

## Department of Computer Science & Engineering

### Vision

To transcend in emerging areas of Computer Science and Engineering by imparting knowledge and practicing evolving technologies so as to prepare individuals who can innovatively serve society and industry for a better world.

### Mission

- To inculcate sound fundamentals in theory and practice of Computer Science.
- To nurture the instinct for problem solving, research and communication skills as an integral component of the education.
- Facilitate collaborative linkages with industry and academia for sustained growth.
- To sow the instinct of ethics and corporate social responsibility among the student community.

### OFFERED PROGRAMMES

Department of Computer Science and Engineering offers three programs that are affiliated to C.S.J.M. University, Kanpur and recognized by AICTE:

- Bachelor of Technology, Degree in Computer Science and Engineering.
- Bachelor of Technology, Degree in Computer Science and Engineering Specialization in Artificial Intelligence
- M. Sc. (two years) Programme, in Computer Science and Engineering.

### Program Outcomes (POs):

PO-1 Engineering Knowledge: Acquire strong fundamental knowledge of computer science and engineering along with mathematics.

PO-2 Programming languages and tools: Possess programming skills in different contemporary programming languages and use different development tools.

PO-3 Problem analysis: Ability to identify, formulate & analyse requirements of a problem

PO-4 Handle complex problems: Develop skills to synthesize research-based knowledge in the design and analysis of data for providing solutions to complex problems.

PO-5 Teamwork: Flexibility to adapt to a team environment. To be able to work as a team leader

PO-6 Ethics: To understand contemporary legal, social & ethical issues in computing.

PO-7 Presentation and Communication: To be able to present and communicate precisely and effectively.

PO-8 Life-long learning: To have passion for acquiring technical advancements in the field of computer science and engineering.

PO-9 Social responsibilities: To apply skills for social causes and work towards sustainable solutions

### Program Specific Outcomes (PSOs)

PSO-1: To be able to understand problem, think of best suitable approach to solve the problem, develop and evaluate effective solutions.

PSO-2: To be able excel in contemporary technologies being adopted by the industry and academia.

PSO-2: To be able to excel in various programming/project competitions and technological challenges laid by professional bodies.

### Course Objectives and Course Outcomes

<p>ISC-S101 Programming in C &amp; UNIX</p>	<p><u>Course Objective:</u></p> <p>The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.</p> <p><u>Course Outcome:</u></p> <p>At the end of the course, a student will be able to:</p> <ul style="list-style-type: none"><li>• Recollect various programming constructs and to develop C programs.</li><li>• Understand the fundamentals of C programming.</li><li>• Choose the right data representation formats based on the requirements of the problem.</li><li>• Implement different Operations on arrays, functions, pointers, structures, unions and files.</li></ul>
<p>CSE-S201 Data Structure</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"><li>• To provide the knowledge of basic data structures and their implementations.</li><li>• To understand importance of data structures in context of writing efficient programs.</li><li>• . To develop skills to apply appropriate data structures in problem solving.</li></ul> <p><u>Course Outcome:</u></p> <p>Upon Completing the Course, Students will able to:</p> <ul style="list-style-type: none"><li>• Learn the basic types for data structure, implementation and application.</li><li>• Know the strength and weakness of different data structures.</li><li>• Use the appropriate data structure in context of solution of given problem.</li><li>• Develop programming skills, which require to solve given problem.</li></ul>

<p>CSE-S202 Digital Electronics &amp; Logic Design</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.</li> <li>• To impart how to design Digital Circuits.</li> </ul> <p><u>Course Outcome:</u></p> <p>At the end of the course, a student will be able to:</p> <ul style="list-style-type: none"> <li>• Convert different type of codes and number systems which are used in digital communication and computer systems.</li> <li>• Employ the codes and number systems converting circuits and Compare different types of logic families which are the basic unit of different types of logic gates in the domain of economy, performance and efficiency.</li> <li>• Analyse different types of digital electronic circuit using various mapping and logical tools and know the techniques to prepare the most simplified circuit using various mapping and mathematical methods.</li> <li>• Design different types of with and without memory element digital electronic circuits for particular operation, within the realm of economic, performance, efficiency, user friendly and environmental constraints.</li> </ul>
<p>CSE-S204 Object Oriented Programming (Using Java)</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• Understand the basic concepts of object-oriented programming and difference between Procedure– Oriented Programming and Object Oriented Programming.</li> <li>• Get a clear understanding of basics of java Programming.</li> <li>• Analyse the concepts of Inheritance, Exception and Packages in java.</li> <li>• Learn how GUI can be designed and developed in Java using Applets and Swings.</li> <li>• Study how to handle events and multi-threaded programming in java.</li> </ul> <p><u>Course Outcome:</u></p> <p>On completion of this course, the students will be able to:</p> <ul style="list-style-type: none"> <li>• Understand the basic concepts of Procedure–Oriented Programming and object-oriented programming.</li> <li>• Achieve the Knowledge of developing simple java programs.</li> <li>• Develop computer programs to solve real world problems.</li> <li>• Design simple GUI interfaces to interact with users, using Applets and swings.</li> <li>• Achieve Knowledge of multi-threading and to comprehend the event-handling techniques.</li> </ul>
<p>CSE-S205 Computer Organization</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• Conceptualize the basics of organizational and architectural issues of a digital computer and Classify and compute the performance of machines, Machine Instructions.</li> <li>• Learn about various data transfer techniques in digital computer and the I/O interfaces.</li> <li>• Estimate the performance of various classes of Memories, build large memories using small memories for better performance and Relate to arithmetic for ALU</li> </ul>

	<p>implementation</p> <ul style="list-style-type: none"> <li>• Understand the basics of hardwired and micro-programmed control of the CPU, pipelined architectures , Hazards and Superscalar Operations.</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Explain the basics of organizational and architectural issues of a digital computer and Classify and compute the performance of machines, Machine Instructions.</li> <li>• Describe various data transfer techniques in digital computer and the I/O interfaces.</li> <li>• Analyse the performance of various classes of Memories, build large memories using small memories for better performance and analyse arithmetic for ALU implementation</li> <li>• Describe the basics of hardwired and micro-programmed control of the CPU, pipelined architectures , Hazards and Superscalar Operations</li> </ul>
<p>CSE-S206 Operating Systems</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• Students will learn how Operating System is Important for Computer System.</li> <li>• To make aware of different types of Operating System and their services.</li> <li>• To learn different process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.</li> <li>• To know virtual memory concepts.</li> <li>• To learn secondary memory management.</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Understands the different services provided by Operating System at different level.</li> <li>• They learn real life applications of Operating System in every field.</li> <li>• Understands the use of different process scheduling algorithm and synchronization techniques to avoid deadlock.</li> <li>• They will learn different memory management techniques like paging, segmentation and demand paging etc..</li> </ul>
<p>CSE-S301 Data Base Management System</p>	<p><u>Course Objective:</u></p> <p>The objective of the course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a DBMS.</p> <p><u>Course Outcome:</u></p> <p>Upon successful completion of this course, students should be able to:</p> <ul style="list-style-type: none"> <li>• Describe the fundamental elements of relational database management systems</li> <li>• Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.</li> <li>• Design ER-models to represent simple database application scenarios</li> <li>• Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.</li> <li>• Improve the database design by normalization.</li> <li>• Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.</li> </ul>

<p>CSE-S302 Design and Analysis of Algorithms</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• To develop proficiency in problem solving and programming.</li> <li>• To be able to carry out the Analysis of various Algorithms for mainly Time and Space Complexity.</li> <li>• To get a good understanding of applications of Data Structures.</li> <li>• To develop a base for advanced study in Computer Science.</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Ability to decide the appropriate data type and data structure for a given problem.</li> <li>• Ability to select the best algorithm to solve a problem by considering various problem characteristics, such as the data size, the type of operations, etc.</li> <li>• Ability to compare algorithms with respect to time and space complexity</li> </ul>
<p>CSE-S303 Microprocessor</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• To introduce students with the architecture and operation of typical microprocessors and microcontrollers.</li> <li>• To familiarize the students with the programming and interfacing of microprocessors and microcontrollers.</li> <li>• To provide strong foundation for designing real world applications using microprocessors and microcontrollers</li> </ul> <p><u>Course Outcome:</u></p> <p>At the end of the course, a student will be able to:</p> <ul style="list-style-type: none"> <li>• Assess and solve basic binary math operations using the microprocessor and explain the microprocessor's and Microcontroller's internal architecture and its operation within the area of manufacturing and performance.</li> <li>• Apply knowledge and demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor and microcontroller.</li> <li>• Compare accepted standards and guidelines to select appropriate Microprocessor (8085) and Microcontroller to meet specified performance requirements.</li> <li>• Analyse assembly language programs; select appropriate assemble into machine a cross assembler utility of a microprocessor and microcontroller.</li> </ul>
<p>CSE-S304 Theory of Computation</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• To understand the concept of machines: finite automata, pushdown automata, linear bounded automata, and Turing machines.</li> <li>• To understand the formal languages and grammars: regular grammar and regular languages, context-free languages and context-free grammar; and introduction to context-sensitive language and context-free grammar, and unrestricted grammar and languages.</li> <li>• To understand the relation between these formal languages, grammars, and machines.</li> <li>• To understand the complexity or difficulty level of problems when solved using these machines.</li> <li>• To understand the concept of algorithm.</li> </ul>

	<p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Design Finite Automata machines for given problems.</li> <li>• Analyze a given Finite Automata machine and find out its Language.</li> <li>• Design Pushdown Automata machine for given CF language(s).</li> <li>• Generate the strings/sentences of a given context-free languages using its grammar.</li> <li>• Design Turing machines for given any computational problem.</li> </ul>
<p>CSE-S305 Compiler Design</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• Provide an understanding of the fundamental principles in compiler design</li> <li>• Provide the skills needed for building compilers for various situations that one may encounter in a career in Computer Science.</li> <li>• Learn the process of translating a modern high-level language to executable code required for compiler construction.</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Understand fundamentals of compiler and identify the relationships among different phases of the compiler.</li> <li>• Understand the application of finite state machines, recursive descent, production rules, parsing, and language semantics.</li> <li>• Analyze &amp; implement required module, which may include front-end, back-end, and a small set of middle-end optimizations.</li> <li>• Use modern tools and technologies for designing new compiler.</li> </ul>
<p>CSE-S306 Computer Networks</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• To develop an understanding of computer networking basics.</li> <li>• To develop an understanding of different components of computer networks, various protocols, modern technologies and their applications..</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Recognize the technological trends of Computer Networking.</li> <li>• Discuss the key technological components of the Network.</li> <li>• Evaluate the challenges in building networks and solutions to those</li> </ul>
<p>CSE-S307 Software Engineering</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• Knowledge of basic SW engineering methods and practices, and their appropriate application.</li> <li>• Describe software engineering layered technology and Process frame work.</li> <li>• A general understanding of software process models such as the waterfall and evolutionary models.</li> <li>• Understanding of software requirements and the SRS documents.</li> <li>• Understanding of the role of project management including planning, scheduling, risk management, etc.</li> <li>• Describe data models, object models, context models and behavioural models.</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Basic knowledge and understanding of the analysis and design of complex systems.</li> <li>• Ability to apply software engineering principles and techniques.</li> <li>• Ability to develop, maintain and evaluate large-scale software systems.</li> <li>• To produce efficient, reliable, robust and cost-effective software solutions.</li> </ul>

	<ul style="list-style-type: none"> <li>• Ability to perform independent research and analysis.</li> <li>• To communicate and coordinate competently by listening, speaking, reading and writing English for technical and general purposes.</li> <li>• Ability to work as an effective member or leader of software engineering teams.</li> </ul>
CSE-S401 Computer Graphics	<p><u>Course Objective:</u> Making the student understand how graphics created in computer world is the main goal of this course. Using colours in different places and for different objects is also one of the goals of the course. Learning how to rescale, transmit (shift), shear (skew), and rotate different graphical objects is another goal. Animating some simple graphics is the last aim of the course.</p> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Understand the basics of computer graphics, different graphics systems and applications of computer graphics.</li> <li>• Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.</li> <li>• Use of geometric transformations on graphics objects and their application in composite form.</li> <li>• Extract scene with different clipping methods and its transformation to graphics display device.</li> <li>• Explore projections and visible surface detection techniques for display of 3D scene on 2D screen.</li> <li>• Render projected objects to naturalize the scene in 2D view and use of illumination models for this</li> </ul>
CSE-S507 Ads. Computer Networks	<p><u>Course Objective:</u> This course aims to provide advanced background on relevant computer networking topics to have a comprehensive and deep knowledge in computer networks.</p> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• To identify and discuss the concepts underlying IPv6 protocol, and their main characteristics and functionality;</li> <li>• To understand the principles and functionality of mobile IP, explaining its concretization in IPv6; to understand the needs of optimization of the mobility mechanisms and description of some extensions that aim to reduce handover latency and requirements from terminals;</li> <li>• To recognize the need for service integration and discuss how it can be accomplished;</li> <li>• To explain and exemplify current QoS architectures and mechanisms, and the QoS support challenges in future networks;</li> <li>• To understand and explain the design issues in transport services in face of applications and services requirements;</li> </ul>
CSE-S517 Wireless and Mobile Computing	<p><u>Course Objective:</u> To impart fundamental concepts in the area of wireless and mobile computing, to provide a computer systems perspective on the converging areas of wireless networking, embedded systems, and software, and to introduce selected topics of current research interest in the field.</p> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Demonstrate knowledge on : cellular concepts like frequency reuse, fading,</li> </ul>

	<p>equalization, CDMA.</p> <ul style="list-style-type: none"> <li>• Demonstrate knowledge hand-off and interface and apply the concept to calculate link budget using path loss model.</li> <li>• Demonstrate knowledge equalization and different diversity techniques.</li> <li>• Apply the concept of GSM in real time applications.</li> <li>• Compare different multiple access techniques in mobile communication.</li> <li>• Study &amp; applications of different types of MANET's Algorithm.</li> </ul>
<p>CSE-S520 Machine Learning</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• To understand the basic theory underlying machine learning.</li> <li>• To be able to formulate machine learning problems corresponding to different applications.</li> <li>• To understand a range of machine learning algorithms along with their strengths and weaknesses.</li> <li>• To be able to apply machine learning algorithms to solve problems of moderate complexity.</li> <li>• To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Appreciate the importance of visualization in the data analytics solution</li> <li>• Apply structured thinking to unstructured problems</li> <li>• Understand a very broad collection of machine learning algorithms and problems</li> <li>• Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory</li> <li>• Develop an appreciation for what is involved in learning from data.</li> </ul>
<p>CSE-505 Distributed Processing</p>	<p><u>Course Objective:</u> The structure of distributed systems using multiple levels of software is emphasized. Specific topics include:</p> <ul style="list-style-type: none"> <li>• distributed algorithms</li> <li>• distributed file systems</li> <li>• distributed databases,</li> <li>• security and protection</li> <li>• distributed services such as the world-wide web, and</li> <li>• examples of research and commercial distributed systems</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• To provide hardware and software issues in modern distributed systems.</li> <li>• To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.</li> <li>• To analyse the current popular distributed systems such as peer-to-peer (P2P) systems will also be analysed.</li> <li>• To know about Shared Memory Techniques.</li> <li>• Have Sufficient knowledge about file access.</li> <li>• Have knowledge of Synchronization and Deadlock.</li> </ul>
<p>CSE-S-511 Advanced Data Base Management Systems</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• To provide a strong foundation in advanced database concepts from an industry perspective.</li> <li>• To covers advanced data modelling concepts like OOD Modelling and ORD</li> </ul>



	<p>Modelling</p> <ul style="list-style-type: none"> <li>To learn query processing and transaction management concepts for object-relational database and distributed database.</li> </ul> <p><u>Course Outcome:</u> After completion of this course, student will be able to:</p> <ul style="list-style-type: none"> <li>Identify advance database concepts and database models.</li> <li>Apply and analyse various terms related to transaction management in centralized and distributed database.</li> <li>Produce data modelling and database development process for object –oriented DBMS.</li> <li>Analyse and Implement the concept of object- relational database in development of various real time software.</li> <li>Examine the issues related to multimedia and mobile database performance.</li> </ul>
<p>CSE-S504 Advance Java Programming</p>	<p><u>Course Objective:</u> Develop error-free, well-documented Java programs; develop and test Java network, search engine, and web framework programs. Learn how to write, test, and debug advanced-level Object-Oriented programs using Java.</p> <p><u>Course Outcome:</u> After completion of this course, student will be able to:</p> <ul style="list-style-type: none"> <li>Develop appropriate data model and database scheme</li> <li>Create and test prototypes</li> <li>Develop Structure</li> <li>Identify major subsystems and interfaces</li> <li>Validate design scheme and models</li> <li>Implement Program</li> </ul>
<p>CSE-S501 Digital Image Processing</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>To study the image fundamentals and mathematical transforms necessary for image processing.</li> <li>To study the image enhancement techniques</li> <li>To study image restoration procedures.</li> <li>To study the image compression procedures.</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>Review the fundamental concepts of a digital image processing system.</li> <li>Analyse images in the frequency domain using various transforms.</li> <li>Evaluate the techniques for image enhancement and image restoration.</li> <li>Categorize various compression techniques.</li> <li>Interpret Image compression standards.</li> <li>Interpret image segmentation and representation techniques</li> </ul>
<p>CSE-S518 Artificial Intelligence</p>	<p><u>Course Objective:</u> The primary objective of this course is to introduce the basic principles, techniques, and applications of Artificial Intelligence. Emphasis will be placed on the teaching of these fundamentals, not on providing a mastery of specific software tools or programming environments. Assigned projects promote a ‘hands-on’ approach for understanding, as well as a challenging avenue for exploration and creativity. Specifically:</p> <ul style="list-style-type: none"> <li>Gain a historical perspective of AI and its foundations.</li> </ul>

	<ul style="list-style-type: none"> <li>• Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.</li> <li>• Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.</li> <li>• Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool.</li> <li>• Experiment with a machine learning model for simulation and analysis.</li> </ul> <p><u>Course Outcome:</u></p> <p>Upon successful completion of this course, the student shall be able to:</p> <ul style="list-style-type: none"> <li>• Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.</li> <li>• Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.</li> <li>• Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.</li> <li>• Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.</li> <li>• Demonstrate proficiency in applying scientific method to models of machine learning</li> </ul>
<p>CSE-S521 Data Mining &amp; Data Warehousing</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• To introduce students to the basic concepts and techniques of Data Mining</li> <li>• To develop skills of using recent data mining software for solving practical problems.</li> <li>• To gain experience of doing independent study and research.</li> <li>• To study the methodology of engineering legacy databases for data warehousing and data mining to derive business rules for decision support systems</li> <li>• Develop and apply critical thinking, problem-solving, and decision-making skills.</li> <li>• Develop and apply enthusiasm for learning. Class participation is encouraged in this course. Enriching</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Understand data mining principles and techniques: Introduce DM as a cutting edge business intelligence method and acquaint the students with the DM techniques for building competitive advantage through proactive analysis, predictive modelling, and identifying new trends and behaviours. Learning objectives include:</li> <li>• Building basic terminology.</li> <li>• Learning how to gather and analyse large sets of data to gain useful business understanding.</li> <li>• Learning how to produce a quantitative analysis report/memo with the necessary information to make decisions.</li> <li>• Describing and demonstrating basic data mining algorithms, methods, and tools</li> <li>• Identifying business applications of data mining</li> <li>• Overview of the developing areas - web mining, text mining, and ethical aspects of data mining.</li> </ul>
<p>CSE-S515</p>	<p><u>Course Objective:</u></p>

Web Technology	<p>On completion of this course, a student will be familiar with client server architecture and able to develop a web application using java technologies. Students will gain the skills and project-based experience needed for entry into web application and development careers.</p> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Students are able to develop a dynamic webpage by the use of java script and DHTML.</li> <li>• Students will be able to write a well formed / valid XML document.</li> <li>• Students will be able to connect a java program to a DBMS and perform insert, update and delete operations on DBMS table.</li> <li>• Students will be able to write a server side java application called Servlet to catch form data sent from client, process it and store it on database.</li> <li>• Students will be able to write a server side java application called JSP to catch form data sent from client and store it on database.</li> </ul>
MTH-S501 Numerical Methods	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• To provide suitable and effective methods called Numerical Methods, for obtaining approximate representative numerical results of the problems.</li> <li>• To solve problems in the field of Applied Mathematics, Theoretical Physics and Engineering which requires computing of numerical results using certain raw data.</li> <li>• To solve complex mathematical problems using only simple arithmetic operations. The approach involves formulation of mathematical models of physical situations that can be solved with arithmetic operations.</li> <li>• To deal with various topics like finding roots of equations, solving systems of linear algebraic equations, interpolation and regression analysis, numerical integration &amp; differentiation, solution of differential equation, boundary value problems, solution of matrix problems.</li> <li>• To facilitate numerical computing.</li> </ul> <p><u>Course Outcome:</u></p> <p>On completion of the course students will be able to</p> <ul style="list-style-type: none"> <li>• Apply Numerical analysis which has enormous application in the field of Science and some fields of Engineering.</li> <li>• Familiar with finite precision computation.</li> <li>• Familiar with numerical solutions of nonlinear equations in a single variable.</li> <li>• Familiar with numerical integration and differentiation, numerical solution of ordinary differential equations.</li> <li>• Familiar with calculation and interpretation of errors in numerical method.</li> </ul>
CSE-S510 Cryptography and Network Security	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• To understand basics of Cryptography and Network Security.</li> <li>• To be able to secure a message over insecure channel by various means.</li> <li>• To learn about how to maintain the Confidentiality, Integrity and Availability of a data.</li> <li>• To understand various protocols for network security to protect against the threats in the networks.</li> </ul> <p><u>Course Outcome:</u></p> <p>After successful completion of the course, the learners would be able to</p>

	<ul style="list-style-type: none"> <li>• Provide security of the data over the network.</li> <li>• Do research in the emerging areas of cryptography and network security.</li> <li>• Implement various networking protocols.</li> <li>• Protect any network from the threats in the world.</li> </ul>
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<b>M.Sc. Computer Science</b>
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**Program Outcome (POs):**

- PO-1 Get core competence in various subjects of Computer Science.
- PO-2 Apply knowledge of computing and mathematics appropriate to the discipline.
- PO-3 Problem analysis: Ability to identify, formulate & analyse requirements of a problem
- PO-4 Recognize the need for and ability to engage in continuing professional development
- PO-5 Teamwork: Flexibility to adapt to a team environment. To be able to work as a team leader
- PO-6 Ethics: To understand contemporary legal, social & ethical issues in computing.
- PO-7 Presentation and Communication: To be able to present and communicate precisely and effectively.
- PO-8 Life-long learning: To have passion for acquiring technical advancements in the field of computer science and engineering.
- PO-9 Social responsibilities: To apply skills for social causes and work towards sustainable solutions

**Program Specific Outcomes (PSOs)**

- PSO-1: To be able to understand problem, think of best suitable approach to solve the problem, develop and evaluate effective solutions.
- PSO-2: Able to handle any kind of software development.
- PSO-2: To be able to excel in various programming/project competitions and technological challenges laid by professional bodies.

**Course Objectives and Course Outcomes**

MCS-101 Unix and C Programming	<p><u>Course Objective:</u></p> <p>The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.</p> <p><u>Course Outcome:</u></p>
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	<p>At the end of the course, a student will be able to:</p> <ul style="list-style-type: none"> <li>• Recollect various programming constructs and to develop C programs.</li> <li>• Understand the fundamentals of C programming.</li> <li>• Choose the right data representation formats based on the requirements of the problem.</li> <li>• Implement different Operations on arrays, functions, pointers, structures, unions and files.</li> </ul>
<p>MCS-S102 Computer Organization</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• Conceptualize the basics of organizational and architectural issues of a digital computer and Classify and compute the performance of machines, Machine Instructions.</li> <li>• Learn about various data transfer techniques in digital computer and the I/O interfaces.</li> <li>• Estimate the performance of various classes of Memories, build large memories using small memories for better performance and Relate to arithmetic for ALU implementation</li> <li>• Understand the basics of hardwired and micro-programmed control of the CPU, pipelined architectures , Hazards and Superscalar Operations.</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Explain the basics of organizational and architectural issues of a digital computer and Classify and compute the performance of machines, Machine Instructions.</li> <li>• Describe various data transfer techniques in digital computer and the I/O interfaces.</li> <li>• Analyse the performance of various classes of Memories, build large memories using small memories for better performance and analyse arithmetic for ALU implementation</li> <li>• Describe the basics of hardwired and micro-programmed control of the CPU, pipelined architectures , Hazards and Superscalar Operations</li> </ul>
<p>MCS-104 Data Base Management System</p>	<p><u>Course Objective:</u> The objective of the course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a DBMS.</p> <p><u>Course Outcome:</u> Upon successful completion of this course, students should be able to:</p> <ul style="list-style-type: none"> <li>• Describe the fundamental elements of relational database management systems</li> <li>• Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.</li> <li>• Design ER-models to represent simple database application scenarios</li> <li>• Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.</li> <li>• Improve the database design by normalization. .</li> </ul>
<p>MCS-201 Operating Systems</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• Students will learn how Operating System is Important for Computer System.</li> <li>• To make aware of different types of Operating System and their services.</li> </ul>

	<ul style="list-style-type: none"> <li>• To learn different process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.</li> <li>• To know virtual memory concepts.</li> <li>• To learn secondary memory management.</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Understands the different services provided by Operating System at different level.</li> <li>• They learn real life applications of Operating System in every field.</li> <li>• Understands the use of different process scheduling algorithm and synchronization techniques to avoid deadlock.</li> <li>• They will learn different memory management techniques like paging, segmentation and demand paging etc.</li> </ul>
MCS-202 Data Structure	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• To provide the knowledge of basic data structures and their implementations.</li> <li>• To understand importance of data structures in context of writing efficient programs.</li> <li>• . To develop skills to apply appropriate data structures in problem solving.</li> </ul> <p><u>Course Outcome:</u></p> <p>Upon Completing the Course, Students will able to:</p> <ul style="list-style-type: none"> <li>• Learn the basic types for data structure, implementation and application.</li> <li>• Know the strength and weakness of different data structures.</li> <li>• Use the appropriate data structure in context of solution of given problem..</li> <li>• Develop programming skills which require to solve given problem.</li> </ul>
MCS-203 Computer Networks	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• To develop an understanding of computer networking basics.</li> <li>• To develop an understanding of different components of computer networks, various protocols, modern technologies and their applications..</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Recognize the technological trends of Computer Networking.</li> <li>• Discuss the key technological components of the Network.</li> <li>• Evaluate the challenges in building networks and solutions to those</li> </ul>
MCS204 Web Technology	<p><u>Course Objective:</u></p> <p>On completion of this course, a student will be familiar with client server architecture and able to develop a web application using java technologies. Students will gain the skills and project-based experience needed for entry into web application and development careers.</p> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Students are able to develop a dynamic webpage by the use of java script and DHTML.</li> <li>• Students will be able to write a well formed / valid XML document.</li> <li>• Students will be able to connect a java program to a DBMS and perform insert, update and delete operations on DBMS table.</li> <li>• Students will be able to write a server side java application called Servlet to catch form data sent from client, process it and store it on database.</li> <li>• Students will be able to write a server side java application called JSP to catch form</li> </ul>

	data sent from client and store it on database.
MCS301 Object Oriented Programming (Using Java)	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• Understand the basic concepts of object-oriented programming and difference between Procedure– Oriented Programming and Object Oriented Programming.</li> <li>• Get a clear understanding of basics of java Programming.</li> <li>• Analyse the concepts of Inheritance, Exception and Packages in java.</li> <li>• Learn how GUI can be designed and developed in Java using Applets and Swings.</li> <li>• Study how to handle events and multi-threaded programming in java.</li> </ul> <p><u>Course Outcome:</u></p> <p>On completion of this course, the students will be able to:</p> <ul style="list-style-type: none"> <li>• Understand the basic concepts of Procedure–Oriented Programming and object-oriented programming.</li> <li>• Achieve the Knowledge of developing simple java programs.</li> <li>• Develop computer programs to solve real world problems.</li> <li>• Design simple GUI interfaces to interact with users, using Applets and swings.</li> </ul> <p>Achieve Knowledge of multi-threading and to comprehend the event-handling techniques.</p>
MCS-302 Theory of Computation and Compiler Design	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• To understand the concept of machines: finite automata, pushdown automata, linear bounded automata, and Turing machines.</li> <li>• To understand the formal languages and grammars: regular grammar and regular languages, context-free languages and context-free grammar; and introduction to context-sensitive language and context-free grammar, and unrestricted grammar and languages.</li> <li>• To understand the relation between these formal languages, grammars, and machines.</li> <li>• To understand the complexity or difficulty level of problems when solved using these machines.</li> <li>• To understand the concept of algorithm.</li> <li>• Provide an understanding of the fundamental principles in compiler design</li> <li>• Provide the skills needed for building compilers for various situations that one may</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Design Finite Automata machines for given problems.</li> <li>• Analyze a given Finite Automata machine and find out its Language.</li> <li>• Design Pushdown Automata machine for given CF language(s).</li> <li>• Generate the strings/sentences of a given context-free languages using its grammar.</li> <li>• Understand fundamentals of compiler and identify the relationships among different phases of the compiler.</li> <li>• Understand the application of finite state machines, recursive descent, production rules, parsing, and language semantics.</li> </ul>
MCS-303 Design and Analysis of	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• To develop proficiency in problem solving and programming.</li> <li>• To be able to carry out the Analysis of various Algorithms for mainly Time and</li> </ul>

Algorithms	<p>Space Complexity.</p> <ul style="list-style-type: none"> <li>To get a good understanding of applications of Data Structures.</li> <li>To develop a base for advanced study in Computer Science.</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>Ability to decide the appropriate data type and data structure for a given problem.</li> <li>Ability to select the best algorithm to solve a problem by considering various problem characteristics, such as the data size, the type of operations, etc.</li> <li>Ability to compare algorithms with respect to time and space complexity</li> </ul>
MCS-501 Digital Image Processing	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>To study the image fundamentals and mathematical transforms necessary for image processing.</li> <li>To study the image enhancement techniques</li> <li>To study image restoration procedures.</li> <li>To study the image compression procedures.</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>Review the fundamental concepts of a digital image processing system.</li> <li>Analyze images in the frequency domain using various transforms.</li> <li>Evaluate the techniques for image enhancement and image restoration.</li> <li>Categorize various compression techniques.</li> <li>Interpret Image compression standards.</li> <li>Interpret image segmentation and representation techniques</li> </ul>
MCS-502 Wireless and Mobile Computing	<p><u>Course Objective:</u></p> <p>To impart fundamental concepts in the area of wireless and mobile computing, to provide a computer systems perspective on the converging areas of wireless networking, embedded systems, and software, and to introduce selected topics of current research interest in the field.</p> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>Demonstrate knowledge on : cellular concepts like frequency reuse, fading, equalization, CDMA.</li> <li>Demonstrate knowledge hand-off and interface and apply the concept to calculate link budget using path loss model.</li> <li>Demonstrate knowledge equalization and different diversity techniques.</li> <li>Apply the concept of GSM in real time applications.</li> <li>Compare different multiple access techniques in mobile communication.</li> <li>Study &amp; applications of different types of MANET's Algorithm.</li> </ul>
MCS-401 Computer Graphics	<p><u>Course Objective:</u></p> <p>Making the student understand how graphics created in computer world is the main goal of this course. Using colors in different places and for different objects is also one of the goals of the course. Learning how to rescale, transmit (shift), shear (skew), and rotate different graphical objects is another goal. Animating some simple graphics is the last aim of the course.</p> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>Understand the basics of computer graphics, different graphics systems and applications of computer graphics.</li> <li>Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.</li> <li>Use of geometric transformations on graphics objects and their application in</li> </ul>



	<p>composite form.</p> <ul style="list-style-type: none"> <li>• Extract scene with different clipping methods and its transformation to graphics display device.</li> <li>• Explore projections and visible surface detection techniques for display of 3D scene on 2D screen.</li> <li>• Render projected objects to naturalize the scene in 2D view and use of illumination models for this.</li> </ul>
<p>MCS-402 Artificial Intelligence</p>	<p><u>Course Objective:</u></p> <p>The primary objective of this course is to introduce the basic principles, techniques, and applications of Artificial Intelligence. Emphasis will be placed on the teaching of these fundamentals, not on providing a mastery of specific software tools or programming environments. Assigned projects promote a 'hands-on' approach for understanding, as well as a challenging avenue for exploration and creativity.</p> <p>Specifically:</p> <ul style="list-style-type: none"> <li>• Gain a historical perspective of AI and its foundations.</li> <li>• Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.</li> <li>• Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.</li> <li>• Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool.</li> <li>• Experiment with a machine learning model for simulation and analysis..</li> </ul> <p><u>Course Outcome:</u></p> <p>Upon successful completion of this course, the student shall be able to:</p> <ul style="list-style-type: none"> <li>• Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.</li> <li>• Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.</li> <li>• Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.</li> <li>• Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.</li> </ul>
<p>MCS403 Software Engineering</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• Knowledge of basic SW engineering methods and practices, and their appropriate application.</li> <li>• Describe software engineering layered technology and Process frame work.</li> <li>• A general understanding of software process models such as the waterfall and evolutionary models.</li> <li>• Understanding of software requirements and the SRS documents.</li> <li>• Understanding of the role of project management including planning, scheduling, risk management, etc.</li> <li>• Describe data models, object models, context models and behavioural models.</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Basic knowledge and understanding of the analysis and design of complex systems.</li> <li>• Ability to apply software engineering principles and techniques.</li> <li>• Ability to develop, maintain and evaluate large-scale software systems.</li> </ul>

	<ul style="list-style-type: none"> <li>• To produce efficient, reliable, robust and cost-effective software solutions.</li> <li>• Ability to perform independent research and analysis.</li> <li>• To communicate and coordinate competently by listening, speaking, reading and writing English for technical and general purposes.</li> <li>• Ability to work as an effective member or leader of software engineering teams.</li> </ul>
<p>MCS-504 Cryptography and Network Security</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• To understand basics of Cryptography and Network Security.</li> <li>• To be able to secure a message over insecure channel by various means.</li> <li>• To learn about how to maintain the Confidentiality, Integrity and Availability of a data.</li> <li>• To understand various protocols for network security to protect against the threats in the networks.</li> </ul> <p><u>Course Outcome:</u></p> <p>After successful completion of the course, the learners would be able to</p> <ul style="list-style-type: none"> <li>• Provide security of the data over the network.</li> <li>• Do research in the emerging areas of cryptography and network security.</li> <li>• Implement various networking protocols.</li> </ul>
<p>MCS-515 Machine Learning</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• To understand the basic theory underlying machine learning.</li> <li>• To be able to formulate machine learning problems corresponding to different applications.</li> <li>• To understand a range of machine learning algorithms along with their strengths and weaknesses.</li> <li>• To be able to apply machine learning algorithms to solve problems of moderate complexity.</li> <li>• To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.</li> </ul> <p><u>Course Outcome:</u></p> <ul style="list-style-type: none"> <li>• Appreciate the importance of visualization in the data analytics solution</li> <li>• Apply structured thinking to unstructured problems</li> <li>• Understand a very broad collection of machine learning algorithms and problems</li> <li>• Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory</li> <li>• Develop an appreciation for what is involved in learning from data.</li> </ul>
<p>MCS-513 Data Mining &amp; Data Warehousing</p>	<p><u>Course Objective:</u></p> <ul style="list-style-type: none"> <li>• To introduce students to the basic concepts and techniques of Data Mining</li> <li>• To develop skills of using recent data mining software for solving practical problems.</li> <li>• To gain experience of doing independent study and research.</li> <li>• To study the methodology of engineering legacy databases for data warehousing and data mining to derive business rules for decision support systems</li> <li>• Develop and apply critical thinking, problem-solving, and decision-making skills.</li> <li>• Develop and apply enthusiasm for learning. Class participation is encouraged in this course. Enriching</li> </ul>

Course Outcome:

- Understand data mining principles and techniques: Introduce DM as a cutting edge business intelligence method and acquaint the students with the DM techniques for building competitive advantage through proactive analysis, predictive modelling, and identifying new trends and behaviours. Learning objectives include:
- Building basic terminology.
- Learning how to gather and analyse large sets of data to gain useful business understanding.
- Learning how to produce a quantitative analysis report/memo with the necessary information to make decisions.
- Describing and demonstrating basic data mining algorithms, methods, and tools 6. Identifying business applications of data mining
- Overview of the developing areas - web mining, text mining, and ethical aspects of data mining.
-