INSTITUTE OF ENGINEERING & MANAGEMENT

(School of University of Engineering and Management, Kolkata)

DEPARTMENT OF ELECTRICAL ENGINEERING

SEMESTER WISE CURRICULAM

2nd YEAR- 3rd SEMESTER

Syllabus for B. Tech Admission Batch 2025-29

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus

University of Engineering & Management, Jaipur

Syllabus for B.Tech Admission Batch 2025-29

Syllabus Structure

Sl. No	Type of Course	Course Code	Course Name	L	T	P	S	Total Contact Hours	Credit Points
1	Basic Science Courses	BSM301	Mathematics-III	2	1	0	0	3	3
2	Professional Core Courses	PCCEE301	Electrical Circuit Analysis	2	1	0	0	3	3
3	Professional Core Courses	PCCEE302	Analog Electronics	3	1	0	0	4	3
4	Professional Core Courses	PCCEE303	Electromagnetic Field theory	3	1	0	0	4	4
5	Professional Core Courses	PCCEE304	Measurement and Instrumentation	3	1	0	0	4	3
6	Humanities and social sciences including Management	MC301	Indian Constitution	0	0	0	2	2	0
7	Humanities and social sciences including Management	ESP301	Essential Studies for Professionals III	2	0	0	0	2	0.5
8	Professional Core Courses	PCCEE391	Electrical Circuit Analysis Laboratory	0	0	3	0	3	1
9	Professional Core Courses	PCCEE392	Analog Electronics Lab	0	0	3	0	3	1
10	Professional Core Courses	PCCEE393	Data Structure and Algorithm Lab	0	1	3	0	4	3
11	Professional Core Courses	PCCEE394	Measurement and Instrumentation Lab	0	0	3	0	3	1
12	Humanities and social sciences including Management	SDP381	Skill Development for Professionals III				2	2	0.5
13	Project. Seminar and Industrial Training	PWEE381	Mini Project I				1	1	1

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**	**6**	**12**	**5**	**38**	**24**

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Syllabus for B.Tech Admission Batch 2025-29

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

Syllabus for B.Tech Admission Batch 2025-29

Subject Name: Electrical Circuit Analysis **Credit: 3** **Lecture Hours: 40**
Subject Code: PCCEE301

List of Faculty Members handling the Subject –

1. Dr. Sourav Das, Dr. Subhajit Kar

Pre-requisite: Basic Electrical Engineering

Course Objective:

- To develop an understanding of electrical network fundamentals, signal types, and network response analysis.
- To introduce two-port network concepts and enable formulation and solution of network equations.
- To apply network theorems, coupled circuit analysis, and simplification techniques for solving complex engineering circuits.
- To utilize Laplace transform and other mathematical tools for analyzing and solving electrical circuit problems.

Course Outcomes:

CO No.	COURSE OUTCOME
CO1	Understand the concept of different types of networks and the application of different types of signals into such networks and analyzing resulting responses.
CO2	Explain the concept of two port networks to formulate network equations and solving circuit related problems.
CO3	Apply the concept of network theorems and other network analysis methods to solve problems related with coupled circuits to develop simpler circuits for complex engineering problems.

CO4	Apply powerful mathematical tools like Laplace transform to analyze and solve different circuit related problems.

Relevant Links: **Study Material** Coursera **Nptel** **LinkedIn Learning:** **Lesson Plan**

Detailed Syllabus:

Module	Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab/ Assignment	Text Book & Mapped Chapter
1.	**Network Theorems:** Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Bisection Theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks,	***International Academia:*** Circuits and Electronics | Electrical Engineering and Computer Science | MIT OpenCourseWare ***AICTE prescribed syllabus:*** ELECTRICAL Engg Final.pdf **Industry Mapping:** Top 15 MATLAB Simulink Projects for Electrical Engineering ***AI mapping:*** Circuit Analysis with AI | Teaching Resources | IDEEAS Lab	**10**	**Design and perform** software-based simulations and **construct hardware circuits** to **verify classical network theorems**, such as **Thevenin's, Norton's, Superposition, and Maximum Power Transfer theorems**. HARDWARE EXPERIMENT: introduction and implementation to design pcb based circuits using KICAD.	**A. Chakrabarti, circuit theory 2,** 3

2.	**Solution of First and Second order networks under transient and steady state response** Solution of first and second order differential equations for Series and parallel R- L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants, pole zero cancellation methods. Introduction to Steady State Analysis of series and parallel A.C Circuits, sinusoidal steady state response of RL, RC and RLC Circuits.	***International Academia:*** Circuits and Electronics | Electrical Engineering and Computer Science | MIT OpenCourseWare ***AICTE prescribed syllabus:*** ELECTRICAL Engg Final.pdf ***Industry Mapping:*** Top 15 MATLAB Simulink Projects for Electrical Engineering ***AI mapping:*** Circuit Analysis with AI | Teaching Resources | IDEEAS Lab	**8**	1. Design and implement the transient response of R-L-C series circuits through AI DIGITAL TWIN MODEL through MATLAB interfacing. 2. Design and simulate the transient response of R-L and R-C circuits using circuit simulation software; develop and test the hardware setup to observe transient behavior practically. 3. Create and evaluate the transient response of R-L-C series and parallel circuits through both software-based simulation and hardware experimentation. 4. **Analyze the amplitude and phase spectra** of different time-domain signals using **MATLAB** to understand their frequency-domain characteristics. 5. **Generate and visualize** various signal types—**Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, and Ramp signals**—in **both discrete and continuous time** using **MATLAB**.	4,8,9

3.	Network graphs and their applications Concept of Tree, Branch, Tree link, Incidence matrix, Tie-set matrix and loop currents, Cut set matrix and node pair potentials. Solution of Problems	***International Academia:*** Circuits and Electronics | Electrical Engineering and Computer Science | MIT OpenCourseWare ***AICTE prescribed syllabus:*** ELECTRICAL Engg Final.pdf ***Industry Mapping:*** Top 15 MATLAB Simulink Projects for Electrical Engineering ***AI mapping:*** Circuit Analysis with AI | Teaching Resources | IDEEAS Lab	**6**	Implementing Djktra's Algorithm for find out the shortest path in network using MATLAB.	**16**
4.	**Two Port Network and Network Functions** Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks, scattering matrix for transmission line, Introduction to Active filter	***International Academia:*** Circuits and Electronics | Electrical Engineering and Computer Science | MIT OpenCourseWare ***AICTE prescribed syllabus:*** ELECTRICAL Engg Final.pdf ***Industry Mapping:***	**8**	Design experiments to determine the Impedance (Z) and Admittance (Y) parameters of a two-port network using simulation tools; implement the setup in hardware to validate results.	**13**

		Top 15 MATLAB Simulink Projects for Electrical Engineering ***AI mapping:*** Circuit Analysis with AI | Teaching Resources | IDEEAS Lab			
5	**Network Synthesis** Network analysis vs. network synthesis, Concept of immittance (impedance + admittance), Hurwitz Polynomial, Positive Real Functions (PRF) / Brune's PRF, Even and odd parts of a network function, Removal of poles at infinity, origin, conjugate imaginary axis, and constant, LC Network Synthesis (one-port, lossless), RC Network Synthesis, RL Network Synthesis, Introduction to time varying network	***International Academia:*** Circuits and Electronics | Electrical Engineering and Computer Science | MIT OpenCourseWare ***AICTE prescribed syllabus:*** ELECTRICAL Engg Final.pdf ***Industry Mapping:*** Top 15 MATLAB Simulink Projects for Electrical Engineering ***AI mapping:*** Circuit Analysis with AI | Teaching Resources | IDEEAS Lab	**8**	1. Hurwitz Realization for system identification and analysis using MATLAB. 2. Identification of Hurtwiz Polynomial for Electrical System using MATLAB.	**21**

Lesson Plan:

Objective: *Equip students to analyse linear networks using classical theorems and systematic node/mesh methods, including networks with dependent sources, and to introduce duality.*

Module 1 — Network Theorems & Network Analysis (Lectures L1–10)

Lec. No.	Topic	Detailed Content / Key Points
1	Introduction & Superposition Theorem	Course overview, assessment scheme; recap of linearity & linear network elements; statement and proof of superposition theorem; applicability conditions; simple DC circuit examples.
2	Superposition Theorem — Advanced Problems	Superposition with multiple independent sources (voltage + current); circuits containing dependent sources — caution on deactivating dependent sources; numerical problems.
3	Thevenin's Theorem	Statement and derivation; procedure for finding V_th and R_th; circuits with independent sources only; numerical problems.
4	Thevenin's Theorem with Dependent Sources	Finding R_th using test source method (V-I method) when dependent sources are present; worked problems; Thevenin equivalent of two-terminal active networks.
5	Norton's Theorem & Source Transformation	Statement and proof; Norton equivalent (I_N, R_N); Thevenin–Norton equivalence and inter-conversion; source transformation technique; problems.
6	Maximum Power Transfer Theorem	Derivation of condition for max power transfer to resistive and complex (AC) loads; efficiency at max power transfer; numerical problems on DC and AC networks.
7	Reciprocity Theorem	Statement, conditions of applicability (linear, bilateral, single source); verification through examples; limitations.
8	Bisection Theorem	Concept of symmetrical (bisymmetric) networks; even/odd excitation; derivation of bisection theorem for lattice/bridge networks; application to ladder/bridge circuits.
9	Compensation Theorem	Statement and derivation; change in branch current/voltage due to change in branch impedance; application to sensitivity-type problems; numerical examples.
10	Node & Mesh Analysis with Dependent Sources; Duality	Systematic node-voltage and mesh-current analysis for circuits with VCVS/VCCS/CCVS/CCCS; supernode/supermesh; concept of duality and dual networks — dual element/element correspondence, construction of dual network from a planar graph.

Module 2 — Transient & Steady-State Response of First/Second Order Networks (Lectures 11–18)

Objective: *Develop ability to set up and solve governing differential equations for RL, RC and RLC circuits, interpret time-domain response, and relate*

response to pole-zero locations.

Lec. No.	Topic	Detailed Content / Key Points
11	First Order RL & RC Circuits — Formulation	Initial and final conditions in inductors/capacitors; writing first-order differential equations for series RL and RC circuits with DC excitation; classification of forced and free (natural) response.
12	First Order Circuits — Time Constant & Solution	Solution of first-order ODE; concept and physical significance of time constant (τ = L/R, RC); charging/discharging curves; step response of RL and RC circuits; numerical problems.
13	Second Order RLC Circuits — Formulation (Series)	Setting up the second-order differential equation for series R-L-C circuit; characteristic equation; roots and their relation to circuit parameters.
14	Second Order Circuits — Damping Cases	Overdamped, critically damped and underdamped response; general solution forms; determination of arbitrary constants from initial conditions; numerical problems on series RLC.
15	Parallel RLC Circuit — Transient Response	Dual nature of parallel RLC w.r.t. series RLC; differential equation and solution; damping cases; comparison with series circuit; problems.
16	Forced & Free Response, Initial/Final Conditions — Consolidation	Step-by-step method for evaluating initial conditions (inductor current, capacitor voltage continuity) and final (steady-state) conditions; complete response = forced + free; worked numerical problems.
17	Concept of Poles and Zeros	Network functions in s-domain; definition of poles and zeros; pole-zero plot; relation between pole locations (s-plane) and nature of transient response (oscillatory/damped/unstable); stability implication.
18	Steady State AC Analysis — Series RL, RC, RLC	Sinusoidal steady-state response using phasor method; impedance of series RL, RC, RLC circuits; concept of resonance in series RLC; bandwidth and Q-factor (introductory).

Module 3 — Network Graphs (Lectures 19–22)

Objective: *Enable formulation of network equations using graph-theoretic concepts — incidence, tie-set and cut-set matrices — independent of circuit topology drawing.*

Lec. No.	Topic	Detailed Content / Key Points
19	Network Graph Fundamentals	Concept of graph, node, branch; oriented graph; tree, branches of a tree (twigs), tree links (chords); number of independent loops and node equations; planar vs non-planar graphs; co-tree.

20	Incidence Matrix	Definition and construction of complete incidence matrix and reduced incidence matrix [A]; properties; relation between branch currents and node equations; worked examples.
21	Tie-Set Matrix & Loop Currents	Concept of tie-set (fundamental loop); construction of tie-set matrix [B]; formulation of loop (mesh) equations in matrix form V = [B]^T Z [B] I; numerical example.
22	Cut-Set Matrix & Node-Pair Potentials	Concept of fundamental cut-set; construction of cut-set matrix [C]; formulation of node equations using cut-set matrix; node-pair potentials; comprehensive solved problem combining tie-set/cut-set approach.

Module 4 — Two-Port Networks and Network Functions (Lectures 23–30)

Objective: *Characterise linear two-port networks through the four standard parameter sets, interrelate them, analyse interconnections, and introduce scattering parameters and active filters.*

Lec. No.	Topic	Detailed Content / Key Points
23	Introduction to Two-Port Networks	Concept of port, terminal pairs; one-port vs two-port networks; assumptions (linear, passive/active, bilateral); relationship between port voltages/currents; general two-port equations overview.
24	Impedance (Z) Parameters	Definition of open-circuit impedance parameters; physical significance; equivalent T-network representation; determination of Z-parameters for resistive/reactive two-ports; reciprocity & symmetry conditions.
25	Admittance (Y) Parameters	Definition of short-circuit admittance parameters; equivalent π-network representation; computation for sample networks; reciprocity in terms of Y-parameters.
26	Transmission (ABCD) Parameters	Definition and physical significance of ABCD parameters; cascade-friendly formulation; relation AD − BC = 1 for reciprocal networks; computation for simple two-ports; image impedance (introductory).
27	Hybrid (h) Parameters	Definition of hybrid parameters; relevance to transistor modelling; determination of h-parameters; relation to Z, Y parameters.
28	Inter-relationships Between Parameter Sets	Conversion formulas between Z, Y, ABCD and h parameters; condition for existence; tabulated conversion chart; numerical conversion problems.
29	Interconnection of Two-Port Networks	Series connection, parallel connection and cascade connection of two-port networks; validity checks; equivalent parameters of interconnected networks; worked examples.
30	Scattering Matrix & Introduction to Active Filters	Concept of incident/reflected waves on transmission lines; scattering (S) parameters — definition and properties; brief introduction to active filters — need, basic first-order active LPF/HPF using op-amp (qualitative).

Module 5 — Network Synthesis (Lectures 31–40)

Objective: *Introduce the inverse problem of network synthesis — realizing a prescribed network function as a physical one-port LC/RC/RL network — building on Hurwitz and positive-real function theory.*

Lec. No.	Topic	Detailed Content / Key Points
31	Network Analysis vs Network Synthesis; Immittance	Distinction between analysis (response from network) and synthesis (network from response); concept of immittance (impedance + admittance) as a unifying function; driving point functions; realisability concept (preview).
32	Hurwitz Polynomials	Definition of Hurwitz polynomial; necessary and sufficient conditions; continued-fraction (Sturm) test for Hurwitz character; examples of testing polynomials.
33	Positive Real Functions (PRF) — Properties	Definition of positive real function; necessary conditions (no poles/zeros in RHP, simple poles on jω-axis with real positive residues, $\mathrm{Re}[F(j\omega)] \geq 0$); significance for passive network realisability.
34	Brune's Positive Real Function Test	Brune's test for verifying positive realness; relation between Hurwitz polynomials and PRF; worked examples testing given F(s) for positive realness.
35	Even & Odd Parts of a Network Function; Removal of Poles at Infinity	Decomposition of F(s) into even and odd parts; properties used in synthesis; procedure for removing a pole at $s = \infty$ (extraction of an inductor) — first Cauer-form step.
36	Removal of Poles at Origin and on the Imaginary Axis	Removal of pole at $s = 0$ (extraction of a capacitor); removal of a pair of conjugate imaginary-axis poles (extraction of parallel/series LC resonant branch) — Foster-form building blocks.
37	Removal of a Constant; General Synthesis Procedure	Removal of a constant term (resistor extraction) ensuring remaining function stays PR; overall step-by-step synthesis algorithm; minimum function concept (brief).
38	LC Network Synthesis — Foster Forms	Properties of LC immittance functions; partial-fraction expansion; Foster Form-I (impedance, series LC branches) and Foster Form-II (admittance, parallel LC branches); worked synthesis examples.
39	LC Network Synthesis — Cauer Forms	Continued-fraction expansion about $s = \infty$ and $s = 0$; Cauer Form-I (ladder of series L / shunt C) and Cauer Form-II (ladder of series C / shunt L); comparison with Foster forms; worked examples.
40	RC / RL Network Synthesis; Introduction to Time-Varying Networks	Properties of RC and RL immittance functions (poles/zeros on negative real axis, alternation property); Foster and Cauer realisation for RC and RL one-ports; brief introduction to time-varying networks — definition, examples, contrast with LTI systems; course recap.

CO-PO MAPPING

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

Text Books

1. A. Chakraborty, “Circuit Theory”, Dhanpat Rai Publications, 2018.
2. D. Roy Choudhury, “Networks and Systems”, New Age International Publications, 1998.

Reference Books

1. M. E. Van Valkenburg, “Network Analysis”, Prentice Hall, 2006.
2. C. K. Alexander and M. N. O. Sadiku, “Electric Circuits”, McGraw Hill Education, 2004.

Syllabus for B.Tech Admission Batch 2025-29

Subject Name: Analog Electronics **Credit:3** **Lecture Hours: 42**

Subject Code: PCCEE302

Pre-requisite: Physics (10+2)

Relevant Links: Study material NPTEL Coursera LinkedIn Learning

Course Objectives:

The purpose of learning this course is-

1. The capability to know Diode circuits, BJT circuits, MOSFET circuits,
2. The ability to know the Differential, multi-stage and operational amplifiers
3. The ability to know the linear applications of op-amp.
4. The ability to know the nonlinear applications of op-amp.
5. The ability to know the Feedback amplifier & Oscillators.

Course Outcomes:

CO1. To appreciate the functioning of OP-AMP, oscillator and the characteristics of BJT and MOSFF.
CO2. Design of sinusoidal and non-sinusoidal oscillators using OP-AMP, design of single stage amplifier using BJT and MOSFET.
CO3. Analyze various rectifier and amplifier circuits based on diode, OP-AMP, BJT and MOSFET.
CO4. To design and construct requirement based multi-stage amplifier using BJT and MOSFET circuits.

Module	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	**Review of basic concepts of Diode**	Electronic system, basic concept of signal, noise. Zener diodes, clamping and clipping circuits. Review of half wave and full wave rectifier,	***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	2	1. Study of ripple and regulation characteristics of full wave rectifier with and without capacitor filter. 2. Study of Zener diode as voltage regulator. Study of Switched Mode 3. Power Supply & construction of a linear voltage regulator using regulator IC chip
2	**BJT circuits**	Structure and I-V characteristics of a BJT; Fabrication steps of 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.	***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	8	1. Construction of a two-stage R-C coupled amplifier & study of it's gain & Bandwidth. V-I Characteristics of BJT
3	**FET circuits**	MOSFET structure and I-V	***International Standards:***	8	V-I Characteristics of JFET and MOSFET

	Current mirrors	characteristics, Fabrication steps of MOSFET, 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 transistor models, Miller's theorem, frequency response of single stage amplifier. Basic topology and its variants, V-I characteristics, Output resistance and minimum sustainable voltage (VON), maximum useable load, generation of current source.	**(**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		
4	**Operational amplifier**	Linear applications of op-amp: Idealized analysis of op-amp circuits. Inverting a n d non-inverting amplifier, differential amplifier, +instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, Feedback amplifiers and Oscillators design (Wien bridge and phase shift). Analog to Digital Conversion. Nonlinear applications of op-amp Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector.	***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	8	Realization of a V-to-I & I-to-V converter using Op-Amps.
5	**Applicatio**	Differential, multi-stage and	***International Standards:***	12	1. Instrumentation

	n of Operational Amplifier	operational amplifiers: Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product), Frequency Response of the amplifier.	**(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		Amplifier using Op-Amp. 2. Construction of a simple function generator using IC
6	**Feedback amplifier & Oscillators**	Feedback amplifier & Oscillators: Concept of feedback, Negative & Positive feedback, Voltage/Current, Series/Shunt feedback, Berkhausen criterion, Colpit, Hartley's, Phase shift, Wien bridge, & Crystal oscillators	***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	6	1. Study of class A, C & Push-Pull amplifiers. Study of timer circuit using NE555 & configuration for monostable & astable and bistable multivibrator. 2. Realization of a Phase Locked Loop using Voltage Controlled Oscillator (VCO).

Lesson Plan:

Module 1: Review of Basic Concepts & Diode Circuits (2 Hours)

Day	Topic
1	Electronic Systems, Signals and Noise
2	Zener Diode, Clipping and Clamping Circuits, Half-wave and Full-wave Rectifiers

Module 2: BJT Circuits (8 Hours)

Day	Topic
3	BJT Structure, Fabrication and I-V Characteristics
4	BJT as a Switch and Introduction to Amplifiers
5	BJT Biasing Techniques
6	Current Mirror Circuits
7	Common Emitter Amplifier
8	Common Base and Common Collector Amplifiers
9	Small Signal Equivalent Circuits
10	High Frequency Equivalent Circuits and Frequency Response

Module 3: FET Circuits and Current Mirrors (8 Hours)

Day	Topic
11	MOSFET Structure, Fabrication and Characteristics
12	MOSFET as a Switch and Amplifier

13	MOSFET Biasing and Small Signal Models
14	Common Source Amplifier
15	Common Gate and Common Drain Amplifiers
16	Gain, Input and Output Impedance Analysis
17	High Frequency Models and Miller's Theorem
18	Current Mirrors: Topology, Characteristics and Applications

Module 4: Operational Amplifier (8 Hours)

Day	**Topic**
19	Introduction to Op-Amp, Ideal and Practical Characteristics
20	Inverting and Non-Inverting Amplifiers
21	Differential and Instrumentation Amplifiers
22	Integrator and Active Filters
23	P, PI and PID Controllers using Op-Amp
24	Lead-Lag Compensation and Voltage Regulators
25	Feedback Amplifiers and Oscillator Design using Op-Amp
26	Analog-to-Digital Conversion

Module 5: Applications of Operational Amplifier (12 Hours)

Day	**Topic**
27	Differential Amplifier Review
28	Multi-stage Amplifiers
29	Power Amplifiers
30	Direct Coupled Amplifiers
31	Internal Structure of Operational Amplifier

32	Output Offset Voltage and Input Bias Current
33	Input Offset Current and Slew Rate
34	Gain-Bandwidth Product
35	Hysteresis Comparator
36	Zero Crossing Detector
37	Precision Rectifier and Peak Detector
38	Square Wave and Triangular Wave Generators

Module 6: Feedback Amplifiers & Oscillators (6 Hours)

Day	**Topic**
39	Concept of Feedback, Positive and Negative Feedback
40	Voltage/Current Series and Shunt Feedback Amplifiers
41	Barkhausen Criterion, Hartley and Colpitts Oscillators
42	Phase Shift, Wien Bridge and Crystal Oscillators

CO-PO mapping

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

Suggested Learning Resources:

Text Books

Name of the Text Book	Author Name	Edition	Publisher Name	Chapter No.	Module No. and Name of the proposed Syllabus
MICROELECTRONIC CIRCUITS	Sedra & Smith	5th	Oxford University Publication	5	Module-2:BJT circuits
				4	Module-3:FET circuits
				3	Module 1: Diode Circuit
				2 & 7	Module 4 and Module 5: OPAMP
				8	Module 6:Feedback amplifier & Oscillators

Reference Books

1. P.R. Gray, R.G. Meyer, and S. Lewis, “Analysis and Design of Analog Integrated Circuits”, John Wiley & Sons.
2. Robert Boylestad Louis Nashelsky "Electronic Devices and Circuit Theory”, Pearson

Syllabus for B.Tech Admission Batch 2025-29

Subject Name: Electromagnetic Field Theory **Credit: 4** **Lecture Hours: 42**

Subject Code: PCCEE303

Pre-requisite: Basic Electrical Engineering, Mathematics, Physics

Relevant Links:

Study material	NPTEL: https://nptel.ac.in/courses/108104087	Coursera	**LESSON PLAN_PCCEE303**

Course Objectives:

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 Outcomes:

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.

Detailed syllabus

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	**Review of Maxwell's equations**	Review of Maxwell's Equation, time-harmonic fields, scalar and vector potentials, boundary conditions, Electrostatics & Electromagnetics, Uniform plane wave	***International Academia:*** https://ocw.mit.edu/courses/8-07-electromagnetism-ii-fall-2012/download/ ***AICTE-prescribed syllabus:*** https://www.aicte.gov.in/downloads/msyllabus/UG/ELECTRICAL%20Engg%20Final.pdf	**12**	**None**
2	**Plane waves at boundaries**	Plane wave reflection and refraction at boundaries: Normal and oblique incidence, Brewster angle		**4**	**None**
3	**Plane waves in dispersive media**	Quarter wave matching, wave propagation in dispersive media		**4**	**None**
4	**Transmission Lines theory & applications**	Transmission line parameters and equations, Input impedance, standing wave ratio and power, Smith chart, Impedance matching, Applications of transmission lines, Transient on transmission lines		**8**	**None**
5	**Guided wave & Waveguides**	TE, TM and TEM waves, parallel-plate waveguide, rectangular and cylindrical waveguides, waveguide resonators, dielectric guides		**8**	**None**
6	**Antennas**	Hertzian dipole, half-wave dipole and quarter-wave monopole antennas, small		**4**	**None**

		loop antenna, antenna characteristics and arrays			

Lesson Plan:

Module Number	Lecture Number	Lecture Topic
Module 1: Review of Maxwell's equations (8 Hours)	1	Review of Maxwell's Equations in differential and integral forms
	2	Understanding time-harmonic fields and phasors
	3	Scalar and vector potentials in electromagnetics
	4	Derivation and application of boundary conditions
	5	Introduction to the Uniform plane wave (UPW)
	6	Wave equations and propagation in lossless media
	7	Plane wave propagation in lossy and conducting media
	8	Intrinsic impedance and wave polarization concepts
Module 2: Plane waves at boundaries (4 Hours)	9	Plane wave reflection at normal incidence
	10	Plane wave refraction at normal incidence
	11	Oblique incidence: TE and TM polarization analysis
	12	Analysis of the Brewster angle and total internal reflection
Module 3: Plane waves in dispersive media (4 Hours)	13	Wave propagation in dispersive media: Phase and group velocity
	14	Characteristics of wave packets and dispersion relations
	15	Introduction to Quarter wave matching techniques
	16	Practical applications of impedance matching in media
Module 4: Transmission Lines theory & applications (8 Hours)	17	Transmission line parameters (R, L, G, C) and Telegrapher's equations
	18	Propagation constant and characteristic impedance
	19	Calculation of Input impedance and reflection coefficients
	20	Standing Wave Ratio (SWR) and power flow on lines
	21	The Smith Chart: Graphical representation of impedance
	22	Impedance matching techniques using the Smith Chart
	23	Analysis of Transients on transmission lines
	24	Engineering applications of transmission lines
	25	Fundamental modes: TE, TM, and TEM waves

Module 5: Guided wave & Waveguides (8 Hours)	26	Analysis of parallel-plate waveguides
	27	Rectangular waveguides: Mode equations and cut-off frequencies
	28	Field distributions in rectangular waveguides
	29	Introduction to Cylindrical (circular) waveguides
	30	Principles of waveguide resonators
	31	Dielectric guides and their characteristics
	32	Power transmission and attenuation in waveguides
Module 6: Antennas & Wave propagation (8 Hours)	33	Radiation principles and the Hertzian dipole
	34	Analysis of the half-wave dipole antenna
	35	Characteristics of quarter-wave monopole antennas
	36	Radiation from small loop antennas
	37	Fundamental antenna characteristics: Gain, Directivity, and Patterns
	38	Introduction to antenna arrays and beamforming
	39	Mechanisms of Ground wave propagation
	40	Ionospheric (Sky wave) and Space wave propagation

CO-PO mapping

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

Suggested Learning Resources:

Text Books

Name of the Text Book	Author Name	Edition	Publisher Name	Chapter No.	Module No. and Name of the proposed Syllabus
Principles of Electromagnetics	M. N. O. Sadiku and S.V. Kulkarni	6th	Oxford University Publication	Chapters 1 to 10	Modules 1 - 7

Reference Books

1. W. Hayt, “Engineering Electromagnetics”, McGraw Hill Education, 2012.
2. Pramanik, “Electromagnetism - Theory and applications”, PHI Learning Pvt. Ltd, New Delhi, 2009.
3. Pramanik, “Electromagnetism-Problems with solution”, Prentice Hall India, 2012.
4. G.W. Carter, “The electromagnetic field in its engineering aspects”, Longmans, 1954.
5. W.J. Duffin, “Electricity and Magnetism”, McGraw Hill Publication, 1980.
6. W.J. Duffin, “Advanced Electricity and Magnetism”, McGraw Hill, 1968.
7. E.G. Cullwick, “The Fundamentals of Electromagnetism”, Cambridge University Press, 1966.
8. D. Popovic, “Introductory Engineering Electromagnetics”, Addison-Wesley Educational Publishers, International Edition, 1971.

Syllabus for B.Tech Admission Batch 2025-29

Subject Name: Measurement and Instrumentation **Credit: 3**

Lecture Hours: 40 **Subject Code: PCCEE304**

Pre-requisite: Engineering Physics**,** Basic Electronics, Basic Electrical

Relevant Links Study Material Coursera NPTEL

Course Objectives:

1. To understand the fundamental principles of measurement and instrumentation, including calibration methods, instrument characteristics, standards, and error analysis.
2. To develop knowledge of voltage, current, power, and energy measurement techniques, along with compensation methods, potentiometers, and instrument transformers.
3. To learn the principles and techniques of analog-to-digital conversion, including sampling, quantization, and ADC methods used in measurement systems.
4. To acquire an understanding of digital instrumentation, data acquisition systems, and their applications in modern engineering measurements and industrial processes.

Course Outcome:

1. Apply calibration procedures effectively to ensure accurate measurements using various instruments.
2. Identify and analyze measurement errors, implementing appropriate compensation techniques for improved accuracy.
3. Utilize principles of power and energy measurement to calibrate relevant instruments and accurately assess power consumption.
4. Demonstrate proficiency in analog- to-digital conversion techniques and effectively employ digital instrumentation for data acquisition and analysis

Module No	Description	Mapping with Industry and international academia	Lecture Hours	Corresponding Lab assignment	Text Book	Mapped Chapter
1	**Basics of Measurement and Instrumentation, Instrument Examples and Error Analysis:** Generalized block diagram of Measurement System, Industrial Standards of measurement. Measurement of current & Voltage using PMMC, MI and Electrodynamometer type instruments. Extension of range of instruments- shunts & multipliers-Current transformers-Potential Transformers. Errors in measurements, Types of errors, Limiting error with examples.	**AICTE Syllabus:** https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf **International Academia:** https://online.stanford.edu/courses/xeiet100-clean-renewable-energy-storage-sustainable-future	**4**	**No Lab**	A.K.Sawhney, Electrical & Electronics Measurements and Instrumentation; DhanpatRai.	**Chapter 2**
2	**Power, Energy and Power Factor Measurements:** Definition of power, types, Measurement of power with different methods, construction and working of Electrodynamometer type Wattmeter, Errors in power measurements, Types of errors, Limiting error with examples. Measurement of Energy using Induction type energy meter. Electrodynamometer type P.F. meter.	**AICTE Syllabus:** https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf **International Academia:** https://online.stanford.edu/courses/xeiet100-clean-renewable-energy-storage-sustainable-future	**6**	**Exp- 7**	A.K.Sawhney, Electrical & Electronics Measurements and Instrumentation; DhanpatRai.	**Chapter 9**
3	**DC and AC Bridges:** Concept of Bridges, Measurement of low resistance by Kelvin Double Bridge Method, A.C. bridges - Maxwell's inductance bridge, Anderson bridge, D-Sauty Bridge, Schering Bridge, Wien	**AICTE Syllabus:** https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf	**7**	**Exp- 1, 2, 3**	A.K.Sawhney, Electrical & Electronics Measurements and	**Chapter 13**

	bridge- Circuit diagram, phasor diagram, derivations of equations for unknown parameter, Q-factor, dissipation factor, advantages and disadvantages for all the bridges.	**International Academia:** https://online.stanford.edu/courses/xeiet100-clean-renewable-energy-storage-sustainable-future			Instrumentation; DhanpatRai.	
4	**Analogue Digital Instruments and its conversion:** Q- Meter circuit and its operation, errors in Q- Meter circuits. Analog-to-Digital Conversion (ADC), Staircase Ramp Compensation, Integrator-based ADC, Delta-Pulse-Modulation-based ADC. Introduction, Digital voltmeters, Digital Frequency Meter, Errors in frequency measurement – possible remedies, Time And Ratio measurement. Frequency Divider Generator, Signal Generator, Digital Multimeter.	**AICTE Syllabus:** https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf **International Academia:** https://online.stanford.edu/courses/xeiet100-clean-renewable-energy-storage-sustainable-future	**8**	**Exp- 1, 2, 3, 4, 5, 6, 10**	A.K.Sawhney, Electrical & Electronics Measurements and Instrumentation; DhanpatRai.	**Chapter 4**
5	**Potentiometer and Instrument Transformer:** DC and AC potentiometer, C.T. and V.T. construction, theory, operation, characteristics.	**AICTE Syllabus:** https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf **International Academia:** https://online.stanford.edu/courses/xeiet100-clean-renewable-energy-storage-sustainable-future	**7**	**Exp- 8**	A.K.Sawhney, Electrical & Electronics Measurements and Instrumentation; DhanpatRai.	**Chapter 18**

6	**Introduction to Sensors**: Definition, significance of measurement and instruments, General concepts and terminology of measurement systems **Resistive transducers: S**train gauges, types, resistance measuring methods, strain gauge applications: Load and torque measurement. **Inductive transducers:** Transformer type, synchros, eddy current transducers, LVDT: Construction, material, input-output characteristics. **Optical Sensors:** LDR, Photo Diode, Stroboscope, IR Sensor. **Thermal sensors:** Resistance temperature detector (RTD): principle, materials and types; Thermistor: principle, materials and types; Thermocouple, Thermoelectric effects, laws of thermocouple,	**AICTE Syllabus:** https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf **International Academia:** https://online.stanford.edu/courses/xeiet100-clean-renewable-energy-storage-sustainable-future	**8**	**No experiment**	A.K.Sawhney, Electrical & Electronics Measurements and Instrumentation; DhanpatRai**.**	**Chapter 18**

Lesson Plan:

Lecture No.	Module	Topic Name	CO Mapping	PO Mapping	Teaching Method
1	M1	Introduction to Measurement Systems	CO1	PO1,PO2	Chalk & Talk + PPT
2	M1	Generalized Block Diagram	CO1	PO1,PO2	PPT + Discussion
3	M1	Standards and Calibration	CO1	PO1,PO4	Case Study
4	M1	Instrument Characteristicsa	CO1	PO1,PO2	Lecture
5	M1	PMMC Instruments	CO1	PO1,PO5	PPT + Numerical
6	M1	Moving Iron Instruments	CO1	PO1,PO5	Lecture
7	M1	Electrodynamometer Instruments	CO1	PO1,PO5	Lecture
8	M1	Shunts and Multipliers	CO1	PO2,PO5	Problem Solving
9	M1	CT and PT Basics	CO1	PO2,PO5	Demonstration
10	M2	Introduction to Power Measurement	CO2	PO1,PO2	Lecture
11	M2	Types of Power	CO2	PO1,PO2	PPT
12	M2	Electrodynamometer Wattmeter	CO2	PO1,PO4	Lecture
13	M2	Errors in Power Measurement	CO2	PO2,PO4	Numerical
14	M2	Measurement Errors	CO2	PO2,PO4	Discussion
15	M2	Limiting Error Problems	CO2	PO2,PO4	Tutorial
16	M2	Induction Energy Meter	CO3	PO1,PO5	PPT
17	M2	Power Factor Meter	CO3	PO1,PO5	Lecture
18	M3	Introduction to DC Bridges	CO2	PO1,PO2	Lecture

19	M3	Kelvin Double Bridge	CO2	PO2,PO4	Numerical
20	M3	AC Bridge Concepts	CO2	PO2,PO4	PPT
21	M3	Maxwell Bridge	CO2	PO2,PO4	Lecture
22	M3	Anderson Bridge	CO2	PO2,PO4	Lecture
23	M3	De-Sauty Bridge	CO2	PO2,PO4	Tutorial
24	M3	Schering Bridge	CO2	PO2,PO4	Tutorial
25	M3	Wien Bridge	CO2	PO2,PO4	Lecture
26	M3	Q Factor & Dissipation Factor	CO2	PO2,PO4	Problem Solving
27	M4	Introduction to Digital Instruments	CO4	PO1,PO3	PPT
28	M4	Q Meter Operation	CO4	PO1,PO3	Lecture
29	M4	Q Meter Errors	CO4	PO2,PO3	Tutorial
30	M4	ADC Fundamentals	CO4	PO1,PO3	PPT
31	M4	Ramp and Integrator ADC	CO4	PO1,PO3	Lecture
32	M4	Delta Modulation ADC	CO4	PO1,PO3	Lecture
33	M4	Digital Voltmeter	CO4	PO1,PO5	Demonstration
34	M4	Digital Frequency Meter	CO4	PO1,PO5	Lecture
35	M4	Time & Ratio Measurement	CO4	PO2,PO5	Tutorial
36	M4	Digital Multimeter	CO4	PO1,PO5	Demonstration
37	M5	DC and AC Potentiometer	CO3	PO1,PO5	Lecture
38	M5	Instrument Transformers	CO3	PO1,PO5	PPT
39	M6	Introduction to Sensors	CO4	PO1,PO5	Lecture + PPT
40	M6	Strain Gauge, LVDT, Optical & Thermal Sensors	CO4	PO1,PO5	Smart Classroom

CO-PO mapping

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

Text Books:

1. A.K.Sawhney, Electrical & Electronics Measurements and Instrumentation; Dhanpat Rai.
2. E.W Golding, Electrical Measurement and Measuring Instruments; Wheeler Publication
3. Electronic Measurement & Instrumentation By H. Cooper – PHI.

Reference Books:

1. Electronics Instruments & Measurement by David A. Bell – PHI.
2. J.B.Gupta, Electrical & Electronics Measurements and Instrumentation; S.K. Kataria and Sons.

Syllabus for B.Tech Admission Batch 2025-29

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

Subject Code: MCEE301

List of Faculty Members handling the Subject – Prof. Deboleena Chakraborty
Pre-requisite: School history

Suggested Learning Resources: **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
1	Indian Constitution	Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy	International Academia: MNIT SYLLABUS AICTE-prescribed syllabus: AICTE SYLLABUS Industry Mapping: https://byjus.com/ias/upsc-syllabus/	5
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,	Academia: IIT GUWAHATI SYLLABUS AICTE-prescribed syllabus: AICTE SYLLABUS Industry Mapping: https://www.drishtiias.com/pdf/1593776909-uttar-pradesh-pcs-preliminary-mains-syllabus.pdf	10
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	Academia: LINK AICTE-prescribed syllabus: AICTE SYLLABUS Industry Mapping: https://www.shiksha.com/exams/wbcs-exam-syllabus	10
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	Academia: https://www.amrita.edu/course/indian-constitution/	10

		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.	LINK AICTE-prescribed syllabus: AICTE SYLLABUS Industry Mapping: https://rpsc.rajasthan.gov.in/Static/Syllabus/5A186FF9-57DB-46D0-A1FA-126B4AA87639.pdf	

Lesson Plan:

1. **Module 1: Indian Constitution (**Prof. Deboleena Chakraborty**)**

Sl. No.	Day	Description	Recommended books for the topic
1	Lecture-1	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

2. Module 2: Union government and its administration (Prof. Deboleena Chakraborty)

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

3. **Module 3: Supreme Court (**Prof. Deboleena Chakraborty**)**

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

4. **Module 4: Local Administration (**Prof. Deboleena Chakraborty**)**

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

CO-PO Mapping:

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

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.

Syllabus for B.Tech Admission Batch 2025-29

Subject Name: Electrical Circuit Analysis Laboratory **Credit:1** **Lecture Hours: 33**
Subject Code: PCCEE391

Pre-requisite: Basic Electrical Laboratory

Study Material	Coursera	Nptel	LinkedIn Learning	Workbook

Course Outcomes:

1. To verify classical network theorems through software simulation and hardware implementation.
2. To analyze the transient and frequency-domain behaviour of R-L, R-C and R-L-C circuits using MATLAB and circuit simulation tools.
3. To design and validate two-port network parameters and PCB-based hardware circuits.

Course objectives:

The purpose of learning this course is to-
1. To verify classical network theorems through software simulation and hardware implementation.
2. To analyze the transient and frequency-domain behaviour of R-L, R-C and R-L-C circuits using MATLAB and circuit simulation tools.
3. To design and validate two-port network parameters and PCB-based hardware circuits.
4. To design and validate AI based networks.

Laboratory Experiments Detailed Syllabus

Expt. no	Description	No of period
1	Design and perform software-based simulations and construct hardware circuits to verify classical network theorems, such as Thevenin's, Norton's, Superposition, and Maximum Power Transfer theorems.	3
2	HARDWARE EXPERIMENT: Introduction and implementation to design PCB based circuits using KiCAD.	3
3	Design and implement the transient response of R-L-C series circuits through an AI Digital Twin Model through MATLAB interfacing.	3
4	Design and simulate the transient response of R-L and R-C circuits using circuit simulation software; develop and test the hardware setup to observe transient behaviour practically.	3
5	Create and evaluate the transient response of R-L-C series and parallel circuits through both software-based simulation and hardware experimentation.	3
6	Analyze the amplitude and phase spectra of different time-domain signals using MATLAB to understand their frequency-domain characteristics.	3
7	Generate and visualize various signal types—Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, and Ramp signals—in both discrete and continuous time using MATLAB.	3
8	Implementing Dijkstra's Algorithm for finding the shortest path in a network using MATLAB.	3
9	Design experiments to determine the Impedance (Z) and Admittance (Y) parameters of a two-port network using simulation tools; implement the setup in hardware to validate results.	3
10	Hurwitz Realization for system identification and analysis using MATLAB.	3
11	Identification of Hurwitz Polynomial for Electrical System using MATLAB.	3

CO PO Mapping:

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

Syllabus for B.Tech Admission Batch 2025-29

Subject Name: **Analog Electronics Lab** **Credit:1** **Lecture Hours: 30**
Subject Code: **PCCEE392**

Pre-requisite: Basic Electronics Engineering Laboratory

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 regulated circuit using Zener diode	3
3	Design a voltage regulated 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

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.

CO-PO Mapping:

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

Syllabus for B.Tech Admission Batch 2025-29

Subject Name: Data Structure & Algorithm Laboratory
Credit: 3
Lecture Hours: 30
Subject Code: PCCEE393
Pre-Requisite(s): C programming, Engineering Mathematics

Course Objective(s):

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

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 dyna mic and static data structures implementations.

Detailed Syllabus

Module No.	Description	No of period
1	**Introduction:** Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. **Corresponding Lab Assignments:** Worst/ average case analysis for small pseudo- codes.	3
2	**Searching:** Linear Search and Binary Search Technique sand their complexity analysis. **Corresponding Lab Assignments:** Variations on binary search with applications, recursive and iterative implementation of binary search with applications to problems.	6
3	**Stacks:** ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding Algorithms and complexity analysis. **Corresponding Lab Assignments:** Implementation of stacks with application to a problem.	3
4	**Queue:** ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis **Corresponding Lab Assignments:** Implementation of queues with application to a problem.	3
5	**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. **Corresponding Lab Assignments:** Singly Linked Lists, Traversing, Searching, Insertion, Deletion operation applications to problems.	6
6	**Sorting:** 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. **Corresponding Lab Assignments**: Applications of Sorting Algorithms, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Comparison Among Sorting Methods.	3
7	**Tree:** Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search T ree, 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.	6

	Corresponding Lab Assignments: 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.	
8	**Graph**: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis. **Corresponding Lab Assignments:** Graph Traversal Algorithms.	3
9	**Hashing** **Corresponding Lab Assignments: (i)** Implementation of hash tables with applications to a problem. (ii) Implementation on trees and applications to a problem.	3
10	**Dynamic Algorithm Selection using AI**: Given runtime characteristics like data size, distribution etc, choose the best algorithm for sorting of a given dataset. **Use AI for Detecting errors in Code**: Use LLMs or code-specific models to detect and correct errors of the code used in any given data structure algorithms. **Use AI to generate Time Complexity Estimator**: Train a neural network to predict the time complexity class from code samples.	6

CO-PO Mapping:

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

Suggested Learning Resources:

Text Books: 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

Syllabus for B.Tech Admission Batch 2025-29

Subject Name: Measurement and Instrumentation Lab **Credit: 1**
Lecture Hours: 30 **Subject Code: PCCEE394**

Course Objective(s):

The purpose of learning this course is to:
1. Develop a clear understanding of various electrical and electronic measurement techniques and their practical applications.
2. Familiarize students with different types of transducers and their use in measuring physical quantities such as temperature, displacement, and speed.
3. Provide hands-on experience in designing, calibrating, and testing measuring instruments and bridges for accurate data acquisition.
4. Introduce compensating circuits and digital techniques used in measurement systems for enhancing precision and reliability.
5. Enable students to understand the construction, working, and assembly of conventional and digital measuring instruments.

Course outcome(s):

At the end of the course, the students will be able to-
CO1: Design and analyze compensating circuits and evaluate their role in improving measurement accuracy.
CO2: Develop and calibrate different transducer based measurement systems (e.g., thermocouple, LVDT, strain gauge, capacitive transducer) for physical parameter measurement.
CO3: Examine and interpret characteristics of electrical and electronic instruments through experimental setups involving instrument transformers and bridges.
CO4: Illustrate the functioning and internal construction of different types of measuring instruments.

Experiment No.	Description	Hours
1	Design a model short transmission system and determine its efficiency by applying Instrument Transformers in Claude Platform.	2
2	Design and calibrate a power and energy measurement system using Digital energy meter.	2
3	Design an unknown temperature measurement system of a Furnace using Thermocouple.	2
4	Core displacement measurement using LVDT with Machine Learning approach.	2
5	Measurement of unknown capacitance of a low pass filter circuit using De Sauty Bridge and its condition monitoring using Schering Bridge	2
6	Calibration of Strain Gauge.	2
7	Rotational speed measurement system using Photo Magnetic pick up.	2
8	Water level measurement and Automatic pump control using PLC.	
9	Design of an Angular Displacement Measurement system using Capacitive transducer.	2
10	Dismantle and assemble different parts of PMMC, Dynamometer, Electro thermal and Rectifier type of instruments, Digital multimeter and various other instruments to get familiarized with their constructions.	2
11	Traffic Signal Automation using PLC.	2

	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