ELECTRICAL AND COMPUTER ENGINEERING (ELC)

COURSE STRUCTURE
(2024-25)

SEMESTER- III

Theory							
Sl. No	**Course Code**	**Subject**	**L**	**T**	**P**	**Total**	**Credit**
1	EX20003	Scientific and Technical Writing	2	0	0	2	2
2	MA21001	Probability and Statistics	3	1	0	4	4
3	EE20001	Network Theory	3	0	0	3	3
4	EE20010	Electrical Machines	3	0	0	3	3
5	ES20001	Data Structure and Algorithms	3	0	0	3	3
6	EE20007	Analog and Digital Electronics Circuit	3	0	0	3	3
Total credit (Theory Subjects)						**18**	**18**
Practical							
1	EE29002	Electrical Machines Laboratory	0	0	2	2	1
2	ES29001	Data Structure and Algorithms Lab	0	0	2	2	1
3	EE29005	Analog and Digital Circuit Design Laboratory	0	0	2	2	1
Total credit (Practical Subjects)						**06**	**03**
Sessional/Vocational							
1		Vocational Electives	0	0	2	2	1
Total credit (Vocational Subjects)						**02**	**01**
Total Practical & Sessional/Vocational						**08**	**04**
Total Credit (Semester)						**26**	**22**

SEMESTER- IV

Theory							
Sl. No	**Course Code**	**Subject**	**L**	**T**	**P**	**Total**	**Credit**
1		HASS Elective II	3	0	0	3	3
2	MA21006	Vectors, Differential Equations and Complex Analysis	3	1	0	4	4
3	EE20004	Linear Control System	3	0	0	3	3
4	ES20002	Computer Organization	3	0	0	3	3
5	ES20004	Introduction to Data Base Management System	3	0	0	3	3
6	EX20001	Industry 4.0 Technologies	2	0	0	2	2
Total credit (Theory Subjects)						**18**	**18**
Practical							
1	ES29002	Data Base Management System Lab	0	0	2	2	1
2	EE29004	Control System Laboratory	0	0	2	2	1
Total credit (Practical Subjects)						**04**	**02**
Sessional/Vocational							
1	EE28002	Electrical System Modeling Using MATLAB	0	0	2	2	1
Total credit (Vocational Subjects)						**02**	**01**
Total Practical & Sessional/Vocational						**06**	**03**
Total Credit (Semester)						**24**	**21**

SCIENTIFIC AND TECHNICAL WRITING

Course Code : EX20003
Credit :2
L-T-P :2-0-0
Prerequisite : Nil

COURSE OBJECTIVE

Technical documents take many forms depending on their purpose and the audience. A technical document can be a project proposal, minutes of a meeting, an advertisement in a newspaper, or even a research paper. A scientific document is a form of technical document where both the author and the audience are experts. The writing styles and the document density of technical documents depend on the nature of the document. The objective of this subject is to train the students in the art and science of writing a range of scientific and technical documents.

COURSE OUTCOMES

After successfully completing the course, the students will be able to

CO1 :Realize the need to articulate the purpose of the document, identify its audience, and decide the density of information to be included in scientific and technical documents.
CO2 :Internalize the art and science of scientific and technical writing.
CO4 :Make appropriate use of crisp language, illustrations, and symbols.
CO4 :Distinguish between bad and good writing. (Analyze and Evaluate).
CO5 :Prepare a variety of scientific and technical documents, including laboratory and project reports;
CO6 :Write these documents in an accurate, clear, concise, coherent, appropriate, and readable manner.

COURSE CONTENT

Introduction

Forms and features of creative, technical, scientific, and science writing; Audience types (general and specific experts, technicians, managers, laypersons, and mixed audience); Examples of documents for technical, professional, and scientific communications; Characteristics of effective technical writing: Accuracy, clarity, conciseness, coherence, appropriateness, and readability.

Language Issues

Revisiting English grammar; Punctuation (period, comma, colon, semicolon, question mark, exclamatory mark, apostrophe, quotation marks, hyphen, dash, parentheses, and brackets); Mechanics (capitalization, italics, abbreviations, acronyms); Latin terms used popularly in English texts; Informal and colloquial English; Dangling modifiers, Faulty parallelism, Judicious use of common words and phrases; Active and passive voice; Nominalization; Common English errors; Pitfalls in writing; Adapting texts to issues of gender, race, and ethnicity; and Guarding against Plagiarism.Paragraphing: Unity of idea, topic sentence, logical and verbal bridges through use of signposts, transitions, and link words; Patterns of development of an idea; and Lists.

Structure of Scientific Documents

Prefatory Materials:Title, Copyright Notice, Declaration and Certificates, Abstract, Keywords, Acknowledgements and Conflict of Interest Statement, Symbols and Abbreviations, and Table of Contents.

Body of Scientific Documents

Introductory Materials—Context, problem and current response, research questions, hypotheses, and objectives and scope; Literature Review—Presentation styles, citations and referencing systems, quoting, paraphrasing, and summarizing; Materials and Methods—Mathematical Materials: Methodology, methods, tools, and techniques; Quantitative, qualitative, experimental, and mixed methods; Numbers and numerals, engineering and scientific notations of numbers, mathematical operators, equations, flowcharts, algorithms, SI units, significant digits and order of magnitude, figures, tables, and photographs; Experimental apparatus, materials, specifications, measuring instruments, procedure, data analysis; Concluding Materials—Conclusions, implications, generalization, limitations, scope for further work, and contributions of the work.

End Matters
References, Appendixes, and Supplementary materials.
Structure of Selected Technical Documents
PowerPoint presentation, Abstract of a paper, Laboratory reports, Progress report, Project proposal, Minutes of a meeting, Brochure, and News items.

Testbooks:

1. Lecture notes on Scientific and Technical Writing
2. Alred, G. J., C. T. Brusaw, and W. E. Oliu (2008), *Handbook of Technical Writing*, St. Martin's Press, New York, Ninth Edition.
3. Angelika H. Hofmann (2014), Scientific Writing and Communication, Papers, Proposals, and Presentations, Oxford: Oxford University Press.
4. Duke Graduate School Scientific Writing Resource(https://sites.duke.edu/scientificwriting/).

Reference Books

1. Gerald. J. Alred, Charles. T. Brusaw, and Walter. E. Oliu (2008), *Handbook of Technical Writing*, St. Martin's Press, New York, Ninth Edition.
2. OWL, The Purdue Online Writing Laboratory, https://owl.english.purdue.edu/owl/.
3. Perelman, L. C., J. Paradis, and E. Barrett (1998), The Mayfield Handbook of Technical and Scientific Writing, Mayfield Publishing (ed.), Available free at http://www.mhhe.com/mayfieldpub/tsw/toc.htm, Mayfield Publishing Company, Inc.,1280 Villa Street, Mountain View, CA 94041, 415.960.3222, <http://www.mayfieldpub.com>, <mailto:hypertext@mayfieldpub.com>
4. Rubens, P. (2001), Science and Technical Writing: A Manual of Style, 2nd Edition, Routledge, New York.

PROBABILITY AND STATISTICS

Course Code : MA21001
Credit :4
L-T-P :3-1- 0
Prerequisite :Differential Equations and Linear Algebra (MA11001)

COURSE OBJECTIVE

The objective of this course is to familiarize the students with the foundation of probability and statistics and to use it in solving the problems arises in engineering and real life applications.

COURSE OUTCOMES

After successfully completing the course, the students will be able to

CO1: Understand basic probability and its applications
CO2: Study probability distributions and can use it in real life data analysis
CO3: Have a knowledge on univariate and bivariate distributions and their properties
CO4: measure the central tendency and dispersion of a data set to draw conclusion from the data and interpret the data with the appropriate pictorial representation.
CO5: Have good understanding of the Central Limit Theorem and its applications
CO6: Analyze the statistical inference

COURSE CONTENT

Probability and random variables

Basic concepts of sample space, events(with example), Axiom of Probability,Conditional Probability, Bayes' Theorem and its applications.Discrete random variable, probability mass function, cumulative distribution function and Moment Generating function for discrete random variable, some special distributions likeUniform distribution, Geometric distribution, Binomial distribution, Negative Binomial distribution, Poisson distribution, Hyper geometric distribution, mean and variance.Continuous random variable, density function, cumulative distribution function and Moment Generating function. Uniform distribution, normal distribution, mean, variance, percentile and critical value of normal distribution,normal approximation of the binomial distributionand exponential distribution.

Joint probability and distributions
Joint probability mass function and marginal probability mass function, joint probability density function and marginal probability density function, concept of independent random variable(joint probability), conditional probability mass function and conditional probability density function. Expected value, covariance and correlation for jointly distributed random variable(both continuous and discrete).

Descriptive Statistics
Frequency distribution,pictorial and tabular representation of data, stem and leaf display, dot plots, histogram, box plots and comparative box plots.Basicconceptson mean, median and mode, Skewness, Kurtosis, Correlation, Coefficient of Correlation, rank correlation, Regression Analysis: Least square method.

Inferential statistics

Population, sample, random sample, sampling distribution, distribution of sample mean, central limit theorem, point estimator, point estimation of parameter using method of maximum likelihood estimation, confidence interval, confidence interval for the mean of a normal population with known and unknown variance, confidence interval for the variance of a normal population, hypothesis testing, one sided and two sided alternatives, Tests for mean of the normal distribution with known variance, Tests for mean of the normal distribution with unknown variance, tests for variance of the normal distribution.

Textbooks:

1. Probability and Statistics for Engineers and Sciences by J. L. Devore, CENGAGE Learning, 9th Edition
2. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley, INC, 10th Edition.

Reference Books:

1. Introduction to Probability and Statistics for Engineers and Scientists by S.M. Ross,

Elsevier/AP, 6th Edition.
2. Introduction to Probability and Statistics by J.S. Milton & J.C. Arnold, Mc Graw Hill, 4th Edition.
3. Introduction to Probability Theory and Statistical Inference by H.J. Larson, John Wiley & Sons Inc, 3rd Edition.
4. Fundamental of Mathematical Statistics by S.C. Gupta &V.K.Kapoor, S. Chand, 12th Edition.

NETWORK THEORY

Subject Code :EE20001
Credit :3
L-T-P : 3-0-0
Prerequisites : Basic Electrical Engineering (EE10002)

COURSE OBJECTIVE

To familiarize the concepts of network theorems, explain the concept of coupling in electric circuits and analyze the transient response of circuits with dc and ac inputs. Understand the concept of two port network, network topology and able to design filters.

COURSE OUTCOMES

After successfully completing the course, the students will be able to

CO1: Analyze different electrical circuits using network theorems.
CO2: Understand the magnetic couple circuits.
CO3: Apply the transients in DC/AC circuits.
CO4: Evaluate different parameters and functions of one port and two port networks
CO5: Know the concept of network topology
CO6: Design different passive filters

COURSE CONTENT

Network Theorems (for DC and AC Circuit)
Superposition theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem.

Magnetic coupled circuits
Self and Mutual Inductance, Dot convention for coupled circuits and coefficient of coupling.

Transient Response
Duality of circuits, Transient response for R-L, R-C and R-L-C circuits with both DC and AC excitation in time domain and Laplace transformation method.

Two-Port Networks
Network Configurations, Open Circuit, Short circuit, transmission and hybrid parameters, Condition of symmetry and reciprocity in two port network, Interconnection of two port networks (Series, Parallel &Cascade).Inter-relationship between parameters of two port network.

Network Function
Concept of complex frequency, driving point and transfer functions of one port and two port network.

Network Topology
Concepts of Network graph, Tree, Co-Tree, Links and Twigs, Formation of incidence matrix [A] and loop matrix [B] Formation of Fundamental Cut-Set Matrix [QF], Tie-Set Matrix. Relation between branch voltage and current, loop current network topology analysis.

Filter Design
Passive filters, Design of low pass, high pass, band pass, and band elimination filter.

Textbooks:

1. Network AnalysisbyM. E. Van Valkenburg, Pearson Education, 3rd Edition, 2006.
2. Fundamentals of Electric Circuits, Charles K. Alexander, Matthew N.O. Sadiku, McGraw Hill Education; 5 edition (1 July 2013).

Reference Books:

1. Circuits and Networks Analysis and Synthesis (Second Edition) A Sudhakar ShyammohanSPalli, Tata McGraw-Hill, 2011.
2. Basic Circuit Analysis(Second Edition), John O'Malley, Schaum'sOutlines, Tata McGraw-Hill, 2010(Reprint).
3. Network Theory Analysis and Synthesis by Ravish R Singh, S. Chand Publication 1st edition 2023.
4. Engineering circuit analysis by William Hart Hayt Jack E Kemmerly Steven M Durbin
5. Networks and systems by D.Roy Choudhury, New Age Publication, 2nd Edition, June 2013.

ELECTRICAL MACHINES

Course Code : EE20010
Credit : 3
L-T-P : 3-0-0
Prerequisite :Network Theory (EE20001)

COURSE OBJECTIVE

To understand construction, working principles, testing and control of different electrical machines and their industrial and domestic applications.

COURSE OUTCOMES

After successfully completing the course, the students will be able to

CO1: Know the Construction, principle, efficiency and control of DC machines.
CO2: Understand the principle, Phasor diagram, losses, efficiency and regulation of transformers.
CO3: Analyze the three phase transformers through vector grouping.
CO4: Comprehend the operation and characteristics of Synchronous machines.
CO5: Investigate the operation and characteristics of Induction Motor.
CO6: Study the construction, principle of operation and application of single phase induction motors.

COURSE CONTENT

DC Machine:
Principle of Operation, emf equation of DC machine, Types and its characteristics. Concepts of back emf, armature and shaft torque, Speed control of DC shunt motor, efficiency, Necessity of starter, 3-point starter.

Transformer:
Single phase transformer, Construction , Principle of operation, emf equation, equivalent circuit and phasor diagram, open circuit and short circuit test, regulation, losses and efficiency. Three phase transformer with different vector group.

Three-phase Synchronous Machine:
Construction, Principle of operation, Pitch factor, distribution factor, winding Factor, winding diagram, EMF equation, armature reaction, equivalent circuit V-curves, method of starting and application, voltage regulation of three phase alternator (synchronous impedance and mmf method), power stage and efficiency.

Three-Phase Induction Motor:
Construction, squirrel cage and slip ring type, principle of operation, equivalent circuit and phasor diagram, Torque slip characteristics, starting torque and maximum torque, losses and efficiency, method of starting, speed control and application.

Single-phase Induction Motor
Construction, Staring method and application

Textbooks
1.Electrical Machinery, P. S Bimbhra, 7th Edition, Khanna Publishers, 2008.
2.Electrical Technology, Volume -II. B. L. Theraja, S .Chand Publications. 2010.
3.Electrical Machines, Ashfaq Hussain, Dhanpat Rai, Delhi, 2nd Edition, 2008.

Reference Books
1. Electric Machines, C. I. Hubert, , Pearson Education, 2003.
2. Electric Machines, by Kothari. D P and I J Nagrath, , 3rd Edn, Tata McGraw-Hill, New Delhi. 2004

DATA STRUCTURE AND ALGORITHMS

Course code:ES20001
Credit: 3
L-T-P: 3-0-0
Prerequisite: Programming Laboratory (CS13001)
COURSE OBJECTIVE: To understand linear and nonlinear data structures and perform complexity analysis.

COURSE OUTCOME:

After successfully completing the course, the students will be able to

CO1: Know the concepts of data structure, data type and abstract data type (ADT).

CO2: Comprehend algorithms and determine their time complexity.
CO3: Implement linked data structure to solve various problems.
CO4: Analyze various data structures such as arrays, stacks, queues, trees and graphs to solve various computing problems.
CO5: Evaluate the utilities of standard algorithms for searching and Sorting.
CO6: Analyze the data structure that efficiently models the solution to a problem.

COURSE CONTENT

Introduction: Basic Concepts of Data Structures, Memory Allocation, Notationsandanalysis, Abstract Data Types, Dynamically Allocated Arrays, Two-Dimensional Arrays, Address Calculation, and Sparse Matrix in array.
Linked Lists, Stacks, and Queues: Singly Linked Lists and Chains, Representing Chains in C, Polynomials, Doubly Linked Lists, Circular & Header Linked Lists. Stacks: Stacks using Dynamic Arrays and Linked Lists. Queues: Queues using Dynamic Arrays and Linked Lists, Deque,Circular Queues using Dynamic Arrays and Linked Lists, Evaluation and conversion of Arithmetic Expressions.

Tree and Graph: ADT Binary Tree - Binary Trees, Binary Search Trees, Tree Traversals, AVL Trees, Concept of B-Trees, Graph ADT, Graph Operations - DFS, BFS.

Sorting and Searching: Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Bubble Sort, Selection Sort, Linear Search, Binary Search, Hashing – Hash Function.

Textbooks:

1. Data Structures, Schaum's OutLines, Seymour Lipschutz, TATA McGraw Hill
2. Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahani Anderson-Freed, Universities Press. Pearson, 2nd Edition

Reference Books:

1. Data Structures using C by Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein. Pearson, 1st Edition
2. Data Structures A Pseudocode Approach with C, 2nd Edition, Richard F. Gilberg, Behrouz Forouzan, CENGAGE Learning, India Edition
3. Data Structures Using C, Second Edition, Reema Thereja, Oxford University Press
4. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson Education, 2nd Edition.

ANALOG AND DIGITAL ELECTRONICS CIRCUIT

Course Code : EE20007
Credit :3
L-T-P :3-0-0
Prerequisite : Basic Electronics (EC10001)

COURSE OBJECTIVES

The course gives an introduction to analysis of elementary analog and digital circuits. This course is intended to develop an understanding power amplifiers, tuned amplifiers and behavior of noise in an amplifier and their applications. It also provides the basic knowledge of digital logic levels to understand digital electronics circuits including Boolean algebra, logic gates, combinational logic, sequential logic concepts and their applications.

COURSE OUTCOMES

After successfully completing the course, the students will be able to

CO1: Understand different applications of P-N Junction diode.
CO2: Develop biasing circuits for BJT.
CO3: Apply Field Effect Transistor as an amplifier.
CO4: Analyze different power Amplifier circuit and different application of OP-AMP circuit.
CO5: Identify and understand various digital circuits.
CO6: Design basic combinational and sequential circuits.

COURSE CONTENT

Diode applications
Limiters, clippers, clampers, Zener diode applications: Voltage stabilizers.
Bipolar junction transistor
Analysis of transistor amplifier in CE configuration using BJT small signal model.
Field Effect Transistors
JFET structure and characteristics, MOS structure and characteristics, MOS as a switch CMOS as an inverter.

Power Amplifier and Feedback circuit
Types of amplifier and their equivalent circuit (VA, CA, Trans conductance and Trans resistance amplifier), Class A, B amplifier, Concept and types of feedback topology, Analysis of practical feedback amplifiers, Barkhausen criterion, RC and LC phase shift oscillator(qualitative description), output frequency of the oscillator.

Operational Amplifier
OP-AMP as differentiator and integrator circuit, OP-AMP as comparator, square wave generator using OP-AMP, Schmitt trigger, 555 timer.

Introduction to Digital Circuits
Logic Gates preview
Boolean Algebra:Logic operations**,** Axioms and Laws of Boolean Algebra, Duality, Reducing Boolean Expressions, Boolean Functions and their representation, Expansion of a Boolean Expression in SOP form and POS form.
Minimization of Switching Functions: Introduction, Two-variable K-Map, Three-variable K-Map, Four Variable K-Map, Don't care Combinations.

Combinational Logic Design: Introduction, Adders, Subtractors, Encoders, Decoders,Priority Encoder, Multiplexer, Demultiplexer.

Sequential Logic Design
Flip Flops: Latches and Flip Flops, Race Around Condition, Master Slave (Pulse-Triggered) Flip Flops, Flip Flop Excitation tables, Shift Registers and Counters

ADC and DAC
Introduction, Digital to Analog converter (Weighted Resistor type and R-2R ladder type), Analog to Digital converter (Flash type, Counter type and Successive approximation type).

Textbooks:

1. Integrated Electronics- Analog and Digital Circuits and Systems, J. Millman&Halkias, C.D. Parikh, Mc-Graw Hill India, 2nd Edition, 2013 (10th Reprint).
2. Op-Amps and Linear Integrated Circuits - Ramakant A. Gayakward , Pearson, 4th Edition, May 2015.
3. Digital Logic and Computer Design – M. Morris Mano – PHI, 2011
4. Fundamentals of Digital Logic – Anand Kumar - PHI, 4th Edition, 2017

Reference Books:

1. Digital Principles and Applications – Malvino & Leach –TMH, 7th edition, 2011
2. Digital Fundamentals – T. L. Floyd & Jain – Pearson Education, 10th edition, 2011
3. Microelectronics circuits- A. S. Sedra and K. C. Smith- 5th Edition, 2011 - Oxford University Press.
4. Linear Integrated Circuits - D. Roy Choudhury and Shail B. Jain- 5th Edition- New Age International Publishers, 2018.
5. Foundations Of Analog and Digital Electronic Circuits:-Anant Agarwal, Elsevier India (2013)

VECTORS, DIFFERENTIAL EQUATIONS AND COMPLEX ANALYSIS

Course Code : MA21006
Credit :4
L-T-P :3-1-0
Prerequisite :Differential Equations and Linear Algebra (MA11001) and Transform Calculus and Numerical Analysis (MA11002)

COURSE OBJECTIVE

The objective of this course is to empower the students to design and solve branch prospective problems by the use of Vector calculus, partial differential equations, Complex variables.

COURSE OUTCOMES

After successfully completing the course, the students will be able to

CO1: understand the physical significance of the concepts like divergence, curl and gradient.
CO2: apply vector integration theorems like Gauss divergence, Stokes and Greens theorem in different engineering applications like work done by force, evaluation of flux etc.
CO3: know the basic analytical techniques for solving the classical wave, heat and Laplace equation
CO4: know the concepts of analytic functions, its differentiation and its series representation
CO5:understand the fundamental concepts of contour integration to evaluate complicated real integralsvia residue calculus
CO6: apply multi steps numerical methods to solve initial and boundary value problems

COURSE CONTENT

Vector Calculus

Brief concepts of vectors, gradient of a scalar field, directional derivatives, divergence and curlof a vector field. Vector line integral, surface integral, Green's theorem, Gauss divergence theorem, Stoke's theorem, engineering applications of above integral theorems like work done by force, flux integration, independence of path etc.

Partial Differential Equations(PDE)

Basic concepts of PDE like order, degree, linear, nonlinear, homogeneous and non-homogeneous PDE. Solution of PDE by Variable Separable method. Classification of PDE and their reduction to normal form. One dimensional Wave equation, D'Alembert and Fourier series solution of 1-D wave equation. Solution of 1-D heat equation by Fourier series method. Solution of 2-D Laplace equation and 2-D heat equations. (steady state) with different types of boundary conditions using Fourier series.Laplace equation in polar co-ordinate and its application to find the electrostatic potential/steady state temperature in a disk with appropriate boundary conditions. Solution of PDE by Laplace Transform.

Complex Analysis

Basic concepts of complex number. Complex functions, derivatives, analytic function, Cauchy Riemann equations, harmonic functions, harmonic conjugate, elementary functions like exponential, trigonometric, hyperbolic, logarithmic functions and general powers. Curves in complex plane and their parametric representation. Line integrals, Cauchy integral theorem, Cauchy integral formula, Derivatives of analytic function. Power series, Taylor's series, Maclaurin's series, Laurent's series, singularities, Residues, Residue Integration, Real Integralsand Cauchy's Principal Value integrals.

Numerical Solution of ODEs

Solution of Linear Difference Equations; IVP (Multi Steps Method): (Predictor-Corrector method) Adams-Bashforth Method, Adam-Moulton Method; BVP: Shooting methods.

Textbooks

1. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley, INC, 10th Edition.
2. Numerical Methods for Scientific and Engineering Computation by Jain , Iyenger and Jain,New age International (P) Ltd.,6th Edition.

Reference books:

1. Higher Engineering Mathematics by B.S.Grewal, Khanna Publishers,36thEdition.
2. Higher Engineering Mathematics by B.V. Ramana, TMH, 2017 Edition.
3. Advanced Engineering Mathematics by H. K. Dass, S. Chand, 2007 Edition

LINEAR CONTROL SYSTEM

Course Code : EE20004
Credit : 3
L-T-P : 3-0-0
Prerequisite : Network Theory(EE20001)

COURSE OBJECTIVE

To understand the control system model of physical systems, and to employ time domain and frequency domain analysis to determine the system stability, the steady state and transient response, also to realize the response of multi input and multi output system.

COURSE OUTCOMES

After successfully completing the course, the students will be able to

CO1: Illustrate different terminology of control system.
CO2: Develop the mathematical model of physical systems.
CO3: Analyze the time domain response of different systems.
CO4: Evaluate the stability of a system by classical methods.
CO5: Analyze frequency domain response of different linear dynamic system.
CO6: Understand the state space modeling and different types of compensators.

COURSE CONTENT

Introduction

Basic concept of control system: open loop and closed loop control system, differential equations and transfer function, Effect of feedback on gain, stability, sensitivity and noise of the system, order and type of the system.

Modeling of physical system

Mathematical modeling of mechanical system and electrical system, Analogous system, Translational and rotational mechanical system, Transfer function by block diagram reduction technique, Developing block diagram from a mathematical model, Signal flow graph terminology, construction & procedure, Transfer function from signal flow graph using Mason's gain formula, Time delay control system.

Time domain analysis

Time response of first order system, Response to the unit step input, unit ramp input, Time response of second order system for unit step input, Time response specification, steady state error & design specification, Error constant of second order system, Minimization of Errors through P, PI and PID controllers.

Concept of stability

The concept of stability, necessary condition for stability, Routh- Hurwitz stability criterion, Relative-stabilityanalysis.

Root Locus Technique

Root locus concept, construction of root locus, construction rules, Determination of gain from root locus.

Frequency domain analysis

Introduction, Polar plots, Bode plots, Nyquist stability criterion, Stability analysis.

Compensators

Realization of basic compensators, Cascade compensation and Feedback compensation.

State Space
Concept of state, State variable, State model, State space model for LTI system, Computation of State transition matrix.

Textbooks:

1. Control System Engineering by Noran S Nise, John Wiley Publication, 6th Edition, 2012.
2. Modern Control Engineering by K. Ogata PHI publication, 5th Edition, 2010.

Reference Books:

1. Control Systems Engineering by R. Anandnatarajan and P. Ramesh Babu, SCITECH,4th edition, 2016.
2. Control Systems: Theory and applications by Smarajit Ghosh, Pearson. Publication 2012
3. Automatic control system by Hasan Saeed, 6th revised edition 2008, S.K. Kataria and Sons.
4. Modern Control Engineering. By D. Roy Choudhury PHI publication, 5th Edition,2009.
5. Automatic Control Systems by Benjamin C. Kuo, Prentice-Hall,7th Edition,2009.
6. Control System Engg, by I. J. Nagrath and M Gopal ,New age international publication, 4th Edition,2011.
7. Control System by D N Manik, Cengage Learning India Pvt, 2012.
8. Automatic control systems by Prof. B.S. Manke and S. N. Verma , Khanna publication, 2012

COMPUTER ORGANIZATION

Course code: ES20002

Credit: 3

L-T-P: 3-0-0

Prerequisite: NIL

COURSE OBJECTIVE

This course provides a foundational understanding of computer architecture and organization, covering key topics such as computer structure, machine instructions, processor and memory organization, and I/O systems. It explores architectures like Von-Neumann and Harvard, memory hierarchies, and CISC vs. RISC designs. Students will gain the skills to analyze and optimize computer systems for various applications.

COURSE OUTCOMES

After successfully completing the course, the students will be able to

CO1: Recognize the components of a computer and various computer architectures.

CO2: Explain instruction formats and various addressing modes.

CO3: Demonstrate the working of control units and address sequencing in practical scenarios.

CO4: Differentiate between memory types and evaluate their performance.

CO5: Assess the performance of various I/O techniques in improving system efficiency.

CO6: Design a basic processor or memory architecture incorporating bus systems and control units for specific applications.

COURSE CONTENT

Structure of computers

Computer types, Functional units, Basic operational concepts, Von- Neumann Architecture and Harvard Architecture, Bus structures and types, Computer performance

Machine instructions and programs

Instruction codes, Computer Registers (GPR and SPR), Instruction cycle, Timing and Control, Instruction Formats, Addressing Modes, Types of instructions, Stack organization, sub-routine, Complex Instruction Set Computer (CISC) Reduced Instruction Set Computer (RISC), CISC vs RISC

Processor organization

Bus architecture- Single Bus, Multi bus, Common bus, Hardwired Control unit, Micro-programmed control unit- Control Memory, Address Sequencing, Micro-Program example, Design of Control Unit.

Memory organization

Memory Hierarchy, Semiconductor Memories, RAM(Random Access Memory), Read Only Memory (ROM), RAM and ROM Architecture, Cache Memory, Performance considerations, Virtual memory, Address translation techniques

Input output and multiprocessors

I/O interface, Programmed IO, Memory Mapped IO, Interrupt Driven IO, DMA, introduction to MP and MCA

Textbooks

1. Carl Hamacher, Zvonks Vranesic, SafeaZaky (2002), Computer Organization, 5th edition, McGraw Hill, New Delhi, India.

Reference books

1. M. Moris Mano (2006), Computer System Architecture, 3rd edition, Pearson/PHI, India.
2. William Stallings (2010), Computer Organization and Architecture- designing for performance, 8th edition, Prentice Hall, New Jersy.
3. Anrew S. Tanenbaum (2006), Structured Computer Organization, 5th edition, Pearson Education Inc,
4. John P. Hayes (1998), Computer Architecture and Organization, 3rd edition, Tata McGrawHill

INTRODUCTION TO DATABASE MANAGEMENT SYSTEM

Course Code: ES20004
Credit: 3
L-T-P: 3-0-0
Prerequisite: Data Structure and Algorithm (ES20001).

OBJECTIVES

This course aims at enabling the students to grasp the concepts of database schemas, structured queries, relational algebra, normalization so that the learners can deal with SQL and creation of databases.

COURSE OUTCOMES

After successfully completing the course, the students will be able to

CO1: Understand Database concepts and Query languages.

CO2: Comprehend the utility of the ER diagram.
CO3: Apply the normalization to build schemas for DBMS.
CO4: Analyze the efficacy of the concepts of SQL in DBMS.
CO5: Evaluate the benefits of functional dependencies in DBMS.
CO6: Design a Database to incorporate transactions and recovery.

COURSE CONTENT

Fundamental of Database Management Systems and Entity Relationship Model
Introduction to Database and Database Users, Database System Concepts and Architecture: data Models, schema, and instances, Conceptual Modeling and Database Design: Entity Relationship (ER) Model: Entity Types, Entity Sets, Attributes, Keys, Relationship Types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, ER Naming Conventions. Enhanced Entity-Relationship (EER) Model.

Functional Dependencies and Normalization
Database Design Theory and Normalization: Functional Dependencies, Theory of Dependencies-Functional Dependency, Armstrong's axioms, closure of a set and minimal covers; Normal Forms based on Primary Keys, Second and third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form.

Relational Data Model and SQL
Relational Model Concepts, Basic SQLs, SQL Data Definition and Data types, Constraints in SQL, Retrieval Queries in SQL, INSERT, DELETE, UPDATE Statements in SQL, Relational Algebra and Relational Calculus: Unary Relational Operations: SELECT and PROJECT, Binary Relation: JOIN and DIVISION.

Introduction to Transaction and Recovery
Introduction to Transaction Processing Concepts and Theory: Introduction to Transaction Processing, Transaction and System Concepts, Properties of Transactions, Recoverability, Serializability, Concurrency Control Techniques, Locking techniques for Concurrency Control, Concurrency Control based on Time-Stamp Ordering.

Textbooks:
1. Fundamentals of Database system by R. Elmasari & SB Navathe, 7th Edition, 2018, Pearson Education
2. Database System Concepts by A. Silberschatz, HF Korth & S. Sudarshan, 7th Edition, 2019, Mc Graw-Hill Education.

Reference books:
1. Database Management Systems by R. RamKrishna & J. Gehrke, 3rd Edition, 2018, Mc-Graw-Hill Education.
2. Database System concepts by P. Rob & CM Coronel, Indian Edition, 2011, Cengage Learning
3. Fundamentals of Relational Database Management Systems by S. Sumathi & S. Esakkirajan, 2007, Springer.

Reference: Syllabus of Database Management Systems of Massachusetts Institute of Technology, US
https://ocw.mit.edu/courses/6-830-database-systems-fall-2010/pages/syllabus/

INDUSTRY 4.0 TECHNOLOGIES

Course Code : EX20001
Credits : 2
L-T-P : 2-0-0
Pre-requisites :Nil

COURSE OBJECTIVES
The current manufacturing industries and businesses are moving from the third industrial revolution of the computers and automation the fourth where the automation becomes even

smarter fueled by data analytic and artificial intelligence. This course is designed to offer learners an introduction to use of Internet and digital technology for better manufacturing and business. Learners will gain deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges.

COURSE OUTCOMES

After successfully completing the course, the students will be able to

CO1: Understand the key components and enablers of Industry 4.0Technology
CO2: Appreciate the smartness in Smart Factories,smart products and smart Services.
CO3: Outline Smart Factory technologies and their role in an Industry 4.0 world
CO4: Outline IoT technology and scope of implementing IoT in Industries and businesses.
CO5: Comprehend distributed cyber-physical and digital manufacturing system
CO6: Demonstrate the opportunities, challenges brought about by Industry 4.0 and how organizations and individuals should prepare to reap the benefits

COURSE CONTENT

Introduction

The Fourth Industrial Revolution, Difference between conventional automation and Industry 4.0, Case Studies: Health, Agriculture, Manufacturing

Industry 4.0 and its components

Internet of Things(IoT) and Industrial Internet of Things(IoT), Internet of Services, Value chains in manufacturing companies, Digital Twins

Digital Manufacturing and Design:

Cyber Physical Systemsand Next Generation sensors, Collaborative Platform and Product Life-cycle Management, Robotics and Automation

Industrial IoT

Cloud Computing, Big-Data Analytic, AI&ML, Virtual and Augmented Reality, Block-chain

Challenges & Opportunities inIndustry4.0

A Digital Strategy alongside Resource Scarcity, Standards and Data security, Financing conditions, availability of skilled workers, Comprehensive broad-band infra-structure, Legal framework, protection of corporate data, liability, handling personal data.

Textbooks:

1. D. Pyo, J. Hwang, and Y.Yoon, Tech Trends of the 4th Industrial Revolution, Mercury Learning &Information publisher, 2021.
2. BrunoS. Sergi, Elena G. Popkova, Aleksei V.Bogoviz, and Tatiana N.LitvinovaUnderstanding Industry4.0: AI, theInternet of Things, and the Future of Work, Pub: Emerald Publishing Limited, 2019

Reference Books:

1. S.Misra,A. Mukherjee,and A.RoyIntroductiontoIoT. CambridgeUniversity Press, 1stedn. 2021
2. Dac-Nhuong Le, Chung Van Le, Jolanda G. Tromp , Gia Nhu Nguyen, Emerging Technologies for Health and Medicine: Virtual Reality, Augmented Reality, Artificial Intelligence, Internet of Things, Robotics, Industry 4.0, John Wiley publisher, 2018
3. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, Apress Berkeley publisher, CA 1st

ELECTRICAL MACHINES LABORATORY

Course Code :EE 29002
Credit :1

L-T-P :0-0-2
Prerequisite(s) : Engineering Laboratory (EX19001)

COURSE OBJECTIVE

The main objective of the Electrical machines laboratory is to provide the practical exposure to the student regarding operation of various electrical machines like DC generators, DC Motors, Alternators, Synchronous motors, Induction Motors, Special Motors and Transformers. Students are allowed to conduct various experiments for the validation of performance characteristics of all the machines. From this laboratory courses student will gain the skill to select correct machine for a specific application.

COURSE OUTCOMES

After successfully completing the course, the students will be able to

CO 1: Memorize the working principle and applications of different electrical machines.
CO 2: Understand the challenges in industrial applications of electric motors.
CO 3: Utilize different electrical machines.
CO 4:Analyse different electrical machine according to the requirement in the industrial applications.
CO 5: Assess the safety precautions to be taken while using electrical equipment.
CO 6: Design the equivalent circuit of the transformer and construct the circle diagram of an induction motor.

COURSE CONTENT

Topics:

- No Load and Load Characteristics of a (i) D.C Shunt Generator and (ii) Separately Excited Generator.
- Design of the equivalent circuit by using the open circuit and short circuit test on a single phase Transformer.
- Determination of the voltage regulation of a three phase alternator using the Open circuit and short circuit test.
- Design of the circle diagram using the No load and Block rotor test on three phase induction motor.
- Speed control of D C Motor by using the different Methods.
- Connection of three single Phase transformers in star-star, star-delta, delta-star, delta-delta and open delta.
- Testing of a D C motor to find the different parameters and to draw the performance characteristics.
- Draw the V curve and inverted V curve of a three phase synchronous motor.
- Draw the performance characteristics of a single phase induction motor by using the different tests.

Textbook(s)

1. Electrical Machinery, P. S Bimbhra, 7th Edition, Khanna Publishers, 2008.
2. Electrical Machines, by P. K. Mukherjee and S. Chakravorti, Dhanpat rai Publication, 18th reprint 2013

Reference Book(s)

1. Electrical Machines, Ashfaq Hussain, Dhanpat Rai, Delhi, 2nd Edition, 2008.
2. Electrical Technology, Volume -II. B. L. Theraja, S .Chand Publications. 2010.
3. Electric Machines, C. I. Hubert, Pearson Education, 2003.
4. Electric Machines ,by Kothari. D P and I J Nagrath, 3rd Edn, Tata McGraw-Hill, New Delhi.

2004.

DATA STRUCTURE AND ALGORITHMS LABORATORY

Course Code :ES29001
Credit :1
L-T-P :0-0-2
Prerequisite(s) : Programming Laboratory (CS13001)

COURSE OBJECTIVE

This course demonstrates familiarity with major algorithms and data structures and analyzes performance of algorithms. It is used to choose the appropriate data structure and algorithm design method for a specified application and determine which algorithm or data structure to use in different scenarios.

COURSE OUTCOMES

After successfully completing the course, the students will be able to

CO 1: Apply the algorithm for problem solving.
CO2: Identify Data Structure to develop program for real time application.
CO 3: Implement linear data structures such as stacks using array and linked list.
CO 4: Implement linear data structures such as queues using array and linked list.
CO 5: Implement non-linear data structures such as trees, graphs.
CO 6: Devlope various kinds of searching, sorting and traversal techniques and know when to choose which technique.

COURSE CONTENT

Topics:

- Introduction (Structure,pointer,Dynamic memory allocation)
- Arrays
- Linked list
- Stacks
- Queues
- Trees
- Graph
- Sorting

Textbook(s):

1. Data Structures, Schaum's OutLines, Seymour Lipschutz, TATA McGraw Hill
2. Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahani Anderson-Freed, Universities Press. Pearson, 2nd Edition

Reference Book(s):

5. Data Structures using C by Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein. Pearson, 1st Edition
6. Data Structures A Pseudocode Approach with C, 2nd Edition, Richard F. Gilberg, Behrouz Forouzan, CENGAGE Learning, India Edition
7. Data Structures Using C, Second Edition, Reema Thereja, Oxford University Press
8. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson Education, 2nd Edition.

ANALOG AND DIGITAL CIRCUIT DESIGN LABORATORY

Course Code :EE29005
Credit :1
L-T-P :0-0-2
Prerequisite(s): Engineering Laboratory (EX19001)

COURSE OBJECTIVE

The main objective of the Analog and Digital electronics Laboratory is to learn and understand the basic concepts to design Schmitt trigger circuit, Active high pass & low pass filter with the help of variac, oscilloscope, function generator, DSO, multimeter etc. understand the concepts of digital electronics. Students will be able to design basic logic circuits using different gates (AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR); combinational circuits like adder, subtractor, decoder, multiplexer, demultiplexer; sequential circuits like synchronous counters, asynchronous counters, shift registers. From this laboratory course students will be able to analyze & design digital circuits for a specific application.

COURSE OUTCOMES

After successfully completing the course, the students will be able to

CO 1: Explain the digital circuits using Boolean algebra and K-maps.
CO 2: Execute different combinational circuits and Differentiating multiplexer and demultiplexer using logic gates.
CO3: Analyse line regulation and load regulation in a voltage regulator circuit using zener diode.
CO 4: Assess the conditions of oscillations in a RC phase shift oscillator and to design Schmitt trigger circuit.
CO 5: Checking the operation of synchronous & asynchronous counters using different flip-flops.
CO 6: Design different types of shift registers.

COURSE CONTENT

Topics:

- Determination of line & load regulation using Zener diode.
- Study of an RC phase shift oscillator and find its frequency of oscillation.
- Design of Schmitt trigger circuit, Active Low Pass & High Pass Filter using op-amp.
- Verification & implementation of different gates using universal gates.
- Realization of adder & subtractor circuits.
- Implementation of MUX & DEMUX using logic gates.
- Design of synchronous & asynchronous counters using flip-flops.
- Design of shift registers.

Textbook(s)

1. Fundamentals of Digital Circuits by A.Anand Kumar - PHI, 4th Edition, 2017.
2. Fundamentals of Electric Circuits 4th Edition, by Charles K. Alexander, Matthew N.O. Sadiku, Mcgraw-Hill, 2009.
3. Digital Logic and Computer Design by M. Morris Mano - PHI, 2011.

Reference Book(s)

1. Digital Fundamentals by T.L. Floyd & Jain -Pearson Education, 10th Edition, 2011.
2. Digital Principles and Applications by Malvino& Leach -TMH, 7th Edition, 2011.

DATABASE MANAGEMENT SYSTEM LABORATORY

Course Code :ES29002
Credit :1
L-T-P :0-0-2
Prerequisite(s) : Data Structure and Algorithms (ES20001)

COURSE OBJECTIVE

The main objective of Database Management System Lab is to make student aware of the knowledge of creation, updating, and maintenance of the database. This lab allows the students to understand the basic concepts of the database management system and apply those concepts in creating and maintaining the database for real-life problems. This lab intends to provide in- depth knowledge in DBMS using SQL commands with different types of integrity constraints. It also focuses on the security aspects of a database system along with a brief discussion on accessing and manipulating data using PL/SQL blocks.

COURSE OUTCOMES

After successfully completing the course, the students will be able to

- CO 1: Understand Oracle client/server Database Management System and its utilities.
- CO 2: Understand in-depth knowledge in database management using SQL commands with different types of integrity constraints.
- CO 3: Apply the knowledge of database security & authorization in order to access database for the different kinds of the user.
- CO 4: Evaluate the database applications related to set theory operations, join and subqueries.
- CO 5: Analyse the various methods to access and manipulate data using PL/SQL blocks.
- CO 6: Create new table, extract and maintain data base file of a system

COURSE CONTENT

Topics:

- SQL Fundamentals - Basic (DDL - DML - DCL) Statements and (DDL - DML - DQL - TCL) Statements.
- Built in functions in SQL
- Aggregate Functions
- Group by and Having Clause
- Set Theory Operations
- Join
- Subqueries
- Views and Sequences
- PL/SQL Basics, Introduction to Cursors in PL/SQL

Software Requirements

- Windows OS
- Oracle/My SQL/DB2/SQL Server

Textbooks:

1. Fundamentals of Database Systems, Elmsri & Navathe, 7th Edition

Reference Book(s):

1. **Database** System Concepts Seventh Edition. Avi Silberschatz · Henry F. Korth · S. Sudarshan. McGraw-Hill ISBN 9780078022159

CONTROL SYSTEM LABORATORY

Course Code :EE29004
Credit :1
L-T-P :0-0-2
Prerequisite(s) : Engineering Laboratory (EX19001)

COURSE OBJECTIVE

The main objective of the Control Systems laboratory is primarily used for teaching Control system basics and Design of controllers for different systems. The Control Systems Laboratory is equipped with different modules for DC position control, AC position Control, DC Motor Speed Control, Frequency Response Analysis, Time Response Analysis, Tunning of PID controller, Temperature Controller, Pressure Controller, Flow Rate Controller etc. From this laboratory courses student will gain the skill to evaluate the performance of PID controller with respect to changes in control parameters, study the effect of controllers on different electrical and mechnical systems, analyse the stability of designed controller & develop computer software programs for analysis of controllers.

COURSE OUTCOMES

After successfully completing the course, the students will be able to

CO 1:Remembers the modern software tools for feedback controllers.
CO 2:Understand the iterative nature of a successful controller design.
CO 3: Apply the theoretical concepts and computational tools while designing controllers.
CO 4:Analusethe characteristics obtained by by varying the input parameters in a SIMULINK environment
CO 5:Evaluate the electrical and mechanical parameters of a given system and to find the transfer function.
CO 6:Create new programs in MATLAB environment.

COURSE CONTENT

Topics:

- Time response analysis of linear system
- Tuning of PID controller or a First Order Process with Time Delay (FOPTD) Simulated System by Process Reaction Curve Method.
- Lead Compensator design
- Stability analysis using bode plot
- Stability analysis using root locus plot
- Design of Speed Controller for Armature controlled DC motor

Textbook(s):

3. Modern Control Engineering- By D. Roy Choudhury, PHI Publication, 5th Edition, 2009.
4. Control Systems- By Smarajit Ghosh, Pearson, Second Impression, 2013.

Reference Book(s):

2. Automatic Control System- By Hasan Saeed, Sixth Revised Edition, 2008

3. Modern Control Engineering- By K. Ogata, PHI publication, 5th edition 2010
4. Automatic Control Engineering- By B. C. Kuo , Prentice Hall, 7th edition 2009
5. Control System Engineering- By I. J. Nagrath and M. Gopal, New Age International Publication
6. Automatic control systems- By Prof. B.S. Manke &S.N.Verma ,Khanna publication, 2012.

ELECTRICAL SYSTEM MODELING USING MATLAB

Course Code : EE28002
Credit :1
L-T-P :0-0-2
Prerequisite(s):Nil

COURSE OBJECTIVE

This course is proposed as a Sessional to UG students with the aim of imparting basic understanding of Modeling and Simulation so that the students will find it easy to use this knowledge in profession for applying to various engineering systems and design.

COURSE OUTCOMES

After successfully completing the course, the students will be able to

CO1: Know the characteristic of half wave and full wave uncontrolled rectifier .
CO2: Understand the characteristic of half wave and full wave controlled rectifier .
CO3: Apply modeling techniques to Simulate the R-L and R-C circuit.
CO4: Analysethe methods of plotting of single phase and 3 phase sine wave.
CO5: Evaluate the simulated design of the PID controller.
CO6: Design a circuit to Plot I-V & P-V Characteristic of a PV cell.

COURSE CONTENT

Topics:

- Simulation of single phase half wave uncontrolled rectifier with R & R-L load.
- Simulation of single phase full wave uncontrolled rectifier with R & R-L load.
- Simulation of Single Phase Half Wave Controlled Rectifier with R &R-L Load
- Simulation of Single Phase Full Wave Controlled Rectifier with R &R-L Load
- DC transient analysis of R-L and R-C series circuit in Matlab-Simulink.
- Simulation of PID Controller
- MatlabProgramming plot a 1-ph and 3-ph sine wave in MATLAB.
- Modelling and simulation of DC shunt motor.
- I-V Characteristic of PV system
- P-V Characteristic of PV system.

Textbook(s):

1. Getting started with MATLAB by Rudra Pratap.

Reference Book(s):

1. Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers by Rudra Pratap.
2. MATLAB: An Introduction with Applications by Amos Gilat.