Baderia Global Institute of Engineering and Management Jabalpur (M.P.)

Office of Director

Vision, Mission, Quality Policy and Core Values for

BGIEM (Code-0246)

Vision:

"Transforming Life by providing professional education with excellence."

Mission:

- Quality Education: Providing Education with quality and shaping up Technocrats and budding managers with a focus on adapting to changing technologies.
- Focused Research & Innovation: Focusing on Research and Development and fostering Innovation among the academic community of the Institution.
- People Focused: Accountable and committed to institutional operations for effective functioning by Faculty members, Staff and Students.
- Holistic Learning: Focus on conceptual learning with practical experience and experiential learning with strong Industrial connections and collaborations.
- Service to Society: Providing Technical and Managerial services to society for betterment of their quality of life with best of the skills, compassion and empathy.

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Programme Outcomes

Program outcome	Statement Engineering Graduates will be able to:
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling to complex engineering activities, with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

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PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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Computer Science Engineering Department Vision and Mission

Vision of the Department

Transforming the life of the graduates by providing excellent education in the field of Computer Science & Engineering.

Mission of the Department

- Create student centric learning ambience so as to produce graduates who are well informed about latest technological trends and advancement in the world of computing, technology and research.
- Produce professionals who are capable to work in diversified fields, find workable solutions to complex problems with awareness and concern for society and environments.
- Continuously upgrade faculty through training so that they function effectively.
- Encourage industry institute collaborations through consultancies and research, helping students to have conceptual learning.

Program Education Objectives

1. To impart in depth concepts of the subject in terms of both theoretical and practical aspects to achieve excellent University results.
2. To produce technically sound engineering graduates who would fulfil the latest requirements of computer science and IT industry at modest cost with the calibre of solving intricacies of deeper programming concepts.
3. To inculcate the lessons of communication skills, teamwork spirit and professional attitude to the budding engineering graduates.

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4. In order to get versatile growth of students, participation of students in extracurricular activities is also made compulsory; and also to develop ethical attitudes in the graduates so that they can also become good citizens of the nation.

5. To develop leadership and entrepreneurship qualities in budding graduates so that they will cherish and nourish the society and the nation with modern trends of digitization and blossom it with their unparalleled technical expertise.

Program Specific Outcomes

Graduates will be able to-

PSO 1: Proficiency in Computer Systems: Capability to understand, analyze and develop computer programs in the areas related algorithms, system software, multimedia, web design, cloud computing and networking enable designing of computer systems that are efficient and support the degree of complexity.

PSO 2: Proficiency in Software Development: Ability to understand the structure and methodologies of software systems with keen knowledge about software design process and practical expertise in the programming languages and the open system platform.

PSO 3: Proficiency in Mathematics and science concepts: Capable of applying mathematics and science concepts to solve computation tasks and model real world problems using suitable algorithms and data structures.

PSO 4: Successful career as a Computer Science Engineer: Ability to employ themselves as computer professionals, to be an entrepreneur having innovative ideas and sound knowledge in various domains leads to enthusiasm in higher studies and research.

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Information Technology Department Vision and Mission

Vision of the Department

To be in the forefront of Information Technology Education that helps in transforming the life of the graduates.

Mission of the Department

- To produce industry ready graduates with strong technical skills and conceptual knowledge.
- To provide state of the art learning ambience using latest technology tools and software
- Obtain consultancy projects, research and live problems from industries and organizations.
- Keep abreast with latest technologies through Development programs for faculty and industrial training for students.

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Department of Computer Science Engineering (Artificial Intelligence-Machine Learning) Vision and Mission

Vision of the Department

Empowering graduates to lead the future of technology by excelling in Artificial Intelligence and Machine Learning, driving innovation and societal progress.

Mission of the Department

The program strives to:

- Create a student-centric learning environment that produces graduates well-informed about the latest technological trends and advancements in artificial intelligence, machine learning, and related fields.
- Develop professionals capable of working in diverse fields, finding innovative solutions to complex problems with a deep awareness of societal and environmental concerns.
- Continuously upgrade faculty through training to ensure effective teaching and mentorship.
- Encourage industry-institute collaborations through consultancies and research, enabling students to engage in conceptual and practical learning.

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Department of Computer Science Engineering (Data Science) Vision and Mission

Vision of the Department

Cultivating leaders in Data Science who drive innovation and informed decision-making through the power of data analytics and scientific discovery.

Mission of the Department

The program strives to:

- Foster a student-centric learning environment that equips graduates with cutting-edge knowledge and skills in data science, analytics, and related technologies.
- Develop professionals who can apply data-driven approaches to solve complex problems across diverse industries, with a commitment to ethical standards and societal well-being.
- Continuously enhance faculty expertise through ongoing training, ensuring the delivery of high-quality education and mentorship.
- Promote collaboration between academia and industry through research and consultancy projects, providing students with practical experiences and opportunities for conceptual learning.

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Department of Computer Science Engineering (Internet of Things,Cybersecurity and Blockchain) Vision and Mission

Vision of the Department

Empowering graduates to innovate and lead in the converging fields of Internet of Things, Cybersecurity, and Blockchain, fostering a secure, connected, and decentralized future.

Mission of the Department

The program strives to:

- Provide a student-centric learning environment that ensures graduates are proficient in the latest advancements and applications in IoT, Cybersecurity, and Blockchain technologies.
- Develop professionals capable of designing and implementing integrated solutions that address complex challenges across various sectors, emphasizing security, connectivity, and decentralization.
- Continuously enhance faculty expertise through targeted training and development to deliver effective education and mentorship.
- Foster industry-academia collaborations through research and consultancy projects, enabling students to gain practical insights and hands-on experience in the convergence of IoT, Cybersecurity, and Blockchain.

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Vision & Mission of Electronics & Communication Department

Vision

To be a center of learning, offering quality education in the field of Electronics and Communication Engineering with focus on imparting technical expertise and producing globally competent graduates that will be beneficial to the Industry and society.

Mission:

To achieve the vision, the department will

- Establish a unique learning environment to enable the students to face the challenges of the Electronics & Communication engineering field.
- To excel in niche technologies through enhancement in innovation and creativity among faculty and students
- Enable students to develop skills to solve complex technological problems and also provide a framework for promoting collaborative and multidisciplinary activities.
- Provide ethical and value based education by promoting activities addressing societal needs.

Program Educational Objectives:

Students will be able to understand the fabrication and signal transmission through optical fibers and clearly understand the concepts of optical transmitters and receivers and optical networks.

1. Graduates will acquire an educational foundation that prepares them for professional careers/higher studies in the field of ECE.

2. Graduates will utilize their expertise in Electronics & Communication engineering in designing new products and finding technically sound, cost effective and socially acceptable solutions.

3. Graduates will utilize their knowledge and skills to design and develop novel technologies to engineering problems in a multidisciplinary work environment.

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4. Graduates will possess leadership qualities and have effective communication skills with their peers in diverse teams and practice appropriate ethical practices.

5. Graduates will develop an attitude in life-long learning, applying and adapting new ideas and technologies as their field evolves.

Program Specific Outcomes

On successful completion of graduation degree the Electronics and Communication graduates will be able to:

PSO 1- Graduates will be adept at analyzing real-world engineering issues in the domain of Electronics and Communication Engineering.

PSO 2- Graduates will be equipped to design and develop systems or processes utilizing fundamental principles of Electronics and Communication Engineering to address interdisciplinary engineering challenges.

PSO3- Develop effective oral and written communication skills, along with strong leadership and managerial abilities and to work independently or collaboratively, adhering to professional ethics to promote the sustainable development of society.

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Mechanical Engineering Department Vision and Mission

Vision of the Department

To be recognized as a pioneer in the field of Mechanical Engineering by providing education with excellence.

Mission of the Department

- Produce mechanical engineers of global standards in manufacturing, processing, and designing
- To serve society through innovation and excellence in teaching and research.
- To develop linkages with R&D organizations, industries and educational institutions in India for
- excellence in teaching, research and consultancy practices.
- To provide students holistic learning through strong Industry Institute connections.

Program Education Objectives

PEO1 The graduate will engage in professional and extension activities in the field of mechanical engineering and its allied areas and contribute to the professional and society at large scale by pushing the frontiers in technology.

PEO2 The graduate will be capable of carrying out research and analysis in the field of design, thermodynamics, industry and production engineering in order to meet requirements of the dynamics market at regional and global level.

PEO3 Students shall generate employment by design as an entrepreneur, employment in different government, public and private research organizations utilizing technical communication skills.

PEO4 Students shall pursue higher education in engineering and management , contribute to the society in general by becoming professional engineers and responsible citizens of the nation.

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Program Specific Objectives (PSO)

After the successful completion of B. Tech. programme in Mechanical Engineering, the graduates will be able to:

PSO-1 Identify, formulate, analyze and develop manufacturing, design, industrial, and thermal systems for solving various problems in industry and society

PSO-2 Pursue higher education and research in fundamental, applied, and interdisciplinary areas to gain knowledge in emerging scientific technologies.

PSO-3 Utilize mechanical engineering skill to build a career in research labs and industry

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Civil Engineering Department Vision and Mission

Vision of the Department

To be a leader in providing quality education in the field of Civil engineering that helps to transform lives of the people.

Mission of the Department

1. Produce civil engineers of world class standards with ethical and moral values.
2. Provide a congenial and holistic learning environment that is constantly evolving as technology advances.
3. Encourage sponsored research and consultancy works to serve society.
4. Offer modern methods of material testing, engineering analysis, and design along with industrial collaborations.

Programme Specific Outcome (PSOs)

The graduate will be able to: -

PSO 1 – Design, analyze, investigate, and construct all aspects of civil engineering infrastructure, along with a sound knowledge of basic science, mathematics, and technical communication.

PSO 2 – Get motivated to continuously self-learn all engineering practices and pursue research in advanced civil engineering to serve society.

PSO 3 – Understand the ethical requirements of the profession and the necessity for life learning to participate in all civil engineering activities.

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Programme Education Objectives (PEOs)

PEO-I- To prepare students for a prosperous industrial career in the field of civil engineering that satisfies the demands of both Indian and international businesses.

PEO-II- To give students a solid foundation in the scientific, mathematical, and engineering principles required to develop, analyze, and solve civil engineering issues as well as to seek higher education programmes.

PEO-III-To foster students & creative abilities through the application of technical proficiency in design, construction and management in the field of civil engineering.

PEO-IV- To encourage students to pursue lifelong learning and converse them with professional concerns in the field of civil engineering, such as those pertaining to ethics, the global economy, and developing technology.

PEO-V- To develop critical skills connected to the workplace, like enhanced written and spoken communication and teamwork experience.

Programme and course outcomes for all programme offered by the institution are stated and displayed on website and communicated to teachers and students

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COs for all Programme

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B.TECH 1ST year CSE/IT/EC/CE/ME/AIML/IOT/DS			
COURSE OUTCOME(COs): B.Tech. I & II Semester			
Session 2022-23			
1.B.Tech. I Semester			
Code	**Course Name**	**Course Outcomes**	
BT101	Engineering Chemistry	CO1	Describe the implications of hard water and its industrial & domestic applications by learning the characteristics, effects, analysis and treatment methods of hard water.
		CO2	Enumerate the importance of lubricants for machines by learning the classification, properties and testing methods of lubricants.
		CO3	Discuss the role of polymers in everyday life and industry by learning the classification, polymerization, properties and applications of various polymers.
		CO4	Comprehend the role of phase equilibrium and corrosion by learning phase diagrams and types, mechanisms, prevention of corrosion.
		CO5	Explain the basic concepts of instrumental techniques in chemical analysis by learning the principle, instrumentation and applications of InfraRed, Ultra Violet-Visible Spectroscopy
		CO6	Understand the significance of periodic properties by learning electronics configuration, s,p,d,f orbital energies of atoms in periodic table.

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BT102	**Mathematics-I**	**CO1**	Understand and Analyze the fundamental problems of differentiation
		CO2	Identify and solve the integral problems and area of irregular plane by using the Concept of Beta and Gamma function.
		CO3	Understand and Analyze to concepts of Fourier series
		CO4	Understand and Analyze to concepts of Vector Space.
		CO5	Identify a system of linear equations and describe its solutions set.
BT103	**English for Communication**	**CO1**	Implement the general grammar rules and sentence structures to comprehend, read, and write sentences correctly.
		CO2	form new meaningful words through prefixes & suffixes; enrich their vocabulary through synonyms & antonyms, and solve reading comprehension exercises with the help of different reading methods.
		CO3	overcome communication barriers effectively, and communication barriers to communicate analyzing the also speak correctly with proper non-verbal features by analyzing theoretical aspects of communication and their implementation.
		CO4	prepare technical & non-technical reports, write technical descriptions and define the technical terms.
BT104	**Basic Electrical & Electronics Engineering**	**CO1**	To analyze and solve electrical circuits using network laws and theorems **.**
		CO2	Analyze and concept of AC circuits of single phase and three phase.
		CO3	Acquire knowledge on the various parameters of Magnetic

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			circuits and Transformers.
		CO4	Acquire knowledge about the constructional details and principle of operation of machines
		CO5	Design the logic circuit and be able to characterize and verify the characteristics of semiconductor devices like diodes, transistors etc.
BT105	**Engineering Graphics**	**CO1**	Sketch the conic sections, special curves, and draw orthographic views from pictorial views and models.
		CO2	Apply the principles of orthographic projections of points in all quadrants, lines and planes in the first quadrant.
		CO3	Sketch the projections of simple solids like prisms, pyramids, cylinder and cone.
		CO4	Practice the sectional views of solids like cube, prisms, pyramids, cylinders & cones and extend its lateral surfaces.
		CO5	Apply CAD software commands for sketching objects.
2.B.Tech. II Semester			
BT201	**Engineering Physics**	**CO1**	Develop understanding of interference, diffraction & polarization; connect it to few engineering applications.
		CO2	Learn basics of Lasers & optical fibers & their use in some industrial applications.
		CO3	Understand concepts & principles in quantum mechanics. Relate them to some applications of physics.
		CO4	Understand theory of semiconductors & their applications in some semiconductor devices.

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		CO5	Summarize fundamentals of magnetism & superconductivity to explore the technological applications.
BT202	**Mathematics-II**	**CO1**	CO1: Understand basic problems of First Order Differential Equations by elementary methods.
		CO2	Evaluate second Order Differential Equations and its solution by various methods.
		CO3	Evaluate solutions of Partial Differential equations by various methods.
		CO4	Apply various techniques based on the function of complex variables.
		CO5	Evaluate line, surface and volume integral by applying the concept of vector calculus.
BT203	**Basic Mechanical Engineering**	**CO1**	Identify the properties of materials as per their specific application and calculate stress, strain by curve
		CO2	Comparing the concept of different measuring devices, lathe operations and production process
		CO3	Expressing various fluid properties and laws governing hydraulic machines such as turbine, pumps & couplings
		CO4	Determining thermodynamics properties of steam and differentiate between boilers
BT204	**Basic Civil Engineering & Mechanics**	**CO1**	Identify and characterize different building materials based on their properties, use and laboratory and in-situ tests.
		CO2	Understand the working principle and functioning of various surveying instruments and calculate angles, distance, leveling
		CO3	Apply fundamental concepts of area and volume calculations.

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		CO4	Understand assumptions and basics of statics and dynamics principles of force system and apply fundamental concepts on simple practical problems.
		CO5	Apply fundamental concepts of kinematics and kinetics on simple practical problems.
BT205	**Basic Computer Engineering**	**CO1**	Understand and describe the fundamental concepts of computer organization, including the CPU, memory, I/O devices, and software applications, and explain their applications in various fields such as e-business, healthcare, and multimedia
		CO2	Develop the ability to design algorithms, understand algorithm complexities, and create flowcharts. Gain proficiency in programming using C++ by understanding its syntax, control structures, data types, and fundamental programming concepts
		CO3	Demonstrate knowledge of object-oriented programming principles, such as classes, inheritance, polymorphism, and encapsulation, and apply these concepts to solve real-world problems using C++
		CO4	Analyze and explain the principles of computer networking, including the ISO-OSI and TCP/IP models, and understand various types of cyber threats and security measures to protect computer systems
		CO5	Understand and explain the fundamentals of database management systems, including data models, architecture, and data manipulation languages, and evaluate the pros and cons of cloud computing and its deployment models

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COMPUTER SCIENCE & ENGINEERING			
COURSE OUTCOME(COs): B.Tech. III,IV,V,VI,VII & VIII			
Session 2022-23			
Code	**Course Name**	**Course Outcomes**	
1.B.Tech. III semester			
CS 301	**Energy & Environment Engineering**	**CO1**	Analyze the environmental trade-offs of different energy systems, considering factors such as resource availability, efficiency, and potential for sustainability
		CO2	Evaluate the energy flow within a selected ecosystem, identifying key components such as producers, consumers, and decomposers, and explaining how ecological succession influences ecosystem dynamics
		CO3	Compare and contrast the various levels of biodiversity (genetic, species, and ecosystem diversity) and assess their respective values, including consumptive, productive, social, ethical, aesthetic, and option values.
		CO4	Apply critical thinking to analyze the causes, effects, and control measures of a specific type of pollution (e.g., air, water, soil), and formulate recommendations for pollution prevention and mitigation
		CO5	Evaluate the implications of unsustainable development practices on urban energy consumption and propose strategies for transitioning towards sustainable urban development through initiatives like water conservation, rainwater harvesting, and watershed management
CS 302	**Discrete Structure**	**CO1**	Understand sets, relations, functions and discrete structures
		CO1	Analyze and apply set operations, set identities, and the Principle of Inclusion-Exclusion. Demonstrate proficiency in computer representation of sets and basic concepts of propositional and predicate logic.
		CO2	Evaluate and apply counting techniques and combinatorial principles. Analyze properties and types of relations and functions, and their

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			applications in databases (RDBMS) and hashing. Apply the Pigeonhole Principle to solve problems
		CO3	Describe and differentiate basic terminologies related to graphs and trees. Analyze properties of graphs, apply shortest path algorithms, understand cutsets, and solve problems related to Hamiltonian and Eulerian paths and circuits. Demonstrate proficiency in tree traversals and spanning trees
		CO4	Analyze and solve recurrence relations and use generating functions. Introduce the complexity of problems and algorithms, and apply mathematical techniques to analyze the efficiency of algorithms
		CO5	Explain the concepts of algebraic systems including groups, rings, fields, integral domains, lattices, and Boolean algebra. Apply algebraic principles to solve problems and analyze structures
CS 303	**Data Structures**	**CO1**	Proficiency in Data Structure Implementation: Students will be able to design, implement, and manipulate fundamental data structures such as arrays, linked lists, stacks, queues, trees, and graphs.
		CO2	Develop the ability to analyze problems and choose appropriate data structures and algorithms for efficient solutions, emphasizing algorithmic complexity and optimization.
		CO3	Gain expertise in memory management and understand the impact of data structure choices on resource utilization, enabling efficient handling of large datasets and optimizing program performance.
		CO4	Enhance programming skills by applying data structures in real- world scenarios, fostering the development of modular and reusable code for effective software design.
		CO5	Cultivate analytical thinking to solve complex problems through the application of various data structures, fostering a deep understanding of algorithmic paradigms and their practical implications.

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CS 304	Digital System	CO1	To apply Boolean algebra and K-Map for the simplified design of digital circuits.
		CO2	To analyze & design various combinational circuits.
		CO3	Explaining sequential logic design with flip-flops, counters, and memory elements, including practical considerations of semiconductor memories and digital IC's
		CO4	Evaluating, and creating knowledge related to A/D & D/A converters, signal processing circuits, multivibrators, IC 555.
		CO5	To enhance knowledge of digital communication with multiplexing and modulation schemes.
CS 305	Object Oriented Programming & Methodology	CO1	Apprehend the core principles of Object-Oriented Programming (OOP) and distinguish it from Procedural Programming, demonstrating knowledge of key features.
		CO2	Demonstrate effective implementation of Object-Oriented Programming principles by designing classes with well-defined attributes and services.
		CO3	Analyze and apply different types of relationships in Object-Oriented Programming to design class structures that model real-world entities effectively.
		CO4	Skillfully demonstrate polymorphism in Object-Oriented Programming by implementing method overriding and method overloading.
		CO5	Design and develop a practical case study (e.g., ATM or Library Management System) using OOP concepts for code organization, reusability, and effective data management.
CS 306	Computer Workshop	CO1	Apply knowledge of programming concepts to write, test, and debug simple Scripting language programs.
		CO2	Analyze a problem and implement Scripting language programs with conditions and loops.

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		CO3	Implement functions for structuring Python programs and compound data using Python lists, tuples, sets and dictionaries.
2.B.Tech. IV semester			
BT 401	**Mathematics-III**	**CO1**	Identified algebraic and transcendent equation
		CO2	Solve the various engineering problem by using numerical method
		CO3	Understand ordinary & partial differential equations and its solution by various methods.
		CO4	Apply to solve various engineering problem by using Laplace transformation, Inverse Laplace transformation and Fourier Transform.
		CO5	Evaluate solutions of Statistics needed in various field of science and engineering
CS402	**Analysis Design of Algorithm**	**CO1**	Recall and explain the fundamental concepts of algorithms, including time and space complexity, asymptotic notations, and the various bounds on complexity (best-case, worst-case, average-case).
		CO2	Analyze the efficiency of different algorithms by solving recurrence relations, using asymptotic notations, and comparing their performance through time and space complexity analysis.
		CO3	Apply algorithmic techniques such as divide and conquer, greedy strategies, dynamic programming, backtracking, and branch & bound to design and implement solutions for complex computational problems.
		CO4	Develop optimized algorithms by employing code tuning techniques, including loop optimization, data transfer optimization, and logic optimization, to enhance algorithm performance.
		CO5	Evaluate the correctness and efficiency of advanced algorithms, prove their correctness, and analyze lower bounds and the complexity of parallel algorithms, particularly in solving NP-hard and NP-complete problems.

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CS403	**Software Engineering**	**CO1**	Analyze and evaluate the strengths and weaknesses of different software development process models, including linear sequential, prototyping, RAD, incremental, and agile approaches, and recommend the most appropriate model for a given project.
		CO2	Design and create clear and complete system and software requirements specifications using appropriate modeling techniques, such as use case modeling, and validate those requirements using traceability and other methods.
		CO3	Evaluate and select appropriate software design principles and techniques, including architectural views and styles, user interface design, function-oriented and component-based design, and design metrics, to create effective software designs.
		CO4	Apply software testing techniques at different levels, including black-box and white-box unit testing, integration testing, system testing, and specialized testing, and create effective test plans and metrics.
		CO5	Assess and recommend software maintenance and project management strategies, including software configuration management, change management, version control, program comprehension, re-engineering, risk assessment and mitigation, and quality assurance, to ensure the long-term success and sustainability of software projects.
CS404	**Computer Org. & Architecture**	**CO1**	Analyze the structure of desktop computers, including CPU organization and I/O systems.
		CO2	Evaluate arithmetic operations in computers, including addition, subtraction, multiplication, and division using various algorithms
		CO3	Assess different I/O interfaces like PCI Bus, SCSI Bus, and USB, and understand data transfer modes.
		CO4	Evaluate characteristics and structures of multiprocessor systems, including inter-processor arbitration and synchronization.

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		CO5	Investigate multicore processors from manufacturers like Intel and AMD, focusing on architecture and performance enhancements.
CS405	**Operating System**	**CO1**	Define the fundamental concepts of operating systems, including their functions, types, and characteristics.
		CO2	Apply file system concepts, disk organization, and directory structures. Evaluate and choose disk allocation methods, and analyze disk scheduling algorithms
		CO3	Implement CPU scheduling algorithms and comprehend memory management techniques, including partitioning, swapping, segmentation, and paging. Apply the concept of virtual memory through demand paging.
		CO4	Design and construct solutions utilizing semaphores to manage concurrent processes effectively, mitigating deadlock concerns.
		CO5	Analyze case studies of Unix/Linux, Windows, and other network, distributed, and multiprocessor operating systems to understand their architecture and functionalities.
CS406	**Programming Practices**	**CO1**	Recall fundamental Java concepts such as variables, data types, classes, and control structures. and explain advanced Java features including multithreading, networking, and JDBC.
		CO2	Implement object-oriented principles like inheritance, polymorphism, and abstraction in Java applications. and distinguish between different object-oriented programming concepts and their appropriate use cases.
		CO3	Break down the Java Collections Framework to understand how lists, sets, maps, and generics work and their applications. and assess different collection types and algorithms to determine the best data structure for specific problems.

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		CO4	Develop dynamic web applications using Servlets and Java Server Pages (JSP). Set up and configure web servers (e.g., Apache Tomcat) for deploying multi tier applications.
		CO5	Critically evaluate programming assignments and projects to enhance problem-solving skills and use the Java SDK environment to create, debug, and run robust Java applications efficiently.
3.B.Tech. V semester			
CS501	**Theory of Computation**	**CO1**	Explain the basic concepts of switching and finite automata theory & languages.
		CO2	Relate practical problems to languages, automata, computability and complexity.
		CO3	Construct abstract models of computing and check their power to recognize the languages.
		CO4	Analyze the grammar, its types, simplification and normal form.
		CO5	Interpret rigorously formal mathematical methods to prove properties of languages, grammars and automata.
CS502	**Database Management SysteM**	**CO1**	Analyze the key concepts of data management and database systems, including data models, schemas, and instances.
		CO2	Apply relational data model concepts to design and manipulate databases, including the use of SQL queries, integrity constraints, and indexing.
		CO3	Evaluate and apply normalization techniques to design and optimize database schemas, ensuring minimal redundancy and dependency preservation.

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		CO4	Analyze transaction processing mechanisms, including concurrency control and recovery techniques, to ensure data consistency and system reliability.
		CO5	Students will be able to design and implement complex SQL queries utilizing various join operations (e.g., equi-join, non equi-join, self-join, outer join) and special operators (e.g., LIKE, ANY, ALL, EXISTS, IN) to extract data from single and multiple tables effectively, demonstrating proficiency in relational database querying and data retrieval.
CS503	**Cyber Security**	**CO1**	Understand the fundamental concepts of cybercrime, its challenges, and classifications, including email spoofing, spamming, internet time theft, and salami attacks.
		CO2	Identify and analyze various cybercrime techniques such as web jacking, online frauds, software piracy, and identity theft, and understand the perception of cybercriminals.
		CO3	Evaluate the IT Act, 2000, in relation to cybercrime, and understand its application in tackling hacking, cyber fraud, defamation, harassment, and other IT Act offenses.
		CO4	Understand the Indian Evidence Act of 1872 versus the IT Act, 2000, and apply concepts of electronic records as evidence, including proving digital signatures and electronic agreements.
		CO5	Analyze and utilize various tools and methods in cybercrime, such as proxy servers, password cracking, keyloggers, spyware, viruses, DoS attacks, and phishing techniques.
CS504	**IWT**	**CO1**	Explain the fundamental concepts of the World Wide Web, Internet, HTTP protocol, and Web 2.0.
		CO2	Demonstrate proficiency in creating structured web pages using HTML and understanding HTML5 features.

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		CO3	Apply CSS to enhance web page styling and implement responsive design, utilizing CSS3 and JavaScript for dynamic content.
		CO4	Utilize XML for data representation and transformation, and integrate PHP for dynamic server-side scripting.
		CO5	Develop dynamic web applications by integrating PHP with MySQL for comprehensive database management.
CS505	**Linux (Lab)**	**CO1**	Define basic features of Unix/Linux, describe their installation and hardware requirements.
		CO2	Demonstrate basic commands of Unix/Linux and be able to design shell programs.
		CO3	Compare different types of file systems and their internal architectures.
		CO4	Demonstrate different commands for process management.
		CO5	Discover security measures through different security tools available in Linux
CS506	**Python (Lab)**	**CO1**	Apply knowledge of programming concepts to write, test, and debug simple Python programs.
		CO2	Analyze a problem and implement Python programs with conditions and loops.
		CO3	Implement functions for structuring Python programs and compound data using Python lists, tuples, sets and dictionaries.
4.B.Tech. VI semester			
		CO1	Apply foundational concepts and techniques in machine learning to analyze and preprocess data for building machine learning models.
		CO2	Evaluate and implement advanced concepts in neural networks to design and train effective deep learning models.

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CS 601	**Machine Learning**	**CO3**	Design and implement convolutional neural networks (CNNs) for image processing tasks using popular frameworks such as TensorFlow and Keras.
		CO4	Develop and implement models for sequence data processing, including recurrent neural networks (RNNs) and RL-frameworks to address complex problems in various domains.
		CO5	Analyze and apply advanced machine learning algorithms to solve real-world problems in computer vision, speech processing, natural language processing, etc. through a comprehensive case study.
CS 602	**Computer Networks**	**CO1**	Summarize and contrast the responsibility of various layered architecture of computer networking.
		CO2	Interpret the conversion of signals into bit/byte streams and choose appropriate error control, flow control and multiple access mechanisms.
		CO3	Design a network and subnet based on given logical address space.
		CO4	Express the working of various routing algorithms and differences among them.
		CO5	Choose a transport layer protocol with best flow control and error control mechanism that suits a particular computer network application and explain the working of various protocols present in upper layers of the computer network.
CS 603 (C)	**Compiler Design**	**CO1**	Describe the analysis synthesis model of compiler and Analyze lexical analysis phase of compiler.
		CO2	Understand Syntax Analysis & Syntax Directed Translation and Construct parsing tables for Top Down and Bottom up parser.

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		CO3	Understand Type Checking & Run Time Environment and also Explain runtime storage management such as, activation records, stack & heap allocation strategies.
		CO4	Explain Intermediate code generation and Design Directed acyclic graph and make three address codes from a given code.
		CO5	Understand code optimization. Construct Basic blocks and data flow analysis.
CS 604 (B)	**Project Management**	**CO1**	Understand the evolution of software economics and strategies for improving software economics.
		CO2	Identify and apply the framework of software management processes, including lifecycle phases, artifacts, and workflows.
		CO3	Implement iterative process planning and understand project organizations and responsibilities in software management.
CS 605	**Data Analytics Lab**	**CO1**	Apply foundational principles of data analytics by employing concepts of statistics and probability.
		CO2	Evaluate the significance of data processing techniques through an explanation of their relevance and necessity in handling information.
		CO3	Apply data analytics techniques using R, MATLAB, and Python, demonstrating knowledge through executing relevant commands and scripts.
		CO4	Skilfully demonstrate polymorphism in Object-Oriented Programming by implementing method overriding and method overloading.
5.B.Tech. VII semester			
		CO1	Understanding the fundamentals, qualities, and terminologies is essential for designing robust, efficient, and maintainable software systems.

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CS 701	Software Architectures	CO2	To maintain a high-level structure of a software system that defines its components and the relationships between them.and use key fundamentals, qualities, and terminologies associated with software architecture:
		CO3	Represents the design decisions related to overall system structure and behavior as well as understand and analyze how the system will achieve essential qualities such as modifiability, availability, and security.
		CO4	The principles of software architectures for enterprise application development involves following established guidelines and best practices to ensure the system is maintainable,secure and efficient.
		CO5	To Ensure the system can handle growth in users, transactions, and data and Divide the system into smaller, manageable, and interchangeable components or modules.
CS 702 (A)	Computational Intelligence	CO1	Describe in-depth about theories, methods, and algorithms in computational Intelligence.
		CO2	Compare and contrast traditional algorithms with nature inspired algorithms.
		CO3	Examine the nature of a problem at hand and determine whether a computation intelligent technique/algorithm can solve it efficiently enough.
		CO4	Design and implement Computation Intelligence algorithms and approaches for solving real- life problems.
		CO1	Understand and explain the fundamentals of Agile processes, including the Agile Manifesto, principles and development models such as Scrum, XP, FDD, Crystal, Kanban and Lean Software Development.

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CS 703 (B)	Agile Software Development	CO2	Analyze and plan Agile projects, including team distribution, project lifecycles, product vision, release, planning and monitoring risks and issues.
		CO3	Implement and manage Scrum framework activities, including sprint planning, execution, review, retrospective, and user story management.
		CO4	Understand and apply Extreme Programming (XP) principles, lifecycle, concepts, and techniques, including pair programming and continuous integration.
		CO5	Apply agile design practices, refactoring techniques,continuous integration, and quality assurance approaches in software development.
CS 704	Computational Intelligence Lab	CO1	Describe in-depth about theories, methods, and algorithms in computational Intelligence.
		CO2	Compare and contrast traditional algorithms with nature inspired algorithms.
		CO3	Examine the nature of a problem at hand and determine whether a computation intelligent technique/algorithm can solve it efficiently enough.
		CO4	Design and implement Computation Intelligence algorithms and approaches for solving real- life problems.
CS 705		CO1	Understand and explain the fundamentals of Agile processes, including the Agile Manifesto, principles and development models such as Scrum, XP, FDD, Crystal, Kanban and Lean Software Development.
		CO2	Analyze and plan Agile projects, including team distribution, project lifecycles, product vision, release, planning and monitoring risks and issues.

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	Agile Software Development Lab	**CO3**	Implement and manage Scrum framework activities, including sprint planning, execution, review, retrospective, and user story management.
		CO4	Understand and apply Extreme Programming (XP) principles, lifecycle, concepts, and techniques, including pair programming and continuous integration.
		CO5	Apply agile design practices, refactoring techniques,continuous integration, and quality assurance approaches in software development.
6.B.Tech. VIII semester			
CS 801	**IoT**	**CO1**	Analyze IoT concepts, architectures, and communication protocols to design and implement IoT solutions for real-world applications
		CO2	Analyze sensor node components, characteristics, and actuator types to design and troubleshoot sensor-based systems effectively
		CO3	Evaluate IoT networking components, protocols, and challenges to design and implement scalable and efficient IoT solutions
		CO4	Analyze MQTT, CoAP, XMPP, and AMQP protocols, their components, and communication models for designing efficient IoT applications.
		CO5	Evaluate IoT platforms, including Arduino and Raspberry Pi, and apply data analytics and cloud solutions to IoT projects
CS 802 (B)	**Cloud Computing**	**CO1**	Understand the fundamental concepts of Service-Oriented Architecture (SOA) and web services, including SOAP, WSDL, UDDI, and RESTful services.
		CO2	Analyze utility computing, elastic computing, and the use of virtualization in enterprises, including the challenges of multi tenant software.
		CO3	Implement and compare cloud data management solutions using GFS, HDFS, Big Table, HBase, Dynamo, and the Map-Reduce model.
		CO4	Evaluate cloud security fundamentals, addressing privacy, security challenges, and virtualization security techniques.

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		CO5	Address issues in cloud computing, including real-time application implementation, QoS, data migration, load balancing, and monitoring.
CS 803 (D)	**Managing Innovation and Entrepreneurship**	**CO1**	Students will be able to explain the interconnection between innovation and entrepreneurship.
		CO2	Learners will categorize various forms of innovation (product, process, organizational, marketing) to evaluate their roles in business development.
		CO3	Students will assess different methods and approaches in innovation management, such as agile management and the NUF test.
		CO4	Through understanding innovation strategies and the co-creation process, learners will develop strategies tailored to specific business contexts.
		CO5	Participants will analyze financial and non-financial metrics to measure innovation benefits and identify barriers to innovation.
CS 804	**Cloud Computing Lab**	**CO1**	Understand the fundamental concepts of Service-Oriented Architecture (SOA) and web services, including SOAP, WSDL, UDDI, and RESTful services.
		CO2	Analyze utility computing, elastic computing, and the use of virtualization in enterprises, including the challenges of multi tenant software.
		CO3	Implement and compare cloud data management solutions using GFS, HDFS, Big Table, HBase, Dynamo, and the Map-Reduce model.
		CO4	Evaluate cloud security fundamentals, addressing privacy, security challenges, and virtualization security techniques.
		CO5	Address issues in cloud computing, including real-time application implementation, QoS, data migration, load balancing, and monitoring.

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INFORMATION TECHNOLOGY			
COURSE OUTCOME(COs): B.Tech. III,IV,V,VI,VII & VIII			
Session 2022-23			
1.B.Tech. III semester			
Code	**Course Name**	**Course Outcomes**	
ES 301	**Energy & Environment Engineering**	**CO1**	Analyze the environmental trade-offs of different energy systems, considering factors such as resource availability, efficiency, and potential for sustainability
		CO2	Evaluate the energy flow within a selected ecosystem, identifying key components such as producers, consumers, and decomposers, and explaining how ecological succession influences ecosystem dynamics
		CO3	Compare and contrast the various levels of biodiversity (genetic, species, and ecosystem diversity) and assess their respective values, including consumptive, productive, social, ethical, aesthetic, and option values.
		CO4	Apply critical thinking to analyze the causes, effects, and control measures of a specific type of pollution (e.g., air, water, soil), and formulate recommendations for pollution prevention and mitigation
		CO5	Evaluate the implications of unsustainable development practices on urban energy consumption and propose strategies for transitioning towards sustainable urban development through initiatives like water conservation, rainwater harvesting, and watershed management
		CO1	Analyze and apply set operations, set identities, and the Principle of Inclusion-Exclusion. Demonstrate proficiency in computer

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IT 302	**Discrete Structure**		representation of sets and basic concepts of propositional and predicate logic
		CO2	Evaluate and apply counting techniques and combinatorial principles. Analyze properties and types of relations and functions, and their applications in databases (RDBMS) and hashing. Apply the Pigeonhole Principle to solve problems
		CO3	Describe and differentiate basic terminologies related to graphs and trees. Analyze properties of graphs, apply shortest path algorithms, understand cutsets, and solve problems related to Hamiltonian and Eulerian paths and circuits. Demonstrate proficiency in tree traversals and spanning trees
		CO4	Analyze and solve recurrence relations and use generating functions. Introduce the complexity of problems and algorithms, and apply mathematical techniques to analyze the efficiency of algorithms
		CO5	Explain the concepts of algebraic systems including groups, rings, fields, integral domains, lattices, and Boolean algebra. Apply algebraic principles to solve problems and analyze structures
IT 303	**Data Structures**	**CO1**	Proficiency in Data Structure Implementation: Students will be able to design, implement, and manipulate fundamental data structures such as arrays, linked lists, stacks, queues, trees, and graphs.
		CO2	Develop the ability to analyze problems and choose appropriate data structures and algorithms for efficient solutions, emphasizing algorithmic complexity and optimization.
		CO3	Gain expertise in memory management and understand the impact of data structure choices on resource utilization, enabling

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			efficient handling of large datasets and optimizing program performance.
		CO4	Enhance programming skills by applying data structures in real-world scenarios, fostering the development of modular and reusable code for effective software design.
		CO5	Cultivate analytical thinking to solve complex problems through the application of various data structures, fostering a deep understanding of algorithmic paradigms and their practical implications.
IT 304	**Object Oriented Programming & Methodology**	**CO1**	Students will Understand the core principles of Object-Oriented Programming (OOP) and distinguish it from Procedural Programming, demonstrating knowledge of key features such as encapsulation, data abstraction, inheritance, and polymorphism
		CO2	Students will Demonstrate effective implementation of Object-Oriented Programming (OOP) principles by designing classes with well-defined attributes and services, using appropriate access modifiers and static members, creating instances of classes, and showcasing a clear understanding of object construction and destruction concepts.
		CO3	Students will be able to Analyze and apply different types of relationships in Object-Oriented Programming (OOP), including 'is a' (inheritance), Association, and Aggregation, to design class structures that model real-world entities effectively.
		CO4	Students will skillfully demonstrate polymorphism in Object-Oriented Programming (OOP) by implementing method overriding and method overloading, showcasing how these

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			techniques achieve runtime and compile-time polymorphism, respectively.
		CO5	Students will Understand Streams classes, Stream Errors, Disk File I/O with streams, file pointers, error handling in file I/O with member function, also overloading the extraction and insertion operators, memory as a stream object, command line arguments, printer output,.
IT 305	**Digital Circuits & Systems**	**CO1**	To apply Boolean algebra and K-Map for the simplified design of digital circuits.
		CO2	To analyze & design various combinational circuits.
		CO3	To design & validate the logics behind the operations of sequential circuits like counters & registers
		CO4	Analyze the various logic families
		CO5	Design circuit using IC 555, LED, LCD etc
IT 306	**Java Programming Lab**	**CO1**	Develop and execute simple Java programs using fundamentals programming constructs, illustrating the basics of Object-Oriented programming.
		CO2	Design and implement Java programs using classes, objects, inheritance, and exception handling, demonstrating effective use of Object-Oriented principles.
		CO3	Construct and manage Java applets to create interactive web-based applications, employing principles of applet architecture and parameters passing.
		CO4	Develop graphical user interfaces using AWT and Swing components, managing events and layouts to enhance user interaction.

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		CO5	Implement advanced Java features such as event handling and JDBC, integrating databases with Java applications for robust data management solutions.
2.B.Tech. IV semester			
BT 401	**Mathematics-III**	**CO1**	Apply the Bisection, Newton-Raphson, and Regula-Falsi methods to solve polynomial and transcendental equations, Newton's divided difference, and Lagrange's formula for interpolation with unequal intervals
		CO2	Apply numerical differentiation methods and numerical integration techniques such as the Trapezoidal rule and Simpson's 1/3rd and 3/8 rules, Gauss's elimination, Gauss-Jordan, Crout's methods, Jacobi's method, Gauss-Seidel method, and Relaxation method
		CO3	Implement Taylor's series, Euler and modified Euler's methods, Runge-Kutta and other methods of fourth order for solving ordinary differential equations.
		CO4	Understand and evaluate Laplace transform, its properties, and Laplace transform of periodic functions, methods to find inverse Laplace transform and use convolution theorem
		CO5	Describe probability concepts including Probability Mass Function (PMF) and Probability Density Function (PDF), discrete distributions such as Binomial and Poisson distributions, and continuous distributions including Normal and Exponential distributions
	Computer Architecture	**CO1**	Analyze the structure of desktop computers, including CPU organization and I/O systems.
		CO2	Evaluate arithmetic operations in computers, including addition, subtraction, multiplication, and division using various algorithms.

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IT402		**CO3**	Assess different I/O interfaces like PCI Bus, SCSI Bus, and USB, and understand data transfer modes.
		CO4	Evaluate characteristics and structures of multiprocessor systems, including inter-processor arbitration and synchronization.
		CO5	Investigate multicore processors from manufacturers like Intel and AMD, focusing on architecture and performance enhancements.
IT403	**Analysis and Design of Algorithm**	**CO1**	Understand fundamental concepts in algorithm design, analysis, and comparison, including asymptotic notations and basic sorting and searching algorithms.
		CO2	Apply various algorithmic techniques such as divide and conquer, greedy, dynamic programming, and backtracking to solve a wide range of computational problems efficiently.
		CO3	Analyze and evaluate the efficiency and correctness of algorithms, including their time and space complexities, through theoretical analysis and practical experimentation.
		CO4	Develop proficiency in implementing and utilizing essential data structures such as heaps, trees, and graphs, along with associated algorithms for sorting, searching, and optimization.
		CO5	Apply algorithmic techniques and data structures to solve complex computational problems encountered in various domains, including optimization, graph theory, and combinatorial problems like NP-completeness
		CO1	Illustrate the fundamentals of signals and systems, including their classification, properties, and representation in time and frequency domains.
		CO2	Interpret Amplitude modulation (AM) techniques, Demodulation methods, and the operation of AM transmitters and receivers.

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IT404	**Analog & Digital Communication**	**CO3**	Inspect the principles of Angle modulation, focusing on Frequency modulation (FM) and Phase modulation (PM), along with their demodulation techniques.
		CO4	Extend the knowledge of Pulse modulation systems, including Pulse amplitude modulation (PAM), Pulse code modulation (PCM), and various digital modulation techniques.
		CO5	Evaluate digital modulation techniques such as amplitude shift keying (ASK), phase shift keying (PSK), frequency shift keying (FSK), and quadrature amplitude modulation (QAM), along with their generation, detection, and bandwidth characteristics..
IT405	**Database Management System**	**CO1**	Analyze and describe DBMS basics, data models, schemas, and ER diagrams, including DBA functions and database advantages
		CO2	Apply relational model concepts, including relational algebra and ER modeling techniques, to design and query databases effectively
		CO3	Analyze SQL data operations, query processing, and optimization strategies through ORACLE and DB2 case studies
		CO4	Analyze relational database designs, including normalization and dependency concepts, to create efficient and structured database schemas
		CO5	Evaluate transaction processing, concurrency control methods, and security in distributed and object-oriented database systems
IT406		**CO1**	Install and configure MATLAB/SciLab, and understand the basics of programming and data types.
		CO2	Develop proficiency in MATLAB/SciLab with control structures, file handling, and basic Simulink introduction.

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	Matlab, Scilab/ Web Design	**CO3**	Understand the fundamentals of web design, including HTML elements, tags, and basic formatting.
		CO4	Integrate multimedia elements and advanced HTML features into web pages.
		CO5	Apply CSS to style and enhance the layout of web pages.
IT407	**Linux/ R**	**CO1**	Introduction to LINUX Operating System covers Linux distributions, hardware requirements, installation, commands, utilities, and basic system administration tasks.
		CO2	focuses on file handling, including file manipulation commands, permissions, networking, and system administration.
		CO3	delves into Bash shell scripting, covering variables, control structures, debugging, and script execution.
		CO4	introduces R programming, covering syntax, control structures, functions, and environment.
		CO5	explores R data structures, including vectors, matrices, lists, data frames, and visualization techniques.
3.B.Tech. V semester			
IT501	**Operating System**	**CO1**	Define the fundamental concepts of operating systems, including their functions, types, and characteristics.
		CO2	Apply file system concepts, disk organization, and directory structures. Evaluate and choose disk allocation methods, and analyze disk scheduling algorithms
		CO3	Implement CPU scheduling algorithms and comprehend memory management techniques, including partitioning, swapping, segmentation, and paging. Apply the concept of virtual memory through demand paging.

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		CO4	Design and construct solutions utilizing semaphores to manage concurrent processes effectively, mitigating deadlock concerns.
		CO5	Analyze case studies of Unix/Linux, Windows, and other network, distributed, and multiprocessor operating systems to understand their architecture and functionalities.
IT502	**Computer Networks**	**CO1**	Students will Characterize and appreciate computer networks from the view point of components and from the view point of services.
		CO2	Students will acquire a good understanding of the flow of a protocol in general and a network protocol in particular.
		CO3	Students will Model a problem or situation in terms of layering concept and map it to the TCP/IP stack
		CO4	Students will be able to select the most suitable Application Layer protocol (such as HTTP, FTP, SMTP, DNS, Bit torrent) as per the requirements of the network application and work with available tools to demonstrate the working of these protocols.
		CO5	Students will be able to design a Reliable Data Transfer Protocol and incrementally develop solutions for the requirements of Transport Layer. describe the essential principles of Network Layers and use IP addressing to create subnets for any specific requirements.
IT503	**OOAD**	**CO1**	Create and interpret class diagrams using object and class concepts, associations, multiplicity, ternary associations, recursive associations, association classes, generalization, inheritance, multiple inheritance, aggregation, composition, abstract classes, and packages

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		CO2	Create and interpret class diagrams using object and class concepts, associations, multiplicity, ternary associations, recursive associations, association classes, generalization, inheritance, multiple inheritance, aggregation, composition, abstract classes, and packages
		CO3	Design state diagrams to model events, states, transitions, and conditions. Differentiate between continuous life cycle state diagrams and one-shot life cycle state diagrams. Apply concepts like sub-states, nested state diagrams, signal generalization, concurrency, junction state, and synchronization state. Relate class and state models
		CO4	Develop use case models including actors, use cases, and their relationships, create sequence diagrams, procedural sequence models, activity models with swim lanes, dynamic concurrency, and decomposing activities.
		CO5	Design system and class structures, Model implementation details including structure and functionality, and concepts like CORBA, COM, and DCOM
IT504	**Java Programming**	**CO1**	Explain the structure and components of the Java development environment, including JDK, JVM, and Java API, and apply Object-Oriented programming principles to develop basic Java applications.
		CO2	Design and implement graphical user interfaces (GUIs) using AWT components, layouts managers and event handling models to create interactive Java applications.
		CO3	Develop multi-threaded Java programs and implement robust exception handling mechanisms to ensure program reliability and efficiency.

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		CO4	Utilize Java I/O streams and JDBC to manage file operations and database connectivity, enabling data persistence and retrieval in Java applications.
		CO5	Implement network-based applications using Java's networking APIs and RMI, demonstrating an understanding of client-server architecture and distributed computing.
IT505	**Advance Java Lab**	**CO1**	Develop and implement Java applications that interact with relational databases using JDBC, demonstrating an understanding of the types of drivers, the client/server model, and the JDBC API.
		CO2	Design and deploy web applications using Java Servlets, understanding their lifecycle, parameter handling, and interaction with HTTP.
		CO3	Construct dynamic web pages using JSP, handling errors appropriately and configuring the server for optional performance.
		CO4	Develop and manage enterprise-level applications using Enterprise Java Bean (EJB), understanding the lifecycle,types and transaction management.
		CO5	Implement web applications using the Struts framework, understanding its architecture, MVC pattern, and validation framework.
4.B.Tech. VI semester			
IT601	**CGM**	**CO1**	Explain the principles and functioning of various display technologies and input devices.
		CO2	Implement and analyze scan conversion algorithms for drawing graphical elements.applications.

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		CO3	Apply 2D and 3D transformations, clipping algorithms, and projection techniques.
		CO4	Describe multimedia system architecture and utilize multimedia tools for content creation.
		CO5	Understand and apply compression techniques and identify multimedia file formats.
IT602	**WMC**	**CO1**	**Analyze** the operation and design of antennas, multiple access techniques, and cellular network components to solve complex engineering problems related to wireless communication
		CO2	**Evaluate** the architecture, protocols, and performance of GSM and other mobile communication systems such as GPRS, DECT, TETRA, and UMTS for efficient communication and mobility management
		CO3	**Compare** the protocol architectures, physical layers, and MAC layers of IEEE 802.11 standards and Bluetooth, and their implications for network performance and management
		CO4	**Analyze** the performance issues and routing protocols in Mobile IP, DHCP, and ad hoc networks, including mobile transport layer protocols like Indirect TCP and Mobile TCP
		CO5	**Evaluate** network security mechanisms including intrusion detection, firewall design, and authentication systems to address and mitigate threats in wireless communication systems
IT603	**Data Mining**	**CO1**	Understand the fundamental concepts, architecture, and processes involved in data warehousing.
		CO2	Gain knowledge on data preprocessing techniques, data mining methodologies, and their applications.
		CO3	Learn to apply association rule mining techniques and algorithms to discover patterns in large datasets.

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		CO4	Develop skills in various classification and clustering methods, including evaluating their effectiveness.
		CO5	Explore advanced topics in web mining, spatial mining, temporal mining, text mining, and related ethical issues.
IT604	**Software Engineering**	**CO1**	Comprehend software development methodologies (SDLC, Agile, etc.) for analyzing their suitability in projects**.**
		CO2	Apply software metrics and estimation techniques (LOC, FP, COCOMO) to predict project costs accurately.
		CO3	Analyze requirements, use design tools for creating user-friendly systems, integrating principles like object-oriented design
		CO4	Implement coding standards, conduct code reviews, apply testing strategies (white-box, black-box) for ensuring software quality.
		CO5	Manage software maintenance, adhere to project schedules, implement quality planning, and SCM activities for compliance with standards like CMM.
IT605	**Programming in Python**	**CO1**	Apply knowledge of programming concepts to write, test, and debug simple Python programs.
		CO2	Analyze a problem and implement Python programs with conditions and loops.
		CO3	Implement functions for structuring Python programs and compound data using Python lists, tuples, sets and dictionaries.
IT606	**Android Programming**	**CO1**	Understand and explain the background of mobile technologies and the role of Android as an open platform for mobile development.
		CO2	Set up an Android development environment and develop a basic Android application.

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		CO3	Understand the Android Project Framework and the components involved in creating an Android application.
		CO4	Design and implement Android activities and user interfaces using various layouts and UI components.
		CO5	Apply understanding of Android internals, activity lifecycle, and intents to create robust Android applications.
5.B.Tech. VII semester			
IT 701	**Soft Computing**	**CO1**	Understand neural network fundamentals, differentiate ANN from biological NN, and apply basic models and learning rules like McCulloch-Pitts and Hebb.
		CO2	Gain proficiency in perceptron learning, develop single and multilayer networks, and utilize neural networks for practical applications like forecasting and data compression.
		CO3	Master unsupervised learning techniques including Kohonen SOM and CNN, and apply them to various theoretical and practical scenarios.
		CO4	Comprehend fuzzy set theory, apply fuzzy logic to engineering problems, and develop fuzzy inference systems for decision making.
		CO5	Understand the principles and operators of genetic algorithms, solve optimization problems like TSP, and explore advanced techniques like ACO and PSO.
		CO1	Students will understand the fundamental concepts of grid and cloud computing, including characteristics, components, cloud models, and the various cloud computing platforms such as Amazon EC2, Google App Engine, and Microsoft Azure.
		CO2	Students will be able to design and implement cloud services such as SAAS, PAAS, and IAAS using SOA principles,

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IT 702	**Cloud Computing**		addressing aspects like cloud stack, cloud analytics, and information security.
		CO3	Students will analyze and apply virtualization technologies, including hypervisors, storage virtualization, and virtualized data centers, to optimize cloud computing environments.
		CO4	Students will assess cloud security fundamentals and implement security measures to address vulnerabilities, privacy issues, and security challenges in virtualized cloud environments.
		CO5	Students will be able to evaluate and utilize advanced cloud computing platforms and concepts, including SOA, OLAP, mobile cloud computing, and various cloud infrastructure benchmarks to enhance cloud performance and address inter-cloud issues.
IT 703	**IOT**	**CO1**	Analyze IoT concepts, architectures, and communication protocols to design and implement IoT solutions for real-world applications
		CO2	Analyze sensor node components, characteristics, and actuator types to design and troubleshoot sensor-based systems effectively
		CO3	Evaluate IoT networking components, protocols, and challenges to design and implement scalable and efficient IoT solutions
		CO4	Analyze MQTT, CoAP, XMPP, and AMQP protocols, their components, and communication models for designing efficient IoT applications.
		CO5	Evaluate IoT platforms, including Arduino and Raspberry Pi, and apply data analytics and cloud solutions to IoT projects
	Cloud Computing Lab	**CO1**	Understand the fundamental concepts of Service-Oriented Architecture (SOA) and web services, including SOAP, WSDL, UDDI, and RESTful services.

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IT 704		**CO2**	Analyze utility computing, elastic computing, and the use of virtualization in enterprises, including the challenges of multi tenant software.
		CO3	Implement and compare cloud data management solutions using GFS, HDFS, Big Table, HBase, Dynamo, and the Map-Reduce model.
		CO4	Evaluate cloud security fundamentals, addressing privacy, security challenges, and virtualization security techniques.
		CO5	Address issues in cloud computing, including real-time application implementation, QoS, data migration, load balancing, and monitoring.
IT 705	**IOT Lab**	**CO1**	Identify and execute necessary software installations for Arduino/Raspberry Pi to prepare for experimental interfacing.
		CO2	Apply programming skills to interface LED/Buzzer with Arduino/Raspberry Pi, demonstrating sequential activation.
		CO3	Develop code to integrate Push button/Digital sensor with Arduino/Raspberry Pi, triggering LED activation upon input detection.
		CO4	Utilize DHT11 sensor integration to Arduino/Raspberry Pi, creating a program to display temperature and humidity readings
		CO5	Design a program to interface the motor via relay with Arduino/Raspberry Pi, activating upon push button press.
6.B.Tech. VIII semester			
		CO1	Gain a foundational understanding of information security principles, classical encryption techniques, and the OSI security architecture.
		CO2	Dive into the complexities of block ciphers, including the Data

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IT 801	**Information Security**		Encryption Standard (DES) and the Advanced Encryption Standard (AES), to ensure secure data encryption.
		CO3	Explore the intricacies of public key encryption systems like RSA and Diffie-Hellman, alongside message authentication and hash functions, for robust data security.
		CO4	Learn about authentication applications such as Kerberos and X.509, electronic mail security, IP security, and web security considerations to safeguard network communications.
		CO5	Develop expertise in system security by addressing intruders, malicious software, and implementing security controls like intrusion detection, password management, and firewalls.
IT 802	**Machine Learning**	**CO1**	Understand and explain various learning paradigms, concept learning, hypothesis spaces, PAC learning, and VC dimension, and apply these concepts to analyze learning algorithms.
		CO2	Implement and evaluate supervised learning algorithms, including decision trees, regression models, neural networks, and support vector machines, to classify and predict data accurately.
		CO3	Analyze and apply ensemble learning techniques, such as bagging, boosting, and stacking, to improve the performance and robustness of machine learning models.
		CO4	Implement various unsupervised learning methods, including hierarchical and partitional clustering, self-organizing maps, and dimensionality reduction techniques like PCA and LLE.
		CO5	Apply probabilistic learning methods, including Bayesian learning, Naïve Bayes classifiers, and Bayesian belief networks, to develop models for frequent pattern mining and optimal classification.

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IT 803	Blockchain Technology	CO1	Students will explain the fundamental concepts of blockchain technology, including public ledgers, Bitcoin, smart contracts, transactions, and distributed consensus, and differentiate between public and private blockchains.
		CO2	Students will analyze the Bitcoin network, including coin creation, transactions, consensus mechanisms like Proof of Work, and the challenges associated with mining and maintaining network security.
		CO3	Students will be able to design and evaluate permissioned blockchain models for enterprise use cases, addressing design issues, consensus models, and fault tolerance mechanisms.
		CO4	Students will be able to design and evaluate permissioned blockchain models for enterprise use cases, addressing design issues, consensus models, and fault tolerance mechanisms.
		CO5	Students will develop and implement smart contracts using platforms like Hyperledger Fabric and Ethereum, and understand the architecture and access control mechanisms of blockchain platforms such as Ripple and Corda.
IT 804	Machine Learning Lab	CO1	Apply knowledge of computing and mathematics to machine learning problems, models and algorithms.
		CO2	Analyze a problem and identify the computing requirements appropriate for its solution.
		CO3	Apply mathematical foundations, algorithmic principles, and computer science theory to the modeling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design choices.

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COURSE OUTCOME(COs): B.Tech. III & IV			
Session 2022-23			
1.B.Tech. III Semester			
Code	**Course Name**	**Course Outcomes**	
COMPUTER SCIENCE & ENGINEERING (AIML)			
AL 301	**Technical Communication**	**CO1**	Understand and articulate the process and scope of communication, emphasizing the importance of unity, brevity, and clarity in various forms of communication within a global context
		CO2	Analyze different types of communication, including verbal and non-verbal, and identify barriers to effective communication. Develop strategies for overcoming these barriers and improving communication skills in a globalized environment
		CO3	Apply principles of technical and business writing to compose effective memos, letters, reports, and research papers. Develop speaking skills, including audience awareness, voice modulation, and presentation techniques, to effectively communicate ideas to varied audiences
		CO4	Evaluate and practice techniques for preparing and delivering effective job interviews and professional presentations. Understand the role of non-verbal communication, body language, and argumentation skills in group discussions and professional settings
		CO5	Demonstrate proficiency in advanced grammar, vocabulary, and pronunciation. Apply these linguistic skills to enhance both written and spoken communication, focusing on professional personality attributes and effective speech delivery
		CO1	Understand probability spaces, conditional probability, and independence. Analyze discrete random variables, multinomial

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			distributions, and Poisson approximation to the binomial distribution. Apply concepts of sums of independent random variables, expectation, moments, variance, correlation coefficient, and Chebyshev's inequality
		CO2	Define continuous random variables and their properties. Discuss distribution functions, densities, and characteristics of normal, exponential, and gamma distributions
		CO3	Describe properties of bivariate distributions. Analyze distribution of sums and quotients, conditional densities, and apply Bayes' rule
AL 302	**Introduction to Probability and Statistics**	**CO4**	Compute measures of central tendency, skewness, and kurtosis. Evaluate probability distributions such as binomial, Poisson, and normal distributions. Calculate statistical parameters for these distributions. Understand correlation, regression, and rank correlation
		CO5	Apply curve fitting using the method of least squares for fitting straight lines, parabolas, and general curves. Perform large sample tests for single proportions, difference of proportions, single mean, difference of means, and difference of standard deviations. Interpret test results and evaluate significance
		CO6	Conduct tests for single mean, difference of means, correlation coefficients, and ratio of variances for small samples. Apply Chi-square test for goodness of fit and independence of attributes
AL 303	**Data Structures**	**CO1**	Proficiency in Data Structure Implementation: Students will be able to design, implement, and manipulate fundamental data structures such as arrays, linked lists, stacks, queues, trees, and graphs.
		CO2	Develop the ability to analyze problems and choose appropriate data structures and algorithms for efficient solutions, emphasizing algorithmic complexity and optimization.

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		CO3	Gain expertise in memory management and understand the impact of data structure choices on resource utilization, enabling efficient handling of large datasets and optimizing program performance.
		CO4	Enhance programming skills by applying data structures in real-world scenarios, fostering the development of modular and reusable code for effective software design.
		CO5	Cultivate analytical thinking to solve complex problems through the application of various data structures, fostering a deep understanding of algorithmic paradigms and their practical implications.
AL 304	**Artificial Intelligence**	**CO1**	Understand the history, motivation, and need for Artificial Intelligence (AI). Describe production systems and their characteristics. Discuss the goals and contributions of AI to modern technology. Compare different search techniques including Hill Climbing, Best First Search, and heuristic search algorithms like A* and AO*
		CO2	Identify problems in knowledge representation. Represent knowledge using propositional and predicate logic. Compare propositional and predicate logic. Explain resolution, refutation, deduction, theorem proving, and inferencing. Discuss monotonic and non-monotonic reasoning
		CO3	Apply probabilistic reasoning techniques including Bayes' theorem. Describe semantic networks, scripts, schemas, frames, and conceptual dependency. Discuss forward and backward reasoning
		CO4	Implement game playing techniques such as minimax procedure and alpha-beta cut-offs. Understand planning and study the Block World problem in robotics. Introduce natural language processing (NLP), its components, and application of NLP in designing expert systems
		CO5	Define Expert Systems (ES) and their characteristics. Identify the requirements of ES and discuss their components and capabilities.

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			Implement Inference Engines using forward and backward chaining. Evaluate limitations of Expert Systems. Describe Expert System Development Environment, technologies involved, and benefits of Expert Systems
AL 305	**Object Oriented Programming & Methodology**	**CO1**	Apprehend the core principles of Object-Oriented Programming (OOP) and distinguish it from Procedural Programming, demonstrating knowledge of key features.
		CO2	Demonstrate effective implementation of Object-Oriented Programming principles by designing classes with well-defined attributes and services.
		CO3	Analyze and apply different types of relationships in Object-Oriented Programming to design class structures that model real-world entities effectively.
		CO4	Skillfully demonstrate polymorphism in Object-Oriented Programming by implementing method overriding and method overloading.
		CO5	Design and develop a practical case study (e.g., ATM or Library Management System) using OOP concepts for code organization, reusability, and effective data management.
AL 306	**Computer Workshop/ Introduction to Python - I**	**CO1**	Apply knowledge of programming concepts to write, test, and debug simple Python programs.
		CO2	Analyze a problem and implement Python programs with conditions and loops.
		CO3	Implement functions for structuring Python programs and compound data using Python lists, tuples, sets and dictionaries.

2.B.Tech. IV Semester

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AL 401	Introduction to Discrete Structure & Linear Algebra	CO1	Define sets and apply set operations using Venn diagrams, types of relations and their compositions, equivalence relations, partial ordering relations (POSET), Hasse diagrams, and lattices
		CO2	Define algebraic structures including semigroups, monoids, groups, Abelian groups, rings, and fields, properties of groups, including cyclic and normal subgroups.
		CO3	Analyze propositions and apply logical operations using truth tables and algebra of propositions, quantifiers and graph theory
		CO4	Define matrices and perform operations such as determinant, trace, Cholesky decomposition, eigen decomposition, and singular value decomposition (SVD) and apply matrix calculus, including gradients and useful identities for computing gradients
		CO5	Explain concepts and formulations of hypothesis testing. Analyze Type-I and Type-II errors. Introduce time series analysis and analysis of variance (ANOVA) techniques
AL 402	Analysis & Design of Algorithms	CO1	Recall and explain the fundamental concepts of algorithms, including time and space complexity, asymptotic notations, and the various bounds on complexity (best-case, worst-case, average-case).
		CO2	Analyze the efficiency of different algorithms by solving recurrence relations, using asymptotic notations, and comparing their performance through time and space complexity analysis.
		CO3	Apply algorithmic techniques such as divide and conquer, greedy strategies, dynamic programming, backtracking, and branch & bound to design and implement solutions for complex computational problems.
		CO4	Develop optimized algorithms by employing code tuning techniques, including loop optimization, data transfer optimization, and logic optimization, to enhance algorithm performance.

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		CO5	Evaluate the correctness and efficiency of advanced algorithms, prove their correctness, and analyze lower bounds and the complexity of parallel algorithms, particularly in solving NP-hard and NP-complete problems.
AL 403	**Software Engineering**	**CO1**	Analyze and evaluate the strengths and weaknesses of different software development process models, including linear sequential, prototyping, RAD, incremental, and agile approaches, and recommend the most appropriate model for a given project.
		CO2	Design and create clear and complete system and software requirements specifications using appropriate modeling techniques, such as use case modeling, and validate those requirements using traceability and other methods.
		CO3	Evaluate and select appropriate software design principles and techniques, including architectural views and styles, user interface design, function-oriented and component-based design, and design metrics, to create effective software designs.
		CO4	Apply software testing techniques at different levels, including black-box and white-box unit testing, integration testing, system testing, and specialized testing, and create effective test plans and metrics.
		CO5	Assess and recommend software maintenance and project management strategies, including software configuration management, change management, version control, program comprehension, re-engineering, risk assessment and mitigation, and quality assurance, to ensure the long-term success and sustainability of software projects.
AL 404	**Computer Organization & Architecture**	**CO1**	Analyze the structure of desktop computers, including CPU organization and I/O systems.

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		CO2	Evaluate arithmetic operations in computers, including addition, subtraction, multiplication, and division using various algorithms
		CO3	Assess different I/O interfaces like PCI Bus, SCSI Bus, and USB, and understand data transfer modes.
		CO4	Evaluate characteristics and structures of multiprocessor systems, including inter-processor arbitration and synchronization.
		CO5	Investigate multicore processors from manufacturers like Intel and AMD, focusing on architecture and performance enhancements.
AL 405	**Machine Learning**	**CO1**	Apply foundational concepts and techniques in machine learning to analyze and preprocess data for building machine learning models.
		CO2	Evaluate and implement advanced concepts in neural networks to design and train effective deep learning models.
		CO3	Develop and implement models for supervised learning algorithms, including classification and regression to address complex problems in various domains.
		CO4	Develop and implement models for unsupervised learning algorithms to address complex problems in various domains.
		CO5	Analyze and apply advanced machine learning algorithms to solve real-world problems in computer vision, speech processing, natural language processing, etc. through a comprehensive case study.
		CO1	Explain the structure and components of the Java development environment, including JDK, JVM, and Java API, and apply Object-Oriented programming principles to develop basic Java applications.
		CO2	Design and implement graphical user interfaces (GUIs) using AWT components, layouts managers and event handling models to create interactive Java applications.

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AL 406	**Java Lab**	**CO3**	Develop multi-threaded Java programs and implement robust exception handling mechanisms to ensure program reliability and efficiency.
		CO4	Utilize Java I/O streams and JDBC to manage file operations and database connectivity, enabling data persistence and retrieval in Java applications.
		CO5	Implement network-based applications using Java's networking APIs and RMI, demonstrating an understanding of client-server architecture and distributed computing.

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Baderia Global Institute of Engineering and Management Jabalpur (M.P.)

COMPUTER SCIENCE & ENGINEERING (DS)			
COURSE OUTCOME(COs): B.Tech. III & IV			
Session 2022-23			
Code	**Course Name**	**Course Outcomes**	
1.B.Tech. III Semester			
CD 301	**Technical Communication**	**CO1**	Understand and articulate the process and scope of communication, emphasizing the importance of unity, brevity, and clarity in various forms of communication within a global context
		CO2	Analyze different types of communication, including verbal and non-verbal, and identify barriers to effective communication. Develop strategies for overcoming these barriers and improving communication skills in a globalized environment
		CO3	Apply principles of technical and business writing to compose effective memos, letters, reports, and research papers. Develop speaking skills, including audience awareness, voice modulation, and presentation techniques, to effectively communicate ideas to varied audiences
		CO4	Evaluate and practice techniques for preparing and delivering effective job interviews and professional presentations. Understand the role of non-verbal communication, body language, and argumentation skills in group discussions and professional settings
		CO5	Demonstrate proficiency in advanced grammar, vocabulary, and pronunciation. Apply these linguistic skills to enhance both written and spoken communication, focusing on professional personality attributes and effective speech delivery
		CO1	Understand probability spaces, conditional probability, and independence. Analyze discrete random variables, multinomial distributions, and Poisson approximation to the binomial distribution. Apply concepts of sums of

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CD 302	**Introduction to Probability and Statistics**		independent random variables, expectation, moments, variance, correlation coefficient, and Chebyshev's inequality
		CO2	Define continuous random variables and their properties. Discuss distribution functions, densities, and characteristics of normal, exponential, and gamma distributions
		CO3	Describe properties of bivariate distributions. Analyze distribution of sums and quotients, conditional densities, and apply Bayes' rule
		CO4	Compute measures of central tendency, skewness, and kurtosis. Evaluate probability distributions such as binomial, Poisson, and normal distributions. Calculate statistical parameters for these distributions. Understand correlation, regression, and rank correlation
		CO5	Apply curve fitting using the method of least squares for fitting straight lines, parabolas, and general curves. Perform large sample tests for single proportions, difference of proportions, single mean, difference of means, and difference of standard deviations. Interpret test results and evaluate significance
		CO6	Conduct tests for single mean, difference of means, correlation coefficients, and ratio of variances for small samples. Apply Chi-square test for goodness of fit and independence of attributes
CD 303	**Data Structures**	**CO1**	Proficiency in Data Structure Implementation: Students will be able to design, implement, and manipulate fundamental data structures such as arrays, linked lists, stacks, queues, trees, and graphs.
		CO2	Develop the ability to analyze problems and choose appropriate data structures and algorithms for efficient solutions, emphasizing algorithmic complexity and optimization.
		CO3	Gain expertise in memory management and understand the impact of data structure choices on resource utilization, enabling efficient handling of large datasets and optimizing program performance.

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		CO4	Enhance programming skills by applying data structures in real- world scenarios, fostering the development of modular and reusable code for effective software design.
		CO5	Cultivate analytical thinking to solve complex problems through the application of various data structures, fostering a deep understanding of algorithmic paradigms and their practical implications.
CD 304	**Database Management Systems**	**CO1**	Analyze the key concepts of data management and database systems, including data models, schemas, and instances.
		CO2	Apply relational data model concepts to design and manipulate databases, including the use of SQL queries, integrity constraints, and indexing.
		CO3	Evaluate and apply normalization techniques to design and optimize database schemas, ensuring minimal redundancy and dependency preservation.
		CO4	Analyze transaction processing mechanisms, including concurrency control and recovery techniques, to ensure data consistency and system reliability.
		CO5	Evaluate storage structures and indexing techniques for efficient data retrieval and management, including the application of contemporary DBMS technologies.
CD 305	**Object Oriented Programming & Methodology**	**CO1**	Apprehend the core principles of Object-Oriented Programming (OOP) and distinguish it from Procedural Programming, demonstrating knowledge of key features.
		CO2	Demonstrate effective implementation of Object-Oriented Programming principles by designing classes with well-defined attributes and services.
		CO3	Analyze and apply different types of relationships in Object-Oriented Programming to design class structures that model real-world entities effectively.
		CO4	Skillfully demonstrate polymorphism in Object-Oriented Programming by implementing method overriding and method overloading.

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		CO5	Design and develop a practical case study (e.g., ATM or Library Management System) using OOP concepts for code organization, reusability, and effective data management.
CD 306	**Computer Workshop/ Introduction to python - I**	**CO1**	Apply knowledge of programming concepts to write, test, and debug simple Python programs.
		CO2	Analyze a problem and implement Python programs with conditions and loops.
		CO3	Implement functions for structuring Python programs and compound data using Python lists, tuples, sets and dictionaries.
2.B.Tech. IV Semester			
CD 401	**Introduction to Discrete Structure & Linear Algebra**	**CO1**	Define sets and apply set operations using Venn diagrams, types of relations and their compositions, equivalence relations, partial ordering relations (POSET), Hasse diagrams, and lattices
		CO2	Define algebraic structures including semigroups, monoids, groups, Abelian groups, rings, and fields, properties of groups, including cyclic and normal subgroups.
		CO3	Analyze propositions and apply logical operations using truth tables and algebra of propositions, quantifiers and graph theory
		CO4	Define matrices and perform operations such as determinant, trace, Cholesky decomposition, eigen decomposition, and singular value decomposition (SVD) and apply matrix calculus, including gradients and useful identities for computing gradients
		CO5	Explain concepts and formulations of hypothesis testing. Analyze Type-I and Type-II errors. Introduce time series analysis and analysis of variance (ANOVA) techniques

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CD 402	**Analysis & Design of Algorithms**	**CO1**	Recall and explain the fundamental concepts of algorithms, including time and space complexity, asymptotic notations, and the various bounds on complexity (best-case, worst-case, average-case).
		CO2	Analyze the efficiency of different algorithms by solving recurrence relations, using asymptotic notations, and comparing their performance through time and space complexity analysis.
		CO3	Apply algorithmic techniques such as divide and conquer, greedy strategies, dynamic programming, backtracking, and branch & bound to design and implement solutions for complex computational problems.
		CO4	Develop optimized algorithms by employing code tuning techniques, including loop optimization, data transfer optimization, and logic optimization, to enhance algorithm performance.
		CO5	Evaluate the correctness and efficiency of advanced algorithms, prove their correctness, and analyze lower bounds and the complexity of parallel algorithms, particularly in solving NP-hard and NP-complete problems.
CD 403	**Software Engineering**	**CO1**	Analyze and evaluate the strengths and weaknesses of different software development process models, including linear sequential, prototyping, RAD, incremental, and agile approaches, and recommend the most appropriate model for a given project.
		CO2	Design and create clear and complete system and software requirements specifications using appropriate modeling techniques, such as use case modeling, and validate those requirements using traceability and other methods.
		CO3	Evaluate and select appropriate software design principles and techniques, including architectural views and styles, user interface design, function-oriented and component-based design, and design metrics, to create effective software designs.

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		CO4	Apply software testing techniques at different levels, including black-box and white-box unit testing, integration testing, system testing, and specialized testing, and create effective test plans and metrics.
		CO5	Assess and recommend software maintenance and project management strategies, including software configuration management, change management, version control, program comprehension, re-engineering, risk assessment and mitigation, and quality assurance, to ensure the long-term success and sustainability of software projects.
CD 404	**Introduction to Data Science**	**CO1**	Describe the evolution of Data Science and its roles. Identify stages in a Data Science project and apply Data Science methodologies in various fields. Recognize and address Data Security issues
		CO2	Implement strategies for data collection. Perform data pre-processing including cleaning, integration, transformation, reduction, and discretization
		CO3	Calculate and interpret descriptive statistics such as mean, standard deviation, skewness, and kurtosis. Visualize data using box plots, pivot tables, heat maps, and correlation statistics. Conduct ANOVA for analysis
		CO4	Develop simple and multiple regression models. Evaluate models using visualization techniques like residual plots and distribution plots. Implement polynomial regression and pipelines. Apply measures for in-sample evaluation, prediction, and decision-making
		CO5	Assess generalization error and perform out-of-sample evaluation using metrics like cross-validation. Identify and mitigate issues of overfitting and underfitting. Select models using Ridge Regression and test multiple parameters using Grid Search
CD 405	**Operating Systems**	**CO1**	Define the fundamental concepts of operating systems, including their functions, types, and characteristics.

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		CO2	Apply file system concepts, disk organization, and directory structures. Evaluate and choose disk allocation methods, and analyze disk scheduling algorithms
		CO3	Implement CPU scheduling algorithms and comprehend memory management techniques, including partitioning, swapping, segmentation, and paging. Apply the concept of virtual memory through demand paging.
		CO4	Design and construct solutions utilizing semaphores to manage concurrent processes effectively, mitigating deadlock concerns.
		CO5	Analyze case studies of Unix/Linux, Windows, and other network, distributed, and multiprocessor operating systems to understand their architecture and functionalities.
CD 406	**Python for Data Science**	**CO1**	**Demonstrate** proficiency in Python as a programming language, data structures and object oriented concepts in python.
		CO2	**Perform** numerical operations using NumPy library.
		CO3	**Perform** data wrangling operations like, merge, reshape, pivot, transform, aggregation, and group-wise operations using pandas library.
		CO4	**Visualize** data using matplotlib and seaborn libraries.

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COMPUTER SCIENCE & ENGINEERING (IOT Cybersecurity & Blockchain)			
COURSE OUTCOME(COs): B.Tech. III & IV			
Session 2022-23			
Code	**Course Name**	**Course Outcomes**	
1.B.Tech. III Semester			
IS 301	**Technical Communication**	**CO1**	Understand and articulate the process and scope of communication, emphasizing the importance of unity, brevity, and clarity in various forms of communication within a global context
		CO2	Analyze different types of communication, including verbal and non-verbal, and identify barriers to effective communication. Develop strategies for overcoming these barriers and improving communication skills in a globalized environment
		CO3	Apply principles of technical and business writing to compose effective memos, letters, reports, and research papers. Develop speaking skills, including audience awareness, voice modulation, and presentation techniques, to effectively communicate ideas to varied audiences
		CO4	Evaluate and practice techniques for preparing and delivering effective job interviews and professional presentations. Understand the role of non-verbal communication, body language, and argumentation skills in group discussions and professional settings
		CO5	Demonstrate proficiency in advanced grammar, vocabulary, and pronunciation. Apply these linguistic skills to enhance both written and spoken communication, focusing on professional personality attributes and effective speech delivery
IS 302	**Discrete Structures**	**CO1**	Analyze and apply set operations, set identities, and the Principle of Inclusion-Exclusion. Demonstrate proficiency in computer

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			representation of sets and basic concepts of propositional and predicate logic
		CO2	Evaluate and apply counting techniques and combinatorial principles. Analyze properties and types of relations and functions, and their applications in databases (RDBMS) and hashing. Apply the Pigeonhole Principle to solve problems
		CO3	Describe and differentiate basic terminologies related to graphs and trees. Analyze properties of graphs, apply shortest path algorithms, understand cutsets, and solve problems related to Hamiltonian and Eulerian paths and circuits. Demonstrate proficiency in tree traversals and spanning trees
		CO4	Analyze and solve recurrence relations and use generating functions. Introduce the complexity of problems and algorithms, and apply mathematical techniques to analyze the efficiency of algorithms
		CO5	Explain the concepts of algebraic systems including groups, rings, fields, integral domains, lattices, and Boolean algebra. Apply algebraic principles to solve problems and analyze structures
IS 303	**Data Structures**	**CO1**	Proficiency in Data Structure Implementation: Students will be able to design, implement, and manipulate fundamental data structures such as arrays, linked lists, stacks, queues, trees, and graphs.
		CO2	Develop the ability to analyze problems and choose appropriate data structures and algorithms for efficient solutions, emphasizing algorithmic complexity and optimization.
		CO3	Gain expertise in memory management and understand the impact of data structure choices on resource utilization, enabling efficient handling of large datasets and optimizing program performance.

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		CO4	Enhance programming skills by applying data structures in real- world scenarios, fostering the development of modular and reusable code for effective software design.
		CO5	Cultivate analytical thinking to solve complex problems through the application of various data structures, fostering a deep understanding of algorithmic paradigms and their practical implications.
IS 304	**Introduction to Information Security**	**CO1**	Explain the fundamental needs for security in digital systems. Define and differentiate basic security terminologies and understand security principles including CIA (Confidentiality, Integrity, Availability), authentication, non-repudiation, and classifications of security attacks
		CO2	Explain symmetric cryptography algorithms such as DES, 3DES, AES, and analyze their modes of operation like ECB and CBC and understand linear and differential cryptanalysis of symmetric key ciphers
		CO3	Analyze and evaluate the concepts of key distribution and management in asymmetric key cryptography. Explain Diffie-Hellman key exchange algorithm and asymmetric key cryptography algorithms such as RSA and ECC.
		CO4	Describe methods for ensuring authentication and integrity , authorization mechanisms and access control.
		CO5	Explain security protocols for email (PGP, MIME, S/MIME), IP (IPsec), and web (TLS, SSL). Describe Secure Electronic Transaction (SET) protocols and their applications. Understand firewall types and their roles in network security. Introduce Intrusion Detection and Prevention Systems (IDPS), risk management strategies, and security planning
IS305	**Object Oriented Programming & Methodology**	**CO1**	Apprehend the core principles of Object-Oriented Programming (OOP) and distinguish it from Procedural Programming, demonstrating knowledge of key features.

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		CO2	Demonstrate effective implementation of Object-Oriented Programming principles by designing classes with well-defined attributes and services.
		CO3	Analyze and apply different types of relationships in Object-Oriented Programming to design class structures that model real-world entities effectively.
		CO4	Skillfully demonstrate polymorphism in Object-Oriented Programming by implementing method overriding and method overloading.
		CO5	Design and develop a practical case study (e.g., ATM or Library Management System) using OOP concepts for code organization, reusability, and effective data management.
IS 306	**Computer Workshop: Introduction to Python**	**CO1**	Apply knowledge of programming concepts to write, test, and debug simple Python programs.
		CO2	Analyze a problem and implement Python programs with conditions and loops.
		CO3	Implement functions for structuring Python programs and compound data using Python lists, tuples, sets and dictionaries.
2.B.Tech. IV Semester			
IS 401	**Probability, Statistics and Linear Algebra**	**CO1**	Demonstrate understanding of probability spaces, conditional probability, and independence. Apply concepts to discrete and continuous random variables including exponential and gamma distributions. Utilize Chebyshev's Inequality and Bayes' rule effectively
		CO2	Calculate and interpret measures of central tendency, moments, skewness, and kurtosis. Evaluate statistical parameters for Binomial, Poisson, and Normal distributions. Apply correlation and regression techniques, including rank correlation

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		CO3	Apply curve fitting using the method of least squares for linear and non-linear models. Conduct tests of significance for single proportions, difference of proportions, single mean, difference of means, and difference of standard deviations
		CO4	Perform tests for single mean, difference of means, and correlation coefficients using small samples. Conduct tests for ratio of variances and tests of hypothesis for independence of attributes and time series analysis
		CO5	Apply Cramer's rule and LU decomposition for solving systems of linear equations. Understand Singular Value Decomposition (SVD), Euclidean vector spaces, Hermitian and Unitary matrices, and Gram-Schmidt orthogonalization process
IS402	**Fundamentals of IOT**	**CO1**	Identify the basic components and architecture of IoT systems, including devices, gateways, and cloud services.
		CO2	Implement IoT solutions using hardware components like Arduino and Raspberry Pi, and software components with Python/Node.js for communication protocols.
		CO3	Evaluate the IoT framework, including architectural views, physical and logical designs, and applications, with a focus on M2M and SDN/NFV.
		CO4	Design and implement IoT applications, focusing on device integration, data acquisition, storage, and authentication/authorization on cloud/local servers.
		CO5	Examine IoT case studies in industrial automation, transportation, agriculture, healthcare, and home automation for insights into practical implementations.
		CO1	Define the fundamental concepts of operating systems, including their functions, types, and characteristics.

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IS 403	**Operating System**	**CO2**	Apply file system concepts, disk organization, and directory structures. Evaluate and choose disk allocation methods, and analyze disk scheduling algorithms
		CO3	Implement CPU scheduling algorithms and comprehend memory management techniques, including partitioning, swapping, segmentation, and paging. Apply the concept of virtual memory through demand paging.
		CO4	Design and construct solutions utilizing semaphores to manage concurrent processes effectively, mitigating deadlock concerns.
		CO5	Analyze case studies of Unix/Linux, Windows, and other network, distributed, and multiprocessor operating systems to understand their architecture and functionalities.
IS404	**Computer Organization and Architecture**	**CO1**	Analyze the structure of desktop computers, including CPU organization and I/O systems.
		CO2	Evaluate arithmetic operations in computers, including addition, subtraction, multiplication, and division using various algorithms
		CO3	Assess different I/O interfaces like PCI Bus, SCSI Bus, and USB, and understand data transfer modes.
		CO4	Evaluate characteristics and structures of multiprocessor systems, including inter-processor arbitration and synchronization.
		CO5	Investigate multicore processors from manufacturers like Intel and AMD, focusing on architecture and performance enhancements.
IS405	**Computer Networks**	**CO1**	Understand the fundamentals of computer networks, their applications, and different network topologies. Describe the ISO-OSI model and explain the functions and services of each OSI layer. Discuss the physical layer principles including digital signals, transmission impairments, and channel capacity theorems

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		CO2	Analyze the design issues and functions of the data link layer. Compare error detection and correction techniques such as Hamming codes and CRC codes. Explain framing techniques and protocols like Stop and Wait, Sliding Window, PPP, SLIP, and HDLC. Evaluate medium access control protocols like ALOHA, CSMA/CD, and CSMA/CA
		CO3	Describe IEEE 802 standards for LANs (802.3, 802.4, 802.5) and LAN devices such as hubs, switches (learning, cut-through, store-and-forward), and bridges. Understand spanning tree protocols and remote bridges. Explain the roles and functions of routers and gateways in internetworking
		CO4	Compare routing algorithms including shortest path, flooding, LSR, distance vector, and hierarchical routing. Describe the TCP/IP protocol stack architecture, classful IP addressing, ARP, RARP, IP datagrams, and ICMP
		CO5	Explain subnetting, supernetting, and CIDR. Discuss congestion control, load shedding, jitter control, addressing, multiplexing, connection establishment, and flow control mechanisms in the transport layer. Introduce DNS and email protocols in the application layer
IS406	**Java Lab**	**CO1**	Explain the structure and components of the Java development environment, including JDK, JVM, and Java API, and apply Object-Oriented programming principles to develop basic Java applications.
		CO2	Design and implement graphical user interfaces (GUIs) using AWT components, layouts managers and event handling models to create interactive Java applications.
		CO3	Develop multi-threaded Java programs and implement robust exception handling mechanisms to ensure program reliability and efficiency.

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		CO4	Utilize Java I/O streams and JDBC to manage file operations and database connectivity, enabling data persistence and retrieval in Java applications.
		CO5	Implement network-based applications using Java's networking APIs and RMI, demonstrating an understanding of client-server architecture and distributed computing.

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ELECTRONIC COMMUNICATION & ENGINEERING		
COURSE OUTCOME(COs): B.Tech. III , IV, V,VI, VII & VIII		
Session 2022-23		
Code	**Course Name**	**Course Outcomes**
1. B.Tech. III Semester		
BT- 301	**M3**	**CO1:** Apply and analyze numerical methods for solving polynomial and transcendental equations, including the Bisection method, Newton-Raphson method, and Regula-Falsi method. Understand finite differences and interpolate using Newton's forward and backward difference formulae, as well as Newton's divided difference and Lagrange's formulae for unequal intervals **CO2:** Implement numerical differentiation and integration techniques such as the Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Solve simultaneous linear algebraic equations using methods like Gauss's Elimination, Gauss's Jordan, Crout's methods, Jacobi's, Gauss-Seidal, and Relaxation methods **CO3:** Solve ordinary differential equations using Taylor's series, Euler and modified Euler's methods, and the fourth-order Runge-Kutta method. Utilize Milne's and Adam's predictor-corrector methods. Address partial differential equations by employing finite difference solutions for two-dimensional Laplace and Poisson equations, and implicit and explicit methods for one-dimensional heat and wave equations **CO4:** Understand and apply the Laplace Transform, including its properties and the Laplace transform of periodic functions. Find inverse Laplace transforms using various methods and apply the convolution theorem. Evaluate integrals and solve ordinary differential equations using Laplace Transform methods, and comprehend Fourier transforms

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		CO5: Describe and utilize concepts of probability, including probability mass function and probability density function. Analyze discrete distributions such as Binomial and Poisson's, as well as continuous distributions like Normal and Exponential distributions
EC 302	**Electronic Measurement & Instrumentation**	**CO1**: Define the fundamentals of measurements and also be able to identify electronics/ electrical instruments, their use, peculiar errors associated with the instruments and how to minimize such errors. **CO2:** Use & understand the importance of CRO for measuring different parameters for electronic equipment. Also students will be able to use of various electrical/electronic instruments, their construction, applications, and principles of operation, standards and units of measurements **CO3:** Analyze & measure the unknown electrical quantity (like capacitor**,** inductor, resistor, loss & storage factor, dissipation factor) & develop basic skills in the design of electronic equipments **CO4**: Distinguish active & passive transducers & their utilization in various industry applications. **CO5**: Understand the technique used to convert an analog signal into a digital signal and digital into analog**.** Also understand the basic design techniques of electronic equipment**..**
EC 303	**Digital System Design**	C**O1**:Develop a digital logic and apply it to solve real life problems. C**O2**:Develop competence in Combinational Logic Problem formulation and Logic Optimization C**O3**:Develop competence in analysis of synchronous and asynchronous sequential circuits. C**O4**:Analyze and solve various engineering problems with finite state machine C**O5**:Design and analyze Logic gates with different technologies.

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EC 304	**Electronic Devices**	**CO1**: Define the fundamentals of measurements and also be able to identify electronics/ electrical instruments, their use, peculiar errors associated with the instruments and how to minimize such errors. **CO2:** Use & understand the importance of CRO for measuring different parameters for electronic equipment. Also students will be able to use of various electrical/electronic instruments, their construction, applications, and principles of operation, standards and units of measurements **CO3:** Analyze & measure the unknown electrical quantity (like capacitor**,** inductor, resistor, loss & storage factor, dissipation factor) & develop basic skills in the design of electronic equipments **CO4**: Distinguish active & passive transducers & their utilization in various industry applications. **CO5**: Understand the technique used to convert an analog signal into a digital signal and digital into analog**.** Also understand the basic design techniques of electronic equipment**..**
EC 305	**Network Analysis**	**CO1:**Students will be able solve the electrical circuits comprising of resistor, inductor, capacitors, current source and voltage source using networks laws i.e. KVL and KCL. **CO2**:Students will understand network graph theory and will be able to analyze graphs of any electrical network. **CO3**:Students will be able to understand different network theorems and solve any electrical circuit using these theorems. **CO4**:Students will be able to understand the transient behavior of passive electrical elements and will be able to determine the time response and also the frequency response of the electrical circuit using the Laplace transform. **CO5**:Students will be able to analyze two-port networks using Z, Y, ABCD and h-parameters and develop an understanding of interconnections of these two-port networks.

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EC 306	**EMI Lab**	**CO1**:Students will **describe** the principles and operating mechanisms of various measurement instruments, such as the Cathode Ray Oscilloscope (CRO), Q-meters, LVDTs, strain gauges, and thermistors. **CO2**:Students will **explain** the processes involved in using bridge methods (Maxwell's, Schering, Wein's, and Hay's bridges) to measure unknown inductance, capacitance, and frequency, demonstrating an understanding of the theoretical underpinnings. **CO3**: Students will **apply** their knowledge of sensor technology to **perform** accurate measurements of physical quantities (e.g., displacement, force, temperature) using LVDTs, strain gauges, thermocouples, transducers in laboratory settings. **CO4**: Students will **analyze** the characteristics and performance of digital-to-analog converters (R-2R ladder type) and other electrical components by interpreting experimental data and identifying discrepancies between theoretical predictions and practical outcomes. **CO5**: Students will **design** measurement circuits and systems, such as digital-to-analog converters and frequency measurement setups using CRO and function generators, and **evaluate** their effectiveness through detailed experimentation and analysis.
2. B.Tech. IV Semester		
ES 401	**EEES**	**CO1** : Introduction to Environmental Studies **CO2**: Definition and concept of Ecosystem. **CO3**:Introduction to Natural Resources. **CO4**:Introduction to Biodiversity and Conservation **CO5**: Environmental pollution and Global Environmental Issues and Policies.
EC402	**Signals & Systems**	**CO1** :Explain basic signals and analyze the representation using Fourier series. **CO2** : Analyze continuous time signals by using appropriate mathematical tools like Fourier Transform and Laplace Transform.

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		CO3 : Determine the response of a LTI System to any arbitrary inputs and learn about signal transmission through linear systems. **CO4**: Apply the concepts of convolution and correlation for continuous time signals. **CO5**:Outline the fundamentals of sampling including the implications of sampling theorem.
EC403	**Analog Communication**	**CO1**. Students will be able to solve time domain and frequency domain problems and plot the signals. **CO2**. Students will be able to evaluate power and bandwidth of AM, FM & PM systems. **CO3**. Students shall be able to analyze the working of heterodyne receiver **CO4**. Students will be able to evaluate the circuit performance parameters for eg.SNR, Noise Figure, FOM of AM, FM & PM systems. **CO5**. Students will be able to evaluate the effect of noise in AM, FM & PM modulation systems.
EC404	**Control System**	**CO1**: Students will **identify** and **classify** different types of control systems and their components. **CO2**: Students will **explain** the time response characteristics and stability criteria of linear control systems. **CO3**:Students will **apply** Routh-Hurwitz, Root Locus, and Nyquist criteria to **determine** the stability of control systems. **CO4**: Students will **analyze** the impact of feedback on control system performance and stability. **CO5**:Students will **design** compensators and controllers to **enhance** system performance using state space methods and transfer functions.
EC405	**Analog Circuits**	**CO1**: Apply the concept of feedback and its application in power amplifiers and oscillators. **CO2.** Compare and infer the DC and AC characteristics of operational

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		amplifiers and its effect on output and their compensation techniques **CO3.** Analyze circuits for designing of inverting and non inverting amplifiers, diff. amps, and comparators. **CO4.** Elucidate and design the linear and non-linear applications of an op. amp, formulate and solve the differential equations describing time behavior of circuits containing energy storage elements **CO5**. Illustrate the function of specific ICs such as Voltage regulators, PLL and its application in communication.
3. B.Tech. V Semester		
EC 501	**Microprocessor & its Application**	**CO1**:Understand the necessity, features and architecture of 8086 and the need and handling of interrupts in 8086 and features of peripheral ICs. Compare the concepts of CISC and RISC processors. **CO2**:Identify the different ways of interfacing memory and I/O with microprocessors. **CO3**:Understand and apply the instruction set of 8051 Microcontroller for programming **CO4**:Understand the hardware and software interrupts and their applications. **CO5**:Outline the architecture of ARM processor and PIC microcontroller.
EC 502	**Digital Communication**	**CO1:** Students will demonstrate knowledge of sampling theorems, modulation techniques, and encoding methods in digital communication systems. **CO2:**Students will comprehend the principles behind pulse code modulation, bandpass data transmission, and spectral properties of modulation schemes like QPSK and MSK. **CO3:** Students will apply their understanding of matched filtering, correlator detection, and error probability calculations to analyze and compare different modulation techniques.

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		CO4: Students will analyze the trade-offs between bandwidth, signal-to-noise ratio, and channel capacity in digital communication systems based on Shannon's theorem and Shannon-Hartley theorem.\ **CO5**:Students will synthesize their knowledge to design and implement error-correcting codes, including linear block codes, cyclic codes, and convolution codes, for reliable data transmission in digital communication networks
EC 503 (B)	**Mobile Communication**	**CO1:** To compare different generations of cellular systems and apply various ways to improve its capacity. **CO2**: To evaluate the impairments due to multipath fading channels and compare channel models for various environments & antenna sub-system. **CO3**: Categorize different types of interference in cellular mobile communication. **CO4**: To Analyze frequency spectrum utilization on mobile cellular technologies and compute Grade of Service. **CO5**: To evaluate different cellular technologies like GSM and CDMA.
EC 504 (A)	**EMT**	**CO1:** Employ various mathematical operations and use them in calculation of electric fields. **CO2**: Calculate magnetic field intensity due to various current distributions. **CO3:** Interpret complex electromagnetic problems using Maxwell Equations. **CO4**: Compute the parameters of bounded and unbounded mediums and their relation with the fields. **CO5:** Formulate and analyze problems involving propagation of uniform plane waves in different types of medium.
EC 504 (B)	**CSO**	**CO1**. Understand the need of computing & basics of a computer System **CO2.** Understand the function of control unit of computer

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		CO3. Understand the modes of data transfer of computer system. **CO4.** Understand memory organization & types of memories. **CO5**. Learn the working of a computer system in a single mode & multimode operations.
EC 505	**CNTL Lab**	**CO1**:Student will be able to Analyze the usages of different network used in filter design. **CO2**:Student will be able to Design various passive filters and their characteristics in communication system. **CO3**:Student will be able to solve different methods to synthesis various networks. **CO4**:Student will be able to Describe basic fundamentals of transmission line and their various parameters. **CO5**:Student will be able understand transmission line at radio frequency.
EC 506	**Matlab Programming**	**CO1**. Students will demonstrate understanding of MATLAB programming fundamentals, syntax, and basic functions. **CO2**. Students will interpret and understand mathematical concepts and algorithms through MATLAB simulations **CO3**. Students will apply MATLAB to simulate and solve engineering problems, including signal processing, control systems, and numerical analysis. **CO4**. Students will analyze and interpret simulation results to evaluate system performance, identify trends, and make informed engineering decisions **CO5**. Students will synthesize their MATLAB skills to design and implement complex simulations, develop algorithms, and create graphical user interfaces (GUIs) for engineering applications

4. B.Tech. VI Semester

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EC601	**Digital Signal Processing**	**CO1**: Student will be able to classify signals and will be able to perform computation on various kinds of signals. **CO2:** Student will be able to identify types of discrete time signals and design discrete time systems. **CO3**: Students will be able to apply transformation on discrete time signals for analysis of signals frequency, amplitude & time. **CO4**: Student will be able to describe the fastest way to compute Transform and analyze system frequency response. **CO5**: Student will be able to design digital filters with specific parameters.
EC602	**Antenna & Wave propagation**	**CO1**:The concepts learned in engineering mathematics and electromagnetic theory in evaluating the expressions responsible for electromagnetic radiation. (BT-3 application). **CO2**:Analyze antenna using different performance parameters like gain, directivity, beamwidth, bandwidth etc. **CO3**:Synthesize antennas, arrays and other electromagnetic structures using different synthesis algorithms and EM CAD tools. **CO4**: Discriminate antennas and verify their behavior for practical applications so that the environment is free from radiation hazards. (BT-6 evaluation). **CO5**:Discuss about the most feasible mode of wave propagation at a given operating frequency and under given circumstances.
EC603	**Data Communication**	**CO1**: Understand various network models and standards explaining the operation of wired and wireless computer networks. **CO2**: Understand the OSI Model, flow of data to and from the physical medium under physical layer and the contribution of data link layer in error control, flow control and multiple accesses. **CO3:** Understanding the various error detection and error correction mechanisms.

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		CO4: Describe various services and host level communication guarantee provided by the transport layer. **CO5**: Compare and predict the behavior of various routing algorithms in network layer and set up subnets using the knowledge of network layer addressing.
EC604	**Microcontroller & Embedded system**	**CO1**: Students will master the interfacing of 8051 microcontrollers with ADC, DAC, stepper motors, and serial communication for data acquisition **CO2**: Students will demonstrate proficiency in programming and utilizing the complete instruction set of the 8096 microcontroller, including addressing modes and parallel port control **CO3**: Students will comprehend the concept of embedded systems, their classification, major application areas, and design metrics **CO4**: Students will analyze and compare the architectural differences between Von Neumann and Harvard architectures, as well as the characteristics of CISC and RISC instruction set architectures **CO5**: Students will develop skills in configuring and utilizing input/output devices such as timers, counters, interrupt controllers, PWM, and ADCs in embedded systems
EC605	**Data Communication Lab**	**CO1**: Understand various network models and standards explaining the operation of wired and wireless computer networks. **CO2**: Understand the OSI Model, flow of data to and from the physical medium under physical layer and the contribution of data link layer in error control, flow control and multiple accesses. **CO3**: Understanding the various error detection and error correction mechanism. **CO4**: Describe various services and host level communication guarantee provided by transport layer.

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		CO5: Compare and predict the behavior of various routing algorithms in network layer and set up subnets using the knowledge of network layer addressing.
EC606	**Microcontroller & Embedded system LAB**	**CO1**: Students will understand various multiplexing techniques for efficient data transmission **CO2**: Students will gain knowledge about the functions and features of Network Interface Cards (NIC) **CO3**: Students will compare and analyze parallel and serial transmission methods in data communication **CO4:** Students will learn about NRZ and RZ coding techniques for digital data transmission **CO5:** Students will explore different types of modems and their roles in data communication
EC608	**Minor Project II**	**CO1**: Prepare a literature survey in a specific domain as a team / individual to motivate lifelong learning **CO2** : Identify the problem which needs to be provided a sustainable solution using modern tools. **CO3**: Analyze the problem definition and its impact on the society and environment. **CO4** : Analyze the design information to provide environment friendly solutions. **CO5** :Develop ability to present the project report and will also gain power of expression of his point of view on various aspects.
5. B.Tech. VII Semester		
EC701	**VLSI Design**	**CO 1**: Demonstrate the Fabrication of IC using cadence tools **CO2**: Design MOSFET based logic circuits **CO3**: Design various gates, adders, Multipliers and Memories using stick

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		diagrams, layouts. **CO4**: Demonstrate an understanding of working principle of operation of different types of memories **CO5**: Demonstrate semiconductor IC design such as PLA's, PAL, FPGA, CPLDs
EC702	**Microwave Engg.**	**CO1**:Students will **identify** and **describe** various microwave tubes, solid-state devices, and their applications. **CO2:**Students will **explain** the principles of wave propagation in different microwave transmission lines and components. **CO3**:Students will **apply** S-parameter techniques to **measure** and **analyze** microwave network characteristics. **CO4**:Students will **analyze** the design and performance of microwave components such as filters, power dividers, and couplers. **CO5**:Students will **design** and **integrate** RF and microwave circuits, including amplifiers, oscillators, and mixers, into functional systems.
EC703	**Internet of Things**	**CO1**. Understand the concept of Internet of things. **CO2**. Establish secure communication for his network for his devices connected in IOT. **CO3**. Store his data securely on cloud and access it when required **CO4**. Design web based application using various internet protocols and services **CO5**. Use sensor technology and RFID and wireless networking for maintaining privacy and security concerns in smart city and housing environmental considerations.
EC704	**Microwave Lab**	**CO1**. Students will demonstrate understanding of microwave principles, components, and measurement techniques.

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		CO2. Students will interpret microwave concepts, including wave propagation, impedance matching, and scattering parameters, through laboratory experiments. **CO3**. Students will apply microwave theory and measurement techniques to design, analyze, and troubleshoot microwave circuits and systems. **CO4**. Students will analyze experimental data and measurements to evaluate the performance and characteristics of microwave components and devices. **CO5**. Students will synthesize their understanding to design and implement microwave circuits, antennas, and systems, and optimize their performance for specific applications.
EC705	**I.O.T. Lab**	**CO1**: Students will **identify** and **describe** the installation and functionalities of various Arduino types and Integrated Development Environments (IDEs). **CO2:** Students will **explain** the working principles of temperature sensors, RFID, NFC, and protocols like Zigbee, MQTT, and CoAP. **CO3**: Students will **write** and **execute** programs for tasks such as LED blinking and RGB LED control using the Arduino IDE. **CO4:** Students will **analyze** and **configure** Raspberry Pi systems to implement LED blink and other protocols like Zigbee and MQTT. **CO5**: Students will **design** and **integrate** IoT solutions by implementing communication protocols such as MQTT and CoAP using Arduino and Raspberry Pi platforms.
EC706	**Major Project-I**	**CO1**: Prepare a literature survey in a specific domain as a team / individual to motivate lifelong learning **CO2** : Identify the problem which needs to be provided a sustainable solution using modern tools. **CO3**: Analyze the problem definition and its impact on the society and environment. **CO4** : Analyze the design information to provide environment friendly solutions.

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		CO5 :Develop ability to present the project report and will also gain power of expression of his point of view on various aspects.
6. B.Tech. VIII Semester		
EC 801	**Optical Fibre Communication**	**CO1**. Understand Optical Fiber Communication System and its parameters. **CO2**. Analyze transmission characteristics of optical fiber. Understand the various types of signal degradation in optical fibers. **CO3**. Understand the construction and operation of various optical sources and detectors. **CO4**. Performance analysis of optical receivers and study of fiber joints. **CO5**. Brief introduction of optical fiber networks and amplifiers.
EC 802	**AI & Signal Processing**	**CO1:** Ability to develop a fundamental comprehension of the essential components of AI as demonstrated through intelligent agents. **CO2:** Ability to select suitable problem-solving methods and techniques for knowledge representation. **CO3:** Ability to evaluate the advantages and limitations of AI techniques for solving complex, knowledge-intensive problems. **CO4:** Understand practical applications of Fourier transform in real-time scenarios. **CO5:** Describe discrete-time systems using difference equations.
	Wireless Communication	**CO 1:** Explain the history, types, requirements, and economic/social aspects of wireless services. **CO 2:** Analyze challenges like multipath propagation, spectrum limitations, and noise in wireless communications. **CO 3:** Evaluate statistical characteristics of wireless propagation channels and fading models. **CO 4:** Apply narrowband, wideband, and directional channel models and conduct channel sounding. **CO 5:** Design transceiver structures, modulation formats, and equalizers, and evaluate error probabilities in fading channels.

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EC 803	**Wireless Network**	**CO 1:** Students will be able to explain and summarize the fundamental concepts of wireless and mobile communication. **CO 2 :** Students will be able to describe and explain the technologies behind LTE and OFDM for mobile telephony. **CO 3:** Students will be able to describe the basic concepts and components of wireless sensor networks. **CO 4:** Students will be able to compare and analyze transport layer protocols for mobile and traditional networks. **CO 5:** Students will be able to describe and explain the technology and standards related to IoT and ZigBee.
EC 804	**Advanced Communication Engg. Lab**	**CO1**: Students will **acquire** a comprehensive understanding of various modulation techniques including Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), and Binary Phase Shift Keying (BPSK). **CO2**: Students will **demonstrate** their comprehension of modulation and demodulation principles and their applications in communication systems through Frequency Shift Keying (FSK) and Differential Phase Shift Keying (DPSK). **CO3**:Students will **apply** their knowledge of modulation and demodulation techniques to **design** and **implement** communication links using optical fiber and microwave test benches. **CO4:**Students will **evaluate** the performance and characteristics of communication systems by **analyzing** parameters such as power division, isolation, and radiation patterns of antennas. **CO5**:Students will **synthesize** their understanding by **designing** and **constructing** communication systems with advanced modulation techniques

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MECHANICAL ENGINEERING			
COURSE OUTCOME(COs): B.Tech. III,IV,V,VI,VII & VIII			
Session 2022-23			
Code	**Course Code**	**Code**	
1.B.Tech. III Semester			
ME 302	**Thermo-dynamics**	CO1	Analyze the first law of thermodynamics to various thermodynamic systems undergoing different thermodynamic processes.
		CO2	Explaining the equivalence of two statements of second law of thermodynamics.
		CO3	Differentiate between thermodynamic systems and processes.
		CO4	Apply the laws of thermodynamics to different types of systems undergoing various processes and to perform thermodynamic analysis.
		CO5	Analyze the thermodynamic cycles and evaluate performance parameters.
ME 303	**Material Technology**	CO1	Comprehension the structure of materials, basic concepts of crystalline materials and Coordination Number etc
		CO2	Familiarity with concept of mechanical behaviour of materials and calculations of same using appropriate equations.
		CO3	Explain the concept of phase & phase diagram and basic terminologies associated with metallurgy.
		CO4	Differentiate significance of properties Vs micro structure and suggest the suggest appropriate heat treatment process, surface hardening
		CO5	Explaining features, classification, applications of newer class materials like smart materials, piezoelectric materials, biomaterials, composite materials etc.

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ME 304	**Strength of Material**	CO1	Calculate the deformation of material under different load condition and grasping the concept of Stress and Strain by knowing such a properties of material.
		CO2	Calculate load on beam, column and different structures with different cross sections.
		CO3	Calculate torsional stress on solid and hollow shaft.
		CO4	Determining the stress and strain by apply theory of failures.
		CO5	Find the stability of structures by Euler's and Rankine's formula.
ME 305	**Materials Technology**	CO1	Describing different cutting tool materials and types & geometry of cutting tools
		CO2	Explaining the gears manufacturing Technique
		CO3	Reviewing need and importance of non-traditional machining methods and process selection
		CO4	Describe the properties and bonding techniques of plastics and various plastic moulding techniques.
		CO5	Preparing CNC program with G code and M code
2.B.Tech. IV Semester			
ME 402	**Instrumentation & Control**	CO1	Explaining concept of measurement, standards and calibration of devices.
		CO2	Analyze dynamic characteristics and responses of measuring instruments.
		CO3	Choose temperature, flow, pressure and force measuring devices for specific measurement conditions
		CO4	Estimating power from rotating shaft and explaining transformers, stroboscope, and electromagnetic technique.
		CO5	Translating physical phenomena into corresponding mathematical model and applies appropriate tools to analyze the behavior of systems.

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ME 403	**Theory of Machine**	CO1	Correlate kinematic concept of links and practical uses.
		CO2	Analyze dynamic motion of mechanisms and machines kinematic and dynamic quantities and their relationships.
		CO3	Design cam profile for different follower motions.
		CO4	Explaining power transmission systems using various mediums.
		CO5	Comprehensive fundamentals of gear theory which will be the prerequisite for gear design.
ME 404	**FM**	CO1	Recognize the type of fluid flow occurring in a particular physical system
		CO2	Apply appropriate simplifying assumptions and basic fluid-flow principles to produce a mathematical model of a physical fluid-flow system
		CO3	Recognize the particular flow regime that is present in a typical engineering system
		CO4	Recognize the type of loss occurring in a pipe system and be able to use the values in energy calculation
		CO5	Compute the magnitude of different forces acting in a flow system and will be able to understand CFD tool
ME 405	**Manufacturing Process**	CO1	Explaining the principle of casting process
		CO2	Describing the different metal working processes
		CO3	Implementing different welding process in different objects
		CO4	Explaining the principle of forging process
		CO5	Comprehending the press working process in industries
ME 406	**Software Lab**	CO1	Associate between role of various design software of CAD and CAM
		CO2	Representing various curves design and surface modeling used in CAD Software.
		CO3	Explaining developments in CAD system advancement.

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		CO4	Creating constructive solid geometry & Boundary conditions for analysis and boundary representation.
		CO5	Associate between roles in various design development methods & graphic exchange systems.
3.B.Tech. V Semester			
ME 501	**I C Engines**	CO1	Demonstrate the operation of internal combustion engine and calculate performance parameters and plot operating characteristics of common IC engines
		CO2	Analyze the process of combustion for common fuels and thermodynamic analysis of Otto and Diesel cycle
		CO3	Explaining the phenomena of normal and abnormal combustion for petrol and diesel engines.
		CO4	Apply concepts of different alternate fuels used for SI and CI engines
		CO5	Analyze different supercharging and its effect on performance of SI and CI engines.
ME 502	**Mechanical Vibration**	CO1	comprehending the phenomena of the vibrating system.
		CO2	Determine the natural frequency of transverse vibrations of the Shaft and torsional vibrations of rotor systems.
		CO3	Explaining the whirling of light flexible shafts.
		CO4	Compute the natural frequencies and mode shapes of a two degree of freedom system and explain the modal analysis of a vibrating system.
		CO5	Explaining fundamentals of noise.
ME 503	**Dynamics of Machine**	CO1	Sketching velocity and acceleration diagrams of various mechanisms.
		CO2	Comprehension the concept of governors and its classification.
		CO3	Analyze the balancing of inertia force.
		CO4	Analyze different types of clutch plate, and friction.

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		CO5	Demonstrate different types of brakes & dynamometer and analysis of cam.
ME 504 (A)	**Industrial Engineering & Ergonomics**	CO1	Prepare charts for man, machine and material activities in an industry.
		CO2	Analyze the existing methods of working for a particular job and develop a good method.
		CO3	Rate a worker engaged on a live job and calculate standard time by providing appropriate allowances for the job.
		CO4	Assess the working environmental factors like noise, light, vibration etc.
		CO5	Distinguishing between display systems and warning systems and sketching anthropometry data.
ME 505	**FEM/CFD LAB**	CO1	Demonstrate proficiency in using FEM and CFD software tools for analysis and simulation.
		CO2	Generate high-quality meshes for complex geometries in both FEM and CFD applications.
		CO3	Analyze static and dynamic structural analyses using FEM.
		CO4	Simulate fluid flow phenomena using CFD techniques.
		CO5	Conduct heat transfer simulations using FEM and analyze temperature distributions.
4.B.Tech. VI Semester			
ME 601	**Thermal Engineering and Gas Dynamics**	CO1	Evaluate the performance of IC engines and compressors under the given operating conditions.
		CO2	Apply the laws of Thermodynamics to analyze thermodynamic cycles.
		CO3	Differentiate between vapor power cycles and gas power cycles.
		CO4	Evaluating from property charts and tables performance parameters of the steam and gas turbine plants.
		CO5	Reviewing the functionality of major components of steam and gas turbine plants and to do the analysis of these components.

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ME 602	**Machine Component Design**	CO1	Calculate the stress acting on various machine elements.
		CO2	Determining the dimensions, stress requirements of shaft and coupling.
		CO3	Calculate the dimensions of energy storing devices for specific applications.
		CO4	Apply the various design concepts on real life products like brakes and clutches.
		CO5	Reviewing appropriate bearings, from standard design data from various applications.
ME 603 (A)	**Turbo Machinery**	CO1	Apply thermodynamics to analyze and solve engineering problems using momentum and Euler equations
		CO2	Evaluate vane efficiency, stage efficiency, and overall performance, considering factors like utilization, speed ratio, and reheat
		CO3	Design vector diagrams for Various turbines & centrifugal Pump and calculate work done.
		CO4	Analyze the performance of centrifugal blowers and compressors using velocity triangles and efficiency characteristics.
		CO5	Apply the general theory of power transmitting turbomachines to determine torque ratio, speed ratio, slip, and efficiency.
ME 604 (C)	**Renewable Energy Technology**	CO1	Fabricate and develop PV generation systems and learn about different methods of harnessing solar energy.
		CO2	Analyze wind energy conversion system
		CO3	Apply different technique of biomass energy conversion system in power generation
		CO4	Evaluate hydro power from various small hydropower systems
		CO5	Explaining various principle related to geothermal energy
ME 605	**CAD Lab**	CO1	Associate between role of various design software of CAD and CAM
		CO2	Draw the object 3D modeling in AUTOCAD

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		CO3	Sketch ISOMETRIC drawing for practice using AutoCAD
		CO4	Creating constructive solid geometry & Boundary conditions for analysis and boundary representation.
		CO5	Differentiate the role of various design development methods, Modeling and Assembling systems in CREO software.
5.B.Tech. VII Semester			
ME 701	**HMT**	CO1	Explaining heat transfer in metals of different thermal conductivity in multiple directions
		CO2	Analyze increasing in rate of heat transfer from surface by using extended surface area
		CO3	Calculate free and forced convection heat transfer in external and internal flows.
		CO4	Describe film wise & drop wise condensation and analyze heat exchanger using LMTD and NTU approaches.
		CO5	Analyze radiation heat transfer between surfaces
ME 702 (c)	**Power Plant engineering**	CO1	Understand methods of converting various energy sources into electric power.
		CO2	Analyze design principles and operational factors of fossil fuel steam stations.
		CO3	Evaluate development, safety, and control principles of nuclear power stations.
		CO4	Design hydro-power station components using hydrological computations.
		CO5	Apply economic principles to estimate load, analyze costs, and assess power station performance.
ME 703 (A)	**Operation Research and Supply Chain**	CO1	Analyze any system with limited constraints and a variety of problems such as assignment, transportation etc. and Convert the problem into a mathematical model and solve it by LINDO, TORA etc.

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		CO2	Relating the role of logistics in the supply chain.
		CO3	Calculate inventory by different inventory control models.
		CO4	Reviewing how to solve problems by Queuing and game theory.
		CO5	Solving networking problems and clear idea of the decision making and meta-heuristic algorithm.
ME 706	**Major Project I**	CO1	Identify the objective, scope and the concept of the work.
		CO2	Develop a prototype/experimental set-up necessary to complete the project.
		CO3	Justify ethical principles in engineering practices.
		CO4	Comprehend the Engineering activities with effective presentation and report.
		CO5	Perform multi-disciplinary task as an individual and / or team member to manage the project/task.
6.B.Tech. VIII Semester			
ME 801	**Refrigeration & Air Conditioning**	CO1	Illustrate the fundamental principles and applications of refrigeration and air conditioning system
		CO2	Obtain cooling capacity and coefficient of performance by conducting test on vapor compression refrigeration systems
		CO3	Present the properties, applications and environmental issues of different refrigerants
		CO4	Calculate cooling load for air conditioning systems used for various
		CO5	Operate and analyze the refrigeration and air conditioning systems.
ME 802 (A)	**Automobile Engineering**	CO1	Comprehend basics of Automobile, Chassis, and different components
		CO2	Expressing working principle of Front Axle, Rear Axle
		CO3	Relating principle of Final Drive and Steering System
		CO4	Reviewing the function of Brakes and Suspension System.

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		CO5	Familiarity with electronic circuits of battery, lightning and wiper system of vehicle and pollution control standard
ME 803 (C)	**Energy Conservation, Management & Audi**	CO1	Comprehence the concepts of energy management and conservation.
		CO2	Conduct an energy audit and submit its report.
		CO3	Explaining energy policy, its purpose and formation.
		CO4	Perform electrical energy audit in different electrical systems
		CO5	Manage thermal energy in various sector of industrial uses
ME 804	**Simulation & Modelling**	CO1	Create simple part design using CATIA software
		CO2	Create simple assembling of parts using CATIA software
		CO3	Analysis 2D frame structural using FEM
		CO4	Calculate thermal stress in 2D components
		CO5	Perform basic computational fluid flow analysis using ANSYS software
ME 805	**Major Project-II**	CO1	Identify the objective, scope and the concept of the work.
		CO2	Develop a prototype/experimental set-up necessary to complete the project.
		CO3	Justify ethical principles in engineering practices.
		CO4	Comprehend the Engineering activities with effective presentation and report.
		CO5	Perform multi-disciplinary tasks as an individual and / or team member to manage the project/task.

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CIVIL ENGINEERING		
COURSE OUTCOME(COs): B.Tech. III,IV,V,VI,VII & VIII		
Session 2022-23		
Code	**Course Name**	**Course Outcomes**
1.B.Tech. III Semester		
BT 301	**MIII**	CO1: Students will be able to define effective mathematical tools to numerically solve algebraic and transcendental equations. Also explain various interpolation methods by using finite difference operators.
		CO2: Students will be able to examine differentiation and integration by interpolation methods. Also discuss various numerical techniques to solve simultaneous linear algebraic equations.
		CO3: Students will be able to implement various mathematical tools to solve ordinary and partial differential equations.
		CO4: Students will be able to identify the importance of Laplace transform, Fourier transform and inverse Laplace transform.
		CO5: Students will be able to analyze the concept of probability and probability distribution.
CE 302	**Construction Material**	CO1: To understand about classification, properties of various materials like Stones, Brick, Mortar and Concrete.
		CO2: To understand about classification, properties of various materials like Timber ,Glass , Steel and Aluminium.
		CO3: To learn about Flooring , Roofing ,Plumbing and Sanitary Material.
		CO4: To study about Paints, Enamels and Varnishes.
		CO5: To study about Miscellaneous Construction Materials.

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CE 303	**Surveying**	CO1: The Fundamentals of Surveying class provides basic knowledge about principles of surveying for location, design and construction of engineering projects
		CO2: Students will gain knowledge handling the equipment Theodolite to find out the horizontal and vertical angles and to find out the elevation of the required points by indirect measurement.
		CO3: To make students aware to prepare contoured maps or plans requiring both the horizontal as well as vertical control, preparation of topographic maps which require both elevations and horizontal distances.
		CO4: Students will learn about the Curves and its types and how the setting out of the curve is implemented in a Highway Site..
		CO5: Study about Hydrographic Survey and Arial Survey and prepare maps for coastal Area and military Area.
CE 304	**Building Planning and Architecture**	CO1: Students will be able to understand the various elements of buildings, various types of footing, open foundation, lintels and arches, stairs and staircase, trusses, flooring, roofs etc.
		CO2: Students will be able to understand the different types of buildings, Provisions of National Building Codes and Rules, Building bye-laws, open area, Setbacks etc.
		CO3: Students will be able to understand the Building Services like water supply, sewerage and drainage systems, sanitary fittings and fixtures, plumbing systems, internal & external drainage systems, principles of electrification of buildings etc.
		CO4: Students will be able to understand the factors influencing architectural development, characteristics features, historic examples, Principles of architectural composition etc.
		CO5: Students will be able to understand the factors influencing Perspective Drawing and Town Planning, structure plan, detailed town planning scheme and

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		action plan, town planning legislation and municipal acts, panning of control development schemes, urban financing etc.
CE 305	**Strength of Material**	CO1: Students will be able to understand the basic concept of strength of material and various properties of material & The action of forces and effects on structural and machine elements such as circular bars, angle iron, and beams etc.
		CO2: Students will be able to understand the basic concept of Bending.So we can conclude that the subject of strength of materials is basically study of The behavior of materials under different types of load and moment.
		CO3: Students will be able to understand the basic concept of Deflection and shear stress & To familiarize the student with the various stresses that may act on a material such as compressive stress, tensile stress, tangential stress, etc and the response of a material to each of these types.
		CO4: Students will be able to understand the basic concept of column and strut, type of column & uses of column & strut.
		CO5: Students will be able to understand the basic concept of Torsion of hollow cylinder , solid body & tube.
CE 306	**SH & ACEP Lab**	CO1: Students will Study of ancient monuments e.g. Forts, Bridges, Buildings and various other civil engineering related structures.
		CO2: The student will be able to understand Environmental practices adopted in construction of historical structures during the ancient/medieval period.
		CO3: The student will able to understand about construction techniques and materials used in historical structures
		CO4: The student studies Various planning aspects adopted in historical structures.
		CO5: The student will visit various historical structures and museums to understand the history of civil engineering practices.

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ES 401	**EEES**	CO1: After studying the content scholar will be able to compare and differentiate about available energy systems, Energy sources and possible future options based on demand and supply.
		CO2: After studying the content, students will be able to identify the various segments of environment and ecosystem, which will help them to be a better engineer and serve the society in a positive manner.
		CO3: After studying the content students will be able to compare and value the Biogeography of India, Biodiversity of the country, Threats to biodiversity and its conservation.
		CO4: After studying the content scholar will be able to identify and examine the sources of pollution, types, solution for the issue and impact on the society.
		CO5: After studying the content students will be able to identify and construct solutions for the issues related to society like energy, climate change and water availability, its harvesting, Issues involved in enforcement of environmental legislation, and public awareness.
CE 402	**Construction technology**	CO1: The student will understand how the foundation distributes the weight of the structure over a large area so as to avoid overloading of the soil beneath.
		CO2: The student will understand The Formwork Safety Course for Supervisor at providing individuals with the knowledge and skill required to supervise the construction, erection, and alteration or dismantling and inspection of formwork structures at any worksites.
		CO3: The student will learn the construction of the masonry wall and partitions provided in residential or commercial buildings.
		CO4: The students are able to understand the concepts of roof and floor construction and its elements that are provided in the various types of buildings.
		CO5: The student will able to Analyze the earthquake resistant structure and find the factors that affecting the stability of building due to earthquake and wind load.

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CE 403	**Structural Analysis I**	CO1: Students will Understand the Principles of virtual work and strain energy method it is useful for finding the deflection and also learn about maxwell's reciprocal theorem
		CO2: Students will Understand the continuous beams by theorem of three moments and solve different cases of effect of sinking and rotation of supports by Moment distribution method
		CO3: After completion of the unit students will be able to analyze beams and frames by slope Deflection method, Column Analogy method.
		CO4: After completion of the unit students will be able to know about Three and Two hinged arches of different shapes.
		CO5: After completion of the unit students will be able to know about Maximum SF and BM curves for various types of Rolling Loads.
CE 404	**Transportation Engg I**	CO1: After completion of the unit student will be able to describe mode of transportation specially railway and its function, they also can explain the various parts like railway car, rail, hauling capacity, traction, tractive resistance, ballast etc.
		CO2: After completion of the unit student will be able to solve problems related to geometric design, super elevation, cant and cant deficiency etc. They also explain and describe various parts of geometric design like signal, interlocking, and different yards.
		CO3: After completion of the unit, students will be able to understand about the bridge component, forces and load, alignment and many terms related to bridge stability and construction.
		CO4: After completion of the unit , students will be able to understand about the foundation used in the bridge and the related terms. They will also be able to describe or discuss cofferdam and retrofitting of the bridge foundation.
		CO5: After completion of unit student will able to understand about the tunnel and the terms related to tunnel engineering

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CE 405	**Engineering Geology and Remote Sensing**	CO1: Students will be able to identify various features developed by natural agencies as well as the natural disasters occuring in nature.
		CO2: Students will be able to understand various minerals used in civil engineering and their occurrence.
		CO3: Students will be able to identify various features developed by natural agencies of rocks type as well as the natural disasters occuring in nature.
		CO4: Students will be able to understand various rock structures and their occurrence.
		CO5: Students will attain a foundational knowledge and comprehension of the physical, computational, and perceptual basis for remote sensing and concept of remote sensing, process of remotely sensed data and It's advantages.
CE 406	**Software Lab**	CO1: Understand the need for software tools in analysis and design of Civil Engineering Systems.
		CO2: Identify the available open source software tools used for specific problems in Civil Engineering.
		CO3: Use the latest software tools for Modeling, Analysis and Design of Civil Engineering Systems Mapping.
		CO4: Students will be able to put forward ideas and understandings to others with effective communication processes.
		CO5: The course will enable the students to an idea of how structures are built and projects are developed on the field.
3.B.Tech. V Semester		
CE501	**Fluid Mechanics I**	CO1: Students will be able to describe or explain various physical and chemical properties of fluid.
		CO2: Students will be able to define the various types of flow and its significance.
		CO3: Students will be able to define the different types of energy equation and its uses in water engineering. They can also solve the various problems.

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		CO4: Students will be able to explain the laminar flow and its properties and also can solve the problem related to it.
		CO5: Student will be able to define the different types of pipe flow problems and losses, the will also able to understand the different function of dimensional analysis
CE502	**Transportation Engg II**	CO1: Students will be able to understand about highways planning, Road classification,Patterns of road and geometric design elements etc.
		CO2: Students will be able to understand the Design of flexible pavements, design of mixes and stability, WBM, WMM, BM, IBM, surface dressing, interfacial treatment-seal coat, tack coat, prime coat, wearing coats, grouted macadam etc.
		CO3: Students will be able to understand the Principles of stabilization, mechanical stabilization, requirements, advantages, disadvantages and uses,Channelised and unchannelized intersections etc.
		CO4: Students will be able to understand the Airport site selection. aircraft characteristics and their effects on runway alignments, windrose diagrams, basic runway length and corrections, classification of airports etc.
		CO5: Students will be able to understand theZoning regulations, approach area, approach surface-imaginary, conical, and horizontal. Rotating beacon etc.
CE503	**Structural Analysis II**	CO1: Student will able to Know Moment distribution method in analysis of frames with sway, analysis of box frames, analysis of portals with inclined members along with analysis of beams and frames by Kani's method
		CO2: Students will be able to define Plastic analysis of beams and frames.
		CO3: Students will be able to Analyse tall frames for wind and earthquake loads, codal provisions for lateral loads and know about Approximate analysis of multistory frames for vertical and lateral loads.

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		CO4: Students will be able to explain the Matrix method of structural analysis in which they are able to solve continuous beams by force method and displacement method.
		CO5: Students will be able to define Influence lines for intermediate structures and define Muller Breslau principle, Analysis of Beam-Columns.
CE504	**Remote Sensing and GIS**	CO1: Students will attain a foundational knowledge and comprehension of the physical, computational, and perceptual basis for remote sensing and concept of remote sensing, process of remotely sensed data and its advantages.
		CO2: Students can understand the basic difference between various kinds of satellites and sensors and perform image enhancement on remotely sensed imagery.
		CO3: Understand the basic concept of GIS and its applications, know different types of data representation in GIS.
		CO4: The students will be able to differentiate raster and vector data modes and also appreciate the role of these models in visualizing and graphical outputs through GIS.
		CO5: The student will be able to apply Compute knowledge of Remote sensing and GIS in different civil engineering applications.
CE505	**Material Testing Lab**	CO1: The student will be able to understand the basic concepts of materials and perform various tests on materials.
		CO2: The student will be able to understand the basic concepts of cement, including initial and final setting time of cement, consistency of cement, and compressive strength of cement.
		CO3:The student will be able to determine the fineness modulus of fine aggregate and coarse aggregate.
		CO4: The student will be able to determine the flexural strength and workability of concrete.

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		CO5: The student will be able to understand the concrete mix design by the IS code method.
CE506	**QSC Lab**	CO1: The student will be able to understand the basic concepts of Estimates.
		CO2: The student will be able to determine the detailed estimate for services of plumbing and water supply or Electrification work.
		CO3:The student will be able to determine the detailed estimate for earth work for the road construction or arched culvert.
		CO4: The student will be able to understand the basic concepts of rate analysis of materials.
		CO5: The student will be able to determine the DPR of civil engineering projects.
CE507	**Field Visit**	CO1: The student will be able to understand the basic concepts of Field Work.
		CO2: The student will be able to understand the real world experience.
		CO3:The student will be able to understand the field learning on site.
		CO4: The student will be able to understand the hand-on experience in the field.
		CO5: The student will be able to improve their knowledge of the field.
CE508	**Internship Evaluation I**	CO1: Get exposed to the Civil Engineering Works in the industry and learn the practical aspects of the same.
		CO2: Understand and correlate the academic and industry based on understanding achieved during the exposure in the industry
		CO3: The student will be able to write the detailed report on understanding achieved related to project planning, design, construction, and management.
		CO4: Understand the legal aspects in construction projects through the understanding of various laws pertaining to civil engineering and architectural planning & sanctioning, labor & organizational welfare measure, provisions of arbitration and litigations.

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		CO5: Implement the quality control aspects in planning & management, modern trends project management, application of information system in management of construction projects, safety provisions and equipments.
4.B.Tech. VI Semester		
CE 601	**Structural Design and Drawing (RCC I)**	CO1: After completion of unit students will be able to analyze and design singly Reinforced beam according to IS 456-2000 specification.
		CO2: After completion of unit students will be able to design and analyze Doubly Reinforced beam and according to IS 456-2000 specification.
		CO3: After completion of the unit students will be able to Design a Slab including one way and two way slab according to IS 456-2000 specification.
		CO4: After completion of unit students will be able to know about Columns and footing according to IS 456-2000 specification.
		CO5: After completion of the unit students will be able to know about Staircases according to IS 456-2000 specification.
CE 602	**Environment Engg I**	CO1: Students will be able to understand about water source, quality, demand and fluctuations in demand.
		CO2: Students will be able to understand about impurities, physical, chemical and bacteriological parameters of water, intake structure, operation of pumps and pumping stations.
		CO3: Students will be able to understand about the method and process of water treatment.
		CO4: Students will be able to understand the different sewerage scheme, collection and coalescence of sewage, design and types of sewers and sewers.
		CO5: Students will be able to understand the characteristics of waste water, oxygen demand, equipment involved in analysis, natural methods of waste water disposal, and self-purifying capacity of the stream.
CE 603	**Water resources Engg**	CO1: Student will be able to understand the soil crop water relationship, and also understand different irrigation methods

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		CO2: Students will be able to understand the confined vs unconfined aquifers and also understand groundwater recharge methods and waterlogging effects.
		CO3: Students will be able to understand rainfall data, its measurement & estimation of missing rainfall. Student will also able to understand unit hydrograph analysis.
		CO4: Students will be able to understand the canal & its structural design and also understand different hydraulic structures like dams, spillways & weirs.
		CO5: Students will be able to understand different types of floods, their estimation and flood control measures.
CE 604	**Fluid Mechanics II**	CO1: Students will be able to describe or explain turbulent & laminar flow.
		CO2: Students will be able to understand about the open channel flow or uniform flow in the open channel.
		CO3: Students will be able to understand about the open channel flow or Non uniform flow in the open channel.
		CO4: Students will be able to explain Drag force on anybody and their application.
		CO5: Students will be able to explain different type turbine, pumps.
CE 605	**Advanced Surveying Lab**	CO1: Make use of knowledge regarding various survey instruments in measuring the distances and angles and also to compute levels of different works
		CO2: Apply the knowledge in preparing various types of maps.
		CO3: Use the knowledge to estimate the quantity (areas and volumes) of the Civil Engineering work.
		CO4: Carry out detailed survey of an area using appropriate technique and draw topological features on the sheet.
		CO5: Understand and make use of various photography surveys in drawing appropriate conclusions.
CE 606	**NDT Lab**	CO1: The student shall be able to select an appropriate NDT technique as per requirement.

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		CO2: Students will understand the terminology and basic concepts of materials and structure failure mode, and failure mechanisms.
		CO3: Students will be able to appreciate NDT methods for Materials and Structural health monitoring and sensing.
		CO4: After study students understand and apply the knowledge to field inspection or monitoring of civil materials and structures.
		CO5: Students will be able to understand fundamental materials mechanical properties and linear fracture mechanics of materials, testing procedures of commonly used civil materials and structures.
CE 608	**Minor Project**	CO1: Work in a team to select a problem for project work..
		CO2: Review and evaluate the available literature on the chosen problem in various fields of Civil engg.
		CO3: Students will be able to formulate the methodology to solve the identified problems.
		CO4: After study students understand and apply the principles, tools and techniques to solve the problem in civil engg.
		CO5: Students will be able to Prepare and present project report.
5.B.Tech. VII Semester		
CE701	**Geotechnical Engg**	CO1: After completion of this unit, students will be able to know various index properties of soil and also the soil classification.
		CO2: After completion of this unit, students will come to know about the permeability, factors affecting it and also the effective stress principle.
		CO3: At the end of this unit, students will come to know about Boussinesqs & Westergaard's stress principles on different areas and also they come to know about different compaction methods.
		CO4: At the end of this unit, students will come to know about consolidation concepts from terzaghi analysis and also they will find out the coefficient of consolidation from different methods.

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		CO5: After completion of this unit, students will be able to know about various shear strength properties and parameters by using laboratory methods. Students will also come to know about soil stabilization.
CE702	**Advanced Structural Design (RCC II)**	CO1: After completion of unit students will be able to Design of Multistory Buildings - Sway and non-sway buildings, shear walls and other bracing elements.
		CO2: After completion of unit students will be able to know about Earth Retaining Structures that is Cantilever and counterfort type retaining walls and Design of it.
		CO3: After completion of the unit students will be able to Design a Water tank and also be able to discuss many functions of the water tank.
		CO4: After completion of the unit students will be able to know about the bunker and silo they also can design both of them.
		CO5: In this chapter students will be able to understand minor and major things about the bridge and the prestressing.
CE703	**Integrated Waste Management**	CO1: To Aware about the problems associated with Municipal solid waste(MSW) and their effective management.
		CO2: To understand the components of Integrated solid waste management systems.
		CO3: To learn about recycling, reuse and reduce, recover of solid wastes and Transfer station.
		CO4: To examine the operation of a resource recovery facility, waste-to-energy strategies.
		CO5: To study the design and operation of a municipal solid waste composting and land-filling.

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CE704	**Prestressed Concrete Lab**	CO1: The student will understand about Fabrication, casting and testing of simply supported prestressed concrete beam/slab for strength and deflection behavior.
		CO2: The student will understand about Fabrication, casting and testing of beam/slab with different layout of cables for strength and deflection behaviour.
		CO3: The student will study about Fabrication, casting and testing of various prestressed structures as per contents IS Code provisions.
		CO4: The student will understand how prestressed reinforcement work in different structures.
		CO5: The student will learn to understand the design basis of prestressed concrete, precast concrete elements and foundations
CE706	**Project I**	CO1: The student will be able to demonstrate the knowledge, skills and attitudes of a professional engineer
		CO2: The student will be able to undertake problem identification, formulation and solution.
		CO3:The student will be able to Demonstrate a sound technical knowledge of their field.
		CO4: The student will be able to demonstrate teamwork skills
		CO5:Students are able to see themselves as individuals with various skills and abilities, some more developed than others, and understand that they can make choices about how they wish to move forward.
CE607	**Internship Evaluation II**	CO1: Get exposed to the Civil Engineering Works in the industry and learn the practical aspects of the same.
		CO2: Understand and correlate the academic and industry based on understanding achieved during the exposure in the industry
		CO3: The student will be able to write the detailed report on understanding achieved related to project planning, design, construction, and management.

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		CO4: Understand the legal aspects in construction projects through the understanding of various laws pertaining to civil engineering and architectural planning & sanctioning, labor & organizational welfare measures, provisions of arbitration and litigations.
		CO5: Implement the quality control aspects in planning & management, modern trends project management, application of information system in management of construction projects, safety provisions and equipment.
6.B.Tech. VIII Semester		
CE801	**Structural Design and Drawing II (Steel I)**	CO1: Students will be able to describe or explain various types of joint and connections.
		CO2: Students will be able to design the tension member and compression member.
		CO3: Students will be able to define the different types of beam and be able to design the beam (like simply support beam, continuous beam, cantilever beam).
		CO4: Students will be able to explain and design lacing and batten systems.
		CO5: Students will be able to explain different types of bracing systems.
CE802	**Foundation Engg**	CO1: The student will be able to understand the behavior criteria of collapsible soil and implement the different methods to increase the strength of collapsible soil and understand the selection of different types of footing on collapsible soil.
		CO2: The Student will be able to understand the design criteria of shallow foundation and different types theories of failure of Shallow Foundation and understand the effect of ground water table on footing.
		CO3: The Student will be able to understand the design criteria of Deep foundation, the different methods of pile driving and understand the pile group efficiency.

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		CO4: The Student will be able to understand different methods of improving soil condition by Geosynthetic material and understand the construction of Under-reamed piles.
		CO5: The Student will be able to understand the different types of earth pressure theory and evaluate the earth pressure in at rest, active and passive state and design the retaining wall.
CE803	**Integrated Water Management**	CO1: To study the paradigm shift in water management with global and national perspectives of the water crisis. It also aims to understand the concepts of 'blue water', 'green water' and 'virtual water' and their roles in water management.
		CO2: To study sustainable water resources management and to plan and develop a framework for the future.
		CO3: To study the modern principles of water management and planning.
		CO4: To develop surface and subsurface water systems along with water balance equations.
		CO5: To study the conventional and non-conventional techniques for water security.
CE804	**Earthquake Resistant Structure Lab**	CO1: The student will be able to understands the earthquake resistant structures
		CO2: The student will be able to understands the design of steel buildings
		CO3:The student will be able to understands the seismic protection of structures
		CO4: The student will be able to Identify design forces and moments in the members.
		CO5:Students are able toDuctility considerations in earthquake resistant design of RCC building
CE805	**Project II**	CO1: The student will be able to demonstrate the knowledge, skills and attitudes of a professional engineer
		CO2: The student will be able to undertake problem identification, formulation and solution.

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		CO3:The student will be able to Demonstrate a sound technical knowledge of their field.
		CO4: The student will be able to demonstrate teamwork skills
		CO5:Students are able to see themselves as individuals with various skills and abilities, some more developed than others, and understand that they can make choices about how they wish to move forward.

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