माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर
MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
Deemed to be University
(Declared under Distinct Category by Ministry of Education, Government of India)
NAAC ACCREDITED WITH A++ Grade
Gola Ka Mandir, Gwalior (M.P.)- 474005, INDIA
Ph.:+91-751-2409300, E-mail: director@mitsgwalior.in, Website: www.mitsgwalior.in

Department of Engineering Mathematics and Computing 2025

B. Tech. (First Semester)
Introduction to Computing
25251101

Course Objectives:

- Explain the needs of hardware and software required for a computation task.
- State typical provisions of cyber law that govern the proper usage of Internet and computing resources.
- Explain the working of important application software and their use to perform any engineering activity.
- Understand the Importance of Operating system & its requirement.

UNIT I - Introduction to Computer Systems: Definition, Classification, Organization i.e. CPU, register, Bus architecture, Instruction set, Memory & Storage Systems, I/O Devices, and System & Application Software, Operating System: Definition, Function, Types, Management of File, Process & Memory.

UNIT II - Mathematical Foundations of Computer Sciences: logic, predicates, quantifiers, truth tables, Propositional and predicate logic in programming, Applications of sets and relations in computer engineering - decision problems, data analysis and algorithm design.

UNIT III - Computational Thinking and Mathematical Modeling: Mathematical modeling of real-world computing problems, Complexity, growth of functions, and algorithm analysis, Graph models for networks, social networks, and routing, Case studies: Cryptography, Blockchain, Internet Traffic Modeling.

UNIT IV - Computers & Mathematical Computing: Compression (JPEG), error correction (parity), Modular arithmetic and RSA encryption (simple overview), Bitmaps and image representation, Mathematical modeling of real-world signals and data.

UNIT V - Advancements in Engineering Mathematics & Computing: Mathematical foundation of LLMs, Geometric Deep Learning, Explainable AI, Quantum algorithms, quantum error correction codes and quantum-safe cryptographic protocols

CO's	Description of CO's
CO1	*Identify* and *describe* the hardware, software, and operating system components of computer systems.
CO2	Apply discrete mathematical structures to logic-based and decision-based computing systems.
CO3	Analyze computational models using mathematical tools to solve real-world engineering problems.
CO4	Analyse how mathematical transformations power real-world computing tools.
CO5	Interpret recent advancements in Engineering Mathematics and Computing

RECOMMENDED BOOKS:

1. "Structured Computer Organization" by Andrew S. Tanenbaum.
2. "Discrete Mathematics and Its Applications" by Kenneth H. Rosen.
3. "Computational Thinking for the Modern Problem Solver" by David D. Riley and Kenny A. Hunt.
4. "The Science of Digital Media" by Jennifer Burg.
5. "Understanding Cryptography" by Christof Paar and Jan Pelzl

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	2	1	1	1	1	1	1	1	2	2
CO2	3	3	2	1	2	2	1	1	1	1	1	1	2	2
CO3	3	3	3	2	2	3	1	1	1	1	1	2	2	2
CO4	2	3	2	2	3	3	1	1	1	1	1	2	2	2
CO5	2	2	1	1	3	2	1	1	1	1	1	2	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

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Department of Engineering Mathematics and Computing

2025

B. Tech. (First Semester)

Computer Programming

25251102

Objective of Course:

- To develop ability to write a computer program to solve specified problems.
- To develop skills in algorithmic problem-solving, expressed in a programming language like C++.
- To understand fundamentals of programming such as variables, conditional and iterative statement, function and its execution etc.
- To introduce students to modern programming tools and platforms, online coding environments, and IDEs for effective software development.

Unit I: Introduction to Programming: Machine Level Languages, Assembly Level Languages, High Level Languages, Program, Program Execution & Translation Process, Problem solving using Algorithms and Flowcharts. Introduction to C++ Programming: Data Types, Constants, Keywords, Operators & Expressions, Precedence of operators and input/output functions.

Unit II: Control Statements and Decision Making: The if statement, The if-else statement, Nesting of if statements, The conditional expression, The switch statement, The while loop, The do…while loop, The for loop, The nesting of for loops, The break and continue statement.

Unit III: Arrays, Strings & Pointers: One Dimensional Array, 2D array, Passing Array to Functions, Multidimensional Array, Strings, Basics of Pointers & Addresses, type of pointers, Application of pointers, Pointer to Pointer, Pointer to Array, Array of Pointers, and Pointer to Strings.

Unit IV: Functions & Structures and File Handling: Function, Function Prototypes, Passing Parameter by Value and by Reference, Passing String & Array to Function, Function Returning Address, Recursion, Structures, Dynamic Memory Allocation by Call of Function, Storage Classes. Defining and Opening a File, Closing Files, Input/output Operations on Files, Predefined Streams, Error Handling during I/O Operations, Command Line Arguments, Pre-processor Directives, Formatted I/O.

Unit V: Emerging Trends in Programming: Use of modern IDEs like Visual Studio Code and Code::Blocks, Basic use of Git and GitHub – creating and managing repositories; committing, pushing, and pulling code, using GitHub for collaboration and code sharing. Introduction to online coding platforms (e.g., HackerRank, LeetCode and Codeforces).

Course Outcomes

CO's	Description of CO's
CO1	Explain basic programming terms, syntax, algorithm and flow chart.
CO2	Solve computational problems using decision control and loops
CO3	Design a program using the concept of array, pointer and functions
CO4	Choose appropriate Functions & Structures and file handling operations to work efficiently with files.
CO5	Use modern programming tools and techniques to write efficient programs and share.

Reference Books

1. E. Balagurusamy, "Programming in ANSI C++", Sevenths Edition, Tata McGraw Hill, 2017.
2. Reema Thareja, "Programming in C++", Second Edition, Oxford publication, 2016.
3. W. Kernighan and Dennis M. Ritchie, "The C/C++ Programming Language", Pearson, 2015.
4. E. Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill, 2009.
5. B.S. Gottfried, "Programming with C++", 3rd edition, Tata McGraw Hill, 2018.
6. Abhiram G. Ranade, "An Introduction to Programming through C++", McGraw Hill Education.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	1	1	1	1	2	1	2	1	2
CO2	2	2	2	1	1	1	1	1	1	2	1	2	1	2
CO3	2	1	3	2	1	1	1	1	1	2	1	2	1	2
CO4	2	3	3	1	1	1	1	1	1	2	1	2	1	2
CO5	2	1	3	1	1	1	1	1	1	2	1	2	1	2

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Department of Engineering Mathematics and Computing

2025

B. Tech. (First Semester)

Advanced Calculus

25251103

Objective of Course

- To understand the basic concepts of differential calculus
- To explore the applications of derivatives
- To familiarize the integral calculus
- To describe multiple integral
- To understand the concepts of Convergence and divergence

Unit I: Maclaurins's and Taylor's theorem, Partial differentiation, Euler's theorem, Tangent and Normal, Maxima and Minima of one and two variables,

Unit II: Jacobian, Rolle's Theorem, First mean value theorem, Second mean value theorem, Curvature, radius of curvature, Asymptotes of Cartesian and Polar forms.

Unit III: Definite integral as limit of a sum, application in summation of series, Improper integral, Beta and Gamma function and its properties, some transformation of Beta function, some transformations of Gama function, relation between Beta and Gama function, Legendre's duplication formula

Unit IV: Multiple integral and their applications, Double and Triple integral, Change of order of integration, Length of the curves, Volumes and Surfaces of solids of revolution.

Unit V: Application based on multiple integrals: Pappus theorem, Dirichlet's theorem, Liouville's theorem for multiple integrals Concept of convergence and divergence, Basic test of convergence for sequence and series, P-Series test, Ratio test, Comparison test, Integral test, Cauchy's root test

Course Outcomes

CO's	Description of CO's
CO1	Determine the solution of function by using one and two variables.
CO2	Interpret the solution of derivatives concepts using different techniques
CO3	Acquire the knowledge of integral calculus
CO4	Obtain the volume and area of surface by using multiple integrals
CO5	Evaluate the Gamma and Beta Function

Recommended Books:

1. E. Kreyszig: Advance Engineering Mathematics, John Wiley & Sons, 10th Edition (2011).
2. R. K. Jain, S. R. K. Iyengar: Advance Engineering Mathematics ,Narosa Publishing House Pvt. Ltd, 5th Edition (2016).
3. F. B .Hildebrand: Advanced Calculus for application, Englewood Cliffs, N. J. Prentice- Hall, 2nd Edition (1980).
4. B. S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Edition (2015).
5. B.V. Ramanna: Higher Engineering Mathematics, McGraw Hill Education, 1st Edition (2017).

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	1	1	1	1	1	1	3	2	1
CO2	3	3	3	3	3	1	1	1	1	1	1	3	3	1
CO3	3	3	3	3	3	1	1	1	1	1	1	3	2	1
CO4	3	3	3	3	3	1	1	1	1	1	1	3	3	2
CO5	3	3	3	3	3	1	1	1	1	1	1	3	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Department of Engineering Mathematics and Computing

2025

B. Tech. (First Semester)

Digital Logic Design

25251104

Course Objectives

- To familiarize with number representation and conversion between various representations in digital electronic circuits.
- To expose the logical operations using combinational logic circuits, sequential logic circuits and the characteristics of memory and their classification.

Unit I: Introduction to Digital Electronics, Needs and Significance, Different Number System: Binary, Decimal, Octal and Hexadecimal Numbers, Conversions, Complement's, Signed Binary Numbers, Binary Arithmetic's, Binary Codes: BCD, ASCII Codes.

Unit II: Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Boolean Relations, Digital Logic Gates, De Morgan's Theorem, Karnaugh Maps and simplifications.

Unit III: Combinational Circuits, Half Adder, Full Adder, Binary Adder-Subtractor, Comparator, Decoders, Encoders, Multiplexers.

Unit IV: Sequential Circuits, Latches, Flip-Flops: RS Latches, Level Clocking, D Latches, Edge-Triggered D Flip-flop, Edge-Triggered JK Flip-flop, JK Master-Slave Flip-flop; Registers, Shift Registers, Counters, Ripple Counters, Synchronous Counters. Memory Systems – RAM, ROM, Programmable Devices: Programmable Logic Array (PLA), Programmable Array Logic (PAL).

Unit V: Introduction to HDL, Practical - Implementation of digital circuits and HDL implementations.

Recommended Books

1. Fundamentals of Digital Logic Design by Charles H. Roth, Jr. Cengage, 7th Edition.
2. Digital Design, Morris Mano M. and Michael D. Ciletti, Pearson Education, 6th Edition.
3. Digital Electronics: Principles, Devices and Applications, Anil K. Maini, Wiley.

Course Outcomes

After completion of the course students would be able to:

CO1. explain different number systems and conversion among them and codes.
CO2. simplify the logic expressions using Boolean laws, and map methods and design them by using logic gates.
CO3. develop the understanding of combinational circuits and design them.
CO4. analyze different types of flip-flops and design a sequential logic circuit.
CO5. design various circuits using the HDL.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	1	1	1	1	1	1	1	2	1	2	1	2
CO2	2	2	2	1	1	1	1	1	1	2	1	2	1	2
CO3	2	1	3	1	1	1	1	1	1	2	1	2	2	2
CO4	2	3	3	1	1	1	1	1	1	2	1	2	1	1
CO5	2	1	1	1	1	1	1	1	1	2	1	2	2	1

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Department of Engineering Mathematics and Computing

2025

B. Tech. (First Semester)

Differential Equations

25251105

Course Objective

- To understand the concept of Ordinary differential equations
- To familiarize the solution techniques of ODE of higher order with constant and variable coefficients
- To describe how to form partial differential equation
- To explore various type of partial differential equation and its application

Unit I: Ordinary differential equations of first and higher order, Differential equations in which variables are separable, Homogeneous differential equations, Differential equation reducible to homogeneous form (Non-homogeneous differentialof first degree), linear differential equation (Leibnitz's linear differential equation), Bernoulli's equation of differential equation reducible to linear form, exact differential equations.

Unit II: Linear higher order differential equation with constant coefficients, Homogeneous linear equations or Cauchy's Euler's equations, Solution of simultaneous differential equations.

Unit III: Second order differential equations with variable coefficients, Methods: one integral is known, Removable of first derivative, changing of independent variable and variation of parameters, Solution of Differential equation by Series Solution method.

Unit IV: Introduction of partial differential equation, Formulation of partial differential equation, Linear Partial differential equations of first order and solution techniques Lagrange's method, and Non-Linear Partial differential equations of first order and standard form I, II, III &IV and Charpit's method.

Unit V: Partial differential equations of higher order with constant coefficients, Homogeneous and Non-Homogeneous Linear Partial differential equations, Classification of Partial differential equations, Application of Partial differential equations to solve wave equation and heat equation (one-dimensional) by Separation of variables method.

Course Outcomes

After completing this course, the students will be able to:

CO's	Description of CO's
CO1	Determine the analytic solution of ordinary differential equations
CO2	Interpretthesolutionofordinarydifferentialequationswithconstantandvariable coefficients
CO3	Acquire the knowledge of second and higher order differential equation
CO4	Formulate the Partial differential equations
CO5	Evaluate the Partial differential equations of higher order with its application

Recommended Books:

1. E. Kreyszig: AdvanceEngineeringMathematics,JohnWiley&Sons,10th Edition(2011).
2. R.K. Jain, S.R.K. Iyengar: AdvanceEngineeringMathematics,NarosaPublishingHousePvt.Ltd.,5thEdition(2016).
3. B.S.Grewal:HigherEngineeringMathematics,KhannaPublisher,43rd Edition(2015).
4. H. K. Dass: Advance Engineering Mathematics, S. Chand Publisher(2018).
5. B.V.Ramanna: Higher Engineering Mathematics ,McGrawHillEducation,1st Edition(2017).

Course Articulation Matrix

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CO2	3	3	3	3	3	1	1	1	1	1	1	3	2	2
CO3	3	3	3	3	3	1	1	1	1	1	1	3	3	2
CO4	3	3	3	3	3	1	1	1	1	1	1	3	2	1
CO5	3	3	3	3	3	1	1	1	1	1	1	3	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially