



INSTITUTE OF ENGINEERING & MANAGEMENT

(School of University of Engineering and Management Kolkata)

DEPARTMENT OF ELECTRICAL ENGINEERING

SEMESTER WISE CURRICULAM

2nd YEAR- 4th SEMESTER

Syllabus for B. Tech Admission Batch 2024

Syllabus Structure:

Sl No	Type of Course	Course Code	Course Name	L	T	P	Total Contact Hours	Credit Points
1	Basic Science Courses	BSM401	Mathematics-IV	2	1	0	3	3
2	Basic Science Courses	MCC471	Sustainability, Climate Actions & Environmental Sciences	2	0	0	2	2
3	Professional Core Courses	PCCEE401	Electrical Machines-I	3	1	0	4	3
4	Professional Core Courses	PCCEE402	Digital Electronics	3	1	0	4	3
5	Professional Core Courses	PCCEE403	Power Electronics	3	1	0	4	3
6	Professional Core Courses	PCCEE404	Signals & Systems	3	0	0	3	3
7	Humanities and social sciences including Management	ESP401	Essential Studies for Professionals IV	2	0	0	2	0.5
8	Professional Core Courses	PCCEE491	Electrical Machines Laboratory-I	0	0	3	3	1
9	Professional Core Courses	PCCEE492	Digital Electronics Laboratory	0	0	3	3	1
10	Professional Core Courses	PCCEE493	Power Electronics Laboratory	0	0	3	3	1
11	Open Elective Courses	OECEE481	A. Object Oriented Programming & Java Lab B. Programming using Python	0	0	2	2	1
12	Humanities and social sciences including Management	SDP481	Skill Development for Professionals IV	0	0	2	2	0.5
13	Project, Seminar and Industrial Training	PWEE481	Mini Project II	0	0	1	1	1
14	Massive Open Online Courses	MOOCs	Massive Open Online Courses (MOOCs)	0	0	0	0	0
15	Industry and Foreign Certification	IFC	Industry and Foreign Certification (IFC)	0	0	0	0	0
16	Mandatory Additional Requirements	MAR481	Mandatory Additional Requirements (MAR)	0	0	0	0	0
Total Credit Points of Semester =								23



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4th Semester Syllabus for B.Tech for Admission Batch 2024

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.

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: <ul style="list-style-type: none"> • MIT Mapping AICTE-prescribed syllabus: <ul style="list-style-type: none"> • AICTE Syllabus 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). <i>Fourier Transforms:</i> Fourier Transform and its properties; Fourier Sine and Cosine Transforms, Fourier Transform of derivatives (statement only); Inverse Fourier Transform	International Academia: <ul style="list-style-type: none"> • MIT Mapping AICTE-prescribed syllabus: <ul style="list-style-type: none"> • AICTE Syllabus Industry Mapping: To analyze periodic signals and transform them into frequency components. https://in.mathworks.com/help/matlab/math/fourier-	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 .

		(statement only); Convolution theorem (statement only), related problems.	transforms.html			❖ Compare Fourier 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.	<p>International Academia:</p> <ul style="list-style-type: none"> • MIT Mapping <p>AICTE-prescribed syllabus:</p> <ul style="list-style-type: none"> • AICTE Syllabus <p>Industry Mapping:</p> <p>To analyze system dynamics, stability, and control in electrical circuits and automation. https://in.mathworks.com/help/symbolic/sym.laplace.html</p>	8	Textbook 1: Chapter 21	<ul style="list-style-type: none"> ❖ 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 and their solution by Z-Transform method.	<p>International Academia:</p> <ul style="list-style-type: none"> • MIT Mapping <p>AICTE-prescribed syllabus:</p> <ul style="list-style-type: none"> • AICTE Syllabus <p>Industry Mapping:</p> <p>To analyze discrete-time systems, especially in control systems and digital signal processing (DSP). https://in.mathworks.com/help/symbolic/sym.ztrans.html</p>	6	Textbook 1: Chapter 23	<ul style="list-style-type: none"> ❖ Compute Z-transform of some elementary of some functions using MATLAB. ❖ Solve linear difference equations with 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 datasets; Data visualization: Line plot, Bar plot, Histogram.	<p><i>International Academia:</i></p> <ul style="list-style-type: none"> ● MIT Mapping <p><i>AICTE-prescribed syllabus:</i></p> <ul style="list-style-type: none"> ● AICTE Syllabus <p><i>Industry Mapping:</i></p> <ol style="list-style-type: none"> 1. To handle datasets and visualize for real-time insights. 2. To solve systems of equations for applications like signal processing. 	4	Textbook 2:	<ul style="list-style-type: none"> ❖ Handling of data using Panda Library. ❖ Plot data using Matplotlib. ❖ Compute Matrix operations using Numpy library. ❖ Calculate central tendencies, standard deviation of a dataset.
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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.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3	3	2	3	-	-	1	1	2	1
CO2	2	3	3	2	3	-	-	1	1	2	1
CO3	2	3	3	2	3	-	-	1	1	2	1
CO4	2	3	3	2	3	-	-	1	1	2	1



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Syllabus and Lesson Plan for B.Tech Admission Batch 2024

Subject Name: Sustainability, Climate Actions & Environmental Sciences

Credit: 2

Subject Code: MCC471

Lecture Hours: 24

[Study Material](#)

[LinkedIn](#)

[NPTEL](#)

[Coursera](#)

[Lesson Plan](#)

Course objectives:

1. To introduce fundamental concepts of environmental systems, sustainability and United Nations Sustainable Development Goals
2. To apply knowledge of sustainable practices and societal challenges.
3. To be able to analyze the challenges and strategies associated with climate change mitigation.
4. To understand the principles of the circular economy.

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.

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.	<p><i>International Academia:</i> https://unccelearn.org/course/view.php?id=170&page=overview https://unccelearn.org/course/view.php?id=181&page=overview</p> <p><i>Industry Mapping:</i></p>	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	<p><i>International Academia:</i> https://ocw.mit.edu/courses/res-env-006-teaching-with-sustainability-january-iap-2022/</p> <p><i>Industry Mapping:</i></p>	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	<p>-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 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</p>	<p>International Academia: https://unccelearn.org/course/view.php?id=7&page=overview&lang=en https://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/</p> <p>Industry Mapping:</p>	4	Using data analytics and modeling tools - evaluate climate change impacts, assess ecosystem health, and propose technical solutions for mitigation and conservation efforts.
IV	UN-call for Action	<p>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.</p>	<p>International Academia: https://unccelearn.org/course/view.php?id=175&page=overview</p> <p>Industry Mapping:</p>	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	<p>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.</p>	<p>International Academia: https://www.igmpi.ac.in/environmental-social-governance?gad_source=1</p>	4	Life Cycle Assessment of a college building using OpenLCA software.

			https://www.iso.org/standard/60857.html#:~:text=ISO%2014001%20is%20the%20internationally,continually%20improve%20their%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	4	Mapping the supply chain of different waste management system and finding the issues & challenges.
			Industry Mapping:		

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

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.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	0	3	2	0	1	0	3
CO2	3	3	3	2	0	3	2	0	1	0	3
CO3	3	3	3	2	0	3	2	0	1	0	3
CO4	2	2	3	2	0	3	3	0	1	0	3



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Syllabus and Lesson Plan for B.Tech Admission Batch 2024

Subject Name: Electrical Machines I

Credit: 3

Lecture Hours: 38

Subject Code: PCCEE401

Pre-requisite: Basic Electrical, Field Theory

Relevant Links:

[Study Material](#)
[Lesson Plan](#)

[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.

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 toque production	Magnetic fields, Energy density and magnetic circuits; Electromagnetic force, torque and General theory of Rotating Electrical Machines	International Academia: MIT MAPPED SYLLABUS AICTE-prescribed syllabus: AICTE SYLLABUS Industry Mapping: IS/ IEC Specification No. 60034-1: 2004 for Rotating Electrical Machines · Simulation Software: MATLAB	2	I.J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010	2,4,5	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	<p>Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core,</p> <p>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.</p> <p>Armature winding and commutation - Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation</p> <p>Working- Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.</p>	<p>International Academia: MIT MAPPED SYLLABUS</p> <p>AICTE-prescribed syllabus: AICTE SYLLABUS</p> <p>Industry Mapping: IS/ IEC Specification No. 60034-1: 2004 for Rotating Electrical Machines ·</p> <p>Simulation Software: MATLAB</p>	7	I.J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010	7	<p>Testing of DC Generators and Motors as per IS Specification No. 9320: 1979 :</p> <ul style="list-style-type: none"> a) Measurement of winding resistances b) Determination of open circuit characteristics c) Determination of regulation characteristics d) Determination of external characteristics (for generator only) e) Determination of efficiency of a machine <p>· Assignments using Simulation Software</p>
3	DC machine – Operation, Control and Efficiency	<p>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.</p>	<p>International Academia: MIT MAPPED SYLLABUS</p> <p>AICTE-prescribed syllabus: AICTE SYLLABUS</p> <p>Industry Mapping: IS/ IEC Specification No. 60034-1: 2004 for</p>	8		7	<p>Testing of DC motor to:</p> <ul style="list-style-type: none"> a) Study Torque- Speed characteristics b) Different Methods of Speed Control <p>· Assignments using Simulation Software</p>

		<p>Motor Operation- V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors.</p> <p>Speed control through armature voltage. Losses,</p> <p>Efficiency, load testing and back-to-back testing of DC machines,</p>	<p>Rotating Electrical Machines ·</p> <p>Simulation Software: MATLAB</p>				
4	Transformers – Working principle, Construction, Operation, Control and Testing	<p>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.</p> <p>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,</p>	<p>International Academia: MIT MAPPED SYLLABUS</p> <p>AICTE-prescribed syllabus: AICTE SYLLABUS</p> <p>Industry Mapping: IS/ IEC Specification No. 60034-1: 2004 for Rotating Electrical Machines ·</p> <p>Simulation Software: MATLAB</p>	17	Prithwiraj Purkait & Indrayudh Bandopadhyay, “Electrical Machines” Oxford University Press	6,7	<p>Routine tests of transformer as per IS 2026:</p> <p>a) Transformer voltage ratio test and polarity</p> <p>b) Winding resistance test of transformer</p> <p>c) Transformer vector group test</p> <p>d) Measurement of impedance voltage/short circuit impedance (principal tap) and load loss (Short circuit test)</p> <p>e) Measurement of no-load loss and current (Open circuit test)</p>

		<p>Autotransformers- construction, principle, applications and comparison with two winding transformer</p> <p>Tap-changing transformers - No- load and on-load tap-changing of transformers, Three-winding transformers.</p> <p>Cooling of transformers, Dry type transformer.</p>				<p>f) Temperature rise test of transformer (Back to Back Test)</p> <p>g) Dielectric tests of transformer (in Power System)</p> <p>h) Measurement of insulation resistance (in Power System)</p> <p>· Assignments using Simulation Software</p>	
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

Suggested Learning Resources:

Text Books

1. I.J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
2. Prithwiraj Purkait & Indrayudh Bandopadhyay, "Electrical Machines" Oxford University Press

Reference Books

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2021
2. 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.
4. Kirtley Jr., James L. Electric Power Principles: Sources, Conversion, Distribution and Use. Wiley, 2010. ISBN: 9780470686362.

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	2	0	0	0	0	0	1	1
CO2	3	3	1	2	0	0	0	0	0	1	1
CO3	3	3	3	3	3	1	0	1	0	1	1
CO4	3	3	3	3	3	1	0	2	0	1	1



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Syllabus and Lesson Plan for B.Tech Admission Batch 2024

Subject Name: Digital Electronics

Credit: 3

Lecture Hours: 36

Subject Code: PCCEE402

Pre-requisite: Mathematics, Basic Electronics

Course Objective:

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 Outcome:

- CO 1:** Students will have a thorough knowledge of number system and different codes and also they will be able to apply those knowledge while required.
- CO 2:** After completing this course, the students will be able to design and analyze combinational logic circuits. They will also learn how to use GEN AI for Combinational Logic Circuits.
- CO 3:** Students will acquire a knowledge about sequential logic circuits and solid states memory devices. They will also learn how to use GEN AI for Sequential Logic Circuits.
- CO 4:** They will be able to design ADC and DAC and also will acquire knowledge on logic families.

Relevant Links:

[STUDY MATERIAL](#)

[COURSERA](#)

[NPTEL](#)

[LinkedIN Learning](#)

[Infosys Springboard](#)

Lesson Plan

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: (MIT MAPPED SYLLABUS) AICTE-prescribed syllabus: (AICTE SYLLABUS) Industry Mapping: SPICE software, Verilog	8	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 Academia: (MIT MAPPED SYLLABUS) AICTE-prescribed syllabus: (AICTE SYLLABUS) Industry Mapping: Hardware Chipsets (IC 7408, 7432,7404), Software-TinkerCad	6	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.
3	Designing Combinational Logic Circuits: Text Book:	Arithmetic circuits (ADDER and SUBTRACTOR), multiplier, comparators, decoders, encoders, multiplexers, demultiplexers, parity generator and checker and their use in logic synthesis; Potential hazards in combinational circuits.	International Academia: (MIT MAPPED SYLLABUS) AICTE-prescribed syllabus: (AICTE SYLLABUS)	6	1. Design of Adder and Subtractor using basic gates (IC 7408, 7432,7404) and use of IC 74LS83 as BCD adder. 2. Design of MUX and

	<p>Salivahanan and Arivazhagan: (Chapter 5,6)</p>		<p>Industry Mapping: Hardware Chipset (IC 7408, 7432,7404, 74153, 74155, 74180)</p> <p>Software: LogiSim and VHDL</p>		<p>DEMUX using basic gates (IC 74153, 74155) and also study the available ICS of MUX and DEMUX.</p> <p>3. Implement logic functions using these ICs.</p> <p>4. Design and implementation of 16-bit odd/even parity checker/generator using IC 74180.</p> <p>5. Implementation of combinational circuits using LogiSim and VHDL</p>
4	<p>Designing Sequential Logic Circuits:</p> <p>Text Book: Anand Kumar (Chapter 8,9,10, 11,12)</p>	<p>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.</p>	<p>International Academia: (MIT MAPPED SYLLABUS)</p> <p>AICTE-prescribed syllabus: (AICTE SYLLABUS)</p> <p>Industry Mapping: Hardware Chipset (IC 7476, 7474) Software: LogiSim and VHDL</p>	6	<p>1. 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.</p> <p>2. Design of synchronous and asynchronous counter using Flip Flop IC 7476.</p> <p>3. Design of 4-bit shift register (shift right) IC 7476/7474</p> <p>4. Implementation of sequential circuits using Logisim and VHDL</p>
5	<p>Introduction to Digital Logic Devices, ADC and DAC:</p> <p>Text Book: Salivahanan and Arivazhagan :(Chapter 10, 13)</p>	<p>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 AFEx8201 16-Bit and 14-Bit Digital-to-Analog Converters (DACs) With Voltage Reference and Diagnostic ADC for Low-Power Applications</p>	<p>International Academia: (MIT MAPPED SYLLABUS)</p> <p>AICTE-prescribed syllabus: (AICTE SYLLABUS)</p> <p>Industry Mapping: Hardware Chipset AFEx8201 ADC AD570, DAC 0808 Software TinkerCad (TINKARCAD LINK)</p>	5	<p>1. Design of PLA and PAL using basic logic gates (IC 7408, 7432,7404)</p> <p>2. Design and testing of half/full adder and multiplexer by burning FPGA Kit.</p> <p>3. Design of ADC and DAC using IC ADC AD570, DAC 0808</p> <p>4. Design of ADC and DAC using TinkerCad</p>

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		5	Study Material

Text Books:

1. Digital Circuits and Design, by S. Salivahanan, S. Arivazhagan, 5th Edition, Oxford University Press India. (Chapter: 2,5,6,10,13)
2. Fundamentals of Digital Circuits; Anand Kumar; PHI Publication (Chapter:2,3,4,8,9,10,11,12)
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

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	2	0	0	0	1	0	2
CO2	3	2	3	3	2	0	0	0	1	0	2
CO3	3	3	2	3	2	0	0	0	1	0	2
CO4	2	2	2	2	1	0	0	0	1	0	1



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



Syllabus and Lesson Plan for B.Tech Admission Batch 2024

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.

Detailed syllabus

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	<p>International Academia: (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/)</p> <p>AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf)</p> <p>Industry Mapping: MATLAB</p>	8	<ol style="list-style-type: none"> 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	<p>International Academia: (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/)</p> <p>AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf)</p> <p>Industry Mapping: PSIM, MATLAB</p>	7	<ol style="list-style-type: none"> 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 controlled converter with 	Power Electronics, P.S. Bimbhra, Khanna Publishers.	Chapters: 3, 6

					<p>source inductance and verification of hardware results using PSIM and MATLAB simulation.</p> <p>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.</p> <p>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.</p>		
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 Converters and assessment of auto - transitional operating modes with AI based I/O & O/P applications	<p>International Academia: (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/)</p> <p>AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf)</p> <p>Industry Mapping: PSIM, MATLAB</p>	8	<p>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 systems.</p> <p>9. Integrating step up and step down chopper using IGBT with DC-DC charging station for solar panels and observing voltage</p>	Power Electronics, P.S. Bimbhra, Khanna Publishers.	Chapters: 7, 14

					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	<p>International Academia: (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/)</p> <p>AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf)</p> <p>Industry Mapping: PSIM, MATLAB</p>	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.	<p>International Academia: (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/)</p> <p>AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf)</p> <p>Industry Mapping: PSIM, MATLAB</p>	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
6	Applications	Separately excited dc motor speed control, switch mode power supply, resonant converter, concept of soft switching	<p>International Academia: (https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/)</p> <p>AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf)</p> <p>Industry Mapping: PSIM, MATLAB</p>	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.

CO-PO mapping

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	2	–	–	–	–	–	1
CO2	3	3	2	2	2	–	–	–	–	–	1
CO3	3	3	2	2	3	–	–	–	1	–	1
CO4	3	2	3	2	3	1	–	1	2	2	2



University of Engineering and Management
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University of Engineering & Management, Jaipur



Syllabus and Lesson Plan for B.Tech Admission Batch 2024

Subject Name: Signals & Systems

Credit: 3

Lecture Hours: 30

Subject Code: PCCEE404

Pre-requisite: Mathematics

Relevant Links:

[Study Material](#)

[Coursera](#)

[Nptel](#)

[Linked In Learning](#)

[Lesson Plan](#)

Course Objective:

1. To describe various signals and systems mathematically and understand how to perform mathematical operations on them.
2. Also familiar with commonly used signals such as the unit step, ramp, and impulse function, sinusoidal signals, complex exponentials and their operations.
3. Analysis using Fourier series and Fourier transform for a given signal.

Course Outcome:

- 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.

Detailed Syllabus:

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Book	Mapped Chapter
1	Introduction to Signals and Systems	<p>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.</p> <p>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.</p> <p><i>AI applications in signal processing, such as signal classification, anomaly detection, and noise reduction.</i></p>	<p>International Standards :MIT Mapping AICTE prescribed syllabus: (Aicte Syllabus)</p> <p>Industry Mapping: MATLAB, SCILAB</p>	10	No Lab	Signals and Systems by P.Ramesh Babu and R. Anandanatarajan	1,2
2	Signal operation of LTI systems	<p>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.</p> <p>Basics of supervised and unsupervised learning, training models for signal pattern recognition</p>	<p>Industry Mapping: MATLAB, OCTAVE</p>	8	No Lab	Signals and Systems by P.Ramesh Babu and R. Anandanatarajan	3,4

		(e.g., sound, image signals), and real-time applications.					
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 : MIT Mapping AICTE prescribed syllabus: (Aicte Syllabus) 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
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 : MIT Mapping AICTE prescribed syllabus: (Aicte Syllabus) Industry Mapping: FPGA Kit Software: MATLAB, OCTAVE	4		Signals and Systems by P.Ramesh Babu and R. Anandanatarajan	9

Text Books:

1. P.Ramesh Babu and R. Anandanatarajan , Signals and Systems, SCITECH Publications, 4th Edition
2. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.
3. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.

Reference Books:

1. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
2. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.



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4th Semester Syllabus for B.Tech Admission Batch 2024

Subject Name: Electrical Machines Laboratory - I

Credit: 1

Subject Code: PCCEE491

Lecture Hours: 24

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.

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/ MATLAB).
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.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	0	0	0	1	0	0	0	1
CO2	3	2	2	2	1	0	1	0	0	0	1
CO3	3	3	3	3	1	0	1	0	0	0	1
CO4	3	2	2	3	1	1	1	0	0	0	1

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://emcoep.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.



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Syllabus and Lesson Plan for B.Tech Admission Batch 2024

Subject Name: Digital Electronics Lab

Credit: 1

Subject Code: PCCEE492

Lecture Hours: 24

Course objective(s):

The purpose of learning this course is to:

1. Understand the fundamental concepts of digital logic design using discrete components, ICs, and programmable devices.
2. Develop skills to design and implement combinational and sequential circuits using basic logic gates and standard ICs.
3. Apply digital design principles to implement circuits such as adders, subtractors, counters, registers, ADCs, and DACs.
4. Analyze and verify the behavior of digital circuits through simulation (Logisim/VHDL) and hardware implementation.
5. Foster the ability to integrate theoretical knowledge with practical applications in modern digital system design.

Course outcome(s):

At the end of the course, the students will be able to-

CO1. Design and implement basic logic gates and combinational circuits using CMOS and TTL ICs.

CO2. Design arithmetic and code conversion circuits such as adders, subtractors, and BCD converters.

CO3. Develop and test sequential circuits like flip-flops, counters, and shift registers using ICs and simulation tools.

CO4. Interface and verify digital systems such as ADCs, DACs, and display drivers through practical implementation.

Expt No.	Description	No. of Hours
1	Design of basic Logic gates using (CMOS/TTL) logic families	2
2	Design of inverter using CMOS	2
3	Design of MUX/DEMUX using basic gates and also design inverter using MUX and also the available ICs of MUX and DEMUX	2
4	Design of BCD to Excess -3 code and vice versa using basic gates (7404,7408,7432/4010,4071,4081)	2
5	Design of Adder and Subtractor using basic gates (7404,7408,7432/ 4010,4071,4081) and use of IC 74LS83 as BCD adder	2
6	Design and implementation of 16 bit add/even parity checker/generator using IC 74180)	2
7	Implementation of combinational circuits using Logisim and VHDL	2
8	Design and testing of half/full adder and Multiplexer by burning FPGA trainer	
9	Design of RS, D, T and JK flip flops using universal gates (7402 and 7400/ 4001 and 4011). Also design master- slave JK flip flop by using IC (7476/ 4027)	2
10	Design of synchronous and asynchronous counter using IC(7076/4027) and also check by using 7 segment display	2

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	1	2	0	0	0	1	0	1
CO2	3	3	2	1	2	0	0	0	1	0	1
CO3	3	2	3	2	3	0	0	0	1	0	1
CO4	3	2	3	2	3	0	0	0	2	0	2



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Syllabus and Lesson Plan for B.Tech Admission Batch 2024

Subject Name: Power Electronics Laboratory

Credit: 1

Subject Code: PCCEE493

Lecture Hours: 24

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 design different power converter for specific application.

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

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.	Investigating the effect of load variation (purely R to R-L) using single phase controlled converter for heating control of appliances.
5.	Obtaining precise voltage control for BLDC motor using single phase half controlled symmetrical bridge converters.
6.	Analysis of the buck-boost chopper performance in terms of voltage regulation and efficiency for charging batteries to match the battery's charging requirements used in industrial UPS systems.
7.	Implement a three phase bridge inverter for star connected lamp load intensity control.
8.	Achieving precise and smooth lighting control using single phase controlled converter and verify the effect of source inductance on the output.
9.	Integrating step up and step down chopper using IGBT with DC-DC charging station for solar panels and observing voltage variation.

10.	Analyze the effect of modulation index on the output voltage of a pulse width modulated bridge inverter used in EV drive systems.
11.	Regulation and control of reactive power flow using three phase controlled converter with load variation (purely R to R-L to purely L).

CO-PO mapping:

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	2	–	–	–	–	–	1
CO2	3	3	2	2	2	–	–	–	–	–	1
CO3	3	3	2	2	3	–	–	–	1	–	1
CO4	3	2	3	2	3	1	–	1	2	2	2



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Syllabus for B.Tech Admission Batch 2024

Subject Name: Object Oriented Programming & Java Lab

Credit: 1

Subject Code: OECEE481A

Lecture Hours: 30

Study Material	Coursera	Nptel	LinkedIn Learning	Infosys Springboard:
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Course Objective:

1. To apply the concepts of classes.
2. To understand and implement packages and interfaces.
3. To handle I/O and exception handling.
4. To understand file processing operations.
5. To develop applications using event handling

Course Outcome:

CO1: Build software development skills using java programming for real-world applications

CO2: Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.

CO3: Develop and implement Java programs using Inheritance and Interfaces.

CO4: Develop and implement Java programs using array list, exception handling and multithreading.

Module number	Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Book	Mapped Chapter
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/10z0_0dMd26WjiPTthCer cGbsi6u3ciE62/view?usp=drive_link) (https://drive.google.com/file/d/1k3qrfDL9p5_IJR_iP2mt6c6AzwmByNtf/view?usp=sharing) AICTE-prescribed syllabus: (https://www.aicteindia.org/sites/default/files/M odel_Curriculum/AICTE%20%20UG%20CSE.pdf) Industry Mapping: Hackerrank, TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be use	2+4	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	Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson	1

2	<p>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</p>	<p>International Academia: https://drive.google.com/file/d/1Rc1KOzkVVRHqLEWApFBplwz7s8IwsyFlf/view?usp=sharing https://drive.google.com/file/d/1e8g7D6nuMwEruToXtNDbh68vx2VKUrgS/view?usp=sharing AICTE- prescribed syllabus: https://www.aicteindia.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</p>	4+4	<p>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</p>	<p>Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson</p>	2
3	<p>Advanced features of OOP: Interfaces, inheritance, polymorphism, abstract classes, immutability, copying and cloning objects. Polymorphism and AI-driven Adaptability</p>	<p>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-memorymanagement-and-c-objectoriented-programming-januaryap-</p>	2+6	<p>Parameter polymorphism, method resolution, declared v/s actual type, partially and fully overriding methods, calling superclass</p>	<p>Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson</p>	3

		<p>2010/67b1aec3f2867734ec0fb33034c8b5c8_MIT6_088IAP10_lec0 5.pdf)</p> <p>AICTE-prescribed syllabus: https://www.aicteindia.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf)</p> <p>Industry Mapping: Hackerrank, TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.</p>		<p>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</p>	
4	<p>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</p>	<p>International Academia: https://drive.google.com/file/d/1yFNf2IBXgy6ch47hR6TGHZddvCPfVm8p/view?usp=sharing)</p> <p>AICTE- prescribed syllabus: https://www.aicteindia.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf)</p> <p>Industry Mapping: Hackerrank, TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.</p>	2+3	<p>Big-O notation, Java collection framework (or Boost libraries), sorting objects, iterating over objects</p>	<p>Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson</p>

5	<p>Defensive program: Exception handling, assertions, Java Thread Programming</p>	<p>International Academia: https://drive.google.com/file/d/1kbRGF396sQPdQbA4wN81EIKU_bdGgFs/view?usp=sharing AICTE- prescribed syllabus: https://www.aicteindia.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</p>	2+3	<p>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</p>	Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson	5
6	<p>Modeling and Design pattern: 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</p>	<p>International Academia: https://drive.google.com/file/d/1DQVPfhmcyKog-PryPdZbxufUC7D0Cfl/view?usp=sharing AICTE-prescribed syllabus: https://www.aicteindia.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.</p>	2+6	UML modeling.	Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson	6

7	<p>Basic Android Programming: Android Components – Activity, Services, Content Provider, Broadcast Receiver; Simple UI Design, Applet and Swin</p>	<p>International Academia: https://online.stanford.edu/courses/cs108-object-oriented-systemsdesign AICTE-prescribed syllabus: https://www.aicteindia.org/sites/default/files/Model_Curriculum/AICTE%20%20UG%20CSE.pdf Industry Mapping: Hackerrank, TCS Codevita projects, GitHub platform, Android Studio will be used.</p>	2+6	Android app making	Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson	7
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Suggested sources of learning:

TEXT BOOK:

1. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
2. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

REFERENCE BOOKS:

1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH

CO-PO mapping

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011
C01	3	3	2	2	2	1	1	2	2	1	2
C02	3	2	1	1	3	0	0	1	2	1	3
C03	3	3	3	2	3	0	1	2	2	1	3
C04	3	3	3	2	3	0	1	2	2	1	3



Syllabus for B.Tech Admission Batch 2024

Subject Name: Programming using Python Lab
Lecture Hours: 40

Credit: 1
Subject Code: OECEE481B

Study Material	<u>Coursera</u>	<u>Nptel</u>	<u>LinkedIn Learning</u>	<u>Infosys Springboard</u>
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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.

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

2	<p>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.</p>	<p><i>International Academia:</i> https://tinyurl.com/2jphac8c</p> <p><i>AICTE-prescribed syllabus:</i> https://tinyurl.com/32a8mp5t</p> <p><i>Industry Mapping:</i> Spyder, SK Learn, Mat Plot Lib, NumPy, Pandas</p>	8	<p>Create and analyse features relevant to the design parameters of solar cells using Python.</p> <p>Design mathematical transformations to preprocess and enhance data for anomaly detection in industrial windmill performance using Python.</p> <p>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.</p> <p>Use of Eigenvalues and Eigenvectors in Principal Component Analysis (PCA) for dimensionality reduction in machine learning using Python.</p> <p>Matrix Rank in detecting redundancy in industrial sensor data using Python.</p> <p>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.</p>	<p>Manaranjan Pradhan and U Dinesh Kumar, “Machine Learning using Python”, First Edition, Wiley India Pvt. Ltd.</p> <p style="text-align: center; font-weight: bold;">1</p>
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3	<p>Regression Model using Python Simple Linear Regression, Multiple Linear Regression, Nonlinear Regression, Model Evaluation in Regression Models, Evaluation Metrics in Regression Models.</p>	<p><i>International Academia:</i> https://tinyurl.com/9d4brw22</p> <p><i>AICTE-prescribed syllabus:</i> https://tinyurl.com/32a8mp5t</p> <p><i>Industry Mapping:</i> Spyder, Regression ML Algorithms</p>	8	<p>Create a Linear Regression and a Non-linear Regression model to predict the performance of a solar cell under different lighting conditions using Python.</p> <p>Create a Non-linear Regression model to predict the suitable material to design a highly efficient solar cell using Python.</p> <p>Performance evaluation of different Regression Models suitable for fault detection of a solar power plant using Python.</p>	<p>Manaranjan Pradhan and U Dinesh Kumar, “Machine Learning using Python”, First Edition, Wiley India Pvt. Ltd.</p>	4
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4	<p>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.</p>	<p><i>International Academia:</i> https://tinyurl.com/9d4brw22</p> <p><i>AICTE-prescribed syllabus:</i> https://tinyurl.com/32a8mp5t</p> <p><i>Industry Mapping:</i> Spyder, Classification on ML Algorithms</p>	<p>1. Design a K Nearest Neighbour Classifier that categorizes data points of disease diagnosis in healthcare using Python.</p> <p>2. Create a Decision Tree algorithm to help in load forecasting, energy demand prediction, and dynamic adjustment of power distribution to prevent overloads using Python.</p> <p>3. 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.</p> <p>4. 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.</p> <p>5. 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.</p>	<p>Manaranjan Pradhan and U Dinesh Kumar, “Machine Learning using Python”, First Edition, Wiley India Pvt. Ltd.</p>	5
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5	<p>Unsupervised Learning using Python Introduction to Clustering, K-Means Clustering, Hierarchical Clustering, Density-Based Clustering, Content-based recommender systems, Collaborative Filtering.</p>	<p><i>International Academia:</i> https://tinyurl.com/9d4brw22</p> <p><i>AICTE-prescribed syllabus:</i> https://tinyurl.com/32a8mp5t</p> <p><i>Industry Mapping:</i> Spyder, Clustering ML Algorithms</p>	8	<ol style="list-style-type: none"> 1. 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. 2. Design a Hierarchical Clustering model that enhances image clarity, reduces errors, and improves the efficiency of diagnostic equipment using Python. 3. Design a Based Clustering model that results in more accurate and reliable sensor systems, improving the performance of Smart irrigation system. 4. 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). 5. 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. 	<p>Andreas C. Muller and Sarah Guido, “Introduction to Machine Learning with Python”, First Edition, O’Reilly Media, Inc.</p> <p style="text-align: right;">3</p>
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Projects:

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

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.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	2	1	1	2	2	1	2
CO2	3	2	1	1	3	0	0	1	2	1	3
CO3	3	3	3	2	3	0	1	2	2	1	3
CO4	3	3	3	2	3	0	1	2	2	1	3