Pimpri Chinchwad Education Trust's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 411044

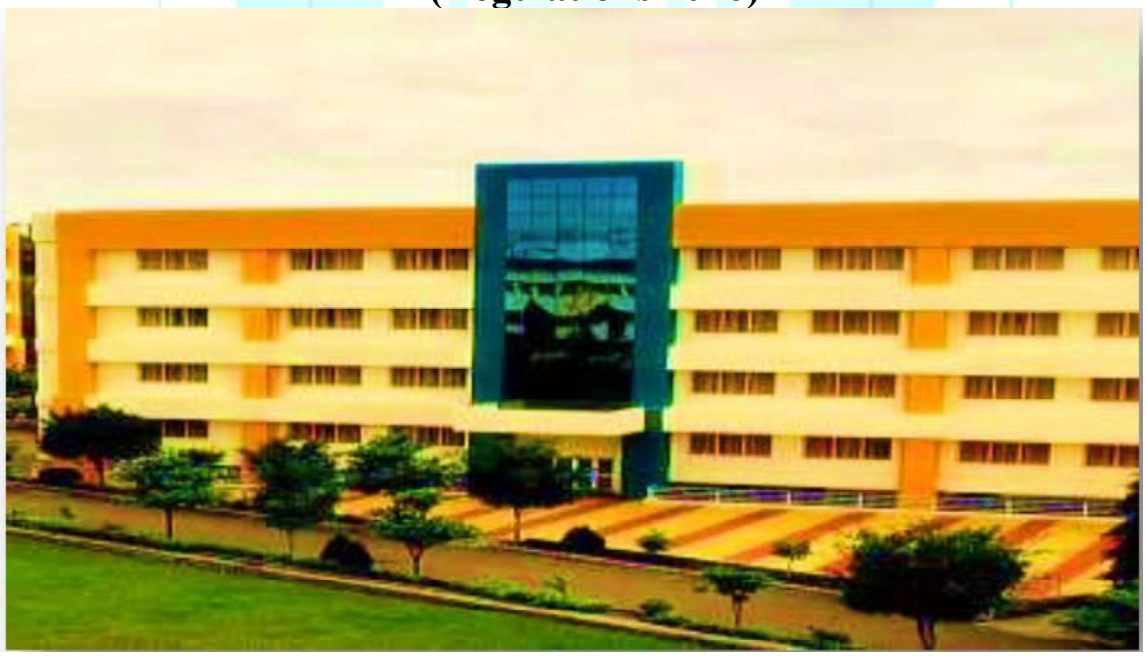
(An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune)

Proposed Curriculum Structure

of

B. Tech. Electronics Engineering (VLSI Design and Technology)

(Regulations 2026)



Effective from Academic Year 2026-27

Overall Credit Structure

Sr. No.		Type of Course		Credits/ Semester								Total
Sr No.		Course Type	Course Components	I	II	III	IV	V	VI	VII	VIII	Credits
1	Science Courses (26)	Basic Science Course (BSC)	BSC	**7**	**7**	**-**	**-**	**-**	**-**	**-**	**-**	**14**
2		Engineering Science Course (ESC)	ESC	**7**	**5**	**-**	**-**	**-**	**-**	**-**	**-**	**12**
3	Program Courses (66)	Programme Core Course (PCC)	PCC	**-**	**2**	**14**	**9**	**13**	**7**	**6**	**-**	**51**
4		Programme Elective Course (PEC)	PEC	**-**	**-**	**-**	**-**	**3**	**6**	**6**	**-**	**15**
5	Multidisciplinary Courses (22)	Multidisciplinary Minor (MDM)	MDM	**-**	**-**	**2**	**2**	**4**	**2**	**4**	**-**	**14**
6		Open Elective Course (OEC)	OEC	**-**	**-**	**2**	**2**	**-**		**2**	**-**	**6**
7	Skill Courses (8)	Vocational and Skill Enhancement Course (VSEC)	VSEC		**2**	**2**	**2**	**-**	**2**	**-**	**-**	**8**
8	Humanities Social Science and Management (14)	Ability Enhancement Course (AEC)	AEC	**1**	**1**	**-**	**2**	**-**	**-**	**-**	**-**	**4**
9		Entrepreneurship/ Economics/ Management Course	HSMC	**-**	**-**			**-**	**2**	**2**	**-**	**4**
10		Indian Knowledge System (IKS)	IKS	**2**	**-**	**-**		**-**	**-**	**-**	**-**	**2**
11		Value Education Course (VEC)	VEC	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**4**
12	Experiential Learning Courses (22)	Research Methodology (RM)	RM	**-**	**-**	**-**	**-**	**-**	**-**		**4**	**4**
13		Community Engineering Project (CEP) /Field Project	CEP/FP	**-**	**-**		**2**	**-**	**-**	-	**-**	**2**
14		Project (PRJ)	PRJ	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**4**	**4**
15		Internship (OJT)	OJT	**-**	**-**	**-**	-	**-**	**-**	**-**	**12**	**12**
16	Liberal Learning Courses (4)	Co-curricular Courses (CC)	CC	**1**	**1**	**-**	**1**	**-**	**1**	**-**	**-**	**4**
			Total	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**160**

CURRICULUM STRUCTURE

First Year B. Tech. E &C (VLSI Design and Technology) Engineering Semester – I

			Credit Scheme				Teaching Scheme(Hours/Week)				Evaluation Scheme and Marks						
Course Code	**Course Type**	**Course Name**	**L**	**P**	**T**	**Total**	**L**	**P**	**T**	**O**	**FA 1**	**FA 2**	**SA**	**TW**	**PR**	**OR**	**Total**
BSH31BS01	BSC	Linear Algebra & Univariate Calculus	2	-	-	2	2	-	-	-	10	10	30	-	-	-	50
BSH31BS02	BSC	Linear Algebra & Univariate Calculus Laboratory	-	1	-	1	-	2	-	-	-	-	-	25	25	-	50
BSH31BS03	BSC	Engineering Chemistry	3	-	-	3	3	-	-	-	20	20	60	-	-	-	100
BSH31BS04	BSC	Engineering Chemistry Laboratory	-	1	-	1	-	2	-	-	-	-	-	25	25	-	50
BET31ES01	ESC	Fundamentals of Electrical Engineering	3	1	-	4	3	2	-	1	20	20	60	25	-	-	125
BET31ES02	ESC	Programming for Problem Solving	2	1	-	3	2	2	-	1	10	10	30	25	-	-	75
BSH31AE01	AEC-I	(Eng/Ger/Jap/Business story telling)	-	1	-	1		2	-	-	25	25	-	-	-	-	50
BHS31VE01	VEC	Universal Human Values	2	-	-	2	2	-	-	-	25	25	-	-	-	-	50
BSH31IKS01	IKS	Indian Knowledge system	2	-	-	2	2	-	-	-	25	25	-	-	-	-	50
BSH31CC01	LLC	Life Skill 1	-	1	-	1	-	2	-	-	-	-	-	50	-	-	50
		Total	**14**	**6**	**0**	**20**	**14**	**12**	**0**	**2**	**135**	**135**	**180**	**150**	**50**	**0**	**650**

***L**-Lecture, **P**-Practical, **T**-Tutorial, O- Self Learning, **FA**–Formative Assessment , **SA**-Summative Assessment, **TW**-Term Work, **OR**-Oral, **PR**-Practical*

CURRICULUM STRUCTURE

First Year B. Tech. E &C(VLSI Design and Technology) Engineering Semester – II

			Credit Scheme				Teaching Scheme				Evaluation Scheme and Marks						
Course Code	**Course Type**	**Course Name**	**L**	**P**	**T**	**Total**	**L**	**P**	**T**	**O**	**FA 1**	**FA 2**	**SA**	**TW**	**PR**	**OR**	**Total**
BSH32BS07	BSC	Multivariate Calculus	2	-	-	2	2	-	-	-	10	10	30	-	-	-	50
BSH32BS08	BSC	Multivariate Calculus Laboratory	-	1	-	1	-	2	-	-	-	-	-	25	25	-	50
BSH32BS05	BSC	Engineering Physics	3	-	-	3	3	-	-	-	20	20	60	-	-	-	100
BSH32BS06	BSC	Engineering Physics Laboratory	-	1	-	1	-	2	-	-	-	-	-	25	25	-	50
BET32ES01	ESC	Electronic Devices	2	1	-	3	2	2	-	1	10	10	30	25	-	-	75
BET32ES02	ESC	Python Programming	1	1	-	2	1	2	-	1	10	10	-	30	-	-	50
BET32PC01	PCC	Network Theory	2	-	-	2	2	-	-	1	10	10	30	-	-	-	50
BET32VS01	VSEC	Electronics Skill Lab.(DIY)	-	2	-	2	-	4	-	-	-	-	-	100	-	-	100
BSH32VC02	VEC	Constitution of India	2	-	-	2	2	-	-	-	25	25	-	-	-	-	50
BSH32AE01/02/03/04	AEC-II	(Eng/Ger/Jap/Business story telling)	-	1	-	1	1	2	-	-	10	10	30	-	-	-	50
BSH31CC02	LLC	Life Skill 2	-	1	-	1	-	2	-	-	-	-	-	50	-	-	50
		Total	**12**	**8**	**0**	**20**	**13**	**16**	**0**	**3**	**95**	**95**	**180**	**255**	**50**	**0**	**675**

***L**-Lecture, **P**-Practical, **T**-Tutorial, O- Self Learning, **FA**–Formative Assessment , **SA**-Summative Assessment, **TW**-Term Work, **OR**-Oral, **PR**-Practical*

Program:	B. Tech. (E & C Engineering)						Semester :I		
Course:	Fundamentals of Electrical Engineering						Code : BEC31ES01		
Credit	Teaching Scheme (Hrs./week)				Evaluation Scheme				
	Lecture	Practical	Tutorial	Other	FA		SA	TW	Total
					FA1	FA2			
4	3	2	-	1	20	20	60	25	125

Prior knowledge of Fundamentals knowledge of electrical components is essential.

Course Objectives:

This course aims at enabling the students to

1. Acquire skills to analyze and solve DC and AC electrical circuits using simplification techniques, theorems, and fundamental principles.
2. Understand magnetic circuits, inductance, and the operation of transformers and DC machines for performance evaluation.
3. Acquire foundational knowledge of electrical measurement principles and instrument operations for precise evaluation of DC and AC quantities.

Course Outcomes:

After learning the course, the students will be able to:

CO1: Solve DC electrical circuits using network simplification techniques and network theorems.

CO2: Analyze magnetic circuits and inductance parameters for engineering applications.

CO3: Compute electrical quantities in single-phase and three-phase AC circuits using fundamental principles.

CO4: Evaluate operation and performance of single-phase transformers and DC machines.

CO5: Apply the theoretical principles governing the operation and performance of electrical measuring instruments for AC and DC measurements.

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**DC Circuits** Basic circuit elements and sources, Ohm's law, Kirchhoff's laws, Series and parallel connections of circuit elements, Star-delta transformation, Mesh current analysis, Node voltage analysis. Theorems: Thevenin's theorem, maximum power transfer theorem, and superposition theorem. (Only independent sources)	9
2	**Magnetic Circuits** Introduction to magnetic circuit terms and definitions, Faraday's laws, Lenz's law , comparison between electric and magnetic circuits, magnetic circuit analysis, series and parallel magnetic circuits, self-inductance, mutual inductance, coefficient of mutual inductance, coefficient of coupling, and dot rule.	
3	**AC Circuits** Generation of alternating emf and associated terms, phasor representation, Analysis of RL and RC series and parallel circuits, power triangle, power factor, resonance in RLC series, and related numerical Generation of three-phase EMF, star connection, delta connection, relationship between line and phase quantities, and solution to three-phase balanced circuits.	9

4	**AC and DC Machines** **Single-Phase Transformers** Principle of operation, construction, types of transformers, EMF equation, leakage flux and leakage reactance, operation of transformer under no load and on load, phasor diagrams, equivalent circuit, losses and efficiency, regulation and all-day efficiency, autotransformer, Applications, AI in Transformers **DC Generator:** Principle of operation, construction, EMF equation **DC Motors:** Principle of operation, back EMF, torque equation, condition for maximum power developed. Types of DC motors, various characteristics, methods of speed control, and the necessity of starters. Applications, AI in DC Machines,	**9**
5	**Electrical Measuring Instruments** DC PMMC instruments, shunts, multipliers, multimeters, moving-iron ammeters and voltmeters, dynamometers, wattmeters, AC watthour meters, extension of instrument ranges, measurement of active and reactive power in a three-phase balanced load by using one wattmeter and two wattmeter methods, and the effect of power factor on wattmeter readings. AI in Measuring Instruments: Standard specifications of single- and three-phase energy meters.	**9**
Total		**45**

Text Books:

1. B. L. Theraja, Electrical Technology, Vol. – I & II, S. Chand & Co.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering," Tata McGraw Hill, 4th Edition, 2019.

Reference Books

1. E. Fitzgerald, Electric Machinery, TMH Publications.
2. M. G. Say, Alternating Current Machines, CBS Publishers.
3. Nagrath and Kothari, Electrical Machines, TMH Publications.
4. P. S. Bhimbra, Electrical Machinery, Dhanpatrai Publishers.
5. D. C. Kulshreshtha, “Basic Electrical Engineering," McGraw Hill, 2nd Edition, 2019.
6. E. Hughes, “Electrical and Electronics Technology”, Pearson, 10th Edition, 2010.
7. Vincent Del Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 2nd Edition, 2015.
8. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2nd Edition, 2003.

E-resources:

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/122106025
3. https://onlinecourses.nptel.ac.in/noc21_ee55/preview

List of Experiments

1.To study and get familiarised with the lab facilities, equipment,, standard operating procedures and lab safety
Know your electrical lab
Safety guidelines and procedures for lab work
proper usage of hand tools and a test equipment

Basic DC Electrical Circuit experiments (Any 2)

2.Verification of Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL)
3.Verification of Superposition Theorem
4.Verification of Thevenin's Theorem
5.Verification of Maximum Power Transfer Theorem

Single and three phase AC circuits (Any 3)

6.Measurement of Power in a Single-Phase AC Circuit
7.To verify the relation between phase and line quantities in three phase balanced star and Delta connected load
8.Open Circuit/ Short Circuit Test on Single-Phase Transformer
9.Determination of Efficiency and Regulation of Transformer by Direct loading test .
10.Study of Auto -Transformer
11.To determine the resonance frequency circuit in a series RLC circuit.(Simulation Base)

DC Machines (Any 2)

12.Speed Control of DC Shunt Motor
13.Study of Starter for DC Motor (3-point / 4-point starter)
14.Study of different parts of DC Machine

Power and Energy Measurements (Any 2)

15.Measurement of Power Using the Two Wattmeter Method
16.Measurement of Power Using the One Wattmeter Method
17.Study of Single-Phase Energy Meter
18.Study of Energy Consumption of Electrical Appliances (verification of electricity bill)
19.Case Study on Energy Saving Techniques

Program:	B. Tech. (E &C Engineering)						Semester :I		
Course:	Programming for Problem Solving						Code : BEC31ES02		
Credit	Teaching Scheme (Hrs./week)				Evaluation Scheme				
	Lecture	Practical	Tutorial	Other	FA		SA	TW	Total
					FA1	FA2			
3	2	2	-	1	10	10	30	25	75

Prior knowledge of Basic knowledge of computers and logical thinking.

Course Objectives:

This course aims at enabling the students to

- To understand the fundamentals of C programming and apply structured problem-solving techniques to design and implement solutions.
- To apply and analyze problem-solving techniques using arrays, searching, and sorting algorithms.
- To apply modular programming concepts using functions, recursion, and pointers for solving computational problems.
- To provide knowledge of structures and file handling for developing simple real-world applications.

Course Outcomes:

After learning the course, the students will be able to:

CO1: Apply conditional statements and loops to solve basic programming problems.

CO2: Analyze and implement searching, and sorting algorithms, and evaluate their performance.

CO3: Implement modular programs using functions, recursion, and pointers.

CO4: Use structures and file handling concepts to build simple applications.

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Introduction to Programming & Problem Solving** **Problem-solving approach:** Algorithms, flowcharts, pseudocode **Basics of C:** Structure of a program, compilation process Data types, variables, constants, operators Input/Output functions Conditional statements (if, switch) Loops (for, while, do-while) **Debugging:** syntax and logical errors ***Enhancement:*** Add simple real-life problems and coding practice.	7
2	**Arrays, Strings & Algorithm Analysis** 1-D and 2-D arrays Strings and character arrays Searching: Linear and Binary Search Sorting: Bubble, Insertion, Selection Introduction to time complexity (basic idea only). *Enhancement:* Implement & Compare sorting algorithms using time/space complexity.	8
3	**Functions, Recursion & Pointers** **Functions:** declaration, definition, types Parameter passing (call by value/reference) **Recursion:** factorial, Fibonacci	8

	Pointers: basics, pointer arithmetic Relationship between arrays and pointers Introduction to dynamic memory allocation (basic idea) **Enhancement:** Problem-solving using divide-and-conquer approach.	
4	**Structures, File Handling & Applications** **structures in C**, Nested structures Introduction to basic data structures (concept only), Array of structures, Pointer to structure, Structures vs Unions, Dynamic memory allocation with structures, File handling: read/write operations Mini-application development (student record, simple database, etc.)	**7**
Total		**30**

Text Books:

1. E Balgurusamy, "Programming in ANSI C", Tata McGraw-Hill, Eighth Edition,2019.
2. Yashavant Kanetkar, "Data Structures Through C: Learn the fundamentals of Data Structures through C", BPB Publication, Third Edition, 2019.
3. R.S. Salaria, AICTE‟s Prescribed Textbook: "Programming for Problem Solving", Khanna Book Publishing Co.,2022

Reference Books

1. 1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Galgotia Books Source, 2nd Edition, 2008. 2. Reema Thareja,
2. "Data Structures using C", Second Edition, Oxford University Press, 2014
3. Herbert Schildt, "C: The Complete Reference", Tata McGraw-Hill, Fourth Edition, 2017.

E-resources: NPTEL Course Name Instructor Host Institute

1. Introduction to Programming in C Prof. Satyadev Nandakumar IITK https://onlinecourses.nptel.ac.in/noc25_cs119/preview
2. Problem Solving Through Programming in C Prof. Anupam Basu IIT KGP https://onlinecourses.nptel.ac.in/noc26_cs53/preview

List of Experiments

General Guidelines: All Experiments are to be performed.
Experiments from the following list need to be completed using Code Blocks /Turbo C / Online GDB.

1.Formulate algorithms, flowcharts, and pseudocode for solving simple real-life problems.
2.Use basic C constructs such as data types, operators, and input/output functions.
3.Apply decision-making statements like if, if-else, and switch in programs.
4.Apply looping constructs (for, while, do-while) to solve problems such as factorial and series.
5.Perform operations on one-dimensional and two-dimensional arrays.
6.Apply string handling operations in C programming.
7.Implement searching techniques such as Linear Search and Binary Search.
8.Implement sorting techniques such as Bubble Sort.
9.Apply functions and parameter passing techniques (call by value and call by reference).
10.Apply recursion for problems like factorial and Fibonacci series.
11.Demonstrate the use of pointers and structures.
12.Apply C programming concepts to complete a mini-project using arrays, functions, pointers, structures, and file handling.

Program:	B. Tech. (E &C Engineering)						Semester: II		
Course:	Electronic Devices						Code : BEC32ES01		
Credit	Teaching Scheme (Hrs./week)				Evaluation Scheme				
	Lecture	Practical	Tutorial	Other	FA		SA	TW	Total
					FA1	FA2			
3	2	2	-	1	10	10	30	25	100

Prior knowledge of the basics of Physics & Mathematics **is essential.**

Course Objectives:

This course aims at enabling the students to

1. Provide students with a strong foundation in the concepts, structure, and operation of semiconductor devices such as P–N junction diodes, BJTs, FETs, and MOSFETs.
2. Enable students to analyze the electrical characteristics, switching behavior, and performance parameters of semiconductor devices.
3. Develop students' ability to apply device knowledge in the design and analysis of basic electronic circuits including amplifiers, switches, and regulators.
4. Introduce students to CMOS technology, scaling challenges, and emerging semiconductor devices relevant to modern VLSI applications.

Course Outcomes:

After learning the course, the students will be able to:

CO1: Explain the construction, operation, and characteristics of semiconductor devices including diodes, BJTs, and FETs.

CO2: Analyze device behavior under different operating conditions including capacitance effects, switching characteristics, and breakdown mechanisms.

CO3: Apply semiconductor device concepts to analyze and design basic electronic circuits such as amplifiers and switching circuits.

CO4: Evaluate CMOS technology, power dissipation, scaling challenges, and emerging semiconductor devices for VLSI applications.

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**P-N Junction Diode:** Formation of P–N junction, Depletion region and barrier potential, V–I characteristics (forward & reverse bias), Diode current components, Temperature dependence, Static and dynamic resistance, Transition and diffusion capacitance, Switching characteristics and reverse recovery time, Breakdown mechanisms (Zener & Avalanche) **Special Diodes:** Zener diode, Tunnel diode, Photodiode, LED	8
2	**Bipolar Junction Transistor (BJT):** Construction and operation of BJT (NPN & PNP), Current components and relationships, Configurations: CB, CE, CC, Input–output characteristics, Operating regions: Cutoff, Active, Saturation, Current gains (α, β), Transistor as an Inverter, amplifier, Ratings and limitations, thermal stability.	8
3	**Field Effect Transistors (FET & MOSFET):** JFET: construction, working, pinch-off voltage, FET parameters (gm, rd), MOSFET: enhancement & depletion type, Threshold voltage, MOSFET I–V characteristics, Biasing techniques, MOSFET amplifiers (CS, CD), BiCMOS Technology.	7
4	**CMOS Technology and Emerging Semiconductor Devices:** MOS capacitor fundamentals, CMOS inverter operation, voltage transfer characteristics, CMOS logic	7

	basics, static and dynamic power dissipation, switching characteristics and propagation delay, MOSFET scaling principles, short channel effects, MOSFET limitations, FinFET structure and operation, SOI devices, overview of modern VLSI and nanoelectronic applications.	
	Total	**30**

Text Books:

1. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory" 11th Edition, Pearson Education, 2013
2. Thomas L. Floyd, "Electronic Devices", 10th Edition, Pearson Education, 2017
3. Adel S. Sedra, Kenneth C. Smith, Microelectronic Circuits" 7th Edition, Oxford University Press, 2014

Reference Books

1. Ben G. Streetman, Sanjay Banerjee, "Solid State Electronic Devices" 7th Edition, Pearson Education, 2015
2. Donald A. Neamen, "Semiconductor Physics and Devices" 4th Edition, McGraw Hill Education, 2012
3. Behzad Razavi, "Fundamentals of Microelectronics" 2nd Edition, Wiley, 2014
4. S. M. Sze, Kwok K. Ng, "Physics of Semiconductor Devices" 3rd Edition, Wiley-Interscience, 2007
5. R. Jacob Baker, "CMOS: Circuit Design, Layout, and Simulation" 4th Edition, Wiley-IEEE Press, 2019
6. Yuan Taur, Tak H. Ning, **"**Fundamentals of Modern VLSI Devices" 3rd Edition, Cambridge University Press, 2021

E-resources:

1. **NPTEL Course: Introduction to Semiconductor Devices**
   Instructor: Prof. Naresh Kumar Emani, IIT Hyderabad
   Platform: NPTEL
   Link: https://nptel.ac.in/courses/108106181
2. **NPTEL Course: Electronic Devices & Circuits**
   Instructor: Dr. Malaya Kumar Nath, NIT Puducherry
   Link: https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr26_ed101
3. **NPTEL Course: Semiconductor Devices for Next Generation Field Effect Transistors (More than Moore): A Physics Perspective**
   Instructor: By Prof. Sudeb Dasgupta, IIT Roorkee
   Link: https://onlinecourses.nptel.ac.in/noc26_ee86/preview

List of Experiments (Any 8)

1. PN junction diode V–I characteristics
2. Zener diode characteristics
3. LED and Photodiode Characteristics
4. BJT characteristics (CE configuration)
5. BJT switching characteristics
6. BJT Biasing Circuit
7. JFET characteristics
8. MOSFET characteristics
9. MOSFET CS amplifier and its frequency response
10. CMOS inverter characteristics
11. MOS Capacitor C–V Characteristics
12. Simulation Study of FinFET Structure and Characteristics
13. Mini Project

Program:	B. Tech. (E &C Engineering)						Semester :II	
Course:	Python Programming						Code :BEC32ES02	
Credit	Teaching Scheme (2 Hrs./week)				Evaluation Scheme			
	Lecture	Practical	Tutorial	Other	FA		TW	Total
					FA1	FA2		
2	1	2	-	1	10	10	30	50

Prior knowledge of basic mathematical aptitude (arithmetic, algebra, and basic logic) and familiarity with the concept of algorithms and flowcharts

Course Objectives:

This course aims at enabling the students to

1. Be acquainted with the fundamental concepts of Python programming, including data types, operators, and input/output operations.
2. Understand control structures and their role in logical problem solving.
3. Gain knowledge of data structures and functions for organizing and structuring programs.
4. Be familiar with file handling concepts and the use of standard Python libraries for basic applications.

Course Outcomes:

After learning the course, the students will be able to:

CO1: Understand fundamental Python programming concepts, including data types, variables, operators, and input/output, to develop simple programs and debug errors.

CO2: Apply control structures and basic data structures (strings, lists, tuples, dictionaries) to solve computational problems using logical and algorithmic approaches.

CO3: Analyze modular programs using functions (including recursion) and basic object-oriented concepts for structured problem solving.

CO4: Apply file handling techniques and standard Python libraries to process data and develop simple real-world applications.

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Introduction to Python, Control Structures and Data Structures:** Basics of Python programming; variables, assignments, dynamic typing; data types; mutable and immutable data types; arithmetic operators and expressions; type conversion; input/output operations; comments and code readability; Syntax and runtime errors.**Control Structures:** Boolean logic and logical operators; conditional statements; loops; use of `range()`; loop control statements; **Basic Data Structures:** Strings; Lists; Tuples; Dictionaries.	**7**
2	**Functions and Introduction to OOP, File Handling,Libraries** **Functions and program design:** function definition and calling; arguments; formal vs actual parameters; return values; recursive functions. **Introduction to OOP:** basics of classes and objects; attributes and methods; constructor (`__init__`).**File handling:** file operations (open, close); reading and writing text files; handling numerical data in files; CSV/tab-separated file handling;	**8**

	basic file-based data processing.Working with directories and file paths.,Basic introduction to data handling libraries (NumPy concept).	
Total		**15**

Text Books:

1. Reema Thareja, "Python Programming Using Problem Solving Approach", Second edition, Oxford University Press, 2019.
2. Ashok N. Kamthane and Amit Ashok Kamthane, "Programming and Problem Solving with Python", Second edition, McGraw Hill Education (India) Pvt. Ltd., 2022.
3. Jeeva Jose and P. Sojan Lal, "Introduction to Computing and Problem Solving with Python", Khanna Book Publication, 2019.

Reference Books

1. R. Nageswara Rao, "Core Python Programming", Third edition, Dreamtech Press, 2022.
2. Paul Barry, "Head First Python: A Brain-Friendly Guide", Second edition, Shroff Publishers, 2019.
3. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Third edition, Shroff Publishers, 2025.

E-resources:

1. **NPTEL — Programming in Python (IIT Madras):** https://nptel.ac.in/courses/106106145 — Free, government-certified course by IIT Madras faculty, directly aligned with Indian engineering syllabi, includes assignments and a certificate exam.
2. **MIT OpenCourseWare — Introduction to CS using Python:** https://ocw.mit.edu/courses/6-0001-introduction-to-computer-science-and-programming-in-python-fall-2016 — Lecture notes, problem sets, and exams from MIT's own first-year course, free of charge.
3. **Coursera — Python for Everybody (University of Michigan):** https://www.coursera.org/specializations/python — Beginner-friendly, audit for free, covers Units 1–5 topics in a structured week-by-week format with graded assignments.

List of Experiments

1.Perform arithmetic operations and formatted input/output using sequential constructs.
2.Identify, analyze, and correct syntax and runtime errors in Python programs.
3.Develop solutions using selection constructs (if-else, elif) for decision-making problems.
4.Apply iterative constructs (for, while) to solve problems such as factorial and Fibonacci series.
5.Implement nested loops to generate numbers and star patterns.
6.Perform string manipulation operations including indexing, slicing, and number system conversions.
7.Create and manipulate lists, tuples, and dictionaries for data handling.
8.Apply functions (including recursion) for modular problem solving.
9.Perform file input/output operations including reading, writing, and appending data.
10.Process structured data from CSV or tab-separated files.
11.Utilize OS, SYS, and standard libraries (math, random) for basic applications.
12.Mini Project – Python-Based Application Development.

Program:	B. Tech. (E &Tc Engineering)						Semester:II	
Course:	Network Theory						Code : BEC32PC01	
Credit	Teaching Scheme (Hrs./week)				Evaluation Scheme			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-		10	10	30	50

Prior knowledge of Fundamentals of Electrical Engineering is essential

Course Objectives:

This course aims at enabling the students to

1. To introduce the fundamentals of network simplification techniques and network theorems for linear circuits.
2. To introduce the transient analysis of linear circuits like series RL, RC and RLC circuits using time domain analysis.
3. To make students familiarize about the two port network parameters and network functions.

Course Outcomes:

After learning the course, the students will be able to:

CO1: Analyze the DC & AC linear circuits for current, voltage or power using basic circuit simplification techniques

CO2: Analyze the DC & AC linear circuits for current, voltage or power using Network Theorems.

CO3: Analyze the responses of series RL, RC, RLC circuits using time domain method.

CO5: Determine the network parameters of two port networks and driving point, transfer functions for one port & two port networks.

Detailed Syllabus

Unit No.	Description	Duration (Hrs.)
1	**Basic circuit simplifaication Techniques** Introduction: Basic Laws, Independent and dependent sources, their interconnection and power calculations. Network analysis: Mesh, Super-mesh, Node and Super-node analysis, Source transformation and source Shifting. For AC and DC sources	7
2	Network Theorems Superposition Theorem, Thevenin's & Norton's Theorem, Maximum Power Transfer Theorem, Miller's Theorem, (for AC and DC circuits for independent and dependent sources)	8
3	**Transient Analysis of RL, RC and RLC circuits** Initial conditions, Analysis of source free and source driven series RL & RC circuits for DC voltage source. Introduction to source free and source driven series RLC circuits for DC voltage source. Overdamped, Under damped and critical damped series RLC circuit.	8

4	**Network parameters and network functions** Terminal characteristics of network: Z, Y, h, ABCD Parameters; Reciprocity and Symmetry conditions, Applications of the parameters. Network functions for the one port and two port networks: Driving point and transfer functions, Poles and Zeros of Network functions, necessary conditions for stability and realizability of driving point & transfer functions, Time domain behavior from Pole-Zero plot and Stability of network.	**7**
Total		**30**

Text Books:

1. Network Analysis, M.E. Van Valkenburg, PHI, 3rd edition, 2015.
2. Network Analysis and synthesis, Ravish Singh, Second edition, 2019

Reference Books

1. A. Chakrabarti – Circuit Theory (Analysis and Synthesis) – Dhanpat Rai Publications – 7th Edition (latest reprint)
2. V. K. Mehta, Rohit Mehta – Principles of Electrical Engineering and Electronics – S. Chand – Latest Edition
3. P. S. Bimbhra – Electrical Circuit Analysis – Khanna Publishers – Latest Edition
4. S. A. Nasar – Electric Circuits – Schaum's Outline / McGraw Hill – Latest Edition
5. Allan H. Robbins, Wilhelm C. Miller – Circuit Analysis: Theory and Practice – Cengage Learning – Latest Edition
6. Engineering Circuit Analysis, William H. Hayt, Jack Kemmerly, Steven M. Durbin, Tata McGraw-Hill ,8thEdition, 2013.

E-resources:

https://asnm-iitkgp.vlabs.ac.in/exp/verification-millman-theorem/
https://asnm-iitkgp.vlabs.ac.in/exp/rlc-circuit-analysis/
certified online courses from NPTEL/SWAYAM

Program :	B. Tech. (E &C Engineering)						Semester: II	
Course:	Electronics Skill Lab (DIY)						Code: BEC32VS01	
Credit	Teaching Scheme (Hrs./week)				Evaluation Scheme			
	Lecture	Practical	Tutorial	Other	TW	PR	OR	Total
2	-	4	-	-	100	-	-	100

Prior knowledge of

Basic knowledge of **physics (electricity), elementary mathematics, and computer fundamentals**. Is Essential

Course Objectives:

This course aims at enabling the students to

1. Enable students to **develop fundamental understanding of electronic components, devices, circuits, and measurement techniques** through structured hands-on experiments.
2. Train students in **circuit design, simulation, PCB development, and sensor interfacing** using modern tools and standard engineering practices.
3. Provide guided practical exposure in **hardware prototyping, soldering, testing, and debugging** of electronic systems.
4. Introduce and orient students towards **electronics product development, basic VLSI concepts, and real-world industrial practices** through experiential learning and industry interaction.

Course Outcomes:

After learning the course, the students will be able to:

CO1: Identify various electronics components with their specifications and measure them different laboratory instruments, component testers.

CO2: Work with printed circuit boards and the tools and design simple circuits using various sensors.

List of Experiments

Experiment No.	Description
Module 1 : Basic Electronics Fundamentals :Understand basic circuit elements and measurements (4 Hours)	
1	Identification and measurement of passive components (resistors, capacitors, inductors) using multimeter and verification of resistor color coding.
2	Verification of Ohm's Law by measuring voltage and current in a resistive circuit using a multimeter and plotting the V–I characteristics.
Module 2 : Electronic Instruments : Familiarization with lab instruments (6 Hours)	
3	Measurement of voltage, current, resistance, and signal parameters using Digital Multimeter (DMM), DVM, CRO/DSO, and frequency counter.
4	Generation and analysis of waveforms (sine, square, triangular) using function generator and observation using CRO/DSO.
5	Study and operation of regulated power supply along with assembling and disassembling a simple electronic gadget to understand internal components and working.
Module 3: Component Testing (4 Hours)	
6	Testing of passive and active components (resistors, capacitors, diodes, transistors) using multimeter

	and component tester for parameter verification.
7	Study and testing of ICs using IC tester to verify functionality and identify faulty ICs.
Module 4 : Datasheet Understanding : Develop ability to read and interpret datasheets(4 Hours)	
8	Study of electronic datasheets to understand structure, ratings, specifications, and electrical characteristics of components. Selection of appropriate electronic components based on datasheet specifications for given application requirements.
9	Analysis of datasheets of diode, transistor, and ICs (555 timer/op-amp) including pin configuration and operational parameters.
Module 5: Breadboard Prototyping: Hands-on circuit building (6 Hours)	
10	Study of breadboard structure and implementation of basic circuits (LED and voltage divider) with proper power supply connections.
11	Design and implementation of rectifier circuit on breadboard and analysis of output waveform.
12	Implementation of transistor as a switch on breadboard and troubleshooting of common circuit faults.
Module 6: EDA Tools & Simulation:Circuit design using software tools (6 Hours)	
13	Schematic capture and simulation of basic circuits; verification of Ohm's Law, KCL, and KVL
14	RC circuit transient analysis (charging and discharging characteristics)
15	Simulation of diode characteristics and rectifier circuits (half-wave and full-wave)
16	BJT common-emitter amplifier simulation and gain analysis
Module 7: Introduction to LSI to VLSI : Exposure to modern electronics design (4 Hours)	
17	Evolution: SSI , MSI , LSI , VLSI , Basic idea of IC fabrication , Packaging Standards.
18	Introduction to digital ICs and scaling ,Applications in modern electronics
Module 8: Working with different types of sensors and components: Introduction to real-world interfacing(6 Hours)	
19	Interfacing and characterization of basic sensors: temperature, moisture, gas, light, and IR sensors Distance and motion-based sensing systems using ultrasonic sensor, accelerometer, and smoke/fire detection sensors with relay control
20	Actuator and output system integration using DC motors, motor drivers, solar panel, LCD and LED display modules, and pH sensor-based monitoring system
Module 9: PCB Design Techniques: Learn PCB design workflow (08 Hours)	
21	Introduction to soldering and de-soldering techniques using basic electronic components
22	Identification and use of general-purpose PCBs and their layout planning , PCB artwork design for simple circuits using manual or software tools
23	PCB design and implementation of a basic electronic circuit
24	Drilling and preparation of PCB using PCB drillers and safety practices, Use of hand tools in electronics: wire stripping, crimping, cutting, and component mounting
25	Assembly and testing of a complete electronic circuit on fabricated PCB
26	**A Small Home Take Away Project (** as per list but not limited to)**
27	
Module 10: Experiential Learning + Industrial Exposure (8 Hours)	
28, 29, 30	A. Experiential Learning: Learning by doing and reflection Eg (not limited to) Automatic light control using LDR, Temperature monitoring system
	B. Industrial Visit / Expert Interaction: Exposure to real-world practices

	• Visit to: PCB manufacturing industry / EMS unit OR Electronics R&D lab / startup • Observation of: PCB fabrication process , Assembly line and testing , Quality control practices **OR (if visit not feasible):** Expert lecture from industry professional OR Virtual lab/industry tour. **Student Activity:** Visit report submission , Learning reflection
Total	**60**

Reference Books

1. Scherz, Paul and Monk, Simon, Practical Electronics for Inventors, 4th Edition, McGraw-Hill Education, 2016.
2. Platt, Charles, Make: Electronics – Learning by Discovery, 3rd Edition, O'Reilly Media, 2021.
3. Horowitz, Paul and Hill, Winfield, The Art of Electronics, 3rd Edition, Cambridge University Press, 2015.
4. Mitzner, Kraig, Complete PCB Design Using OrCAD Capture and PCB Editor, 2nd Edition, Newnes, 2009.
5. Weste, Neil H. E. and Harris, David Money, CMOS VLSI Design: A Circuits and Systems Perspective, 4th Edition, Pearson, 2011.

Online Resources

1. National Instruments Multisim tutorials
2. Texas Instruments application notes
3. Analog Devices design resources

** Small Home Take Away Project Ideas (Simple Sensor Based)

1. Automatic room light control using LDR (Light Sensor)
2. Temperature-based fan speed control using temperature sensor
3. Soil moisture-based automatic plant watering system
4. Gas leakage detection system using gas sensor with alarm
5. Smart dustbin with IR sensor for automatic lid opening
6. Water level indicator using ultrasonic sensor
7. Fire and smoke alarm system using smoke sensor
8. Simple obstacle detection robot using IR sensor and DC motor