Department of Electrical and Electronics Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500075

VISION and MISSION of the Institute

Vision

To be a centre of excellence in technical education and research

Mission

To address the emerging needs through quality technical education and advanced research

Quality Policy

Chaitanya Bharathi Institute of Technology imparts value based technical education and training to meet the requirements of student, industry, trade/profession, research, and development organizations for self-sustained growth of society.

VISION and MISSION of the Department

Vision

To achieve Academic and Professional Excellence in Teaching and Research in the frontier areas of Electrical and Electronics Engineering Vis-a -Vis serve as a Valuable Resource for Industry and Society.

Mission

Empowering the Faculty and Student Rendezvous to Nurture Interest for Conceptual Keystone, Applied Multidisciplinary Research, Inspiring Leadership and Efficacious Entrepreneurship culture, Impeccable Innovation in frontier areas to be synergetic with Environmental, Societal and Technological Developments of the National and International community for Universal Intimacy.

M1: Emphasis on providing Strong Theoretical Foundation & Engineering Leadership Eminence, infusion of Creativity and Management skill while maintaining Ethics and Moral for Sustainable Development. **(Individual development)**

M2: Enable the Faculty and Student Interactions to trigger interest for Applied Multidisciplinary Research and Entrepreneurship Culture resulting in Significant Advancement of the field of Specialization with Involvement of Industries and Collaborative Educational Networks. **(Sense of Ownership, Networking and Eco system Development)**

M3: Extend the Conducive Neighborhoods for Innovation in frontier areas to keep pace with Environmental, Societal and Technological Developments of the National and International Community to Serve Humanity. **(Service to Society, Atmanirbhar Bharat)**

Program Educational Objectives (PEOs)

PEO 1- Graduates will Ennoble in offering Design solutions for Complex Engineering Problems using appropriate modern Software tools, with the specified need of the Industry and Protagonist in transforming the Society into a Knowledge Society.

PEO 2- Graduates will Elevate Engineering Leadership and will be recognized as Experts working in Government, Consulting firms, international organizations with their Creativity in Design of Experiments, Analysis and Interpretation of Data and Synthesis of Information.

PEO 3- Graduates will Exalt in their Professional career by Persistence in Teamwork, Ethical behavior, Proactive involvement, and Effective Communication.

PEO 4- Graduate will Excel by becoming Research, Professors and Entrepreneurs who will create and disseminate new knowledge in the frontier areas of Engineering, Technology and Management

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Evaluate complex Engineering Problems to meet the distinct need of Industry & Society, by utilizing knowledge of Mathematics, Science, Emerging Technologies such as AI, Block chain & IT tools.

PSO 2: Exhibit Latent talent in understanding the Engineering and Administration standards at workplace as a team leader to manage Projects in the Multi-Disciplinary Environments.

PSO 3: Establish Engineering Expertise in Power system, Machines and Drives Systems and also Pursue Research in the Frontier areas such as embedded systems, Renewable Energy, E- Mobility and Smart grid.

ADDITIONAL MINOR ENGINEERING

The Electrical and Electronics Engineering department is offering "**Additional Minor Engineering"** degree under the following rules and eligibility criteria.
Students, who have taken admission on or after 2018-19 academic years, will be eligible to get Undergraduate Degree with "Additional Minor Engineering", if he/she earns an **additional 18 credits** through **MOOCs/NPTEL/an**y other on-line courses apart from 160 academic credits.

INSTRUCTIONS FOR MINOR ENGINEERING DEGREE:

1. For Additional Minor Engineering, a student has to earn at least eighteen (18) Additional credits from professional courses.
2. A Student can choose the courses which were not studied earlier in the previous semester. Further the courses should not be present in the curriculum of the forthcoming semesters.
3. For "Additional Minor Engineering", a student must earn additional credits from **other than their own branch/ discipline** of study only.
4. Credits for the 4-week course is-1, for 8 weeks course is-2, for 12 weeks course is-3.
5. A student must ensure that he/she earns these additional credits before the completion of the regular course.
6. It is the student's responsibility for registering for the courses ONLINE and the required registration fee shall be borne by the respective student.
7. Students must register for the courses with the **approval of the Head of the Department.**
8. A student is eligible to opt either for "Honors" or "Additional Minor Engineering", not eligible for both.
9. Eligibility for admission to the Additional Minor Degree program (R22A) is based on the BE/B.Tech First Year CGPA, which must be 7.0 or above.

With effect from AY 2024-25

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
SCHEME OF INSTRUCTION AND EXAMINATION

B.E/B.Tech Additional Minor Electrical Engineering under AICTE Model Curriculum

List of Courses

Sno	Course code	Title of the course	Credits	Weeks
1.	24EEM01	Control engineering	3	12 weeks
2.	24EEM02	Power Electronics	3	12 weeks
3.	24EEM03	Network Analysis	3	12 weeks
4.	24EEM04	Power System Engineering	3	12 weeks
5.	24EEM05	Analog Electronic Circuits	3	12 weeks
6.	24EEM06	Basic Electronics	3	12 weeks
7.	24EEM07	Digital Electronic Circuits	3	12 weeks
8.	24EEM08	Matlab Programming for Numerical Computation	3	12 weeks
9.	24EEM09	Sensors and actuators	3	12 weeks
10.	24EEM10	Signals and Systems	3	12 weeks
1.1	24EEM11	Industrial Automation and Control	3	12 weeks
12.	24EEM12	FACTS Devices	2	8 weeks
13.	24EEM13	Introduction to Robotics	3	12 weeks
14.	24EEM14	Fundamentals of Electric Vehicles: Technology & Economics	3	12 weels
15.	24EEM15	Electric Vehicles- Part1	1	4 weeks
16.	24EEM16	Electric Machines-1	3	12 weeks

With effect from AY 2024-25

24EEM01

CONTROL ENGINEERING

Course Duration	12 weeks
Duration of SEE	3 Hours
SEE	75 Marks
CIE	25 Marks
Credits	3

UNIT -I
Mathematical Modelling of Systems, Laplace Transforms, transfer functions, block diagram representation

UNIT -II
Block diagram reduction, Time response characteristics. Introduction to stability, Routh Hurwitz stability criterion. Root locus plots, stability margins.

UNIT -III
Frequency response analysis: Nyquist stability criterion, Bode plots and stability margins in frequency domain. Basics of control design, the proportional, derivative, and integral actions.

UNIT -IV
Design using Root Locus, Design using Bode plots.

UNIT -V
Effects of zeros, minimum and non-minimum phase systems. State space analysis, Design using State space

Text Books:

1. Norman S. Nise, "Control Systems Engineering", 6th edition, Wiley.
2. Katsuhiko Ogata, "Modern Control Engineering", Pearson Education Inc.

Suggested Reading:

1. Richard C. Dorf, Robert H. Bishop, "Modern Control Systems", 12th Edition
2. Farid Golnaraghi and Benjamin C Kuo, "Automatic Control Systems", 9th Edition, John Wiley, and Sons
3. Karl Astrom and Richard M. Murray, "Feedback Systems: An Introduction for Scientists and Engineers".

Suggested NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Control Engineering https://onlinecourses.nptel.ac.in/noc21_ee67/preview	Prof. Ramkrishna Pasumarthy	IIT Madras
Other Online Resources:			
1	http://www.cds.caltech.edu/~murray/books/AM05/pdf/am08-complete_22Feb09.pdf) MATLAB Tutorial		

With effect from AY 2024-25

24EEM02

POWER ELECTRONICS

Course Duration	12 weeks
Duration of SEE	3 Hours
SEE	75 Marks
CIE	25 Marks
Credits	3

UNIT -I
Introduction to power electronics, power devices: diodes, SCR, GTO, BJT, MOSFET, TRAIC and IGBT

UNIT -II
Single phase uncontrolled and controlled rectifiers, numerical on single phase rectifiers, three phase rectifiers.

UNIT -III
Dual convertor and communication overlap, introduction to AC- AC convertors, Single phase and three phase AC voltage controllers, cycloconverters

UNIT -IV
Introduction, Classification, Principle and Operation, Control strategies, Chopper configurations, Thyristor chopper circuits, Jones chopper, Morgan chopper, AC (Multiphase) chopper, Cuk converter.

UNIT -V
Introduction, voltage source inverter, PWM techniques, SPWM and SVM, current source inverters

Text Books:

1. John G. Kassakian, Martin F. Schlecht and George C. Verghese, "Principles of Power Electronics," Pearson, 2010.
2. P. Wood, Switching Power Converters, New York: Van Nostrand Reinhold Inc., 1981.
3. Ned Mohan, T. Undeland, and W. Riobbins, “Power Electronics: Converters, Applications and Design,” Wiley-India, 2011.
4. J. W. Motto, “Introduction to solid state power electronics” POWEREX Semiconductor Division, 1977
5. R.W. Erickson and D. Maksimovic, “Fundamentals of Power Electronics”, Springer, 2001.
6. S. B. Dewan and A. Straughen, "Power Semiconductor Circuits", Wiley, 1975.
7. J. Vithayathil, "Power Electronics: Principles and Application", McGraw-Hill Series, International Edition, 1995.
8. S. Sedra and K. C. Smith, "Microelectronic Circuits", Oxford University Press, Fifth Edition, 1998.

Suggested NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Power Electronics https://archive.nptel.ac.in/courses/108/102/108102145/	Prof. G. Bhuvaneshwari	IIT Delhi

With effect from AY 2024-25

24EEM03

NETWORK ANALYSIS

Course Duration	12 weeks
Duration of SEE	3 Hours
SEE	75 Marks
CIE	25 Marks
Credits	3

UNIT -I

Introduction to Network, circuit elements & sources. KVL & KCL, Solution of linear differential equation with different excitation.

UNIT -II

Deeper look into energy storing elements: inductor and capacitor, Ideal and practical voltage & current sources.

UNIT -III

Mesh and nodal analysis of networks. Transforming voltage to current source and vicr-versa. Thevenin / Norton's equivalent circuit.

UNIT -IV

Tellegen Theorem and its implication. Theory of reciprocity. Network function. Two-port network: Z-parameters, Y-parameters, h-parameters & ABCD parameters.

UNIT -V

Definition of graph & tree of a network. Cut-set matrix. [A], [B] & [Q] matrices : Relationship among them Tutorial-1 & Tutorial-2

Text Books:

1. M. E. Van Valkenburg, "Network Analysis", 3 rd Edition, Prentice Hall, 2015.
2. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits",6th Edition, McGraw Hill Education, 2019.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", 8th Edition, McGraw Hill Education, 2013.
4. D. RoyChoudhury, "Networks and Systems", 2 nd Edition, New Age International, 2010. 14

Suggested Reading:

1. Robert L. Boylestad, ", Introductory Circuit Analysis", 13th Edition, Pearson Education, 2011.
2. Sudhakar and Syammohan, "Circuits& Networks", 5th Edition, Tata McGraw Hill Education, 2017.
3. Asfaq Hussain, "Networks and Systems", 2nd Edition, Khanna Publishing House, 2021

Suggested NPTEL/SWAYAM Course

S.No.	NPTEL Course Name	Instructor	Host Institute
1	Network analysis https://onlinecourses.nptel.ac.in/noc22_ee07/preview	Prof. Tapas Kumar Bhattacharya	IIT Kharagpur

With effect from AY 2024-25

24EEM04

POWER SYSTEM ENGINEERING

Course Duration	12 weeks
Duration of SEE	3 Hours
SEE	75 Marks
CIE	25 Marks
Credits	3

UNIT -I
Overhead Line Insulators, Underground Cables

UNIT -II
Transient Overvoltage's and Insulation Coordination, Corona

UNIT -III
Sag and Tension, Distribution System Load Flow and Voltage Stability

UNIT -IV
Approximate Method of Distribution System Analysis, Application of Capacitors for Radial Distribution Systems Load Frequency Control

UNIT -V
Load Frequency Control, Unit commitment –I, Unit Commitment -II

Text Books:

1. Debapriya Das, "Electrical Power Systems", New Age International.
2. Hadi Saadat, "Power System Analysis", McGraw Hill.
3. Turan Gonen, "Electric Power Transmission System Engineering Analysis and Design", Wiley-Inter science.

Suggested NPTEL/SWAYAM Course:

S.No.	NPTEL Course Name	Instructor	Host Institute
1	Power System Engineering https://onlinecourses.nptel.ac.in/noc20_ee39/preview	Prof. Debapriya Das	IIT Kharagpur

With effect from AY 2024-25

24EEM05

ANALOG ELECTRONIC CIRCUITS

Course Duration	12 weeks
Duration of SEE	3 Hours
SEE	75 Marks
CIE	25 Marks
Credits	3

UNIT -I

Nonlinear-circuit analysis using incremental networks, Characteristics of an amplifying nonlinear device; the MOSFET, the common-source amplifier: gain and swing limits.

UNIT -II

Robust biasing of transistor amplifiers, the incremental VCVS and VCCS using negative feedback, the incremental CCVS and CCCS using negative feedback

UNIT -III

The PMOS transistor, active load and CMOS inverter, the differential pair and common-mode rejection ration

UNIT -IV

The basic two-stage opamp; parasitic capacitances in MOS transistors, multi-stage amplifiers in a feedback loop: stability and phase margin

UNIT -V

Dominant pole compensation of a two-stage opamp, the Miller effect, Introduction to BJTs and BJT-based circuits

Text Books:

1. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 11th Edition, PHI, 2015.
2. Gayakwad R.A. “Op-Amps and Linear Integrated Circuits”, 4th Edition, PHI, 2015.
3. Roy Choudhury, Shail B. Jain, “Linear Integrated Circuits”, 4th Edition, New Age Intern. (P) Ltd., 2002.
4. Malvino Albert Paul, “Electronic Principles”, 7th Edition, Tata McGraw Hill, 2006.
5. J. V. Wait, L. P. Huelsman and G. A. Korn, “Introduction to Operational Amplifier theory and applications”, 2nd Edition, McGraw Hill U. S., 2013.

Suggested NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Analog Electronics https://onlinecourses.nptel.ac.in/noc23_ee77/preview	Prof. Shanthi Pavan	IIT Madras

With effect from AY 2024-25

24EEM06

BASIC ELECTRONICS

Course Duration	12 weeks
Duration of SEE	3 Hours
SEE	75 Marks
CIE	25 Marks
Credits	3

UNIT -1

A brief history of electronics, Superposition, Useful circuit techniques-1,: Useful circuit techniques-2, Phasors-1, Phasors-2, RC/RL circuits in time domain-1,RC/RL circuits in time domain-2,RC/RL circuits in time domain-3,RC/RL circuits in time domain-4,RC/RL circuits in time domain-5,Simulation of RC circuit, Lecture 13 : Diode circuits-1, Diode circuits-2,Diode circuits-3,Diode circuits-4, Diode circuits-5,: Diode circuits-6, Lecture 19 : Diode rectifiers-1, Diode rectifiers-2, Diode rectifiers-3, Bipolar Junction Transistor-1, Bipolar Junction Transistor-2, Bipolar Junction Transistor-3

UNIT -II

BJT amplifier-1, BJT amplifier-2, BJT amplifier-3, BJT amplifier-4, BJT amplifier-5, BJT amplifier-6, BJT amplifier-7, Introduction to op-amps, Op-amp circuits-1, Op-amp circuits-2, Op-amp circuits-3, Difference amplifier, Instrumentation amplifier-1.

UNIT -III

Instrumentation amplifier-2, Op-amp nonidealities-1, Op-amp nonidealities-2, Bode plots-1, Bode plots-2, Bode plots-3, Op-amp filters, Simulation of op-amp filter, Precision rectifiers-1, Precision rectifiers-2, Precision rectifiers-3, Simulation of triangle-to-sine converter,

UNIT -IV

Schmitt triggers-1, Schmitt triggers-2,: Schmitt triggers-3, Sinusoidal oscillators-1,Sinusoidal oscillators-2, Introduction to digital circuits, Boolean algebra, Karnaugh maps, Combinatorial circuits-1, Combinatorial circuits-2, Combinatorial circuits-3,Introduction to sequential circuits.

UNIT -V

Latch and flip-flop, JK flip-flop, D flip-flop, Shift registers, Counters-1, Counters-2, Simulation of a synchronous counter, 555 timer, Digital-to-analog conversion-1, Digital-to-analog conversion-2, Analog-to-digital conversion

Text Books:

1. J. Millman and A. Grabel, "Digital and analog circuits and systems," Wiley Eastern, 1987.
2. A.S. Sedra and K. C. Smith, "Microelectronic Circuits: Theory and Applications", Oxford University Press, 2014.

Suggested NPTEL/SWAYAM Course:

S.No.	NPTEL Course Name	Instructor	Host Institute
1	Basic Electronics https://onlinecourses.nptel.ac.in/noc23_ee62/preview	Prof. M.B. Patil	IIT Bombay

With effect from AY 2024-25

24EEM07

DIGITAL ELECTRONIC CIRCUITS

Course Duration	12 weeks
Duration of SEE	3 Hours
SEE	75 Marks
CIE	25 Marks
Credits	3

UNIT -1

Introduction; Relation between switching and logic operation; Use of Diode and Transistor as switch; Concept of noise margin, fanout, propagation delay; TTL, Schottky TTL, Tristate; CMOS Logic, Interfacing TTL with CMOS,: Basic logic gates, Universality of NAND, NOR gates, AND-OR-Invert gates, Positive and Negative Logic; Boolean Algebra axioms and basic theorems; Standard and canonical representations of logic functions, Conversion between SOP and POS; Simplification of logic functions, Karnaugh Map, Don't Care Conditions

UNIT -II

Minimization using Entered Variable Map, Minimization using QM algorithm; Cost criteria, Minimization of multiple output functions; Static-0, Static-1 and Dynamic Hazards and their cover, Multiplexer; Demultiplexer / Decoder, BCD to 7-segment decoder driver; Encoder, Priority encoder; Parity, generator and checker.

UNIT -III

Number systems-binary, Signed binary, Octal, hexadecimal number; Binary arithmetic, One's and two's complements arithmetic; Codes, Code converters; Adder, Subtractor, BCD arithmetic, Carry look ahead adder; Magnitude comparator; ALU; Error detecting and correcting codes, Bistable latch, SR, D, JK, T Flip-Flop: level triggered, edge triggered, master – slave, Various representations of flip-flops; Analysis and synthesis of circuits that use flip-flop.

UNIT -IV

Register, Shift register, Universal shift register; Application of shift register: ring counter, Johnson counter, sequence generator and detector, serial adder; Linear feedback shift register, Up and down counter, Ripple (asynchronous) counters, Synchronous counters; Counter design using flip flops, Counter design with asynchronous reset or preset; Applications of counters.

UNIT -V

Design of synchronous sequential circuit using Mealy model and Moore model: state transition diagram, algorithm state machine (ASM) chart; State reduction technique, Digital to analog converters: weighted resistor/converter, binary ladder, converter, accuracy and resolution; Analog to digital converter, quantization and encoding, different types of conversion, accuracy and resolution, Memory organization and operation, Memory expansion; Memory cell; Different types of memory, ROM, PROM, PAL, PLA, CPLD, FPGA

Text Books:

1. Donald P. Leach, Albert P. Malvino and Goutam Saha, "Digital Principles & Applications 8e", McGraw Hill.
2. M. Morris Mano and Michael D. Ciletti, "Digital Design 5e", Pearson.
3. Thomas L Floyd, "Digital Fundamentals 9e", Pearson.
4. Taub and Shilling, "Digital Integrated Electronics", McGraw Hill.

Suggested NPTEL/SWAYAM Course

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Digital electronic circuits https://onlinecourses.nptel.ac.in/noc20_ee32/preview	Prof. Goutam Saha	IIT Kharagpur

With effect from AY 2024-25

24EEM08

MATLAB PROGRAMMING FOR NUMERICAL COMPUTATION

Course Duration	12 weeks
Duration of SEE	3 Hours
SEE	75 Marks
CIE	25 Marks
Credits	3

UNIT -1
Introduction to MATLAB Programming: This module will introduce the students to MATLAB programming through a few examples. Students who have used MATLAB are still recommended to do this module, as it introduces MATLAB in context of how we use it in this course, building your Code with MATLAB: This module covers MATLAB Script and Function files, loops, execution control, best-practices for MATLAB functions and tips on how to debug a MATLAB code.

UNIT -II
Approximations and Errors: Taylor's / Maclaurin series expansion of some functions will be used to introduce approximations and errors in computational methods, Linear Equations: The focus of this module is to do a quick introduction of most popular numerical methods in linear algebra, and use of MATLAB to solve practical problems.

UNIT -III
Nonlinear Equations: After introduction to bisection rule, this module primarily covers Newton-Raphson method and MATLAB routines fzero and fsolve, Numerical Differentiation and Integration: Methods of numerical differentiation and integration, trade-off between truncation and round-off errors, error propagation and MATLAB functions for integration will be discussed.

UNIT -IV
Ordinary Differential Equations (ODE): Explicit ODE solving techniques in single variable will be covered in this module, ODE-IVP in Multiple Variables: This module will cover ODE solving in multiple variables, stiff systems, and practical problems. The importance of ODEs in engineering is reflected by the fact that two modules are dedicated to ODEs.

UNIT -V
Regression and Interpolation: The focus will be practical ways of using linear and nonlinear regression and interpolation functions in MATLAB.ODE-BVP and DAE: ODE-Boundary Value Problems; Differential Algebraic Equations. Partial Differential Equations (PDEs): Practical ways of solving Hyperbolic and Parabolic PDEs. Bringing it all together: Optimization and Solving interesting computational problems by bringing together multiple concepts.

Update: Based on feedback from previous students, the Final Exam will be based on the material covered in the first nine weeks of the course. Assignments will continue to be given in the last three weeks. This allows learners to "digest" the material and perform well in the exam.
This course was first introduced as an eight-week course in 2016. With feedback from students, this course was expanded to a twelve-week (three credits) course in 2023. Some new aspects have been introduced and additional video lectures have been added to better explain some important concepts.

Thanks to the support from MathWorks, enrolled students have access to MATLAB for the duration of the course.

Text Books:

1. Fausett L.V., “Applied Numerical Analysis Using MATLAB”, 2nd Ed., Pearson Education, 2007.

Suggested Reading:

1. Chapra S.C. and Canale R.P. () “Numerical Methods for Engineers”, 5th Ed., McGraw Hill, 2006.

Suggested NPTEL/SWAYAM Course

S. No.	NPTEL Course Name	Instructor	Host Institute
1	MATLAB Programming for Numerical Computation https://onlinecourses.nptel.ac.in/noc23_ch42/preview	Prof. Niket Kaisare	IIT Madras
2	Computational Techniques http://nptel.ac.in/courses/103106074/	Dr. Niket S.Kaisare	IIT Madras
3	Numerical methods and programing http://nptel.ac.in/courses/122106033/	Prof. P.B. Sunil Kumar	IIT Madras

With effect from AY 2024-25

24EEM09

SENSORS AND ACTUATORS

Course Duration	12 weeks
Duration of SEE	3 Hours
SEE	75 Marks
CIE	25 Marks
Credits	3

UNIT -I

Basics of Energy Transformation: Transducers, Sensors and Actuators, Understanding of thin film physics: Application in MOSFET and its variants. Thin Film Deposition Techniques: Chemical Vapor Deposition (APCVD, LPCVD, UHVCVD, PECVD, ALCVD, HPCVD, MOCVD)

UNIT -II

Thin Film Deposition Techniques: Physical Vapor Deposition (Thermal Deposition, E-beam Evaporation, Sputtering, Pulsed Laser Deposition). Basics understanding of Photolithography for pattering layer. Detailed overview of Etching methods. Understanding various gas sensors: Optical gas sensor, Metal oxide semiconductor gas sensor, Field effect transistor gas sensor, Piezoelectric gas sensor, Polymer gas sensor, Nano-structured based gas sensors.

UNIT -III

Design and fabrication process of Micro sensors: Force Sensors, Pressure Sensors, Strain gauges and practical applications. Explain working principles of Actuators. Piezoelectric and Piezoresistive actuators, micro pumps and micro actuators with practical applications.

UNIT -IV

Understanding basics of microfluidics to assist Photomask design using Clewin Software, pattern transfer techniques, PDMS moulding and degassing, device bonding techniques. Simulation, Optimization and characterization of various sensors using COMSOL Multiphysics.

UNIT -V

Understanding of Sensor Interfacing with Microprocessor to build electronic system. Static and Dynamic Characteristic Parameters for Sensors and Actuators, Calibration of Sensor based electronics systems.

Text Books:

1. Lecture notes on some topics will be provided by the instructor Pallás- Areny Ramón, and John G. Webster.
2. Sensors and Signal Conditioning Wiley-Blackwell, 2008 Jacob Fraden, Handbook of modern sensors, Springer, Stefan Johann Rupitsch.
3. Piezoelectric Sensors and Actuators: Fundamentals and Applications, Springer, 2018 Senturia S. D.
4. Microsystem Design, Kluwer Academic Publisher, 2001 J.D. Plummer, M.D. Deal, P.G. Griffin.
5. Silicon VLSI Technology, Pearson Education, 2001 S.M. Sze (Ed).
6. VLSI Technology, 2 Edition, McGraw Hill, 1988 Madou
7. M Fundamentals of Microfabrication, CRC Press, 1997.

Suggested NPTEL/SWAYAM Course

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Sensors and actuators https://onlinecourses.nptel.ac.in/noc23_ee66/preview	Prof. Hardik Jeetendra Pandya	IISc Banglore

With effect from AY 2024-25

24EEM10

SIGNALS AND SYSTEMS

Course Duration	12 weeks
Duration of SEE	3 Hours
SEE	75 Marks
CIE	25 Marks
Credits	3

UNIT -I

Mathematical Preliminaries: Real and Complex numbers, Sinusoid and Phasor, Limits and Continuity, Differentiation and Integration, L'Hospital's Rule, Input-Output relations for RLC circuits, Unit step and delta functions. Types of signals and transformations: Even signal and odd signal, Orthogonality of signals, shifting and scaling, Signals and scaling in physical world, Signals and sensory perception.

UNIT -II

Fourier series for periodic signals — Fourier Transform — properties- Laplace Transforms and properties.

UNIT -III

Impulse response — convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems — Systems connected in series / parallel.

UNIT -IV

Baseband signal Sampling — Fourier Transform of discrete time signals (DTFT) — Properties of DTFT — Z Transform & Properties

UNIT -V

Impulse response — Difference Equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.

Text Books:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and Systems", 2nd Edition
2. Simon & Haykins, "Signals & Systems", Wiley Eastern Ltd.

Suggested NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Signals & Systems https://onlinecourses.nptel.ac.in/noc21_ee28/preview	Prof. K K Shah	IISER Bhopal

With effect from AY 2024-25

24EEM11

INDUSTRIAL AUTOMATION AND CONTROL

Course Duration	12 weeks
Duration of SEE	3 Hours
SEE	75 Marks
CIE	25 Marks
Credits	3

UNIT -I

Introduction, Architecture of Industrial Automation Systems, Measurement Systems Characteristics, Temperature Measurement, Pressure, Force and Torque Sensors, Motion Sensing, Flow measurement, Signal Conditioning, Data Acquisition Systems

UNIT -II

Introduction to Automatic Control, P-I-D Control, PID Control Tuning, Feedforward Control Ratio Control, Time Delay Systems and Inverse Response Systems, Special Control Structures,

UNIT -III

Introduction to Sequence Control, PLC, RLL, Sequence Control. Scan Cycle,Simple RLL Programs, Sequence Control. More RLL Elements, RLL Syntax, A Structured Design Approach to Sequence, PLC Hardware Environment.

UNIT -IV

Introduction To CNC Machines, Contour generation and Motion Control, Flow Control Valves, Hydraulic Control Systems – I & II, Pneumatic Control Systems – I & II.

UNIT -V

Energy Savings with Variable Speed Drives, DC Motor Drives, DC and BLDC Servo Drives, Induction motor drives, S

Embedded systems, Field bus network I & II, High level automation systems.

Text Books:

1. S. Mukhopadhyay, S. Sen and A. K. Deb, Jaico "Industrial Instrumentation, Control and Automation", Publishing House, 2013
2. George Stephanopoulos "Chemical Process Control, An Introduction to Theory and Practice", , Prentice Hall India, 2012
3. R. Krishnan, "Electric Motor Drives, Modelling, Analysis and Control", Prentice Hall India, 2002
4. Herbert E.Merritt, "Hydraulic Control Systems", Wiley, 1991.

Suggested NPTEL/SWAYAM Course

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Industrial Automation and Control https://nptel.ac.in/courses/108105063	Prof. S. Mukhopadhyay & Prof.S Sen	IIT Kharagpur

With effect from AY 2024-25

24EEM12

FACTS DEVICES

Course Duration	12 weeks
Duration of SEE	3 Hours
SEE	75 Marks
CIE	25 Marks
Credits	3

UNIT -I
Introduction, Switch realization, Pulse width modulation, closed loop control, multi-level inverter.

UNIT -II
Shunt compensator analysis, thyristor-controlled reactor, thyristor-controlled capacitor, static VAR compensator, STATCOM, External control design of STATCOM, DSTATCOM, Design of DSTATCOM

UNIT -III
Series compensator, GCSC, SSSC, TSSC, TCSC, TCSC control characteristics, Voltage and Phase angle regulation

UNIT -IV
UPQC Introduction, Classification, Operation, Control and Application

UNIT -V
UPFC Control structure and operation, Comparison of UPFC with PAR and series compensators, IPFC and practical applications

Text Books:

1. Hingorani N. G. and Gyugyi L., "Understanding FACTS", IEEE Press, Standard Publishers Distributors
2. Song Y. H. and Johns A. T., "Flexible AC Transmission Systems (FACTS)", IEE Press.
3. Mathur R. M. and Varma R. K., "Thyristor Based FACTS Controllers for Electrical Transmission Systems", John Wiley, and Sons.

Suggested NPTEL/SWAYAM Course

S. No.	NPTEL Course Name	Instructor	Host Institute
1	FACTS Devices https://onlinecourses.nptel.ac.in/noc23_ee58/preview	Prof. Avik Bhattacharya	IIT Roorkee

With effect from AY 2024-25

24EEM13

INTRODUCTION TO ROBOTICS

Course Duration	12 weeks
Duration of SEE	3 Hours
SEE	75 Marks
CIE	25 Marks
Credits	3

UNIT -I

Introduction to robotics- History, growth; Robot applications- Manufacturing industry, defense, rehabilitation, medical etc., Laws of Robotics, Robot mechanisms; Kinematics- coordinate transformations, DH parameters.

UNIT -II

Forward kinematics, Inverse Kinematics, Jacobians, Statics, Trajectory Planning, Actuators (electrical)- DC motors, BLDC servo motors

UNIT -III

Sensors, sensor integration, Control – PWM, joint motion control, feedback control, Computed torque control

UNIT -IV

Perception, Localisation and mapping, Probabilistic robotics, Path planning, BFS; DFS; Dijkstra; A-star; D-star; Voronoi; Potential Field; Hybrid approaches

UNIT -V

Simultaneous Localization and Mapping, Introduction to Reinforcement Learning

Text Books:

1. Robert J Schilling, “Fundamentals of Robotics”, Prentice Hall India, 2003
2. John J Craig, “Introduction to Robotics”, Prentice Hall International, 2005

Suggested NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Introduction to Robotics https://onlinecourses.nptel.ac.in/noc20_de11/preview	Prof. T Asokan, Prof. B Ravindran and Prof. K Vasudevan	IIT Madras

With effect from AY 2024-25

24EEM14

FUNDAMENTALS OF ELECTRIC VEHICLES: TECHNOLOGY & ECONOMICS

Course Duration	8 weeks
Duration of SEE	3 Hours
SEE	75 Marks
CIE	25 Marks
Credits	2

UNIT -I

Overview of Electric Vehicles in India, Can India Drive its EV program Innovatively and Differently and scale?, A bit about batteries, Charging and Swapping Infrastructure, Where will we get Lithium for batteries?, EV Sub systems

UNIT -II

Forces acting when a vehicle move, Aerodynamic drag, Rolling Resistance and Uphill Resistance, Power and Torque to accelerate, Putting it all together, Concept of Drive Cycle, Drive Cycles and Energy used per km , EV Subsystem: Design of EV Drive Train

UNIT -III

Introduction to Battery Parameters, Why Lithium Ion Battery?, Batteries in Future, Li-Ion Battery Cells, SoH and SoC estimation and Self Discharge, Battery Pack Development, Computation of Effective cost of battery, Charging Batteries

UNIT -IV

Fundamentals of Battery Pack Design, Mechanical Design, Thermal Design, Electrical Design, BMS Design of Electric Vehicle, EV Motors and Controllers - Understanding Flow

UNIT -V

Power and Efficiency, Torque Production, Speed and Back EMF, The d-q Equivalent circuit , Field-oriented Control, Three phase AC , Thermal Design, Engineering Considerations, Future Frontiers, EV Chargers: Introduction, EV Chargers: Slow or Fast, Battery Swapping, Standardization and On board Chargers, Public Chargers, Bulk Chargers/Swap Stations, Economics of Public Chargers in context, Analytics

Text Books:

1. John G. Hayes and A. Goodarzi, "Electric Powertrain - Energy Systems, Power electronics and drives for Hybrid, electric and fuel cell vehicles", Wiley Publication.

Suggested NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Fundamentals of Electric Vehicles: Technology & Economics https://archive.nptel.ac.in/courses/108/106/108106170/	Prof. Ashok Jhunjhunwala Prof. Prabhjot Kaur Prof. Kaushal Kumar Jha Prof. L Kannan	IIT Madras

With effect from AY 2024-25

24EEH15

ELECTRIC VEHICLES - PART 1

Course Duration	4 weeks
Duration of SEE	3 Hours
SEE	75 Marks
CIE	25 Marks
Credits	1

UNIT -I

Introduction to EV Historical Background, Introduction to EV Benefits of Using Evs, Introduction to EV Overview of types of Evs and its Challenges

UNIT -II

Introduction to EV Motor Drive Technologies, Introduction to EV Energy Source Technologies, Introduction EV Battery Charging Technologies, Introduction EV Vehicle to Grid

UNIT -III

Introduction to EV Subsystems and Configurations, Introduction to HEV Subsystems and Configurations, Introduction to HEV Subsystems and Modes of Operation

UNIT -IV

Vehicle Dynamics intro and tractive effort, Vehicle Dynamics and dynamic equation

UNIT -V

Vehicle Dynamics simulation dynamic equation constant Fte, Vehicle Dynamics dynamic equation variable Fte, Vehicle Dynamics simulation dynamic equation variable Fte, Vehicle Dynamics Modelling and simulation in Simulink

Text Books:

1. Iqbal Husain, ELECTRIC and HYBRIDVEHICLES, Design Fundamentals, CRC Press,2003.2.
2. M. Ehsani, Y. Gao, S. Gay and A. Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, CRC Press, 2005.

Suggested NPTEL/SWAYAM Course:

S.No.	NPTEL Course Name	Instructor	Host Institute
1	Electric Vehicles-1 https://onlinecourses.nptel.ac.in/noc23_ee01/preview	Prof. Amit Jain	IIT Delhi

With effect from AY 2024-25

24EEH16

ELECTRICAL MACHINES-1

Course Duration	4 weeks
Duration of SEE	3 Hours
SEE	75 Marks
CIE	25 Marks
Credits	1

UNIT -I

Magnetic Circuit and Transformer, Magnetizing Current from B-H Curve, Ideal Transformer, Dot Convention and Phasor Diagram, Operation of Ideal Operation with Load Connected, Equivalent Circuit of Ideal Transformer, Rating of Single-Phase Transformer: Rated Current and Rated Voltage with Example, Transformer with Multiple Coils, Modelling of Practical Transformer, Core Loss - Eddy Current Loss, Hysteresis Loss, Exact and Approximate equivalent circuits.

UNIT -II

Determination of Equivalent Circuit Parameters - No Load Test, Short Circuit Test, Efficiency of Transformer, Regulation of transformer, Autotransformer, ideal and practical auto transformer, comparison of two winding transformer and auto transformer, polarity test and sumperner's test.

UNIT -III

Three phase transformers, various connections of three phase transformer, vector group, three phase core type and shell type, zigzag connection, Scott connection, effect of third harmonic exciting current and flux, choosing transformer connection, parallel operation of transformers, specific magnetic and electric loading, cooling and fillings of transformers.

UNIT -IV

Introduction to DC machine, single conductor DC generator/ motor operation, homopolar DC machines, construction of DC machine, types of DC machines, working principle of DC generator, EMF equation of DC generator, working principle of DC motor, torque equation of DC motor, effect of armature reaction and significance of back EMF.

UNIT -V

Starting of DC motor (3-point starter), speed control of DC shunt motor, armature voltage control method, field flux control method, DC motor braking, introduction to series motor, characteristics of series motor, universal motor.

Text Books:

1. Bimbra P. S., "Electrical Machinery", 7/e, Khanna Publishers, 2011.
2. Nagrath J. and D. P. Kothari, "Theory of AC Machines", Tata McGraw Hill, 201

Suggested NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Electrical Machines-1 https://archive.nptel.ac.in/courses/108/105/108105155/	Prof. Tapas kumar Battacharya	IIT Kharagpur

Faculty Coordinator
Minor Engineering Courses

HoD-EEE