SEMESTER-III

Major Courses

Name of the Programme : B.E. in Electronics and Computer Engineering
Course Code : ECM-200
Title of the Course : Data Structures using C++
Number of Credits : 3
Effective from AY : 2024-25

Pre-requisites for the Course:	Nil	
Course Objectives:	This course will enable students to: 1. To introduce object-oriented programming (OOP) concepts using C++. 2. To understand and implement data structures like arrays, linked lists, stacks, queues, trees, and graphs. 3. To develop efficient algorithms for problem-solving and understand their complexities. 4. To apply C++ concepts in real-world applications.	
Contents:		**No of Hours**
Unit - 1	**Basics of C++:** Structure of a C++ Program, Data Types, Operators, Expressions and control structures. **Functions in C++:** Function Prototypes, Default Arguments, Function Overloading **Introduction to OOP**: Principles (Encapsulation, Abstraction, Inheritance, Polymorphism) **Classes and Objects:** Defining Classes, Access Specifiers, Constructor and Destructor, Friend Functions and Friend Classes, Static Data Members and Static Member Functions **Inheritance:** derived classes, Types of inheritance, constructors in derived classes, nesting of classes	**12**
Unit -2	**Concepts of polymorphism:** Function overloading, operator overloading. Overloading types, and rules, explicit &amp: implicit type conversion operators, function overriding. **Pointers:** pointers to objects, this pointer. Virtual functions. **Exceptions**: Exception Objects, Throwing and Catching Exceptions, Exception Specification**.** **Linked list:** Singly (Insertion, Deletion, Traversal), Doubly, Circular linked lists	**11**
Unit -3	**Stacks**: Implementation (array and linked list), applications of stacks: Expression evaluation (Infix to postfix, Infix to prefix and vice versa) **Queues**: Implementation (array and linked list), Circular **Trees:** Basic terminology, binary trees and their representation,	**11**

	Traversals of a Binary Tree, Reconstruction of Binary Tree.	
Unit - 4	**Graphs:** Basic terminology, The Graph ADT, Data Structures for Graphs, Graph Traversal – Depth First Search, Breadth First Search, Shortest Path Algorithm (Dijkstra's Algorithm, Prims and Kruskal's Algorithm) **Searching Algorithms:** Binary Search, Linear Search. **Sorting Algorithms**: Bubble sort, selection sort, Quick sort, Insertion sort, Merge sort, Heap sort. **Hashing:** Hash Functions, Collision Resolution Techniques.	**11**
Pedagogy:	Interactive, reflective, and inquiry-based methods, with a strong emphasis on critical thinking and problem-solving skills	
References/ Readings:	**TEXTBOOKS:** 1. E. Balagurusamy, Object-Oriented Programming with C++, 5th Edition, Tata McGraw-Hill, 2011.ISBN-13: 978-0070669193 2. Yeshwant Kanetkar, Data Structures Using C++, 1st Edition, BPB Publications, 2011.ISBN-13: 978-8176569408 3. Michael T. Goodrich, Roberto Tamassia, David Mount, Data Structures and Algorithms in C++, 2nd Edition, John Wiley & Sons, 2004.ISBN-13: 978-8126512607 **REFERENCE BOOKS:** 1. S. Sahni, Data Structures, Algorithms and Applications in C++, 2nd Edition, Universities Press, 2005.ISBN-13: 978-8173715543 2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 4th Edition, Pearson Education, 2013.ISBN-13: 978-0273769385 3. Adam Drozdek, Data Structures and Algorithms in C++, 4th Edition, Cengage Learning, 2013.ISBN-13: 978-8131521267 4. 4.Yeshwant Kanetkar, Let Us C++, 16th Edition, BPB Publications, 2017.ISBN-13: 978-9387284494	
Course Outcomes:	**Upon completion of the course, students will be able to:** CO 1. Implement object-oriented concepts using C++. CO 2. Design basic data structures. CO 3. Develop efficient algorithms for problem-solving. CO 4. Apply C++ concepts in real-world scenarios**.**	

Name of the Programme : **B.E. in Electronics and Computer Engineering**
Course Code : **ECM-201**
Title of the Course : **Data Structures using C++ Lab**
Number of Credits : **1**
Effective from AY : **2024-25**

Pre-requisites for the Course:	Basic Programming skills	
Course Objectives:	This course will enable students to: 1. Understand the generic principles of object-oriented programming using C++. 2. Plan, Design, execute and document sophisticated object-oriented programs to handle different computing problems 3. To use data structures as the foundational base for computer solutions to engineering problems. 4. To plan, design, execute and document sophisticated technical programs to handle various sorts of data structures using object-oriented principles	
Contents:	**List of Programs /Experiments *(Following experiments should be conducted. A certified journal reporting the experiments conducted should be submitted at the end of the term)***	**No of Hours**
	1. Implementing Classes, Objects, and Overloading 2. Friend Function and Friend Classes 3. Implementation of Inheritance 4. Implementation of Singly/Doubly/Circular Linked List 5. Implementation of Stack Using Array/Linked List 6. Implementation of Queue Using Array/Linked List 7. Implementation of Sorting Techniques 8. Implementation of Graph Representations (Adjacency Matrix and Adjacency List) 9. Implementation of Graph Traversal Techniques (BFS and DFS) 10. Implementation of Shortest Path Algorithms (Dijkstra's Algorithm, Prims and Kruskal's Algorithm	**30**
Pedagogy:	Integration of instructional learning, constructive thinking, inquiry-based, collaborative, experiential, and problem-solving approaches.	
References/ Readings:	**TEXTBOOKS:** 1. E. Balagurusamy, Object-Oriented Programming with C++, 5th Edition, Tata McGraw-Hill Education, 2011.ISBN-13: 978-0071072830 2. Yeshavant P. Kanetkar, Data Structures Using C++, 1st Edition, BPB Publications, 2011.ISBN-13: 978-8176569408 3. Aaron M. Tenenbaum, Data Structures Using C++, 2nd Edition, Pearson Education, 2011. ISBN-13: 978-8131726976 **REFERENCE BOOKS:** 1. Robert Lafore, Object-Oriented Programming in Turbo C++, 4th Edition,	

	Pearson Education, 2013.ISBN-13: 978-8131718063 2. E. Balagurusamy, Mastering C++, 1st Edition, McGraw-Hill Education, 2011. ISBN-13: 978-0070701994 3. Yeshavant P. Kanetkar, Let Us C++, 2nd Edition, BPB Publications, 2014.ISBN-13: 978-8176561068
Course Outcomes:	Upon completion of the course, students will be able to: CO 1. Explain object-oriented concepts like classes, objects, overloading, and inheritance. CO 2. Apply linked lists, stacks, and queues for data organization. CO 3. Apply graph algorithms for traversal and shortest path determination. CO 4. Implement searching, sorting, and tree structures for problem-solving.

Name of the Programme : **B.E. in Electronics and Computer Engineering**
Course Code : **ECM-202**
Title of the Course : **Logic Design**
Number of Credits : **03**
Effective from AY : **2024-25**

Pre-requisites for the Course:	Basics of digital systems	
Course Objectives:	This course will enable students to: 1. Master number system conversions and complement arithmetic in digital Systems. 2. Simplify Boolean expressions and design combinational circuits using logic Gates. 3. Understand flip-flops and registers for data storage and sequence control. 4. Design and analyse sequential circuits, including state machines and Counters.	
Contents:		**No of Hours**
Unit - 1	**Introduction**: Digital and Analog Systems, Logic Levels and Pulse Waveforms. **Number Systems:** Decimal, Binary, Octal, Hexadecimal Number System and their interconversions. **Binary Arithmetic:** Binary signed numbers, 1's and 2's Complement Arithmetic. **Binary Codes**: Classification, 8421 code, Excess 3 Code, Gray Code, Parity generation and detection. **Logic Gates**: AND, OR, NOT, Universal Gates, XOR and XNOR Gates.	**11**
Unit -2	**Boolean Algebra:** Logic Operations, Laws of Boolean Algebra, Reducing Boolean Expressions, Introduction to SOP and POS Forms, Boolean Expression and Logic Diagrams, Converting AOI to NAND/NOR Logic. **Minimization of Switching Functions:** 2, 3 and 4 Variable K-map. Don't Care Combinations. **Combinational Logic Design:** Adders, Subtractors, Code converters (Binary to Gray and Gray to Binary), Parity Bit Generator, Comparators, Encoders, Decoders, Multiplexers, Demultiplexers.	**11**
Unit -3	**Flip-flops**: Latch v/s Flip-Flops- D, JK, RS and T Flip-flop. Master Slave Flip-flops, Flip-flop Excitation Tables. **Shift Registers**: Serial In Serial Out (SISO), Serial In Parallel Out (SIPO), Parallel In Serial Out (PISO) and Parallel In Parallel Out (PIPO) Shift Registers.	**11**

Unit - 4	**Asynchronous Counters**: Ripple Up counters, Ripple Down Counters (Using Positive and Negative edge triggering) **Synchronous Counters**: Design of synchronous counters, Synchronous up counter and Synchronous down counter. Ring Counter and Johnson counter. Applications of counters. **Sequential Circuits:** Design procedure for sequential circuits using state diagrams, state table, state equations, state reduction and assignment. Moore and Mealy Machine.	**12**
Pedagogy:	Interactive, reflective, and inquiry-based methods, with a strong emphasis on critical thinking and problem-solving skills	
References/ Readings:	**TEXTBOOKS:** 1. Anand Kumar, Fundamentals of Digital Circuits, 2nd Edition, PHI Learning, 2007.ISBN-13: 978-8120330607 2. Thomas L. Floyd, Digital Fundamentals, 11th Edition, Pearson Education, 2017.ISBN-13: 978-9332584600 **REFERENCE BOOKS:** 1. M. Morris Mano, Digital Logic and Computer Design, Pearson Education, 2013.ISBN-13: 978-9332542525 2. Albert Paul Malvino & Donald P. Leach, Digital Principles and Applications, 8th Edition, McGraw Hill Education, 2014.ISBN-13: 978-9339203405 3. R.P. Jain, Modern Digital Electronics, 4th Edition, McGraw Hill Education, 2010.ISBN-13: 978-0070681071.	
Course Outcomes:	**Upon completion of the course, students will be able to:** CO 1. Explain the fundamentals of digital and analog systems, number systems, and binary arithmetic CO 2. Analyze and simplify Boolean expressions, and design combinational logic circuits using Boolean algebra and Karnaugh maps. CO 3. Design sequential circuits, including flip-flops, shift registers, and counters. CO 4. Evaluate state-based sequential circuits using Moore and Mealy machines for practical applications.	

Name of the Programme : **B.E. in Electronics and Computer Engineering**
Course Code : **ECM-203**
Title of the Course : **Logic Design Lab**
Number of Credits : **01**
Effective from AY : **2024-25**

Pre-requisites for the Course:	Nil	
Course Objectives:	**This course will enable students to:** 1. To know the concepts of Combinational circuits. 2. To understand the concepts of flipflops, registers and counters	
Contents:	**List of Programs /Experiments *(Following experiments should be conducted. A certified journal reporting the experiments conducted should be submitted at the end of the term)***	**No of Hours**
	1. Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates. 2. Realization of logic functions with the help of universal gates NAND and NOR Gate. 3. Realization of Boolean expressions in SOP & POS forms 4. Design of Adders and Subtractors 5. Design of Code Converters 6. Design and Implementation and Verification of Encoders and Decoders 7. Design and Implementation of Multiplexers and Demultiplexers 8. Design and Implement Parity Bit Generators & Comparators 9. Verify the truth table of JK and D flip-flops. 10. Design SISO/SIPO Shift register 11. Design of Synchronous Counter 12. Design of Asynchronous Counter	**30**
Pedagogy:	Integration of instructional learning, constructive thinking, inquiry-based, collaborative, experiential, and problem-solving approaches.	
References/ Readings:	**TEXTBOOKS:** 1. Anand Kumar, Fundamentals of Digital Circuits, Fourth Edition, PHI Learning Pvt. Ltd., 2016, ISBN: 9788120352681 2. Thomas L. Floyd, Digital Fundamentals, Eleventh Edition, Pearson Education Limited, 2015, ISBN: 9781292075983 **REFERENCE BOOKS:** 1. Morris Mano, Digital Logic and Computer Design, First Edition, Pearson, 1979, ISBN: 9780132145107 2. Malvino and Leach, Digital Principles and Applications, Fourth Edition, McGraw-Hill, 1986, ISBN: 9780070398832 3. R. P. Jain, Modern Digital Electronics, Third Edition, Tata McGraw-Hill, 2003, ISBN: 9780070494923	
Course	**Upon completion of the course, students will be able to:**	

Outcomes:	CO 1. Apply logic gate operations to verify and interpret truth tables in digital circuits CO 2. Design combinational circuits like adders, subtractors, code converters, and multiplexers using Boolean algebra and logic gates CO 3. Analyze sequential circuits such as flip-flops, counters, and shift registers to ensure correct functionality CO 4. Design a complete digital system, integrating knowledge of logic gates, combinational and sequential circuits.

Minor/IC/PE

Name of the Programme : B. E Electronics and Computer Engineering
Course Code : ECM-221
Title of the Course : Integrated Electronics
Number of Credits : 3
Effective from AY : 2024-25

Pre-requisites for the Course:	Elements of Electrical and Electronics Engineering	
Course Objectives:	The subject aims to provide the student with: 1. Analysis of small-signal equivalent circuits for BJT amplifiers and evaluation of BJT voltage divider circuit. 2. An understanding of Class A, B, AB, and C power amplifiers, and effects of positive and negative feedback in amplifier circuits. 3. An understanding of differential amplifiers and operational amplifiers along with its applications. 4. An understanding of active filters, data converters and IC 555 timer.	
Contents:		**No of Hours**
Unit-1	**Hybrid parameters:** Transistor equivalent circuits of CE, CB and CC configurations, analysis of BJT voltage divider circuit With and without bypass capacitor **Multistage stage amplifiers:** Concepts of cascaded amplifier, Types of coupling, RC Coupled Amplifier. **BJT switch:** BJT as a switch, Improving switching times.	**11**
Unit-2	**Power amplifiers Classification**: Classification as Class A, B, C and AB , Working and efficiency of class A Transformer coupled Amplifier and Class B push pull amplifier, **Feedback:** Concept of positive and negative feedback, advantages of negative feedback, basic block diagram of negative feedback configurations. Positive feedback: Barkhausen criterion, concept of tank circuit, RC Phase Shift Oscillator, Crystal Oscillator.	**12**
Unit-3	**Differential amplifier:** Concept, construction and working **Op amp basics:** Block diagram, ideal op amp characteristics, open loop and closed loop configurations of inverting and non-inverting amplifier. **Applications**: Summing Scaling Averaging amplifier, Schmitt trigger, Sample and hold circuit, Instrumentation amplifier.	**11**
Unit-4	**Active filters:** First order and second order high pass and low pass butterworth filters, Wide bandpass filter. **Data converters:** Concept, Resolution and accuracy for data converters, Weighted resistor DAC, quantization error, Successive approximation ADC.	**11**

	IC555 Timer: Functional block diagram and specifications, Working of IC555 in Astable and Monostable modes , Application of IC 555 as VCO, Missing pulse detector, Frequency divider.	
Pedagogy:	Interactive, reflective, and inquiry-based methods, with a strong emphasis on critical thinking and problem-solving skills	
References/ Readings:	**TEXTBOOKS** 1. Boylestad R. & Nashelsky L.; "Electronic Devices and Circuit Theory"; Pearson Education Limited.11th edition; ISBN 9789332542600. 2. Ramakant A. Gayakwad; Op-Amps and linear integrated circuits; Pearson 2015. ISBN-13. 978-9332549913 **REFERENCES** 1. J.B Gupta; Electronic Devices and Circuits; S. K. Kataria & Sons 2009, reprint, ISBN 9788185749754 2. K. R. Botkar; Integrated Circuits; Khanna Publishers-Delhi , 2008, ISBN-10 : 8174092080	
Course Outcomes:	**Upon completion of the course, students will be able to** CO 1. Explain the small-signal equivalent circuits of BJT amplifiers in CE, CB, and CC configurations, and describe the behavior of voltage divider bias circuits and the influence of bypass capacitors. CO 2. Classify various power amplifiers, describe their operating principles, and analyze the effects of positive and negative feedback on amplifier performance and stability. CO 3. Analyze the functionality of differential and operational amplifiers and apply this understanding to design practical amplifier circuits. CO 4. Design and implement active filters and IC 555 timer circuits in both a stable and monostable modes for applications in signal processing and waveform generation.	

Name of the Programme : **B.E. in Electronics and Computer Engineering**
Course Code : **ECM-222**
Title of the Course : **Integrated Electronics Lab**
Number of Credits : **1**
Effective from AY : **2024-25**

Pre-requisites for the Course:	Elements of Electrical & Electronics Engineering Lab	
Course Objectives:	The subject aims to provide the student with: 1. Design and analyze passive filter circuits, BJT switches, oscillators, and RC coupled amplifiers. 2. Develop and evaluate op-amp based configurations, including filters, wave shaping circuits, amplifiers, digital-to-analog converters (DACs), and Schmitt Trigger circuits. 3. Design and verify integrated circuit (IC) voltage regulators and IC555 timer-based circuits. 4. Apply theoretical knowledge to design and verify a comprehensive mini-project circuit.	
Contents:	**List of Programs /Experiments *(Following experiments should be conducted. A certified journal reporting the experiments conducted should be submitted at the end of the term)***	**No of Hours**
	1. Implementation of a BJT as a Switch 2. Design and Analysis of RC/LC Oscillator 3. Frequency Response Analysis of an RC Coupled Amplifier 4. Op-Amp Configurations 5. Summing, Scaling, and Averaging Amplifiers using Op-Amp 6. Op-Amp as Integrator and Differentiator 7. IC 555 Timer in Astable and Monostable Modes 8. Design of Active Filters using Op-Amp 9. Application of IC Voltage Regulators: LM317 and LM723 10. Mini project (using analog devices)	**30**
Pedagogy:	Integration of instructional learning, constructive thinking, inquiry-based, collaborative, experiential, and problem-solving approaches.	
References/ Readings:	**Text Books:** 1. Electronics Lab Manual(Volume2) , PHI Learning Pvt Ltd, 6th edition, 2018, ISBN-13 978-9388028080 2. Operational Amplifiers & Linear Integrated Circuits + Lab Manual, James Fiore, Milne Open Text Books 3. David Bell; Solid state Pulse circuits; Oxford University Press, 2nd Edition, 1981 **REFERENCES** 1. J.B Gupta; Electronic Devices and Circuits; S. K. Kataria & Sons 2009, reprint, ISBN 9788185749754	

	2. K. R. Botkar; Integrated Circuits; Khanna Publishers-Delhi, 2008, ISBN-10: 8174092080
Course Outcomes:	**Upon completion of the course, students will be able to:** CO 1. Design and verify passive Filters, BJT switch, BJT oscillators, and RC coupled amplifiers circuits CO 2. Design and verify op amp configurations, filters, wave shaping circuits, and amplifiers. CO 3. Design and verify voltage regulator and timer circuits using standard ICs. CO 4. Build a Project circuit and verify it's working.

Name of the Programme : **B.E. in Electronics and Computer Engineering**
Course Code : **ECM-223**
Title of the Course : **Communication Technology**
Number of Credits : **03**
Effective from AY : **2024-25**

Pre-requisites for the Course:	Nil	
Course Objectives:	**The students shall be able to:** 1. Understand the fundamentals of data communication, including its components, data representation, and network types. 2. Analyze data transmission, signal processing, transmission impairments, and performance measurement. 3. Explore different transmission media, multiplexing techniques, and their applications in communication systems. 4. Examine mobile communication systems and multiple access techniques	
Contents:		**No. of Hours**
Unit - 1	**Introduction to Data Communication:** Components of data communication, data representation, data flow. Networks- Criteria and physical Structures, Network types (LAN, WAN, Switching, The Internet) **Data and Signals:** Periodic Analog Signals, Digital Signals, Transmission impairment (Attenuation, distortion, Noise), Data Rate limits and Performance Measurement. **Transmission Media**: Guided Media (Twisted Pair, Coaxial, Fiber Optic), Unguided wireless media (Radio waves, Microwaves, Infrared)	**11**
Unit - 2	**Digital Transmission:** Digital-to-Digital Conversion, Analog-to-Digital Conversion (PCM, DM), Transmission Modes **Analog Transmission:** Digital-to-Analog Conversion (ASK, FSK, PSK, QAM), Analog-to-Analog Conversion (AM, FM, PM). **Multiplexing:** FDM, WDM, TDM, Spread Spectrum- FHSS, DSSS	**12**
Unit - 3	**Mobile Communication Cellular Systems:** Frequency Reuse, Channel Assignment strategies, Handoff strategies, Interface and system capacity, Improving coverage and capacity **Multiple Access Techniques:** FDMA, TDMA, FHMA, CDMA, SDMA, Packet radio (Pure and Slotted ALOHA, CSMA)	**12**
Unit - 4	**Electromagnetic Wave Propagation:** Electromagnetic Waves and Polarization, Radiation, Free-space impedance, Spherical wave front and inverse Square Law, Wave Attenuation and Absorption, Optical Properties of Radio Waves, Terrestrial propagation of Electromagnetic Waves, Propagation Terms and Definitions, Free-space path loss, Fading and Fade Margin.	**10**

Pedagogy	Interactive, reflective, and inquiry-based methods, with a strong emphasis on critical thinking and problem-solving skills
References/ Readings	**TEXTBOOKS:** 1. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill Education, 2012, ISBN: 9780073376226 2. Theodore S. Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Pearson Education, 2002, ISBN: 780130422323 3. Wayne Tomasi, Electronic Communications Systems: Fundamentals Through Advanced, 5th Edition, Pearson Education, 2004, ISBN: 9788131719534
	REFERENCE BOOKS: 1. Jochen Schiller, Mobile Communications, 2nd Edition, Pearson Education, 2009, ISBN: 9788131724262 2. William Stallings, Wireless Communications & Networks, 2nd Edition, Pearson Education, 2009, ISBN: 9788131720936 3. Andrew S. Tanenbaum & David J. Wetherall, Computer Networks, 5th Edition, Pearson Education, 2011, ISBN: 9789332531772 4. William Stallings, Data and Computer Communications, 10th Edition, Pearson Education, 2013, ISBN: 9789332586932
Course Outcome	**Upon completion of the course, students will be able to:** CO 1. Explain key components of Data and Mobile Communication CO 2. Differentiate between Analog and Digital transmission. CO 3. Apply multiple access techniques in Communication systems to optimize data transmission. CO 4. Evaluate transmission impairments and performance of Communication systems

Name of the Programme : **B.E. in Electronics and Computer Engineering**
Course Code : **ECM-224**
Title of the Course : **Communication Technology Lab**
Number of Credits : **1**
Effective from AY : **2024-25**

Pre-requisites for the Course	Nil	
Course Objectives	The students shall be able to: 1. To understand and implement various modulation techniques. 2. To explore multiplexing techniques to enhance data transmission efficiency. 3. To model and simulate line encoding and wireless communication systems using MATLAB/open source software 4. To design, analyze, and evaluate wireless communication standards, multiple access techniques and Spread Spectrum modulation.	
Contents	**List of Programs /Experiments *(Following experiments should be conducted. A certified journal reporting the experiments conducted should be submitted at the end of the term)***	**No. of Hours**
	1. Implementation and Comparison of Line Encoding Techniques: Unipolar, Polar, Bipolar 2. Design and Analysis of Pulse Code Modulation (PCM) / Delta Modulation (DM) 3. Generation and Analysis of ASK/FSK/ PSK/QAM Signals 4. Implementation of Frequency Division Multiplexing (FDM) 5. Implementation of Time Division Multiplexing (TDM) 6. Modeling of Wireless Communication Systems Using MATLAB/Open-Source Tools 7. Simulation of Multipath Fading Channels and Their Effects on Signal Quality 8. Design and Simulation of Direct Sequence Spread Spectrum (DSSS) Modulation and Demodulation 9. Simulation of Multiple Access Techniques: FDMA/ TDMA/ CDMA/ SDMA 10. Modelling and Comparison of Random Access Techniques: Pure ALOHA/ Slotted ALOHA/ CSMA	**30**
Pedagogy	Integration of instructional learning, constructive thinking, inquiry-based, collaborative, experiential, and problem-solving approaches.	
References/ Readings	**TEXT BOOKS:** 1. Theodore S. Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Pearson Education, 2010, ISBN 9788131731864 2. E.S. Gopi, MATLAB and Simulink for Wireless Communications, Springer, 2016, ISBN 978-9811006117 3. Behrouz A. Forouzan, Data Communications and Networking, 5th	

	Edition, McGraw Hill Education, 2017, ISBN 978-1259064753
	REFERENCE BOOKS: 1. Jochen Schiller, Mobile Communications, 2nd Edition, Pearson Education, 2008, ISBN 9788131724262 2. John G. Proakis, Masoud Salehi, Gerhard Bauch, Contemporary Communication Systems Using MATLAB, 3rd Edition, Wadsworth Publishing Co Inc, 2012, ISBN 978-0495082514 3. Holly Moore, MATLAB for Engineers, 5th Edition, Pearson Education, 2017, ISBN 978-0134688287 4. B.P. Lathi & Zhi Ding, Modern Digital and Analog communication Systems, 4th Edition, Oxford University Press, 2009, ISBN 9780195384932
Course Outcome	**Upon completion of the course, students will be able to:** CO 1. Analyse Digital and Analog modulation techniques CO 2. Analyse and apply multiplexing techniques. CO 3. Model line encoding and wireless communication systems using MATLAB/Open source Software CO 4. Design, test, and evaluate wireless standards, multiple access techniques, and Spread Spectrum modulation.

Multidisciplinary Courses

Name of the Programme : B.E. in Electronics and Computer Engineering
Course Code : SHM-234
Title of the Course : Engineering Mathematics-II
Number of Credits : 3
Effective from AY : 2024-25

Pre-requisites for the Course:	Basic Knowledge of Mathematics	
Course Objectives:	The course will enable the students to: 1. Analyze relations, functions, and integer concepts (prime factorization, GCD, modular arithmetic) 2. Apply propositional calculus, proof techniques, and counting methods. 3. Evaluate vector spaces, linear independence, and rank. 4. Apply analytic geometry concepts and techniques like Gram-Schmidt and matrix decompositions.	
Contents:		**No of Hours**
Unit - 1	**Relations and Functions:** Relations and their properties, Equivalence Relations, partial orderings. One-to-One and Onto Functions, Inverse Function, Composition of functions. **Integers:** Integers and division, primes and greatest common divisors, Euclidean algorithm, Basic properties of Congruence, Modular arithmetic. **Mathematical Induction:** Principle of Mathematical Induction and applications.	**10**
Unit - 2	**Propositional Calculus:** Propositional logic, truth tables, propositional connectives (logical operators), propositional equivalences, propositional implications, complete set of connectives, consistency of statements, theory of inference in propositional logic, predicates and quantifiers. **Counting Principles**: Pigeonhole principle and Inclusion and Exclusion Principle. **Advanced Counting Techniques**: Recurrence relations, formulation, solving linear recurrence relations using characteristic roots.	**12**
Unit - 3	**Linear Algebra**: Vector Spaces, Null and Column Space of a Matrix, Linear Independence, Basis and Rank, Rank-Nullity theorem, Linear Mappings, One-to-One, Onto and Bijective Linear Maps(Isomorphisms), Matrix of a Linear Transformation, Change of Basis Formula. **Analytic Geometry**: Norms, Inner Products, Lengths and Distances, Angles and Orthogonality, Gram-Schmidt	**11**

	Orthogonalization, Orthonormal Basis, Orthogonal Complement, Inner Product of Functions	
Unit - 4	**Analytic Geometry:** Orthogonal Projections, Orthogonal Projection and the Normal Equation, Least Squares Problem, Rotations. **Decompositions:** QR Decomposition, Eigen decomposition and Diagonalization via orthogonal Transformation, Cholesky Decomposition, Singular Value Decomposition, Matrix Approximation.	**12**
Pedagogy:	Interactive, reflective, and inquiry-based methods, with a strong emphasis on critical thinking and problem-solving skills	
References/ Readings:	1. J. P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, 1st Edition, McGraw Hill, 2017. 2. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong: Mathematics for Machine Learning, Cambridge University Press, 2020. 3. Swapan Kumar Sarkar, A Text Book of Discrete Mathematics, 9th Edition, S. Chand Publication, 2019. **Reference Books** 1. David C. Lay: Linear Algebra and Its Applications, 5th Edition, Pearson Education India, 2023. 2. Kenneth H. Rosen, Discrete Mathematics and Its Applications, 6th Edition, Tata McGraw Hill, 2006.	
Course Outcomes:	**Upon completion of the course the student will be able to:** CO 1. Analyze sets, functions, relations, and modular arithmetic for integer computations. CO 2. Solve combinatorial problems using logic and proof techniques. CO 3. Analyze vector spaces and apply linear transformations using matrices. CO 4. Apply analytic geometry and matrix decomposition for multidimensional data analysis	

Skill Enhancement Courses

Name of the Programme : B.E. in Electronics and Computer Engineering
Course Code : ECM-241
Title of the Course : Web Design
Number of Credits : 03
Effective from AY : 2024-25

Pre-requisites for the Course:	Nil	
Course Objectives:	**The subject aims to provide the student with:** 1. Ability to design and implement static and dynamic website. 2. Illustration of the implementation of JavaScript for dynamic effects. 3. Ability to choose best technologies for solving web client/server problems. 4. Implementation aspects of server-side technologies like PHP and MySQL.	
Contents:	**List of Programs /Experiments *(Following experiments should be conducted. A certified journal reporting the experiments conducted should be submitted at the end of the term)***	**No of Hours**
	1. Create a webpage using basic elements of HTML 2. Create class timetable using table tags in HTML 3. Design forms using HTML and CSS. 4. Create a web page with all types of Cascading style sheets. 5. Implementation of different JavaScript functions. 6. Implementation of different JavaScript functions for validation. 7. Implementation of JavaScript functions for validation of user login and registration form. 8. Implementation of JSON on the client framework. 9. Implementation of JSON on the server side. 10. Implementation of XML 11. Implementation of XML & XSL 12. Implementation of basic PHP Programs. 13. Implementation of PHP HTTP request methods. 14. Implementation of PHP and connection to MySQL 15. Implementation of PHP (Insert and View operation) 16. Implementation of PHP (Update operation) 17. Implementation of PHP (Delete operation) 18. Implementation of AJAX 19. Implementation of cookies using PHP. 20. Implementation of sessions using PHP Mini-Project Demonstrating the use of HTML, CSS, JS and Php	**90**

Pedagogy:	Integration of instructional learning, constructive thinking, inquiry-based, collaborative, experiential, and problem-solving approaches.
References/ Readings:	**TEXT BOOKS** 1. N. P. Gopalan and J. Akhilandeswari; Web Technology: A Developer's Perspective; PHI; ISBN: 978-81-203-5006-9 2 2. DT Editorial Services; Web Technologies Black Book;dreamtechpress; ISBN: 9788177229974 3 3. Kogent Learning Solutions; HTML5 Black Book; dreamtechpress; ISBN: 978-93-5004- 4 095-9 **REFERENCE BOOKS** 1. Smith, Ben; Beginning JSON, Apress; ISBN 978-1-4842-0202-9 2. Lindsay Bassett; Introduction to JavaScript Object Notation;O'Reilly Media; ISBN: 978-1- 491-92948-3
Course Outcomes:	**Upon completion of the course, students will be able to:** CO 1. Analyse the role of languages like HTML and CSS to solve real world problems. CO 2. Design and transform data using XML and JSON. CO 3. Design Dynamic Webpages using JavaScript. CO 4. Develop interactive web pages using PHP.

SEMESTER-IV

Major Courses

Name of the Programme : B.E. in Electronics and Computer Engineering
Course Code : ITH-204
Title of the Course : Object-Oriented Programming Using Java
Number of Credits : 2
Effective from AY : 2024-25

Pre-requisites for the Course:	Basic knowledge of programming	
Course Objectives:	**This course will enable students to:** 1. Understand the various concepts of object-oriented programming. 2. Illustrate competency in object-oriented programming by effectively utilizing basic OOP constructs. 3. Apply advanced OOP principles to design and implement applications 4. Develop event driven GUI applications	
Contents:		**No of Hours**
Unit - 1	**Introduction to Java:** Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java. **Objects and Classes:** Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, StringBuffer, File, this reference	**9**
Unit - 2	**Inheritance and Polymorphism**: Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java.	**7**
Unit - 3	**I/O programming:** Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files. **Multithreading in java:** Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try-catch-finally, Collections in java. **Introducing Swing:** Features of Swing, Swing Components: Buttons, Labels, Text Fields, and Containers, Event Handling in Swing, Advanced Swing Components: JScrollPane, JTabbedPane, JTable, and JTree.	**7**
Unit - 4	**Introduction to Java Web Development:** Servlets and JSP Basics (optional, for understanding legacy web apps), Introduction to Spring Boot (Dependency Injection, REST APIs) **Database Connectivity in Java:** JDBC Basics, Using JPA	**7**

	(Hibernate) for ORM.	
Pedagogy:	Interactive, reflective, and inquiry-based methods, with a strong emphasis on critical thinking and problem-solving skills	
References/ Readings:	**Text Books** 1. Cay S. Horstmann, Core Java: Fundamentals, 13th Edition, Oracle Pr, 2024. 2. Herbert Schildt and Danny Coward, Java: The Complete Reference, 13th Edition, McGraw Hill Education, 2023. **Reference Books** 1. Joyce Farrell, Java Programming, 10th Edition, Cengage Learning India Private Limited, 2018. 2. Joshua Bloch, Effective Java, 3rd Edition, Addison-Wesley Professional, 2017.	
Course Outcomes:	**Upon completion of the course, students will be able to:** CO 1. Explain the concepts of object-oriented programming. CO 2. Demonstrate competency in object-oriented programming by effectively utilizing basic OOP constructs. CO 3. Apply OOP principles to design and implement applications that solve real- world problems efficiently. CO 4. Develop interactive GUI-based applications.	

Name of the Programme : **B.E. Electronics and Computer Engineering**
Course Code : **ITH-205**
Title of the Course : **Object-Oriented Programming Using Java Lab**
Number of Credits : **2**
Effective From AY : **2024-25**

Pre-requisites for the Course:	Basic knowledge of programming	
Course Objectives:	**The course will enable students to:** 1. Understand core OOP concepts and basic Java syntax. 2. Apply inheritance, polymorphism, and multithreading techniques. 3. Develop GUI and web-based applications using Java technologies. 4. Create and manage Java packages, exception handling, and file operations	
Content:	**List of Programs *(Following experiments should be conducted. A certified journal reporting the experiments conducted should be submitted at the end of the term)***	**No of Hours**
	1. Implement basic concepts of OOP: Classes and Objects, Constructors and Overloading 2. Implement different forms of inheritance and demonstrate multiple inheritance using interfaces 3. Implement Java program to demonstrate method overriding and dynamic method dispatch. 4. Implement multithreading using Thread class and Runnable interface. 5. Design a GUI based application using Java Swing controls. 6. Implement a web-based database application. 7. Implement Java programs using decision making and looping statements. 8. Implement java programs using Arrays 9. Implement java programs using Strings 10. Implement Java program to perform file IO 11. Implement Java program that demonstrates the use of Random-Access File class for file IO 12. Implement Java program to demonstrate Generics 13. Implement Java program to create a user-defined package and access it in another program. 14. Implement Java program to create your own exception and handle it. 15. Create a web application using Java servlet.	**60**
Pedagogy:	Integration of instructional learning, constructive thinking, inquiry-based, collaborative, experiential, and problem-solving approaches.	

References/ Readings:	**Text Books** 1. Cay S. Horstmann, Core Java: Fundamentals, 13th Edition, Oracle Pr, 2024. 2. Herbert Schildt and Danny Coward, Java: The Complete Reference, 13th Edition, McGraw Hill Education, 2023. **Reference Books** 1. Joyce Farrell, Java Programming, 10th Edition, Cengage Learning India Private Limited, 2018. 2. Joshua Bloch, Effective Java, 3rd Edition, Addison-Wesley Professional, 2017.
Course Outcomes:	**Upon completion of the course, students will be able to:** CO 1. Demonstrate class design, constructors, and method overriding. CO 2. Implement inheritance, interfaces, and multithreading programs. CO 3. Design GUI applications and build simple web database apps. CO 4. Develop Java programs for file I/O, generics, packages, and exception handling.

Name of the Programme : **B.E Electronics and Computer Engineering**
Course Code : **ECM-204**
Title of the Course : **Database Management Systems**
Number of Credits : **3**
Effective from AY : **2024-25**

Prerequisites for the Course:	Nil	
Course Objectives:	This course will enable students to: 1. Understand the Basics of Database Management Systems (DBMS) and ER Diagrams 2. Understand the structure and usage of SQL queries to manage and manipulate data within a relational database system. 3. Explore transaction processing, including the principles of concurrency control and ensuring data integrity in multi-user environments. 4. learn about NoSQL databases, with a focus on MongoDB, to address the needs of modern applications requiring scalable and flexible data storage solutions	
Content:		**No of Hours**
Unit - 1	**Introduction**: Characteristics of Database approach, advantages of using the DBMS approach, Three schema architecture, Data Models. **Entity–Relationship Model**: Entity –Relationship Model, Constraints, removing redundant attribute in entity set, Entity-Relationship diagram. **The Relational Model:** Relational model concepts, Constraints, and relational Database schema **Relational Algebra:** Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set theory Binary Relational Operations: JOIN and DIVISION, Aggregate functions, and Grouping	**12**
Unit - 2	**Extended ER Model:** Reduction to relational schema, Extended-ER features. **Basic SQL:** SQL Data Definition and Data Types, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, INSERT, DELETE and UPDATE statements in SQL. **More SQL**: Complex Queries, Nested Queries, Aggregate Operators, Views, Specifying Constraints as Assertions and Actions as Triggers. **Relational Database Design:** Informal design guidelines for relational schemas, Functional dependencies, Normal forms: 1NF, 2NF, 3NF, BCNF.	**11**
Unit-3	**Transaction processing concepts:** Concepts of transaction processing, ACID properties, characterizing schedules based on	**11**

	recoverability, characterizing schedules based on serializability. Concurrency Control: Two phase locking technique for concurrency control, concurrency control based on timestamp ordering, Multiversion concurrency control technique, validation concurrency control technique.	
Unit-4	**Getting Started with NoSQL**: About NoSQL, Why NoSQL?, SQL versus NoSQL, ACID versus BASE, CAP Theorem **Introduction to different types of NoSQL Databases:** Key−Value Pair Databases, Document Databases, Column-Family Databases, Graph Database **MongoDB:** Introduction, CRUD Operations, Aggregation, Sharding & Replication in MongoD	**11**
Pedagogy:	Interactive, reflective, and inquiry-based methods, with a strong emphasis on critical thinking and problem-solving skills	
References/ Readings:	**Text Books** 1. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson Education, 2018, ISBN: 9788131716250 2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, 6th Edition, McGraw Hill Education, 2013, ISBN: 9789332901384 **Reference Books** 1. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw-Hill, 2002, ISBN: 9780072465631 2. Seema Acharya, Demystify NoSQL, Wiley, 2019, ISBN: 9788126579969 3. Manu Sharma, MongoDB Complete Guide, BPB Publications, 2021, ISBN: 978938989886	
Course Outcomes:	**Upon completion of the course, students will be able to:** CO 1. Define and explain the fundamentals of data models and represent database systems using ER diagrams. CO 2. Construct SQL queries and apply normalization techniques in database applications. CO 3. Analyze and implement transaction processing and concurrency control mechanisms for database problems. CO 4. Evaluate the differences between advanced schema-less databases and traditional databases.	

Name of the Programme : **B.E Electronics and Computer Engineering**
Course Code : **ECM-205**
Title of the Course : **Database Management Systems Lab**
Number of Credits : **1**
Effective from AY : **2024-25**

Prerequisites for the Course:	Basic Programming skills	
Course Objectives:	The subject aims to provide the student with: 1. Understanding of fundamental database concepts and the underlying concepts of database Technology. 2. Strong practice in SQL programming through a variety of database problems 3. To demonstrate the use of integrity constraints 4. The fundamental knowledge of MongoDB	
Content:		**No of Hours**
	1. Study of Data Definition Language (DDL) statements 2. Study of Data Manipulation Language (DML) statements 3. Use of SELECT command with various clauses 4. Use of GROUP BY with aggregate functions (AVG, COUNT, MAX, MIN, SUM) 5. Implementation of Integrity Constraints (PRIMARY KEY, FOREIGN KEY, etc.) 6. Use of SET OPERATORS (UNION, INTERSECT, MINUS) 7. Study of various types of JOINS (INNER, LEFT, RIGHT, FULL) 8. Creation and usage of SQL Views 9. Implementation of Triggers in SQL 10. Study of basic MongoDB operations (Insert, Find, Update, Delete) 11. Implement a MongoDB database and perform CRUD operations 12. Mini Project – Develop a database application with front-end and back-end integration	**30**
Pedagogy:	Integration of instructional learning, constructive thinking, inquiry-based, collaborative, experiential, and problem-solving approaches.	
References/ Readings:	**Text Books** 1. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson Education, 2018, ISBN: 9788131716250 2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, 6th Edition, McGraw Hill Education, 2013, ISBN: 9789332901384 **Reference Books** 1. Shakuntala Gupta Edward, Navin Sabharwal, Practical MongoDB: Architecting, Developing, and Administering MongoDB, 1st Edition,	

	Apress, 2015, ISBN: 9781484206485 2. Manu Sharma, MongoDB Complete Guide, BPB Publications, 2021, ISBN: 978938989886
Course Outcomes:	**Upon completion of the course, students will be able to:** CO 1. Apply the basics of SQL and construct queries using SQL CO 2. Formulate queries using various SQL clauses. CO 3. Implement the various types of joins, Views, Triggers. CO 4. Implement basic MongoDB operations.

Name of the Programme : **B.E. in Electronics and Computer Engineering**
Course code : **ECM-206**
Title of the course : **Microcontrollers and Interfacing**
Number of Credits : **3**
Effective from AY : **2024-25**

Pre-requisites for the Course:	Digital Electronics	
Course Objectives:	The subject aims to provide the student with: 1. An understanding the basic architecture and operation of 8051 microcontroller. 2. Knowledge about assembly language and embedded C programs of 8051 microcontroller. 3. An understanding the importance of different peripheral devices & their interfacing to 8051 microcontroller. 4. An ability to design real world applications using microcontroller.	
Contents:		**No of Hours**
Unit-1	**Microcontrollers**-Comparison between microcontroller and microprocessor, criteria for choosing microcontroller, 8051 Architecture, Input Output pins, ports and circuits, Internal RAM Organization and Stack, External memory access, Counters and Timers, Serial Communication, Interrupts.	**10**
Unit-2	**Assembly Language Programming** – 8051 data types and directives, Instructions for moving data, arithmetic and logic instructions, rotate instructions, Jump and Call instructions, I/O Port Programming, addressing modes, Instructions used to access memory. Bit addressable instructions.	**12**
Unit-3	**8051 Programming in C** – Data types, Creating time delays in C, Timer Programming, Counter Programming, Serial Communication Programming, Interrupt programming.	**10**
Unit-4	**Interfacing and Programming in C**- External memory interfacing, LED and Switch interfacing. Seven segment LED interfacing, LCD interfacing, Matrix Keyboard Interfacing, Stepper motor Interfacing.	**13**
Pedagogy:	Interactive, reflective, and inquiry-based methods, with a strong emphasis on critical thinking and problem-solving skills	
References/ Readings:	**Text Books** 1. Kenneth Ayala," 8051 Microcontroller", 3rd Edition, Cengage Learning. 2. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D McKinlay, The 8051 Microcontroller And Embedded Systems Using Assembly And C, 2nd Edition, Pearson . **Reference books**	

	1. Manish K. Patel, The 8051 Microcontroller Based Embedded Systems, McGraw Hill Education (India) Pte. Limited, 2014 2. Shibu K V, Introduction to Embedded Systems; McGraw Hill, 2nd Edition 2017. ISBN-13: 978-9339219680
Course Outcomes:	**Upon completion of the course, students will be able to:** CO 1. Explain the architecture of 8051 microcontroller. CO 2. Analyze the instruction set of 8051 microcontroller and Create assembly level programs using 8051 microcontroller. CO 3. Create embedded C programs using 8051 microcontroller. CO 4. Interface the hardware with 8051 microcontroller for given applications.

Name of the Programme : **B.E. in Electronics and Computer Engineering**
Course code : **ECM-207**
Title of the course : **Microcontrollers and Interfacing Lab**
Number of Credits : **1**
Effective from AY : **2024-25**

Pre-requisites for the Course:	Digital Electronics	
Course Objectives:	The subject aims to provide the student with: 1. Ability to develop assembly language programming skills in students. 2. Ability to write 8051 Assembly level programs using 8051 instruction set. 3. Ability to write embedded C programs using 8051. 4. Ability to interface peripherals with 8051	
Contents:	**List of programs/ Experiments**	**No of Hours**
	1. Assembly language program for block transfer of memory 2. Assembly program to find largest and smallest from a set of numbers in memory 3. Assembly program to arrange the numbers in ascending and descending order 4. Interfacing of LEDs/LCDs and Switches to 8051 5. Interfacing of seven segment display to 8051. 6. Interfacing of DC, Stepper and Servo Motor to 8051 7. Measurement of pulse width using timers of 8051 8. Interfacing of ADC and DAC with 8051 9. Implementation of hardware interrupt using simple switch and led Serial port programming 10. Microcontroller based Mini Project.	**30**
Pedagogy:	Integration of instructional learning, constructive thinking, inquiry-based, collaborative, experiential, and problem-solving approaches.	
References/ Readings:	**Text Books** 1. Kenneth Ayala, The 8051 Microcontroller, 3rd Edition, Cengage Learning, 2007, ISBN: 9788131502006 2. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, The 8051 Microcontroller and Embedded Systems Using Assembly and C, 2nd Edition, Pearson Education, 2005, ISBN: 9780131194021 **Reference book** 1. Manish K. Patel, The 8051 Microcontroller Based Embedded Systems, McGraw Hill Education (India) pvt Limited, 2014, ISBN: 9781259029752 2. Shibu K V, Introduction to Embedded Systems; McGraw Hill, 2nd Edition 2017. ISBN-13: 978-9339219680	

Course Outcomes:	**Upon completion of the course, students will be able to:** CO 1. Write assembly language programming and use of simulation tool. CO 2. Write assembly language programs using data movement, arithmetic and logical instructions. CO 3. Write embedded C programs using 8051 microcontroller. CO 4. Interface different peripherals with 8051.

Name of the Programme : **B.E. in Electronics and Computer Engineering**
Course code : **ECM-208**
Title of the course : **Engineering Mathematics-III**
Number of Credits : **4**
Effective from AY : **2024-25**

Pre-requisites for the Course:	Basic knowledge of Mathematics	
Course Objectives:	The course will enable the students to: 1. Analyze data using descriptive statistics and visual tools. 2. Apply discrete and continuous distributions to compute statistical measures. 3. Conduct point/interval estimation and hypothesis tests across sample sizes. 4. Use linear regression to model relationships and predict outcomes.	
Contents:		**No of Hours**
Unit - 1	**Descriptive Statistics**: Type of data, data collection techniques, Quantitative methods for analysis: Mean, Median, Mode (Empirical formula), Range, Quartiles, Interquartile range, Variance and Standard - deviation, Coefficient of variation, Frequency Distribution and Histogram, Box plot, Scatter diagram.	**10**
Unit - 2	**Elements of Probability Theory**: Sample space & event, Axioms of Probability, Conditional Probability, Bayes' theorem. **Random Variables**: Definition of a random variable, Cumulative distribution function Continuous and Discrete random variables, probability mass function and probability density function, functions of random variables, moment generating function. **Special Distributions**: Bernoulli, Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions, computation of mean, variance, standard deviation and quartiles, application to numerical problems.	**14**
Unit - 3	**Sampling Theory:** Population & Sampling, standard error, Sampling distribution of Mean (σ known and unknown), Sampling distribution of variance, Point Estimation and Interval Estimation, Alternative and Null Hypotheses, Tests of Hypotheses - one sided and two-sided Hypotheses, Type I and Type II errors. **Test of Hypotheses for large samples**: Test of Hypotheses on single mean and difference of Mean, Test of hypothesis on single proportion and difference of proportions.	**10**
Unit - 4	**Test of hypothesis for small sample**: T-test for single mean and difference of means (equal variances), Chi-square test for Variance and Independence of Attributes, F-test for difference of Variances. **Regression Analysis:** Method of least squares, Linear regression, correlation coefficient of determination.	**11**

Pedagogy:	Interactive, reflective, and inquiry-based methods, with a strong emphasis on critical thinking and problem-solving skills
Instruction	One or more assignments to be carried out on topics covered in each unit above- Total time allotted for tutorials is 15 Hours.
References/ Readings:	**Textbooks:** 1. Douglas C. Montgomery George C. Runger, Applied Statistics and Probability for Engineers, 6th Edition, Wiley India Pvt. Ltd., 2017. 2. Richard A. Johnson, Irwin Miller, John Freund, Miller and Freund's Probability and Statistics for Engineers, 9th Edition, Pearson Education India, 2017. **Reference Books** 1. Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, 6th Edition, Academic Press, 2021.
Course Outcomes:	**Upon completion of the course, students will be able to:** CO 1. Apply descriptive statistics and visualizations (mean, median, mode, variance; histograms, box plots). CO 2. Apply appropriate probability distributions (Binomial, Poisson, Normal) for computing measures. CO 3. Perform point/interval estimation and hypothesis testing for any sample size. CO 4. Analyze relationships and predict outcomes using linear regression.

Name of the Programme : **B.E Electronics and Computer Engineering**
Course Code : **ECM-225**
Title of the Course : **Computer Graphics**
Number of Credits : **3**
Effective from AY : **2024-25**

Prerequisites for the Course:	Knowledge of Basic Mathematics	
Course Objectives:	The subject aims to provide the student with: 1. An introduction to fundamental concepts and theory of Computer Graphics. 2. Knowledge about computer graphics hardware and software used. 3. An understanding of drawing algorithms, polygon filling, clipping and transformation both in 2D and 3D graphics. 4. Ability to understand methods used in modelling motion in the virtual world.	
Content:		**No of Hours**
Unit-1	**Overview of graphics systems:** Raster scans systems, Random scan systems. **Output Primitives:** Points and lines, Line drawing algorithms, DDA, Bresenham's line algorithm, Circle generating algorithms, Properties of circles, Midpoint circle algorithm, Ellipse generating algorithm, Properties of Ellipses, Midpoint ellipse algorithm. **Filled area primitives:** Scan line polygon Fill algorithm, Inside – outside tests, Scan line fill of curved boundary, Boundary fill algorithm, Flood fill algorithm, Fill area functions.	**12**
Unit-2	**Two Dimensional Geometric Transformations:** Basic Transformations, Translation, Rotation, Scaling, Composite transformation: Translations, Rotations, Scaling, Other transformations- Reflection, Shear. **Two-Dimensional Viewing:** The viewing pipeline, Viewing coordinate reference frame, Window to viewport coordinate transformation, 2-D viewing functions. **Clipping operations:** Point Clipping, Line clipping, Cohen-Sutherland Line Clipping, Polygon Clipping, Sutherland Hodgeman Polygon clipping, Weiler-Atherton Polygon Clipping, Curve clipping, Text clipping.	**11**
Unit-3	**Three Dimensional Concepts:** 3-Dimensional display methods, Parallel projections, Perspective projection, Depth cueing, Surface rendering, Exploded and cutaway views. **Three-Dimensional Object representations:** Polygon surfaces, Polygon tables. **Three Dimensional Geometric and Modeling transformations:** Translation Rotation, Coordinate Axes, rotations, Scaling,	**11**

	Reflections, Shears **Curves and surfaces:** Shape description requirements, Parametric functions, Bezier methods, B-Spline methods.	
Unit- 4	**Visible surface detection algorithms:** Back – Face detection, Depth buffer method, A – Buffer method, Scan – Line method, Depth Sorting method, BSP- Tree method, Area Sub-division method. **Color Models and Color Applications:** Properties of light, Standard primaries, Chromaticity Diagram, XYZ Color model, CIE Chromaticity Diagram, RGB color model, YIQ Color Model, CMY Color Model, HSV Color Model, HLS Color Model. **Computer Animation:** Design of animation sequences, General computer animation functions, Raster Animations, Motion specification, Direct motion specification, Goal directed systems Kinematics and dynamics.	**11**
Pedagogy:	Interactive, reflective, and inquiry-based methods, with a strong emphasis on critical thinking and problem-solving skills	
References/ Readings:	**TEXTBOOKS:** 1. Donald Hearn, M. P. Baker, Computer Graphics, 2nd Edition; Prentice Hall of India Pvt. Ltd. 1999. ISBN-10: 8120309448 2. William Newman, Robert Sproull, Principles of Interactive Graphics, 2nd Edition, Tata McGraw hill publishing company Ltd.1979. ISBN-10: 0070463387 **REFERENCES**: 1. Rajiv Chopra, Computer Graphics: A Practical Approach, S. Chand publications, Revised Edition. ISBN-13: 978-8121935814 2. N. Krishnamurthy, "Introduction to Computer Graphics", Tata McGraw Hill. ISBN-13: 978-0070435360 3. Steven Harrington, Computer Graphics: A Programming Approach, 2nd Edition, Tata McGraw Hill. ISBN-13: 978-0071004725 4. Foley, Van Dam, Feiner, Hughes, "Computer Graphics: Principles and Practice", 2nd Edition, Addison- Wesley Publishing Company, 1997. ISBN-13: 978-0201848403	
Course Outcomes:	**Upon completion of the course, students will be able to:** CO 1. Identify and apply various graphic primitives used in generating computer graphics. CO 2. Illustrate and Apply techniques of 2d and 3d transformation and clipping used in graphical applications. CO 3. Analyse the basics of curves and surfaces used to represent graphical models. CO 4. Analyse techniques involved in visible surface detection, color models and computer animation.	

Name of the Programme : **B.E Electronics and Computer Engineering**
Course Code : **ECM-226**
Title of the Course : **Computer Graphics Lab**
Number of Credits : **01**
Effective from AY : **2024-25**

Prerequisites for the Course:	Knowledge of Programming like C, C++ and Basic Mathematics	
Course Objectives:	The subject aims to provide students with: 1. An introduction to the fundamental practical concepts of Computer Graphics. 2. Knowledge of computer graphics hardware and software. 3. The ability to develop effective programs to solve graphics programming challenges, including rendering different shapes. 4. Ability to implement methods used in modelling motion in the real world.	
Content:	**List of Programs /Experiments *(Following experiments should be conducted. A certified journal reporting the experiments conducted should be submitted at the end of the term)***	**No of Hours**
	1. Implement the Digital Differential Analyzer (DDA) Line Drawing Algorithm 2. Implement Bresenham's Line Drawing Algorithm 3. Implement the Midpoint Circle Generation Algorithm 4. Display Text in Various Sizes, Colors, and Fonts Using Graphics Functions 5. Create Simple 2D Shapes (House, Car, Fish, or Human) Using Basic Primitives 6. Implement Basic 2D Transformations: Translation, Scaling, Rotation, Shearing, and Reflection 7. Implement Flood Fill Algorithm to Fill a Closed Shape with Color 8. Implement the Scanline Polygon Fill Algorithm 9. Implement Cohen-Sutherland Line Clipping Algorithm 10. Implement Bézier Curve Generation Using Control Points	**30**
Pedagogy:	Interactive, reflective, and inquiry-based methods, with a strong emphasis on critical thinking and problem-solving skills	
References/ Readings:	**TEXTBOOKS:** 1. Donald Hearn, M. P. Baker, Computer Graphics, 2nd Edition; Prentice Hall of India Pvt. Ltd. 1999. 2. William Newman, Robert Sproull, Principles of Interactive Graphics, 2nd Edition, Tata McGraw hill publishing company Ltd.1979. **REFERENCES**: 1. Er. Rajiv Chopra, Computer Graphics (A Practical Approach), S. Chand publications, Revised Edition.	

	2. N. Krishnamurthy, Introduction to Computer Graphics, Tata McGraw Hill 3. Steven Harrington, Computer Graphics, 2nd Edition, Tata McGraw Hill. 4. Foley, Van Dam, Feiner, Hughes, Computer Graphics: Principles and Practice, 2nd Edition, Addison- Wesley Publishing Company, 1997
Course Outcomes:	**Upon completion of the course, students will be able to:** CO 1. Implement Line drawing algorithm, circle generating algorithm and ellipse generating algorithm. CO 2. Apply clipping and filling techniques for modifying an object. CO 3. Implement programs that demonstrate geometrical transformations. CO 4. Implement curves, colour modelling and animation.

Name of the Programme : **B.E Electronics and Computer Engineering**
Course Code : **ECM-227**
Title of the Course : **Introduction to Artificial Intelligence**
Number of Credits : **3**
Effective from AY : **2024-25**

Pre-requisites for the Course:	Logic Theory, Probability Theory, Numerical Analysis, Operations on Matrices	
Course Objectives:	**This course aims to provide the students with:** 1. An Introduction to AI Techniques for solving real world problems. 2. An Understanding of search strategies, planning, logic and knowledge representation in AI. 3. An Introduction to Game playing and Learning methods in AI. 4. The fundamentals of Machine Learning techniques and its applications.	
Content		**No of hours**
Unit - 1	**Introduction:** Definition, Defining a Problem, Problem Solving approach to typical AI problems, Characteristics and types of Intelligent Agents. **State Space Search:** Breadth First Search, Depth First Search, Depth Bounded DFS (DBDFS), Depth First Iterative Deepening (DFID). **Heuristic Search:** Heuristic Functions, Best First Search, Hill Climbing, Variable Neighbourhood Descent. **Optimal Search:** A* algorithm, Iterative Deepening A*.	**12**
Unit - 2	**Problem Decomposition:** Goal Trees, Rule Based Systems, Rule Based Expert Systems **Planning:** The STRIPS Domain, Forward and Backward State Space Planning, Goal Stack Planning, Plan Space Planning **Constraint Satisfaction:** N-Queens, Constraint Propagation. **Game Playing:** Mini-Max Search Procedure, Alpha-Beta Pruning.	**12**
Unit - 3	**Logic and Inferences:** Formal Logic, Propositional Logic, Resolution method in Propositional Logic, First Order Logic, Resolution Refutation in FOL, Forward & Backward Chaining. **Knowledge Representation:** Frames, Semantic Nets.	**11**
Unit - 4	**Learning:** Introduction, Types of Learning: Rote Learning, Learning by taking advice, Learning by Induction **Machine Learning:** Supervised and Unsupervised Learning, Naïve Bayes Classifiers, Decision Trees, The K-Means Clustering Algorithm.	**10**
Pedagogy:	Interactive, reflective, and inquiry-based methods, with a strong emphasis on critical thinking and problem-solving skills	

References/ Readings:	**Textbooks:** 1. Deepak Khemani, A First Course in Artificial Intelligence, 1st Edition, McGraw Hill Education (India), 2013, ISBN: 9781259029981 2. Ela Kumar, Artificial Intelligence, 1st Edition, I.K. International Publishing House Pvt. Ltd., 2008, ISBN: 9788189866615 3. Elaine Rich, Kevin Knight, Nair, Artificial Intelligence, 3rd Edition, Tata McGraw-Hill, 2010, ISBN: 9780070087705 4. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson Education, 2009, ISBN: 9780136042594 **Reference Books:** 1. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, 1st Edition, Morgan Kaufmann Publishers Inc., 1998, ISBN: 9781558604674 2. Patrick Henry Winston, Artificial Intelligence, 3rd Edition, Pearson Education, 2004, ISBN: 9788131715055
Course Outcomes:	**After taking this course, student will be able to:** CO 1. Discuss the structure of an AI problem and apply various problem solving methods to solve related problems CO 2. Describe the concept of Learning and analyse the suitability of Machine Learning Algorithms for any application. CO 3. Apply concepts of planning, constraint satisfaction and game playing to solve AI problems. CO 4. Develop solutions to AI problems using logic, frames and semantic nets.

Name of the Programme : **B.E Electronics and Computer Engineering**
Course Code : **ECM-228**
Title of the Course : **Introduction to Artificial Intelligence Lab**
Number of Credits : **01**
Effective from AY : **2024-25**

Prerequisites for the Course:	Basic Mathematics for AI, Knowledge of programming in Python.	
Course Objectives:	The subject aims to provide students with: 1. The ability to implement fundamental AI search techniques. 2. The ability to develop problem-solving strategies for game-playing AI. 3. Hands-on experience with machine learning techniques. 4. The ability to design and implement AI-based solutions in Python.	
Content:	**List of Programs /Experiments *(Following experiments should be conducted. A certified journal reporting the experiments conducted should be submitted at the end of the term)***	**No of Hours**
	1. Implementation of Breadth First Search algorithm. 2. Implementation of Depth First Search algorithm. 3. Implementation of Hill Climbing Algorithm. 4. Implementation of A* Search algorithm. 5. Implementation of 8 puzzle problem. 6. Implementation of N- Queens problem. 7. Implementation of 2-gallon and 3-gallon water jug problems. 8. Implementation of Alpha-Beta Pruning for game playing. 9. Implementation of Tower of Hanoi puzzle using recursion. 10. Implementation of Tic – Tac – Toe game using Minimax algorithm. 11. Implementation of Decision tree based ID3 algorithm for a given dataset. 12. Implementation of Naive Bayes Classifier. 13. Implementation of K-means clustering algorithm.	**30**
Pedagogy:	Integration of instructional learning, constructive thinking, inquiry-based, collaborative, experiential, and problem-solving approaches.	
References/ Readings:	**Textbooks:** 1. Deepak Khemani, A First Course in Artificial Intelligence, 1st Edition, McGraw Hill Education (India), 2013, ISBN: 9781259029981 2. Ela Kumar, Artificial Intelligence, 1st Edition, I.K. International Publishing House Pvt. Ltd., 2008, ISBN: 9788189866615 3. Elaine Rich, Kevin Knight, Shivashankar B. Nair, Artificial Intelligence, 3rd Edition, Tata McGraw-Hill, 2010, ISBN: 9780070087705 4. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson Education, 2003, ISBN: 9780136042594	

	Reference Books: 1. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, 1st Edition, Morgan Kaufmann Publishers Inc., 1998, ISBN: 9781558604674. 2. Patrick Henry Winston, Artificial Intelligence, 3rd Edition, Pearson Education, 2004, ISBN: 9788131715055
Course Outcomes:	**Upon completion of the course, students will be able to:** CO 1. Implement fundamental Search Algorithms in AI. CO 2. Implement Game Playing and Optimization Strategies. CO 3. Apply AI techniques to analyze and solve problems CO 4. Develop Machine Learning Models for Classification and Clustering.