University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus

3rd Semester Syllabus for B.Tech
(Admission Batch 2024)

Electrical & Electronics Engineering

B.Tech. 2nd Year Course Structure

3rd Semester

Sl No	Type of Course	Subject Code	Subject Name	L	T	P	S	Total Conta	Credit Points
Theory									
1	Basic Science Course	BSM301	Mathematics -III	2	1	0		3	3
2	Professional Core Courses	PCCEEE301	Electric Circuit theory	2	1	0		3	3
3	Professional Core Courses	PCCEEE302	Analog Electronics	2	1	0		3	3
4	Professional Core Courses	PCCEEE303	Electromagnetic field theory	2	1	0		3	3
5	Professional Core Courses	PCCEEE304	Semiconductor Fabrication and Design	3	0	0		3	2
6	Mandatory Courses	MCC371	Indian Constitution	2	0	0		2	0
7	Humanities and social sciences including Management	ESP301	Essential Studies For Professionals III	2	0	0		2	0.5
PRACTICAL									
8	Professional Core Courses	PCCEEE391	Electric Circuit Theory Laboratory	0	0	3		2	1
9	Professional Core Courses	PCCEEE392	Analog Electronics Laboratory	0	0	3		2	1
10	Professional Core Courses	PCCEEE393	Semiconductor Fabrication and Design laboratory	0	0	3		2	1
11	Engineering Sciences	ESCEEE391	Data Structure & Algorithms Laboratory	0	0	3		2	1
SESSIONAL									
12	Humanities and social sciences including Management	SDP381	Skill Development For Professionals III	0	0		2	2	0.5
13	Project. Seminar and Industrial Training	PWEEE01	Mini Project I	0	0		2	2	1
Value Added Courses									
14	Massive Open Online Courses (MOOCs)	MOOCS	Massive Open Online Courses (MOOCs)						
15	Industry and Foreign Certification (IFC)	IFC	Industry and Foreign Certification (IFC)						
16	Mandatory Additional Requirements (MAR)	MAR381	Mandatory Additional Requirements (MAR)						
Total Credit Points of Semester				**15**	**4**	**12**	**4**	**31**	**20**

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Syllabus for B. Tech Admission Batch 2024

Subject Name: Mathematics - III **Credit: 3**

Subject Code: BSM301 **Lecture Hours: 42**

Pre-Requisites: Permutation & Combination, Concept of Basic Probability, Evaluation of definite, improper and infinite integrals, Concept of β & Γ functions.

Relevant Links:

Coursera: Probability & Statistics https://www.coursera.org/learn/machine-learning-probability-and-statistics
NPTEL Advanced Engineering Mathematics https://onlinecourses.nptel.ac.in/noc24_ma03/preview

Study Material Link (BL 4, 5,6)

https://drive.google.com/drive/folders/19umqy3stib1-wuHy0h-p0arM0NkIzdxC?usp=sharing

COURSE OBJECTIVES:

1. The syllabus will prepare the learners for Engineering Exit Examinations, ESE and campus placements.
2. Students will apply concepts of various probability distributions to find probabilities.
3. Students will make estimations for a mean, variance, standard deviation and proportions for big data.
4. Students will be eligible to work in the Data domain which is the emerging technology of the future and create more opportunities for creative work.
5. Students will be able to describe and quantify the uncertainty inherent in predictions made by machine learning models.

COURSE OUTCOMES:

CO	Course Outcomes
CO 1	Illustrate the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment that will make a bridge between elementary statistical tools and probability theory.
CO 2	Find the inter-relation between two or more phenomena with the help of curve fitting.
CO 3	Understand the basic components of sampling and have the knowledge on exact sampling distributions which are essential for estimating and testing hypothetical statements. Know the various sampling methodologies and their efficiencies in theoretical and practical aspects.
CO 4	Estimate and test the parameters associated with the relevant areas for forecasting and verification of economic theory
CO 5	Apply the statistical tools in business, economical and commercial areas for analyzing problems and to make better decisions for future in their fields.

Detailed Syllabus:

Module No.	Topic	Sub-topics	Mapping with Chapters of the Text Book	Mapping with Industry & International Academia	Lecture hour	Corresponding Lab Assignment
1	**Random Variables and Probability Distributions**	*Discrete Random Variable:* Discrete Probability Distribution, Expectation and Variance of random variables; Binomial and Poisson Distributions; Mean, Variance and Moment Generating Functions of Binomial and Poisson Variates; Convergence of Binomial to Poisson Variate. *Continuous Random Variable;* Continuous Probability Distributions, Expectation and Variance of random variables, Exponential, Normal Distributions; Mean, Variance and Moment Generating Functions of the corresponding variates.	Chapters 2 and 3/Text Book 1 Chapter 12 /Text Book 2	https://ocw.mit.edu/courses/18-05-introduction-to-probability-and-statistics-spring-2022/	**12**	"R" software for statistical computing
2	**Method of Least Squares and Curve Fitting**	Principle of Least Squares, Curve fitting by the method of Least Squares - fitting of straight lines, second degree parabolas and exponential curves.	Chapter 9/Text Book 1 Chapter 8 /Text Book 2	https://ocw.mit.edu/courses/18-05-introduction-to-probability-and-statistics-spring-2022/	**4**	"stata": statistical software for data science

3	**Sampling and Sampling Distributions**	Population and Sample, Sampling With and Without Replacement (SRSWR and SRSWOR); Random Samples, Population Parameters, Sample Statistics, Sampling Distributions, Standard Error and Probable Error; Sample Mean, Sampling Distribution of Means; Sample Proportion, Sampling Distribution of Proportions, Sample Variances, Sampling Distribution of Variances; Case where Population Variance is unknown; Central Limit Theorem (Statement only); Degrees of freedom, Chi-square distribution, Mean & Variance of Chi-square variate.	Chapter 11 /Text Book 1 Chapter 13/Text Book 2	https://www.cl.cam.ac.uk/teaching/2021/IntroProb/materials.html	**8**	"stata": statistical software for data science
4	**Estimation of Parameters**	Point and Interval estimations, Biased and Unbiased estimators, Minimum Variance Unbiased Estimator (MVUE), Consistent Estimator, Maximum Likelihood Estimation of Parameters, Applications in populations following theoretical distributions (Binomial, Poisson and Normal), Calculation of confidence limits for population mean and population proportions.	Chapter 12 /Text Book 1 Chapters 14/ Text Book 2	https://ocw.mit.edu/courses/1-010-uncertainty-in-engineering-fall-2008/	**6**	"R" software for statistical computing

5	**Testing of Hypothesis**	*Large Sample Test***:** Statistical Hypotheses, Test Statistic, Best Critical Region, Test for single mean, difference of means, single proportion, difference of proportions, and difference of standard deviations. *Small Sample Test:* Test for single mean, difference of means and correlation coefficients, Test for ratio of variances, Chi-square test for goodness of fit and independence of attributes.	Chapter 13/ Text Book 1 Chapter 14?Text Book 2	https://ocw.mit.edu/courses/6-041-probabilistic-systems-analysis-and-applied-probability-fall-2010/	**12**	"R" software for statistical computing

TEXT BOOK:

1. Saktipada Nanda and Sibashis Nanda , "A Course on Probability & Statistics", 2nd Edition (2024), Mindprobooks Academic Series [Available in flipkart.com/amazon.in]

2. N.G.Das, "Statistical Methods", Combined Edition Vol. 1 &2 (2017) McGraw Hill Education

REFERENCE BOOKS:

1. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 6th Edition (2020), Academic

2. Douglas C, Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, 7th edition (2018), John Wiley & Sons.

3. Murray R. Spiegel, John J. Schiller and R. Alu Srinivasan, "Schaum's Outline of Probability & Statistics" , 4th Edition (2012), McGraw Hill Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	1	1	2	1
CO2	3	3	3	3	2	1	1	1	1	1	2	1
CO3	3	3	3	3	2	1	1	1	1	1	2	1
CO4	3	3	3	3	2	1	1	1	1	1	2	1
CO5	3	3	3	2	2	2	1	2	2	2	3	2

3: Strong correlation
2: Medium correlation
1: Weak correlation

PSO	PSO Description
PSO1	**Technical knowledge and analysis:** Apprehend and analyze specific engineering problems of communication, networking, electrical & electronics circuits, signal processing, computer programming, embedded systems, VLSI design and semiconductor technology by applying the knowledge of basic sciences, engineering mathematics and engineering fundamentals.
PSO2	**Design and Implementation:** Ability to design and implement the acquired technical knowledge with proficiency in logical programming for applications in electronics & communication engineering.
PSO3	**Development of professional skill and professional ethics:** Ability to communicate effectively with excellent professional proficiency, interpersonal skills and demonstrate the practice of professional ethics for societal benefit.

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Syllabus and Lesson Plan for B.Tech Admission Batch 2024

Subject Name: Electric Circuit Theory **Credit: 03** **Lecture Hours: 40**

Subject Code: PCC EEE 301

Maximum: 100 marks (Internal: 30 marks; External: 70 marks)

List of Faculty Members handling the Subject –

1. Prof. Dr. Manas Mukherjee,
2. Prof. Nirban Chakraborty

Pre-requisite: ESC (EE) 101

Course Objective:

The purpose of learning this course is to-

1. Understand the structure and properties of different type of electric circuits and sources.

2. Learn different mathematical techniques to analyze electric networks.

3. Learn circuit analysis techniques such as nodal analysis, mesh analysis, theorems, source transformation and several methods to simplify electric networks.

4. Acquire problem solving skills of electric circuit through the application of techniques and principles of electrical circuit analysis to common circuit problems

Course Outcome:

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

CO1. Describe different type of networks, sources and signals with examples.

CO2. Explain different network theorems, coupled circuit and tools for solution of networks

CO3. Apply network theorems and different tools to solve network problems

CO4. Select suitable techniques of network analysis for efficient solution.

Relevant Links:

Study Material	Coursera Hyperlinked	Nptel	LinkedIn Learning:	Infosys Springboard:

Detailed Syllabus:

Module number	Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Book	Mapped Chapter
1	**Introduction:** Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems. Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Sawtooth signals.	**International Academia** *https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/pages/lecture-notes/* **Industry Mapping:** MATLAB	2	-	Circuit theory, Dr. Abhijit Chakrabarty, DhanpatRai& Co Pvt. Ltd.	Chapters 1, 2
2	**Coupled circuits:** Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modeling of coupled circuits, and Solution of problems	**International Academia** *https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/pages/lecture-notes/* **Industry Mapping:** MATLAB	3	-	Circuit theory, Dr. Abhijit Chakrabarty, DhanpatRai& Co Pvt. Ltd.	Chapter 11

3	**Laplace transforms:** Impulse, Step & Sinusoidal response of RL, RC, and RLC circuits. Transient analysis of different electrical circuits with and without initial conditions. Concept of Convolution theorem and its application. Solution of Problems with DC & AC sources.	**International Academia** *https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/pages/lecture-notes/* **Industry Mapping:** MATLAB/	3	Determination of Laplace transform and Inverse Laplace transform using MATLAB to model different electrical systems by analyzing transient behaviour.	Circuit theory, Dr. Abhijit Chakrabarty, DhanpatRai& Co Pvt. Ltd.	Chapter 9
4	**Fourier method of waveform analysis:** Fourier series and Fourier Transform (in continuous domain only). Application in circuit analysis, Solution of Problems	**International Academia** *https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/pages/lecture-notes/* **Industry Mapping:** MATLAB	3	Amplitude and Phase spectrum analysis of different signals using MATLAB for Designing Active and Passive Filter	Circuit theory, Dr. Abhijit Chakrabarty, DhanpatRai& Co Pvt. Ltd.	Chapter 16
5	**Network equations**: Formulation of network equations, Source transformation, Loop variable analysis, Node variable analysis. Network theorem: Superposition, Thevenin's, Norton's & Maximum power transfer theorem. Millman's theorem and its application in three phase unbalanced circuit analysis. Solution of Problems with DC & AC sources.	**International Academia** *https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/pages/lecture-notes/* **Industry Mapping:** MATLAB	10	Hardware and software modelling of electrical networks and verification of Network theorems.	Circuit theory, Dr. Abhijit Chakrabarty, DhanpatRai& Co Pvt. Ltd.	Chapters 3, 13
6	**Graph theory and Networks equations:** Concept of Tree, Branch, Tree link, Incidence matrix, Tie-set matrix and loop currents, Cut set matrix and node pair potentials. Duality, Solution of Problems	**International Academia** *https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/pages/lecture-notes/* **Industry Mapping:** MATLAB	7	-	Circuit theory, Dr. Abhijit Chakrabarty, DhanpatRai& Co Pvt. Ltd.	Chapter 15
7	**Two port networks analysis:** Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and their inter relations. Driving point impedance & Admittance. Solution of Problems	**International Academia** *https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/pages/lecture-notes/* **Industry Mapping:** MATLAB/	4	Hardware modelling & Analyzing Two-Port Networks: Evaluation of Impedance and Admittance parameter	Circuit theory, Dr. Abhijit Chakrabarty, DhanpatRai& Co Pvt. Ltd.	Chapter 12

8	**Filter Circuits:** Analysis and synthesis of Low pass, High pass, Band pass, Band reject, All pass filters (first and second order only) using operational amplifier. Solution of Problems	**International Academia** *https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/pages/lecture-notes/* **Industry Mapping:** MATLAB	4	Frequency response of LP and HP filters: simulation & hardware modelling	Circuit theory, Dr. Abhijit Chakrabarty, DhanpatRai& Co Pvt. Ltd.	Chapter 18
9	**Generative AI** for Enhanced Millman's Theorem Application in Unbalanced Systems, **AI-Assisted** Circuit Synthesis based on Desired Characteristics:	-	4		Study Material	

Lesson Plan:

Module 1: Introduction: Year 2025 (Faculty : Dr. MANAS MUKHERJEE)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems.
2	Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Sawtooth signals.

Module 2: Coupled circuits Year 2025 , (Faculty : Dr. MANAS MUKHERJEE)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Magnetic coupling, Polarity of coils, Polarity of induced voltage,
2	Concept of Self and Mutual inductance, Coefficient of coupling,
3	Modeling of coupled circuits, and Solution of problems

Module 3: Laplace transforms Year 2025 , (Faculty : Mr. NIRBAN CHAKRABORTY)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Impulse, Step & Sinusoidal response of RL, RC, and RLC circuits..
2	Transient analysis of different electrical circuits with and without initial conditions.
3	Concept of the Convolution theorem and its application. Solution of Problems with DC & AC sources.

Module 4: Fourier method of waveform analysis Year 2025, (Faculty : Mr. NIRBAN CHAKRABORTY)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Fourier series and Fourier Transform
2	Application in circuit analysis, Solution of Problems
3	Application in circuit analysis, Solution of Problems.

Module 5: Network Equations Year 2025, (Faculty : Mr. NIRBAN CHAKRABORTY)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Formulation of network equations, Source transformation,
2	Source transformation, Loop variable analysis
3	Network theorem: Superposition, Thevenin's.
4	Norton's & Maximum power transfer theorem.
5	Millman's theorem and its application in three-phase unbalanced circuit analysis
6	Solution of Problems with DC & AC sources
7	Solution of Problems with DC & AC sources
8	Solution of Problems with DC & AC sources
9	Solution of Problems with DC & AC sources
10	Solution of Problems with DC & AC sources

Module 6: Graph theory and Networks equations: Year 2025 , (Faculty : Dr. MANAS MUKHERJEE)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Concept of Tree, Branch, Tree link, Incidence matrix,
2	Tie-set matrix and loop currents,
3	Cut set matrix
4	node pair potentials
5	Duality
6	Solution of Problems

Module 7: Two port networks analysis: Year 2025 , (Faculty : Dr. MANAS MUKHERJEE)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Open circuit Impedance & Short circuit Admittance parameter,
2	Transmission parameters, Hybrid parameters and their inter relations.
3	Driving point impedance & Admittance
4	Solution of Problems

Module 8: Filter Circuits: Year 2025 , (Faculty : Dr. MANAS MUKHERJEE)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Analysis and synthesis of Low pass, High pass,
2	Band pass, Band reject,
3	All pass filters (first and second order only) using operational amplifier.
4	Solution of Problems

TEXT BOOK:

1. Circuit theory, Dr. Abhijit Chakrabarty, DhanpatRai& Co Pvt. Ltd.

REFERENCE BOOKS:

1. Network Analysis, M.E. Valkenburg, Pearson Education.
2. Engineering Circuit Analysis, W.H. Hyat, J.E. Kemmerly& S.M. Durbin, The McGraw Hill
3. Networks and Systems, D. Roy Chowdhury, New Age International Publishers
4. Network Analysis and Synthesis, C.L. Wadhwa, New Age International Publishers
5. Circuit and Networks: Analysis and synthesis, A. Sudhakar& S.S. Palli4th edition. Tata McGraw Hill Education Pvt. Ltd.
6. Fundamental of Electric circuit theory, D. Chattopadhay& P.C. Rakshit, S. Chand

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	1	1	1	1	2	1	0	1
CO2	3	3	3	3	2	1	1	1	3	1	0	2
CO3	3	3	3	3	2	1	1	2	2	2	1	1
CO4	3	3	2	3	2	1	2	3	2	2	2	3

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Syllabus for B.Tech Admission Batch 2024

Subject Name: Analog Electronics **Credit: 3** **Lecture Hours: 37**

Subject Code: PCCEEE302

Maximum: 100 marks (Internal: 30 marks; External: 70 marks)

List of Faculty Members handling the Subject –

1. Neeta Sahay
2. Tanmay Sinha Roy

Pre-requisite: Electrical technology and, Semiconductor Devices

Course Objective:

The purpose of learning this course is to-

1. Understand the structure and properties of different components of analog electronics.

2. Explain principle of operation of analog electronics components and circuits.

3. Understand the application of operational amplifier.

4. Solve problems of analog electronic components and circuits.

5. Analyze amplifiers, oscillators and other analog circuits

Course Outcome:

After completion of this course, the learners will be able to

CO1. Describe analog electronic components and analog electronics circuits

CO2. Compute parameters and operating points of analog electronic circuits using BJT and MOSFET.

CO3. Understand different types amplifier and different types oscillators based on application using Op-Amps.

CO4. Understand different types of power amplifier, filters and Special function circuits applications.

Relevant Links:

Study Material	**Coursera**	**LinkedIn learning**	**Nptel**	**Infosys Springboard**

Detailed Syllabus:

Module number	Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Book	Mapped Chapter
1	**Regulators:** Review of half wave and full wave rectifier, ripple factor, series and shunt voltage regulator, percentage regulation.	***International Standards:*** **(https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/video_galleries/video-lectures/)** ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** Hardware Chipset (SCR), Software: Labview, P-Spice	4	1. Design an unregulated power supply using a full wave rectifier with and without capacitor to find ripple factors and load regulation 2. Design a voltage regulated circuit using Zener diode. 3. Design a voltage regulated circuit using IC	Microelectronic Circuits SEVENTH EDITION Adel S. Sedra University of Waterloo Kenneth C. Smith University of Toronto	4

2	**Operational amplifier**, Application of Operational Amplifier: Ideal OPAMP, Differential amplifier, Constant current source (Current mirror etc), Level shifter, CMRR, Open & closed loop circuits, importance of feedback loop (positive & negative), inverting & non-inverting amplifiers, Voltage follower/Buffer circuits. Adder, Integrator & Differentiator, Comparator, Schmitt Trigger, Instrumentation Amplifier, Log & Antilog amplifier, Trans-conductance multiplier, Precision rectifier, Voltage to current &Current to voltage converter. Introduction to differential equation solving using Op Amp.	***International Standards:*** **(https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/video_galleries/video-lectures/)** ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** Hardware Chipset (SCR) Software: Labview, P-Spice	14	1. Design a low-level current source and voltage source using op-amp. 2. Design an amplifier and signal conditioner for weak voltage signals using an instrumentation amplifier.	Electronic Devices and Circuit Theory Boylestad & Nashelsky Pearson	10,11
3	**BJT & FET circuits:** Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits. MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.	***International Standards:*** **(https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/video_galleries/video-lectures/)** ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** Hardware Chipset (CMOS, IGBT) Software: P-Spice	12	1. Design a low voltage audio amplifier and computing its frequency response using R-C coupled amplifier. 2. Design voltage-controlled amplifiers using JFET and MOSFET and finding its characteristics. 3. Fabrication of BJT (Skill Development using SEMulator3D). 4. Fabrication of MOSFET (Skill Development using SEMulator3D)	Microelectronic Circuits SEVENTH EDITION Adel S. Sedra University of Waterloo Kenneth C. Smith University of Toronto	5,6

4	**Feedback amplifier & Oscillators, Power amplifier, Oscillator, 555 Timer:** Concept of feedback, Negative & Positive feedback, Voltage/Current, Series/Shunt feedback, Berkhausen criterion, Colpit, Hartley's, Phase shift, Wien bridge, & Crystal oscillators. Capacitor filters, □-section filter Class A, B, AB, C, Conversion efficiency. Monostable, Bistable multivibrator,Monostable&Astable operation using 555 timer.	***International Standards:*** **(https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/video_galleries/video-lectures/)** ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** Software: P-Spice	7	1. Design current controlled in various types of configurations. 2. Design a multivibrator circuit in various modes.	Electronic Devices and Circuit Theory Boylestad & Nashelsky Pearson	14
					Microelectronic Circuits SEVENTH EDITION Adel S. Sedra University of Waterloo Kenneth C. Smith University of Toronto	7

Lesson Plan:

Module 1: Regulators Year 2025 , (Faculty : Neeta Sahay)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Review of half wave and full wave rectifier
2	Bridge rectifier, ripple factor,
3	series and shunt voltage regulator, percentage regulation
4	Clipper, clamper circuits

Module 2: Operational amplifier Year 2025 , (Faculty : Neeta Sahay)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Application of Operational Amplifier
2	Ideal OPAMP
3	Differential amplifier, Constant current source (Current mirror etc),
4	Level shifter, CMRR
5	Open & closed loop circuits, importance of feedback loop (positive & negative)
6	inverting & non-inverting amplifiers,
7	Voltage follower/Buffer circuits.
8	Adder, Integrator & Differentiator
9	Comparator, Schmitt Trigger
10	Instrumentation Amplifier
11	Log & Antilog amplifier
12	Trans-conductance multiplier, Precision rectifier,
13	Voltage to current &Current to voltage converter
14	Introduction to differential equation solving using Op Amp

Module 3: BJT & FET circuits Year 2025 , (Faculty : Tanmay Sinha Roy)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Structure and I-V characteristics of a BJT
2	BJT as a switch
3	BJT as an amplifier
4	small-signal model
5	biasing circuits, current mirror
6	common-emitter, common-base and common-collector amplifiers
7	high-frequency equivalent circuits.
8	MOSFET structure and I-V characteristics
9	MOSFET as a switch
10	MOSFET as an amplifier: small-signal model and biasing circuits,
11	common-source, common-gate and common-drain amplifiers;
12	small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit

Module 4: Feedback amplifier & Oscillators, Power amplifier, Oscillator, 555 Timer: Year 2025 , (Faculty : Tanmay Sinha Roy)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Concept of feedback, Negative & Positive feedback
2	Voltage/Current, Series/Shunt feedback
3	Berkhausen criterion
4	Colpit, Hartley's, Phase shift, Wien bridge, & Crystal oscillators.
5	Capacitor filters, □-section filter
6	Class A, B, AB, C, Conversion efficiency
7	Monostable, Bistablemultivibrator, Monostable&Astable operation using 555 timer.

CO- PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3	2	3	2	3	-	3	-	-	-	-
2	1	1	3	3	3	1	3	3	1	3	-	1
3	2	3	3	2	1	3	3	-	1	-	1	-
4	3	2	2	3	3	3	-	3	2	-	-	3

TEXT BOOK:

1. Adel S. Sedra and K. C. Smith, "Microelectronic Circuits"Oxford University Press, 2004.

REFERENCE BOOKS:

1. Millman & Halkias, "Integrated Electronics", Tata McGraw Hill.
2. Boylestad & Nashelsky, "Electronic Devices and Circuit Theory", Pearson.
3. Gayakwad R.A, "OpAmps and Linear IC's", 4/e, Pearson-PHI.
4. Franco—Design with Operational Amplifiers & Analog Integrated Circuits, 3/e, TMH.

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Syllabus and Lesson Plan for B.Tech Admission Batch 2024

Subject Name: Electromagnetic Field Theory **Credit: 3** **Lecture Hours: 42**

Subject Code: PCCEEE303

Maximum: 100 marks (Internal: 30 marks; External: 70 marks)

List of Faculty Members handling the Subject –

1. Rajat Shubhra Pal

Pre-requisite: Physics, Mathematics

Course Objective:

The purpose of learning this course is to-

1. To understand the basic mathematical tools to deal with Electromagnetic field Problem.
2. To understand properties and application of Electric and magnetic field.
3. To analyze electromagnetic wave propagation.
4. To solve problem related to Electromagnetic field

Course Outcome:

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

CO1. To remember the basic laws of electromagnetism.
CO2. To understand the static and time varying electromagnetic field
CO3. To solve electric and magnetic field for different source distribution.
CO4. To analyze electromagnetic wave propagation in different medium.

Relevant Links:

Study material	NPTEL	Coursera	Infosys Springboard

Detailed Syllabus:

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding LabAssignment	Text Book	Mapped Chapter
1	**Review of Vector Calculus**	Vector algebra - addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus - differentiation, partial differentiation, integration, vector operator del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.	***International Academia:*** https://ocw.mit.edu/courses/8-07-electromagnetism-ii-fall-2012/ ***AICTE-prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf ***Industry Mapping:*** Software: MATLAB, ANSYS	6	No corresponding lab	M. N. O. Sadiku and S.V. Kulkarni, "Principles of Electromagnetics", Oxford University Publication, 6th Edition	1, 2, 3
2	**Static Electric Field**	Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.	**International Standards**: https://ocw.mit.edu/courses/6-013-electromagnetics-and-applications-spring-2009/ ***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf	6	No corresponding lab	M. N. O. Sadiku and S.V. Kulkarni, "Principles of Electromagnetics", Oxford University Publication, 6th Edition	4

3	**Conductors, Dielectrics and Capacitance**	Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations, Method of Images.	***International Standards***: https://ocw.mit.edu/courses/6-013-electromagnetics-and-applications-spring-2009/ ***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf ***Industry Mapping:*** Software: MATLAB, ANSYS	6	No corresponding lab	M. N. O. Sadiku and S.V. Kulkarni, "Principles of Electromagnetics", Oxford University Publication, 6th Edition	5, 6
4	**Static Magnetic Fields**	Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.	***International Standards:*** https://ocw.mit.edu/courses/6-641-electromagnetic-fields-forces-and-motion-spring-2005/ ***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf ***Industry Mapping:*** Software: MATLAB, ANSYS	6	No corresponding lab	M. N. O. Sadiku and S.V. Kulkarni, "Principles of Electromagnetics", Oxford University Publication, 6th Edition	7

5	**Magnetic Forces, Materials and Inductance**	Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances.	***International Standards:*** https://ocw.mit.edu/courses/6-641-electromagnetic-fields-forces-and-motion-spring-2005/ ***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf ***Industry Mapping:*** Software: MATLAB, ANSYS	6	No corresponding lab	M. N. O. Sadiku and S.V. Kulkarni, "Principles of Electromagnetics", Oxford University Publication, 6th Edition	8
6	**Time Varying Fields and Maxwell's Equations**	Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Transformer and Motional Electromotive forces. Time-Varying Potentials.	***International Standards:*** https://ocw.mit.edu/courses/8-07-electromagnetism-ii-fall-2012/ ***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf ***Industry Mapping:*** Software: MATLAB, ANSYS	6	No corresponding lab	M. N. O. Sadiku and S.V. Kulkarni, "Principles of Electromagnetics", Oxford University Publication, 6th Edition	9
7	**Electromagnetic Waves**	Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poynting theorem, Reflection of a Plane Wave.	***International Standards:*** https://ocw.mit.edu/courses/8-07-electromagnetism-ii-fall-2012/ ***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf ***Industry Mapping:*** Software: MATLAB, ANSYS	6	No corresponding lab	M. N. O. Sadiku and S.V. Kulkarni, "Principles of Electromagnetics", Oxford University Publication, 6th Edition	10

Lesson Plan:

Module 1: Review of Vector Calculus, Year: 2nd , (Faculty : Rajat Shubhra Pal)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Vector algebra - addition, subtraction, components of vectors, scalar and vector multiplications, triple products
2	Orthogonal coordinate systems (rectangular, cylindrical)
3	Orthogonal coordinate systems (spherical), Conversion of a vector from one coordinate system to another.
4	Vector calculus - differentiation, partial differentiation, integration, vector operator del, gradient
5	Divergence and curl
6	Integral theorems of vectors.

Module 2: Static Electric Field , Year: 2nd , (Faculty : Rajat Shubhra Pal)

WORKING DAY	LESSON PLAN – DESCRIPTION
7	Coulomb's law, Electric field intensity
8	Electrical field due to point charges. Line, Surface and Volume charge distributions.
9	Gauss law and its applications
10	Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations
11	Electric dipole,
12	Electrostatic Energy and Energy density.

Module 3: Conductors, Dielectrics and Capacitance , Year: 2nd , (Faculty : Rajat Shubhra Pal)

WORKING DAY	LESSON PLAN – DESCRIPTION
13	Current and current density, Ohms Law in Point form, Continuity of current, ,
14	Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials,
15	Capacitance, Capacitance of a two wire line,
16	Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation
17	Application of Laplace's and Poisson's equations,
18	Method of Images.

Module 4: Static Magnetic Fields, Year: 2nd , (Faculty : Rajat Shubhra Pal)

WORKING DAY	LESSON PLAN – DESCRIPTION
19	Biot-Savart Law,
20	Ampere Law,
21	Magnetic flux and magnetic flux density,
22	Scalar Magnetic potentials.
23	Vector Magnetic potentials.
24	Steady magnetic fields produced by current carrying conductors.

Module 5: Magnetic Forces, Materials and Inductance, Year: 2nd , (Faculty : Rajat Shubhra Pal)

WORKING DAY	LESSON PLAN – DESCRIPTION
25	Force on a moving charge, Force on a differential current element,
26	Force between differential current elements,
27	Nature of magnetic materials, Magnetization and permeability,
28	Magnetic boundary conditions,
29	Magnetic circuits,
30	Inductances and mutual inductances.

Module 6: Time Varying Fields and Maxwell's Equations, Year: 2nd , (Faculty : Rajat Shubhra Pal)

WORKING DAY	LESSON PLAN – DESCRIPTION
31	Faraday's law for Electromagnetic induction,
32	Transformer and Motional Electromotive forces.
33	Displacement current,
34	Modified Ampere's law
35	Point form of Maxwell's equation, Integral form of Maxwell's equations,
36	Time-Varying Potentials.

Module 7: Electromagnetic Waves, Year: 2nd , (Faculty : Rajat Shubhra Pal)

WORKING DAY	LESSON PLAN – DESCRIPTION
37	Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form,
38	Plane waves in free space and in a homogenous material.
39	Wave equation for a conducting medium, Plane waves in lossy dielectrics,
40	Propagation in good conductors, Skin effect.
41	Poynting theorem,
42	Reflection of a Plane Wave.

TEXT BOOK:

1. M. N. O. Sadiku and S.V. Kulkarni, "Principles of Electromagnetics", Oxford University Publication, 6th Edition.

REFERENCE BOOKS:

1. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2014.
2. John Kraus and Daniel Fleisch, Electromagnetics with Applications, McGraw-Hill, 2014.
3. Guru B. S. and H. R. Hizroglu, Electromagnetic Field Theory Fundamentals, Cambridge University Press, 2010.
4. W.J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
5. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
6. Joseph A. Edminister, Electromagnetics, Schaum's Outline Series, Tata McGraw Hill, 2015.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	-	-	-	-	-	-	-
CO2	3	3	1	2	1	-	-	-	-	-	-	1
CO3	3	3	2	3	1	1	1	-	-	-	-	2
CO4	3	3	3	3	1	1	1	-	-	-	-	2

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Syllabus and Lesson Plan for B.Tech Admission Batch 2024

Subject Name: Semiconductor Fabrication and Design Credit: 3 Lecture Hours: 28

Subject Code: PCCEEE304

List of Faculty Members handling the Subject –

1. Prof. Dr. Unmesha Ray

Pre-requisite: Basic Electronics

Software: SEMulator 3D

Course Objective:

The purpose of learning this course is to-

1. Provide fundamental knowledge and understand the ecosystem of semiconductor manufacturing from design to product.
2. Explore advanced semiconductor devices including MOSFETs, FINFETs, scaling effects, and their impact on device design.
3. Gain working knowledge of process simulation using SEMulator3D.
4. Apply statistical tools for process control and optimization in semiconductor fabrication.

Course Outcome:

After completion of this course, the learners will be able to
CO1: Distinguish between design, fab, packaging, and system/product levels.
CO2: Explain key microfabrication processes and scaling benefits.
CO3: Analyze FinFET process integration challenges across multiple modules.
CO4: Use SEMulator3D to simulate FinFET processes and extract layout parameters.

Relevant Links:

STUDY MATERIAL	COURSERA	NPTEL	LinkedIn Learning:	Infosys Springboard:

Detailed Syllabus:

Module number	Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Text Book	Mapped Chapter
1	**Introduction to Semiconductor Physics**: Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams, Types of materials, metals, insulators and semiconductors, Band gap, Miller indices, Crystal Structure of Silicon, Intrinsic `Semiconductors, Extrinsic semiconductors, Fermi level, Thermal Equilibrium, Law of mass action, mobility, generation recombination, Transport Equations, Continuity Equations	***International Standards: (***Solid-State Circuits | Electrical Engineering and Computer Science | MIT OpenCourseWare***)*** ***AICTE prescribed syllabus:*** ***(***https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final%20Minor%20VLSI.pdf***)*** ***Industry Mapping:*** ***(***Intel, Samsung, Texas Instruments, STMicroelectronics***)***	5	1. Familiarization of the SEMulator3D software and basic GUI navigation.	G. Streetman, and S. K. Banerjee, Solid State Electronic Devices, 7th edition	1

2	**Elements of Fabrication Technology:** Wafer Cleaning, Epitaxial Growth, Oxidation, Diffusion, Ion Implantation, Metallization, Photolithography, Wet Chemical Etching, Dry or Plasma Etching, Steps of Chip Assembly, Die Bonding, Wire Bonding, Packaging	***International Standards: (***Solid-State Circuits | Electrical Engineering and Computer Science | MIT OpenCourseWare***)*** ***AICTE prescribed syllabus:*** ***(***https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final%20Minor%20VLSI.pdf***)*** ***Industry Mapping: (***Intel, Samsung, Texas Instruments, STMicroelectronics***)*** ***Software: SEMulator 3D***	5	1. Introduction to process simulation steps (material properties, basic crystal growth/wafer prep simulation, thermal oxidation). 2. Introduction to Process Simulators and Simulating Crystal growth.	G. Streetman, and S. K. Banerjee, Solid State Electronic Devices, 7th edition	5
3	**Thin Film Transistors:** Large Area Electronics, Anderson's Theory, Conduction Mechanisms, Charge concentration in loclized states, TFT- Fermi level movement through the localized states, Differences: a-Si TFT and c-Si MOSFET, TFT-analytical modeling – MIS electrostatics, I-V characteristics above threshold operation. VT shift, LED.	***International Standards: (***Solid-State Circuits | Electrical Engineering and Computer Science | MIT OpenCourseWare***)*** ***AICTE prescribed syllabus:*** ***(***https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final%20Minor%20VLSI.pdf***)*** ***Industry Mapping: (***Intel, Samsung, Texas Instruments, STMicroelectronics***)*** ***Software: SEMulator 3D***	6	1. Understanding the difference between LOCOS isolation verses Shallow Trench Isolation (STI) 2. Deposition of Gate-First versus Gate-Last 3. Different steps of Spacer and multiple patterning	Study Material	1
4	**CMOS FinFET Process Integration**: Isolation: STI vs LOCOS, Device Architecture: Planar to FinFET, strain, SiGe; Gate Stack: High-k dielectrics, metal gates, gate-first vs gate-last; Junction and Implantation: Well, source-drain, LDD; Contact: Metal-silicon contact, silicides (Ti/Co/Ni), salicidation; Interconnect: Cu vs Al, RC delay, electromigration, Damascene; ILD: Low-k dielectrics, integration challenges	***International Standards: (***Solid-State Circuits | Electrical Engineering and Computer Science | MIT OpenCourseWare***)*** ***AICTE prescribed syllabus:*** ***(***https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final%20Minor%20VLSI.pdf***)*** ***Industry Mapping: (***Intel, Samsung, Texas Instruments, STMicroelectronics***)*** ***Software:SEMulator 3D***	7	1. Replacement of metal gate 2. Implement the process of Implantation & Silicidation	Study Material	

5	**Characterization Techniques (brief overview):** SEM, AFM, XRD, XPS, Ellipsometry, Electrical probing. Emerging trends: Heterogeneous integration, 3D ICs, flexible electronics, quantum computing **Process Simulation Using SEMulator3D:** SEMulator3D overview; Layout import and creation; FinFET process flow simulation; Extraction of cross-sections; Geometric and overlay analysis.	***International Standards: (***Solid-State Circuits | Electrical Engineering and Computer Science | MIT OpenCourseWare***)*** ***AICTE prescribed syllabus:*** ***(***https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final%20Minor%20VLSI.pdf***)*** ***Industry Mapping: (***Intel, Samsung, Texas Instruments, STMicroelectronics***)*** ***Software:SEMulator 3D***	5	Understanding the difference between Damascene and Dual-Damascene Designing of PlanarFET and FinFET inverter	Study Material	

Lesson Plan:

Module 1: Introduction to Semiconductor Physics Year 2025 , (Faculty :Unmesha Ray)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Introduction to Semiconductor Physics: Review of Quantum Mechanics.
2	Electrons in periodic Lattices, E-k diagrams, Types of materials, metals, insulators and semiconductors, Band gap,
3	Miller indices, Crystal Structure of Silicon, Intrinsic `Semiconductors, Extrinsic semiconductors
4	Fermi level, Thermal Equilibrium, Law of mass action,
5	mobility, generation recombination, Transport Equations, Continuity Equations

Module 2: Elements of Fabrication Technology Year 2025, (Faculty : Unmesha Ray)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Wafer Cleaning, Epitaxial Growth,
2	Oxidation, Diffusion, Ion Implantation,
3	Metallization, Photolithography, Wet Chemical Etching,
4	Dry or Plasma Etching, Steps of Chip Assembly,
5	Die Bonding, Wire Bonding, Packaging

Module 3: Thin Film Transistors Year 2025, (Faculty : Unmesha Ray)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Thin Film Transistors: Large Area Electronics,
2	Anderson's Theory, Conduction Mechanisms,
3	Charge concentration in loclized states, TFT- Fermi level movement through the localized states,
4	Differences: a-Si TFT and c-Si MOSFET,
5	TFT-analytical modeling – MIS electrostatics,
6	Interconnect: Cu vs Al, RC delay, electromigration, Damascene;

Module 4: CMOS FinFET Process Integration Year 2025 , (Faculty : Unmesha Ray)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	Isolation: STI vs LOCOS, Device Architecture:
2	Planar to FinFET, strain, SiGe;
3	Gate Stack: High-k dielectrics, metal gates, gate-first vs gate-last;
4	Junction and Implantation: Well, source-drain, LDD;
5	Contact: Metal-silicon contact, silicides (Ti/Co/Ni), salicidation;
6	Interconnect: Cu vs Al, RC delay, electromigration, Damascene;
7	ILD: Low-k dielectrics, integration challenges

Module 5: Characterization Techniques Year 2025 , (Faculty : Unmesha Ray)

WORKING DAY	LESSON PLAN – DESCRIPTION
1	SEM, AFM,
2	XRD, XPS,
3	Ellipsometry, Electrical probing.
4	Emerging trends: Heterogeneous integration
5	3D ICs, flexible electronics, quantum computing

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	3	-	2	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-
CO4	3	2	2	2	2	-	-	-	-	-	-	1

TEXT BOOK:

1. G. Streetman, and S. K. Banerjee, Solid State Electronic Devices, 7th edition, Pearson,2014.

REFERENCE BOOKS:

1. Donald Neamen , Dhrubes Biswas "Semiconductor Physics and Devices" McGraw-Hill Education
2. S. M. Sze & Kwok K. Ng, Physics of Semiconductor Devices, 3rd Edition, Wiley.
3. Marc Madou, Fundamentals of Microfabrication and Nanotechnology, 3rd Edition, CRC Press.
4. Stephen D. Senturia, Microsystem Design, Springer.
5. Chang Liu, Foundations of MEMS, 2nd Edition, Pearson.
6. James D. Plummer, Michael D. Deal, Peter B. Griffin, Silicon VLSI Technology: Fundamentals, Practice and Modeling, Pearson.

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

3rd Semester Syllabus for B.Tech EEE Batch 2024-2028

Subject Name: Indian Constitution **Credit: 0** **Lecture Hours: 24**

Subject Code: MCC371

List of Faculty Members handling the Subject –

1. Prof. Riya Barui
2. Prof. Susmita Bhakat

Pre-requisite: School history

Relevant Links: Study Material Coursera NPTEL

Course Objectives:

The purpose of learning this course is-

1. Understand different features of Indian constitution. Power and functioning of Union, state and local self-government.
2. Understand basics of PIL and guideline for admission of PIL.
3. Analyze of local administration starting from block to Municipal Corporation.
4. Study the identification of authority to redress a problem in the profession and in the society.

Course Outcomes:

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

CO1. Recall the meaning and significance of the Indian Constitution as the fundamental law of the land.
CO2. Understand the Indian political system, the powers and functions of the Union, State and Local Governments in detail.
CO3.Exercise their fundamental rights in proper sense and analyze the outcomes of the Electoral Process, Emergency provisions, Amendment procedure and the basics of PIL and guideline for admission of PIL.
CO4. Access the Functioning of local administration starting from block to Municipal Corporation.

Detailed Syllabus

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	**Indian Constitution**	Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy	***International Academia:*** ***https://mnit.ac.in/dept_hss/downloads/Syllabus/UG/21HST808.pdf*** ***AICTE-prescribed syllabus:*** ***https://www.aicte-india.org/sites/default/files/Vol.%20II%20%20AICTE%20UG%20%20Curriculum.pdf*** ***Industry Mapping:*** *https://byjus.com/ias/upsc-syllabus/*	5	Designing of a small set of rules and regulations (constitution) for an educational institution

2	**Union government and its administration**	Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha. State government and its administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions,	***International Academia:*** https://www.iitg.ac.in/hss/page_syllabus_details.php?slno=YzdtOS9VVGhiV25PNDZkMWh1ZkdXdz09 http://unipune.ac.in/university_files/Constitution/All%20PG%20Compulsory%20Paper%20Introduction%20to%20Constitution_13.012021.pdf ***AICTE-prescribed syllabus:*** ***https://www.aicte-india.org/sites/default/files/Vol.%20II%20%20AICTE%20UG%20%20Curriculum.pdf*** ***Industry Mapping:*** https://www.drishtiias.com/pdf/1593776909-uttar-pradesh-pcs-preliminary-mains-syllabus.pdf	10	Queries on the following – Union Govt. President of India Role of PM Centre-State Relationship State Govt. CMs of States Council of Ministers Latest Developments in States' Politics
3	**Supreme court**	Organization of supreme court, procedure of the court, independence of the court, jurisdiction and power of supreme court. High court: Organization of high court, procedure of the court, independence of the court, jurisdiction and power of supreme court. Subordinate courts: constitutional provision, structure and jurisdiction. National legal services authority, Lok adalats, family courts, gram nyayalays. Public interest litigation (PIL): meaning of PIL, features of PIL, scope of PIL, principle of PIL, guidelines for admitting PIL	***International Academia:*** https://www.kuk.ac.in/lms/syllabus?did=NDE=&sid=NDUxNQ==&pn=TS5UZWNoLiBDb21wdXRlciBFbmdpbmVlcmluZyAoVUlFVCk= ***AICTE-prescribed syllabus:*** ***https://www.aicte-india.org/sites/default/files/Vol.%20II%20%20AICTE%20UG%20%20Curriculum.pdf*** ***Industry Mapping:*** https://www.shiksha.com/exams/wbcs-exam-syllabus	10	Queries on Lok Adalats, Family courts and PIL

4	**Local Administration**	District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.	***International Academia:*** https://www.amrita.edu/course/indian-constitution/ https://www.kud.ac.in/file_upload/nep/3-4%20Sem%20NEP/Revised%20Syllabus%20of%20All%20UG%204th%20Semester%20for%20India%20&%20Indian%20Constitution%20Compulsory%20Subject%20under%20NEP.pdf ***AICTE-prescribed syllabus:*** ***https://www.aicte-india.org/sites/default/files/Vol.%20II%20%20AICTE%20UG%20%20Curriculum.pdf*** ***Industry Mapping:*** https://rpsc.rajasthan.gov.in/Static/Syllabus/5A186FF9-57DB-46D0-A1FA-126B4AA87639.pdf	10	Make a list of Local-District Administrators, Major Officials of District and Their role

Lesson Plan:

Module 1: Indian Constitution (Prof. Riya Barui, Prof. Susmita Bhakat)

Sl. No.	Day	Description	Recommended books for the topic
1	Lecture-1	Introduce the concept and importance of a constitution in democratic governance. Introduce the concept and importance of a constitution in democratic governance.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
2	Lecture-2	Discuss the historical development of the Indian Constitution. Explain the role of the Constituent Assembly and key architects like Dr. B.R. Ambedkar.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
3	Lecture-3	Highlight the major sources and influences from other countries.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
4	Lecture-4	Examine the salient features of the Indian Constitution (e.g., federal structure, parliamentary system, fundamental rights, secularism).	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India

Module 2: Union government and its administration

Sl. No.	Day	Description	Recommended books for the topic
5	Lecture-5	Features of Indian federalism Division of powers: Union, State & Concurrent Lists	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
6	Lecture-6	Understand the constitutional structure and real-world dynamics of Indian federalism.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
7	Lecture-7	Learn how Union-level decisions are made and implemented. President: Election, powers, role,	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
8	Lecture-8	Understand state-level administration and Centre–State administrative parallels.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
9	Lecture-9	PM & Council of Ministers: Functions and responsibilities, Cabinet & Central Secretariat structure.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
10	Lecture-10	Governor: Role and discretionary powers, CM & State Council of Ministers.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India

Module 3: Supreme Court (Prof. Riya Barui, Prof. Susmita Bhakat)

Sl. No.	Day	Description	Recommended books for the topic
11	Lecture-11	Learners understand how the apex court is structured and how it functions independently as the guardian of the Constitution. Jurisdiction & Powers: Original, Appellate, Advisory, Writ, Review powers	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
12	Lecture-12	Explain the role of High Courts and their relationship with state legal systems. Appointment and service conditions of High Court judges.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
13	Lecture-13	Learners grasp the ground-level legal structure and alternative dispute resolution methods in India.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
14	Lecture-14	Students understand how PIL democratizes access to justice and empowers civil society.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
15	Lecture-15	Features and scope (Fundamental Rights, social justice), Supreme Court guidelines for PIL admission	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
16	Lecture-16	Subordinate Courts: Structure (Civil, Criminal, District Courts), jurisdiction. Family Courts, Gram Nyayalayas.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India

Module 4: Local Administration (Prof. Riya Barui, Prof. Susmita Bhakat)

Sl. No.	Day	Description	Recommended books for the topic
17	Lecture-17	Introduce the role and importance of the District Collector as the administrative head overseeing law and order, development, and revenue in the district.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
18	Lecture-18	Explain the structure, functions, and constitutional status of Municipal Corporations, Councils, and Nagar Panchayats as urban local bodies.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
19	Lecture-19	Describe the powers of the Mayor and the responsibilities of elected municipal councillors in urban governance.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
20	Lecture-20	Discuss the role of the Municipal Commissioner/CEO in executing policies and managing municipal services effectively.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
21	Lecture-21	Provide an overview of the Panchayati Raj System as a decentralized governance model promoting rural empowerment.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
22	Lecture-22	Outline the three-tier structure of PRIs and the functions of elected representatives at each level, especially in the Zila Panchayat.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
23	Lecture-23	Explain the role of the CEO of Zila Panchayat in coordinating rural development programs and administrative functions.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India
24	Lecture-24	Describe the organizational setup at block and village levels, highlighting the role of elected and appointed officials in strengthening grassroots democracy.	Constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India

Suggested Learning Resources:

Text Books

1. Introduction to the constitution of India, DD Basu, 21st Edition, Lexis Nexis Books Publication ltd, India

Reference Books

1. Indian polity, M, Laxmikanth, MC Graw Hill education, 5th Edition.

University of Engineering and Management

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Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Syllabus for B.Tech Admission Batch 2024

Name of the course/subject	Electric Circuit Theory Laboratory	**Subject code**	PCCEEE391
Semester	3rd	**Course nature**	Practical
Pre- requisites	Basic Electrical Engineering		
Lecture Periods/ Week	**Tutorial Periods/ Week**	**Practical Periods/ Week**	**Credit**
0	0	3	1

Course Objective (s):

The purpose of learning this course is to:

1. Familiarize with electrical components and instruments.
2. Develop student's understanding through laboratory activities to solve problems related to key concepts taught in the classroom.
3. Develop student's debugging capability in order to propose and apply effective engineering solutions in network theorem and circuit analysis.

Laboratory Experiments: -

Experiment No	**Description**	**No of Hours**
1	Investigating Transient Response in R-L and R-C Circuits to Model an Electrical System: A Hybrid Simulation and Hardware Approach	**3**
2	RLC Circuits: hardware modelling and Simulating Transient Behavior (Series & Parallel)	**3**

3	Hardware modelling & Analyzing Two-Port Networks: Evaluation of Impedance and Admittance parameter	**3**
4	Frequency response of LP and HP filters: simulation & hardware modelling	**3**
5	Frequency response of BP and BR filters: simulation & hardware modelling	**3**
6	Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signals using MATLAB in both discrete and analog form to model the various electrical system	**3**
7	Determination of Laplace transform and Inverse Laplace transform using MATLAB to model different electrical systems by analyzing transient behavior.	**3**
8	Amplitude and Phase spectrum analysis of different signals using MATLAB for Designing Active and Passive Filter	**3**
9	Hardware and software modelling of electrical networks and verification of Network theorems.	**3**

Laboratory Outcome(s) (LOs):

After completion of this course, the learners will be able to
LO1. Apply appropriate instruments and handle them carefully and safely to make measurements of physical quantities or perform data analysis.
LO2. Identify the strength and limitations of theoretical models.
LO3. Establish a relationship between measured data and underlying physical principles.
LO4. Design and build a hardware part to meet desired specifications and tests it using appropriate testing strategy and/or equipment's.

Suggested Learning Resources:

1. Workbook
2. Coursera
3. Linkedin Learning
4. NPTEL

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Syllabus for B.Tech Admission Batch 2024

Name of the course/subject	Analog Electronics Laboratory	**Subject code**	PCCEEE392
Semester	3rd	**Course nature**	Practical
Pre- requisites	Basic Electronics Engineering		
Lecture Periods/ Week	**Tutorial Periods/ Week**	**Practical Periods/ Week**	**Credit**
0	0	3	1

Course objectives:

The purpose of learning this course is to-
1. To identify appropriate equipment and instruments for the experiment.
2. To study the various characteristics of different electronic components.
3. To work effectively in a team.

Detailed Syllabus

Expt. no	**Description**	**No of period**
1	Design an unregulated power supply using a full wave rectifier with and without capacitor to find ripple factors and load regulation.	3
2	Design a voltage regulator circuit using Zener diode	3

3	Design a voltage regulator circuit using IC	3
4	Design a low-level current source and voltage source using op-amp	3
5	Design an amplifier and signal conditioner for weak voltage signals using an instrumentation amplifier.	3
6	Design a low voltage audio amplifier and computing its frequency response using R-C coupled amplifier.	3
7	Design voltage-controlled amplifiers using JFET and MOSFET and finding its characteristics.	3
8	Design current controlled in various types of configurations.	3
9	Design a multivibrator circuit in various modes.	3
10	Fabrication of BJT (Skill Development using SEMulator3D)	3
11	Fabrication of MOSFET (Skill Development using SEMulator3D)	3

Course outcomes:

At the end of this course, students will demonstrate the ability to:
CO1. Explain the principle of operation of analog electronic components, Filters, regulators and analog electronic circuits.
CO2. Compute parameters and operating points of analog electronic circuits.
CO3. Determine response of analog electronic circuits
CO4. To design and construct requirement based multi-stage amplifier using BJT and MOFSET circuits

Suggested Learning Resources:

1. Coursera
2. Linkedin Learning
3. NPTEL
4.Workbook

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Syllabus for B.Tech Admission Batch 2024

Name of the course/subject	Semiconductor Fabrication and Design Laboratory	**Subject code**	PCCEEE393
Semester	3rd	**Course nature**	Practical
Pre- requisites	Basic Electronics Engineering		
Lecture Periods/ Week	**Tutorial Periods/ Week**	**Practical Periods/ Week**	**Credit**
0	0	3	1

Sl. No.	**Experiments**	**No. of periods**
1	Familiarization of the SEMulator3D software and basic GUI navigation.	3
2	Introduction to process simulation steps (material properties, basic crystal growth/wafer prep simulation, thermal oxidation).	3
3	Introduction to Process Simulators and Simulating Crystal growth.	3
4	Design the CMOS inverter layout	3
5	Understanding the difference between LOCOS isolation verses Shallow Trench Isolation (STI) and deposition of Gate-First versus Gate-Last	3
6	Different steps of Spacer and multiple patterning	3
7	Replacement of metal gate	3
8	Implement the process of Implantation & Silicidation	3
9	Understanding the difference between Damascene and Dual-Damascene	3

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Syllabus for B. Tech Admission Batch 2024

Subject Name: Data Structure & Algorithm Laboratory **Credit: 1**
Lecture Hours: 16+24 **Subject Code: ESCEEE391**

Study Material	Coursera	Nptel:	LinkedIn Learning:	Infosys Springboard:

Course Objective:

The purpose of learning this course is

1. To understand the basics of abstract data types.

2. To understand the principles of linear and nonlinear data structures.

3. To build an application using sorting and searching

Detail Syllabus:

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	Introduction:	Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Technique sand their complexity analysis.	Academic Mapping: https://ocw.mit.edu/courses/6-854j-advanced-algorithms-fall-2008/pages/syllabus/ CTE Model Curriculum for (aicte-india.org) **Industry Mapping:** Elementary Data Organizations: Arrays, Asymptotic Notations, Time-Space Trade-Off, Searching Algorithms, Complexity Analysis	4+6	(i)Worst/average case analysis for small pseudo-codes. (ii) Variations on binary search with applications, recursive and iterative implementation of binary search with applications to problems.
2	Stacks and Queues:	ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis	Academic Mapping: https://ocw.mit.edu/courses/6-854j-advanced-algorithms-fall-2008/pages/syllabus/ CTE Model Curriculum for (aicte-india.org) **Industry Mapping:** Push, Pop, Expression Conversion (Infix to Postfix/Prefix), Simple and Circular Queues, Priority Queues	4+6	(i)Implementation of stacks with application to a problem. (ii)Implementation of queues with application to a problem.
3	Linked Lists:	Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis. Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis	Academic Mapping: https://ocw.mit.edu/courses/6-854j-advanced-algorithms-fall-2008/pages/syllabus/ CTE Model Curriculum for (aicte-india.org) **Industry Mapping:** Singly Linked Lists, Traversing, Searching, Insertion, Deletion, Trees and Their Types, Threaded Binary Tree, Binary Search Tree (BST), AVL Tree, B Tree and B+ Tree	4+6	(i)Implementation of AVL trees with search, insert, delete operations and application to a problem. Comparison with unbalanced Binary Search Trees. (ii)Implementation of 2-4 trees with search, insert, delete operations and application to a problem. (iii) Comparison of the two implementations above.

4	Sorting and Hashing:	Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.	Academic Mapping: https://ocw.mit.edu/courses/6-854j-advanced-algorithms-fall-2008/pages/syllabus/ CTE Model Curriculum for (aicte-india.org) **Industry Mapping:** Sorting Algorithms, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Comparison Among Sorting Methods, Hashing, Graphs: Terminologies and Representations, Graph Traversal Algorithms	4+6	(i)Implementation of hash tables with applications to a problem. (ii)Implementation of tries and applications to a problem.

Course outcomes:

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

CO1. Differentiate how the choices of data structure & algorithm methods impact the performance of program.
CO2. Solve problems based upon different data structure & also write programs write programs based on different data structure
CO3. Identify appropriate data structure & algorithmic methods in solving problem
CO4. Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing, Compare the benefits of dynamic and static data structures implementations.

Suggested Learning Resources:

Text Books:

1. Data Structures in C, Aaron M. Tenenbaum. Pearson

Reference Books:

1. Data Structures and Program Design In C, 2/E by Robert L. Kruse, Bruce P. Leung. PHI
2. Data Structure & Algorithms Using C, R.S. Salaria, 5th Ed., Khanna Publishing House
3. Data Structure, S. Lipschutz.. Mc Graw Hill

QUESTION PAPER PATTERN AND DATES

EXAMINATION	Dates	PART – A	PART – B	PART – C	TOTAL MARKS
Mid Term 1		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		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		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