



Syllabus Structure:

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University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus



4th Semester Syllabus for B.Tech Admission Batch 2023

Subject Name: Mathematics-IV

Credit: 3

Lecture Hours: 36

Subject Code: BSM401

Relevant Links:

[Study-material-BSM401](#)

[NPTEL](#)

[Coursera](#)

COURSE OBJECTIVES:

1. To learn about Calculus of Complex functions.
2. To learn about Fourier series and Fourier Transform.
3. To learn about Laplace transform.
4. To learn about Z-transform.
5. To develop a basic understanding of Data analysis using Python.

COURSE OUTCOMES:

- CO 1:** Identify different tools for differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.
- CO 2:** Appraise the notions of Fourier series and Transform to solve advanced engineering problems.
- CO 3:** Apprehend the concept of Laplace Transform together with its applications in evaluating integrals and solving ordinary differential equations.
- CO 4:** Relate the use of Z-Transform for discrete functions and solve difference equations using Z-Transform technique.
- CO 5:** Acquire an understanding of handling and analyzing datasets, creating data visualizations, solving linear equations.

4th Semester Syllabus for B.Tech Admission Batch 2023

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Text Book Mapping	Corresponding Lab Assignment
1.	Calculus of Complex Functions	Complex function, Limit, Continuity and Differentiation; Analytic functions, Cauchy-Riemann equations (statement only); Harmonic functions, Harmonic Conjugate; construction of Analytic functions; elementary Analytic functions (exponential, trigonometric, logarithmic) and their properties. Statement for Cauchy's Integral formula for evaluation of $\int_C f(z)dz$ where C is a circle.	International Academia: https://ocw.mit.edu/courses/18-04-complex-variables-with-applications-spring-2018/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: To analyze the frequency response of filters by evaluating the behavior of complex functions that represent signals or system responses along a contour. https://in.mathworks.com/help/matlab/math/complex-line-integrals.html	8	Text book 1: Chapter 19 & Chapter 20	❖ Evaluation of contour integrals using MATLAB .
2.	Fourier Series & Transform	<i>Fourier Series:</i> Even function, Odd function. Periodic function, Euler's formula, Dirichlet's conditions; Sum of the Fourier series at the point of discontinuity and end points of an interval; Half Range Sine and Cosine Series; Parseval's Theorem (statement only).	International Academia: https://see.stanford.edu/Course/EE261 AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE	10	<i>Fourier Series:</i> Textbook 1: Chapter 10 <i>Fourier Transform:</i> Textbook 1: Chapter 22	❖ Perform Fourier sine and cosine transforms using MATLAB . ❖ Write Fourier series for some elementary functions using MATLAB . ❖ Compare Fourier

4th Semester Syllabus for B.Tech Admission Batch 2023

		<i>Fourier Transforms:</i> Fourier Transform and its properties; Fourier Sine and Cosine Transforms, Fourier Transform of derivatives (statement only); Inverse Fourier Transform (statement only); Convolution theorem (statement only), related problems.	.pdf Industry Mapping: To analyze periodic signals and transform them into frequency components. https://in.mathworks.com/help/matlab/math/fourier-transforms.html			Transform results with Spectrum Analyzer outputs in real-world signal frequency analysis.
3.	Laplace Transform	Laplace Transform and its properties; First and Second Shifting theorems; Laplace Transform of Periodic functions; Inversion of Laplace Transform by different methods, Convolution theorem; evaluation of integrals by Laplace Transform; solving boundary value problems by Laplace Transform method.	International Academia: https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/resources/mit6_003f11_1ec06/ https://web.stanford.edu/~boyd/ee102/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: To analyze system dynamics, stability, and control in electrical circuits and automation. https://in.mathworks.com/help/symbolic/sym.laplace.html	8	Textbook 1: Chapter 21	❖ Perform Laplace transform of some elementary functions using MATLAB. ❖ Perform inverse Laplace transform using MATLAB. ❖ Analyze system stability using Laplace Transform and verify results through control lab experiments with real-world systems.
4.	Z-Transform	Sequence, representation of sequence, Z-Transform and its properties, Shifting theorems, Inverse Z-transform, Convolution theorem, region of convergence, concept of difference equation	International Academia: https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/64490a008c1c5c25c86044351465abf7/MIT6_003F11_1ec05.pdf	6	Textbook 1: Chapter 23	❖ Compute Z-transform of some elementary of some functions using MATLAB. ❖ Solve linear difference equations with

4th Semester Syllabus for B.Tech Admission Batch 2023

		and their solution by Z-Transform method.	AICTE-prescribed syllabus: • https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: To analyze discrete-time systems, especially in control systems and digital signal processing (DSP). https://in.mathworks.com/help/symbolic/sym.ztrans.html			constant coefficients using MATLAB .
5.	Data Analysis using Python	Arithmetic, logical operations; List, tuple, dictionary, set; Managing arrays and matrices; Solving linear equations; Data handling: Import, clean, sort, filter, summarize, handle missing data; Calculating central tendency, standard deviation of dataset; Data visualization: Line plot, Bar plot, Histogram.	International Academia: • https://ocw.mit.edu/courses/15-075j-statistical-thinking-and-data-analysis-fall-2011/pages/lecture-notes/ • https://ocw.mit.edu/courses/6-0001-introduction-to-computer-science-and-programming-in-python-fall-2016/pages/readings/ Industry Mapping: 1. To handle datasets and visualize for real-time insights. 2. To solve systems of equations for applications like signal processing.	4	Textbook 2:	❖ Handling of data using Panda Library. ❖ Plot data using Matplotlib. ❖ Compute Matrix operations using Numpy library. ❖ Calculate central tendencies, standard deviation of a dataset.

4th Semester Syllabus for B.Tech Admission Batch 2023

TEXT BOOKS:

1. **B. S. Grewal**, “Higher Engineering Mathematics”, 44th Edition (2021), Khanna Publishers. (Chapter No.s: 10, 19, 20, 21, 22, 23)
2. **Wes Mckinney**, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython”, 2nd Edition (2017), United States: O'Reilly Media.

REFERENCE BOOKS:

1. **Biswadip Basu Mallik & Krishanu Deyasi**, “Engineering Mathematics” – Vol. 2B, 1st Edition (2020), Cengage Learning.
2. **B. K. Pal & K. Das**, “Engineering Mathematics” - Vol. IIB, 13th Edition (2019), Vol. IIIB, 8th Edition (2019), U. N. Dhur & Sons.
3. **Erwin Kreyszig**, “Advanced Engineering Mathematics”, 10th Edition (2017), John Wiley & Sons.
4. **R. K. Jain and S. R. K. Iyengar**, “Advanced Engineering Mathematics”, 5th Edition (2016), Narosa Publication House.
5. **B. V. Ramana**, “Higher Engineering Mathematics”, 11th Reprint (2017), Tata McGraw Hill.



University of Engineering and Management
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4th Semester Syllabus for B.Tech Admission Batch 2023

Subject Name: Sustainability, Climate Actions & Environmental Sciences Credit: 2 Lecture Hours: 24

Subject Code: MCC471

[Study Material](#)

[LinkedIn](#)

[NPTEL](#)

[Coursera](#)

Course Outcomes:

The concepts developed in this course will help the students in their higher studies. The course will enable the student to

CO1: Understand fundamental concepts of environmental systems, sustainability, United Nations Sustainable Development Goals (UNSDGs) and their interrelationship with human society.

CO2: Apply knowledge of sustainable practices, different technical tools and existing frameworks to address environmental and societal challenges.

CO3: Analyze the challenges and strategies associated with climate change mitigation, sustainable cities, and waste management within the context of international agreements and frameworks.

CO4: Evaluate and design innovative approaches to energy, water, and waste management, considering the principles of the circular economy and global SDG progress reports.

4th Semester Syllabus for B.Tech Admission Batch 2023

Module Number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
I	Overview - United Nations Sustainable Development Goals (UNSDGs)	Basic ideas of environment, basic concepts: man, society & environment, their interrelationship. Significance of sustainability in today's world. 17 United Nations Sustainable Development Goals (UNSDGs) - background, significance, interconnectedness of goals, global challenges and recent progress. Climate change and mitigation. Explain and evaluate the evidence for human-caused climate change, in the context of historical climate change, as well as the relevant scientific uncertainties and possible evidence to the contrary.	International Academia: https://unccelearn.org/course/view.php?id=170&page=overview https://unccelearn.org/course/view.php?id=181&page=overview Industry Mapping:	4	Assess the college campus alignment with the United Nations Sustainable Development Goals (SDGs) and rank the performance across selected goals mentioning the actionable strategies for improvement.
II	Sustainable Management	Sustainable management of water and sanitation- introduction, key components, challenges and innovative approaches. Ensure access to affordable, reliable, sustainable, and modern energy- introduction, importance, key targets, challenges and strategies. Sustainable Cities and Communities- Definition of sustainable cities, current challenges, strategies, innovative solution, smart city	International Academia: https://ocw.mit.edu/courses/res-env-006-teaching-with-sustainability-january-iap-2022/ Industry Mapping:	4	Design and propose innovative, sustainable solutions for managing water, energy, and urban systems, inspired by the principles of SDG 6, SDG 7 and SDG 11.
III	Climate Action	Climate change and its consequences, international agreements on climate change, strategies and actionable step, Life Below Water- Importance of water bodies and marine ecosystem, strategies for protecting aquatic life and water bodies, Life on Land- importance of biodiversity, carbon sequestration, Food security, Strategies for Conservation and Restoration of Ecosystems, Sustainable Land Management, Biodiversity Conservation, Accountable steps for life on land. The successes and	International Academia: https://unccelearn.org/course/view.php?id=7&page=overview&lang=en https://unccelearn.org/c	4	Using data analytics and modeling tools - evaluate climate change impacts, assess ecosystem health, and propose technical solutions for mitigation and conservation efforts.

4th Semester Syllabus for B.Tech Admission Batch 2023

		failures of past national and international efforts to address climate change, and evaluate prospects for future management of climate change. Provisions of the United Nations Framework Convention on Climate Change, Paris Agreement	https://www.unccelearn.org/course/view.php?id=145&page=overview https://unccelearn.org/course/view.php?id=48&page=overview https://ocw.mit.edu/courses/res-env-001-climate-action-hands-on-harnessing-science-with-communities-to-cut-carbon-january-iap-2017/		
IV	UN-call for Action	Focus on annual SDG Goals Report and the United Nations Secretary-General's calls for action to accelerate the progress on the Sustainable Development Goals (SDGs). Examine the global progress trends, challenges highlighted in recent reports, and key priorities proposed by the Secretary-General to achieve the 2030 Agenda.	International Academia: https://unccelearn.org/course/view.php?id=175&page=overview	4	Using quantitative analysis, strategic planning, and innovative approaches, evaluate the global progress on the Sustainable Development Goals (SDGs) as highlighted in the annual SDG Goals Report.
V	Environmental Systems Analysis	Environmental impact assessment - lifecycle assessment (LCA), Using of LCA software tools – OpenLCA, Environmental, social, and governance (ESG), Integrated Impact Assessment of ESG, Carbon Management, Green Hydrogen, Importance of green building (LEED, IGBC etc.) certification. Environmental Management System (EMS) in industry - ISO 14001.	International Academia: https://www.lse.ac.uk/unit-ed-states/Assets/Documents/Syllabus-Hub-PDFs/Michael-Carbajales-Dale-Clemson-Environmental-Systems-Analysis.PDF	4	Life Cycle Assessment of a college building using OpenLCA software.

4th Semester Syllabus for B.Tech Admission Batch 2023

			https://www.igmpi.ac.in/environmental-social-governance?gad_source=1 https://www.iso.org/standard/60857.html#:~:text=ISO%2014001%20is%20the%20internationally,continually%20improve%20the%20environmental%20performance. Industry Mapping:		
VI	Waste Management	Waste Management Rules - Hazardous Waste, E-waste, Municipal Solid Waste, Bio-medical waste, Plastic Waste & Construction and Demolition Waste. Management of different waste streams – collection, transportation, treatment, storage and disposal. Basel Convention, Extended producer responsibility (EPR) Energy & Resource Recovery - Incineration, Co-processing, Composting, Bio-methanation, Management of solar photo-voltaic modules or panels or cells, Battery Waste Management Rules, Circular Economy	International Academia: https://cpcb.nic.in/rules-6/ https://ocw.mit.edu/courses/ec-716-d-lab-waste-fall-2015/ https://unccelearn.org/course/view.php?id=131&page=overview https://unccelearn.org/course/view.php?id=87&page=overview Industry Mapping:	5	Mapping the supply chain of different waste management system and finding the issues & challenges.

Field works will be assigned for each and every student/ group of students, on completion of which they have to give a presentation along with a model display if possible.



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4th Semester Syllabus for B.Tech Admission Batch 2023

Learning Resources:

Text Books:

This syllabus has been designed on the United Nations Sustainability Development Goals, so there is no prescribed text books. Please refer to the study material and online courses.



University of Engineering and Management
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4th Semester Syllabus for B.Tech Admission Batch 2023

Subject Name: Electrical Machines I

Credit: 3

Lecture Hours: 38

Subject Code: PCCEE401

Relevant Links:

[Study Material](#)

[NPTEL](#)

[Coursera](#)

[Linkedin Learning](#)

Course Objectives:

The purpose of learning this course is to-

1. Understand the concepts of magnetic circuit.
2. Understand the principle of electromagnetic force and torque production
3. Learn the working principle, operation, characteristics and application of different DC machines
4. Learn the principle of operation, connections and different tests on single phase as well as 3 phase Transformers
5. To acquire problem solving skills on DC machines and transformers.

Course Outcomes:

1. To remember and understand the basic concept and laws pertaining to Magnetic field & circuits, E.M. forces & torque.
2. To appreciate the working principle, characteristics and different problems related to DC generator.
3. To understand the working principle, characteristics, testing and control mechanism of DC motor.
4. To develop the capability to analyze the operation, characteristics and testing of Transformers as per their usage in different sector.

4th Semester Syllabus for B.Tech Admission Batch 2023

Module Number	Topic	Sub-topics	Mapping with Industries, National and International Academia	Lecture Hours	Text Book	Module Number	Corresponding Lab assignments
1	Review of Magnetic Field systems and torque production	Magnetic fields, Energy density and magnetic circuits; Electromagnetic force, torque and General theory of Rotating Electrical Machines	International Academia: https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/pages/syllabus/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Vol.%20I_UG.pdf Industry Mapping: IS/ IEC Specification No. 60034-1: 2004 for Rotating Electrical Machines · Simulation Software: MATLAB	2	Prithwiraj Purkait & Indrayudh Bandopadhyay, “Electrical Machines” Oxford University Press	1,2	Introduction to IS/ IEC Specification No. 60034-1: 2004 for Rotating Electrical Machines regarding: · Duty Type, · Rating and · Co-ordination of voltage and output
2	Construction and Principle of working of DC machines	Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Armature winding and commutation	International Academia: https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/pages/syllabus/ AICTE-prescribed syllabus:	7	Prithwiraj Purkait & Indrayudh Bandopadhyay, “Electrical Machines” Oxford University Press	3,4	Testing of DC Generators and Motors as per IS Specification No. 9320: 1979 : a) Measurement of winding resistances b) Determination of open

4th Semester Syllabus for B.Tech Admission Batch 2023

		Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Working- Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.	https://www.aicte-india.org/sites/default/files/Vol.%20I_UG.pdf Industry Mapping: IS Specification No. 9320: 1979 regarding Guide for testing of DC Machines Simulation Software: MATLAB			circuit characteristics c) Determination of regulation characteristics d) Determination of external characteristics (for generator only) e) Determination of efficiency of a machine • Assignments using Simulation Software
3	DC machine – Operation, Control and Efficiency	Generator Operation- Armature circuit equation for motoring and generation, Types of field excitations - separately excited, shunt and series. Open circuit characteristic of separately excited and self excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. Motor Operation- V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, Efficiency, load testing and back-to-back testing of DC machines,	International Academia: https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/pages/syllabus/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Vol.%20I_UG.pdf • Industry Mapping: IS Specification No. 9320: 1979 regarding Guide for testing of DC Machines Simulation Software: MATLAB	8		5 Testing of DC motor to: a) Study Torque- Speed characteristics b) Different Methods of Speed Control • Assignments using Simulation Software

4th Semester Syllabus for B.Tech Admission Batch 2023

4	Transformers – Working principle, Construction, Operation, Control and Testing	Single-phase transformers- Principle, construction and operation. Equivalent circuit, phasor diagram, voltage regulation, losses and efficiency. Testing - open circuit and short circuit tests, polarity test, back- to-back test, separation of hysteresis and eddy current losses. Three-phase transformer- - construction, types of connection, Phasor groups and their comparative features, Parallel operation of single-phase and three-phase transformers. Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Autotransformers- construction, principle, applications and comparison with two winding transformer Tap-changing transformers - No- load and on-load tap-changing of transformers, Three-winding transformers. Cooling of transformers, Dry type transformer.	International Academia: https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/pages/syllabus/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Vol.%20I_UG.pdf Industry Mapping: IS Specification No.2026: 1981 (Part 1) for Power Transformer and IS Specification No. 11171: 1985 for Dry type transformer Simulation Software: MATLAB	17	Prithwiraj Purkait & Indrayudh Bandopadhyay, “Electrical Machines” Oxford University Press	6,7	Routine tests of transformer as per IS 2026: a) Transformer voltage ratio test and polarity b) Winding resistance test of transformer c) Transformer vector group test d) Measurement of impedance voltage/short circuit impedance (principal tap) and load loss (Short circuit test) e) Measurement of no-load loss and current (Open circuit test) f) Temperature rise test of transformer (Back to Back Test) g) Dielectric tests of transformer (in Power System) h) Measurement of insulation resistance (in Power System) · Assignments using Simulation Software
5	Special Machines	Permanent Magnet DC (PMDC) motor, Brushless DC (BLDC) Motors, Universal Motor, Stepper Motor, Tacho		4	Prithwiraj Purkait & Indrayudh Bandopadhyay, “Electrical Machines” Oxford University Press	15	Labs on special machines

4th Semester Syllabus for B.Tech Admission Batch 2023

Suggested Learning Resources:

Text Books

1. Prithwiraj Purkait & Indrayudh Bandopadhyay, “Electrical Machines” Oxford University Press

Reference Books

1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2021
 2. I.J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.
 3. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
 2. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.
 3. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
- Kirtley Jr., James L. Electric Power Principles: Sources, Conversion, Distribution and Use. Wiley, 2010. ISBN: 9780470686362.

Lesson Plan:

Module 1: Review of Magnetic Field systems and torque production : 2nd Year, Sec A & B (Faculty : Prof. Somnath Hazra)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Syllabus discussion, importance of the subject in EE and application exposure
2	Overview and Visualisation of magnetic field and magnetic Circuit
3	Electromechanical Energy Conversion Principle, Singly Excited Magnetic System and Doubly Excited Magnetic system.

Module 2: Construction and Principle of working of DC machines : 2nd Year, Sec A & B (Faculty : Prof. Somnath Hazra)

WORKING DAY	LESSON PLAN – DESCRIPTION
4	Constructional features of DC machines- different parts and function
5	Different types of Windings -Lap & Wave

4th Semester Syllabus for B.Tech Admission Batch 2023

6	Working of DC machines, visualisation of fields and excitation system
7	EMF generated in the armature. Methods of Excitation,
8	Numerical Problems
9	Armature reaction & its effect in the performance,
10	Methods of decreasing the effects of Armature reaction, Effect of Brush shift.
11	Commutation process, Resistance commutation, Delayed commutation, Voltage commutation,
12	Improvement of Commutation.
13	Numerical Problems

Module 3: DC machine – Operation, Control and Efficiency : 2nd Year, Sec A & B (Faculty : Prof. Somnath Hazra)

WORKING DAY	LESSON PLAN – DESCRIPTION
11	Operating Characteristics of DC Generators: Separately Excited generators, Shunt Generators, Numerical Problems
12	Operating Characteristics of Series Generators and Compound Generators. Numerical Problems
13	Torque equation of D.C motor, Operating Characteristics of Shunt motors, Numerical Problems
14	Operating Characteristics of Series & Compound motors. Numerical Problems
15	Losses and efficiency of DC machines, Numerical Problems
16	Testing of DC Machines- Hopkinson's and Swinburne's test.
17	D.C Machine application: Generator application, Motor application
18	BLDC Motor
19	PMDC Motor

Module 4: Transformers – Working principle, Construction, Operation, Control and Testing : 2nd Year, Sec A (Faculty : Tapas Kumar Datta) & 2nd Year, Sec B (Faculty: Ankit Ray Ghatak)

WORKING DAY	LESSON PLAN – DESCRIPTION
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4th Semester Syllabus for B.Tech Admission Batch 2023

1	Single-phase transformers- Principle, construction and operation.
2	Equivalent circuit, phasor diagram
3	voltage regulation
4	losses and efficiency
5	Testing - open circuit and short circuit tests; separation of hysteresis and eddy current losses.
6	polarity test, back- to-back test
7	Three-phase transformer- - construction
8	types of connection, Phasor groups and their comparative features
9	Parallel operation of single-phase and three-phase transformers
10	Magnetizing current, effect of nonlinear B-H curve of magnetic core material
11	harmonics in magnetization current, Phase conversion - Scott connection
12	Three-phase to six-phase conversion,
13	Autotransformers- construction and principle
14	Applications and comparison with two winding transformer
15	Tap-changing transformers - No- load and on-load tap-changing of transformer
16	Three-winding transformers
17	Cooling of transformers, Dry type transformer

Module 5: Special Machines 2nd Year, Sec A (Faculty : Tapas Kumar Datta) & 2nd Year, Sec B (Faculty: Ankit Ray Ghatak)

WORKING DAY	LESSON PLAN – DESCRIPTION
18	Stepper Motor
19	Universal Motor & Tacho

4th Semester Syllabus for B.Tech Admission Batch 2023

QUESTION PAPER PATTERN AND DATES

EXAMINATION	Dates	PART – A	PART – B	PART – C	TOTAL MARKS
Mid Term 1	February 10, 2025 to February 21, 2025	Attempt 5 out of 10 questions; Each question carries 2 marks (2×5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5×2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10×1)	30
Mid Term 2	March 24, 2025 to April 2, 2025	Attempt 5 out of 10 questions; Each question carries 2 marks (2×5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5×2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10×1)	30
End Semester Examination	April 21, 2025 to May 9, 2025	Attempt 10 out of 15 questions; Each question carries 2 marks (2×10)	Attempt 6 out of 9 questions; Each question carries 5 marks (5×6)	Attempt 5 out of 8 questions; Each question carries 10 marks (10×5)	100

Examination Rules & Regulations:

https://iemcollege-my.sharepoint.com/:b:/g/personal/iemcoe_office_iem_edu_in/EXrcoe3d6oxIogHKO074XeUBC9qm3XNaf_qUeSiVTNh5OQ?e=MMQn40



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4th Semester Syllabus for B.Tech Admission Batch 2023

Subject Name: Digital Electronics

Credit: 3

Lecture Hours: 40

Subject Code: PCCEE402

Pre-requisite: Analog Electronics

Relevant Links:

[Study Material](#)

[Coursera](#)

[NPTEL](#)

[Linkedin Learning](#)

[Infosys Springboard](#)

Course Objectives:

The purpose of learning this course is-

1. To introduce basic postulates of Boolean algebra and to introduce the methods for simplifying Boolean expressions.
2. To study formal procedures for the analysis and design of combinational and sequential circuits.
3. To introduce the concept of logic families, semiconductor memories and implementation of digital circuits using programmable logic devices.
4. To illustrate the concept of synchronous and asynchronous sequential circuits.

Course Outcomes:

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

- CO1. Describe the function of different building blocks of digital electronics, semiconductor memories and programmable logic devices.
- CO2. Explain the principle of operation of combinational and sequential digital circuits, A/D and D/A converter.
- CO3. Solve numerical problems of Boolean algebra, number system, combinational & sequential digital circuits and A/D and D/A converter.
- CO4. Specify applications of combinational and sequential digital circuits.

4th Semester Syllabus for B.Tech Admission Batch 2023

Detailed Syllabus:

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	Number System and Logic Families Text Books: Anand Kumar (Chapter 2, 3, 4)	Introduction to number systems, Binary, Octal and Hexadecimal representation and their conversions; BCD, ASCII, gray codes and their conversions, thermometric codes, Signed binary number representation with 1's and 2's complement methods ,basic logic functions Standard forms of logic expressions, and simplification of logic expressions using K Map. Review of TTL and CMOS families, their operations and specifications. Overview of Verilog	International Academia: (https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html) AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: SPICE software, Verilog	5	1. Simulation of MOS Inverter with different loads using SPICE software. 2. Simulation of CMOS Inverter for different parameters K_n , K_p as a design variable in SPICE software. 3. Introduction to programming using Verilog
2	Introduction to Boolean Algebra and K-map: Text Books: Salivahanan and Arivazhagan: (Chapter 2)	Basic Definitions and Axiomatic Definition of Boolean Algebra, Boolean Functions, Canonical and Standard Forms. The Map Method - K-map, Product of Sums and Sum of Products Simplification, NAND and NOR Implementation.	International Standards :(https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html) AICTE prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf)) Industry Mapping: Hardware Chipsets (IC 7408, 7432,7404), Software-TinkerCad	5	1. Design of BCD-Excess 3 code and vice-versa using basic gates (IC 7408, 7432,7404) 2. Design of basic digital circuits using Tinkercad.

4th Semester Syllabus for B.Tech Admission Batch 2023

3	Designing Combinational Logic Circuits: Text Book: Salivahanan and Arivazhagan: (Chapter 5,6)	Arithmetic circuits (ADDER and SUBTRACTOR), multiplier, comparators, decoders, encoders, multiplexers, de- multiplexers, parity generator and checker and their use in logic synthesis; Potential hazards in combinational circuits.	International Standards : (https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html) AICTE prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: Hardware Chipset (IC 7408, 7432,7404, 74153, 74155, 74180) Software: LogiSim and VHDL	6	- Design of Adder and Subtractor using basic gates (IC 7408, 7432,7404) and use of IC 74LS83 as BCD adder. - Design of MUX and DEMUX using basic gates (IC 74153, 74155) and also study the available ICS of MUX and DEMUX. Implement logic functions using these ICs. - Design and implementation of 16-bit odd/even parity checker/ generator using IC 74180. - Implementation of combinational circuits using LogiSim and VHDL
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4th Semester Syllabus for B.Tech Admission Batch 2023

4	Designing Sequential Logic Circuits: Text Book: Anand Kumar (Chapter 8,9,10, 11,12)	Basic memory element-S-R, J-K, D and T Flip Flops, various types of Registers and counters and their design, Design of Synchronous Sequential Circuits- State Table and State Diagrams, Design of Mealy and Moore FSM -Sequence Detection.	International Standards: https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html) AICTE prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: Hardware Chipset (IC 7476, 7474) Software: LogiSim and VHDL	6	5. Design of R-S, J-K, D and T Flip flops using universal gates and also study master slave J-K flip flop IC 7476. 6. Design of synchronous and asynchronous counter using Flip Flop IC 7476. 7. Design of 4-bit shift register (shift right) IC 7476/7474 8. Implementation of sequential circuits using Logisim and VHDL
5	Introduction to Digital Logic Devices, ADC and DAC: Text Book: Salivahanan and Arivazhagan: (Chapter 10, 13)	Introduction of ROM and RAM, PLA, PAL and FPGA. IC iCE40 FPGA family D/A converter -specifications - weighted resistor type, R-2R Ladder type. A/D Converters specifications - Flash type-Successive Approximation type, Pipeline ADC AFE8201 16-Bit and 14-Bit Digital-to-Analog Converters (DACs) With Voltage Reference and Diagnostic ADC for Low-Power Applications	AICTE prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: Hardware Chipset AFE8201 ADC AD570, DAC 0808 Software TinkerCad https://www.ti.com/lit/ds/symlink/afe88201.pdf?ts=1700473002665&ref_url=http	4	9. Design of PLA and PAL using basic logic gates (IC 7408, 7432,7404) 10. Design and testing of half/full adder and multiplexer by burning FPGA Kit. 11. Design of ADC and DAC using IC ADC AD570, DAC 0808 12. Design of ADC and DAC using TinkerCad

4th Semester Syllabus for B.Tech Admission Batch 2023

			s%253A%252F%252Fwww.ti.com%252Fdata-convertisers%252Fintegrated-special-function%252Fprecision-adcs-and-dacs%252Fproducts.html)		
6	GEN AI for Digital Circuits Research papers and study material	Introduction of GEN AI Use of GEN AI for Designing Digital Circuits Use of GEN AI for optimizing power and delay of Digital Circuits			

Text Books:

1. Digital Circuits and Design, by [S. Salivahanan](#), [S. Arivazhagan](#), 5th Edition, Oxford University Press India.
2. Fundamentals of Digital Circuits; Anand Kumar; PHI Publication
3. Digital Logic and Computer Design; M Morris Mano, Pearson Publication

Reference Books:

1. Digital Design, M. Morris. Mano & Michael D. Ciletti, PEARSON Publication
2. Digital Electronics; Tokheim; TMH Publication

4th Semester Syllabus for B.Tech Admission Batch 2023

Lesson Plan:

Module 2: Introduction to Boolean Algebra and K-map: 2nd Year, Sec A (Faculty : Prof. Sahitya Roy)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
9	6 th January, 2025	Monday	Syllabus discussion
10	13 th January, 2025	Monday	Basic Definitions and Axiomatic Definition of Boolean Algebra, Boolean Functions
11	20 th January, 2025	Monday	Canonical and Standard Forms.
12	27 th January, 2025	Monday	The Map Method - K-map,
13	3 rd February, 2025	Monday	Product of Sums and Sum of Products Simplification
14	10 th February, 2025	Monday	NAND and NOR Implementation.

Module 2: Introduction to Boolean Algebra and K-map: 2nd Year, Sec B (Faculty : Prof. Sahitya Roy)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
9	8 th January, 2025	Wednesday	Syllabus discussion
10	15 th January, 2025	Wednesday	Basic Definitions and Axiomatic Definition of Boolean Algebra, Boolean Functions
11	22 nd January, 2025	Wednesday	Canonical and Standard Forms.
12	29 th January, 2025	Wednesday	The Map Method - K-map,
13	5 th February, 2025	Wednesday	Product of Sums and Sum of Products Simplification
14	12 th February, 2025	Wednesday	NAND and NOR Implementation.

4th Semester Syllabus for B.Tech Admission Batch 2023

Module 1: Number System and Logic Families: 2nd Year, (Faculty : Prof. Neeta Sahay)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
1	10 th January, 2025	Friday	Syllabus discussion
2	17 th January, 2025	Friday	Introduction to number systems, Binary, Octal and Hexadecimal representation and their conversions; BCD, ASCII, gray codes and their conversions
3	24 th January, 2025	Friday	Thermometric codes, Signed binary number representation with 1's and 2's complement methods ,basic logic functions
4	31 st January, 2025	Friday	Standard forms of logic expressions, and simplification of logic expressions using K Map: Part 1
5	7 th February,2025	Friday	Standard forms of logic expressions, and simplification of logic expressions using K Map: Part 2
6	14 th February,2025	Friday	Review of TTL families, their operations and specifications.
7	21 st February,2025	Friday	Review of CMOS families, their operations and specifications.
8	28 th February,2025	Friday	Overview of Verilog

Module 1: Number System and Logic Families: 2nd Year,Sec B (Faculty : Prof. Neeta Sahay)

4th Semester Syllabus for B.Tech Admission Batch 2023

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
1	10 th January, 2025	Friday	Syllabus discussion
2	17 th January, 2025	Friday	Introduction to number systems, Binary, Octal and Hexadecimal representation and their conversions; BCD, ASCII, gray codes and their conversions
3	24 th January, 2025	Friday	Thermometric codes, Signed binary number representation with 1's and 2's complement methods ,basic logic functions
4	31 st January, 2025	Friday	Standard forms of logic expressions, and simplification of logic expressions using K Map: Part 1
5	7 th February,2025	Friday	Standard forms of logic expressions, and simplification of logic expressions using K Map: Part 2
6	14 th February,2025	Friday	Review of TTL families, their operations and specifications.
7	21 st February,2025	Friday	Review of CMOS families, their operations and specifications.
8	28 th February,2025	Friday	Overview of Verilog

Module 3: Designing Combinational Logic Circuits: 2nd Year,Sec A (Faculty : Prof. Neeta Sahay)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
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4th Semester Syllabus for B.Tech Admission Batch 2023

15	17 th February,2025	Monday	Arithmetic circuits (ADDER and SUBTRACTOR)
16	24 th February,2025	Monday	Multiplier, comparators, decoders, encoders
17	3 rd March,2025	Monday	Multiplexers
18	10 th March,2025	Monday	De- multiplexers
19	17 th March,2025	Monday	Parity generator and checker and their use in logic synthesis
20	24 th March,2025	Monday	Potential hazards in combinational circuits.

Module 3: Designing Combinational Logic Circuits: 2nd Year, Sec B (Faculty : Prof. Neeta Sahay)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
15	19 th February,2025	Wednesday	Arithmetic circuits (ADDER and SUBTRACTOR)
16	26 th February,2025	Wednesday	Multiplier, comparators, decoders, encoders
17	5 th March,2025	Wednesday	Multiplexers
18	12 th March,2025	Wednesday	De- multiplexers
19	19 th March,2025	Wednesday	Parity generator and checker and their use in logic synthesis
20	26 th March,2025	Wednesday	Potential hazards in combinational circuits.

Module 4: Designing Sequential Logic Circuits: 2nd Year, Sec A (Faculty : Prof. Sahitya Roy)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
21	7 th January,2025	Tuesday	Basic memory element-S-R, J-K, D and T Flip Flops,
22	9 th January,2025	Thursday	Various types of Registers
23	14 th January,2025	Tuesday	Counters and their design

4th Semester Syllabus for B.Tech Admission Batch 2023

24	16 th January,2025	Thursday	Design of Synchronous Sequential Circuits- State Table and State Diagrams Part 1
25	21 st January,2025	Tuesday	Design of Synchronous Sequential Circuits- State Table and State Diagrams Part 2
	23rd January,2025	Thursday	HOLIDAY
26	28 th January,2025	Tuesday	Design of Mealy and Moore FSM - Sequence Detection.

Module 4: Designing Sequential Logic Circuits: 2nd Year,Sec B (Faculty : Prof. Sahitya Roy)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
21	6 th January,2025	Monday	Basic memory element-S-R, J-K, D and T Flip Flops,
22	10 th January,2025	Friday	Various types of Registers
23	13 th January,2025	Monday	Counters and their design
24	17 th January,2025	Friday	Design of Synchronous Sequential Circuits- State Table and State Diagrams Part 1
25	20 th January,2025	Monday	Design of Synchronous Sequential Circuits- State Table and State Diagrams Part 2
26	24 th January,2025	Friday	Design of Mealy and Moore FSM - Sequence Detection.

Module 5: Introduction to Digital Logic Devices, ADC and DAC: 2nd Year,Sec A (Faculty : Prof. Sahitya Roy)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
27	30 th January,2025	Thursday	Introduction of ROM and RAM, PLA, PAL and FPGA.

4th Semester Syllabus for B.Tech Admission Batch 2023

28	4 th February,2025	Tuesday	IC iCE40 FPGA family D/A converter -specifications - weighted resistor type, R-2R Ladder type.
29	6 th February,2025	Thursday	A/D Converters specifications - Flash type-Successive Approximation type,
30	11 th February,2025	Tuesday	Pipeline ADC AFEx8201 16-Bit and 14-Bit Digital-to-Analog Converters (DACs) With Voltage Reference and Diagnostic ADC for Low-Power Applications

Module 5: Introduction to Digital Logic Devices, ADC and DAC: 2nd Year,Sec B (Faculty : Prof. Sahitya Roy)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
27	27 th January,2025	Monday	Introduction of ROM and RAM, PLA, PAL and FPGA.
28	31 st January,2025	Friday	IC iCE40 FPGA family D/A converter -specifications - weighted resistor type, R-2R Ladder type.
29	3 rd February,2025	Monday	A/D Converters specifications - Flash type-Successive Approximation type,

4th Semester Syllabus for B.Tech Admission Batch 2023

30	7 th February,2025	Friday	Pipeline ADC AFEx8201 16-Bit and 14-Bit Digital-to-Analog Converters (DACs) With Voltage Reference and Diagnostic ADC for Low-Power Applications
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Module 6: GEN AI for Digital Circuits: 2nd Year,Sec A (Faculty : Prof. Neeta Sahay)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
31	11 th February,2025	Tuesday	Introduction of GEN AI
32	13 th February,2025	Thursday	Use of GEN AI for Designing Digital Circuits Part 1
33	18 th February,2025	Tuesday	Use of GEN AI for Designing Digital Circuits Part 2
34	20 th February,2025	Thursday	Use of GEN AI for optimizing power and delay of Digital Circuits Part 1
35	25 th February,2025	Tuesday	Use of GEN AI for optimizing power and delay of Digital Circuits Part 2

4th Semester Syllabus for B.Tech Admission Batch 2023

Module 6: GEN AI for Digital Circuits: 2nd Year, Sec B (Faculty : Prof. Neeta Sahay)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
31	10 th February, 2025	Monday	Introduction of GEN AI
32	14 th February, 2025	Friday	Use of GEN AI for Designing Digital Circuits Part 1
33	17 th February, 2025	Monday	Use of GEN AI for Designing Digital Circuits Part 2
34	21 st February, 2025	Friday	Use of GEN AI for optimizing power and delay of Digital Circuits Part 1
35	24 th February, 2025	Monday	Use of GEN AI for optimizing power and delay of Digital Circuits Part 2

QUESTION PAPER PATTERN AND DATES

EXAMINATION	Dates	PART – A	PART – B	PART – C	TOTAL MARKS
Mid Term 1	February 10, 2025 to February 21, 2025	Attempt 5 out of 10 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	30

4th Semester Syllabus for B.Tech Admission Batch 2023

Mid Term 2	March 24, 2025 to April 2, 2025	Attempt 5 out of 10 questions; Each question carries 2 marks (2×5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5×2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10×1)	30
End Semester Examination	April 21, 2025 to May 9, 2025	Attempt 10 out of 15 questions; Each question carries 2 marks (2×10)	Attempt 6 out of 9 questions; Each question carries 5 marks (5×6)	Attempt 5 out of 8 questions; Each question carries 10 marks (10×5)	100

Examination Rules & Regulations:

<https://iemcollege->

[my.sharepoint.com/:b:/g/personal/iemcoe_office_iem_edu_in/EXrcoe3d6oxIogHKO074XeUBC9qm3XNaf_qUeSiVTNh](https://iemcollege-my.sharepoint.com/:b:/g/personal/iemcoe_office_iem_edu_in/EXrcoe3d6oxIogHKO074XeUBC9qm3XNaf_qUeSiVTNh5OQ?e=MMQn40)

[5OQ?e=MMQn40](https://iemcollege-my.sharepoint.com/:b:/g/personal/iemcoe_office_iem_edu_in/EXrcoe3d6oxIogHKO074XeUBC9qm3XNaf_qUeSiVTNh5OQ?e=MMQn40)



University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus



4th Semester Syllabus for B.Tech Admission Batch 2023

Subject Name: Power Electronics

Credit: 3

Lecture Hours: 43

Subject Code: PCCEE403

Pre-requisite: Basic Electronics, Analog Electronics

Relevant Links:

[Study Material](#)

[Coursera](#)

[NPTEL](#)

[Linkedin Learning](#)

Course Objectives:

1. To introduce basic postulates of power electronics devices and to introduce the methods for application of power electronics devices.
2. To study formal procedures for the analysis and design of control and uncontrol rectifiers.
3. To introduce the concept of ac to dc converter, dc to ac converters ac to ac converters.
4. To illustrate the concept of application of power electronics devices.

Course Outcomes:

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

- CO1. Know the operation of different power electronics switches
- CO2. Understand the basic operating principle of converters.
- CO3. Evaluate the performance of different types of converter.
- CO4. Design power electronic converter for specific application.

4th Semester Syllabus for B.Tech Admission Batch 2023

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Book	Mapped Chapter
1	Power switching devices	Diode, Thyristor, MOSFET, IGBT; I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT. Implementation of EMB1412 - MOSFET Gate Driver – using Artificial Intelligence (AI) based system	International Academia: (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) Industry Mapping: MATLAB	8	1. Performance parameter analysis of power semiconductor switches for designing inverters used in renewable energy systems 2. Design different triggering circuit for controlling the voltage applied to motors enabling speed control in conveyor belts, elevators, and cranes.	Power Electronics, P.S. Bimbhra, Khanna Publishers.	Chapters: 2, 4, 5
2	Thyristor rectifiers	Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor. Study of LM5045 Full-Bridge PWM Controller and using intelligent systems to study its various control modes	International Academia: (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) Industry Mapping: PSIM, MATLAB	7	3. Design of firing circuits suitable for triggering SCR in a 1- phase full controlled bridge converter used in battery charging systems, enabling controlled DC output suitable for large industrial batteries 4. Obtaining precise voltage control for Li-Po battery charging using single phase full controlled bridge converter (MATLAB+PSIM) 5. Achieving precise and smooth lighting control using single phase	Power Electronics, P.S. Bimbhra, Khanna Publishers.	Chapters: 3, 6

4th Semester Syllabus for B.Tech Admission Batch 2023

					controlled converter with source inductance and verification of hardware results using PSIM and MATLAB simulation. 6. Observation of BLDC motor operation (with reversing) using single phase half controlled symmetrical bridge converters attached to CRO / DSO and verification of hardware results using PSIM and MATLAB simulation. 7. Regulation and control of reactive power flow using three phase controlled converter with load variation (purely R to R-L to purely L) and representation using CRO / DSO and verification using PSIM and MATLAB software.		
3	DC-DC buck converter and boost converter	Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage. Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage. Study of TPS631010 Buck-Boost	International Academia: (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) Industry Mapping: PSIM, MATLAB	8	8. Analysis of the buck-boost chopper performance in terms of voltage regulation and efficiency for charging batteries by stepping up or down the input voltage to match the battery's charging requirements, especially in industrial UPS	Power Electronics, P.S. Bimbhra, Khanna Publishers.	Chapters: 7, 14

4th Semester Syllabus for B.Tech Admission Batch 2023

		Converters and assessment of auto - transitional operating modes with AI based I/O & O/P applications			systems. 9. Integrating step up and step down chopper using IGBT with DC-DC charging station for solar panels and observing voltage variation using CRO / DSO with software replication using PSIM and MATLAB		
4	Single-phase voltage source inverter	Power circuit of single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage	International Academia: (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) Industry Mapping: PSIM, MATLAB	6	10. Analyze the effect of modulation index on the output voltage and frequency of a pulse width modulated bridge inverter used in EV drive systems to convert DC battery power to variable AC for motor operation, allowing efficient acceleration, deceleration, and speed control.	Power Electronics, P.S. Bimbhra, Khanna Publishers.	Chapter s: 8, 9
5	Three-phase voltage source inverter	Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation. Study of TIDA-010025 three-phase inverter along with AI based optimization & control for internal IGBTs.	International Academia: (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) Industry Mapping: PSIM,	8	11. Investigating the effect of load variation (purely R to R-L to purely L) using single phase controlled converter for heating control of appliances	Power Electronics, P.S. Bimbhra, Khanna Publishers.	Chapter s: 8, 9

4th Semester Syllabus for B.Tech Admission Batch 2023

			MATLAB				
6	Applications	Separately excited dc motor speed control, switch mode power supply, resonant converter, concept of soft switching	International Academia: (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/) AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) Industry Mapping: PSIM, MATLAB	6	12.Design a TRIAC-based single-phase induction motor speed control system to control domestic fans, industrial motors etc.	Power Electronics, Md. H Rashid	Chapter 5

Suggested Learning Resources:

Text Books

1. Power Electronics, P.S. Bimbhra, Khanna Publishers.
2. M. H. Rashid, “Power electronics: circuits, devices, and applications”, Pearson Education India, 2009.

Reference Books

1. N. Mohan and T. M. Undeland, “Power Electronics: Converters, Applications and Design”, John Wiley & Sons, 2007.
2. R. W. Erickson and D. Maksimovic, “Fundamentals of Power Electronics”, Springer Science & Business Media, 2007.
3. L. Umanand, “Power Electronics: Essentials and Applications”, Wiley India, 2009.

Lesson Plan:

Module 1: Power switching devices: 2nd Year, Sec A (Faculty : Prof. Dr. Deepro Sen)

4th Semester Syllabus for B.Tech Admission Batch 2023

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
2		Tuesday	Power transistors, steady state characteristics, switching performance & operating regions
3		Thursday	Power MOSFETS, steady state characteristics, comparison with BJTs, driving circuits
6		Tuesday	IGBT and its switching characteristics, driving circuits
7		Thursday	Uncontrolled converters, advantages and disadvantages of power electronics converters, various types of power electronic systems & converters

Module 2: Thyristors and rectifiers: 2nd Year, Sec A (Faculty : Prof. Dr. Deepto Sen)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
10		Tuesday	Concept of half controlled & full controlled converters, effect of different loads & load current on converter performance, single & three phase converters
11		Thursday	Operation & explanation of single phase half wave, half controlled, full controlled converters with R, R-L and RLE loads,
14		Tuesday	Operation & explanation of three phase half wave, full controlled converters with R, R-L and RLE loads
15		Thursday	Effects of free wheeling diodes and source inductance on the performance of converters

Module 4 & 5: Single-phase & Three-phase voltage source inverter: 2nd Year, Sec A (Faculty : Prof. Dr. Deepto Sen)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
18		Tuesday	Definition, classification of inverters based on nature of input source, wave shape of output voltage, method of commutation & connections.
19		Thursday	Principle of operation of single phase and three phase bridge inverter with R and R-L loads
22		Tuesday	Three phase bridge inverters with 180° and 120° degree operation
23		Thursday	PWM Inverters with single & multiple pulse modulations
26		Tuesday	Performance parameters of inverters and methods of voltage control
27		Thursday	Harmonic reduction of inverters by PWM, transformers & stepped-wave techniques

Module 6: Applications: 2nd Year, Sec A (Faculty : Prof. Dr. Deepto Sen)

4th Semester Syllabus for B.Tech Admission Batch 2023

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
30		Tuesday	Operationn of UPS using power electronic applications
31		Thursday	Operationn of SMPS using different converters
37		Wednesday	Concept of soft switching

Module 1: Power switching devices: 2nd Year, Sec B (Faculty : Prof. Dr. Deepto Sen)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
2		Wednesday	Power transistors, steady state characteristics, switching performance & operating regions
3		Thursday	Power MOSFETS, steady state characteristics, comparison with BJTs, driving circuits
6		Wednesday	IGBT and its switching characteristics, driving circuits
7		Thursday	Uncontrolled converters, advantages and disadvantages of power electronics converters, various types of power electronic systems & converters

Module 2: Thyristors and rectifiers: 2nd Year, Sec B (Faculty : Prof. Dr. Deepto Sen)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
10		Wednesday	Concept of half controlled & full controlled converters, effect of different loads & load current on converter performance, single & three phase converters
11		Thursday	Operation & explanation of single phase half wave, half controlled, full controlled converters with R, R-L and RLE loads,
14		Wednesday	Operation & explanation of three phase half wave, full controlled converters with R, R-L and RLE loads
15		Thursday	Effects of free wheeling diodes and source inductance on the performance of converters

Module 4 & 5: Single-phase & Three-phase voltage source inverter: 2nd Year, Sec B (Faculty : Prof. Dr. Deepto Sen)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
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4th Semester Syllabus for B.Tech Admission Batch 2023

DAY			
18		Wednesday	Definition, classification of inverters based on nature of input source, wave shape of output voltage, method of commutation & connections.
19		Thursday	Principle of operation of single phase and three phase bridge inverter with R and R-L loads
22		Wednesday	Three phase bridge inverters with 180 ⁰ and 120 ⁰ degree operation
23		Thursday	PWM Inverters with single & multiple pulse modulations
26		Wednesday	Performance parameters of inverters and methods of voltage control
27		Thursday	Harmonic reduction of inverters by PWM, transformers & stepped-wave techniques

Module 6: Applications: 2nd Year, Sec B (Faculty : Prof. Dr. Deepto Sen)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
30		Wednesday	Operationn of UPS using power electronic applications
31		Thursday	Operationn of SMPS using different converters
37		Wednesday	Concept of soft switching

Module 1: Power switching devices: 2nd Year, Sec A (Faculty : Prof. Dr. Subhajit Kar)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
1		Monday	Discuss about syllabus, Difference between electronics and power electronics, different applications
4		Friday	Introduction to power diode, construction, characteristic
5		Monday	Construction and working principle of thyristor
8		Friday	V-I characteristic of SCR, concept of latching and holding current
9		Monday	Thyristor turn on methodologies, Natural and forced commutation, Switching characteristic
12		Friday	Turn off methodologies, Class A turn off
13		Monday	Class B turn off of SCR
16		Friday	Class C turn off of SCR
17		Monday	Class D turn off of SCR

4th Semester Syllabus for B.Tech Admission Batch 2023

20		Friday	Class F commutaion
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Module 3: DC-DC buck and boost converter: 2nd Year, Sec A (Faculty : Prof. Dr. Subhajit Kar)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
21		Monday	Working principle of dc-dc step down converter, derivation of output voltage
24		Friday	Control strategies of step down chopper
25		Monday	Working principle of step up chopper, derivation of output voltage, application
28		Friday	Types of chopper, class A, class B chopper
29		Monday	Types of chopper, class C, class D, class E chopper
32		Friday	Voltage commutation of chopper
33		Monday	Current commutation of chopper
34		Friday	Load commutated chopper

Module 6: Applications: 2nd Year, Sec A (Faculty : Prof. Dr. Subhajit Kar)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
35		Monday	Separately excited dc motor speed control
36		Friday	Resonant converter: Zero current switching
38		Monday	Resonant converter: Zero voltage switching

Module 1: Power switching devices: 2nd Year, Sec B (Faculty : Prof. Dr. Subhajit Kar)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
1		Monday	Discuss about syllabus, Difference between electronics and power electronics, different applications
4		Friday	Introduction to power diode, construction, characteristic
5		Monday	Construction and working principle of thyristor
8		Friday	V-I characteristic of SCR, concept of latching and holding current
9		Monday	Thyristor turn on methodologies, Natural and forced commutation, Switching characteristic
12		Friday	Turn off methodologies, Class A turn off

4th Semester Syllabus for B.Tech Admission Batch 2023

13		Monday	Class B turn off of SCR
16		Friday	Class C turn off of SCR
17		Monday	Class D turn off of SCR
20		Friday	Class F commutaion

Module 3: DC-DC buck and boost converter: 2nd Year, Sec B (Faculty: Prof. Dr. Subhajit Kar)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
21		Monday	Working principle of dc-dc step down converter, derivation of output voltage
24		Friday	Control strategies of step down chopper
25		Monday	Working principle of step up chopper, derivation of output voltage, application
28		Friday	Types of chopper, class A, class B chopper
29		Monday	Types of chopper, class C, class D, class E chopper
32		Friday	Voltage commutation of chopper
33		Monday	Current commutation of chopper
34		Friday	Load commutated chopper

Module 6: Applications: 2nd Year, Sec B (Faculty: Prof. Dr. Subhajit Kar)

WORKING DAY	DATE	DAY	LESSON PLAN – DESCRIPTION
35		Monday	Separately excited dc motor speed control
36		Friday	Resonant converter
38		Monday	Resonant converter: Zero voltage switching

QUESTION PAPER PATTERN AND DATES

EXAMINATION	Dates	PART – A	PART – B	PART – C	TOTAL MARKS

4th Semester Syllabus for B.Tech Admission Batch 2023

Mid Term 1	February 10, 2025 to February 21, 2025	Attempt 5 out of 10 questions; Each question carries 2 marks (2×5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5×2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10×1)	30
Mid Term 2	March 24, 2025 to April 2, 2025	Attempt 5 out of 10 questions; Each question carries 2 marks (2×5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5×2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10×1)	30
End Semester Examination	April 21, 2025 to May 9, 2025	Attempt 10 out of 15 questions; Each question carries 2 marks (2×10)	Attempt 6 out of 9 questions; Each question carries 5 marks (5×6)	Attempt 5 out of 8 questions; Each question carries 10 marks (10×5)	100

Examination Rules & Regulations:

<https://iemcollege->

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[Qn40](#)

4th Semester Syllabus for B.Tech Admission Batch 2023

Subject Name: Signals & Systems

Credit: 3

Lecture Hours: 25

Subject Code: PCCEE404

Relevant Links:

[Study Material](#)

[NPTEL](#)

[LinkedIn Learning](#)

Course Objectives:

The purpose of learning this course is-

1. At the end of this course, students will demonstrate the ability to understand the concepts of continuous time and discrete time systems.
2. Analyse systems in complex frequency domain.
3. Understand sampling theorem and its implications.

Course Outcomes:

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

- CO1. Understand the concepts of continuous time and discrete time signals.
- CO2. Evaluate the frequency spectra for different kind of signals.
- CO3. Analyze different transformations for continuous and discrete signals.
- CO4. Design sampling frequency and filters to recover the original signal.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Book	Mapped Chapter
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4th Semester Syllabus for B.Tech Admission Batch 2023

1	Introduction to Signals and Systems	Signals and systems as seen in everyday life, and in various branches of engineering and science. Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift- invariance, causality, stability, realizability. Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift invariant systems. System representation through differential equations. AI applications in signal processing, such as signal classification, anomaly detection, and noise reduction.	International Academia: (https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/pages/lecture-notes/) AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_EE.pdf) Industry Mapping: MATLAB, SCILAB	10	No Lab	Signals and Systems by P.Ramesh Babu and R. Anandanatarajan	1,2
2	Signal operation of LTI systems	Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and orthogonal bases.	International Standards (https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/pages/lecture-notes/) AICTE prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_EE.pdf) Industry Mapping: MATLAB,	8		Signals and Systems by P.Ramesh Babu and R. Anandanatarajan	3,4

4th Semester Syllabus for B.Tech Admission Batch 2023

		Basics of supervised and unsupervised learning, training models for signal pattern recognition (e.g., sound, image signals), and real-time applications.	OCTAVE				
3	Fourier, Laplace and z-Transforms:	Evolution of Transforms: Fourier Transform, Laplace Transform, Z-transform (single sided and Double sided). The Laplace Transform, notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, solution to differential equations and system behavior using Laplace Transformation. The z-Transform for discrete time signals and systems-eigen functions, region of convergence, z-domain analysis.	International Standards : (https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/pages/lecture-notes/) AICTE prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_EE.pdf) Industry Mapping: Hardware Chipset (DSP KIT) Software: MATLAB, OCTAVE	8		Signals and Systems by P.Ramesh Babu and R. Anandanatarajan	5,6,7,8,10

4th Semester Syllabus for B.Tech Admission Batch 2023

4	Introduction to Sampling and Reconstruction:	The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.	International Standards: (https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/pages/lecture-notes/) AICTE prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_EE.pdf) Industry Mapping: FPGA Kit Software: MATLAB, OCTAVE	4		Signals and Systems by P.Ramesh Babu and R. Anandanatarajan	9
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4th Semester Syllabus for B.Tech Admission Batch 2023

Suggested Learning Resources:

Text Books

1. P.Ramesh Babu and R. Anandanatarajan, 'Signals and Systems', Paperback
2. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India, 1997.
3. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.

Reference Books

1. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.
2. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
3. V. Oppenheim and R. W. Schaffer, "Discrete-Time Signal Processing", Prentice Hall, 2009.
4. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
5. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

Lesson Plan:

Module 1: Introduction to Signals and Systems:: 2nd Year, Sec A & B (Faculty: Prof. Madhumita Pal, Prof. Sanjoy Mondal)

WORKING	LESSON PLAN – DESCRIPTION
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4th Semester Syllabus for B.Tech Admission Batch 2023

DAY	
1	Syllabus discussion
2	Signals and systems as seen in everyday life, and in various branches of engineering and science.
3	Signal properties: periodicity, absolute integrability, determinism and stochastic character
4	Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential,
5	some special time- limited signals; continuous and discrete time signals, continuous and discrete amplitude signals
6	System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.
7	System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.
8	System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.
9	Introduction to AI
10	<i>AI applications in signal processing, such as signal classification, anomaly detection, and noise reduction.</i>

Module 2: Fourier, Laplace and z- Transforms: 2nd Year, Sec A & B (Faculty: Prof. Madhumita Pal, Prof. Sanjoy Mondal)

WORKING DAY	LESSON PLAN – DESCRIPTION
11	Syllabus discussion
12	Impulse response and step response

4th Semester Syllabus for B.Tech Admission Batch 2023

13	convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections.
14	Characterization of causality and stability of LTI systems.
15	System representation through differential equations and difference equations.
16	State-space Representation of systems
17	State-Space Analysis, Multi-input, multi-output representation.
18	State Transition Matrix and its Role. Periodic inputs to an LTI system,
19	Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.
20	Basics of supervised and unsupervised learning, training models for signal pattern recognition (e.g., sound, image signals), and real-time applications.

Module 3: Fourier, Laplace and z- Transforms: 2nd Year, Sec A & B (Faculty: Prof. Madhumita Pal, Prof. Sanjoy Mondal)

WORKING DAY	LESSON PLAN – DESCRIPTION
21	Syllabus discussion
22	Fourier series representation of periodic signals
23	Waveform Symmetries, Calculation of Fourier Coefficients

4th Semester Syllabus for B.Tech Admission Batch 2023

24	Fourier Transform, convolution/ multiplication and their effect in the frequency domain
25	magnitude and phase response
26	Fourier domain duality
27	The Discrete-Time Fourier Transform (DTFT), the Discrete Fourier Transform (DFT)
28	Parseval's Theorem. Review of the Laplace Transform for continuous time signals and systems
29	system functions, poles and zeros of system functions and signals, Laplace domain analysis,
30	solution to differential equations and system behavior
31	The z- Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

Module 4: Sampling and Reconstruction: 2nd Year, Sec A & B (Faculty: Prof. Madhumita Pal, Prof. Sanjoy Mondal)

WORKING DAY	LESSON PLAN – DESCRIPTION
32	Syllabus discussion
33	The Sampling Theorem and its implications. Spectra of sampled signals
34	Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects.

4th Semester Syllabus for B.Tech Admission Batch 2023

35	Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory
36	modulation for communication, filtering, feedback control systems.

QUESTION PAPER PATTERN AND DATES

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4th Semester Syllabus for B.Tech Admission Batch 2023

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4th Semester Syllabus for B.Tech Admission Batch 2023

Subject Name: Electrical Machines Laboratory - I Credit: 1 Lecture Hours: 24

Subject Code: PCCEE491

Course Objective(s):

The purpose of learning this course is to-

1. To learn the principle of production of electromagnetic force and torque.
2. To learn the concept of magnetic fields and magnetic circuits.
3. To learn the basic principle of operation of DC machine.
4. To learn the principle of operation and characteristics of DC motor and generator.
5. To learn the principle of operation, connections and different tests on Transformers.

Course Outcomes:

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

- CO1. Identify appropriate equipment and instruments for the experiment.
- CO2. Test the instrument for application to the experiment.
- CO3. Construct circuits with appropriate instruments and safety precautions.
- CO4. Validate different characteristics of DC machine, methods of speed control of DC motor and parallel operation of the transformer.

4th Semester Syllabus for B.Tech Admission Batch 2023

List of Experiment

Expt No	Description
1	Design and assembling of a single a phase 220/12V, 20-30VA shell type transformer for EV charging.
2	Design and Construction of a Brushless DC Motor winding
3	Speed control of DC traction motor for locomotive based system using power electronics drives (Hardware/ MAT LAB).
4	Speed Control of DC motors for air compressor-based application (Hardware/MATLAB)
5	Acceptance tests of dry type transformer as per BIS11172 by undertaking a) voltage ratio test b) open circuit test c) Short Circuit test d) insulation test
6	Type test of Single Phase transformer at different load and temperature rise test.
7	Load Sharing and flexible load management by paralleling multiple single phase transformer.
8	Vector grouping of three-phase transformer as par BIS 2026
9	IOT Based control of Brushless DC Motor (BLDC) for ceiling fan application
10	Design and assembling of air core transformer

4th Semester Syllabus for B.Tech Admission Batch 2023

Virtual Lab. Details

Experiment Name	Web-Link/ Software Used
Determination of the characteristics of a separately excited DC generator.	https://ems-iitr.vlabs.ac.in/exp/magnetization-characteristics-dcshunt/ https://ems-iitr.vlabs.ac.in/exp/load-characteristics-dc-shunt/
Determination of the characteristics of a DC motor.	http://em-coep.vlabs.ac.in/Exp1/Theory.html?domain=Electrical%20Engineering&lab=Welcome%20to%20Electrical%20Machines!
Study of methods of speed control of DC motor.	https://ems-iitr.vlabs.ac.in/exp/dcmotor-field-resistance-control/ https://ems-iitr.vlabs.ac.in/exp/dcshunt-motor-armature-control/
Determination of equivalent circuit of a single phase transformer and efficiency.	https://ems-iitr.vlabs.ac.in/exp/circuit-parameters-oc-test/

Simulation Based Experiments:

1. Machine Modelling of DC Shunt Motor using MATLAB/Simulink to validate constant Torque and Constant Speed Application.
2. Machine Modelling of DC traction Motor using MATLAB/Simulink for locomotive application
3. Machine Modelling of DC generators with different excitation systems using MATLAB/Simulink

4th Semester Syllabus for B.Tech Admission Batch 2023

Subject Name: Digital Electronics Laboratory

Credit: 1

Lecture Hours: 30

Subject Code: PCCEE492

Pre-requisite: Basic Electronics

COURSE OBJECTIVES:

1. To impart knowledge of number systems, binary arithmetic, and Boolean algebra.
2. To impart knowledge on Design and implement combinational circuits like adders, subtractors, and multiplexers.
3. To impart knowledge on sequential circuits and understand their timing diagrams
4. To impart knowledge on simulation tools like Multisim, Xilinx, or VHDL/Verilog for digital circuit design and testing.

COURSE OUTCOMES:

- CO 1:** Demonstrate knowledge of basic digital logic gates, truth tables, Boolean algebra and K-Map to simplify logical expressions.
- CO 2:** Design and implement combinational Circuits using both hardware and software.
- CO 3:** Design and implement sequential Circuits using both hardware and software.
- CO 4:** Design and implementation of ADC-DAC

4th Semester Syllabus for B.Tech Admission Batch 2023

Serial No	Experiment Title	Description
1	Introduction to Lab Components and Equipment.	Overview of breadboards, Basic Gates FPGAs, power supplies, and digital ICs.
2	Introduction to VHDL and Basic Syntax	Basic VHDL programming concepts: entity, architecture, signals, and assignments.
3	Combinational Circuit Design (Hardware and Software)	Design of Multi-bit binary adder /Basic arithmetic units in small-scale processors using VHDL/Verilog. Also perform the experiment using IC7483.
4		Design of Carry Look-Ahead Subtractor circuit using VHDL/Verilog and verify the result on FPGA board.
5		Design 16X1 Multiplexer using 4X1 multiplexer using VHDL/Verilog and verify the result on FPGA board. Also perform the experiment using TTL and CMOS ICs.
6		Design 1-16 Demultiplexer using 1-4 Demultiplexer using VHDL/Verilog and verify the result on FPGA board. Also perform the experiment using TTL and CMOS ICs.
7		Design a code converter circuit using FPGA Board.
8	Sequential Circuit Design (Hardware and Software)	Design and simulate flip-flop circuits (SR, D, JK, T) using VHDL. Build a small RAM module using D flip-flops .

4th Semester Syllabus for B.Tech Admission Batch 2023

9		Design a sequential circuit to control a traffic light system with specific timing using VHDL/Verilog . Also perform the experiment using Flip flop ICs.
10		Design a circuit that detects a specific binary sequence using hardware.
11		Design a sequential circuit which can convert serial Data to parallel data using register.
12	A/D and D/A Converters	Design of Temperature Indicator using IC ADC AD570. Design a circuit using IC Chip AFEx8201 Digital-to-Analog Converters (DACs) for PLC applications .

Textbooks and Resources

Digital Design with VHDL by Mark Zwolinski
Digital Systems Design Using VHDL by Charles H. Roth

4th Semester Syllabus for B.Tech Admission Batch 2023

Subject Name: Power Electronics Laboratory

Credit: 1

Lecture Hours: 26

Subject Code: PCCEE493

Course Objective(s):

The purpose of learning this course is-

1. To identify the basic elements of the power electronics engineering
2. To understand the basic operation of different power converter
3. To understand the basic operation of SCR and Triac.

Course Outcomes:

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

- CO1. Identify the basic elements of the power electronics engineering.
- CO2. Understand the basic operation of electronic switches.
- CO3. Understand the operation of different types of power converter.
- CO4. Design basic converter for various applications

4th Semester Syllabus for B.Tech Admission Batch 2023

Laboratory Experiments

Experiment No.	Description
1.	Performance parameter analysis of power semiconductor switches for designing inverters used in renewable energy systems
2.	Design different triggering circuit for controlling the voltage applied to motors enabling speed control in conveyor belts, elevators, and cranes.
3.	Design of firing circuits suitable for triggering SCR in a 1- phase full controlled bridge converter used in battery charging systems, enabling controlled DC output suitable for large industrial batteries
4.	Analysis of the buck-boost chopper performance in terms of voltage regulation and efficiency for charging batteries by stepping up or down the input voltage to match the battery's charging requirements, especially in industrial UPS systems.
5.	Design a TRIAC-based single-phase induction motor speed control system to control domestic fans, industrial motors etc.
6.	Analyze the effect of modulation index on the output voltage and frequency of a pulse width modulated bridge inverter used in EV drive systems to convert DC battery power to variable AC for motor operation, allowing efficient acceleration, deceleration, and speed control.
7.	Investigating the effect of load variation (purely R to R-L to purely L) using single phase controlled converter for heating control of appliances.
8.	Obtaining precise voltage control for Li-Po battery charging using single phase full controlled bridge converter (MATLAB+PSIM)
9.	Achieving precise and smooth lighting control using single phase controlled converter with source inductance and verification of hardware results using PSIM and MATLAB simulation.
10.	Integrating step up and step down chopper using IGBT with DC-DC charging station for solar panels and observing voltage variation using CRO / DSO with software replication using PSIM and MATLAB

4th Semester Syllabus for B.Tech Admission Batch 2023

11.	Observation of BLDC motor operation (with reversing) using single phase half controlled symmetrical bridge converters attached to CRO / DSO and verification of hardware results using PSIM and MATLAB simulation.
12.	Regulation and control of reactive power flow using three phase controlled converter with load variation (purely R to R-L to purely L) and representation using CRO / DSO and verification using PSIM and MATLAB software.

Subject Name: Object Oriented Programming & Java Lab

Credit: 1

Lecture Hours: 24

Subject Code: OECEE481A

Pre-requisite: Familiarity with data structures and introduction to programming.

Course Outcomes

Essential:

1. Understanding the build system: IDE, tools for testing, debugging, profiling, and source code management.
2. Students are able to demonstrate proficiency in object-oriented programming.
3. Identify and abstract the programming task involved for a given programming problem.
4. Learning and using language libraries for building large programs.
5. Ability to apply defensive programming techniques (e.g., assertions, exceptions).

4th Semester Syllabus for B.Tech Admission Batch 2023

Desirable/Advanced:

1. Ability to implement basic event-driven programming.
2. Understanding of the fundamentals of parallel programming.
3. Understanding of the basics of cloud computing.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Corresponding Lab Assignment
1.	Familiarity with the programming environment	Understanding the build system, IDE, debugging, profiling and source code management. Introduction to various programming paradigms, advantages of OOP, comparison of OOP with Procedural Paradigm	International Academia: https://drive.google.com/file/d/10z00dMd26WjiPTThCercGbsi6u3ciE62/view?usp=drive_link https://drive.google.com/file/d/1k3qrfDL9p5_IJR_iP2mt6c6AzwmByNtf/view?usp=sharing AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf Industry Mapping:	Familiarity with terminal/command prompt, using git commands and github to pull/ commit/ push/ merge code, writing, compiling and running simple programs, debugging by setting breakpoints

4th Semester Syllabus for B.Tech Admission Batch 2023

			<i>Hackerrank, TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.</i>	
2.	Basic principles of the object-oriented development process	Introduction to Object-Oriented Paradigm: Data encapsulation, modularity, code reuse, identifying classes, attributes, methods and objects, class relationships	International Academia: https://drive.google.com/file/d/1Rc1KOzkVRHqLEWApFBplwz7s8IwsyFlf/view?usp=sharing https://drive.google.com/file/d/1e8g7D6nuMwEruToXtNDbh68vx2VKUrgS/view?usp=sharing AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf Industry Mapping: <i>Hackerrank, TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.</i>	Importing pre-written classes using the this keyword, calling and defining methods, writing and instantiating classes, setter/getter methods, instance variables, returning values, debugging using print function, containment and association, scope and parameter passing

4th Semester Syllabus for B.Tech Admission Batch 2023

3.	Advanced features of OOP	Interfaces, inheritance, polymorphism, abstract classes, immutability, copying and cloning objects	International Academia: International Standards Mapping (MIT Open Courseware): String: immutability, BufferedReader, StringBuilder (https://ocw.mit.edu/ans7870/6/6.005/s16/classes/09-immutability/) Polymorphism : Methods : Overloading and overriding Methods, overloading constructors (https://ocw.mit.edu/courses/6-088-introduction-to-c-memory-management-and-c-object-oriented-programming-january-iap-2010/67b1aec3f2867734ec0fb33034c8b5c8/MIT6_088IAP10_lec05.pdf) AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) Industry Mapping: Hackerrank, TCS Codevita projects, GitHub platform.	Parameter polymorphism, method resolution, declared v/s actual type, partially and fully overriding methods, calling superclass constructor from child class constructor, protected fields and methods, using an abstract parent class v/s an interface with default and abstract methods, object equality check, object comparison (Comparable/Comparator interface), Cloneable interface/copy constructor
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4th Semester Syllabus for B.Tech Admission Batch 2023

			<i>NetBeans and Eclipse IDE will be used.</i>	
4.	Using language APIs	Language supported libraries for handling advanced data structures. Abstraction: abstract class, design debugging interface, multiple inheritance, packages Access control, class scope, packages, Java API	International Academia: (https://drive.google.com/file/d/1yFNf2IBXgy6ch47hR6TGHZddvCPfVm8p/view?usp=sharing) AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) Industry Mapping: Hackerrank, TCS Codevita projects, GitHub platform. <i>NetBeans and Eclipse IDE will be used.</i>	Big-O notation, Java collection framework (or Boost libraries), sorting objects, iterating over objects

4th Semester Syllabus for B.Tech Admission Batch 2023

5.	Defensive programming	Exception handling, assertions, Java Thread Programming	International Academia: (https://drive.google.com/file/d/1kbRGF396sQPdQbA4w-N81EIKU_bdGgFs/view?usp=sharing) AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) Industry Mapping: Hackerrank, TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.	Exception handling using try/catch block, nesting try/catch blocks, throw and throws keywords, rethrowing exceptions, handling checked exception, user defined exceptions. Thread Synchronization and Thread Communication
6.	Modeling and Design patterns	Basic modeling techniques – e.g. Class diagram, sequence diagram, use case diagrams, etc. Introduction to design patterns: iterator, singleton, flyweight, adapter, strategy, template, prototype, factory, façade, decorator, composite, proxy, chain of responsibility, observer, state) Model View Controller	International Academia: (https://drive.google.com/file/d/1DQVPfhmcyKog-PryPdZ-bxufUC7D0Cfl/view?usp=sharing) AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf)	UML modeling.

4th Semester Syllabus for B.Tech Admission Batch 2023

			Industry Mapping: Hackerrank, TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.	
7.	Basic Android Programming	Android Components – Activity, Services, Content Provider, Broadcast Receiver; Simple UI Design, Applet and Swing	International Academia: (https://online.stanford.edu/courses/cs108-object-oriented-systems-design) AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf) Industry Mapping: Hackerrank, TCS Codevita projects, GitHub platform, Android Studio will be used.	Android app making

Suggested Learning Resources:

Text Books

1. Herbert Schildt, Java: The Complete Reference, 11st edition

4th Semester Syllabus for B.Tech Admission Batch 2023

2. Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen, Kelli A. Houston. Object-Oriented Analysis and Design with Applications.
3. E. Balaguruswami, Programming with Java, 6th edition
4. Barry A. Burd and John Mueller, Android Application Development All-in-One For Dummies

Reference Books:

1. J. Rumbaugh et al. The Unified Modeling Language Reference Manual.
2. P. Van Roy and S. Haridi. Concepts, Techniques, and Models of Computer Programming.
3. Horton, I. (2005). Ivor Horton's Beginning Java 2. John Wiley & Sons.
4. <https://missing.csail.mit.edu/>
5. <https://www.baeldung.com/junit>
6. <https://www.tutorialspoint.com/junit/index.htm>

For UML tools, open source tools may be used (e.g. www.starUML.io, argouml.tigris.org/)

4th Semester Syllabus for B.Tech Admission Batch 2023

Subject Name: Programming using Python

Credit: 1

Lecture Hours: 24

Subject Code: OECEE481B

Course Objective:

1. To develop logical skills and basic technical skills so that students should be able to solve basic computing problems.
2. The students should be able to learn the basic of any computer programming language.

Course Outcome:

CO1: Understand real world problems and developing computer solutions for those.

CO2: Understand the basics of python.

CO3: Apply python for solving basic programming solutions.

CO4: Create algorithms using learnt programming skills.

4th Semester Syllabus for B.Tech Admission Batch 2023

Module number	Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Book	Mapped Chapter
1	Introduction to Python Data Types, Operators, Expression, Indexing & Slicing, Strings, Conditionals, Functions, Control Flow, Nested Loops, Sets & Dictionaries.	<i>International Academia:</i> https://tinyurl.com/bdass3 <i>AICTE-prescribed syllabus:</i> https://tinyurl.com/32a8mp5t <i>Industry Mapping:</i> Jupyter Notebook	8	- Hands-on exploration of core Python data types for analysing 10-year climate dataset. - Hands-on experiments to implement and apply arithmetic and logical operators in power calculations of thermal power plant using Python. - Design Python indexing techniques in image processing in healthcare. - Developing real-time decision-making systems for healthcare solutions using conditional statements, control flow, and nested loops using Python. - Design a dictionary to manage student records, mapping roll numbers to scores using Python. - Designing sets to find students enrolled in common or unique subjects using Python.	David Amos, Dan Bader, Joanna Jablonski, Fletcher Heisler, "Python Basics: A Practical Introduction to Python 3", 4th Edition, Real Python.	3,4,5,6,8,9

4th Semester Syllabus for B.Tech Admission Batch 2023

2	Introduction to Machine Learning Machine Learning Vs Statistical Modelling, Supervised vs Unsupervised Learning, Supervised Learning, Classification, Unsupervised Learning, Reinforcement Learning, Applications, Python libraries suitable for Machine Learning: Pandas, Numpy, Scikitlearn, Visualization libraries: matplotlib etc.	<i>International Academia:</i> https://tinyurl.com/2jphac8c <i>AICTE-prescribed syllabus:</i> https://tinyurl.com/32a8mp5t <i>Industry Mapping:</i> Spyder, SK Learn, Mat Plot Lib, NumPy, Pandas	8	1. Create and analyse features relevant to the design parameters of solar cells using Python. 2. Design mathematical transformations to preprocess and enhance data for anomaly detection in industrial windmill performance using Python. 3. Create insightful visualizations of data distributions: (a) Scatter plots of customer segmentation for marketing, (b) Heatmaps for supply chain optimization and (c) Trend analysis in stock prices using Python. 4. Use of Eigenvalues and Eigenvectors in Principal Component Analysis (PCA) for dimensionality reduction in machine learning using Python. 5. Matrix Rank in detecting redundancy in industrial sensor data using Python. 6. Create 'Training' and 'Testing' using Python by treating algorithms like decision trees and nearest neighbours as black boxes, focusing on their application in healthcare domain.	Manaranjan Pradhan and U Dinesh Kumar, "Machine Learning using Python", First Edition, Wiley India Pvt. Ltd.	1
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4th Semester Syllabus for B.Tech Admission Batch 2023

3	Regression Model using Python Simple Linear Regression, Multiple Linear Regression, Nonlinear Regression, Model Evaluation in Regression Models, Evaluation Metrics in Regression Models.	<i>International Academia:</i> https://tinyurl.com/9d4brw22 <i>AICTE-prescribed syllabus:</i> https://tinyurl.com/32a8mp5t <i>Industry Mapping:</i> Spyder, Regression ML Algorithms	8	1. Create a Linear Regression and a Non-linear Regression model to predict the performance of a solar cell under different lighting conditions using Python. 2. Create a Non-linear Regression model to predict the suitable material to design a highly efficient solar cell using Python. 3. Performance evaluation of different Regression Models suitable for fault detection of a solar power plant using Python.	Manaranjan Pradhan and U Dinesh Kumar, "Machine Learning using Python", First Edition, Wiley India Pvt. Ltd.	4
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4th Semester Syllabus for B.Tech Admission Batch 2023

4	Classification Model using Python Introduction to Classification, K-Nearest Neighbour, Decision Trees, Logistic Regression, Support Vector Machines, Logistic regression vs Linear regression, Evaluation Metrics in Classification.	<i>International Academia:</i> https://tinyurl.com/9d4brw22 <i>AICTE-prescribed syllabus:</i> https://tinyurl.com/32a8mp5t <i>Industry Mapping:</i> Spyder, Classification on ML Algorithms	8	- Design a K Nearest Neighbour Classifier that categorizes data points of disease diagnosis in healthcare using Python. - Create a Decision Tree algorithm to help in load forecasting, energy demand prediction, and dynamic adjustment of power distribution to prevent overloads using Python. - Design a Logistic Regression model that can analyze energy usage data and suggest or implement optimal energy-saving strategies for smart thermostats or lighting systems using Python. - Design Support Vector Machine models that are trained on historical fault data and can automatically detect abnormalities or anomalies in real-time data of short circuits or voltage imbalances in power grids using Python. - Performance evaluation of different Classification Models suitable for predicting peak usage times and adjusting energy distribution or prices dynamically to prevent power shortages using Python.	Manaranjan Pradhan and U Dinesh Kumar, "Machine Learning using Python", First Edition, Wiley India Pvt. Ltd.	5
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4th Semester Syllabus for B.Tech Admission Batch 2023

5	Unsupervised Learning using Python Introduction to Clustering, K-Means Clustering, Hierarchical Clustering, Density-Based Clustering, Content-based recommender systems, Collaborative Filtering.	<i>International Academia:</i> https://tinyurl.com/9d4brw22 <i>AICTE-prescribed syllabus:</i> https://tinyurl.com/32a8mp5t <i>Industry Mapping:</i> Spyder, Clustering ML Algorithms	8	- Design a K-Means Clustering model that detects anomalies in equipment behaviour; predictive maintenance models help prevent costly downtime and improve the lifespan of machinery. using Python. - Design a Hierarchical Clustering model that enhances image clarity, reduces errors, and improves the efficiency of diagnostic equipment using Python. - Design a Based Clustering model that results in more accurate and reliable sensor systems, improving the performance of Smart irrigation system. - Develop a system that recommends the most suitable electronic components (resistors, capacitors, transistors, etc.) for a given circuit design based on specific requirements (e.g., power rating, tolerance, capacitance). - Develop a collaborative filtering-based system to recommend settings or features for smart home devices (e.g., thermostats, lighting, or security cameras) based on user behavior and preferences.	Andreas C. Muller and Sarah Guido, "Introduction to Machine Learning with Python", First Edition, O'Reilly Media, Inc.	3
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Projects:

- Develop a machine learning model to predict failures or maintenance needs of electrical equipment (motors, transformers, etc.) based on sensor data.
- Create a model to predict energy consumption patterns in smart grids based on historical usage data.
- Use machine learning to predict the output of solar panels based on weather and environmental data.
- Develop a machine learning model to optimize the placement and operation of EV charging stations.
- Build a condition monitoring system for transformers using ML to predict transformer failures and optimize their operation.

4th Semester Syllabus for B.Tech Admission Batch 2023

Suggested sources of learning:

TEXT BOOK:

1. David Amos, Dan Bader, Joanna Jablonski, Fletcher Heisler, “Python Basics: A Practical Introduction to Python 3”, 4th Edition, Real Python.
2. Manaranjan Pradhan and U Dinesh Kumar, “Machine Learning using Python”, First Edition, Wiley India Pvt. Ltd.
3. Andreas C. Muller and Sarah Guido, “Introduction to Machine Learning with Python”, First Edition, O’Reilly Media, Inc.

REFERENCE BOOKS:

1. Mark Lutz, “Learning Python”, Fourth Edition, O’Reilly Media, Inc.