TECHNO INDIA UNIVERSITY
WEST BENGAL

Department of Electronics and Communication Engineering

Third Semester

Program: BTech in Electronics and Communication Engineering	**Year, Semester: 2nd year, 3rdsem**
Course Title: CAREER ADVANCEMENT & SKILL DEVELOPMENT	**Subject Code:** TIU-UEN-S297
Contact Hours/Week: 2-0-0 (L-T-P)	**Credit:** 2

COURSE OBJECTIVE:

Enable the student to:

1. Acquire basic communication skills in French.
2. Develop listening, speaking, reading, and writing abilities at a beginner level.
3. Understand and use simple grammatical structures and everyday vocabulary.
4. Engage in basic conversations in French related to common situations.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	Recognize and use common French greetings and expressions.	K1
CO-2:	Memorize and repeat simple sentences using regular verbs and basic vocabulary.	K1
CO-3:	Understand and respond to basic questions about personal identity.	K2
CO-4:	Identify and explain short passages related to daily life.	K2
CO-5:	Construct short texts such as self-introductions and informal messages.	K3
CO-6:	Arrange isolated sentences and questions to engage in simple spoken exchanges in a variety of familiar contexts.	K4

COURSE CONTENT:

MODULE 1:	INTRODUCTION TO FRENCH LANGUAGE • The French alphabet and pronunciation • Greetings and introductions • Numbers and basic expressions of time	**6 Hours**
MODULE 2:	IDENTITY AND PERSONAL INFORMATION • Talking about oneself and others • Nationalities, professions, and family • Using "être" and "avoir" verbs	**6 Hours**
MODULE 3:	EVERYDAY INTERACTIONS • Asking for and giving personal details • Talking about preferences and habits • Introduction to regular -ER verbs	**6 Hours**
MODULE 4:	• Ordering at a café or restaurant • Asking for directions • Using "aller" and "faire" verbs	**6 Hours**
MODULE 5:	DESCRIBING DAILY LIFE • Talking about routines and leisure activities • Expressing likes and dislikes • Introduction to present tense conjugation	**6 Hours**
TOTAL LECTURES		**30 Hours**

Books:

Tech French - French for Science and Technology, Goyal Publishers, 2011

Program: B.Tech. Electronics and Communications Engineering	**Year, Semester:** 2nd Yr., 3rd Sem.
Course Title: Mathematics III	**Subject Code:** TIU-UMA-T201
Contact Hours/Week: 4–0–0 (L–T–P)	**Credit:** 4

COURSE OBJECTIVE:

Enable the student to:

1. be familiar with numerical methods of solving complicated mathematical problems
2. have an idea about different errors, interpolations and to solve initial value problems
3. study transformations such as Laplace, Fourier transform and their application on solving differential equations

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	develop a concrete knowledge about data, rounding off, significant figures and corresponding errors.	K2
CO-2:	analyze the data and calculate its explicit form via interpolation techniques.	K4
CO-3:	apply integration, differentiation numerically to approximate area under a curve and calculate gradients	K4
CO-4:	compose various numerical techniques to resolve algebraic and transcendental equations, system of equations, initial value problems.	K4
CO-5:	summarise Laplace Transform, Fourier Transform and have a knowledge of Fourier series.	K4
CO-6:	illustrate transform calculus techniques to resolve differential equations.	K4

COURSE CONTENT:

MODULE 1:	**Transform Calculus**	**18 Hours**
UNIT 1: Laplace Transform: Laplace Transform, properties, Inverse, Convolution, Evaluation of some particular integrals by Laplace Transform, Solution of initial value problems. UNIT 2: Fourier Series: Periodic functions, Fourier series representation of a function, half range series, sine and cosine series, Fourier integral formula, Parseval's identity. UNIT 3: Fourier Transform: Fourier Transform, Fourier sine and cosine transforms. Linearity, scaling, frequency shifting and time shifting properties. Self-reciprocity of Fourier Transform, convolution theorem. Applications to boundary value problems.		
MODULE 2:	**Numerical Methods**	**27 Hours**

UNIT 1: Approximations and round off errors, Truncation errors and Taylor Series. UNIT 2: Interpolation – Newton's Forward, Backward, Lagrange's interpolation methods UNIT 3: Numerical Integration – Trapezoidal, Simpson's 1/3rd rules. UNIT 4: Determination of roots of polynomials and transcendental equations by Bisection, Iteration, Newton-Raphson, Regula-Falsi methods. UNIT 5: Solutions of system of linear algebraic equations by Gauss Elimination and Gauss-Seidel iteration methods. UNIT 6: Numerical solution of initial value problems by Euler, Modified Euler, Runge-Kutta and Predictor-Corrector methods.	
TOTAL LECTURES	**45 Hours**

Books:

1. S. S. Sastry-An Introduction to Numerical Analysis.
2. Dutta and Jana- Numerical Analysis.
3. S. A. Mollah- Numerical Analysis and Computational Procedures
4. J. K. Goyal, K. P. Gupta, G. S. Gupta - Laplace's and Fourier Transforms
5. Sreenadh S. et. al. - Fourier series and Integral Transforms
6. A.N. Srivastava - Integral Transforms and Fourier Series

Program: B.Tech Electronics and Communication Engineering	**Year,Semester:**2nd Yr.,3rd Sem
Course Title: Environmental Science	**SubjectCode:**TIU-UMB-T201
Contact Hours/Week:2–0–0(L–T–P)	**Credit:**Theory–2

COURSE OBJECTIVE:

1. Understand the fundamentals of environmental pollution from chemical processes, including characterization of emissions and effluents, and relevant environmental regulations.
2. Apply pollution prevention strategies through process modification, resource recovery, and waste minimization techniques.
3. Analyze and design air and water pollution control systems, including particulate and gaseous emission control, and physical water treatment processes.
4. Evaluate and implement biological treatment methods for wastewater and appropriate solid waste disposal techniques.

COURSE OUTCOME:

The students will be able to:

CO-1:	Sources & types of pollution, industrial emissions & effluents, environmental laws & standards	K2
CO-2:	Pollution prevention, waste recovery & reuse, material & energy balance, water & emission control	K3
CO-3:	Selection & design of particulate and gaseous emission control systems, equipment performance analysis	K4
CO-4:	Wastewater treatment principles, solids removal processes (sedimentation, filtration, coagulation, etc.)	K4
CO-5:	Biological treatment principles, biochemical kinetics, aeration & sludge separation design	K4
CO-6:	Solid waste disposal methods, briquetting & gasification	K4

COURSE CONTENT:

MODULE 1:	**INTRODUCTION**	**10 Hours**
Environment and environmental pollution from chemical process industries, characterization of emission and effluents, environmental Laws and rules, standards for ambient air, noise emission and effluents.		
MODULE 2:	**POLLUTION PREVENTION**	**8 Hours**
Process modification, alternative raw material, recovery of by co-product from industrial emission effluents, recycle and reuse of waste, energy recovery and waste utilization. Material and energy balance for pollution minimization. Water use minimization, Fugitive emission/effluents and leakages and their control-housekeeping and maintenance.		
MODULE 3:	**AIR POLLUTION CONTROL**	**9 Hours**

Particulate emission control by mechanical separation and electrostatic precipitation, wet gas scrubbing, gaseous emission control by absorption and adsorption, Design of cyclones, ESP, fabric filters and absorbers		
MODULE 4:	**WATER POLLUTION CONTROL**	**9 Hours**
Physical treatment, pre-treatment, solids removal by setting and sedimentation, filtration centrifugation, coagulation and flocculation.		
MODULE 5:	**BIOLOGICAL TREATMENT**	**5 Hours**
Anaerobic and aerobic treatment biochemical kinetics, trickling filter, activated sludge and lagoons, aeration systems, sludge separation and drying.		
MODULE 6:	**SOLID DISPOSAL**	**4 Hours**
Solids waste disposal - composting, landfill, briquetting / gasification and incineration.		
	TOTAL LECTURES	**45 Hours**

Books:

1. A. K. De, "Environmental Chemistry", New Age
2. G. M. Masters, "Introduction to Environmental Engineering and Science", Pearson 3. G. S. Sodhi, "Fundamental Concepts of Environmental Chemistry", Narosa
3. E. Odum, M. Barrick& G. W. Barrett, "Fundamentals of Ecology", Brooks

Program: B. Tech. in ECE	**Year, Semester:** 2nd Yr., 3rd Sem.
Course Title: Semiconductor Devices	**Subject Code:** TIU-UEC-T209
Contact Hours/Week: 3–1–0 (L–T–P)	**Credit:** 4

COURSE OBJECTIVE:

Enable the student to:

1. Understand the principles of semiconductor Physics.
2. analyze the concept of carrier concentration of electrons and also idea of continuity equation and its mathematical representation
3. design and implement of working principle of different diodes, transistors and their application.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	Student should be able to **analyze** the behavior of Fermi Level Diagram and from FERMI DIRAC equation should be able predict the occupation of a energy state by electrons and holes. Student must be able to mathematically calculate carrier concentration. Student must be able to understand and frame continuity equation and also be able to solve mobility related problems	K4
CO-2:	Student should be able to mathematically derive diode forward and reverse current equation, solve numerical problems of simple diode circuits and **understand** characteristics of Zener diode.	K2
CO-3:	Student must be able to **design** basic semiconductor circuits and the difference between NPN and PNP transistor in terms of working, be able to draw input and output characteristics in different modes and also be able to solve simple Transistor circuits.	K2
CO-4:	Student must be able to **design** basic semiconductor circuits and the difference between NPN and PNP transistor in terms of working, be able to draw input and output characteristics in different modes and also be able to solve simple Transistor circuits.	K3
CO-5:	Student must be able to **express** the new semiconductor devices.	K1
CO-6:	**Apply** the semiconductor devices in advanced semiconductor materials and technologies.	K3

COURSE CONTENT:

MODULE 1:	**Energy Bands and Charge Carriers in Semiconductors**	**10 Hours**
Semiconductor fundamentals, crystal structure, Fermi level, Energy-band (E-k) diagram, effective mass, intrinsic and extrinsic semiconductor, carrier concentration, scattering and drift of electrons and holes, drift current, diffusion mechanism, transient response, basic governing equations in semiconductor.		
MODULE 2:	**Rectifier and detector diodes**	**12 Hours**
Physical description of p-n junction, transport equations, current voltage characteristics and temperature dependence, Junction Capacitance, small signal ac analysis, Diode switching, Optical devices & Solar cells, Zener diode, Tunnel diode, photoconductors, PIN photodiode, avalanche photodiode, LED, semiconductor lasers, negative conductance in semiconductors.		
MODULE 3:	**Bipolar Junction Transistors**	**8 Hours**
Physical mechanism, current gain, Equivalent circuits and modeling frequency response of transistors, High voltage and high-power transistors, Frequency limitations, High frequency transistors, Power transistors		
MODULE 4:	**Field Effect Transistors**	**12 Hours**

JFETS and its characteristics, Equivalent Circuit, IGFETS and MOSFETs, MOS structure, flat-band threshold voltages, MOS static characteristics, small signal parameters and equivalent circuit, MOS-capacitors, strong, moderate and weak inversion, short channel effects, Gate protection of MOSFET, MOS capacitance, scaling laws of MOS transistors, P and N-channel MOSFETS, CMOS and VLSI MOSFETS, BiCMOS devices, Semiconductor sensors and detectors	
TOTAL LECTURES	**42Hours**

Books:

1. J. Millman, C. C. Halkias and C. Parikh, "Integrated Electronics", McGraw Hill
2. D. A. Neamen and D. Biswas, "Semiconductor Physics & Devices", Tata McGraw Hill
3. B. G. Streetman and S. Banerjee, "Solid State Electronic Devices", Pearson, 7th edition, 2017
4. S. M. Sze, "Physics of Semiconductor Devices", John Wiley
5. J. Millman and A. Grabel, "Microelectronics", McGraw Hill
6. C.T. Sah, " Fundamentals of solid state electronics," World Scientific Publishing Co. Inc, 1991
7. Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ.Press, 2011.
8. A. K. Maini, "All-in-One Electronic Simplified", Khanna Publishing House

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Program: B. Tech. in ECE	**Year, Semester:** 2nd Yr., 3rd Sem.
Course Title: Network Theory	**Subject Code:**TIU-UEC-T203
Contact Hours/Week: 3–1–0 (L–T–P)	**Credit:** 4

COURSE OBJECTIVE:

Enable the student to:

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Analyse electrical network theorems.
3. Apply Laplace Transform for steady state and transient analysis.
4. Understand different network functions.
5. Understand the frequency domain techniques.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	Understand basic terms and network techniques, like node analysis and loop analysis, and apply them to write equations for different circuit networks.	K2
CO-2:	Apply Thevenin and Norton theorems to analyze and design for maximum power transfer. Understand the concepts of Fourier and Laplace transforms.	K3, K4

CO-3:	Analyze circuits using graph theory.	K1,K4
CO-4:	Analyze transient response of first and second order circuits.	K4
CO-5:	Analyzeparameters of two port networks.	K1, K4
CO-6:	Understand the concepts of poles, zeroes and transfer function(laplace transform)	K2

COURSE CONTENT:

MODULE 1:	**Network Solution Methodology & components:**	**8 Hours**
Passive and active components, Series and Parallel Connection of Circuit Elements, Mesh Analysis, Nodal Analysis, Voltage and Current Source, Dependent Sources, Power and Energy, Network Theorems, physical phenomenon and circuit interpretation of network using appropriate models.		
MODULE 2:	**Signals:**	**13 Hours**
Significance of eigen function, Fourier transform and Laplace transform of Standard Functions, Transient and steady state response of RC, RL and RLC circuits using Laplace transform. Network equations and solutions using Laplace transform initial conditions. Degenerate networks.		
MODULE 3:	**Graph theory & Coupled Circuits:**	**6 Hours**
Basic definitions loop (or tie set), cut-set, mesh matrices and their relationships, applications of graph theory in solving network equations, Magnetic coupling, concept of Self and mutual inductance, Coefficient of coupling, Solution of Problems.		
MODULE 4:	**Two-port networks:**	**12 Hours**
Two-port networks: Network parameters (z parameters, y parameters, h parameters, ABCD matrix, transmission matrix), Inter-Connection of Two Port Networks, reciprocity theorem, image parameter concepts, balanced/unbalanced transmission lines, lumped-parameter model, characteristic impedance, propagation aspects.		
MODULE 5:	**Network functions & Elements of network synthesis:**	**8 Hours**
Driving point function, transfer function, concepts of poles and zeros. Impulse response and convolution, basic concepts of insertion-loss synthesis, Approximation functions for filters - Design of Butterworth and Chebyshev filters.		
TOTAL LECTURES		**47 Hours**

TEXT BOOKS:

1. P. Ramesh Babu, "Electric Circuit Analysis", ScitechB.Ram, "Fundamentals of Microprocessors and Microcontrollers" ,Dhanpat Rai Publication.
2. A. Hussain, "Networks and Systems", Khanna Publishing House.
3. A. Sudhakar and S. P. Shyammohan, "Circuits and Networks", Tata McGraw Hill

REFERENCE BOOKS:

1. M. A. Van Valkenburg, "Network Analysis", Prentice Hall
2. D. Roy Choudhury, "Networks & Systems", New Age

3. D. Chattopadhyay and P. C. Rakshit, “Fundamentals of Electric Circuit Theory”, S. Chand
4. S. M. Durbin, J. E. Kemmerly & W. H. Hayt, “Engineering Circuit Analysis”, McGraw Hill
5. C. K. Alexander and M. N. O. Sadiku, “Fundamentals of Electric Circuits”, McGraw Hill
6. F. F. Kuo, “Network Analysis and Synthesis”, Wiley
7. J. Edminister and M. Nahmi, “Schaum's Outlines in Electric Circuits”, McGraw Hill

Program: B.Tech. Electronics and Communications Engineering	**Year, Semester:** 2nd Yr., 3rd Sem.
Course Title: Data Structures and Algorithms	**Subject Code:**TIU-UCS-T201
Contact Hours/Week: L-T-P: 3-0-0	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Understand fundamental data structures, their representation, and algorithm design principles.
2. Implement arrays, stacks, queues, linked lists, and trees for problem-solving.
3. Analyze and apply searching, sorting, and graph traversal algorithms for efficiency.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	Understand basic data types, abstract data types, and primitive data structures for representing and manipulating data efficiently.
CO-2:	Apply algorithm design techniques and analyze the time and space complexity of various algorithms for solving problems.
CO-3:	Perform operations on arrays, including matrix manipulation and sparse polynomial representation, using both row and column-major orderings.
CO-4:	Implement stacks and queues using arrays and linked lists, and apply these structures in expression evaluation and queue operations
CO-5:	Construct and manipulate linked lists, including singly, doubly, and circular lists, and implement polynomial representation using linked structures.
CO-6:	Analyze and apply tree traversal techniques, search algorithms, and sorting techniques while considering time complexity in different scenarios.

COURSE CONTENT:

MODULE 1:	**Data Representation and Algorithm Design**	**8 Hours**

Abstract and derived data types, primitive structures. Algorithm definition, top-down/bottom-up design. Algorithm analysis, time/space complexity.		
MODULE 2:	**Arrays and Their Applications**	**13 Hours**
Array representation: single, multidimensional, row/column-major. Operations on arrays, matrix multiplication, sparse polynomial representation and addition.		
MODULE 3:	**Stacks, Queues, and Their Applications**	**6 Hours**
Stack and queue representation using arrays, linked-lists. Circular queues, priority queues, D-queues. Applications: infix-to-postfix/prefix conversion, postfix evaluation.		
MODULE 4:	**Linked Lists and Trees**	**12 Hours**
Singly, doubly, circular linked lists, generalized lists. Linked stacks/queues, polynomial representation. Binary tree traversal methods (preorder, inorder, postorder), forest-to-tree conversion, AVL, B-trees, B+ trees.		
MODULE 5:	**Searching, Sorting, and Graphs**	**8 Hours**
Sequential/binary searches, indexed search, hashing. Sorting techniques: insertion, selection, bubble, quick, merge, radix, shell, heap. Graphs: adjacency matrix/lists, DFS, BFS.		
TOTAL LECTURES		**47 Hours**

Recommended Books:

1. Horowitch and Sahani, Data Structure using C,

2. Lipshutz, Data Structures with C, Mc-Graw Hill.

Supplementary Reading:

1. Robert Lafore, Data Structures And Algorithms In Java, Sams.

2. A.M. Tennenbaum, Y. Langsam And M. J. Augenstein, Data Structures Using C, PHI, 1996.

3. D. E. Knuth, The Art Of Computer Programming-Vol-I & Vol-II, Narosa Publication.

4. S. Chottopadhyay, D. Ghoshdastider& M. Chottopadhyay, Data Structures Though C Language, First Edition, 2001, BPB Publication.

Department of Electronics &Communication Engineering

Program: B.Tech. in ECE	**Year, Semester:** 2nd, 3rd
Course Title: Semiconductor Device Laboratory	**Subject Code:** TIU-UEC-L209
Contact Hours/Week: 0–0–3	**Credit:** 1.5

COURSE OBJECTIVE:

Enable the student to:

1. To understand and analyze the working principles of half-wave and full-wave rectifiers, focusing

on their conversion efficiency and output waveforms.

2. To study and interpret the V-I characteristics of LEDs and gain insights into their behavior and applications in electronic circuits.
3. To analyze the input and output characteristics of Bipolar Junction Transistors (BJT) to understand their operation in various regions.
4. To explore the characteristics of Junction Field Effect Transistors (JFET) and understand their use in amplifying and switching applications.
5. To examine the characteristics of solar cells and understand their working principles for energy conversion.
6. To study the V-I characteristics of photodiodes and understand their applications in detecting light in various conditions.

COURSE OUTCOME:

On completion of the course, the student will be able:

CO-1	Understand and analyze the working and performance of a half-wave rectifier and its application in converting AC to DC.	K3
CO-2	Analyze the operation of a full-wave rectifier and evaluate its efficiency and ripple factor compared to a half-wave rectifier.	K3
CO-3	Investigate and interpret the V-I characteristics of an LED, understanding its behavior under different current and voltage conditions.	K4
CO-4	Study and evaluate the input and output characteristics of a BJT, understanding its use as a switch or amplifier in circuits.	K3
CO-5	Examine the characteristics of a JFET and comprehend its working principles as a voltage-controlled device.	K4
CO-6	Analyze the V-I characteristics of a solar cell and a photodiode, gaining insights into their application in renewable energy and light-sensing systems.	K3

COURSE CONTENT:

MODULE 1:	Half-Wave Rectifier	**9 Hours**
Study the operation, waveform analysis, and efficiency of a half-wave rectifier circuit.		
MODULE 2:	Full-Wave Rectifier	**9 Hours**
Analyze the performance, output waveform, and efficiency of a full-wave rectifier circuit.		
MODULE 3:	V-I Characteristics of LED	**6 Hours**
Examine the voltage-current characteristics of a Light Emitting Diode (LED) under different conditions.		
MODULE 4:	Input and Output Characteristics of BJT	**6 Hours**
Study the input and output characteristics of a Bipolar Junction Transistor (BJT) in different regions of operation.		
MODULE 5:	JFET Characteristics	**6 Hours**
Introduction to solving systems of linear equations, Gauss Elimination Method: Direct approach to solving equations, Gauss-Seidel Iterative Method: Convergence and Stopping Criteria		

MODULE 6:	V-I Characteristics of Solar Cell	**9 Hours**
Study the voltage-current characteristics of a solar cell and determine its efficiency and output under varying conditions.		
TOTAL LAB HOURS		**45 Hours**

Books:

1. "Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Chapra,
2. "Principles of Electronics" by V.K. Mehta and Rohit Mehta
3. Solid State Electronic Devices" by Ben G. Streetman and Sanjay Banerjee
4. Electronic Devices and Circuits" by David A. Bell

Department of Electronics & Communication Engineering

Program: B.Tech. in ECE	**Year, Semester: 2nd**, 3rd
Course Title: Network Theory Laboratory	**Subject Code:** TIU-UEC-L213
Contact Hours/Week: 0–0–3	**Credit: 1.5**

COURSE OBJECTIVE:

Enable the student to:

1. This course introduces the basic concepts ofsimple DC & AC Circuits.
2. To understand the basics of circuit theory and analysis of electric circuits.
3. To apply the network elements and theorems for the analysis of complex circuits.
4. To analyze the coupled circuits using the series & parallel resonance circuit terminologies.
5. To design electrical systems.

- The Emphasis of this course is laid on the PSPICE Simulation of DC & AC Circuits.
- To analyze a given network by applying various network theorems.

COURSE OUTCOME:

On completion of the course, the student will be able:

CO-1	**Understand** the basic properties of electrical elements, and also solve DC circuit Problems The student should also Understand the basics of PSpice simulation and verify circuit **analysis** techniques.	K1,K2, K3
CO-2	**Understand** the fundamental behavior of AC circuits and solve AC circuit problems. **Analyze** and verify power transfer conditions in electrical circuits.	K1,K2,K3,K5
CO-3	**Apply** the knowledge gained to explain the behavior of the circuit at series & parallel resonance of circuit & the effect Of resonance. **Examine** the transient behavior of RL and RC circuits under step response conditions.	K1,K3, K6
CO-4	**Analyze** the transient response of RLC circuits for different initial conditions.	K3,K5,K6

CO-5	**Apply** two-port network analysis in the design and analysis of filter and attenuator.**Understand** the frequency response of basic passive filters and their applications.	K1,K3,K4,K6
CO-6	**Analyze** the characteristics and applications of band-pass and band-stop filters. Evaluate the functionality of notch filters and their significance in signal processing.	K1,K3,K4,K6

COURSE CONTENT:

MODULE 1:	Familiarization with P-Spice	**12 Hours**
Introduction of PSpice & Verification of Ohm's Law.		
MODULE 2:	Network Theorems	**9 Hours**
Verification of Superposition Theorem and Verification of Maximum PowerTransfer Theorem.		
MODULE 3:	Analysis of R-L, R-C and R-L-C Circuit	**9 Hours**
Transient response of Series R-L & Series R-C Circuits and DC Transient response of Series R-L-C Circuit		
MODULE 4:	Filter Design	**12 Hours**
To study characteristics of Low Pass Filter & High Pass Filter and also To study characteristics of Band Pass Filter & Band Stop Filter (To study Notch Filter as a special case)		
TOTAL LAB HOURS		**42 Hours**

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Program: B. Tech. in ECE	**Year, Semester:** 2nd Yr., 3rd Sem..
Course Title: Data Structure Lab	**Subject Code:**TIU-UCS-L209
Contact Hours/Week: 0–0–3 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Implement search and sorting algorithms on arrays.
2. Develop data structures like linked lists, stacks, and queues.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	Implement linear and binary search algorithms on arrays.	

CO-2:	Apply different sorting algorithms on data structures.	
CO-3:	Perform operations on linked lists, stacks, and queues.	
CO-4:	Implement and manipulate graphs for various operations.	

COURSE CONTENT:

MODULE 1:	Searching and Sorting	**5 Hours**
Linear search and binary search implementation. Different sorting algorithms and their operations.		
MODULE 2:	Arrays and Linked Lists	**5 Hours**
Implement 1-D and 2-D arrays, perform basic operations. Implement linked lists and perform various operations.		
MODULE 3:	Stacks and Queues	**5 Hours**
Implement stacks and perform push, pop, and other operations. Implement linear and circular queues with their operations.		
MODULE 4:	Graphs and Advanced Operations	**5 Hours**
Implement graphs and perform operations like traversal and pathfinding.		
TOTAL LECTURES		**20 Hours**

Program: B.Tech. Electronics and Communications Engineering	**Year, Semester:** 2ND year, Sem 3
Course Title: Mathematics III (Numerical Lab)	**Subject Code:** TIU-UMA-L201
Contact Hours/Week: 0–0–3	**Credit:** 1.5

COURSE OBJECTIVE:

Enable the student to:

1. Understand the mathematical foundations of various numerical methods and their significance in solving engineering and scientific problems.
2. Apply numerical techniques to solve algebraic equations, system equations, interpolation, differentiation, and integration using computational tools.
3. Analyze the accuracy, stability, and applicability of numerical methods while implementing them for real-world engineering applications.

COURSE OUTCOME:

On completion of the course, the student will be able:

CO-1	Implement numerical algorithms based on mathematical foundations.	K3
CO-2	Identify and apply numerical methods to solve algebraic and system equations.	K3
CO-3	Implement numerical techniques for interpolation, differentiation, and integration.	K3
CO-4	Apply appropriate numerical methods to engineering and scientific problems.	K3
CO-5	Develop optimized numerical solutions using mathematical principles.	K5
CO-6	Analyze the accuracy, stability, and applicability of numerical methods.	K4

COURSE CONTENT:

MODULE 1:	**FORWARD AND BACKWARD DIFFERENCE TABLE**	**9 Hours**
Introduction to finite differences and their applications, Forward and Backward Difference Operators, Construction of Difference Tables, Higher-order differences and accuracy analysis		
MODULE 2:	**INTERPOLATION METHODS**	**9 Hours**
Newton's Forward and Backward Interpolation Formulas, Lagrange's Interpolation Method, Applications of interpolation in numerical computations		
MODULE 3:	**NUMERICAL INTEGRATION**	**6 Hours**
Introduction to Numerical Integration, Trapezoidal Rule and its implementation, Simpson's 1/3rd Rule and applications, Error analysis in numerical integration		
MODULE 4:	**NUMERICAL SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS**	**6 Hours**
Bisection Method: Concept, Algorithm, and Implementation, Newton-Raphson Method: Convergence, Limitations, and Applications		
MODULE 5:	**NUMERICAL SOLUTION OF A SYSTEM OF EQUATIONS**	**6 Hours**
Introduction to solving systems of linear equations, Gauss Elimination Method: Direct approach to solving equations, Gauss-Seidel Iterative Method: Convergence and Stopping Criteria		
MODULE 6:	**NUMERICAL SOLUTION OF INITIAL VALUE PROBLEMS**	**9 Hours**
Euler's Method: Concept and Implementation, Modified Euler's Method for higher accuracy, Runge-Kutta Methods: 2nd and 4th Order Techniques, Applications in solving Ordinary Differential Equations (ODEs).		
TOTAL LAB HOURS		**45 Hours**

Books:

1. Balagurusamy, E. (2017). Numerical Methods (1st ed.). McGraw-Hill Education.
2. Veerarajan, T., & Ramachandran, T. (2006). Numerical Methods with Programs in C and C++ (1st ed.). Tata McGraw-Hill.
3. Chapra, S. C. (2018). Applied Numerical Methods with MATLAB for Engineers and Scientists (4th ed.). McGraw-Hill Education.
4. Pradeep, N., & Govindarajan, G. (2008). Numerical Methods and Computer Programming (1st ed.). New Age International Publishers.
5. Grewal, B. S. (2019). Numerical Methods in Engineering and Science with Programs in C and C++ (10th ed.). Khanna Publishers.
6. Rajaraman, V. (2012). Computer Oriented Numerical Methods (3rd ed.). PHI Learning Pvt. Ltd.