- Estimate the required flow of river water, cost of generation and number of units generated in hydel power generation
- Determine the load capacity of the plant and Plot the load curve,load duration curve.
- Assess the theory and practices of conventional and non-conventional power generation method.
- Explain various factors like load factor, plant factor.
- Evaluate the tariffs to be charged for the consumers.

| **Text books:** |
| --- |
| 1. A Text Book on Power System Engineering by M.L. Soni, P.V. Gupta, U.S. Bhatnagar and A. Chakraborti, Dhanpat Rai & Co. Pvt. Ltd., 1999.<br>2. Electric Power Generation Distribution and Utilization by C.L Wadhwa, New Age International (P) Ltd., 2005.<br>3. Non Conventional Energy Sources by G.D. Rai, Khanna Publishers, 2000. |
| **Reference Books:** |
| 1. Renewable Energy Resources – John Twidell and Tony Weir, Second Edition, Taylor and Francis Group, 2006.<br>2. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2003.<br>3. Principles of Power Systems by V.K Mehta and Rohit Mehta S.CHAND& COMPANY LTD., New Delhi 2004.<br>4. Wind Electrical Systems by S. N. Bhadra, D. Kastha & S. Banerjee – Oxford University Press, 2013. |
| Online Learning Resources: |
| https://www.digimat.in/nptel/courses/video/108102047/L01.html |

| ELECTRICAL CIRCUITS & SIMULATION LABORATORY | | | | | |
|---|---|---|---|---|---|
| **Course Code** | **L:T:P:S** | **Credits** | **Exam Marks** | **Exam Duration** | **Course Type** |
| **22A0210P** | **0:0:3:0** | **1.5** | **CIE: 30 & SEE:70** | **3Hours** | **PCC** |

**Course Objectives:**

**Student will be able to**

1. Understand and analyze active, reactive power measurements in three phase balanced &unbalanced circuits.
2. Understand and analyze various current locus diagrams
3. Apply and experimentally analyze two port network parameters
4. Simulation of various circuits using PSPICE software.

**List of Experiments**:

1. Measurement of Active Power for Star Connected Balanced and Unbalanced Loads
2. Measurement of Reactive Power for Star Connected Balanced Loads
3. Measurement of 3-Phase Power by Two Wattmeter Method for Unbalanced Loads
4. Measurement of Active Power for Delta Connected Balanced Loads
5. Measurement of Reactive Power for Delta Connected Balanced Loads
6. Locus Diagram of RL Series Circuits: a) Variable 'R' and Fixed 'L' b) Variable 'L' and Fixed 'R'
7. Locus Diagram of RC Series Circuits: a) Variable 'R' and Fixed 'C' b) Variable 'C' and Fixed 'R'
8. Determination of Z Parameters
9. Determination of Y Parameters
10. Transmission Parameters
11. Hybrid Parameters
12. Simulation of DC Circuits
13. Simulation of AC Circuits
14. DC Transient Response

(**Any 10 experiments from the above list)**

**Course Outcomes:**

At the end of the course, students should be able to

1. Understand 3 phase balanced and unbalanced, star and delta connected supply and load
2. Measure reactive power in 3-phase circuit using different methods
3. Analyze the two-port network
4. Design and analyze the both ac and dc circuits by simulation

**Text Book(s):**


1. Fundamentals of Electric Circuits Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th Edition, 2013.
2. Engineering circuit analysis William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 7th Edition, 2006.
3. Circuit Theory Analysis & Synthesis A. Chakrabarti, Dhanpat Rai & Sons, 7th Revised Edition, 2018


**Reference Book(s):**


1. Network Analysis M.E Van Valkenberg, Prentice Hall (India), 3rd Edition, 1999.
2. 2. Electrical Engineering Fundamentals V. Del Toro, Prentice Hall International, 2nd Edition, 2019.
3. 3. Electric Circuits- Schaum's Series, Mc Graw Hill, 5th Edition, 2010.
4. 4. Electrical Circuit Theory and Technology John Bird, Routledge, Taylor & Francis, 5th Edition, 2014.

| ANALOG AND DIGITAL ELECTRONICS LAB | | | | | |
|---|---|---|---|---|---|
| **Course Code** | **L: T:P** | **Credits** | **Exam. Marks** | **Exam Duration** | **Course Type** |
| **22A0413P** | **0:0:3** | **1.5** | **CIE:30 & SEE:70** | **3 Hours** | **ESC** |

**Course Objectives:**

- To learn basic techniques for the design of analogue circuits, digital circuits and fundamental concepts used in the design of systems.
- To design and analyse multistage amplifiers, feedback amplifiers and OP AMP based circuits.
- To implement simple logical operations using combinational logic circuits.
- To design combinational logic circuits and sequential logic circuits.

**Syllabus**

**MINIMUM TWELVE EXPERIMENTS MUST CONDUCT: (Six from each part A & B)**

**PART -A:**

1. Design and simulate two stage RC coupled amplifier for given specifications. Determine Gain and Bandwidth from its frequency response curve.
2. Design and simulate Darlington amplifier. Determine Gain and Bandwidth from its frequency response curve.
3. Design and simulate voltage series feedback amplifier for the given specifications. Determine the effect of feedback on the frequency response of a voltage series feedback amplifier.
4. Design RC Phase shift oscillator/ Wien bridge oscillator for the given specifications. Determine the frequency of oscillation.
5. Design IC 555 Timers – Monostable Operation Circuits.
6. Design Active Low pass, High pass Butterworth (Second Order).
7. Design inverting and non-inverting amplifiers for the given specifications using OP-AMP and verify the same experimentally.
8. Design practical differentiator and integrator circuits using OP-AMP for the given specifications and verify the same practically.

**PART -B:**

1. To study basic gates (AND, OR, NOT) and verify their truth tables.
2. Realization of Boolean Expressions using Gates
3. Design a 3 – bit Adder / Subtractor
4. Design and realization a 4 – bit Gray to Binary and Binary to Gray Converter
5. Design and construct basic flip-flops R-S, J-K, J-K Master slave flip-flops using gates and verify their truth tables
6. Design and implementation of Mod-N synchronous counter using J-K flip-flops.
7. Design and implementation of i) Ring counter and ii) Johnson counter using 43-bit shift register
8. Verify the functionality of Universal shift Register(74LS194/195)

Equipment required for Laboratories:

1. RPS
2. CRO
3. Function Generator
4. Multi Meters
5. Bread Boards
6. Components: - IC741, IC555, IC566, IC1496, IC723, 7805, 7809, 7912 and other essential

components.
7. Analog IC Tester

**Course Outcomes:**

After the completion of the course students will able to

1. Analyse various amplifier circuits.
2. Design multistage amplifiers.
3. Design Feedback and Oscillator Circuits.
4. Design OPAMP based analog circuits.
5. Understand working of logic gates.
6. Design and implement Combinational and Sequential logic circuits.

| DC MACHINES & TRANSFORMERS LAB | | | | | |
|---|---|---|---|---|---|
| **Course Code** | **L: T:P** | **Credits** | **Exam. Marks** | **Exam Duration** | **Course Type** |
| **22A0211P** | **0:0:3** | **1.5** | **CIE:30 & SEE:70** | **3 Hours** | **PCC** |

**Course Objectives:**

**To conduct various experiments on**

- DC motors and DC Generators.
- The speed control techniques of DC motors..
- To conduct various experiments for testing on 1-phase transformers.

**List of Experiments:**

Minimum ten experiments from the following list are required to be conducted

1. Magnetization characteristics of DC shunt generator. Determination of critical field Resistance and critical speed.
2. Load test on DC shunt generator. Determination of characteristics.
3. Brake test on DC shunt motor. Determination of performance curves.
4. Swinburne's test on DC shunt motor, Predetermination of efficiency.
5. Speed control of DC shunt motor (Armature control and Field control method).
6. Hopkinson's tests on DC shunt machines. Predetermination of efficiency.
7. OC and SC test on single phase transformer
8. Parallel operation of single phase transformers.
9. Sumpner's test on single phase transformers.
10. Load test on DC long shunt compound generator. Determination of Characteristics.
11. Load test on DC short shunt compound generator. Determination of Characteristics.
12. Separation of losses in DC shunt motor.
13. Separation of losses of single phase transformer

**Course Outcomes:**

After the completion of the course students will able to

1. Able to conduct and analyse load test on DC shunt generator.
2. Able to understand and analyze magnetization characteristics of DC shunt generator.
3. Able to understand and analyze speed control techniques and efficiency of DC machines
4. Able to understand to predetermine efficiency and regulation of single-phase Transformers

**References:**

D. P. Kothari and B. S. Umre, Laboratory Manual for Electrical Machines, I.K International Publishing House Pvt. Ltd., 2017

| ELECTRICAL ENGINEERING WORK SHOP (SKILL) | | | | | |
|---|---|---|---|---|---|
| **Course Code** | **L:T:P:S** | **Credits** | **Exam Marks** | **Exam Duration** | **Course Type** |
| **22A0212P** | **1: 0:2:0** | **2** | **CIE: 30 & SEE:70** | **3Hours** | **SC** |

**Course Objectives:**

1. To know about different tools, abbreviations and symbols in Electrical Engineering
2. To learn about types of measuring instruments to measure electrical quantities
3. To gain knowledge on different types of earthing and earth resistance
4. To study different types of wiring.

**Course Outcomes (CO):**

**On completion of this course, student will be able to**

1. Demonstrate knowledge on different tools, abbreviations and symbols used in Electrical Engineering
2. Measure different electrical quantities using measuring instruments
3. Demonstrate how to trouble shoot the electrical equipment's (like fan, grinder, Motor, etc.)
4. Do wiring and Earthing for residential houses
5. Identification of color code and Measurement of wire guages using guage meter.

| **Syllabus** | **Total Hours:48** |
|---|---|

1. Study of Introduction to Electrical tools, symbols and abbreviations
2. Study of types of sizes of wires and making "T" joint and straight joint for wires
3. Measurements of Electrical quantities (like Voltage, Current, Power, Power factor in RLC circuits)
4. Study of measurements of Energy (using Single phase and Three phase Energy meter) by connecting different loads
5. Study of earthing and measurement of earth resistance
6. Study and performance of residential wiring (using Energy meter, Fuses, Switches, Indicator, Lamps, etc.)
7. Study of various electrical gadgets (CFL and LED)
8. Study of PV Cell
9. Assembly of choke or small transformer
10. Study of trouble shooting of electrical equipments (fan, iron box, mixer-grinder, etc.)
11. Introduction to basics of Electronic components: Solder practice, Multi meter, Power supply
12. Measurement of wire guages using guage meter
13. Identification of color code, resistors, ICs, Transistors, capacitors, diodes, SCRs, IGBTs etc.

**Reference Books:**

1. 1. Lab manual of Electrical Engineering by TTTI, Chennai

**ENVIRONMENTAL STUDIES**
**(Common to CSE, AI&ML, ECE, EEE, ME)**

| Course Code | L:T:P:S | Credits | Exam Marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 22A0028T | 2: 0:0:0 | 0 | CIE: 30 & SEE:70 | 3Hours | MC |

**Course Objectives:**

- To make the students to get awareness on environment.
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life.
- To save earth from the inventions by the engineers.

| UNIT - I | MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES AND NATURAL RESOURCES | 6Hrs |
|---|---|---|

Definitions , components of Environment, Scope and Importance –Need for Public Awareness

Renewable and non-renewable resources –Forest resources – Use and over – exploitation, deforestation,– Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

| UNIT - II | ECOSYSTEMS | 6Hrs |
|---|---|---|

Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers– Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem

a. Grassland ecosystem.
b. Desert ecosystem

| UNIT - III | BIODIVERSITY AND ITS CONSERVATION | 8Hrs |
|---|---|---|

Introduction Definition: genetic, species and ecosystem diversity – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values — India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching ,Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

| UNIT - IV | ENVIRONMENTAL POLLUTION | 6Hrs |
|---|---|---|

Definition, Cause, effects and control measures of :

a. air pollution
b. water pollution
c. noise pollution

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

| UNIT - V | SOCIAL ISSUES AND THE ENVIRONMENT | 6Hrs |
|---|---|---|

From Unsustainable to Sustainable development – Urban problems related to energy –Environment Protection Act. – Air (Prevention and Control of Pollution) act

Definition, Cause, effects and control measures of :

Global warming

Acid rain

Ozone layer depletion

**Field Work:** Visit to a local area to document environmental assets River/forest grassland/hill/mountain –Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

**Course Outcomes (CO):**

- Recognize the knowledge about environment, natural resources and different techniques involved in its conservation.
- Describe the information about different eco-systems and its functions.
- Explain the different types of bio-diversity along with values and conservation methods.
- Predict various environmental pollutions and able to design the environmental friendly process in engineering.
- Apply the sustainable development concepts in life, society and industry.

**Text Books:**

1. Text book of Environmental Studies for Undergraduate Courses- Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies- Kaushik & kaushik, New Age Pubilishers.

**Reference Books:**

1. Environmental studies- R.Rajagopalan, Oxford University Press
2. Comprehensive Environmental studies- J.P.Sharma, Laxmi publications.