Department of Computer Science & Engineering
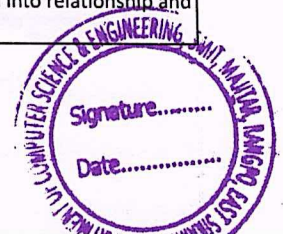## Cousrse Outcomes

2nd Year-3rd Semester

Subject Code	Subject Name	
MA 1308	**Discrete Mathematics**	
	CO1	Apply concepts of Group theory to the model real-world problems.
	CO2	Analyze the use of graphs in Engineering applications.
	CO3	Extend the concepts of Predicate Calculus in computer science like design of computing machines, artificial intelligence, definition of data structures for programming languages etc
	CO4	Evaluate problems related to mathematical logic and pigeonhole principle.
	CO5	Solve problems using Permutation and Combination, Recursion and generating functions.
CS 1302	**Data Structures**	
	CO1	Describe the working of data structures like array, stack, queue, linked list, tree and graph
	CO2	Explain common applications for array, stack, queue, linked list, tree and graph
	CO3	Solve a given problem using appropriate data structures and algorithm
	CO4	Discuss about the working of the principal algorithms for sorting, searching, and hashing
	CO5	Correlate the performance of a program with respect to the choice of data structure & algorithm
CS 1304	**Digital Circuits and Logic Design**	
	CO1	Relate and implement Boolean algebra in Digital Logic Circuits
	CO2	Design combinational logic circuits
	CO3	Design sequential logic circuits
	CO4	Interpret various logic families
	CO5	Explain the working of multivibrator circuits
CS 1306	**Computer Organization and Architecture**	
	CO1	Demonstrate competence in mapping relation between computer programming and computer organization and architecture.
	CO2	Identify computer model requirements.
	CO3	Analyze and evaluate the competence of a model.
	CO4	Identify the evolution of Computer systems and the complexities in data processing.
	CO5	Propose various microprocessor design alternatives to learn the concepts of parallel processing, pipelining and interprocessor system performance
CS 1307	**Intellectual Property Rights and Software Ethics**	
	CO1	Identify regulations, legislation and standards for Intellectual Property Rights
	CO2	Describe the impact of Intellectual Property Rights on engineering and industrial practices vis a vis social, environmental and economic contexts.
	CO3	Apply principles of Intellectual Property Rights to sustainable design and development.
	CO4	Analyse ethical lapses and recognize ethical dilemmas.
	CO5	Distinguish professional issues which arise in the intellectual property law context
CS 1308	**Object Oriented Concepts & Programming using C++**	
	CO1	Describe the principles of Object Oriented Programming and C++ features that support OOP Paradigm.
	CO2	Compare and differentiate between OOP and structured or procedural programming.
	CO3	Explain programming constructs and features of C++ programming language.
	CO4	Employ C++ constructs to write Object Oriented Programs to solve problems.
	CO5	Adapt to bottom up approach of problem solving using classes and objects.
CS 1361	**Data Structures Lab**	
	CO1	Write program related to application of data structures using programming constructs of a language like C programming language
	CO2	Identify the suitable input and output for a specified problem statement
	CO3	Conclude the working of various algorithms in terms of time and space complexity
	CO4	Examine the errors enounterd in the program using appropriate tools and fix them
	CO5	Write well-indented and well-documented code
CS 1363	**Digital Circuits and Logic Design Lab**	
	CO1	Design and analyze basic combinational circuits.
	CO2	Relate logic circuits to solve digital electronics problems.
	CO3	Express flip-flops as memory elements and design digital electronics circuit with a memory.
	CO4	Design small sequential circuits and implement them in software and hardware.
	CO5	Design programmable counters and implement them in software and hardware.
CS 1365	**Object Oriented Concepts & Programming using C++ Lab**	
	CO1	Tell the syntax and semantics of the C++ programming language.
	CO2	Apply the concepts and principles of Object Oriented programming while writing programs using C++.
	CO3	Extend the concepts of encapsulation, polymorphism, inheritance using class, objects, function/operator overloading, function overriding, etc.
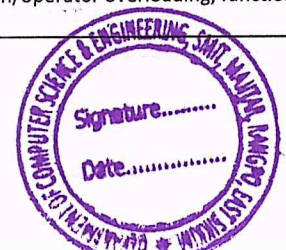
	CO4	Write programs with Inheritance, virtual functions that supports code reusability, dynamic binding and run time polymorphism.
	CO5	Adapt to bottom up approach of problem solving using classes and objects.
BP1391	**Constitution of India**	
	CO1	Describe the importance of the Constitution of India.
	CO2	Identification and use of different types of political system in India.
	CO3	Explain the parliamentary form of government in India.
	CO4	Investigation of urban and local government systems and development of ideas for the betterment of government.
	CO5	Development of the concept of democracy, fundamental rights, and laws
BP 1392	**Indian Traditional Knowledge**	
	CO1	Identification of core features and importance of Vedic knowledge.
	CO2	Discuss modern science, Indian knowledge, and yogic practices.
	CO3	Develop philosophical understanding of Indian traditional and Indian linguistic systems.
	CO4	Illustrate the impact of yogic practices.
	CO5	Measure the impact of Indian traditional knowledge.
2nd Year-4th Semester		
MA1408	**Numerical Methods, Complex and Fourier Analysis**	
	CO1	Create ability to handle complex integrations appearing in different engineering areas.
	CO2	Apply the concepts of interpolation to find best Curve fitting for given data and also evaluate Integration and differentiation numerically.
	CO3	Solve differential equations numerically.
	CO4	Evaluate solution of algebraic and Transcendental equations and system of linear equations using iterative methods
	CO5	Associate between the concepts of Fourier analysis and applications in the field of Signal processing, Image processing etc.
CS 1403	**Database Management Systems**	
	CO1	Describe fundamental elements of a relational database management system
	CO2	Design entity-relationship diagrams to represent simple database application scenarios
	CO3	Explain the basic concepts of relational data model, Entity-relationship model, Relational database design, relational algebra and database language SQL
	CO4	Apply and relate the concept of transaction, concurrency control and recovery in database
	CO5	Analyze various Normalization techniques and improve the database design by normalization
CS 1405	**Design and Analysis of Algorithms**	
	CO1	Define asymptotic notations and solve problems related to it
	CO2	Calculate time and space complexities for recursive/non-recursive algorithm based on following algorithm design techniques - divide and conquer, greedy, dynamic programming and branch and bound.
	CO3	Select appropriate algorithm design technique to solve a given problem.
	CO4	Explain the working of existing algorithm / algorithm design techniques
	CO5	Discuss and describe the classes P, NP, and NP-Complete
CS 1406	**Advanced Computer Organization & Architecture**	
	CO1	Review Computer System Architecture.
	CO2	Evaluate complexities in data representation and processing.
	CO3	Apply concepts of parallel processing and multiprocessor architectures in reviewing processors.
	CO4	Solve problems related to multiprocessing , distributed processing and non von Neumann architectures.
	CO5	Illustrate the concept of data flow computers, Reduction computer architecture and systolic architecture
CS 1437	**Open Elective-I # Enterprose Resource Planning**	
	CO1	Identify the important business functions provided by typical business software such as enterprise resource planning and customer relationship management.
	CO2	Illustrate basic concepts of ERP systems for manufacturing or service companies
	CO3	Analyze the technical aspect of telecommunication systems, internet and their roles in business environment.
	CO4	Reframe open-ended problem descriptions to feasible solutions
	CO5	Illustrate the use of various tools used in ERP for industry
	Programme Elective-I #	
CS1435	**Python Programmming**	
	CO1	Define the basic structure of python programming.
	CO2	Differentiate imperative, functional and procedural programming features in Python
	CO3	Practice features for designing and implementing python program.
	CO4	Compose applications using various libraries and concepts of Python.
	CO5	Select methods to build and package Python modules for reusability
CS 1462	**Database Management Systems Lab**	
	CO1	Select appropriate SQL/MongoDB commands and functions for a given query on the database.
	CO2	Infer constraints and relationships between tables from conceptual/logical level schema and convert them into relationship and integrity constraints at the physical level schema.

	CO4	Compute amount of information in terms of entropy and apply in source coding and channel coding
	CO5	Compose methods for analyzing the performance of error control codes
CS 1561	**Operating Systems Lab**	
	CO1	Illustrate the concept of process and thread creation for executing user's task.
	CO2	Apply the theory for implementing various process scheduling algorithms.
	CO3	Produce a optimal solution for data inconsistency problem by synchronizing processes and threads.
	CO4	Examine the various memory management strategies for efficient resource utilization and implement it.
	CO5	Analyse and debug various technical issues related to operating systems services and use different types of Modern OS
CS 1566	**Software Engineering and Object-Oriented Analysis Lab**	
	CO1	Demonstrate competence in using engineering fundamentals to visualize solutions using knowledge of software engineering skills.
	CO2	Extend an ability to formulate a solution plan and methodology for an engineering problem using software engineering.
	CO3	Apply an ability to formulate and interpret a model for project management
	CO4	Identify modern engineering tools, techniques, and resources to solve software related problems.
	CO5	Develop a quality software products by possessing the leadership skills as an individual or contributing to the team development and demonstrating effective and modern working strategies by applying both communication and negotiation management skill.
CS1567	**Scripting Language Lab**	
	CO1	Design simple websites using HTML, CSS and Javascript
	CO2	Create front-end web applications using Angular JS
	CO3	Build server-side applications using Node JS and Express JS
	CO4	Connect front-end web applications with Mongo DB database
	CO5	Create a program for solving different problems and evaluate its performance and effectiveness.
CS 1581	**Industrial Training/Industrial Visit I**	
	CO1	Describe fundamental principles of science and engineering.
	CO2	Discover comprehensive learning platform where they can enhance their employability skills
	CO3	Express their knowledge in one particular technology.
	CO4	Develop self-confidence in finding their own proficiency
	CO5	Illustrate competence in listening, speaking, and presentation.
3rd Year-6th Semester		
CS 1604	**Formal Languages and Automata Theory**	
	CO1	Explain different concepts in automata theory and formal languages.
	CO2	Produce various grammars and their acceptors.
	CO3	Analyze the various language acceptors.
	CO4	Acquire a fundamental understanding of computational models related to decidability and recursive enumerability.
	CO5	Illustrate various proofs using mathematical principles.
CS 1606	**Computer Networks-II**	
	CO1	Understand and discover the engineering fundamentals involved in Computer Network and other related frame work
	CO2	Identify the complex engineering problem relating computer network relating to host Identification data delivery and routing.
	CO3	Ability to formulate a solution plan and methodology for an engineering problem concerning Computer Networking like Sub network, super network, and DNS etc
	CO4	Ability to formulate and interpret a model based on the Computer Networks and its related framework.
	CO5	Understand and explain basic responsibilities/concept of protocols in protocol present stack ,DNS, DHCP ,security, etc.
CS 1663	**Computer Networks Lab**	
	CO1	Identify and understand various functions used in socket programs
	CO2	Develop and test of socket program for client server interaction for various purpose.
	CO3	Implementing and Validate Sub network with static and various dynamic routing protocols.
	CO4	Analyze the packet structure of various protocols used for communication
	CO5	Understand the fundamentals of SDN
CS1666	**Parallel Programming Lab**	
	CO1	Classify the different parallel programming constructs.
	CO2	Simulate various parallel programming constructs in any high level language.
	CO3	Select appropriate constructs to be used in different algorithms.
	CO4	Justify the output of a program in solving different problems and evaluate its performance and effectiveness.
	CO5	Compare the performance of programs designed on two different paradigms.
CS 1671/1771	**Mini Project**	
	CO1	Identify and distinguish issues related to real life applications.

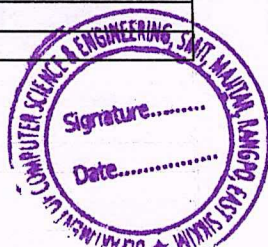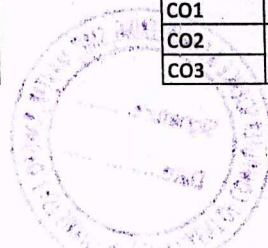|		
	CO3	Write Oracle PL/SQL Programs for data processing.
	CO4	Design nested queries for efficient data processing on the database.
	CO5	Test an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database.
CS 1464	**Advanced Programming Lab**	
	CO1	Discuss the concept of objects and class.
	CO2	Evaluate requirements for given problem and decide the functionalities of programs accordingly.
	CO3	Illustrate a diverse set of problem solutions using techniques of Interface, Packages, File Handling, Multi-threading, etc
	CO4	Apply the concept java network program to establish connection between client and server.
	CO5	Design modern website to fulfill users requirement..
CS 1465	**Algorithm Lab**	
	CO1	Calculate time and space complexities for algorithms using mathematical models
	CO2	Calculate time and space complexities for algorithms by performing an empirical measurement
	CO3	Select appropriate algorithm design technique to solve a given problem
	CO4	Write a computer program to implement any algorithm using a programming language
	CO5	Choose the most optimal algorithm by comparing time and space complexities
3rd Year-5th Semester		
MA1502	**Probability, Statistics and Stochastic Processes**	
	CO1	Explain concept of probability, random variables.
	CO2	Differentiate the ideas between discrete and continuous random variables.
	CO3	Discuss fundamentals of probability and statistical theories.
	CO4	Apply the knowledge of probability and statistics to analyze different real-world situations.
	CO5	Develop the models of many time dependent processes such as signals in communications , time series analysis.
CS 1502	**Operating Systems**	
	CO1	Describe the different operating system architectures and structures.
	CO2	Select the appropriate scheduling algorithms or techniques for efficient utilization of computer resource like CPU, Memory, etc.
	CO3	Interpret theory of data inconsistency problem and provide a procedure for synchronization problem.
	CO4	Manage various technical issues related to operating systems' services using principles of computer science and engineering.
	CO5	Compose methods for analyzing the performance of various identified algorithms or techniques in operating systems
CS 1508	**Computer Networks – I**	
	CO1	Understand and identify the engineering fundamentals concerning Data Communication and Computer Network.
	CO2	Identify the complex engineering problem involved in Data communication and its architecture for a successful network based communication.
	CO3	Ability to Practice and formulate a solution for an engineering problem concerning any layers in Data Communication model
	CO4	Demonstrate an ability to formulate and interpret a model based on the fundamentals of Computer Networks
	CO5	Compare and understand the IOS reference model and TCP-IP reference model for data communication
CS 1509	**Software Engineering**	
	CO1	Demonstrate competence in using engineering fundamentals to visualize solutions using knowledge of software engineering skills.
	CO2	Extend an ability to formulate a solution plan and methodology for an engineering problem using software engineering.
	CO3	Apply an ability to formulate and interpret a model for project management
	CO4	Explain an ability to define complex problem , find and analyze requirements
	CO5	Apply new software models, techniques and technologies to bring out innovative and novelistic solutions for the growth of the society in all aspects and evolving into their continuous professional development.
CS 15**	**Programme Elective-II#**	
	BIOINFORMATICS(CS1540/CS1632)	
	CO1	Describe basic principles and concepts of biology, computer science and mathematics
	CO2	Choose suitable computational models to solve the problem for a given biological sequence analysis
	CO3	Compare various approaches of data analysis by evaluating their advantages and disadvantages
	CO4	Analyze various bioinformatics tools for handling biological data and to solve problems by applying acquired knowledge, facts, techniques and rules in a different way.
	CO5	Develop computer programs for bioinformatics data analysis.
CS1531	**INFORMATION TRANSMISSION AND CODING THEORY(CS1531)**	
	CO1	Describe the principles and applications of information theory.
	CO2	Differentiate the various types of coding schemes available in coding theory
	CO3	Compare various error control encoding and decoding techniques

	CO1	Identify the important business functions provided by typical business software such as enterprise resource planning and customer relationship management.
	CO2	Illustrate basic concepts of ERP systems for manufacturing or service companies
	CO3	Analyze the technical aspect of telecommunication systems, internet and their roles in business environment.
	CO4	Reframe open-ended problem descriptions to feasible solutions
	CO5	Illustrate the use of various tools used in ERP for industry
CS 1438/CS1423/	**Microprocessors and Peripheral Devices**	
	CO1	Identify and describe the structure and functions of basic elements of 8085, 8086 Microprocessors and various peripheral devices.
	CO2	Sketch block diagrams of Microprocessors and peripheral devices. Illustrate the execution of instructions by the MP using timing diagrams. Explain interfacing of MP with peripheral devices
	CO3	Design circuit diagrams for interfacing the MP with peripheral devices as per the problem statement for creating an application
	CO4	Write programs for microprocessors and MP based applications using assembly language
	CO5	Describe the MP-specific assmebly language constructs and syntaxes.
CS 1439/EC 1424/	**Communication Techniques**	
	CO1	Describe the basic component of a complete communication system
	CO2	Identify and analyze signal level analysis of the communication system at the physical layer.
	CO3	Identify and distinguish the various modulation and demodulation techniques of a comunication system.
	CO4	Analyse transmitter and receiver circuits.
	CO5	Compare and contrast design issues, advantages, disadvantages and limitations of a communication system.
CS 1440/CS1425	**Internet, Technology and Society**	
	CO1	Describe while identifying the impact of technology and internet on the modern society
	CO2	Interpret software freedom principles and free/open-source licensing system
	CO3	Identify ethical issues related to surveillance system, digital divide and identify data privacy concerns
	CO4	Prioritize privacy concerns by applying free & open-source software solutions
	CO5	Recognize the impact of engineering and industrial practices on social contexts.
		Programme Elective I
CS 1423/CS 1432/	**PC Hardware and Peripherals**	
	CO1	Indicate the names and functions of hardware ports and the parts of the motherboard
	CO2	Identify the names and distinguishing features of different kinds of input and output devices
	CO3	Describe how the CPU processes data and instructions and controls the operation of all other devices
	CO4	Illustrate the names, distinguishing features, and units for measuring different kinds of memory and storage devices
	CO5	Assess the troubleshoots in microcomputer systems hardware and software and other peripheral equipment
CS 1434/CS 1421/	**Java Programming**	
	CO1	Demonstrate an ability describe and recall the various object oriented concept
	CO2	Formulate and interpret an object oriented model and design solution using object oriented concepts.
	CO3	Ability to illustrate a diverse set of design solutions using techniques of Interface, Packages, File Handling, Multi-threading, etc.
	CO4	Select and design methodology using bottom up approach and solve open ended problems using Java.
	CO5	Define and create modern engineering tools, techniques and resources to build software using Java programming language.
CS 1435	**Python Programming**	
	CO1	Define the basic structure of python programming.
	CO2	Differentiate imperative, functional and procedural programming features in Python
	CO3	Practice features for designing and implementing python program.
	CO4	Compose applications using various libraries and concepts of Python.
	CO5	Select methods to build and package Python modules for reusability
CS 1436/CS 1642	**Fundamentals of Web Technologies**	
	CO1	Identify the various terms and components of HTML, CSS, JavaScript, PHP and Drupal
	CO2	Illustrate various components of web development languages
	CO3	Connect different modules of open source technologies for website development
	CO4	Select appropriate web technology for implementing solution to a given problem
	CO5	Construct a web domain using appropriate tools and techniques
CS 1442	**User Interface/User Experience (UI/UX) Design**	
	CO1	select and utilize design thinking processes and UX/UI tools,
	CO2	Differentiate between user interface and user experience design
	CO3	Discover how typography and layout enrich the user experience
	CO4	Distinguish various tools available for user interface design
	CO5	Assess various HCI (human-computer interaction) and the psychology behind user decision-making.
CS 1539	**Biology**	
	CO1	Describe how biological observations lead to major discoveries

	CO2	Develop a computational model to meet the desired requirements identified within ethical and realistic constraints.
	CO3	Select appropriate modern programming languages and technologies known, to develop a sustainable and a robust solution.
	CO4	Analyse the results achieved to understand the performance of the system for optimal result achievement.
	CO5	Summarize the important attributes and performance analysis of the proposed system.

4th Year-7th Semester

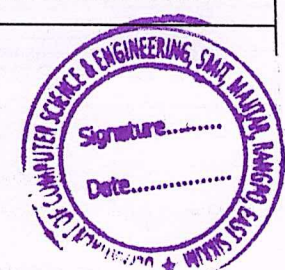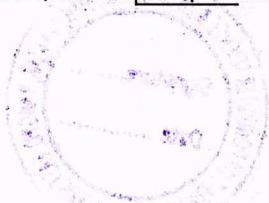| CS 1703	**Compiler Design**	
	CO1	Define the competence in designing compilers .
	CO2	Describe the functioning in various problem domains.
	CO3	Discover complex engineering problem and able to solve it using the concept of compiler design.
	CO4	Analyze and select optimal design scheme using compiler design principles
	CO5	Develop and experiment using knowledge of compilers for compiling different programs.
BA1710	**Industrial Engineering Management**	
	CO1	Understand different concepts regarding Organization and Productivity in industries.
	CO2	Evaluate control charts for variable as well as attribute data for different types of manufacturing processes and service activities.
	CO3	Identify the techniques, skills and modern management tools necessary for engineering practice.
	CO4	Apply knowledge of science, mathematics and engineering.
	CO5	Analyze the concept of Inventory management and reliability.
CS 1733	**Cryptography & Network Security**	
	CO1	Define mathematical modelling of a Security services to address modern security issues and challenges.
	CO2	Demonstrate and an ability to formulate a solution plan and methodology for security in information systems using Cryptography
	CO3	Analyze diverse set of alternative design solutions to meet the basic requirements and goals of a security system.
	CO4	Recognize technical issues for existing security principles and network applications consistent with their level of knowledge and understanding.
	CO5	Develop solutions for existing security principles and network applications.
CS 1762	**Compiler Design Lab**	
	CO1	Simulate the functioning of various phases of compilers in various problem domains.
	CO2	Devise solutions to solve complex engineering problem.
	CO3	Identify an optimal design among all available design alternatives for further manipulation using compiler design principles to execute the code faster.
	CO4	Apply tools using knowledge of compilers for compiling different programs.
	CO5	Evaluate the effectiveness of different compilation tools.
CS 1763	**Intelligent System Lab**	
	CO1	Classify procedures for Machine Learning algorithms.
	CO2	Simulate various procedures of Machine learning in any high level language.
	CO3	Select appropriate datasets to be used in different algorithms.
	CO4	Justify the application of an algorithm in solving real world problems and evaluate its performance and effectiveness.
	CO5	Apply Machine learning algorithms in solving various rela life problems.
CS 1781	**Industrial Training/ Course Work II**	
	CO1	Discover comprehensive learning platform where they can enhance their employ ability skills
	CO2	Identify real lifesituations in industrial organizations and their related environments and accelerating thelearning process
	CO3	Express their knowledge in one particular technology.
	CO4	Develop skills and techniques directly applicable to their career
	CO5	Analyse competence in listening, speaking, and presentation.

4th Year-8th Semester

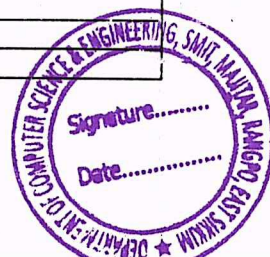| CS 1875	**Major Project**	
	CO1	Analyze, design and implement a computational system to meet desired needs within realistic constraints.
	CO2	Apply modern programming languages and technologies to develop a sustainable and robust software / hardware application or perform qualitative analysis on computational systems using appropriate tools.
	CO3	Propose set of alternative design solutions to problems for which standard algorithmic solutions do not exist.
	CO4	Express ethics, values and respects legal as well as social issues for the computing profession or computational application.
	CO5	Justify the technical design incorporated in the computational system with the help of in-depth analysis, presentation as well as document pertaining to the project work. (BL-V).

Open Elective I		
CS1437/1422	**Enterprise Resource Planning**	

	CO5	Identify introduction to microbiology.
CS 1540/CS 1632	**Bioinformatics**	
	CO1	Describe basic principles and concepts of biology, computer science and mathematics
	CO2	Choose suitable computational models to solve the problem for a given biological sequence analysis problem
	CO3	Compare various approaches of data analysis by evaluating their advantages and disadvantages
	CO4	Analyze various bioinformatics tools for handling biological data and to solve problems by applying acquired knowledge, facts, techniques and rules in a different way.
	CO5	Develop computer programs for bioinformatics data analysis.
CS 1541/CS 1633	**Digital Image Processing**	
	CO1	Describe the fundamental concepts of a digital image processing system.
	CO2	Analyze images in the spatial domain using mathematical transformation function.
	CO3	Write the procedure for implemeting various image enhancement techniques .
	CO4	Interpret image segmentation and representation techniques.
	CO5	Select the morphological operation for extracting different features from an image.
CS 1542/CS 1635	**Embedded Systems**	
	CO1	Identify the internal architecture and interfacing of different peripheral devices with Microcontrollers
	CO2	Understand hardware and software design requirements of embedded systems
	CO3	Analyze the role of embedded systems in industry
	CO4	Evaluate the requirements of programming Embedded Systems, related software architectures and tool chain for Embedded Systems
	CO5	Design real time embedded systems using the concepts of RTOS.
CS 1543	**Low Power Circuits and Systems**	
	CO1	Explain the sources of power dissipation in MOS devices
	CO2	Classify the special techniques to mitigate the power consumption in VLSI circuits
	CO3	Summarize the power optimization and trade-off techniques in digital circuits
	CO4	Compare the power estimation at logic and circuit level
	CO5	Formulate the software design for low power in various level
CS 1544	**Information Retrieval**	
	CO1	Define information retrieval models.
	CO2	Develop Web Search Engine..
	CO3	Analyze the different tools, techniques and algorithms with an experiment.
	CO4	Experiment with Hadoop and Map Reduce.
	CO5	Select appropriate tools and techniques.
CS 1546/CS 1404	**Computer Graphics**	
	CO1	Describe the competence in application of mathematical modelling to computer graphics
	CO2	Explain an ability to interpret a solution plan and methodology for an engineering problem using computer graphics
	CO3	Discuss an ability to conduct investigations of technical issues related to computer vision with their level of knowledge and understanding
	CO4	Illustrate an ability to advance an engineering design to defined end state
	CO5	compare different algorithms used to solve a computer vision problem
CS 1752	**Advanced Algorithms**	
	CO1	Describe the divide-and-conquer paradigm with an approach to design an algorithm.
	CO2	Define the dynamic-programming paradigm to explain an algorithmic design.
	CO3	Identify the greedy paradigm with an approach to design an algorithm.
	CO4	Analyze randomized algorithms for a given set of problems.
	CO5	Explain competitive analysis of various algorithms for a given set of problems.
CS 1759/CS 1644	**Artificial Intelligence**	
	CO1	Identify areas in engineering and real life where Artificial Intelligence (AI) can find its application
	CO2	Discuss the role of mathematical and statistical models in AI
	CO3	Demonstrate an ability to formulate problems using AI
	CO4	Analyse techniques and resources to solve AI problems
	CO5	Test techniques and resources to solve AI problems
CS 1545	**Artificial Neural Networks**	
	CO1	Display sufficient understanding of mathematical and engineering fundamentals in the perspective of Artificial neural network theory.
	CO2	Identify Artificial Neural network suitable for a complex problem.
	CO3	Awake the importance of tolerance of imprecision and uncertainty for design of robust and low-cost intelligent machines.
	CO4	Investigate a problem to identify technical issues and solve the problems using various Artificial neural network.
	CO5	Design real-life application using various neural network algorithm.

Programme Elective IV, V & VI

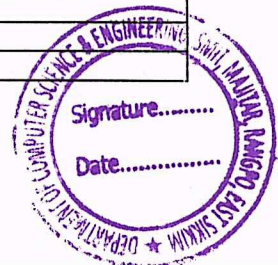| CS 1634	Data Warehousing and Data Mining

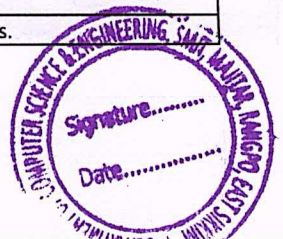|		
	CO2	Identify classification and Genetics in biology
	CO3	Understand cell structure and functions, inheritance & evolution
	CO4	Illustrate Macromolecular analysis and Metabolism
	CO5	Identify introduction to microbiology.
	Programme Elective II and III	
CS 1531	**Information Transmission and Coding Theory**	
	CO1	Describe the principles and applications of information theory.
	CO2	Differentiate the various types of coding schemes available in coding theory
	CO3	Compare various error control encoding and decoding techniques
	CO4	Compute amount of information in terms of entropy and apply in source coding and channel coding
	CO5	Compose methods for analyzing the performance of error control codes
CS 1532	**Advanced Java Programming**	
	CO1	Write program codes displaying competence in basic object-oriented programming using Java
	CO2	Compare and able to develop scalable network applications using Java
	CO3	Illustrate and practice component-based software.
	CO4	Explain and able to conduct investigations of technical issues consistent with their level of knowledge on distributed applications.
	CO5	Design and implement the understanding pertaining to database applications
CS 1533	**System Programming**	
	CO1	Describe the evolution of Programming and understand how an Operating and other system softwares have evolved since its inception.
	CO2	Examine various system programs and it's usage for proper functioning of Computer System.
	CO3	Analyze the theory and design the procedure for implementing assembler and macro-processor system programs.
	CO4	Compare various program loading schemes and discuss issues pertaining to design of some loading schemes.
	CO5	Understand the basic concepts of Compiler Program and issues related to its design.
CS 1534/CS 1507	**Discrete Structure**	
	CO1	Identify effectively algebraic techniques to analyze basic discrete structures and algorithms.
	CO2	Apply the concepts of sets, integers, reals and functions of such quantities to solve simple problems
	CO3	Understand and relate the graphs and related discrete structures to practical examples
	CO4	Understand the notion of mathematical and algorithmic thinking and apply them for problem solving
	CO5	Infer logical reasoning to solve a problem
CS 1535/CS 1636	**Graph Theory**	
	CO1	Distinguish competence in graphical modelling of problems
	CO2	Compute a solution process using graph theoretical concepts and analyze results for multiple problems
	CO3	Illustrate and interpret a graph model.
	CO4	Develop diverse set of alternative design solutions for multiple problems
	CO5	Analyze and interpret the results using contemporary tools.
CS 1536/CS 1638	**System Simulation and Modeling**	
	CO1	Explain the understanding of mathematical modeling through use in computer system modelling and simulations
	CO2	Describe the system behavior in investigating discrete event simulation, modeling and system dynamics
	CO3	Develop simulation models
	CO4	Test validity of model through analysis of output data
	CO5	Simulate the models for the purpose of optimum control by using different software.
CS 1537	**Advanced Web Technologies**	
	CO1	Define the basic terms of HTML, CSS and JavaScript
	CO2	Identify appropriate web based technologies for developing dynamic webpages
	CO3	Choose an appropriate database language and technologies for conecting front end to backend
	CO4	Distinguish major frameworks for development of web services and cloud applications
	CO5	Test appropriate content management system for developing scalable websites
CS 1538/CS 1601	**Object Oriented Analysis and Design Using UML**	
	CO1	Identify object oriented design techniques suitable for a complex problem
	CO2	Demonstrate an ability to formulate a solution plan and methodology for an engineering problem using object oriented analysis and design using UML.
	CO3	Determination of the formula and interpretation of a model for project management.
	CO4	Investigate a problem to identify technical issues and solve the problems using variousobject oriented design tools and techniques.
	CO5	Design real-life application using modern UML tools, techniques and resources .
CS 1539	**Biology**	
	CO1	Describe how biological observations lead to major discoveries
	CO2	Identify classification and Genetics in biology
	CO3	Understand cell structure and functions, inheritance & evolution
	CO4	Illustrate Macromolecular analysis and Metabolism

	CO5	Decide the individual specialization from the recent trends in computer science of their interest.
CS 1653	**Neural Networks and Deep Learning**	
	CO1	Discuss the computational complexity of most neural network problems requires us regularly to deal with approximate techniques
	CO2	Evaluate the basic problem solving methods based on AI-based search, knowledge representation, reasoning, planning, and machine learning algorithms.
	CO3	Develop a set of alternative design solutions to problems for which standard algorithmic solutions do not exist.
	CO4	Classify the different technical issues related to Deep Architectures consistent with their level of knowledge and understanding.
	CO5	Construct neural network models and make these models work on practical problems in deep Learning
CS 1654/CS 1623	**Remote Sensing**	
	CO1	Enumerate methods used in preprocessing, image analysis and information extraction from different types of imageries.
	CO2	Select and apply appropriate data manipulation and visualization methods for a number of earth science applications.
	CO3	Explain the use of geographical applications in remote sensing
	CO4	Focus photographic techniques, photogrammetric, multispectral, hyper spectral, thermal imaging, and RADAR/ LIDAR images.
	CO5	Differentiate between contemporary data manipulation and visualization tools in remote sensing
CS 1655/CS 1624	**Autonomous Mobile Robotics and Computational Intelligence**	
	CO1	Identify application of Robots
	CO2	Describe the evolution, kind of robots and basics of design of a Robotics System
	CO3	Choose correct choices of Locomotion, Kinematics, Perception techniques
	CO4	Apply Intelligent Algorithms for decision making in Motion Planning and path optimization
	CO5	Develop simple robot control systems integrating perception, planning, and action
CS 1656/CS 1625/	**Geographical Information System**	
	CO1	Define appropriate data manipulation and visualization method for a number of Earth Science applications in GIS
	CO2	Operate PC-based visualization software effectively.
	CO3	Illustrate earth science data and present the result in an organized and concise fashion.
	CO4	Connect the hand-held GPS units for demarking geographical location/ latitude /longitude/etc.
	CO5	Compare different contemporary methods used in earth science data interpretation
CS 1657	**Soft Skills and Interpersonal Communication**	
	CO1	Define and describe personality types, communication styles, low/high context cultures and other terms and concepts important for interpersonal and communication skills
	CO2	Apply principles of negotiations to persuade and negotiate with idealistic and practical moral values
	CO3	Analyze, explain and solve conflicts using principles of conflict resolution
	CO4	Describe and explain principles of behavioral psychology
	CO5	Manage time, stress, criticism, and team by formulating strategies appropriate for the situation and type of people.
CS 1658	**Human Resource Development and Organizational Behavior**	
	CO1	Determine the concept of organizational behavior principles and their influence in workplace.
	CO2	Analyze the complexities associated with management of individual human behaviour as well as group behavior in the organization.
	CO3	Evaluate management styles of self and others and also able integrate in understanding the motivation (whys) behind behavior of people in the organization.
	CO4	Express and defend opinions through the use of management case studies.
	CO5	Infer critical thinking and apply in research, writing and presentation skills.
CS 1741	**Machine Learning**	
	CO1	Display sufficient understanding of mathematical and engineering fundamentals in the perspective of machine learning theory.
	CO2	Identify problems that can be solved using machine learning techniques.
	CO3	Appreciate the importance of tolerance of imprecision and uncertainty for design of robust and low-cost intelligent machines.
	CO4	Investigate a problem to identify technical issues and solve the problems using various machine learning techniques.
	CO5	Design real-life applications using machine learning techniques.
CS 1659	**Ethical Hacking**	
	CO1	Examine competence in applying acquired expertise in computer networks
	CO2	Determine an ability to interpret and evaluate behaviour of malwares and their countermeasures
	CO3	Evaluate the approaches used by hackers and work on its countermeasures to reach a valid conclusion
	CO4	Describe an ability to identify the limitation of tools used to break an insecure web application
	CO5	Decide the problem in the decision-making process between possible options using tools
CS 1659	**Ethical Hacking**	

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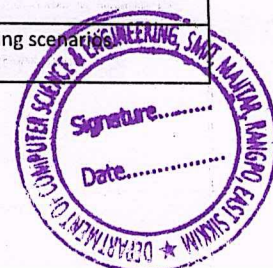
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	CO1	Distinguish the concepts of data warehousing and data mining
	CO2	Illustrate the dimensional modelling technique for designing a data warehouse and data warehouse architectures and OLAP
	CO3	Explain the knowledge discovery process.
	CO4	Deduction of data mining tasks and study their well-known techniques
	CO5	Apply various data mining techniques in varied problem scenarios.
CS 1637	**Software Quality Management**	
	CO1	Explain the requirements of ISO 9000 Certification and other process evaluation models
	CO2	Discuss the role of software quality measures, quality assurance and quality control in improving the software development process
	CO3	Prepare a software quality plan for a software project - to include sections on change management, configuration management, defect elimination, validation, verification and measurement.
	CO4	Apply the techniques learned to improve the quality of their own software development
	CO5	Employ the latest software quality tools
CS 1639	**Real Time Systems**	
	CO1	Discuss the concepts of Real-Time systems and interpret its model.
	CO2	Recognize the characteristics of a real-time system
	CO3	Develop and document on an architectural design of a real-time system
	CO4	Express an ability to select appropriate algorithms for task scheduling and resource management in Real Time System.
	CO5	Illustrate Real-time Operating Systems and Fault Tolerant applications of Real-Time Systems
CS 1641	**Social Network Analysis**	
	CO1	Explain and extend the competence in structural properties of Social Networks fundamentals
	CO2	Illustrate the ability to formulate and interpret several Social Network models
	CO3	Represent the mathematical representation and analyse Social Network results.
	CO4	Compare and analyze Social Network Data to reach a valid conclusion.
	CO5	Define competence in Social Network Analysis fundamentals.
CS 1643	**VLSI Design**	
	CO1	Identify the various IC fabrication methods
	CO2	Discuss the Layout of simple MOS circuit using Lambda based design rules
	CO3	Apply the Lambda based design rules for subsystem design
	CO4	Design an application using Verilog HDL
	CO5	Evaluate a digital system using Hardware Description Language.
CS 1645/CS 1605	**Unix Internals and Shell Programming**	
	CO1	Describe the function of the basic UNIX commands
	CO2	Identify various useful UNIX commands on a standard UNIX based Operating System
	CO3	Write shell programming on UNIX based Operating System
	CO4	Select suitable system calls for file handling
	CO5	Choose appropriate algorithms for process control and synchronization
CS 1646	**Speech and Natural Language Processing**	
	CO1	Define the concepts used for describing and analyzing language
	CO2	Explain semantics related to the language
	CO3	Construct language models for understanding pragmatics of the language
	CO4	Illustrate modeling concepts using programming languages like Python
	CO5	Evaluate basic language modeling techniques using some standard dataset
CS 1648	**Signals and Networks**	
	CO1	Compute mathematical description and representation of continuous and discrete time signals and networks
	CO2	Illustrate input output relationship for linear shift invariant system and understand the convolution operator for continuous and discrete time system
	CO3	Measure the signals in frequency domain using Fourier series and Fourier transforms
	CO4	Predict the limitations of Fourier transform and need for Laplace transform
	CO5	Develop the ability to analyze the system in S- domain and Z- domain
CS 1650	**Agile Methodology**	
	CO1	Explain the philosophy and historical context of agile methods
	CO2	Enumerate the common agile practices and principles based on the contemporary scientific discourse
	CO3	Analyze the strengths and weaknesses of an agile approach within a particular development context
	CO4	Modify selected agile practices and principles based on own experience from project
	CO5	Employ the latest tools in agile methodology
CS 1651	**Latest Trends in Computer Science**	
	CO1	Discuss various recent technologies used in computer science associated with research and application.
	CO2	Select optimal design scheme suitable for data analytics techniques and tools for extraction of knowledge
	CO3	Identify modern engineering tools, techniques and resources to solve various Computer Vision, Big Data, Block chain Problems, etc
	CO4	Classify machine learning algorithms for sovling Artificial Intelligence problems or other related probems.

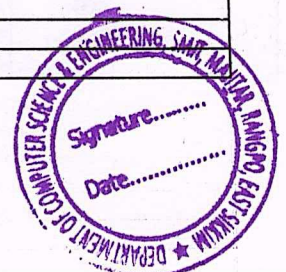|	CO1	Explain competence in using engineering fundamentals to visualize solutions using knowledge of software engineering skills.
	CO2	Determine a solution plan and methodology for an engineering problem using software engineering.
	CO3	Interpret a model for project management as well as define complex problem , also find and analyse requirements
	CO4	Develop modern engineering tools, techniques and resources to solve software related problems.
	CO5	Demonstrate an ability to identify/create modern engineering tools, techniques and resources to solve cloud architecture and storage solution.
CS 1545	**Artificial Neural Networks**	
	CO1	Display sufficient understanding of mathematical and engineering fundamentals in the perspective of Artificial neural network theory.
	CO2	Identify Artificial Neural network suitable for a complex problem.
	CO3	Awake the importance of tolerance of imprecision and uncertainty for design of robust and low-cost intelligent machines.
	CO4	Investigate a problem to identify technical issues and solve the problems using various Artificial neural network.
	CO5	Design real-life application using various neural network algorithm.
CS 1631	**Deep Learning**	
	CO1	Describe deep learning techniques and computing environment that are suitable for the applications under consideration.
	CO2	Discuss various solution plans and methodologies for an engineering problem using Deep Learning.
	CO3	Develop a set of alternative design solutions to problems for which standard algorithmic solutions do not exist.
	CO4	Classify the different technical issues related to Deep Architectures consistent with their level of knowledge and understanding.
	CO5	Apply Deep Learning techniques to solve real-life problems which directly or indirectly benefits to the society
CS 1720 /CS1626	**Intellectual Property Rights**	
	CO1	Identify regulations, legislation and standards for Intellectual Property Rights
	CO2	Describe the impact of Intellectual Property Rights on engineering and industrial practices vis a vis social, environmental and economic contexts
	CO3	Apply principles of Intellectual Property Rights to sustainable design and development.
	CO4	Analyse ethical lapses and recognize ethical dilemmas.
	CO5	Distinguish professional issues which arise in the intellectual property law context
CS 1660/CS 1702	**Soft Computing**	
	CO1	Differentiate between basic soft and hard computing models.
	CO2	Analyze, evaluate and build fuzzy models.
	CO3	Appreciate the importance of tolerance of imprecision and uncertainty for design of robust and low-cost intelligent systems.
	CO4	Apply specified techniques in design and implementation of soft computing models for solving real life problems.
	CO5	To acquire the knowledge of the fuzzy Neural network and Genetic Language.
CS 1535/CS 1636	**Graph Theory**	
	CO1	Distinguish competence in graphical modelling of problems.
	CO2	Compute a solution process using graph theoretical concepts and analyze results for multiple problems.
	CO3	Illustrate and interpret a graph model.
	CO4	Develop diverse set of alternative design solutions for multiple problems.
	CO5	Analyze and interpret the results using contemporary tools.
CS 1537	**Advanced Web Technologies**	
	CO1	Define the basic terms of HTML, CSS and JavaScript
	CO2	Identify appropriate web based technologies for developing dynamic webpages
	CO3	Choose an appropriate database language and technologies for conecting front end to backend
	CO4	Distinguish major frameworks for development of web services and cloud applications
	CO5	Test appropriate content management system for developing scalable websites
Programme Elective VII & VIII		
CS 1730	**Augmented Reality**	
	CO1	Develop interactive augmented reality applications for both PC based mobile devices using a variety of novel input devices.
	CO2	Compare and describe a knowledge of the research literature in Augmented Reality for both compositing and interactive applications.
	CO3	To create environment using AR/VR technology which can help us in our life.
	CO4	It is easy to use this kind of technology to illustrate applications with AR toolkit and mobile AR.
	CO5	Estimate the knowledge of the research literature in Augmented Reality for both compositing and interactive applications.
CS 1731	**Ad-Hoc Wireless Networks**	
	CO1	Understand the involved engineering fundamentals of Ad-Hoc wireless.
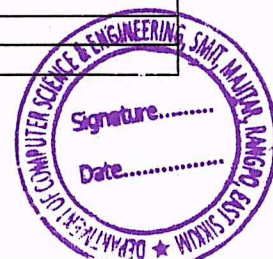
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	CO2	Ability to identify the complex engineering problem relating to Infrastructure based wireless network and Ad-Hoc wireless Network.
	CO3	Ability to formulate a solution plan and methodology by applying appropriate theory, practices and tools to the development of Ad-Hoc network for related application domain.
	CO4	Demonstrate an ability to select optimal design scheme suitable for Ad-Hoc Network considering its inherent characteristics.
	CO5	Understand the various routing protocols especially designed for Ad-Hoc network
CS 1732	**Cloud Computing**	
	CO1	Explain competence in using engineering fundamentals to visualize solutions using knowledge of software engineering skills.
	CO2	Determine a solution plan and methodology for an engineering problem using software engineering.
	CO3	Interpret a model for project management as well as define complex problem , also find and analyse requirements
	CO4	Develop modern engineering tools, techniques and resources to solve software related problems.
	CO5	Demonstrate an ability to identify/create modern engineering tools, techniques and resources to solve cloud architecture and storage solution.
CS 1733	**Cryptography and Network Security**	
	CO1	Define mathematical modelling of a Security services to address modern security issues and challenges.
	CO2	Demonstrate and an ability to formulate a solution plan and methodology for security in information systems using Cryptography
	CO3	Analyze diverse set of alternative design solutions to meet the basic requirements and goals of a security system.
	CO4	Recognize technical issues for existing security principles and network applications consistent with their level of knowledge and understanding.
	CO5	Develop solutions for existing security principles and network applications.
CS 1734	**Distributed Database System**	
	CO1	Describe the various range of data models, database architectures and features supported by different database management systems.
	CO2	Compare the procedural and non-procedural languages and use them where appropriate to process data.
	CO3	Evaluate various types of client-side interfaces to databases using selected modern tools appropriate for the task.
	CO4	Discuss issues underpinning distributed database administration, security and performance.
	CO5	Define and manipulate distributed database data using Structured Query Language (SQL)
CS 1739	**Wireless Sensor Networks**	
	CO1	Understanding the engineering fundamentals of wireless communication applied in sensor network.
	CO2	Ability to identify and relate the complex engineering problem relating to sensor network architectures and functions.
	CO3	Formulate a solution plan and methodology by Applying appropriate theory, practices and tools to the development of wireless sensor network with respect to its applications area.
	CO4	Ability to differentiate and select optimal design scheme suitable for wireless sensor network
	CO5	Discuss and compare the design principles and implementation of a variety of key sensor networking protocols and algorithms
C. 1741	**Machine Learning**	
	CO1	Display sufficient understanding of mathematical and engineering fundamentals in the perspective of machine learning theory.
	CO2	Identify problems that can be solved using machine learning techniques.
	CO3	Appreciate the importance of tolerance of imprecision and uncertainty for design of robust and low-cost intelligent machines.
	CO4	Investigate a problem to identify technical issues and solve the problems using various machine learning techniques.
	CO5	Design real-life applications using machine learning techniques.
CS 1742	**Data Analytics**	
	CO1	Apply data analytics techniques and tools to produce knowledge from a given dataset.
	CO2	Analyze and apply statistical and probabilistic approach for the development of a model using large dataset.
	CO3	Create and evaluate the model using suitable machine learning algorithms.
	CO4	Formulate statistical hypothesis testing and inference for the model development.
	CO5	Explain the dataset using different data representation tools.
C. 1744	**Mobile Computing**	
	CO1	Examine fundamentals of wireless communications.
	CO2	Analyse security, energy efficiency, mobility, scalability, and their unique characteristics in wireless networks.
	CO3	Develop basic skills for cellular networks design.
	CO4	Apply knowledge of TCP/IP extensions for mobile and wireless networking.
	CO5	Measure the awareness of the life-long learning, business ethics, professional ethics and current marketing scenario

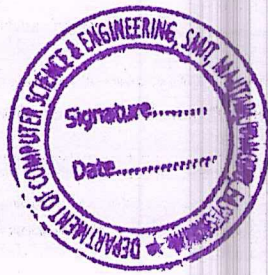|		
CS 1745	**High Performance Computing**	
	CO1	Define the fundamental concepts and techniques in parallel computation structuring and design
	CO2	Describe several parallelization methodologies and paradigms
	CO3	**Choose various mathematical paradigms describing parallel computing systems**
	CO4	Explain the architectures of high-performance computing systems
	CO5	Select appropriate application/platform for algorithm implementation
CS 1746	**Human Computer Interaction**	
	CO1	Describe and apply core theories, models, and methodologies from the field of HCI
	CO2	Analyze one after another the main features of interactive systems, and explain how to gauge the usability of digital environments, tools, and interfaces
	CO3	Identify the various tools and techniques for interface analysis, design, and evaluation.
	CO4	Identify the impact of usable interfaces in the acceptance and performance utilization of information systems.
	CO5	Apply theories and concepts associated with effective work design to real-world application
CS 1747	**Computational Number Theory**	
	CO1	Explain the different concepts in divisibility and modular arithmetic.
	CO2	Develop various algorithms for polynomials
	CO3	Acquire a fundamental understanding of computational models related to elliptic curves and Integer factoring algorithms.
	CO4	Analyze the various methods to compute discrete logarithms.
	CO5	Analyze the various methods to compute integer factoring algorithms.
CS 1748	**Advanced Operating Systems**	
	CO1	Explain and manipulate the different concepts in advanced operating systems.
	CO2	Analyze the working of various subsystems connected to the network.
	CO3	Select appropriate approaches for building a range of distributed systems, including some that employ middleware.
	CO4	Apply standard design principles in the construction of these systems.
	CO5	Select appropriate approaches for building a range of distributed systems
CS 1749	**Fault Tolerant Computing**	
	CO1	Manipulate different concepts in fault tolerant computing.
	CO2	Correlate the basic knowledge of fault tolerant computing with real time situations.
	CO3	Decide on the applicability of such tools during safety critical cases.
	CO4	Select an appropriate tool for testability, controllability and observability.
	CO5	Select an appropriate algorithm for resilience and self- checking.
CS 1750	**Multi-agent Intelligent Systems**	
	CO1	Illustrate the different agent architectures and inter agent communication with different examples
	CO2	Represent distributed rational decision making in various applications.
	CO3	Construct different agent modelling techniques.
	CO4	Summarize the different multi-agent learning techniques.
	CO5	Summarize the different ways of agent communications
CS 1751	**Parallel and Distributed Algorithms**	
	CO1	Discuss about in-depth discourse on how to think about algorithms in a parallelized manner.
	CO2	Select algorithms suitable for conventional, single-processor computers are not appropriate for parallel architectures.
	CO3	Compare inherent parallel algorithms with their counterparts.
	CO4	Justify the choice of parallel algorithms to accomplish a task.
	CO5	Illustrate the process of synchronization.
CS 1752	**Advanced Algorithms**	
	CO1	Describe the divide-and-conquer paradigm with an approach to design an algorithm.
	CO2	Define the dynamic-programming paradigm to explain an algorithmic design.
	CO3	Identify the greedy paradigm with an approach to design an algorithm.
	CO4	Analyze randomized algorithms for a given set of problems.
	CO5	Explain competitive analysis of various algorithms for a given set of problems.
CS 1753	**Computational Geometry**	
	CO1	Describe the divide-and-conquer paradigm and the scenario when it should be employed.
	CO2	Construct algorithms related to computational geometry.
	CO3	Analyze various algorithms based on certain underlying parameters.
	CO4	Evaluate various computational geometry problems
	CO5	Apply computational geometry in solving real world problems
MA 1754	**Queuing Theory and Modeling**	
	CO1	Apply probability techniques, models to analyse the basics of queuing theory.
	CO2	Identify the areas and hence apply the mathematical techniques necessary.
	CO3	Apply knowledge of continuous time stochastic processes for deeper understanding.
	CO4	Learn to design resources such as buffer and link capacities to meet specified required quality of service of a queueing system.
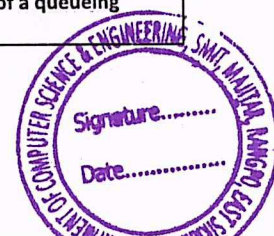
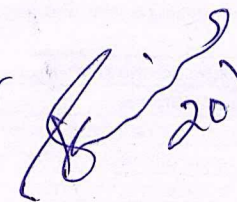|	CO5	The students will develop ability to identify, evaluate, formulate and solve engineering problems related to resource allocation of queueing system.
CS 1755	**Quantum Computing**	
	CO1	Describe the fundamentals of quantum information processing. (BL II).
	CO2	Illustrate the fundamentals of quantum computation, quantum cryptography, and quantum information theory.
	CO3	Device the quantum circuit model consisting of qubits, unitary operators, measurement, entanglement
	CO4	Represent various implementations of Quantum computers.
	CO5	Represent various applications of Quantum computers in real life.
CS 1756	**R Programming**	
	CO1	Choose various mathematical techniques for the data analysis.
	CO2	Describe the process, solution and analyse the results.
	CO3	Develop/create different models and experiment with it.
	CO4	Apply appropriate tools, techniques, algorithms etc.
	CO5	Examine the case study of the different available models.
CS 1757	**Internet of Things**	
	CO1	Show competence in engineering fundamentals through solutions to real world problems Using Networking Technologies
	CO2	Identify solutions to complex engineering problems pertaining to real world.
	CO3	Formulate a solution plan and methodology for an engineering problem using IoT.
	CO4	Plan investigation of technical issues and requirements pertaining to IoT applications.
	CO5	Select and apply discipline specific tools, techniques and resources for IoT applications for various domains.
CS 1640 /CS1758	**Computer Vision**	
	CO1	Display sufficient understanding of mathematical and engineering fundamentals in the perspective of computer vision.
	CO2	Identify problems that can be solved using computer vision techniques.
	CO3	Appreciate the importance of tolerance of imprecision and uncertainty for design of robust and low-cost intelligent machines.
	CO4	Investigate a problem to identify technical issues and solve the problems using various computer vision techniques.
	CO5	Design real-life applications using computer vision techniques.
CS 1760	**Block Chain Coding**	
	CO1	Describe crypto currencies and blockchain fundamentals
	CO2	Explain individual building blocks and understand the working mechanism of any blockchain technology.
	CO3	Discover the modern engineering tools, techniques and resources in the field of blockchain technology.
	CO4	Differentiate between different version of Blockchain technology
	CO5	Illustrate use of blockchain technology in a broader context like health, banking sector and identify security concerns in blockchain technology
CS 1752	**Advanced Algorithms**	
	CO1	Describe the divide-and-conquer paradigm with an approach to design an algorithm.
	CO2	Define the dynamic-programming paradigm to explain an algorithmic design.
	CO3	Identify the greedy paradigm with an approach to design an algorithm.
	CO4	Analyze randomized algorithms for a given set of problems.
	CO5	Explain competitive analysis of various algorithms for a given set of problems.
CS 1759/CS 1644	**Artificial Intelligence**	
	CO1	Identify areas in engineering and real life where Artificial Intelligence (AI) can find its application
	CO2	Discuss the role of mathematical and statistical models in AI
	CO3	Demonstrate an ability to formulate problems using AI
	CO4	Analyse techniques and resources to solve AI problems.
	CO5	Test techniques and resources to solve AI problems.
CS 1655/CS 1624	**Autonomous Mobile Robotics and Computational Intelligence**	
	CO1	Identify application of Robots
	CO2	Describe the evolution, kind of robots and basics of design of a Robotics System
	CO3	Choose correct choices of Locomotion, Kinematics, Perception techniques
	CO4	Apply Intelligent Algorithms for decision making in Motion Planning and path optimization
	CO5	Develop simple robot control systems integrating perception, planning, and action
CS 1641	**Social Network Analysis**	
	CO1	Explain and extend the competence in structural properties of Social Networks fundamentals
	CO2	Illustrate the ability to formulate and interpret several Social Network models
	CO3	Represent the mathematical representation and analyse Social Network results.
	CO4	Compare and analyze Social Network Data to reach a valid conclusion.
	CO5	Define competence in Social Network Analysis fundamentals.
CS 1650	**Agile Methodology**	
	CO1	Explain the philosophy and historical context of agile methods
	CO2	Enumerate the common agile practices and principles based on the contemporary scientific discourse

	CO3	Analyze the strengths and weaknesses of an agile approach within a particular development context
	CO4	Modify selected agile practices and principles based on own experience from project
	CO5	Employ the latest tools in agile methodology
CS 1659	**Ethical Hacking**	
	CO1	Demonstrate competence in applying acquired expertise in computer networks
	CO2	Determine an ability to interpret and evaluate behaviour of malwares and their countermeasures
	CO3	Evaluate the approaches used by hackers and work on its countermeasures to reach a valid conclusion
	CO4	Demonstrate an ability to identify the limitation of tools used to break an insecure web application
	CO5	Decide the problem in the decision-making process between possible options using tools
CS 1743	**Cyber Security**	
	CO1	Discover the concepts of Cyber security and its social, technical and political techniques.
	CO2	Illustrate on the various Intrusion detection and prevention techniques.
	CO3	Analyze various algorithms based on Cryptography and Network security.
	CO4	Asses various methods of handling investigations in the field of cyber forensics
	CO5	Asses the legal and social issues in the development and management of cyber security.
CS 1754	**Future Internet Architecture**	
	CO1	Describe the basic concepts of networking.
	CO2	Construct algorithms related to different backbone networks and Software Defined Networking (SDN)
	CO3	Analyze various algorithms based on data centre networks and data centre virtualization
	CO4	Evaluate various problems based on overlay networks
	CO5	Evaluate various problems based on virtualization.
CS 1631	**Deep Learning**	
	CO1	Describe deep learning techniques and computing environment that are suitable for the applications under consideration.
	CO2	Discuss various solution plans and methodologies for an engineering problem using Deep Learning.
	CO3	Develop a set of alternative design solutions to problems for which standard algorithmic solutions do not exist.
	CO4	Classify the different technical issues related to Deep Architectures consistent with their level of knowledge and understanding.
	CO5	Apply Deep Learning techniques to solve real-life problems which directly or indirectly benefits to the society.
Open Elective-II		
CS 1728 /CS1701	**Distributed Systems**	
	CO1	Observe the complexities of distributed system development.
	CO2	Develop a strategy to overcome important issues including time, inter-process communication, and state management in distributed computing.
	CO3	Construct systems in a constrained distributed environment by integrating several modules and validate the detailed design.
	CO4	Illustrate the ability to apply the knowledge in analysing and designing distributed systems.
	CO5	Summarize the middleware technologies that support distributed applications such as RPC, RMI and object-based middleware
CS 1721 /CS1407	**Principle of Programming Languages**	
	CO1	Examine the major programming paradigms, and the principles and techniques involved in design and implementation of modern programming languages.
	CO2	Classify notations to describe syntax and semantics of programming languages.
	CO3	Analyse the behaviour of simple programs in imperative languages using concepts such as binding, scope, control structures, subprograms and parameter passing mechanisms.
	CO4	Classification of the concepts of ADT and object oriented programming for large scale software development.
	CO5	Evaluate the concepts of concurrency control and exception handling in programming language
CS 1723	**Big Data**	
	CO1	Demonstrate competence in statistics and mathematical modelling to solve big data problems.
	CO2	Apply research-based knowledge and research methods including design of experiments, analysis and interpretation of data. and synthesis of the information to provide valid conclusions.
	CO3	Solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.
	CO4	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations for solving big data problems.
	CO5	Demonstrate an ability to recognize ethical dilemmas between Transparency, Identity and Power.
CS 1724/CS 1736	**Optimization Technique**	
	CO1	Demonstrate the knowledge and understanding of the basic ideas underlying optimization techniques.
	CO2	Apply the mathematical approach to optimization problems relevant to engineering
	CO3	Analyze the robustness of continuous linear optimization problems solutions using sensitivity analysis.
	CO4	Ability to understand and interpret the results and information provided by a particular method.
	CO5	Compare the robustness of continuous linear optimization problems solutions using various techniques
CS 1725	**Indian Music System**	
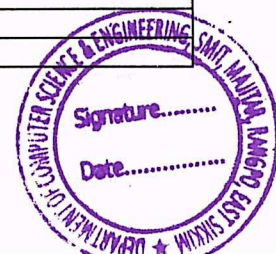
	CO1	Identify, in an oral fashion, the main melodic, rhythmic and formal characteristics of Indian classical music.
	CO2	Identify and use the principal instruments of Indian classical music
	CO3	To identify the names of some major composers and performers of Indian classical music.
	CO4	Represent various applications of music in industry and household.
	CO5	To identify the pioneers of Indian classical music.
CS 1726	**History of Science**	
	CO1	Define science and the scientific method.
	CO2	Describe the possible future of science
	CO3	Explain the difficulties involved in predicting the future of science
	CO4	Explain some of the effects of technology on modern society
	CO5	Compare modern and past examples of science.
CS 1727	**Introduction to Art and Aesthetics**	
	CO1	Focus on the range of questions based on philosophy and science.
	CO2	Apply the history of aesthetics, and the contemporary state of the subject in various problem domains
	CO3	facilitate the application of philosophical thought on aesthetics to students' own engagements with art and the aesthetic.
	CO4	Develop philosophical skills.
	CO5	Practice the appropriate usage of scholarly reviews and primary sources
CS 1729	**Engineering Research Methodology**	
	CO1	Apply appropriate procedure/algorithm, dataset and test cases and choose appropriate hardware/software tools to conduct the experiment.
	CO2	Identify gaps in knowledge and a strategy to complete this gap enhancing knowledge.
	CO3	Select discipline-specific tools, techniques and resources based on strengths and limitations of tools and techniques.
	CO4	Create/develop comprehend technical literature and document project work to produce well formulated written document for supporting logical progression of ideas.
	CO5	Analyze the experimental data and ethical issues.
CS 1720 /CS1626	**Intellectual Property Rights**	
	CO1	Identify regulations, legislation and standards for Intellectual Property Rights
	CO2	Describe the impact of Intellectual Property Rights on engineering and industrial practices vis a vis social, environmental and economic contexts
	CO3	Apply principles of Intellectual Property Rights to sustainable design and development.
	CO4	Analyse ethical lapses and recognize ethical dilemmas.
	CO5	Distinguish professional issues which arise in the intellectual property law context

Signature.........

Date..............

for 20/7/22