**SWARNANDHRA**

**COLLEGE OF ENGINEERING & TECHNOLOGY (Autonomous)**

**SEETHARAMPURAM, NARSAPUR - 534 280, W.G. Dt., A.P.**

Department of **Electrical & Electronics Engineering**

**B. Tech. R-23 – IV Semester (II Year)**

 **(EEE)**

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| **Sl. No.** | **Category** | Course Code | **Title** | **L/D** | **T** | **P** | **Credits** |
| 1 | BS & H | 23HS4T01 | Universal Human Values- Understanding Harmony | 2 | 1 | 0 | 3 |
| 2 | Professional Core | 23EC4T04 | Analog Circuits | 3 | 0 | 0 | 3 |
| 3 | Professional Core | 23EE4T01 | Power Systems-I | 3 | 0 | 0 | 3 |
| 4 | Professional Core | 23EE4T02 | Induction and Synchronous Machines | 3 | 0 | 0 | 3 |
| 5 | Professional Core | 23EE4T03 | Control Systems | 3 | 0 | 0 | 3 |
| 6 | Professional Core | 23EE4L01 | Induction and Synchronous Machines Lab | 0 | 0 | 3 | 1.5 |
| 7 | Professional Core | 23EE4L02 | Control Systems Lab | 0 | 0 | 3 | 1.5 |
| 8 | Professional Core | 23EE4S01 | Python Programming Lab | 0 | 1 | 2 | 2 |
| 9 | BS & H | 23BS4M01 | Design Thinking & Innovation | 1 | 0 | 2 | 2 |
|  |  |  | **Total** | **15** | **02** | **10** | **22** |

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| **IV SEMESTER** | **L** | **T** | **P** | **C** |
| **3** | **0** | **0** | **3** |
| **23HS4T01: UNIVERSAL HUMAN VALUES - UNDERSTANDING HARMONY**(EEE) |

**Course Objectives:**

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

**Course Outcomes:**

CO1: Students are expected to become more aware of themselves, and their surroundings

 (Family, society, nature)

CO2: They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

CO3: They would have better critical ability.

CO4: They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).

CO5: 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.

**SYLLABUS**

**UNIT-I**

**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**

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 their correct priority.

Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

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

**UNIT-II**

**Understanding Harmony in the Human Being - Harmony in Myself!**

Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’ Understanding the needs of Self (‘I’) and ‘Body’-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’s own 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**

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 reflect on 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**

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

Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self- regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all- pervasive space Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film “Home” can be used), pollution, depletion of resources and role of technology etc.

**UNIT-V**

**Implications of the above Holistic Understanding of Harmony on Professional Ethics**

Natural acceptance of human values Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: (a) Ability to utilize the professional competence for augmenting universal human order (b) Ability to identify the scope and characteristics of people friendly and eco- friendly production systems, (c) Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems Strategy for transition from the present state to Universal Human Order:

1. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
2. At the level of society: as mutually enriching institutions and organizations Sum up.

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.

**TEXT BOOKS:**

1. R R Gaur, R Asthana, G P Bagaria, “A Foundation Course in Human Values and Professional Ethics”, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, “Teachers’ Manual for A Foundation Course in Human Values and Professional Ethics”, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

**Reference Books:**

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

**MODE OF CONDUCT**

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor’s role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one’s own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up “ordinary” situations rather than” extra-ordinary” situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practicals are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignments and/or activities are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

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| **IV SEMESTER** | **L** | **T** | **P** | **C** |
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| **23EC4T04: ANALOG CIRCUITS**(EEE) |

**Pre-requisite:** Knowledge of electronic components and semiconductor devices, number systems, binary arithmetic, Boolean or switching algebra, and logic gates.

**Course Objectives:**

* To acquire the basic knowledge on clippers, clampers & biasing circuits.
* To determine the h-parameters of a transistor circuit & understand the concepts of feedback amplifiers.
* To know the operation of oscillators and operational amplifier.
* To understand the applications of operational amplifier.
* To acquire the knowledge on IC 555 timer and their applications.
* To know the operation of Analog to Digital Converters and Digital to Analog Converters.

**Course Outcomes:**

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

CO1**:** Analyze diode clipping and clamping circuits. Understand different types of biasing circuits of a transistor.

CO2**:** Use small signal modeling for transistor circuit analysis and illustrate the operation of feedback amplifiers.

CO3**:** Understand operation of oscillators, operational amplifier and their applications.

CO4**:** Use 555 timers in multi-vibrators, Schmitt Trigger and PLL applications.

CO5**:** Describe the operation of different ADC’s and DAC’s.

**Unit – 1:**

**Diode clipping and clamping circuits:** Diode clippers, clipping at two independent levels, Transfer characteristics of clippers, clamping circuit operation.

**DC biasing of BJTs:** Load lines, Operating Point, Bias Stability, Collector-to-Base Bias, Self-Bias, Stabilization against Variations in VBE and β for the Self-Bias Circuit, Bias Compensation, Thermal Runaway, Thermal Stability.

**Unit – II:**

**Small Signals Modelling of BJT:** Analysis of a Transistor Amplifier Circuit using h-parameters, Simplified CE Hybrid Model, Analysis of CE, CC, CB Configuration using Approximate Model, Frequency Response of CE and CC amplifiers.

**Feedback Amplifiers:** Classification of Amplifiers, the Feedback Concept, General Characteristics of Negative-Feedback Amplifiers, Effect of Negative Feedback upon Output and Input Resistances, Voltage-Series Feedback, Current-Series Feedback, Current-Shunt Feedback, Voltage-Shunt Feedback.

**Unit – III:**

**Oscillator Circuits:** Barkhausen Criterion of oscillation, Oscillator operation, R-C phase shift oscillator, Wien bridge Oscillator, Crystal Oscillator.

**Operational Amplifiers:** Introduction, Basic information of Op-Amp, Ideal Operational Amplifier, Block Diagram Representation of Typical Op-Amp, OP-Amps Characteristics: Introduction, DC and AC characteristics, 741 op-amp & its features.

**Unit – IV:**

**OP-AMPS Applications:** Introduction, Basic Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Multiplier and Divider, Differentiator, integrator.

**Comparators and Waveform Generators:** Introduction, Comparator, Square Wave Generator, Monostable Multivibrator, Triangular Wave Generator, Sine Wave Generators.

**Unit – V:**

**Timers and Phase Locked Loop:** Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger, PLL block schematic, principles and description of individual blocks, 565 PLL, Applications of VCO (566).

**Digital to Analog And Analog to Digital Converters:** Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A-D Converters – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

**Textbooks:**

1. Electronic Devices and Circuits- J. Millman, C.Halkias, Tata Mc-Graw Hill, 2nd Edition, 2010.
2. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd

Edition, 2003.

**Reference Books:**

1. Electronic Devices and Circuit Theory – Robert L.Boylestad and LowisNashelsky, Pearson Edition, 2021.
2. Electronic Devices and Circuits–G.K. Mithal, Khanna Publisher, 23rd Edition, 2017.
3. Electronic Devices and Circuits – David Bell, Oxford, 5thEdition, 2008.
4. Electronic Principles–Malvino, Albert Paul, and David J. Bates, McGraw-Hill/Higher Education, 2007.
5. Operational Amplifiers and Linear Integrated Circuits– Gayakwad R.A, Prentice Hall India, 2002.
6. Operational Amplifiers and Linear Integrated Circuits –Sanjay Sharma, Kataria& Sons, 2ndEdition, 2010.

**Online Learning Resources:**

1. https://nptel.ac.in/courses/122106025.
2. https://nptel.ac.in/courses/108102112.

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| **23EE4T01: POWER SYSTEMS-I**(EEE) |

**Pre-requisite:** Electrical Circuit Analysis

**Course Objectives:**

* To study principle of operation of different components of a hydro and thermal power stations.
* To study principle of operation of different components of a nuclear power stations.
* To study constructional and operation of different components of an Air and Gas Insulated substations.
* To study different types of cables and distribution systems.
* To study different types of load curves and tariffs applicable to consumers.

**Course Outcomes:**

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

CO1: Understand the different types of power plants, operation of power plants.

CO2: Describe the different components of air and gas insulated substations.

CO3: Discuss the construction of single core and three core cables and describe distribution system configurations.

CO4: Analyse different economic factors of power generation and tariffs.

**Unit I:**

**Hydroelectric Power Stations:** Selection of site, general layout of a hydroelectric power plant with brief description of major components and principle of operation

**Thermal Power Stations:** Selection of site, general layout of a thermal power plant. Brief description of components: boilers, super heaters, economizers and electrostatic precipitators, steam turbines: impulse and reaction turbines, condensers, feed water circuit, cooling towers and chimney.

**Unit II:**

**Nuclear Power Stations:** Location of nuclear power plant, working principle, nuclear fission, nuclear fuels, nuclear chain reaction, nuclear reactor components: moderators, control rods, reflectors and coolants, types of nuclear reactors and brief description of PWR, BWR and FBR. Radiation: radiation hazards and shielding, nuclear waste disposal.

**Unit III:**

**Substation**s:

**Air Insulated Substations** – indoor & outdoor substations, substations layouts of 33/11 kV showing the location of all the substation equipment. Bus bar arrangements in the sub-stations: simple arrangements like single bus bar, sectionalized single bus bar, double bus bar with one and two circuit breakers, main and transfer bus bar system with relevant diagrams.

**Gas Insulated Substations (GIS)** – advantages of gas insulated substations, constructional aspects of GIS, comparison of air insulated substations and gas insulated substations.

**Unit IV:**

**Underground Cables:** Types of cables, construction, types of insulating materials, calculation of insulation resistance, stress in insulation and power factor of cable. Capacitance of single and 3-Core belted Cables. Grading of cables: capacitance grading and intersheath grading.

**Distribution Systems:** Classification of Distribution systems, A.C Distribution, Overhead versus Underground system, Connection schemes of Distribution system, Requirements of Distribution system, requirements of a Distribution system, Design considerations in Distribution system.

**UNIT V:**

**Economic Aspects & Tariff:**

 **Economic Aspects** – load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity factor and plant use factor, base and peak load plants.

**Tariff Methods**– Costs of generation and their division into fixed, semi-fixed and running costs, desirable characteristics of a tariff method, tariff methods: simple rate, flat rate, block-rate, two-part, three–part, and power factor tariff methods.

**Text Books:**

1. S. N. Singh, Electric Power Generation, Transmission and Distribution, PHI Learning Pvt Ltd, New Delhi, 2nd Edition, 2010
2. J.B.Gupta, Transmission and Distribution of Electrical Power, S.K.Kataria and sons,10th Edition, 2012

**Reference Books:**

1. I.J. Nagarath& D.P. Kothari, Power System Engineering, McGraw-Hill Education, 3rd Edition, 2019.
2. C.L.Wadhwa, Generation, Distribution and Utilization of Electrical Energy, New Age International Publishers, 6th Edition, 2018.
3. V. K. Mehta and Rohit Mehta, Principles of Power System, S. Chand, 4th Edition, 2005.
4. TuranGonen, Electric Power Distribution System Engineering, McGraw-Hill, 1985.
5. Handbook of switchgear, BHEL, McGraw-Hill Education, 2007.

**Online Learning Resources:**

1. https://nptel.ac.in/courses/108102047

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| **IV SEMESTER** | **L** | **T** | **P** | **C** |
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| **23EE4T02: INDUCTION AND SYNCHRONOUS MACHINES**(EEE) |

**Pre-requisite:** Principles of Electromechanical Energy Conversion, Electromagnetic fields and Electrical Circuit Analysis.

**Course Objectives:**

Students will get exposure to understand the concepts of

* Characteristics, starting and testing methods of Induction Motor
* Torque production and performance of Induction Motor.
* In determining the performance parameters of Induction Motor.
* Working of synchronous machines

**Course Outcomes:**

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

CO1: Explain the construction and operation of three-phase induction motor.

CO2: Analyse the performance of three-phase induction motor.

CO3: Describe the working of single-phase induction motors.

CO4: Analyse the performance of Synchronous generators and motors.

**UNIT-I:**

**3-phase induction motors:**

Construction of Squirrel cage and Slipring induction motors– production of rotating magnetic field – principle of operation – rotor emf and rotor frequency – rotor current and power factor at standstill and during running conditions– rotor power input, rotor copper loss and mechanical power developed and their inter-relationship –equivalent circuit – phasor diagram

**UNIT-II:**

**Performance of 3-Phase induction motors:**

Torque equation – expressions for maximum torque and starting torque – torque-slip characteristics – double cage and deep bar rotors –No load, Brake test and Blocked rotor tests – circle diagram for predetermination of performance- methods of starting –starting current and torque calculations -speed control of induction motor with V/f control method, rotor resistance control and rotor emf injection technique –crawling and cogging – induction generator operation.

**UNIT – III:**

**Single Phase Motors:**

Single phase induction motors – constructional features – double revolving field theory, Cross field theory – equivalent circuit- starting methods: capacitor start capacitor run, capacitor start induction run, split phase & shaded pole, AC series motor.

**UNIT–IV:**

**Synchronous Generator**:

Constructional features of non-salient and salient pole type alternators- armature windings – distributed and concentrated windings – distribution& pitch factors – E.M.F equation –armature reaction – voltage regulation by synchronous impedance method – MMF method and Potier triangle method –two reaction analysis of salient pole machines -methods of synchronization- Slip test – Parallel operation of alternators.

**UNIT–V:**

**Synchronous Motor:**

Synchronous motor principle and theory of operation – Effect of excitation on current and power factor– synchronous condenser –expression for power developed –hunting and its suppression – methods of starting.

**Text Books:**

1. Electrical Machinery, Dr. P.S. Bhimbra, Khanna Publishing, 2021,First Edition.
2. Performance and analysis of AC machines by M.G. Say, CBS, 2002.

**Reference Books:**

1. Electrical machines, [D.P. Kothari](https://www.amazon.in/s/ref%3Ddp_byline_sr_book_1?ie=UTF8&field-author=D.P.+Kothari&search-alias=stripbooks) and [I.J. Nagrath](https://www.amazon.in/s/ref%3Ddp_byline_sr_book_2?ie=UTF8&field-author=I.J.+Nagrath&search-alias=stripbooks), McGraw Hill Education, 2017, Fifth Edition.
2. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria& Sons, 2007.
3. Electric Machinery, A.E.Fitzgerald, Charles kingsley, Stephen D.Umans, McGraw-Hill, 2020, Seventh edition.

**Online Learning Resources:**

1. nptel.ac.in/courses/108/105/108105131
2. https://nptel.ac.in/courses/108106072

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| **IV SEMESTER** | **L** | **T** | **P** | **C** |
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| **23EE4T03: CONTROL SYSTEMS**(EEE) |

**Pre-requisite**: Basic Engineering Mathematics

**Course Objectives:**

* To obtain the mathematical models of physical systems and derive transfer function.
* To determine the time response of systems and analyse system stability.
* To analyse system stability using frequency response methods.
* To design compensators using Bode diagrams.
* To obtain the mathematical models of physical systems using state space approach and determine the response.

**Course Outcomes**:

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

**CO1:** Derive the transfer function of physical systems and determine overall transfer function using block diagram algebra and signal flow graphs.

**CO2:** Obtain the time response of first and specifications of second order systems and determine error constants. Analyze the absolute and relative stability of LTI systems using Routh’s stability criterion and root locus method.

**CO3:** Analyze the stability of LTI systems using frequency response methods.

**CO4:** Design Lag, Lead, Lag-Lead compensators to improve system performance using Bode Diagrams.

**CO5:** Apply state space analysis concepts to represent physical systems as state models, derive transfer function and determine the response. Understand the concepts of controllability and observability

**UNIT - 1**

**Mathematical Modelling Of Control Systems:** Classification of control systems - open loop and closed loop control systems and their differences - Feedback characteristics - transfer function of linear system, differential equations of electrical networks- translational and rotational mechanical systems - transfer function of Armature voltage controlled DC servo motor - block diagram algebra – representation by signal flow graph – reduction using Mason’s gain formula.

**UNIT - 2**

**Time Response Analysis:** Standard test signals – time response of first and second order systems – time domain specifications - steady state errors and error constants - effects of proportional (P) - proportional integral (PI) - proportional derivative (PD) proportional integral derivative (PID) systems.

**Stability and Root Locus Technique:** The concept of stability – Routh’s stability criterion – limitations of Routh’s stability, root locus concept – construction of root loci (simple problems) - Effect of addition of Poles and Zeros to the transfer function.

**UNIT - 3**

**Frequency Response Analysis:** Introduction to frequency domain specifications – Bode diagrams – transfer function from the Bode diagram –Polar plots, Nyquist stability criterion- stability analysis using Bode plots (phase margin and gain margin).

**UNIT - 4**

**Classical Control Design Techniques:** Lag, lead, lag-lead compensators - physical realisation - design of compensators using Bode plots.

**UNIT - 5**

**State Space Analysis of LTI Systems:** Concepts of state - state variables and state model - state space representation of transfer function: Controllable Canonical Form - Observable Canonical Form - Diagonal Canonical Form - diagonalization using linear transformation - solving the time invariant state equations State Transition Matrix and its properties- concepts of controllability and observability.

**Text Books**:

1. Modern Control Engineering by Kotsuhiko Ogata, Prentice Hall of India, 2010.
2. Automatic control systems by Benjamin C.Kuo, Prentice Hall of India, 2nd Edition.

**Reference Books:**

1. Control Systems principles and design by M.Gopal, Tata Mc Graw Hill education Pvt Ltd., 4th

 Edition.

2. Control Systems Engineering by Norman S. Nise, Wiley Publications, 7th edition

3. Control Systems by Manik Dhanesh N, Cengage publications.

4. Control Systems Engineering by I.J.Nagarath and M.Gopal, Newage International Publications, 5th Edition.

5. Control Systems Engineering by S.Palani, Tata Mc Graw Hill Publications.

**Online Learning Resources:**

1. <https://archive.nptel.ac.in/courses/107/106/107106081/>
2. <https://archive.nptel.ac.in/courses/108/106/108106098/>
3. <https://nptelvideos.com/video.php?id=1423&c=14>

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| **IV SEMESTER** | **L** | **T** | **P** | **C** |
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| **23EE4L01: INDUCTION AND SYNCHRONOUS MACHINES LAB**(EEE) |

**List of Experiments**

**(Any 10 of the following experiments are to be conducted)**

1. Brake test on three phase Induction Motor.
2. Circle diagram of three phase induction motor.
3. Speed control of three phase induction motor by V/f method.
4. Determination of equivalent circuit parameters, efficiency and regulation of a three phase Induction motor
5. Equivalent circuit of single-phase induction motor.
6. Power factor improvement of single-phase induction motor by using capacitors.
7. Load test on single phase induction motor.
8. Regulation of a three -phase alternator by synchronous impedance &MMF methods.
9. Regulation of three-phase alternator by Potier triangle method.
10. V and Inverted V curves of a three-phase synchronous motor.
11. Determination of Xd, Xq& Regulation of a salient pole synchronous generator.
12. Determination of efficiency of three phase alternator by loading with 3-Ph induction motor.
13. Parallel operation of three-phase alternator under no-load and load conditions.
14. Determination of efficiency of a single-phase AC series Motor by conducting Brake test.

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| **IV SEMESTER** | **L** | **T** | **P** | **C** |
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| **23EE4L02: CONTROL SYSTEMS LAB**(EEE) |

**List of Experiments**

**(Any 10 of the following experiments are to be conducted)**

1. Analysis of Second order system in time domain

2. Characteristics of Synchros

3. Effect of P, PD, PI, PID Controller on a second order systems

4. Design of Lag and lead compensation – Magnitude and phase plot

5. Transfer function of DC motor

6. Temperature controller using PID

7. Characteristics of magnetic amplifiers

8. Characteristics of AC servo motor

9. Characteristics of DC servo motor

10. DC position control system

11.Root locus, Bode Plot and Nyquist Plot for the transfer function of systems up to 5th order using MATLAB.

12. Kalman’s test of Controllability and Observability using MAT LAB.

13. Study and verify the truth table of logic gates and simple Boolean expressions using PLC.

14. State Space model for classical transfer function using Matlab.

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| **IV SEMESTER** | **L** | **T** | **P** | **C** |
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| **23EE4S01: PYTHON PROGRAMMING LAB**(EEE) |

**UNTI-I:**

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

**Sample Experiments:**

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.

i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators

1. Write a program to add and multiply complex numbers
2. Write a program to print multiplication table of a given number.

**UNIT-II:**

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, \*args and \*\*kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

**Sample Experiments:**

1. Write a program to define a function with multiple return values.
2. Write a program to define a function using default arguments.
3. Write a program to find the length of the string without using any library functions.
4. Write a program to check if the substring is present in a given string or not.
5. Write a program to perform the given operations on a list:
	* 1. addition ii. insertion iii. slicing
6. Write a program to perform any 5 built-in functions by taking any list.

**UNIT-III:**

Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

**Sample Experiments:**

1. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
2. Write a program to count the number of vowels in a string (No control flow allowed).
3. Write a program to check if a given key exists in a dictionary or not.
4. Write a program to add a new key-value pair to an existing dictionary.
5. Write a program to sum all the items in a given dictionary.

**UNIT-IV:**

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

**Sample Experiments:**

1. Write a program to sort words in a file and put them in another file. The output file
 should have only lower-case words, so any upper-case words from source must be

lowered.

1. Python program to print each line of a file in reverse order.
2. Python program to compute the number of characters, words and lines in a file.
3. Write a program to create, display, append, insert and reverse the order of the items in the array.
4. Write a program to add, transpose and multiply two matrices.
5. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

**UNIT-V:**

Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

**Sample Experiments:**

1. Python program to check whether a JSON string contains complex object or not.
2. Python Program to demonstrate NumPy arrays creation using array () function.
3. Python program to demonstrate use of ndim, shape, size, dtype.
4. Python program to demonstrate basic slicing, integer and Boolean indexing.
5. Python program to find min, max, sum, cumulative sum of array
6. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
	1. Apply head () function to the pandas data frame
	2. Perform various data selection operations on Data Frame
7. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

**Reference Books:**

1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

**Online Learning Resources/Virtual Labs:**

1. <https://www.coursera.org/learn/python-for-applied-data-science-ai>
2. <https://www.coursera.org/learn/python?specialization=python#syllabus>

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| **23BS4M01: DESIGN THINKING & INNOVATION**(Common to all Branches) |