NARASARAOPETA
ENGINEERING COLLEGE
(AUTONOMOUS)

1.1.1-Curriculum Design and Development

2024-2025 Academic Year

Additional Information

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department of Civil Engineering
Vision-Mission-PEOs-PSOs-POs

Vinson	To be a centre of excellence with state of art infrastructure and imbibe knowledge on advanced technologies in the field of Civil engineering with a focus on research and sustainable development for the benefit of society.	
Mission	M1: Train the students as technologically motivated Civil engineers who can serve the society competently, collaboratively and ethically as Planners, designers, constructors, and operators. M2: To provide quality-based consultancy services to the communities for the development of civil engineering industry and other allied fields. M3: To ignite innovative thinking, entrepreneur skills and research among students.	
Program Education objectives	PEO1	Analyse and design infrastructural projects of civil engineering.
	PEO2	Lead their teams to complete the projects ethically and sustainably.
	PEO3	Apply innovative technologies and update skills through lifelong learning.
Program Specific Objectives	PSO1	The students will be able to apply fundamental concepts of structural, geotechnical, water resources and environmental engineering to make best projects in civil engineering.
	PSO2	The students will develop skills to design sustainable solutions for real time problems of civil engineering by adopting modern technologies and designing tools.
Program outcomes	PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2	**Problem analysis:** Identify, formulate, review 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 the 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 the 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.
	PO9	**Individual and teamwork:** 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 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.

QAC

PRINCIPAL
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601
Guntur (Dist.), A.P.

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department Electrical & Electronics Engineering (EEE)

Vision-Mission-PEOs-PSOs-POs

Vinson	To impart student centric education in the field of Electrical and Electronics Engineering to transform the individuals into competent engineers with a focus on research and ethics.	
Mission	M1: To provide knowledge based technology and infrastructure to meet the needs of industry and society. M2: To assimilate innovation and research oriented culture to make successful professionals and entrepreneurs. M3: To encourage lifelong learning with ethics among the students so as to make them as responsible individuals.	
Program Education objectives	PEO1	Apply the science and engineering knowledge to solve complex problems of electrical and electronics engineering.
	PEO2	Continue their education to become as researchers and entrepreneurs.
	PEO3	Work effectively with high ethical values, as individuals and as team members.
Program Specific Objectives	PSO1	Apply appropriate techniques and modern tools in the field of electrical and electronics engineering.
	PSO2	Demonstrate the sustainable development in non-conventional Energy sources.
Program outcomes	PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fun damentals, and an engineering specialization to the solution of complex engineering probl ems.
	PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex en gineering 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 the public health and safety, and the 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 the 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 professionalengineering 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.
	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 en gineering community and with 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 eng ineering 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.

QAC

PRINCIPAL
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601.
Guntur (Dist.), A.P.

NEC NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department Mechanical Engineering
Vision-Mission-PEOs-PSOs-POs

Vinson	To strive for making competent Mechanical Engineering Professionals to cater the real time needs of Industry and Research Organizations of high repute with Entrepreneurial Skills and Ethical Values.	
Mission	M1: To train the students with State of Art Infrastructure to make them industry ready professionals and to promote them for higher studies and research. M2: To employ committed faculty for developing competent mechanical engineering graduates to deal with complex problems. M3: To support the students in developing professionalism and make them socially committed mechanical engineers with morals and ethical values.	
Program Education objectives	PEO1	Excel in profession with sound knowledge in mathematics and applied sciences
	PEO2	Demonstrate leadership qualities and team spirit in achieving goals
	PEO3	Pursue higher studies to ace in research and develop as entrepreneurs
Program Specific Objectives	PSO1	The students will be able to apply knowledge of modern tools in manufacturing enabling to conquer the challenges of Modern Industry..
	PSO2	The students will be able to design various thermal engineering systems by applying the principles of thermal sciences.
	PSO3	The students will be able to design different mechanisms and machine components of transmission of power and automation in modern industry.
Program outcomes	PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fun damentals, and an engineering specialization to the solution of complex engineering probl ems.
	PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex en gineering 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 the public health and safety, and the 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 the 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 knowle dge of, and need for sustainable development
	PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
	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 en gineering community and with 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 eng ineering 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.

IQAC

PRINCIPAL
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601
Guntur (Dist.), A.P.

Department of Electronics And Communication Engineering
Vision-Mission-PEOs-PSOs-POs

Vinson	To emerge as a centre of excellence in Electronics and Communication Engineering through student-centric education and research focus to cater to the current and future needs of society.	
Mission	M1: To provide the best infrastructure for empowering the students with quality education to motivate them towards higher studies and research. M2: To provide qualified and experienced faculty for student-centric teaching in order to mold the students as successful professionals in the modern Electronics industry. M3: To inculcate leadership qualities, professional etiquette, ethical values, and social responsibilities.	
Program Education objectives	PEO1	Demonstrate successful professional careers with strong fundamental knowledge in mathematics, science and engineering to meet real time requirements of industry.
	PEO2	Learn continuously with a focus on advanced emerging trends in the field of ECE and allied to meet the societal needs.
	PEO3	Pursue higher education leading to masters and research programs for knowledge dissemination in profession.
Program Specific Objectives	PSO1	Design and develop IoT applications using Raspberry Pi, Arduino and other advanced processors.
	PSO2	Design and synthesize various circuits using latest hardware and EDA tools.
	PSO3	Design and analyse modern communication systems to meet the present and future needs of industry with cost effective solutions.
Program outcomes	PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2	**Problem analysis**: Identify, formulate, review 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 the public health and safety, and the 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 the 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.
	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 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.

IQAC

PRINCIPAL
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601
Guntur (Dist.), A.P.

Department Computer Science of Engineering
Vision-Mission-PEOs-PSOs-POs

Vinson	To become a centre of excellence in nurturing the quality Computer Science & Engineering professionals embedded with software knowledge, aptitude for research and ethical values to cater to the needs of industry and society.	
Mission	**M1:** Mould the students to become Software Professionals, Researchers and Entrepreneurs by providing advanced laboratories. **M2:** Impart high quality professional training to get expertize in modern software tools and technologies to cater to the real time requirements of the Industry. **M3:** Inculcate team work and lifelong learning among students with a sense of societal and ethical responsibilities.	
Program Education objectives	PEO1	Apply the knowledge of Mathematics, Science and Engineering fundamentals to identify and solve Computer Science and Engineering problems.
	PEO2	Use various software tools and technologies to solve problems related to academia, industry and society.
	PEO3	Work with ethical and moral values in the multi-disciplinary teams and can communicate effectively among team members with continuous learning.
Program Specific Objectives	PSO1	Apply mathematical and scientific skills in numerous areas of Computer Science and Engineering to design and develop software-based systems.
	PSO2	Acquaint module knowledge on emerging trends of the modern era in Computer Science and Engineering
Program outcomes	PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fun damentals, and an engineering specialization to the solution of complex engineering probl ems.
	PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex en gineering 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 the public health and safety, and the 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 the 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 professionalengineering 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.
	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 en gineering community and with 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 eng ineering 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.

IQAC

PRINCIPAL
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601
Guntur (Dist.), A.P.

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department of CSE (Artificial Intelligence)
Vision-Mission-PEOs-PSOs-POs

Vinson	To be renowned department that imparts creative, learning and research skills to students in the domain of artificial intelligence.	
Mission	To Impart Strong foundation of statistics for understanding Artificial Intelligence. 1. To establish high performance computational facilities and tools to develop innovative and intelligent solutions. 2. To collaborate with renowned companies for multidisciplinary research and development. 3. To guide the students in learning and creative for developing intelligent technology based solutions to societal problems.	
Program Education objectives	PEO1	To Formulate, analyse and solve Engineering problems with strong foundation in Mathematical, Scientific, Engineering fundamentals and modern computing practices through advanced curriculum.
	PEO2	Analyse the requirements, realize the technical specification and design the Engineering solutions by applying artificial intelligence theory and principles.
	PEO3	Demonstrate technical skills, competency in AI and promote collaborative learning and team work spirit through multi -disciplinary projects and diverse professional activities.
Program Specific Objectives	PSO1	Ability to analyse and apply the knowledge of human cognition, Artificial Intelligence, Machine Learning and data engineering in terms of real world problems to meet the challenges of the future.
	PSO2	Ability to develop computational knowledge and project development skills using innovative tools and techniques to solve problems in the areas related to Deep Learning, Machine learning, Artificial Intelligence.
	PSO3	Ability to lead a product development company/team and use the acquired knowledge to identify real-world research problems.
Program outcomes	PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex en gineering 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 the public health and safety, and the 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 the 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 knowle dge of, and need for sustainable development
	PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
	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 en gineering community and with 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 eng ineering 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 broades context of technological change.

IQAC

PRINCIPAL
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department of Information Technology
Vision-Mission-PEOs-PSOs-POs

Vinson	To transform into a research and technological hub to develop prominent IT professionals to serve the needs of industry and society.	
Mission	M1: Induce preliminary and contemporary IT principles of the industry among the students. M2: Develop strong force of students to solve the real time problems of the IT industry. M3: Incubate the students with emerging entrepreneur intelligence.	
Program Education objectives	PEO1	Apply the knowledge of mathematics, science and engineering fundamentals to identify and solve IT and engineering problems.
	PEO2	Use various software tools and technologies to solve problems related to Academia, industry and society.
	PEO3	Work with ethical and moral values in the multi-disciplinary teams and can Communicate effectively among team members with continuous learning.
	PEO4	Pursue higher studies and develop their career in software industry.
Program Specific Objectives	PSO1	Ability to analyse and develop computer programs in the areas related to Algorithms, system software, application software, web design, big data analytics, database design and networking for efficient design of computer based systems of varying complexity.
	PSO2	Design, Implement and evaluate a computer-based system to meet desired needs.
	PSO3	Develop IT application services with the help of different current engineering tools.
Program outcomes	PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2	**Problem analysis:** Identify, formulate, review 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 the public health and safety, and the 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 the 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 modelling 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.
	PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse t
	PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with 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.

IQAC

PRINCIPAL
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601
Guntur (Dist.), A.P.

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department: CSE (Data Science)
Vision-Mission-PEOs-PSOs-POs

Vinson	To nurture skilled professionals in the Data Science for industry innovation and create meaningful societal impact through advanced analytics, machine learning, and impactful data-driven solutions.	
Mission	M1: To develop skilled data scientists who can effectively solve challenges in data analytics through comprehensive education and practical training in statistical analysis, machine learning, data visualization, and data manipulation. M2: To develop students with strong research capabilities who can revolutionize multiple fields through the application of data science. M3: To develop ethical data science professionals who utilize data for the welfare of society.	
Program Education objectives	PEO1	Graduates be proficient in applying advanced analytics techniques to solve complex data challenges.
	PEO2	Graduates contribute to the advancement of the field through the development of innovative methodologies, algorithms, and models.
	PEO3	Graduates utilize data science principles to create meaningful societal impact. They will prioritize ethical considerations in data usage and develop solutions that address societal challenges, and benefit individuals and communities.
Program Specific Objectives	PSO1	Apply Data Science Techniques, statistical analysis, machine learning algorithms, data visualization, and data manipulation effectively to solve complex data problems.
	PSO2	Design and develop AI systems by integrating appropriate algorithms, models, and technologies to address specific problem domains.
	PSO3	Able to independently carry out research and investigation to solve societal problems.
Program outmcomes	PO1	**Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2	**Problem Analysis**: Identify, formulate, review research literature and analyse 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 the public health and safety and the 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 the information to provide valid conclusions.
	PO5	**Modern tools usage**: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
	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.
	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 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 broad test context of technological change.

IQAC

PRINCIPAL
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601
Guntur (Dist.), A.P.

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department: CSE (Cyber Security)
Vision-Mission-PEOs-PSOs-POs

Vinson	To cultivate a future generation of proficient Cyber Security professionals dedicated to fortifying industry and society by employing cutting-edge security measures.	
Mission	M1: To provide allied research and academic resources that support for cyber security professionals. M2: To cultivate research-oriented thinking for the design of new security algorithms. M3: To collaborate with innovators for solving real world cyber security threats.	
Program Education objectives	PEO1	Graduates will apply the necessary skills and knowledge to become Cyber Security professionals capable of addressing current security challenges effectively.
	PEO2	Graduates are able to develop a research-oriented mind set and the ability to contribute to the field of Cyber Security through innovative approaches and solutions.
	PEO3	Graduates possess the skills to solve security issues efficiently and adapt to changing circumstances, ensuring the resilience and protection of digital systems.
Program Specific Objectives	PSO1	Apply a range of Cyber Security techniques and measures to protect digital systems effectively and mitigate security risks.
	PSO2	Demonstrate to conduct research in the field of Cyber Security, contributing to the development of new knowledge, algorithms, and approaches for enhanced security.
	PSO3	Analyse and develop proficiency in the areas of network security, cyber laws and ethics.
Program outmcomes	PO1	**Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2	**Problem Analysis**: Identify, formulate, review research literature and analyse 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 the public health and safety and the 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 the information to provide valid conclusions.
	PO5	**Modern tools usage**: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
	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.
	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 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 broad test context of technological change.

IQAC

PRINCIPAL
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601
Guntur (Dist.), A.P.

Department of CSE (Artificial Intelligence & Machine Learning)

Vision-Mission-PEOs-PSOs-POs

Vinson	To empower students to become AI and ML professionals, driving industry innovation and positively impacting society through cutting-edge technologies.	
Mission	M1: To establish a solid foundation in Artificial Intelligence and Machine Learning and effectively address real-world challenges. M2: To develop resilient professionals by encouraging them to create applications for industry innovation. M3: To cultivate a research-oriented mind set in students, encouraging them to create applications that have practical value and make a positive impact on society.	
Program Education objectives	PEO1	Graduates possess a strong knowledge of Artificial Intelligence and Machine Learning principles, enabling them to effectively address real-world challenges.
	PEO2	Graduates continuously enhance their skills and adapt to the evolving field of AI and ML, empowering them to confidently face future challenges.
	PEO3	Graduates apply their AI and ML knowledge to develop practical applications that positively impact society and address societal challenges.
Program Specific Objectives	PSO1	Apply a range of AI and ML techniques to analyse and solve real-world problems effectively.
	PSO2	Design and develop AI systems by integrating appropriate algorithms, models, and technologies to address specific problem domains.
	PSO3	Develop the ethical implications and societal impact of AI and ML technologies.
Program outcomes	PO1	**Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2	**Problem Analysis**: Identify, formulate, review research literature and analyse 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 the public health and safety and the 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 the information to provide valid conclusions.
	PO5	**Modern tools usage**: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
	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.
	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 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 broad test context of technological change.

IQAC

PRINCIPAL
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601
Guntur (Dist.), A.P.

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Department of CSE (Artificial Intelligence & Machine Learning)

Vision-Misson-PEOs-PSOs-POs

Vinson	To empower students to become AI and ML professionals, driving industry innovation and positively impacting society through cutting-edge technologies.	
Mission	M1: To establish a solid foundation in Artificial Intelligence and Machine Learning and effectively address real-world challenges. M2: To develop resilient professionals by encouraging them to create applications for industry innovation. M3: To cultivate a research-oriented mind set in students, encouraging them to create applications that have practical value and make a positive impact on society.	
Program Education objectives	PEO1	Graduates possess a strong knowledge of Artificial Intelligence and Machine Learning principles, enabling them to effectively address real-world challenges.
	PEO2	Graduates continuously enhance their skills and adapt to the evolving field of AI and ML, empowering them to confidently face future challenges.
	PEO3	Graduates apply their AI and ML knowledge to develop practical applications that positively impact society and address societal challenges.
Program Specific Objectives	PSO1	Apply a range of AI and ML techniques to analyse and solve real-world problems effectively.
	PSO2	Design and develop AI systems by integrating appropriate algorithms, models, and technologies to address specific problem domains.
	PSO3	Develop the ethical implications and societal impact of AI and ML technologies.
Program outmcomes	PO1	**Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
	PO2	**Problem Analysis**: Identify, formulate, review research literature and analyse 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 the public health and safety and the 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 the information to provide valid conclusions.
	PO5	**Modern tools usage**: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
	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.
	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 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 broad test context of technological change.

IQAC

PRINCIPAL
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601
Guntur (Dist.), A.P.

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

MASTERS OF BUSINESS ADMINISTRATION

Vision-Mission-PEOs-PSOs-POs

Vinson	To evolve as a centre of excellence in Management by transmitting innovative education to magnify students to be harbingers in business and research focus on cultivating the social responsibilities and ethical values among budding managers.	
Mission	**M1:** To provide all required inputs, and means, and support to the students to gain a distinctive competitive edge and excel in the corporate world. **M2:** To accommodate enriched and skilful faculty for learner-cantered teaching in order to shape the students as corporate competent. **M3:** To install world-class, socially responsible, creative leaders and triumphant entrepreneurs.	
Program Education objectives	PEO1	The MBA graduates will be successfully engaged in multidisciplinary domains in the chosen management discipline.
	PEO2	The MBA graduates will be able to exhibit personal and professional leadership in the work and community environment.
	PEO3	The MBA graduates engaging formal and informal learning opportunities to maintain and enhance professional and personal growth.
Program Specific Objectives	PSO1	Equip students with the necessary knowledge and managerial skills and competencies to occupy positions of management and administration in business, industry, public system, and the government.
	PSO2	Develop the ability to examine and analyse the impact of the changing environment and to respond appropriately at the tactical and strategic levels.
	PSO3	Develop essential decision-making, critical and creative thinking, leadership, and entrepreneurial abilities.
Program outcomes	PO1	Ability to apply the knowledge of business management in to practice.
	PO2	Ability to apply the knowledge of areas of economics, technology, law, accounting into complex situations and provide solution.
	PO3	Able to receive and give clear instructions, comprehend, write reports, prepare documentation ahd make effective presentations.
	PO4	Ability to work independently and also in a team in a diverse and multidisciplinary situations.
	PO5	Ability to apply management principles in to practice and exhibiting leadership qualities.
	PO6	Ability to keep abreast with the latest developments in the business environment by environmental scanning.
	PO7	Ability to do research and apply modern statistical tools and computational tools to analyse the situations and take a right decisions.
	PO8	Demonstrate IT knowledge and skills for efficient and effective business processes and develop innovative methods of applying IT and e-commerce for competitive advantage.
	PO9	Ability to generate new & innovative ideas, putting it into practice by knowing the particulars of starting a business.
	PO10	Demonstrate ethical conduct in personal and professional decisions and appreciation of business ethics and social responsibility and environmental concerns in the decision making process.
	PO11	Ability to actively involve and understanding the importance of independent and continuous learning and research.
	PO12	Formulate and communicate an original business idea to the broader business public and or formulate and communicate business plan

IQAC

PRINCIPAL
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601
Guntur (Dist.), A.P.

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF MASTERS OF COMPUTER APPLICATION

Vision-Mission-PEOs-PSOs-POs

Vinson	To groom MCA Department as a generator of world class Software Professionals / Entrepreneurs with Indian values.	
Mission	M1.Imparting employability skills in students. M2.Encourage research activities among students and staff.	
Program Education objectives	PEO1	Apply their knowledge to solve real-world problems using Computer Apps.
	PEO2	Get employment as Software Professional capable of undertaking software development matching with the current and future needs through technological innovations, and inter-disciplinary works.
	PEO3	Functions effectively as individuals and in any team at the workplace demonstrating ethical behavior, quality conscious Software Professional with sensitivity to the impact of technology on society.
	PEO4	Work with confidence, commitment, capabilities to grow technically, temperamentally as; highly technical professionals, project management team members and leaders etc., through their continued efforts for lifelong learning to remain up to date in their professional pursuits.
	PEO5	Perform search, research and feasibility studies to develop; Project Planning Documents (PPDs), User Requirements Documents (URDs), Modules on Business Process Modeling (BPM), Software Requirements Document (SRD) etc., with awareness and adaptation of various models and to replace waterfall life cycle models by other alternatives like 'Unified Process Model' and 'Agile Software Development' with abilities to; collect, analyze, translate end user requirements in to system and software requirements, architectural design etc.
Program Specific Objectives	PSO1	To design and develop algorithms for business and computer applications.
	PSO2	To apply security mechanisms for online applications.
Program outcomes	PO1	Grasp, understand and comprehend the fundamentals of Information Technology and computer-based systems enabling them to apply their learnt knowledge, skills with right attitude after critical evaluation of approaches, procedures, trade-offs, results related engineering problems and issues in ethically responsible manner for the good of the society through the developments in the current state of the art, and future issues.
	PO2	Apply knowledge of Mathematics, Science, and Computer Applications.
	PO3	Design and conduct experiments, as well as to analyse and interpret data.
	PO4	Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
	PO5	Function on multidisciplinary teams.
	PO6	Identify, formulate, and solve real-world problems using Computer Apps.
	PO7	Get an understanding of professional and ethical responsibility.
	PO8	Communicate effectively.
	PO9	Appreciate the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
	PO10	Recognize the need for, and an ability to engage in life-long learning.
	PO11	Possess the knowledge of contemporary issues.
	PO12	Have abilities to use the techniques, skills, and modern engineering tools necessary for software engineering practice.

IQAC

PRINCIPAL
NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)
NARASARAOPET - 522 601
Guntur (Dist.), A.P.

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Course Outcomes

2024-2025

NEC

COURSE OUTCOMES

R23-B. TECH.(EEE) - COURSE OUTCOMES

I B. TECH

I Semester	II Semester
LINEAR ALGEBRA & CALCULUS CODE: R23CC1101 **CO1:** Solve the system of linear equations and transformations. **CO2:** Analyze the applications of matrices in various fields and obtain Eigen values and Eigenvectors. **CO3:** Analyze mean value theorems to real life problems **CO4:** Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering **CO5:** Identify the area and volume by interlinking them to appropriate double and triple integrals.	**DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS CODE : R23CC1201** **CO1:** First order ordinary differential equations to real life situations. **CO2:** Identify and apply suitable methods in solving the higher order differential equations **CO3:** Solve the partial differentiation equations. **CO4:** Interpret the physical meaning of different operators as gradient, curl and divergence. **CO5:** Estimate the work done against a field, circulation and flux using vector calculus.
INTRODUCTION TO PROGRAMMING CODE :R23CC1102 **CO1:** Infer the basic concepts of computers, algorithms and Flowcharts. **CO2:** Develop programs using appropriate control structures. **CO3:** Write programs using arrays and strings. **CO4:** Develop programs using structures and pointers. **CO5:** Make use of functions and file Operations in C programming for a given application.	**COMMUNICATIVE ENGLISH CODE: R23CC1206** **CO1:** Summarize texts based on the comprehension of the material provided. **CO2:** Create coherent and well-structured paragraphs, essays, and letters on a range of familiar topics **CO3:** Use a diverse array of grammatical structures with flexibility, striving to minimize errors. **CO4:** Use vocabulary adequately and appropriately to express and write on a variety of topics.
ENGINEERING PHYSICS CODE:R23CC1106 **CO1**: Analyze the intensity variation of Laser light and it's propagation in optical fibers. **CO2**: Familiarize with the basics of crystals and their structures. **CO3:** Summarize various types of Magnetic materials and Super conductors. **CO4:** Explain the basic concepts of Quantum Mechanics and the band theory of solids. **CO5:** Identify the type of semiconductor and smart materials.	**ENGINEERING CHEMISTRY CODE :R23CC1208** **CO1:** Understand the difference between soft and hard water and why it matters in daily life and industries. **CO2:** Apply electrochemical principles to real-problems, making informed decisions about materials selection, corrosion mitigation, and energy storage solutions. **CO3:** Analyze the production, properties, and environmental implications of polymers, fuels and biofuels. **CO4:** Apply the knowledge of diverse engineering materials like composites, refractories, lubricants, and Portland cement, to make material selection and applications. **CO5:** Apply the Knowledge of various applications to synthesize colloids and characterize nano materials
BASIC ELECTRICAL & ELECTRONICS ENGINEERING CODE :R23CC1107 **CO1:** Explore the fundamental laws and concept of DC and AC circuits. **CO2:** Demonstrate the working and operating principles of electrical machines, measuring instruments. **CO3:** Demonstrate the working and operating principles of different power generation stations.	**ELECTRICAL CIRCUIT ANALYSIS -I CODE: R23EE1210** **CO1:** Relate the basic fundamental laws and apply different reduction techniques to different networks. **CO2:** Apply the electrical concepts to obtain various mathematical and graphical representations in Single phase AC Circuits.

CO4: Calculate electrical load, electricity bill of residential and commercial buildings and safety measures.	**CO3:** Distinguish the concept of self-inductance, mutual inductance and different Magnetic Circuits. **CO4:** Examine Series and Parallel Resonance circuits to find specifications and to draw Locus diagrams. **CO5:** Analyse the Electrical Networks using different Network theorems.
ENGINEERING GRAPHICS CODE : R23CC1108 **CO1:** Construct the principles of engineering drawing, including engineering curves, scales, Orthographic and isometric projections. **CO2:** Construct orthographic projections of points, lines, planes and solids in front, top and Side views. **CO3:** Analyze and draw projection of solids in various positions in first Quadrant. **CO4:** Develop the sections of Solids & Development of Surfaces. **CO5:** Compare & Draw isometric Views & Orthographic Views.	**BASIC CIVIL AND MECHANICAL ENGINEERING CODE: R23CC1212** **CO1:** Acquire knowledge on various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society. **CO2:** Apply the concepts of surveying to calculate distances, angles and levels. **CO3:** Realize the importance of transportation in nation's economy and to identify the importance of Water Storage and Conveyance Structures. **CO4:** Illustrate the role of mechanical engineering and its technologies in various sectors and knowledge of engineering materials. **CO5:** Explain the basics of various manufacturing processes and thermal engineering and its applications. **CO6:** Describe the working of different powerplants, mechanical power transmission systems and basics of robotics and its applications.
COMPUTER PROGRAMMING LAB CODE:R23CC11L1 **CO1:** Analyze and trace the execution of programs written in C language. **CO2:** Implement programs with appropriate control structures for solving the problems. **CO3:** Develop C programs which utilize memory efficiently using programming constructs like pointers. **CO4:** Code, Debug and Execute programs to demonstrate the applications of arrays, functions, files and various other concepts in C	**ENGINEERING WORKSHOP SUB CODE: R23CC12L9** **CO1:** Identify workshop tools and their operational capabilities. **CO2:** Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry, welding and Plumbing. **CO3:** Apply fitting operations in various applications. **CO4:** Apply basic electrical engineering knowledge for House Wiring Practice
IT WORKSHOP CODE:R23CC1 1L5 **CO1:** Identify Hardware components and inter dependencies. **CO2:** Utilize Antivirus s/w to safeguard computer systems while using Internet **CO3:** Develop a Document or Presentation. **CO4:** Make use of spreadsheets to perform calculations **CO5:** Utilize the AI Tool Chat GPT.	**ELECTRICAL CIRCUITS LAB SUB CODE: R23EE12L5** **CO1:** Describe the concepts of network theorems, node and mesh networks, series and parallel resonance and Locus diagrams. **CO2:** Apply various theorems to compare practical results obtained with theoretical calculations. **CO3:** Determine self, mutual inductances and coefficient of coupling values, parameters of choke coil. **CO4:** Analyse different circuit characteristics with the help of fundamental laws and various configurations.

	CO5: Create locus diagrams of RL, RC series circuits and examine series and parallel resonance.
ENGINEERING PHYSICS LAB CODE: R23CC11L6 **CO: 1** Operate optical instruments like travelling microscope and spectrometer **CO: 2** Estimate the wavelengths of different colors using diffraction grating. **CO: 3** Plot the intensity of the magnetic field of circular coil carrying current with distance. **CO: 4** Calculate the band gap of a given semiconductor.	**ENGINEERING CHEMISTRY LAB SUB CODE: R23CC12L11** **CO1:** Develop and perform analytical chemistry techniques to address the water related problems. **CO2:** Determine the strength of an acid, cell constant, potentials and conductance of solutions. **CO3:** Prepare advanced polymer Bakelite and nanomaterials. **CO4:** Explain the functioning of different analytical instruments.
EEE WORKSHOP CODE :R23CC11L7 **CO1:** Measure voltage, current and power in an electrical circuit. **CO2:** Measure of Resistance using Wheatstone bridge **CO3:** Discover critical field resistance and critical speed of DC shunt generators. **CO4:** Investigate the effect of reactive power and power factor in electrical loads	**COMMUNICATIVE ENGLISH LAB SUB CODE : R23CC12L12** **CO1:** Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning. **CO2:** Create a compelling resume, cover letter and Sop. **CO3:** Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts. **CO4:** Apply employability skills to confidently navigate job interviews..
NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE SCODE :R23CC11MC2 **CO1:** Understand the importance of discipline, character and service motto. **CO2:** Solve some societal issues by applying acquired knowledge, facts, and techniques. **CO3:** Explore human relationships by analyzing social problems. **CO4:** Determine to extend their help for the fellow beings and downtrodden people. **CO5:** Develop leadership skills and civic responsibilities	**HEALTH AND WELLNESS, YOGA AND SPORTS SUB CODE: R23CC12MC1** **CO1**: Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning. **CO2:** Create a compelling resume, cover letter and Sop. **CO3:** Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts. **CO4:** Apply employability skills to confidently navigate job interviews

R23-B. TECH.(EEE) - COURSE OUTCOMES

II B.TECH.

I Semester	II Semester
COMPLEX VARIABLES & NUMERICAL METHODS: R23EE2101 **CO1:** Evaluate the approximate roots of polynomial and transcendental equations by different algorithms. Apply Newton's forward and backward and Lagrange's formulae for equal and unequal intervals (L3) **CO2:** Apply numerical integral techniques to different Engineering problems. Apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations (L3) **CO3:**Apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic(L3) **CO4:** Evaluate the Taylor and Laurent expansions of simple functions, determining the nature of the singularities and calculating residues. Make use of Cauchy Residue theorem to evaluate certain integrals (L3) **CO5:** Explain properties of various types of conformal mappings (L5)	**MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS: R23CC2201** **CO1:**Define the concepts related to Managerial Economics, financial accounting and management(L2) **CO2:**Understand the fundamentals of Economics viz., Demand, Production, cost,revenue and markets (L2) **CO3:**Apply the Concept of Production cost and revenues for effective Business decision(L3) **CO4:** Analyze how to invest their capital and maximize returns (L4) **CO5:** Evaluate the capital budgeting techniques. (L5) **CO6:** Develop the accounting statements and evaluate the financial performance of business entity (L5)
UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY& ETHICAL HUMAN CONDUCT: R23CC2102 **CO1: Interpret** the terms like Natural Acceptance, Happiness and Prosperity **CO2: Identify** one's self, and one's surroundings (family, society nature) **CO3: Apply** what they have learnt to their own self in different day-to-day settings in real life **CO4: Relate** human values with human relationship and human society. **CO5: Justify** the need for universal human values and harmonious existence **CO6: Develop** as socially and ecologically responsible engineers	**ANALOG CIRCUITS: R23EE2202** **CO1:** Design the operation of feedback amplifiers. **CO2:** Explain different wave shaping circuits **CO3:** Design different basic op-amp circuits. **CO4:** Design different multivibrators using op-amp and 555 timers, different oscillators. **CO5:** Analyze about different D/A and A/D converters.
ELECTROMAGNETIC FIELD THEORY: R23EE2103 **CO1: Compute** electric fields and potentials using Gauss law/ solve Laplace's or Poisson's equations for various electric charge distributions **[K3]**. **CO2: Analyse** the behaviour of conductors in electric fields, electric diploe and the capacitance and energy stored in dielectrics **[K4].** **CO3: Calculate** the magnetic field intensity due to current carrying conductor and understanding the application of Ampere's law, Maxwell's second and third law **[K3].** **CO4: Determine** the self and mutual inductances and the energy stored in the magnetic field **[K3].** **CO5: Apply** the concepts of Faraday's laws, Displacement current, Poynting theorem and Poynting vector **[K3].**	**POWER SYSTEM - I: R23EE2203** **CO1:** Demonstrate the different types of power plants, operation of power plants.(K2) **CO2:** Describe the different components of air and gas insulated substations.(K4) **CO3:** Discuss the construction of single core and three core cables and describe distribution system configurations.(K2) **CO4:** Analyze different economic factors of power generation and tariffs.(K4)

ELECTRICAL CIRCUIT ANALYSIS-II: R23EE2104 **CO1: Analyse** the balanced and unbalanced 3 phase circuits for power calculations **(K4)** **CO2: Analyse** the transient behaviour of electrical networks in different domains **(K4)** **CO3: Estimate** various Network parameters **(K4)** **CO4: Apply** the concept of Fourier series to electrical systems **(K3)** **CO5:** Analyse the filter circuit and network topology for electrical circuits (K4)	**INDUCTION & SYNCHRONOUS MACHINES**: **R23EE2204** **CO1:**Explain the construction and operation of three-phase induction motor.(K2) **CO2:**Analyse the performance of three-phase induction motor (K4). **CO3:**Describe the working of single-phase induction motors.(k2) **CO4:**Analyse the performance of Synchronous generators and motors.(k4)
DC MACHINES & TRANSFORMERS: R23EE2105 **CO1:**Sktech the Characteristics of DC generators. **CO2: Analyze** starting and speed control methods of DC motors. **CO3: Calculate** the efficiency and regulation of single phase transformers. **CO4: Analyze** the testing of single phase transformers. **CO5: Differentiate** various configurations of three-phase transformers.	**CONTROL SYSTEMS**: **R23EE2205** **CO1: Derive** the transfer function of physical systems and determine overall transfer function using block diagram algebra and signal flow graphs**. (K2)** **CO2: Analyze** the time response of first & second order systems and absolute and relative stability of LTI systems using Routh's stability criterion and root locus method**.(K3)** **CO3: Analyz**e the stability of LTI systems using frequency response methods**. (K4)** **CO4: Design** Lag, Lead, Lag-Lead compensators to improve system performance using Bode Diagrams (K4). **CO5: Apply** state space analysis concepts to represent physical systems as state models **(K3)**
ELECTRICAL CIRCUIT ANALYSIS-II AND SIMULATION LAB: R23EE21L1 **CO1:** Apply the power calculations in three phase circuits. (K3) **CO2:** Evaluate the time response of given network. (K5) **CO3:** Evaluate two port network parameters. (K5) **CO4:** Evaluate of Filters circuits. (K5)	**INDUCTION AND SYNCHRONOUS MACHINES LAB**: **R23EE22L1** **CO1:** Analyze the performance characteristics of Induction motors. **CO2:** Evaluate the performance of 3-phase Induction Motor by obtaining the locus diagram and equivalent circuit of 3-phase Induction Motor **CO3:** Adapt the power factor improvement methods for single phase Induction Motor **CO4:** Examine performance of alternators using various methods. **CO5:** Assess direct and quadrature axes reactance for a given synchronous machine
DC MACHINES & TRANSFORMERS LAB: R23EE21L2 **CO1:** Demonstrate starting and speed control methods of DC Machines. **CO2:** Predetermine performance of DC machine. **CO3:** Determine performance of DC machines by direct tests **CO4:** Design experiments for testing of transformers & operate the transformers in parallel.	**CONTROL SYSTEMS LAB**: **R23EE22L2** **CO1:**Analyze the performance of Magnetic amplifier, D.C and A.C. servo motors and synchros. **CO2:**Design of PID controllers and compensators. **CO3:**Evaluate temperature control of an oven using PID controller **CO4:**Determine the transfer function of D.C Motor and examine the truth table of logic gates using PLC. **CO5:**Judge the stability in time and frequency domain and Kalman's test for controllability and observability.

DATA STRUCTURES LAB:R23EE21L3 **CO1:**Identify the role of data structures in organizing andaccessing data. **CO2:**Design, implement, and apply linked lists for dynamic datastorage. **CO3:**Develop applications using stacks and queues. **CO4:**Design and implement algorithms for operations on binary trees and trees binary search. **CO5:** Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees.	**SKILL ENHANCEMENT COURSE: PYTHON PROGRAMMING LAB**: **R23EE22L4** **CO1:** Make use of control flow statements and functions to develop python programs.[K3]. **CO2:** Develop Python programs using strings, Lists, dictionaries, tuples and sets. [K3]. **CO3:** Develop Python programs on object oriented programming and regular expressions. [K3]. **CO4:** Develop Python programs using Nuimpy and Pandas. [K3].
	DESIGN THINKING & INNOVATION: **R23CC22L3** **CO1: Explain** the concepts related to design thinking. **CO2: Explain** the fundamentals of Design Thinking and innovation. **CO3: Apply** the design thinking techniques for solving problems in various sectors. **CO4: Analyse t**o work in a multidisciplinary environment. **CO5: Evaluate** the value of creativity
	ENVIRONMENTAL STUDIES: **R23CC22MC** **CO1: Analyze** the natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources. **CO2: Explain** the concepts of the ecosystem, need, biodiversity and its functions. **CO3: Distinguish** various attributes of the pollution, their impacts and measures to reduce or control the pollution along with waste management **CO4: Analyze** the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation. **CO5: Illustrate** the causes of population explosion, value education and welfare programmers.

R20-B. TECH.(EEE) - COURSE OUTCOMES

III B.TECH.

I Semester	II Semester
Problem Solving with Python R20EE3101 CO 1: Outline the computer system concepts. CO 2: Summarize the fundamental concepts of python programming. CO 3: Apply the suitable data structures to solve the real time situational problems. CO 4: Interpret object oriented concepts in python.	**MICROPROCESSORS & MICROCONTROLLERS Code: R20EE3201** **CO1:** Recall the basic concepts, elements & operations of digital computer system. **[K1]** **CO2:** Demonstrate memory organization and I/O processing for microprocessor and microcontroller. **[K3]** **CO3:** Make use of Instruction set to develop Assembly Language Programming for computational operations. **[K3]** **CO4:** Model a microprocessor based system by interfacing different electronic devices. **[K3]** **CO5:** Illustrate the instruction set present in a microcontroller for different operations. **[K2]**
POWER ELECTRONICS Code: R20EE3102 **CO1: Draw** the characteristics of various power semiconductor devices and **analyze** the operation of siliconcontrolled rectifier. **[K4]** **CO2: Analyze** the operation of half-wave and full-wave phase-controlled rectifiers and harmonics in the input current. **[K4]** **CO3: Examine** the operation of three phase full converter and dual converter. **[K3]** **CO4: Examine** the operation of AC voltage controller and single phase cyclo converter. **[K3]** **CO5: Examine** dc-dc converters and **apply** PWM technique for voltage control. **[K4]**	**POWER SYSTEM ANALYSIS Code: R20EE3202** **CO 1: Construct** a single line diagram & impedance diagram of a power system. [**K3**] **CO 2: Analyse** an impedance matrix with any addition or removal of element. [**K4**] **CO 3: Formulate** the power flow problem and **analyse** the power system. [**K4**] **CO 4: Design** the positive, negative, and zero sequence networks for systems consisting of machines, transmission lines and transformers. [**K4**] **CO 5: Derive** the swing equation & power angle curve in the stability analysis of power system. [**K4**]
POWER GENERATION AND TRANSMISSION Code: R20EE3103 **CO 1: Apply** the knowledge of Power Generation from conventional sources. [**K3**] **CO 2: Apply** the knowledge of Power Generation from Non - conventional sources. [**K3**] **CO 3: Derive** the inductance and capacitance for various conductor configurations. [**K3**] **CO 4: Analyse** the performance of transmission lines based on distance. [**K4**] **CO 5: Apply** the knowledge on design of transmission lines, insulated Cables and effect of corona. [**K3**]	**MEASUREMENTS AND INSTRUMENTATION Code: R20EE3203** **CO1: Understand** the Basic functional elements of instrumentation**. [K2] CO2: Understand** and **Applying** the concepts of Fundamentals of electrical and electronic instruments**. [K3] CO3: Analyze** the compare between various measurements techniques**. [K4] CO4: Understand** the Various storage and display devices**. [K2] CO5: Apply** the knowledge about transducers effectively and Piezoelectric, Hall effect**. [K3]**

Fundamentals of Electrical Engineering **Code: R20CC1OE04** **CO1: Describe** the history and classify elements of electrical engineering**(K3)** **CO2: Apply** various laws to the electrical circuits**. (K3)** **CO3: Describe** the concept of self, Mutual Impedances**. (K3)** **CO4: Measure** the performance quantities such as losses, efficiency of DC machines**(k3)** **CO5: Create** the construct of transformer and Induction motor**(k3)**	**ELECTRIC DRIVES** **Professional Elective-II) Code: R20EE3205** **CO1: Know** about the fundamentals of electric drive and different electric braking methods. **[K3]** **CO2: Operation** of single-phase controlled converter fed dc motors and **Analyse** the steady state behaviour of DC motor drive.[K4] **CO3: Apply** the knowledge of choppers for speed control of DC Motors. **[K3]** **CO4:** Know the **analysis** of speed control of induction motor with variable voltage and v/f control. **[K4]** **CO5:** Know the **analysis** of speed control mechanism of synchronous motors. **[K4]**
DIGITAL CONTROL SYSTEMS **(Professional Elective-I) Code: R20EE3106** **CO1: Identify** the basic principles and techniques of A/D and D/A conversions and basics of transform**. (K2)** **CO2: Apply** Z-Transformation to Linear differential Equations. **(K3)** **CO3: Analyze** the concept of stability analysis of discrete time systems. **(K3)** **CO4: Calculate** the performance of a given pulse transfer function in time domain and frequency domain. **(K3) CO5: Design** the state feedback control by "the pole placement method." **(K3)**	**UTILIZATION OF ELECTRICAL ENERGY** **Professional Elective-II) Code: R20EE3206** **CO1: Differentiate** the various types of heating and welding methods. **[K4]** **CO1: Demonstrate** the basic principles of illumination and ight control. **[K3]** **CO3: Design** illumination systems for residential, commercial and industrial environments. **[K3]. CO4: llustrate** the basic principles of electric traction including speed–time curves of different traction services. **[K3]** **CO5: Calculate** Adhesive force, tractive power and specific energy consumption. **[K3]**
SIGNALS AND SYSTEMS **(Professional Elective-1) Code: R20EE3107** **CO1:** Apply signal operations on basic Signals. **[K3]** **CO2:** Develop Fourier series representation for trigonometric and exponential signals. **[K3]** **CO3:** Translate signals from time-domain to frequencydomain and vice versa. **[K2]** **CO4:** Build the LTI system and responses for different inputs. **[K3]** **CO5:** Evaluate different properties of Sampling. **[K5]**	**Big Data Analytics (Professional Elective-II)** **Code: R20EE3207** **CO 1:** Interpret the architectural elements of big data and Hadoop framework. [K2] **CO 2:** Analyse various big data applications using map reduce programming module. [K4] **CO 3:** Analyse Spark capabilities such as distributed datasets, in-memory caching, and the interactive shell. [K4] **CO 4:** Summarize Spark's powerful built-in libraries, including Spark SQL, Spark Streaming. [K2] **CO 5:** Analyze Hadoop data with PIG and Hive. Interpret the applications and architecture of Mobile Computing and multiplexing techniques. [K4]
SPECIAL ELECTRICAL MACHINES **(Professional Elective-1) Code: R20EE3108** **CO1: Contrast** the performance and control of stepper motors, and their applications**.(K3)** **CO2: Illustrate** the control of switched reluctance motor**. (K3)** **CO3: Classify** different types of permanent magnet motors & explain PMDC motor operation**.(K3)** **CO4: Compare** the construction and operation of PMDC Motor &PM synchronous motor**.(K3)** **CO5: Select** a special Machine for a particular application**.(K4)**.	**HYBRID ELECTRIC VEHICLES Code: R20CC2OE03** 1. **Analyse** the behaviour of an electrical vehicles. **[K4]** 2. **Measure** the performance quantities such as Capacity, and Properties of Batteries. **[K3]** 3. **Know** the different ratings of DC and AC Electrical Machines. **[K3]** 4. **Analyse** the importance of components of Electric Vehicle Drive Train. **[K4]** 5. **Analyse** the different types of HEV. **[K4]**.

Micro Electro Mechanical System Code:R20CC1OE03 **CO1:** Understand the basics of MEMS sensors and actuators. (K2) **CO2:** Know the working principle of MOEMS. (K2) **CO3:** Use various Magnetic Sensors and Actuators. (K3) **CO4:** Explain the principle of Micro Fluidic systems. (K2) **CO5:** Illustrate the Chemical and Bio Medical Micro Systems. (K4)	**RENEWABLE AND DISTRIBUTED ENERGY SYSTEMS** (Professional Elective-II) **Code: R20EE3204** **CO1: Illustrate** the significance of renewable energy. **(K2)** **CO2: Analyze** the principles of wind energy and Biomass. **(K4)** **CO3: Distinguish** the principles of Geothermal, Ocean, Tidal and Wave energy. **(K4)** **CO4: Illustrate** the principles of MHD power generation**(K2)** **CO5: Outline** the Distributed Generation and Micro grid.**(K2)**
ENERGY CONSERVATION AND AUDITING (Professional Elective-1) Code: R20EE3109 **CO1: Demonstrate** skills required for energy audit and management.**(K2)** **CO2: Identify** different areas of Energy conservation and management. **(K2)** **CO3: Suggest** cost-effective measures towards improving energy efficient and energy **conservation. (K3) CO4: Analyse** the power factor and to design a good illumination system and can find the applications of all the areas in day to day life. **(K4)** **CO5: Determine** pay back periods for energy saving equipment. **(K3)**	**ENERGY AUDITAND CONSERVATION Code:R20CC2OE04** **CO1:** Understand energy efficiency, scope, conservation and technologies. (K2) **CO2:**Design energy efficient lighting systems. (K4) **CO3:** Estimate/calculate power factor of systems and propose suitable compensation techniques. (K4) **CO4:** Calculate life cycle costing analysis and return on investment on energy efficient technologies. (K3) **CO5:** Calculate power factor of systems and propose suitable compensation techniques. (K3)
PROBLEM SOLVING WITH PYTHON PROGRAMMING LAB (OTHER THAN CSE) Code:R20EE31L1 **CO 1:** Create interactive visual programs using Scratch. **CO 2:** Develop flowcharts using raptor to solve the given problems. **CO 3:** Develop Python programs for numerical and text based problems. **CO 4:** Develop graphics and event based programming using Python.	**MICROPROCESSORS AND MICROCONTROLLERS LAB Code:R20EE32L1** **CO1:** Apply the assembly language programs on arithmetic, logical and string operations. **[K3]** **CO2:** Construct an 8086 system by interfacing I/O and other devices. **[K6]** **CO3:** Make Use of Instruction set of 8086 for modular programming and DOS/BIOS Programming. **[K3] CO4:** Model the 8051 based embedded systems for various applications. **[K3]** **CO5:** Design the stepper motor control circuit with proper interfacing. **[K6]**
POWER ELECTRONICS LAB Code: R20EE31L2 **CO1:** Study the characteristics of various power electronic devices and analyse firing circuits and commutation circuits of SCR. **CO2:** Analyse the performance of single–phase and half wave and Full wave bridge converters, single– phase dual converter with both resistive and inductive loads. **CO3:** Understand the operation of AC voltage controller and cyclo converter with resistive and inductive loads. **CO4:** Understand the working of single–phase bridge inverter and PWM inverter.	**MEASUREMENTS AND INSTRUMENTATION LAB Code: R20EE32L2** **CO1:** Measure the electrical parameters voltage, current, power, energy and **CO2:** Electrical Characteristics of resistance, inductance and capacitance. **CO3:** Known the characteristics of transducers.

INTERNET OF THINGS Code: R20EE31SC3 **CO1:** Explain the application areas of IOT · **CO2:** Influence the revolution of Internet in Mobile Devices, **CO3:** Discuss about the importance of Cloud in IOT. **CO4:** Justify about the importance of Sensor Networks. **CO5:** Explain building blocks of Internet of Things and characteristics.	**POWER SYSTEM SIMULATION LAB** **Code: R20EE32L3** **CO1:** Understand how to measure electrical parameters characteristics of a 3-phase transmission line. **CO2:** Ability to simulate Rectifier, Chopper, Inverter and AC Voltage Controller. **CO3:** Calculate the Load flow solution of power system by iterative methods **CO4:** Analyse single area load frequency control.
PROFESSIONAL ETHICS AND HUMAN VALUES **Code:R20CC31MC01** **CO1:** Interpret the fundamentals of Human values. **[K2]** **CO2:** Analyse the ethical issues and role of engineers in industry. **[K4]** **CO3:** Develop the principles of harmony in value education. **[K3]** **CO4:** List out the duties and rights of engineers. **[K4] CO5:** Summarise the engineer's responsibilities towards safety and risk. **[K2]**	**ENGLISH EMPLOYABILITY SKILLS** (Common to All Branches) **Code: R20CC32SC1** **CO 1:** Write effective Resume for employment.. **CO 2:** Make formal presentations using relevant technical style of communication and appropriate strategies for both academic and professional purpose. **CO 3:** Participate in Group Discussions using analytical and problem solving skills. **CO 4:** Face job interviews confidently and enhance employability.

R20-B. TECH.(EEE) - COURSE OUTCOMES

IV B.TECH.

I Semester	II Semester
HIGH VOLTAGE ENGINEERING **(Professional Elective-III) Code: R20EE4102** **CO1:** Analyze the performance of high voltages with regard to different configurations of electrode systems. **CO2:** Compare the breakdown and withstand phenomena of all types of dielectric materials. **CO3:** Apply knowledge for measurement of high voltage and high current AC, DC and Impulse. **CO4:** Measure DC resistivity, dielectric constant and loss factor, partial discharge. **CO5:** Apply the techniques of testing various equipment's used in HV engineering.	Internship Main project
POWER SYSTEM STABILITY **(Professional Elective-III) Code: R20EE4103** **CO1:** Analyze the different types of stability in power systems. **CO2:** Develop the modelling of synchronous machine. **CO3:** Analyze the significance of small signal stability analysis. **CO4:** Compare the various methods to enhance transient stability & the significance of voltage stability analysis.	
FLEXIBLE AC TRANSMISSION SYSTEMS **(Professional Elective-III) Code: R20EE4104** CO1: Analyze the power flow control in transmission lines using facts controllers. CO2: Explain the operation and control of voltage and current source converter. CO3: Analyze method of shunt compensation using static VAR compensators. CO4: Evaluate different methods of compensations using series compensators. CO5: Apply unified power flow controller (UPFC) on transmission systems.	
SMART GRID TECHNOLIGY **(Professional Elective-III) Code: R20EE4105** CO1: Illustrate the importance of smart grid initiation. CO2: Apply the technologies for data communication and follow the appropriate standards. CO3: Analyze the data and Communication security by adopting encryption and decryption procedures. CO4: Utilize the smart metering application and demand side integration. CO5: Measure the performance quantities such as Monitoring, operating, and managing the transmission and distribution tasks under smart grid environment.	

POWER QUALITY **(Professional Elective-IV) Code: R20EE4106** CO1: Demonstrate the various power quality problems in power system. CO2: Illustrate the harmonic distortion problem due to commercial and industrial loads. CO3: Examine the suitable device for power quality measurements & voltage regulation methods CO4: Apply skills in design of various custom power devices for power quality improvement. CO5: Differentiate the different power quality issues in Distributed Generation	
ELECTRICAL AND HYBRID VEHICLES **(Professional Elective – IV) Code: R20EE4107** CO1: Know the concept of electric vehicles and hybrid electric vehicles. CO2: Examine the different configuration of hybrid electric vehicles. CO3: Analyse with different configuration of hybrid electric vehicles. CO4: Analyse the power converters used in hybrid electric vehicles. CO5: Measure the performance quantities such as Capacity and Properties of Batteries.	
INTRODUCTION TO EMBEDDED SYSTEMS **(Professional Elective-IV) Code:R20EE4108** CO1: Illustrate the classification and applications of embedded systems. CO2: Classify the memory devices and passive components of embedded systems. CO3: Summarize various Communication interface in Embedded Systems. CO4: Summarize the steps involved in developing application specific embedded systems with suitable example. CO5: Describe the RTOS basics and various Communication & Synchronization techniques.	
POWER SYSTEM OPERATION AND CONTROL **(Professional Elective-IV) Code: R20EE4109** CO1: Analyze the economic operation of power systems. CO2: Solve unit commitment problems. CO3: Model speed governing system, turbine and generator. CO4: Develop the Block Diagram of Load frequency control of two area system. CO5: Illustrate the compensation in power systems.	
HVDC TRANSMISSION **(Professional Elective-V) Code: R20EE4110** CO1: Describe the control principles of HVDC converters. CO2: Analyze the operation of power converters. CO3: Demonstrate the concept of harmonics in HVDC systems. CO4: Assess the importance of MTDC systems. CO5: Apply the Modelling of HVDC system and analysis of AC-DC system interactions.	

SWITCHGEAR AND PROTECTION **(Professional Elective-V) Code:R20EE4111** CO1: Estimate the principles of arc interruption for application to high voltage circuit breakers of air, oil, vacuum, SF6 gas type. CO2: Ability to know the working principle and constructional features of different types of electromagnetic protective relays. CO3: Estimate the type of faults that is observed to occur in high power generator and transformers and protective schemes used for all protections. CO4: Choose the Protective Schemes to various types of feeders and bus bar protection. CO5: Sketch the different types of static over current relays used in power system	
ELECTRICAL MACHINE DESIGN. **(Professional Elective-V) Code:R20EE4112** CO1: Illustrate the various materials used for design of static and rotating machines. CO2: Derive the output equation of DC machine & design of main dimensions of DC machines & field circuit. CO3: Derive the output equations of transformer, discuss selection of specific loadings, and estimate the number of cooling tubes, no load current and leakage reactance of core type transformer. CO4: Develop the output equation of induction motor, design stator and rotor circuits of a induction motor. CO5: Develop the output equation of alternator, design the field windings of Synchronous machine & short circuit ratio and its effects on performance of synchronous machines.	
AI TECHNIQUES TO POWER SYSTEM **(Professional Elective-V) Code: R20EE4113** CO1: apply the fundamentals of soft computing techniques. CO2: apply knowledge of Mathematics and Engineering to understand the importance of ANN, Fuzzy and GA CO3: apply the knowledge of AI for power system applications.	
CONCEPT OF SMART GRID TECHNOLIGES **Code:R20CC3OE03** 1. Analyse the smart grid policies and developments in smart grids. 2. Develop concepts of smart grid technologies in hybrid electrical vehicles etc. 3. Illustrate the different types of smart substations and feeder automation. 4. Analyse micro grids and distributed generation systems. 5. Analyse the effect of power quality in smart grid and to understand latest developments in ICT for smart grid	

INDUSTRIAL AUTOMATION Code:R20CC3OE04 1. Illustrate the basics of PLC & its Programming. 2. Analyze the Characteristics of Registers, module addressing and its importance in Ladder diagram. 3. Develop PLC programs using various functions of PLCs for various Industrial applications of PLC. 4. Distinguish between various data handling functions. 5. Differentiate the Analog modules and systems, Analog signal processing, multi bit data processing.	
NON-CONVENTIONAL ENERGY RESOURCES Code:R20CC4OE03 CO1: Illustrate the principles of solar radiation and their applications. CO2: Analyze the functioning of basic components of wind energy and the utilization of biomass in power generation. (CO3: Summarize the working principles of geothermal, ocean, tidal and wave energy techniques. CO4: Interpret the functioning of Thermal Electric Power. CO5: Analyze the MHD power generation and its future prospects.	
ELECTRICAL SAFETY Code:R20CC4OE04 CO 1: Describe electrical hazards and safety equipment. CO 2: Analyse and apply various grounding and bonding techniques. CO 3: Select appropriate safety method for low, medium and high voltage equipment. CO 4: Develop different types of safety programme structures. CO 5: Analyse the maintenance of electrical equipment by using various safety & health Standards.	
Business Management Concepts for Engineers Code:R20CC4101 CO1: Summarize fundamentals of Managerial economics for decision making. CO2: Apply concepts of Financial Accounting and BEP for business decisions. CO3: Evaluate fundamental concepts and principles of management. CO4: Discuss functional areas of management like HR, marketing and finance. CO5: Apply project management techniques for project planning and evaluation	
ENTREPRENURSHIP & INNOVATION Code:R20CC4117 CO1 : Outline the concepts of Entrepreneurship. CO2 : Create the awareness on creativity and innovation. CO3 : Adopt the Entrepreneurship Development programs. CO4 : Evaluate the project planning and feasibility studies. CO5 : Analyze the concept of small and micro enterprises.	
Machine Learning with Python Code:R20EE41SC1 CO 1: Acquire the knowledge on exploratory data analysis. CO 2: Analyze the real word datasets presented in different formats using python libraries to perform exploratory data analysis and Machine Learning algorithms.	

R23-B.TECH. (ECE)-COURSE OUTCOMES

I-B.TECH

I Semester	II Semester
LINEAR ALGEBRA AND CALCULUS **CO 1**: Solve the system of linear equations and transformations. **CO 2**: Analyze the applications of matrices in various fields and obtain Eigen values and Eigenvectors. **CO 3**: Utilize mean value theorems to real life problems**.** **CO 4**: Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering. **CO 5**: Identify the area and volume by interlinking them to appropriate double and triple integrals.	**DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS** **CO1 :** Apply first order ordinary differential equations to real life situations. **CO2 :** Identify and apply suitable methods in solving the higher order differential equations. **CO3 :** Solve the partial differentiation equations. **CO4 :** Interpret the physical meaning of different operators as gradient, curl and divergence. **CO5 :** Estimate the work done against a field, circulation and flux using vector calculus.
INTRODUCTION TO PROGRAMMING **CO1:** Infer the basic concepts of computers, algorithms and Flowcharts. **CO2:** Develop programs using appropriate control structures. **CO3:** Write programs using arrays and strings. **CO4:** Develop programs using structures and pointers. **CO5:** Make use of functions and file Operations in C programming for a given application.	**COMMUNICATIVE ENGLISH** **CO1: S**ummarize texts based on the comprehension of the material provided**.** **CO2:** Create coherent and well-structured paragraphs, essays, and letters on a range of familiar topics. **CO3:** Use a diverse array of grammatical structures with flexibility, striving to minimize errors. **CO4:** Use vocabulary adequately and appropriately to express and write on a variety of topics.
ENGINEERING PHYSICS **CO 1 :** Analyze the intensity variation of Laser light and it's propagation in optical fibers. **CO 2** : Familiarize with the basics of crystals and their structures. **CO 3** : Summarize various types of Magnetic materials and Super conductors. **CO 4 :** Explain the basic concepts of Quantum Mechanics and the band theory of solids. **CO 5 :** Identify the type of semiconductor and smart materials.	**CHEMISTRY** **CO 1**: Explain the concept of electron delocalization and its importance in chemical bonding. **CO 2**: Solve problems and utilize modern materials in practical engineering scenarios. **CO 3**: Apply scientific concepts, experimental findings and applications related to electrochemistry**.** **CO4**: Explore the synthesis of polymers, with specific polymer structures, properties and applications**.** **CO5**: Summarize the concepts of Instrumental methods**.**
BASIC ELECTRICAL & ELECTRONICS ENGINEERING **CO1:** Explore the fundamental laws and concept of DC and AC circuits. **CO2:** Demonstrate the working and operating principles of electrical machines, measuring instruments. **CO3:** Demonstrate the working and operating principles of different power generation stations. **CO4:** Calculate electrical load, electricity bill of residential and commercial buildings and safety measures.	**NETWORK ANALYSIS** **CO 1**: Analyse the basic electrical circuits with nodal and mesh analysis. **CO 2:** Analyse the circuit using network simplification theorems. **CO 3**: Find Transient response and Steady state response of a network. **CO 4**: Analyse electrical networks in the Laplace domain. **CO 5**: Compute the parameters of a two-port network**.**

ENGINEERING GRAPHICS **CO1:** Construct the principles of engineering drawing, including engineering curves, scales, Orthographic and isometric projections**.** **CO2:** Construct orthographic projections of points, lines, planes and solids in front, top and Side views**.** **CO3:** Analyze and draw projection of solids in various positions in first Quadrant. **CO4:** Develop the sections of Solids & Development of Surfaces**.** **CO5:** Compare & Draw isometric Views & Orthographic Views**.**	**BASIC CIVIL AND MECHANICAL ENGINEERING PART A: BASIC CIVIL ENGINEERING** **CO1**: Acquire knowledge on various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society. **CO2**: Apply the concepts of surveying to calculate distances, angles and levels. **CO3**: Realize the importance of transportation in nation's economy and to identify the importance of Water Storage and Conveyance Structures. **PART B: BASIC MECHANICAL ENGINEERING** **CO1**: Illustrate the role of mechanical engineering and its technologies in various sectors and knowledge of engineering materials. **CO2**: Explain the basics of various manufacturing processes and thermal engineering and its applications. **CO3**: Describe the working of different power plants, mechanical power transmission systems and basics of robotics and its applications.
COMPUTER PROGRAMMING LAB **CO1:** Analyze and trace the execution of programs written in C language. **CO2:** Implement programs with appropriate control structures for solving the problems. **CO3:** Develop C programs which utilize memory efficiently using programming constructs like pointers. **CO4:** Code, Debug and Execute programs to demonstrate the applications of arrays, functions, files and various other concepts in C.	**NETWORK ANALYSIS AND SIMULATION LAB** **CO 1**: Analyze Kirchhoff's laws and network theorems **CO 2**: Measure time constants of RL & RC circuits. **CO 3**: Analyze behavior of RLC circuit for different cases. **CO 4**: Design resonant circuit for given specifications**.** **CO 5**: Characterize and model the network in terms of all network parameters.
IT WORKSHOP **CO1:** Identify Hardware components and inter dependencies. **CO2:** Utilize Antivirus s/w to Safeguard computer systems while using Internet. **CO3:** Develop a Document or Presentation. **CO4:** Make use of spreadsheets to perform calculations. **CO5:** Utilize the AI Tool Chat GPT .	**ENGINEERING WORKSHOP** **CO1**: Identify workshop tools and their operational capabilities**.** **CO2**: Compare Manufacturing Components used in Workshop trades including fitting, carpentry, foundry, welding and Plumbing**.** **CO3**: Apply fitting operations in various applications**.** **CO4**: Apply basic electrical engineering knowledge for House Wiring Practice.
ENGINEERING PHYSICS LAB **CO:1** Operate optical instruments like travelling microscope and spectrometer. **CO:2** Estimate the wavelengths of different colors using diffraction grating. **CO:3** Plot the intensity of the magnetic field of circular coil carrying current with distance. **CO:4** Calculate the band gap of a given semiconductor.	**CHEMISTRY LAB** **CO 1**: Develop and perform analytical chemistry techniques to address the water related problems. **CO 2**: Determine the strength of an acid, cell constant, potentials and conductance of solutions. **CO 3**: Prepare advanced polymer Bakelite and nanomaterial's. **CO 4**: Explain the functioning of different analytical instruments.

EEE WORKSHOP **PART A: ELECTRICAL ENGINEERING LAB** **CO1**: Measure voltage, current and power in an electrical circuit. **CO2**: Measure of Resistance using Wheatstone bridge. **CO3**: Discover critical field resistance and critical speed of DC shunt generators. **CO4**: Investigate the effect of reactive power and power factor in electrical loads. **PART B: ELECTRONICS ENGINEERING LAB** **CO1:** Analyze the characteristics of various electronic components. **CO2:** Implement Rectifiers circuits. **CO3:** Design Amplifiers circuit. **CO4:** Examine the operation of Logic gates.	**COMMUNICATIVE ENGLISH LAB** **CO 1**: Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning. **CO 2**: Create a compelling resume, cover letter and Sop. **CO 3**: Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts. **CO 4**: Apply employability skills to confidently navigate job interviews.
NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE **CO1:** Understand the importance of discipline, character and service motto. **CO2:** Solve some societal issues by applying acquired knowledge, facts, and techniques. **CO3:** Explore human relationships by analyzing social problems. **CO4:** Determine to extend their help for the fellow beings and downtrodden people. **CO5:** Develop leadership skills and civic responsibilities.	**HEALTH AND WELLNESS, YOGA AND SPORTS** **CO1:** Understand the importance of yoga and sports for Physical fitness and sound health. **CO2:** Demonstrate an understanding of health-related fitness components. **CO3:** Compare and contrast various activities that help enhance their health. **CO4:** Assess current personal fitness levels. **CO5:** Develop Positive Personality. .

R23-B.TECH. (ECE)-COURSE OUTCOMES

II-B.TECH

I Semester	II Semester
PROBABILITY THEORY AND STOCHASTIC PROCESS: R23EC2101 **CO1.** Understanding of concept of random variable. **CO2.**Calculate the expectation of different random variables. **CO3.**Calculate the operations of multiple random variables. **CO4.**Understanding types of random processes. **CO5.**Understanding of random processes and its spectral characteristics.	**MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS: R23CC2201** **CO1:**Define the concepts related to Managerial Economics, financial accounting and management(L2) **CO2:** Understand the fundamentals of Economics viz.,Demand,Production, cost, revenue and markets (L2) Apply the Concept of Production cost and revenues for effective Business decision (L3) **CO3:** Analyze how to invest their capital and maximize returns (L4) **CO4:** Evaluate the capital budgeting techniques. (L5) **CO5:** Develop the accounting statements and evaluate the financial performance of business entity (L5)
UNIVERSAL HUMAN VALUES– UNDERSTANDING HARMONY ANDETHICAL HUMAN CONDUCT: R23CC2102 **CO1:** Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2) **CO2:** Identify one's self, and one's surroundings (family, society nature) (L1, L2) **CO3:** Apply what they have learnt to their own self in different day-to- day settings inreal life (L3) **CO4:** Relate human values with human relationship and human society. (L4) **CO5:** Justify the need for universal human values and harmonious existence (L5) **CO6:** Develop as socially and ecologically responsible engineers (L3, L6)	**LINEAR CONTROL SYSTEMS: R23EC2202** **CO1.**Apply the knowledge of mathematical concepts to obtain transfer function of various systems.(K3) **CO2.**Analyze the performance of a linear time invariant system in Time Domain(K4) **CO3.** Analyze the stability of the closed and open loop systems (K4) **CO4.** Formulate different types of analysis in frequency domain (K3) CO5. Analyze state space models (K4)
SIGNALS AND SYSTEMS: R23EC2103 **CO1:** Define basic signals and its operations. **CO2:** Identify Trigonometric and Exponential Fourier Series of signals. **CO3:** Develop Fourier Transforms for various signals. **CO4:** Solve Laplace Transform and z-Transform for various signals. **CO5:** Compare LTI system responses for different inputs and illustrate sampling concepts.	**ELECTROMAGNETIC WAVES AND TRANSMISSION LINES: R23EC2203** **CO1:** Apply the concepts of Electric and Magnetic Fields in different applications. **CO2:** Apply Maxwell's equations in electromagnetics. **CO3:** Understand wave propagation and derive the Wave Equations in Perfect Dielectric and Conducting Media. **CO4:** Understand wave characteristics - reflection and refraction of Electromagnetic Waves in different media and analyze different transmission lines and applications.

ELECTRONICS DEVICES AND CIRCUITS: R23EC2104 **CO1:** Use P-N diodes in electronic circuits. **CO2:** Use special diodes and rectifiers in electronic circuits. **CO3**: Explore the operation of BJT and its applications. **CO4**: Analyze the thermal stability of BJT. **CO5:** Explore the operation of FET, other transistors and their applications	**ELECTRONIC CIRCUIT ANALYSIS: R23EC2204** **CO1:** Design and analysis of small signal high frequency transistor amplifier using BJT andFET. **CO2:** Design and analysis of multistage amplifiers using BJT and FET and Differential amplifier using BJT. **CO3:** Derive the expressions for frequency of oscillation and condition for oscillation of RC and LC oscillators and their amplitude and frequency stability concept. **CO4:** Know the classification of the power and tuned amplifiers and their analysis with performance comparison
SWITCHING THEORY AND LOGIC DESIGN: R23EC2105 **CO1:** Classify and work on different types of number systems and codes that are used in the design of digital systems. **CO2:** Make use of theorems and postulates of Boolean algebra to minimize various Boolean expressions. **CO3:** Construct the basic logic circuits and combinational circuits. **CO4:** Apply different models of Finite State Machines for design of sequential circuits. **CO5:** Utilize the concept of PLDs to realize switching functions and code converters.	**ANALOG COMMUNICATIONS: R23EC2205** **CO1:** Describe the Modulation and Demodulation techniques of standard AM. **CO2:** Compare different types of Amplitude Modulation and Demodulation techniques. **CO3:** Analyse the concepts of generation and detection of Angle Modulated signals. **CO4:** Outline the Radio Receivers with different sections. **CO5:** Interpret the Radio Transmitters completely. Illustrate the noise performance in Analog Modulation techniques and also the concepts of Pulse Analog Modulation and Demodulation techniques.
ELECTRONIC DEVICES AND CIRCUITS LAB: R23EC21L1 **CO1:** Make use of PN junction diode and Zener diode characteristics in electronic circuits. **CO2:** Analyze the operational difference between Half wave and Full wave Rectifiers. **CO3:** Identify the switching characteristics of transistor. **CO4:** Analyze the characteristics of transistor. **CO5:** Identify and analyze the UJT characteristics and its applications.	**SWITCHING THEORY AND LOGIC DESIGN LAB: R23EC22L1** **CO1:** Identify the operation of various logic gates. **CO2:** Examine basic logical and arithmetic circuit operations. **CO3:** Illustrate and compare the operation of different flip flops and counters. **CO4:** Develop the complex combinational digital logic circuit by using computer-aided design tools **CO5:** Develop the complex sequential digital logic circuits by using computer-aided design tools
SIGNALS AND SYSTEMS LAB: R23EC21L2 **CO1:** Practice MATLAB as a programming tool for many of the signals and their operations **CO2:** Identify various signals based on their classifications. **CO3:** Perform Correlation and Convolution concepts. **CO4:** Implement the concept of Fourier series and Fourier transforms. **CO5:** Identify different functions of Laplace and Z-Transforms.	**ELECTRONIC CIRCUIT ANALYSIS LAB: R23EC22L2** **CO1:** Understand the effect of frequency response of single stage and multi stage amplifiers. **CO2:** Understand how frequency response varies by applying negative feedback on amplifiers. **CO3:** Determine the efficiency of power amplifiers. **CO4:** Construct high input impedance circuits. **CO5:** Understand the operation of different Oscillators and Tuned amplifiers.

DATA STRUCTURES USING PYTHON: R23EC21L3 **CO1:** Implement oops concepts in Python. **CO2:** Develop Programs on modules and Packages. **CO3:** Design and implementation of programs on BST and Graph Traversals. **CO4:** Apply Hashing techniques in real world applications **CO5:** Develop the programs on stacks, trees and its applications.	**SOFT SKILLS: R23EC22L4** **CO1:** Grasp the meaning and importance of soft skills and learn how to develop them. **CO2:** Comprehend the significance of Soft skills in the working environment for professional excellence. **CO3:** Prepare to undergo the placement process with confidence and clarity **CO4:** Ready to face any situation in life and equip themselves to handle them effectively. **CO5:** Understand and learn the importance of etiquette in both professional and personal life.
	DESIGN THINKING AND INNOVATION: R23EC22L3 **CO1: Explain** the concepts related to design thinking. **CO2: Explain** the fundamentals of Design Thinking and innovation. **CO3: Apply** the design thinking techniques for solving problems in various sectors. **CO4: Analyze** to work in a multidisciplinary environment. **CO5: Evaluate** the value of creativity.
	ENVIRONMENTAL STUDIESL: R23EC22MC **CO1:** Understand multi-disciplinary nature of environmental studies and Analyze the natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources. **CO2:** Explain the concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web. Explain the biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity. **CO3:** Distinguish various attributes of the pollution, their impacts and measures to reduce or control the pollution along with waste management **CO4:** Understand the rainwater harvesting, watershed management, and ozone layer depletion and waste land reclamation. CO5: Illustrate the causes of population explosion, value education and Welfare programmes.

R20-B.TECH. (ECE)-COURSE OUTCOMES

III-B.TECH

I Semester	II Semester
LINEAR AND DIGITAL IC APPLICATIONS CO1 : Recall the basics of FET, MOSFET, amplifiers, standard memories and their characteristics. CO2 : Extend the logic gate concept to realize basic combinational and sequential circuits for various Boolean expressions. CO3 : Illustrate the operation of IC 555 timer, utilization of filters, VCO, data converters and PLL in the development of various circuits. CO4 : Demonstrate the applications of Operational amplifier and IC 555 timer such as Adder, Subtractor, V-I, I-V converter, Differentiator, Integrator, and Triangular, Square wave generators, PWM, PPM generation respectively. CO5 : Make use of the computer-aided design tools for development of complex digital logic circuits.	**MICROWAVE AND OPTICAL COMMUNICATIONS** CO1 : Summarize the field components and analyse different modes in waveguide CO2 : Interpret different microwave components and devices. CO3 : Experiment with microwave measurements through bench setup . CO4 : Classify different types of optical fibers. CO5: Categorize the optical sources, optical detectors and explain digital receiver.
ANTENNAS AND WAVE PROPAGATION CO1 : Analyze radiation mechanism and basic antenna parameters. CO2 : Identify the radiation mechanism in linear wire antenna. CO3 : Analyze the different antenna arrays. CO4 : Make Use of different antennas at HF, VHF and UHF frequencies and utilize the antenna measurements to know antenna's performance. CO5 : Identify the characteristics of wave propagation in atmospheric conditions.	**VLSI DESIGN** CO1: Apply the concept of fabrication steps involved in IC design for various MOS transistors and come across basic electrical properties of MOSFET. CO2: Develop the expressions for inverter and propagation delays. CO3: Analyse the behaviour of amplifier circuits with various loads. CO4: Build combinational and sequential logic circuits using CMOS Logic design. CO5: Apply the knowledge of FPGA design to introduce advanced technologies.
DIGITAL SIGNAL PROCESSING CO1 : Analyze the signals and system in Time and Frequency domain through transformations CO2 : Solve DFT and IDFT coefficients of a given discrete time sequence using Fast Fourier Transform algorithm. CO3 : Examine the significance of various filter structures and responses. CO4 : Construct the digital filter circuits for generating desired signal wave shapes. CO5 : Inspect the performance of a variety of windowing techniques.	**MICROPROCESSORS AND MICROCONTROLLERS** CO1: Make use of Instruction set in developing the assembly language programming. CO2: Demonstrate the hardware features of 8086 and Pentium processors. CO3: Model an 8086 based microcomputer system by interfacing memory and I/O devices. CO4: Explain 8051 architecture and the function of on-chip hardware units in 8051. CO5: Develop 8051 embedded C programs for interfacing Matrix Keyboard, LCD, DAC, ADC and 7segment LED Display.

PRINCIPLES OF SIGNALS, SYSTEMS AND COMMUNICATIONS (OPEN ELECTIVE-I) CO1 : Explain basic concepts of signals CO2: Analyze time-domain signals in frequency-domain using Fourier transforms. CO3 : Demonstrate the concepts of linear systems. CO4 : Illustrate various analog modulation techniques. CO5 : Compare various digital modulation techniques.	**DATA ACQUISITION AND TRANSMISSION (PROFESSIONAL ELECTIVE – II)** CO1: Construct analog and digital data acquisition system. CO2: Identify different data transmission systems. CO3: List the different display system. CO4: Classify different types of digital instruments. CO5: Analyze the working principle of recorders.
INTRODUCTION TO DATA SCIENCE (OPEN ELECTIVE-I) CO 1: Summarize the basics of Data Science. CO 2: Outline data collection and data pre-processing methods. CO 3: Outline the statistical parameters used in Data Science. CO 4: Illustrate model development and decision making. CO 5: Illustrate model evaluation by using metrics and prediction.	**SATELLITE COMMUNICATIONS (PROFESSIONAL ELECTIVE – II)** CO1: Apply the concepts of communication satellites and earth. CO2: Analyze communication link for satellite communications. CO3: Compare various multiple access techniques. CO4: Illustrate various multiple access techniques and Satellite Navigation. CO5: Apply Non-Geostationary orbit satellite systems and Satellite navigation.
ELECTRONIC MEASUREMENTS AND INSTRUMENTATION (PROFESSIONAL ELECTIVE–I) CO1: List out Electronic Instruments, their Characteristics and use, Peculiar Errors Associated with the Instruments and how to minimize such Errors. CO2: Identify with transducers, electrical and electronic instruments. CO3: Apply the Principle of Operation of Electronic Measuring Instruments. CO4: Illustrate various concepts of electronic instruments. Computer controlled test systems. CO5: constructed Storage and display instruments for experimenting andAnalysis the working & uses of Electronic voltmeter & multimaster, Digital multimaster, Q meter	**INTRODUCTION OF MACHINE LEARNING (PROFESSIONAL ELECTIVE – II)** CO1: Identify the characteristics of machine learning that make it useful to real-world Problems. CO2: Compare and contrast supervised, semi-supervised, and unsupervised machine learning Algorithms. CO3: Apply regularized regression algorithms. CO4: Summarize the concept of Neural Networks for learning nonlinear functions. CO 5: Analyse support vector machines, Instance based learning and genetic algorithms.

DATA COMMUNICATIONS AND COMPUTER NETWORKS (PROFESSIONAL ELECTIVE–I) CO1: List the different types of services, layers and switching techniques in computer networks. CO2: Identify design issues of various layers in the reference model of computer networks. CO3: Analyze various network topologies, transmission media and ISDN techniques. CO4: Classify protocols used in different layers of the computer network. CO5: Identify the concepts of network security, domain name service, network management protocol.	**DIGITAL IMAGE PROCESSING** CO1: Develop any image processing application and List different techniques employed for the enhancement of images. CO2: Compare different causes for image degradation and overview of image restoration Techniques. CO3: Relate the need for image compression and to learn the spatial and frequency domain techniques of image compression. CO4: Interpret Image compression standards and representation techniques. CO5: Construct different feature extraction techniques for image analysis and recognition.
STATISTICAL METHODS IN AI (PROFESSIONAL ELECTIVE-I) CO1: Summarize the basics of Artificial Intelligence. Intelligent Agents and its structure for problem solving by various searching techniques. CO2: Outline symbols, semantics, axioms, literals and forms. CO3: Compare different reasoning and search methods used in AI. CO4: Summarize Knowledge Representation techniques and knowledge acquisition stages. CO5 Illustrate expert systems in AI and problem solving techniques.	**FUNDAMENTALS OF IMAGE PROCESSING (OPEN ELECTIVE-II)** CO1: Interpret the limitations of the computational methods on digital images. CO2: Develop Fourier transform for image processing in frequency domain. CO3: Illustrate the spatial and frequency domain image transforms on enhancement and restoration of images. CO4: Utilize the image enhancement techniques.]CO5: Define the need for compression and evaluate the basic compression algorithms.
SIGNALS AND TRANSFORM TECHNIQUES (PROFESSIONAL ELECTIVE-I) CO1: Make use of Fourier series and Fourier transform, DFT. CO2: Analyze different transforms like Walsh, Hadamard, Haar and Slant. CO3 : Model Continuous Wavelet Transforms. CO4 : Apply Multi Rate Analysis and DWT CO5 : List special topics like Wavelet Packet Transform, Multidimensional Wavelets.	**GLOBAL POSITIONING SYSTEM (OPEN ELECTIVE-II)** CO1: Identify the importance of Space segment, Control segment and User segment in GPS. CO2: Analyse the GPS observables like code, phase pseudo ranges, Doppler data and Biases. CO3: Estimate surveying with GPS. CO4: Categorize the different application areas of GPS. CO5: Recommend the Hardware and Software improvements for future GPS.
DIGITAL SIGNAL PROCESSING LAB CO1 : Demonstrate the architecture of DSP chips – TMS 320C 5X/6X. CO2 : Illustrate time and Frequency domain response of signals and systems through simulation. CO3 : Develop IIR filters and extend it to convert into FIR filters using windowing techniques and also to obtain the frequency response. CO4 : Interpret the LTI system response for different types of inputs. CO5 : Develop the power density spectrum of different sequence to analyze the power of the sequences.	**MICROPROCESSORS & MICROCONTROLLERS LAB** CO1: Build Up the assembly language programs on arithmetic, logical and string operations. CO2: Construct an 8086 system by interfacing I/O and other devices. CO3: Make Use of Instruction set of 8086 for modular programming and Dos/Bios Programming. CO4: Distinguish processor based systems and controller system. CO5: Model the 8051 based embedded systems for various applications.

LINEAR & DIGITAL IC APPLICATIONS LAB CO1 : Demonstrate the applications of Op-amp such as Adder, Subtractor, Comparator, Integrator and Differentiator Circuits. CO2 : Classify the active filters such as LPF, HPF, BPF and Band Reject Filters. CO3 : Interpret the operation of Oscillator circuits. CO4 : Illustrate the operation of Multivibrator circuits and compare various types of voltage regulators. CO5 : Develop the complex digital logic circuits including both combinational and Sequential logics by using computer-aided design tools	**VLSI LAB** CO1: Construct and test Logic gates using CMOS using EDA Tool. CO2: Construct and test Combinational logic circuits like Adder, Subtractor, and Decoder using EDA Tools. CO3: Construct and test Sequential logic circuits like Flip Flops, Counters using EDA Tools. CO4: Construct and test static RAM cell and Differential Amplifier using CMOS using EDA Tools.
EMBEDDED SYSTEMS AND ROBOTICS LAB CO1: Develop basic program on serial communication implementation and Delay generation using timers using microcontroller. CO2: Develop Interrupt handling, Share resource using MUTEX and Allocate resource using semaphores with ARM. CO3: Construct robotic concept like sensor guided robotics, spy robotics etc. CO4: Examine the different behavior of robotics.	**MICROWAVE AND OPTICAL COMMUNICATIONS LAB** CO1: Illustrate the different microwave sources. CO2: Identify the characteristics of microwave components. CO3: Inspect the signal parameters at microwave frequencies. CO4: Find numerical aperture of an optical fiber. CO5: Analyze the characteristics of optical sources and analog link setup.
PROFESSIONAL ETHICS AND HUMAN VALUES CO1: Interpret the fundamentals of Human values. CO2: Analyse the ethical issues and role of engineers in industry. CO3: Develop the principles of harmony in value education. CO4: List out the duties and rights of engineers. CO5: Summarise the engineer's responsibilities towards safety and risk.	**ENGLISH EMPLOYABILITY SKILLS (Common to All Branches)** CO 1: Write effective Resume for employment. CO 2: Make formal presentations using relevant technical style of communication and appropriate strategies for both academic and professional purpose. CO 3: Participate in Group Discussions using analytical and problem solving skills. CO 4: Face job interviews confidently and enhance employability.
	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE CO 1: Understand the philosophy of Indian Culture. CO 2: Know the Indian languages, Epics Ramayana and Mahabharata. CO 3: Acquire the information about Indian arts and architecture. CO 4: Know the spread of cultural exchange in abroad. CO 5: Know the contributions of scientists in different eras.

R20-B.TECH. (ECE)-COURSE OUTCOMES

IV-B.TECH

I Semester	II Semester
PC BASED INSTRUMENTATION (Professional Elective – III) CO1: Demonstrate the main functional units in a PC and be able to explain how they interact. CO2: Interpret the standard serial and parallel interfacing buses and able to distinguish account for different generations of PCs. CO3: Analyze the basics of PLC and its programming. CO4: Identify different PLC functions to applications. CO5: Analyze the basics of SCADA and Develop DAQ using I/O systems.	
CELLULAR AND MOBILE COMMUNICATIONS (Professional Elective – III) CO1: Illustrate fundamental concept of Cellular Radio System Operation and Design. CO2: Analyze Measurement of C/I value in Omni directional & Directional Antenna System, Co-channel, Non Co-channel interference, and Adjacent Channel Interference. CO3: Interpret cell coverage for signal and traffic, diversity techniques and mobile antennas and demonstrate Frequency management and Channel assignment. CO4: Classify different types of handoffs. CO5: Summarize GSM architecture and channels, TDMA architecture and channels, and CDMA architecture and channels.	
INTRODUCTION TO DEEP LEARNING (Professional Elective – III) CO1: Summarize the characteristics of Machine Learning and Deep Learning that make it useful to real-world Problems. CO2: Organize high dimensional data using reduction techniques. CO3: Analyze optimization and generalization in deep learning. CO4: Outline various deep learning models. CO5: Analyze case studies of deep learning techniques.	
SPEECH PROCESSING (Professional Elective – III) CO1: Identify the fundamentals of speech and speech production system. CO2: Analyze time domain models for speech signals. CO3: Compare various speech coding techniques in time domain. CO4: Analyze the speech enhancement techniques. CO5: Elaborate the purpose of the various blocks in applications of Speech Synthesis.	

BIOMEDICAL INSTRUMENTATION (Professional Elective – IV) CO1: Compare the different bio potential characteristics and recording methods so as to enable to record various bio signals. CO2: Apply nonelectrical parameters measurements so as to enable to record various non-electrical parameters. CO3: Identify the patient safety issues related to biomedical instrumentation. CO4: Build and operate bio potential amplifiers. CO5: Classify Patient care monitoring systems and operation of displays.	
RADAR SYSTEMS (Professional Elective – IV) CO1: Demonstrate the basic principles of RADAR System. CO2: Solve the RADAR Equation and to calculate Transmitter power. CO3: Know working principles of different types of RADARs. CO4: Demonstrate the knowledge of solving issues related to different RADAR problems. CO5: Contrast the different methods used for tracking targets.	
SOFT COMPUTING TECHNIQUES (Professional Elective – IV) CO1: Classify the concepts of Artificial Neural Network, different features of fuzzy logic and their modelling, control aspects and different hybrid control schemes. CO2: Explain modelling of Artificial Neural Network and Control Technique. CO3: Apply knowledge on modelling and control of fuzzy control schemes. CO4: Analyze knowledge on hybrid control schemes. CO5: Evaluate the concepts of Adaptive Resonance Theory and Hybrid Control Schemes.	
DSP ARCHITECTURES (Professional Elective – IV) CO1: Identify the functions of building blocks in DSP Architecture. CO2: Perceive the knowledge on Instructions and Interrupts of TMS320C6x Processors. CO3: Model programming of TMS320C6x Processors. CO4: Recommend suitable FFT algorithms for computation on TMS320C54XX DSP device. CO5: Choose the DSP programmable devices that will interface with memories and I/O peripherals.	

ANALYTICAL INSTRUMENTATION **(Professional Elective – V)** CO1: Interpret different Analyzers in Analytical Instrumentation. CO2: Apply the Knowledge of Gas Analyzers. CO3: Analyze the basic Principles of Chromatography Techniques. CO4: Choose Instrumentation Associated with Spectrophotometer and Sources for Flame Photometer. CO5: Explain the basic instrumentation associated with NMR Spectrophotometer, principle and discussion on ESR.	
ADVANCED COMMUNICATION TECHNOLOGIES **(Professional Elective –V)** CO1: Analyze the working principle of Smart Antennas. CO2: Identify the various Diversity Schemes. CO3: Utilize the UWB modulation methods in wireless communication. CO4: Analyze the Antenna radiation for UWB signals. CO5: Examine the UWB Communication Standards in UWB Communication Systems.	
EDGE COMPUTING (Professional Elective – V) CO1: To illustrate the .Edge Computing use cases and outline Edge computing hardware architecture. CO2: Make use of IoT architecture and implementation use cases. CO3: Analysing the layout and interface, configure of Rasberry Pi. CO4: List out the relationships of edge computing with Rasberry Pi, with cloud protocols, industrial and commercial IoT and Edge Computing.	
MULTIMEDIA SIGNAL PROCESSING **(Professional Elective – V)** CO1: Apply & illustrate the Principles and techniques of signal processing in Multimedia systems. CO2: Analyze the speech and audio using multichannel filtering techniques and Cepstral Analysis: Compress audio signals using LPC, CELP and MELP techniques. CO3: Analyze basic image compression techniques; compress images with linear prediction DCT and sub band coding Techniques. CO4: Analyze video signals with motion estimation techniques; describe video compressionStandards (MPEG and H263/264).	

INTRODUCTION TO MICROPROCESSORS AND MICROCONTROLLERS (Other than ECE) (Open Elective-III) CO1: Explain the architecture of 8086 microprocessor. CO2: Demonstrate programming proficiency using Instruction set. CO3: Analyze concept of interfacing different peripheral devices with 8086. CO4: Interpret the memory organization and I/O management of 8051. CO5: Summarize various interfacing and applications of 8051.	
NANOELECTRONICS (Open Elective - III) CO1:.Describe the classification of nano structures with energy bands. CO2:.Differentiate the scanning probe techniques and diffraction techniques. CO3: Compare and contrast Quantum well width fluctuations and thermally annealed quantum well. CO4: Summarize the features of carbon clusters and nano tubes. CO5:.Differentiate the key features of NEMS and MEMS.	
INTRODUCTION TO EMBEDDED SYSTEMS (Other than ECE) (Open Elective - IV) CO1: Illustrate the classification and applications of embedded systems. CO2: Classify the memory devices and passive components of embedded systems. CO3: Summarize various Communication interface in Embedded Systems. CO4: Summarize the steps involved in developing application specific embedded systems with suitable example. CO5: Describe the RTOS basics and various Communication & Synchronization techniques.	
EMBEDDED AND REAL TIME OPERATING SYSTEMS (Open Elective - IV) CO1: Survey the basics of an embedded system. CO2: Survey the general structure of a real-time system. CO3: Develop task scheduling and task communication algorithms. CO4: Develop task synchronization algorithms. CO5: Identify the design methods of embedded systems.	

BUSINESS MANAGEMENT CONCEPTS FOR ENGINEERS **(Humanities and Social Science Elective)** CO1: Summarize fundamentals of Managerial economics for decision making. CO2: Apply concepts of Financial Accounting and BEP for business decisions. CO3: Evaluate fundamental concepts and principles of management. CO4: Discuss functional areas of management like HR, marketing and finance. CO5: Apply project management techniques for project planning and evaluation.	
ENTREPRENEURSHIP & INNOVATION **(Humanities and Social Science Elective)** CO1 : Outline the concepts of Entrepreneurship. CO2 : Create the awareness on creativity and innovation. CO3 : Adopt the Entrepreneurship Development programs. CO4 : Evaluate the project planning and feasibility studies. CO5 : Analyze the concept of small and micro enterprises.	

R23-B.TECH.(CE)-COURSE OUTCOMES

I-B.TECH

I Semester	II Semester
LINEAR ALGEBRA AND CALCULUS **CO1**: Solve the system of linear equations and transformations. **CO2**: Analyze the applications of matrices in various fields and obtain Eigen values and Eigenvectors. **CO3**: Utilize mean value theorems to real life problems**.** **CO4**: Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering. **CO5**: Identify the area and volume by interlinking them to appropriate double and triple integrals.	**DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS** **CO1 :** Apply first order ordinary differential equations to real life situations. **CO2 :** Identify and apply suitable methods in solving the higher order differential equations. **CO3 :** Solve the partial differentiation equations. **CO4 :** Interpret the physical meaning of different operators as gradient, curl and divergence. **CO5 :** Estimate the work done against a field, circulation and flux using vector calculus.
INTRODUCTION TO PROGRAMMING **CO1:** Infer the basic concepts of computers, algorithms and Flowcharts. **CO2:** Develop programs using appropriate control structures. **CO3:** Write programs using arrays and strings. **CO4:** Develop programs using structures and pointers. **CO5:** Make use of functions and file Operations in C programming for a given application.	**COMMUNICATIVE ENGLISH** **CO1: S**ummarize texts based on the comprehension of the material provided**.** **CO2:** Create coherent and well-structured paragraphs, essays, and letters on a range of familiar topics. **CO3:** Use a diverse array of grammatical structures with flexibility, striving to minimize errors. **CO4:** Use vocabulary adequately and appropriately to express and write on a variety of topics.
ENGINEERING PHYSICS **CO1 :** Analyze the intensity variation of Laser light and it's propagation in optical fibers. **CO2** : Familiarize with the basics of crystals and their structures. **CO3** : Summarize various types of Magnetic materials and Super conductors. **CO4 :** Explain the basic concepts of Quantum Mechanics and the band theory of solids. **CO5 :** Identify the type of semiconductor and smart materials.	**ENGINEERING CHEMISTRY** **CO1**: Understand the difference between soft and hard water and why it matters in daily life and industries. **CO2**: Apply electrochemical principles to real-problems, making informed decisions about materials selection, corrosion mitigation, and energy storage solutions . **CO3** Analyze the production, properties, and environmental implications of polymers, fuels and biofuels. **CO4**: Apply the knowledge of diverse engineering materials like composites, refractories, lubricants, and Portland cement, to make material selection and applications. **CO5**: Apply the Knowledge of various applications to synthesize colloids and characterize nano materials.
BASIC ELECTRICAL & ELECTRONICS ENGINEERING **CO1:** Explore the fundamental laws and concept of DC and AC circuits. **CO2:** Demonstrate the working and operating principles of electrical machines, measuring instruments. **CO3:** Demonstrate the working and operating principles of different power generation stations. **CO4:** Calculate electrical load, electricity bill of residential and commercial buildings and safety measures.	**ENGINEERING MECHANICS** **CO 1**: Apply the principles of mechanics to determine the resultant of several concurrent Forces acting on a particle. **CO 2**: Analyze the trusses using method of joints and method of sections; apply the basic Concepts of dry friction and wedges**.** **CO 3**: Solve the centroid and centre of gravity bodies and composite sections**.** **CO 4**: Solve the Area Moment of Inertia and Mass Moment of Inertia of areas bodies and Composite sections**.** **CO 5**: Apply the work-energy principle to particles and connected systems for engineering Applications.

BASIC ELECTRONICS ENGINEERING **CO 1:** Describe the working of diode and explore the operation of BJT and its applications. **CO 2:** Describe the working of Rectifiers and amplifiers in electronic circuits. **CO 3:** Manipulate numeric information in different forms, various codes such as ASCII, Gray, and BCD, simple Boolean expressions and Boolean Theorems **.** **CO 4:** Design and analyse combinational circuits, sequential circuits, flip flops Registers and Counters.	**BASIC CIVIL AND MECHANICAL ENGINEERING** **PART A: BASIC CIVIL ENGINEERING** **CO1**: Acquire knowledge on various sub-divisions of Civil Engineering and to appreciate their role inensuring better society. **CO2**: Apply the concepts of surveying to calculate distances, anglesand levels. **CO3**: Realize the importance of transportation in nation's economy and to identify the importance of Water Storage and Conveyance Structures. **PART B: BASIC MECHANICAL ENGINEERING** **CO1**: Illustrate the role of mechanical engineering and its technologies in various sectors and knowledge of engineering materials. **CO2**: Explain the basics of various manufacturing processes and thermal engineering and its applications. **CO3**: Describe the working of different power plants, mechanical power transmission systems and basics of robotics and its applications.
ENGINEERING GRAPHICS **CO1:** Construct the principles of engineering drawing, including engineering curves, scales,Orthographic and isometric projections**.** **CO2:** Construct orthographic projections of points, lines, planes and solids in front,top and Side views**.** **CO3:** Analyze and draw projection of solids in various positions in first Quadrant. **CO4:** Develop the sections of Solids & Development of Surfaces**.** **CO5:** Compare & Draw isometric Views& Orthographic Views**.**	**ENGINEERING WORKSHOP** **CO1**: Identify workshop tools and their operational capabilities**.** **CO2**: Compare Manufacturing Components used in workshop trades including fitting, carpentry, foundry, welding and Plumbing**.** **CO3**: Apply fitting operations in various applications**.** **CO4**: Apply basic electrical engineering knowledge for House Wiring Practice.
COMPUTER PROGRAMMING LAB **CO1:** Analyze and trace the execution of programs written in C language. **CO2:** Implement programs with appropriate control structures for solving the problems. **CO3:** Develop C programs which utilize memory efficiently using programming constructs like pointers. **CO4:** Code, Debug and Execute programs to demonstrate the applications of arrays, functions, files and various other concepts in C.	**ENGINEERING MECHANICS & BUILDING PRACTICES LAB** **CO1**: Evaluate the coefficient of friction between two different surfaces and between the inclined plane and the roller. **CO2**: Verify Law of Parallelogram of forces and Law of Moment using force polygon and bell crank lever. **CO3**: Determine the Centre of gravity different configurations. **CO4**: Understand the Quality Testing and Assessment Procedures and principles of Non- Destructive Testing. **CO5**: Exposure to safety practices in the construction industry.
IT WORKSHOP **CO1:** Identify Hardware components and inter dependencies. **CO2:** Utilize Antivirus s/w to Safeguard computer systems while using Internet. **CO3:** Develop a Document or Presentation. **CO4:** Make use of spreadsheets to perform calculations. **CO5:** Utilize the AI Tool Chat GPT .	**CHEMISTRY LAB** **CO 1:** Develop and perform analytical chemistry techniques to address the water related problems. **CO 2:** Determine the strength of an acid, cell constant, potentials and conductance of solutions. **CO 3:** Prepare advanced polymer Bakelite and nanomaterials. **CO 4:** Explain the functioning of different analytical instruments.

ENGINEERING PHYSICS LAB **CO:1** Operate optical instruments like travelling microscope and spectrometer. **CO:2** Estimate the wavelengths of different colors using diffraction grating. **CO:3** Plot the intensity of the magnetic field of circular coil carrying current with distance. **CO:4** Calculate the band gap of a given semiconductor.	**COMMUNICATIVE ENGLISH LAB** **CO 1:** Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning. **CO 2:** Create a compelling resume, cover letter and Sop. **CO 3:** Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts. **CO 4:** Apply employability skills to confidently navigate job interviews.
EEE WORKSHOP **PART A: ELECTRICAL ENGINEERING LAB** **CO1:** Measure voltage, current and power in an electrical circuit. **CO2:** Measure of Resistance using Wheatstone bridge. **CO3:** Discover critical field resistance and critical speed of DC shunt generators. **CO4:** Investigate the effect of reactive power and power factor in electrical loads. **PART B: ELECTRONICS ENGINEERING LAB** **CO1:** Analyze the characteristics of various electronic components. **CO2:** Implement Rectifiers circuits. **CO3:** Design Amplifiers circuit. **CO4:** Examine the operation of Logic gates.	**HEALTH AND WELLNESS, YOGA AND SPORTS** **CO 1:** Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning. **CO 2:** Create a compelling resume, cover letter and Sop. **CO 3:** Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts. **CO 4:** Apply employability skills to confidently navigate job interviews.
NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE **CO1:** Understand the importance of discipline, character and service motto. **CO2:** Solve some societal issues by applying acquired knowledge, facts, and techniques. **CO3:** Explore human relationships by analyzing social problems. **CO4:** Determine to extend their help for the fellow beings and downtrodden people. **CO5:** Develop leadership skills and civic responsibilities.	

R23-B.TECH. (CE)-COURSE OUTCOMES

II-B.TECH

I SEMSTER	II SEMSTER
NUMERICAL TECHNIQUES AND STATISTICAL METHODS: R23CE2111 **CO 1:** Evaluate the approximate roots of polynomial and transcendental equations by different algorithms. Apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3) **CO 2:** Apply numerical integral techniques to different Engineering problems. Apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations (L3) **CO 3:** Apply discrete and continuous probability distributions (L3) **CO 4:** Design the components of a classical hypothesis test (L6) **CO 5:** Infer the statistical inferential methods based on small and large sampling tests (L4)	**MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS: R23CC2201** **CO 1:** Define the concepts related to Managerial Economics, financial accounting and management (L2) **CO 2:** Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets (L2) **CO 3:** Apply the Concept of Production cost and revenues for effective Business decision (L3) **CO 4:** Analyze how to invest their capital and maximize returns (L4) **CO 5:** Evaluate the capital budgeting techniques. (L5 **CO 6:** Develop the accounting statements and evaluate the financial performance of business entity (L5)
UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT: R23CC2102 **CO 1:** Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2) **CO 2:** Identify one's self, and one's surroundings (family, society nature) (L1, L2) **CO 3:** Apply what they have learnt to their own self in different day-to-day settings in real life (L3) **CO 4**: Relate human values with human relationship and human society. (L4) **CO 5:** Justify the need for universal human values and harmonious existence (L5) **CO 6:** Develop as socially and ecologically responsible engineers (L3, L6)	**ENGINEERING GEOLOGY: R23CE2202** **CO1:** Understand the significance of geological agents on Earth surface and its significance in Civil Engineering. **CO2:** Identify and understand the properties of Minerals and Rocks. **CO3:** Understand the concepts of Groundwater and its geophysical methods. **CO4:** Classify and measure the Earthquake prone areas, Landslides and subsidence to practice the hazard zonation. **CO5:** Investigate the project site for mega/mini civil engineering projects and site selection for mega engineering projects like Dams, Reservoirs and Tunnels.
SURVEYING: R23CE2103 **CO1:** Apply the principle and methods of surveying and measuring of horizontal and vertical- distances and angles. **CO2:** Identify the source of errors and rectification methods **CO3**: Apply surveying principles to determine areas and volumes **CO4**: Setting out curves and using modern surveying equipment **CO5***:* Apply the basics of photogrammetry surveying In field	**CONCRETE TECHNOLOGY: R23CE2203** **CO1:** Familiarize the basic ingredients of concrete and their role in the production of concrete and its behavior in the field. **CO2:** Test the fresh concrete properties and the hardened concrete properties. Understand the basic concepts of concrete. Design the concrete mix by BIS method. **CO3:** Evaluate the ingredients of concrete through lab test results. realize the importance of quality of concrete **CO4:** Understand the behavior of concrete in various environments. **CO5:** Familiarize the basic concepts of special concrete and their production and applications.

STRENGTH OF MATERIALS : R23CE2103 **CO1:** To understand the basic materials behavior under the influence of different external loading conditions and the support conditions. **CO2:** To draw the diagrams indicating the variation of the key performance features like axial forces, bending moment and shear forces in structural members. **CO 3 :** To acquire knowledge of bending concepts and calculation of section modulus and for determination of stresses developed in the beams **CO 4 :** To analyze the deflections due to various loading conditions. **CO 5:** To assess stresses across section of the thin, thick cylinders and columns to arrive at optimum sections to withstand the internal pressure using Lame's equation.	**STRUCTURAL ANLAYSIS: R23CE2204** **CO1:** Apply energy theorems to analyze trusses **CO2:** Analyze indeterminate structures by using Castigliano's–II theorem **CO3:** Analysis of fixed and continuous beams **CO4:** Analyze continuous beams and portal frames by using slope-deflection method **CO5:** Analyze continuous beams and portal frames by using Moment – distribution method
FLUID MECHANICS: R23CE2104 **CO1:** Understand the principles of fluid statics, kinematics and dynamics **CO2:** Apply the laws of fluid statics and concepts of buoyancy **CO3:** Understand the fundamentals of fluid kinematics and differentiate types of fluid flows **CO4:** Apply the Principle of conservation of energy for flow measurement. **CO5:** Analyse the losses in pipes and discharge through pipe network.	**HYDRAULICS AND HYRAULIC MACHINERY: R23CE2205** **CO1:** Understand the characteristics of laminar and turbulent flows. **CO2:** Apply the knowledge of fluid mechanics to address the uniform flow problems in open channels. **CO3:** Solve non-uniform flow problems and hydraulic jump phenomenon in open channel flows. **CO4:** Evaluate the performance of impact of jets on plates and design Pelton L3 wheel, Francis and Kaplan turbine **CO5:** Understand the principles, losses and its efficiencies of centrifugal pumps
SURVEYING LAB: R23CE21L1 **CO1:** Handle various linear and angular measuring instruments **CO2:** Measure the linear and angular measurements **CO3:** Calculate the area and volume by interpreting the data obtained from surveying activities **CO4:**Handle modern equipment such as total station **CO5:** Prepare field notes from survey data	**CONCRETE TECHNOLOGY LABORATORY: R23CE22L1** **CO1:** Outline importance of testing cement and its properties **CO2:** Assess different properties of Aggregates **CO3 :**Assess fresh concrete properties and their relevance to hardened concrete **CO4 :**Assess hardened concrete properties
STRENGTH OF MATERIALS LAB: R23CE21L2 **CO1:** Conduct tensile strength test and draw stress-strain diagrams for ductile metals **CO2:** Perform bending test and determine load-deflection curve of steel/wood **CO3:** Able to conduct torsion test and determine torsion parameters **CO4:** Perform hardness, impact and shear strength tests and calculate hardness numbers, impact and shear strengths **CO5:** Able to conduct tests on closely coiled and open coiled springs and calculate deflections	**ENGINEERING GEOLOGY LABORATORY: R23CE22L2** **CO 1:** Identify megascopic minerals & their properties. **CO 2:** Identify megascopic rocks & their properties. **CO 3:** Identify the site parameters such as contour, slope & aspect for topography. **CO 4:** Know the occurrence of materials using the strike & dip problems.
BUILDING PLANNING AND DRAWING: R23CE21L3 **CO1:** Plan various buildings as per the building by-laws. **CO2:** Distinguish the relation between the plan, elevation and cross section and identify the form and functions among the buildings. **CO3:** Draw signs and bonds **CO4:** Draw different building units **CO5:** Learn the skills of drawing building elements and plan the buildings as per requirements.	**REMOTE SENSING AND GIS: R23CE22L3** **CO1:** Acquire knowledge about concepts of remote sensing, sensors and their characteristics. **CO2:** Familiarize with data models and data structures to introduce various Raster and Vector Analysis capabilities in GIS. **CO3:** Digitize and create thematic map and extract important features to calculate geometry. **CO4:** Perform surface analysis over Contour to develop digital elevation model. **CO5:** Use GIS software to perform simple analysis in

	water resources and transportation engineering
ENVIRONMENTAL SCIENCE: R23CE21L3 **CO1:** Grasp multi-disciplinary nature of environmental studies and various renewable and non-renewable resources **CO2:** Understand flow and bio-geo- chemical cycles and ecological pyramids. **CO3:** Understand various causes of pollution and solid waste management and related preventive measures. **CO4:** Understand the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation. **CO5:** llustrate the causes of population explosion, value education and welfare programmes.	**DESIGN THINKING & INNOVATION: R23CC22L3** **CO1:** Define the concepts related to design thinking. **CO2:** Explain the fundamentals of Design Thinking and innovation. **CO3:** Apply the design thinking techniques for solving problems in various sectors. **CO4:** Analyse to work in a multidisciplinary environment. CO5 Evaluate the value of creativity.
	BUILDING MATERIALS AND CONSTRUCTION: R23CE22MC **CO 1:** Select appropriate building materials (stones, bricks, tiles, timber, and glass) based on their structural requirements and properties. **CO 2:** Identify the composition, types, and quality tests for binding materials like lime and cement and understand their use in concrete. **CO 3:** Differentiate between various masonry bonds (English, Flemish) and wall types (rubble, ashlar, and cavity) for specific applications. **CO 4:** Analyze the structural design principles and types of building components such as arches, lintels, roofs (trusses), and staircases. **CO 5:** Specify suitable finishing materials (plasters, paints, waterproofing) and temporary structures (scaffolding, formwork) for construction work.

R20-B.TECH. (CE)-COURSE OUTCOMES

III-B.TECH

I SEMSTER	II SEMSTER
DESIGN AND DRAWING OF CONCRETE STRUCTURES – (R20CE3101) **CO1:** Understand the fundamental behaviour of RCC structures and code provisions of IS 456:2000 and IS 875. **CO2:** Analyse the different types of beams subjected to different loading conditions and understand the variation of moment of resistance (Understanding, Analysing) . **CO3:** Apply the IS code provisions for design of sections and determining the reinforcement detailing satisfying the given loading conditions (Applying, Analysing). **CO4:** Design of slabs, columns and footings for given loading conditions (Designing) . **CO5:** Drawing the reinforcement detailing of beams, columns and footings and slabs for obtained data in design. (Analysing, drawing).	**DESIGN AND DRAWING OF STEEL STRUCTURES (R20CE3201)** **CO1:** Analyse and design welded and bolted connections. **CO2:** Design Tension members, simple and Built-up compression members. **CO3:** Design Laterally-Supported and Laterally Unsupported Beams. **CO4:** Design Beam-Columns, Column Splices and Bases **CO5:** Analyse, Design and Detail Gantry girder and Roof Trusses
SOIL MECHANICS – (R20CE3102) **CO1:** Classify -soil and their engineering properties (Understanding) . **CO2:** Explain-the importance of permeability, seepage and its effects (Understanding, Applying) **CO3:** Calculate -the stresses in soils under external loads (Analysing, Evaluating). **CO4:** Analysis- settlement behaviour of soils under compaction and consolidation (Analysing, Evaluating) . **CO5:** Explain- the failure mechanism under the influence of different loading and drainage conditions (Understanding).	**ENVIRONMENTAL ENGINEERING-(R20CE3202)** **CO1:** Assess the quality and quantity of water requirements for a city. **CO2:** Design of different treatment units and distribution systems for water supply. **CO3:** Analyse the characteristics, collection, conveyance and disposal of wastewater. **CO4:** Design of sewers and various units in a wastewater treatment plant. **CO5:** Design of secondary and biological treatment units.
HIGHWAY ENGINEERING – (R20CE3103) **CO1:**Plan road network by linking of various surveys and to evaluate and develop master plans for a better road network . **CO2:**Select appropriate materials for use in different road layers for different types of pavements. **CO3:** Perform road pavement design and analysis by various IRC and other methods . **CO4:** Interpret geometric design fundamentals, in relation to safety and driver comfort, focusing on horizontal and vertical alignment **CO5:** Ability to develop traffic signals and help to properly regulate the traffic and better use of road network.	**HYDROLOGY & IRRIGATION ENGINEERING-(R20CE3203)** **CO1:** Understanding about Hydrologic cycle and Precipitation. **CO2:** Understand the concepts of Abstractions of Precipitation i.e., Evaporation, Inixltration, Evapotranspiration. **CO3:** To know the concepts of Runoff and to know about Hydrograph concept and to develop Hydrographs. **CO4:** To understand about Groundwater flow conditions. **CO5:**To understand about Irrigation Engineering.
DISASTER MANAGEMENT – (R20CC1OE01) **CO1:** Understanding Disasters, man-made Hazards and Vulnerabilities. **CO2:** Understanding disaster management mechanism. **CO3:**Understanding capacity building concepts. **CO4**: Understanding coping Strategies. **CO5:** Understanding planning of disaster managements.	**REMOTE SENSING AND GIS -(R20CC2OE01)** **CO1:** Be familiar with ground, air and satellite based sensor platforms. **CO2:** Interpret the aerial photographs and satellite imageries . **CO3:** Create and input spatial data for GIS application. **CO4:** Apply RS and GIS concepts in general. **CO5:** Apply RS and GIS concepts in hydrology.

GREEN TECHNOLOGY-(R20CC1OE02) **CO1:**Enlist different concepts of green technologies in a project . **CO2:**Understand the principles of Energy efficient technologies. **CO3:**Estimate the carbon credits of various activities. **CO4:**Identify the importance of life cycle assessment. **CO5:**Recognize the beneixts of green fuels with respect to sustainable development.	**TRAFFIC SAFETY -(R20CC2OE02)** **CO1:**To understand fundamentals of Traffic Engineering. **CO2:**To investigate and determine the collective factors & remedies of accident involved. **CO3:**To design and plan various road geometrics. **CO4:**To manage the traffic system from road safety point of view.
ADVANCED STRUCTURAL ANALYSIS – (R20CE3104) **CO1:** Analyze structures using various methods - Energy theorems, Moment Distribution method. **CO2:** Analyze continuous beams and portal frames using Kani's Method. **CO 3:** Analyze Two Hinged and Three Hinged Arches. **CO4:** Apply approximate methods and determine the structural response of building frames subjected to gravity loads and lateral loads respectively. **CO5:** Analyze Cable and Suspension Bridge structure.	**FOUNDATION ENGINEERING-(R20CE3204)** **CO1:** To understand the various types of shallow foundations and decide on their location based on soil characteristics. **CO2:** To compute the magnitude of foundation settlement and decide on the size of the foundation accordingly. **CO3:** To use the ixeld test data and arrive at the bearing capacity. **CO4:** To apply the principles of bearing capacity of piles and design them accordingly.
ENVIRONMENTAL IMPACT ASSESSMENT – (R20CE3106) **CO1:** Prepare EMP, EIS and EIA report, estimate cost beneixt ratio of a project. **CO2:** Selection of an appropriate EIA methodology . **CO3:** Evaluation of impacts on environment . **CO4:** Evaluation of risk assessment. **CO 5:** Know the latest acts and guidelines of MoEF & CC.	**BRIDGE ENGINEERING-(R20CE3205)** **CO1:** Explain different types of Bridges with diagrams and Loading standards. **CO2:** Carryout analysis and design of Slab bridges, T Beam bridges and suggest structural detailing . **CO3:** Carryout analysis and design of Plate girder bridges. **CO4:** Organize for attending inspections and maintenance of bridges and prepare reports.
SOLID WASTE AND HAZARDOUS MANAGEMENT – (R20CE3107) **CO1:** Correlate various functions elements of solid waste management . **CO2:** Suggest effective methods for on-site storage, processing, collection and transport of solid waste. **CO3:** to plant methods for recovery, reuse and treatment of solid waste. **CO4:** locate a suitable site and design sanitary land ixll. **CO5:** Visualize the impacts of hazardous wastes and plan proper methods for collection, treatment and disposal of bio-medical wastes and radioactive wastes.	**URBAN TRANSPORTATION PLANNING – (R20CE3206)** **CO1:** Estimate travel demand for an urban area. **CO2:** Plan the transportation network for a city. **CO3:** Identify the corridor and plan for providing good transportation facilities. **CO4:** Evaluate various alternative transportation proposals.
SOIL MECHANICS LAB – (R20CE31L1) **CO1:** To determine basic soil properties and classify the soil for Engineering application. **CO2:** To investigate the engineering properties of the soil such as Strength- Compressibility and permeability and apply the same to the engineering problems.	**ENVIRONMENTAL ENGINEERING LAB-(R20CE32L1)** **CO1:** Test the quality of water as per IS standards. **CO2:** Decide whether the water body is polluted or not. **CO3:** Assess the quality of sewage. **CO4:** Draw some conclusion and decide whether the water is potable or not.

HIGHWAY ENGINEERING LAB – (R20CE31L2) **CO1:** Conduct traffic studies for estimating traffic flow characteristics. **CO2:** Perform quality control tests on pavement materials. **CO3:** Estimate earth work from longitudinal and cross-section details	**GIS LAB-(R20CE32L2)** **CO1:** Work comfortably on GIS software. **CO2:** Digitize and create thematic map and extract important features. **CO3:** Develop digital elevation model. **CO4:** Interpretation and Estimation of features from satellite imagery. **CO5:** Analyze and Modelling using GIS software.
STAAD.Pro – (R20CE31SC3) **CO1:** Analyse the beams. **CO2:** Deisgn space frame. **CO3:** Deisgn of two-storied R.C.C frame building.	**CIVIL ENGINEERING DRAWING- (R20CE32L3)** **CO1:** Draw and illustrate the plan, elevation and section of culverts drawings . **CO2:** Prepare the plan, elevation and section of Bridge drawings . **CO3:** Sketch and draw the plan, elevation and section of earthen bunds and Tank surplus weirs drawings . **CO4:** Develop the plan, elevation and section of Tank sluice and Canal drop drawings.
PROFESSIONAL ETHICS AND HUMAN VALUES – (R20CC31MC01) **CO1:** Interpret the fundamentals of Human values. **CO2:** Analyse the ethical issues and role of engineers in industry. **CO3:** Develop the principles of harmony in value education. **CO4:** List out the duties and rights of engineers. **CO5:**Summarise the engineer's responsibilities towards safety and risk.	**ENGLISH FOR EMPLOYABILITY SKILLS- (R20CE32SC1)** **CO1:** Write effective Resume for employment. **CO2:** Make formal presentations using relevant technical style of communication and appropriate strategies for both academic and professional purpose. **CO3:** Participate in Group Discussions using analytical and problem solving skills. **CO4:** Face job interviews conixdently and enhance employability.
SUMMER INTERNSHIP/COMMUNITY SERVICE PROJECT – (R20CC31IN) **CO1:**Apply engineering concepts acquired in the classroom to actual industrial/laboratory conditions. **CO2:**Develop an increased sense of social responsibility. **CO3:**Apply academic learning to real-life events. **CO4:**Improve lifelong communication, interpersonal, and critical thinking skills.	**ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE- (R20CC32MC1)** **CO1:** Understand the philosophy of Indian Culture. **CO2:** Know the Indian languages, Epics Ramayana and Mahabharata . **CO3:** Acquire the information about Indian arts and architecture . **CO4:** Know the spread of cultural exchange in abroad . **CO5:** Know the contributions of scientists in different eras.

R20-B.TECH. (CE)-COURSE OUTCOMES

IV-B.TECH

I SEMSTER	II SEMSTER
ADVANCED FOUNDATION ENGINEERING (ELECTIVE –III) **CO 1:** Explain – the types of earth pressures and classical theories and computation of pressures in homogenous and layered soils. **CO 2:** Understanding-the types and failure of retaining wall,stability requirements. **CO 3:** Analyse –Cantilever and anchored sheet piles and evaluating location and forces in anchors. **CO 4:** Understanding- the concept and mechanism of soil reinforcement and design of embankment. **CO 5:** Explain- the concept of braced cuts and coffer dams.	**MAJOR PROJECT & INTERNSHIP** **CO 1:** Identify a topic in advanced areas of Civil Engineering. **CO 2:** Develop the ability to solve a speciixc problem right from its identiixcation and literature review till the successful solution of the same. **CO 3:** Create a professional report as per recommended format and defend the work.
WATERSHED MANAGEMENT (ELECTIVE –III) **CO 1:** Calculate watershed parameters. **CO 2:** Analyse watershed characteristics to take appropriate management action. **CO 3:** Quantify soil erosion and design control measures. **CO 4:** Apply land grading techniques for proper land management. **CO 5:** Suggest suitable harvesting techniques for better watershed management.	
IRRIGATION STRUCTURES (ELECTIVE –III) **CO 1:** Ability to design irrigation canals and canal network. **CO 2:** Design irrigation canal structures . **CO 3:** Plan and design diversion head works. **CO 4:** Analyse stability of gravity and earth dams. **CO 5:** Design ogee spillways and energy dissipation works.	
PRESTRESSED CONCRETE (ELECTIVE – IV) **CO 1:** Understand different methods of pre-stressing. **CO 2:** Estimate effective prestress including short and long term losses. **CO 3:** Analyze and design prestressed concrete beams under flexure and shear. **CO 4:** Understand the relevant IS Code provisions for prestressed concrete.	

REPAIR & REHABILITATION OF STRUCTURES (ELECTIVE –IV) **CO 1:** Conduct field monitoring and non-destructive evaluation of concrete structures. **CO 2:** Design and suggest repair strategies for deteriorated concrete structures including repairing with composites. **CO 3:** Assessment of the serviceability and residual life span of concrete structures by Visual inspection and in situ tests. **CO 4:** Evaluation of causes and mechanism of damage. **CO 5:** Repair / Rehabilitate / Strengthening techniques by using traditional and advanced materials and techniques.	
ESTIMATION COSTING AND VALUATION(ELECTIVE –V) **CO 1:** Estimate the quantities of different items of works of like single storey residential building, BT road, canal etc. **CO 2:** Estimate the cost of different items of works of like single storey residential building, BT road, canal etc. **CO 3:** Determine the unit rate of different items of work. **CO 4:** Prepare the schedule of reinforcement bars. **CO 5:** Demonstrate the Preparing tender notice and various approvals needed for a project.	
GROUND IMPROVEMENT TECHNIQUES (ELECTIVE –V) **CO 1:** To possess the knowledge of various methods of ground improvement and their suitability to different field situations. **CO 2:** To design a reinforced earth embankment and check its stability. **CO 3:** To know various functions of Geosynthetics and their applications in Civil Engineering practice. **CO 4:** To understand the concepts and applications of grouting.	
PAVEMENT MATERIALS (ELECTIVE –V) **CO 1:** Understand the need for tests and procedures adopted for construction. **CO 2:** Equip the students with practical sense of road construction using suitable materials. **CO 3:** Conduct traffic studies for estimating traffic flow characteristics. **CO 4:** Perform quality control tests on pavement materials.	
RAILWAY, AIRPORT& HARBOUR ENGINEERING(OPEN ELECTIVE –III) **CO 1:** Judge and identify proper material and component for a railway track. **CO 2:** Design various component of a track. **CO 3:** State importance of a railway station. **CO 4:** Plan various amenities of an airport planning and runway design. **CO 5:** Describe various features of a harbor and a port to enable for proper design and maintenance of various amenities.	

LOW COST HOUSING (OPEN ELECTIVE –III) **CO 1**:Understand about the Housing scenario and Housing finance concepts. **CO 2:** Understand about the Land Use and Physical Planning for Housing and Housing the Urban. **CO 3:** Understand about the Development and Adopt on of Low-Cost Housing Technology. **CO 4:** Understand about the Low Cost Infrastructure Services and Rural Housing. **CO 5:** Understand about the Housing in Disaster Prone Areas.	
ENVIRONMENTAL POLLUTION & CONTROL (OPEN ELECTIVE –IV) **CO 1:** Identify the air pollutant control devices. **CO 2:** Have knowledge on the NAAQ standards and air emission standards . **CO 3:** Differentiate the treatment techniques used for sewage and industrial wastewater treatment methods. **CO 4:** Understand the fundamentals of solid waste management, practices adopted in his town/village and its importance in keeping the health of the city. **CO 5:** Appreciate the methods of environmental sanitation and the management of community facilities without spread of epidemics.	
CONSTRUCTION TECHNOLOGY AND MANAGEMENT (OPEN ELECTIVE –IV) **CO 1:** Appreciate the importance of construction planning and Project Management. **CO 2:** Apply the gained knowledge to project Planning and Control. **CO 3:** Apply the concept of Quality control and Safety Management in construction. **CO 4:** To find out the function of various construction equipment's.	
BUSINESS MANAGEMENT CONCEPTS FOR ENGINEERS **CO 1:** Summarize fundamentals of Managerial economics for decision making. **CO 2:** Apply concepts of Financial Accounting and BEP for business decisions. **CO 3:** Evaluate fundamental concepts and principles of management. **CO 4:** Discuss functional areas of management like HR, marketing and ixnance. **CO 5:** Apply project management techniques for project planning and evaluation.	
ENTREPRENEURSHIP & INNOVATION **CO 1:** Outline the concepts of Entrepreneurship. **CO 2**: Create the awareness on creativity and innovation. **CO 3:** Adopt the Entrepreneurship Development programs. **CO 4:** Evaluate the project planning and feasibility studies. **CO 5:** Analyze the concept of small and micro enterprises.	

QUANTITY ESTIMATION & PROJECT MANAGEMENT LAB **CO 1:** Estimating quantities and cost estimation required for different civil engineering works like single storey residential building, R.C.C work, BT road, canal etc. **CO 2:** Finding the unit rate of different items of work. **CO 3:** Preparing the Plan and schedule for different civil engineering works like single storey residential building, BT road, canal etc. using software packages like Primavera/MS Project etc. **CO 4:** Optimize and manage resources.	
INTERNSHIP/COMMUNITY SERVICE PROJECT **CO 1:** Apply engineering concepts acquired in the classroom to actual industrial/laboratory conditions. **CO 2:** Develop an increased sense of social responsibility. **CO 3:** Apply academic learning to real-life events. **CO 4:** Improve lifelong communication, interpersonal, and critical thinking skills.	
WATER SHED MANAGEMENT – (19BCC7OE01) **CO 1:** Distinguish the different components of watershed. **CO 2:** Plan for developing watershed management in a needy area. **CO 3 :** Plan for integrating the conservation aspects such as water harvesting, land management, and ecosystem management for developing an integrated watershed with minimum disturbance to the natural resources.	

R23-B.TECH. (ME)-COURSE OUTCOMES

I-B.TECH

I Semester	II Semester
LINEAR ALGEBRA & CALCULUS CODE: R23CC1101 **CO1:** Solve the system of linear equations and transformations. **CO2:** Analyze the applications of matrices in various fields and obtain Eigen values and Eigenvectors. **CO3:** Analyze mean value theorems to real life problems **CO4:** Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering **CO5:** Identify the area and volume by interlinking them to appropriate double and triple integrals.	**DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS CODE : R23CC1201** **CO 1:** Solve first order ordinary differential equations to real life situations. **CO 2:** Identify and apply suitable methods in solving the higher order differential equations **CO 3:** Solve the partial differentiation equations. **CO 4:** Interpret the physical meaning of different operators as gradient, curl and divergence. **CO 5**: Estimate the work done against a field, circulation and flux using vector calculus.
INTRODUCTION TO PROGRAMMING CODE :R23CC1102 CO1: Infer the basic concepts of computers, algorithms and Flowcharts. CO2: Develop programs using appropriate control structures. CO3: Write programs using arrays and strings. CO4: Develop programs using structures and pointers. CO5: Make use of functions and file Operations in C programming for a given application.	**COMMUNICATIVE ENGLISH CODE: R23CC1206** CO1: Summarize texts based on the comprehension of the material provided. CO2: Create coherent and well-structured paragraphs, essays, and letters on a range of familiar topics CO3: Use a diverse array of grammatical structures with flexibility, striving to minimize errors. CO4: Use vocabulary adequately and appropriately to express and write on a variety of topics.
ENGINEERING PHYSICS CODE:R23CC1106 CO 1: Analyze the intensity variation of Laser light and it's propagation in optical fibers. CO 2: Familiarize with the basics of crystals and their structures. CO 3: Summarize various types of Magnetic materials and Super conductors. CO 4: Explain the basic concepts of Quantum Mechanics and the band theory of solids. CO 5: Identify the type of semiconductor and smart materials.	**ENGINEERING CHEMISTRY CODE :R23CC1208** CO1:Understand the difference between soft and hard water and why it matters in daily life and industries. CO2:Apply electrochemical principles to real-problems, making informed decisions about materials selection, corrosion mitigation, and energy storage solutions CO3:Analyze the production, properties, and environmental implications of polymers, fuels and biofuels. CO4:Apply the knowledge of diverse engineering materials like composites, refractories, lubricants, and Portland cement, to make material selection and applications. CO5:Apply the Knowledge of various applications to synthesize colloids and characterize nano materials.

BASIC ELECTRICAL & ELECTRONICS ENGINEERING CODE :R23CC1107 CO1: Explain the fundamental laws and concept of DC and AC circuits. CO2: Demonstrate the working and operating principles of electrical machines, measuring instruments. CO3: Demonstrate the working and operating principles of different power generation stations. CO4: Calculate electrical load, electricity bill of residential and commercial buildings and safety measures. CO5: Describe the working of diode and explore the operation of BJT and its applications. CO6: Describe the working of Rectifiers and amplifiers in electronic circuits. CO7: Manipulate numeric information in different forms, various codes such as ASCII, Gray, and BCD, simple Boolean expressions and Boolean Theorems CO8: Design and analyse combinational circuits, sequential circuits, flip flops Registers and Counters.	**ENGINEERING MECHANICS CODE: R23CC1209** CO 1: Apply the principles of mechanics to determine the resultant of several concurrent Forces acting on a particle. CO 2: Analyze the trusses using method of joints and method of sections; apply the basic Concepts of dry friction and wedges. CO 3: Solve the centroid and centre of gravity bodies and composite sections. CO 4: Solve the Area Moment of Inertia and Mass Moment of Inertia of areas bodies and Composite sections. CO 5: Apply the work-energy principle to particles and connected systems for engineering Applications.
ENGINEERING GRAPHICS CODE : R23CC1108 CO1: Construct the principles of engineering drawing, including engineering curves, scales, Orthographic and isometric projections. CO2: Construct orthographic projections of points, lines, planes and solids in front,top and Side views. CO3: Analyze and draw projection of solids in various positions in first Quadrant. CO4: Develop the sections of Solids & Development of Surfaces. CO5: Compare & Draw isometric Views & Orthographic Views.	**BASIC CIVIL AND MECHANICAL ENGINEERING CODE: R23CC1212** CO1: Acquire knowledge on various sub-divisions of Civil Engineering and to appreciate their role inensuring better society. CO2: Apply the concepts of surveying to calculate distances, anglesand levels. CO3: Realize the importance of transportation in nation's economy and to identify the importance of Water Storage and Conveyance Structures. CO4: Illustrate the role of mechanical engineering and its technologies in various sectors and knowledge of engineering materials. CO5: Explain the basics of various manufacturing processes and thermal engineering and its applications. CO6: Describe the working of different powerplants, mechanical power transmission systems and basics of robotics and its applications.
COMPUTER PROGRAMMING LAB CODE:R23CC11L1 CO1: Analyze and trace the execution of programs written in C language CO2: Implement programs with appropriate control structures for solving the problems CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers CO4: Code, Debug and Execute programs to demonstrate the applications of arrays, functions, files and various other concepts in C.	**ENGINEERING WORKSHOP CODE: R23CC12L9** CO1: Identify workshop tools and their operational capabilities. CO2: Make manufacturing of components using workshop trades including fitting, carpentry, foundry, welding and Plumbing. CO3: Apply fitting operations in various applications. CO4: Apply basic electrical engineering knowledge for House Wiring Practice.

ENGINEERING PHYSICS LAB CODE: R23CC11L6 CO 1: Create interactive visual programs using Scratch. CO 2: Develop flowcharts using raptor to solve the given problems. CO 3: Develop Python programs for numerical and text based problems. CO 4: Develop graphics and event based programming using Python.	**ENGINEERING CHEMISTRY LAB CODE: R23CC12L11** CO 1: Develop and perform analytical chemistry techniques to address the water related problems. CO 2: Determine the strength of an acid, cell constant, potentials and conductance of solutions. CO 3: Prepare advanced polymer Bakelite and nanomaterials. CO 4: Explain the functioning of different analytical instruments.
IT WORKSHOP CODE:R23CC11L5 CO1: Identify Hardware components and inter dependencies. CO2: Utilize Antivirus s/w to safeguard computer systems while using Internet CO3: Develop a Document or Presentation CO4: Make use of spreadsheets to perform calculations CO5: Utilize the AI Tool Chat GPT	**ENGINEERING MECHANICS LAB CODE: R23ME12L7** CO1 : Evaluate the coefficient of friction between two different surfaces and the roller. CO2 : Apply Law of Polygon of forces and Law of Moment using force polygon. CO3 : Determine the Centre of gravity and Moment of Inertia of different configurations. CO4 : Solve the equilibrium conditions of a rigid body under the action of different force systems.
EEE WORKSHOP CODE :R23CC11L7 CO1: Measure voltage, current and power in an electrical circuit. CO2: Measure of Resistance using Wheatstone bridge CO3: Discover critical field resistance and critical speed of DC shunt generators. CO4: Investigate the effect of reactive power and power factor in electrical loads. CO5: Analyze the characteristics of various electronic components. CO6: Implement Rectifiers circuits. CO7: Design Amplifiers circuit. CO8: Examine the operation of Logic gates	**COMMUNICATIVE ENGLISH LAB CODE : R23CC12L12** CO 1: Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning. CO 2: Create a compelling resume, cover letter and Sop. CO 3: Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts. CO 4: Apply employability skills to confidently navigate job interviews.
NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE SCODE :R23CC11MC2 CO1: Understand the importance of discipline, character and service motto. CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques. CO3: Explore human relationships by analyzing social problems. CO4: Determine to extend their help for the fellow beings and downtrodden people. CO5: Develop leadership skills and civic responsibilities.	**HEALTH AND WELLNESS, YOGA AND SPORTS CODE: R23CC12MC1** CO 1: Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning. CO 2: Create a compelling resume, cover letter and Sop. CO 3: Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts. CO 4: Apply employability skills to confidently navigate job interviews.

R23-B.TECH. (ME)-COURSE OUTCOMES

II-B.TECH

I SEMSTER	II SEMSTER
NUMERICAL METHODS AND TRANSFORM TECHNIQUES:R23CC2110 **CO1:** Evaluate the approximate roots of polynomial and transcendental equations by different algorithms. **CO2:** Apply numerical integral techniques to different Engineering problems. Apply different Algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations **CO3:** Apply the Laplace transform for solving differential equations **CO4:** Analyze the Fourier series of periodic signals **CO5:** Apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms	**INDUSTRIAL MANAGEMENT:R23ME2201** **CO1:** Explain about how to design the optimal layout **CO2:**Demonstrate work study methods **CO3:**Explain Quality Control techniques **CO4:**Discuss the financial management aspects and **CO5:** Interpret the human resource management methods.
UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY& ETHICAL HUMAN CONDUCT:R23CC2102 **CO1:** Interpret the terms like Natural Acceptance, Happiness and Prosperity **CO2:** Identify one's self, and one's surroundings (family, society nature) **CO3:** Apply what they have learnt to their own self in different day-to-day settings in real life **CO4:** Relate human values with human relationship and human society. **CO5**: Justify the need for universal human values and harmonious existence **CO6:** Develop as socially and ecologically responsible engineers	**COMPLEX VARIABLES, PROBABILITY AND STATISTICS:R23ME2202** **CO1:** Apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic. **CO2:** Make use of the Cauchy residue theorem to evaluate certain integrals. **CO3:** Infer the statistical inferential methods based on small and large sampling tests. **CO4:** Solve the differentiation and integration of complex functions used in engineering problems. **CO5:** Design the components of a classical hypothesis test.
THERMO DYNAMICS:R23ME2102 **CO1:** Explain the importance of thermodynamic properties related to conversion of heat energy into work. **CO2:** Apply the Zeroth and First Law of Thermodynamics. **CO3:** Analyze the Second Law of Thermodynamics. **CO4:** Analyze Mollier charts, T-S and h-s diagrams, Phase Transformations, Dryness Fraction and Steam calorimetry. **CO5:** Evaluate the COP of refrigerating systems and properties, processes of psychrometry and sensible and latent heat loads.	**MANUFACTURING PROCESSES:R23ME2203** **CO1:** Design the patterns and core boxes for metal casting processes **CO2:** Inspect the different welding processes **CO3:** Analyze the different types of bulk forming processes **CO4:** Analyze sheet metal forming processes **CO5:** Distinguish about the different types of additive manufacturing processes

MECHANICS OF SOLIDS:R23ME2104 **CO1:** Analyze concepts of stress and strain, Elasticity and plasticity, Bars of varying section, composite bars, Temperature stresses, Principal planes and principal stresses, Mohr's circle. **CO2:** Analyze beams and draw shear force diagrams and bending moment diagrams to the different loads for the different support arrangements. **CO3:** Determine flexural stresses and shear stresses induced in the beams which are made with different cross sections like rectangular, circular, I and T sections. **CO4:** Evaluate the equations of slope and deflection for beams by using double integration method, Macaulay's method, Mohr's theorem and Moment area method. **CO5:** Determine stresses induced in thin and thick cylinders subjected to internal, external pressures for longitudinal and circumferential stresses.	**FLUID MECHANICS & HYDRAULIC MACHINES:R23ME2204** **CO1: Analyze** the basic concepts of fluid properties and Calculation of metacenter height. Stability analysis and applications **CO2: Estimate** the mechanics of fluids in static and dynamic conditions. **CO3: Apply** the Boundary layer theory, flow separation and dimensional analysis. **CO4: Estimate** the hydro dynamic forces of jet on vanes indifferent positions. **CO5: Evaluate** the performance of hydraulic pumps and turbines.
MATERIAL SCIENCE & METALLURGY:R23ME2105 **CO1:** Analyze the crystalline structure of different metals and study the stability of phases in different alloy systems. **CO2:** Identify the behavior of ferrous and non-ferrous metals and alloys and their application in different domains. **CO3:** Analyze the effect of heat treatment, addition of alloying elements on properties of ferrous metals. **CO4:** Analyze the methods of making of metal powders and applications of powder metallurgy. **CO5:** Inspect the properties and applications of ceramic, composites and other advanced methods.	**THEORY OF MACHINES:R23ME2205** **CO1: Analyze** different mechanisms and inversions of four bar chain and slider crank chains. **CO2: Evaluate** displacement, velocity and acceleration of different links in a mechanism. **CO3: Apply** effects of gyroscopic couple in ships, aero planes and road vehicles and **Evaluate** the unbalanced mass in rotating machines using analytical and graphical methods. **CO4: Design** different types of Cam and Gear Profiles. **CO5: Analyze** free and forced vibrations of single degree freedom systems.
MECHANICS OF SOLIDS & MATERIALS SCIENCE LAB:R23ME21L1 **CO1:** Analyze the stress, strain behavior of different materials. **CO2:** Evaluate the hardness of different materials. **CO3:** Compare the relation between elastic constants and hardness of materials. **CO4:** Identify various microstructures of steels and cast irons. **CO5:** Evaluate hardness of treated and untreated steels.	**FLUID MECHANICS & HYDRAULIC MACHINES LAB:R23ME22L1** **CO1:Measure** the Impact of jets on Vanes **CO2: Evaluate** the operating parameters of turbines. **CO3: Evaluate** the operating parameters of pumps. **CO4: Determine** the friction factor and major losses in pipes. **CO5: Measure** the flow rate in Venturimeter, Orificemeter and Turbine Flow Meter
COMPUTER-AIDED MACHINE DRAWING:R23ME21L2 **CO1:** Utilize the conventional representations of materials and machine components. **CO2:** Model the riveted, welded and key joints using CAD system. **CO3:** Model the solid models and sectional views of machine components by using 3D software package. **CO4:** Model the solid models of machine parts and assemble them by using 3D software package. **CO5:** Analyze the limits, fits and tolerances for mating parts and prepare manufacturing drawing	**MANUFACTURING PROCESSES LAB:R23ME22L2** **CO1: Make** moulds for sand casting. **CO2: Make** different types of components using various manufacturing techniques. **CO3: Analyze** unconventional manufacturing methods. **CO4: Develop** Different Weld joints. **CO5: Analyze** different types of 3D Printing techniques.

PYTHON PROGRAMMING LAB:R23ME21L3 **CO1:** Develop a solid foundation in Python programming, covering essential syntax, semantics, and constructs. **CO2:** Analyze data using Python libraries like Pandas and NumPy. **CO3:** Develop various algorithms and data structures in Python. **CO4:** Develop skills, including version control, package management, and project documentation. **CO5:** Analyze web scraping, API interaction, and database management.	**SOFT SKILLS:R23ME22L4** **CO1: Grasp** the meaning and importance of soft skills and learn how to develop them. **CO2: Comprehend** the significance of soft skills in the working environment for professional excellence. **CO3: Prepare** to undergo the placement process with confidence and clarity. **CO4: Interpret** any situation in life and equip themselves to handle them effectively. **CO5: Interpret** the importance of etiquette in both professional and personal life.
EMBEDDED SYSTEMS & IOT:R23ME21L4 **CO1:** Comprehend Microcontroller-Transducers Interface techniques. **CO2:** Establish Serial Communication link with Arduino **CO3:** Analyze basics of SPI interface. **CO4:** Analyze the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor. **CO5:** Analyze the revolution of internet in mobile devices, cloud and sensor networks	**DESIGN THINKING & INNOVATION:R23CC22L3** **CO1: Explain** the concepts related to design thinking. **CO2: Explain** the fundamentals of Design Thinking and innovation. **CO3: Apply** the design thinking techniques for solving problems in various sectors. **CO4: Analyse t**o work in a multidisciplinary environment. **CO5: Evaluate** the value of creativity.
ENVIRONMENTAL STUDIES:R23CC21MC **CO1:** Analyze the natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources. **CO2:** Explain the concepts of the ecosystem, need, biodiversity and its functions. **CO3:** Distinguish various attributes of the pollution, their impacts and measures to reduce or control the pollution along with waste management **CO4:** Analyze the rainwater harvesting, watershed management, and ozone layer depletion and waste land reclamation. **CO5:** Illustrate the causes of population explosion, value education and welfare programmers.	

R20-B.TECH. (ME)-COURSE OUTCOMES

III-B.TECH

I SEMSTER	II SEMSTER
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING R20ME3101 CO 1: Summarize the characteristics of AI that make it useful to real-world problems. [K2] CO 2: Analyze different search techniques and predicate logic in artificial Intelligence. [K3] CO 3: Interpret knowledge representation and symbolic reasoning using different rules. [K2] CO 4: Apply the basic knowledge on learning and reinforcement learning. [K3] CO 5: Explore different machine learning algorithms [K3	**HEAT POWER ENGINEERING R20ME3102** CO1: Illustrate the various types of efficiency improvements of Rankine cycle CO2: Describe the various boilers, mountings and accessories. CO3: Identify different types of nozzles used in steam turbines. CO4: Classify different turbines based on utility and applications. CO5: Discuss gas turbines, jet propulsion and rocket propulsion.
DESIGN OF MACHINE ELEMENTS-1 R20ME3103 CO1: Analyze the design considerations and stresses in machine members. CO2: Solve the problems related to strength of machine elements. CO3: Apply the engineering principles for the design of simple engineering machine members such as riveted joints, welded joints, CO4: Apply the engineering principles for the design of keys, cotters, knuckle joints and power transmission of joints. CO5: Solve the problems related to shaft coupling	**AUTOMOBILE ENGINEERING (PE) R20ME3105** CO1: Identify chassis models for different automobile applications. CO2: Understand the concept of Ignition and Fuel supply. CO3: Estimate suitable conventional and automatic transmission system, contrast steering, braking and suspension systems CO4: Identify the usage of Electrical vehicles / Hybrid vehicles and power plants. CO5: Predict the formation of pollution and its control methods.
REFRIGERATION AND AIR CONDITIONING (PE) R20ME3106 CO1: Illustrate of concepts of refrigeration and their applications. CO2: Evaluate the performance parameters of different types of refrigeration systems. CO3: Identify the desirable properties of refrigerant and its use in various refrigeration systems. CO4: Examine the special types of refrigeration systems CO5: Design of Air Conditioning systems for human comfort conditions.	**METAL CUTTING AND MACHINE TOOLS R20ME3107** CO1: Identify different cutting tool materials, and tool nomenclature and calculate cutting parameters to enhance tool life CO2: Explain the construction and specification of various machine tools and apply machining economics CO3: Explain the working of Shaping, slotting, planning, drilling, and boring machines and apply machining economics CO4: Illustrate the working of milling machines and apply machining economics. CO5: Distinguish the working of grinding, lapping, honing, and broaching processes.
WORK STUDY (PE) R20ME3108 CO1: Demonstrate the fundamental concepts of work systems and work study. CO2: Demonstrate the fundamental concepts of method study. CO3: Analyze the movements at workplace. CO4: Explain work measurement and time study. CO5: Explain work sampling and predetermined time standards. Predetermined motion time measurement (MTM).	**PROFESSIONAL ETHICS AND HUMAN VALUES R20CC31MC01** CO1: Interpret the fundamentals of Human values. [K2] CO2: Analyse the ethical issues and role of engineers in industry. [K4] CO3: Develop the principles of harmony in value education. [K3] CO4: List out the duties and rights of engineers. [K4] CO5: Summarize the engineer's responsibilities towards safety and risk. [K2]

DESIGN OF MACHINE ELEMENTS -2 R20ME3201 CO1: Apply the design procedure to engineering problems, including the consideration of technical and manufacturing constrains of bearings. CO2: Identify the loads and stresses while designing the connecting rod and crank shaft. CO3: Analyze stresses on the piston and cylinder depending upon Design and proportions. CO4: Identify the loads and machine members subjected and calculate static and dynamic stresses to ensure safe design. CO5: Compare capacities of power transmission of Belt, Rope and Chain Drives.	**HEAT TRANSFER R20ME3202** CO1: Illustrate various modes of heat transfer CO2: Analyze various methods of heat transfer using extended surfaces and fins CO3: Estimate heat loss from the system to the surroundings using convection. CO4: Determine various methods of design of heat exchangers. CO5: Estimation of radiation heat transfer between bodies.
DYNAMICS OF MACHINERY R20ME3203 CO1 Analyze the effect of precession motion on the stability of motor cycles, aero planes and ships, under gyroscope CO2 compute the frictional losses and transmission in clutches CO3 compute the frictional losses and transmission in brakes and dynamometers. CO4 analyze the stability of different types of governors under dynamic analysis and study the difference between governor and flywheel CO5 analyze balancing of rotating and reciprocating masses for primary and secondary forces by analytical and graphical methods	**ADVANCED MECHANICS OF SOLIDS R20ME3204** CO1 Illustrate the theories of stress strain relations for engineering applications. CO2 Analyze bending stresses in beams subjected to unsymmetrical bending. CO3 Analyze the radial stress in curved beams subjected to concentrated and uniform loads. CO4 Analyze stresses induced cylindrical bending of thin rectangular plates by classical methods. CO5 Illustrate the torsion of thin wall torsion members subjected to multiple connected cross sections.
NON- CONVENTIONAL SOURCES OF ENERGY (PE) R20ME3205 CO1: Describe the environmental aspects of nonconventional energy resources. CO2: Describe the use of solar energy and the various components used in the energy production with respect to applications. CO3: Appreciate the need of Wind Energy, OTEC and the various components used in energy generation and know the classifications CO4: Illustrate the concept of geothermal energy resources. CO5: Acquire the knowledge of fuel cells and its applications.	**QUALITY CONCEPTS IN DESIGN (PE) R20ME3206** CO1: Apply the knowledge of Differential calculus to solve problems related to the field of structural and thermal engineering by approximate and numerical methods. CO2: Design a new component or improve the existing components using FEA CO3: Solve the problems in solid mechanics and heat transfer using FEM CO4: Identify, formulate, and solve engineering problems CO5: Use the techniques, skills, and modern engineering tools necessary for engineering practice.
ROBOTICS AND APPLICATIONS R20ME3207 CO1: Distinguish between automation and robotics and identify various components of robot. CO2: Select appropriate type of actuators and sensors for different applications. CO3: Analyze kinematics of a robot CO4:Analyze Dynamics of a robot CO5: Illustrate present and future applications of robots	

R20-B.TECH. (ME)-COURSE OUTCOMES

IV-B.TECH

I SEMSTER	II SEMSTER
DIGITAL MANUFACTURING **Code: R20ME4102** CO1: Illustrate the concepts and learn the tenets of smart manufacturing. CO2: Interpret agile manufacturing systems and smart manufacturing standards. CO3: Analyze implemented automated manufacturing systems. CO4: Compare different concepts for multi-machine systems. CO5: Choose the opportunities, challenges brought about by Industry 4.0	
DESIGN FOR MANUFACTURING **Code: R20ME4103** CO1: Design components for machining. CO2: Simulate the casting design and choose the best casting process for a specific product. CO3: Evaluate the effect of thermal stresses in weld joints. CO4: Design components for sheet metal work by understanding in depth the sheet metal processes and their formation mechanisms. CO5: Design plastic components for machining and joining and selecting a proper processes for different joining cases.	
POWER PLANT ENGINEERING **Code: R20ME4104** CO1: Explain the layout, construction and working of the components inside a thermal power plant. CO2: Illustrate the components inside a Diesel, Gas and Combined cycle power plants. CO3: Analyze the concepts and flows and processes of different power plants. CO4: Enumerate the types of power production from renewable energy CO5: Examine the economics of power plants	

OPTIMIZATION TECHNIQUES **Code: R20ME4105** CO1 :Use the various techniques of optimization and provide an optimum solution to the problems involving the design of machine elements. CO2: Discrete the type of problems and optimize as per the requirements. CO3: Assess the search methods and provide local and/or global maxima or minima. CO4: Analyze stresses and the deflection of curved flexural members like chain links and crane hooks. CO5: Apply the knowledge of optimization in designing of various machine elements and systems.	
TOTAL QUALITY MANAGEMENT **Code: R20ME4106** CO1: Interpret Quality Management principles and process. CO2: Distinguish different TQM principles of Leadership, Motivation, Team work and supplier relationship CO3: Identify and Recommend appropriate type of TQM tools for various industries CO4: Choose various Quality charts, Quality functions and TPM concepts CO5: Select various quality management systems	
FINITE ELEMENT METHODS **Code: R20ME4107** CO1: apply the knowledge of Differential calculus to solve problems related to structural Engineering by approximate methods. CO2: apply finite element method to solve problems in one dimensional bar element problems CO3: apply finite element method for trusses and beams CO4: apply finite element method for 2-D CST element, numerical integration CO5: evaluate the rate of heat transfer and temperature distribution in thin plates and fin the longitudinal and transverse vibrations by eigen values and eigen vectors	
EXPERIMENTAL STRESS ANALYSIS **Code: R20ME4108** CO1: Illustrate the three-dimensional stress strain relations for engineering applications. CO2: Experiment with recording instruments at different levels of frequencies for static and dynamic recording and birefringent coatings CO3: Examine the brittle coating stresses by brittle coating analysis and moiré-fringe analysis. CO4: Illustrate the Photo elasticity materials and isochromatic fringes for engineering applications. CO5: Analyze the three dimensional Photo elasticity models by Frozen-stress method, the scattered-light method	

SOLAR ENERGY SYSTEMS Code: R20ME4109 CO1: Understand the potential and importance of non-conventional energy sources, concept of solar radiation and Energy conversion. CO2: Understand the concept of solar radiation and Flat plate collectors. CO3: Understand the concept of solar radiation and concentric tube collectors. CO4: Understand PV technology principles and techniques of various solar cells / materials for energy conversion. CO5: Understand the concepts of solar energy storage and Industrial applications.	
BIG DATA ANALYTICS Code: R20ME4110 CO 1: Interpret the architectural elements of big data and Hadoop framework. CO 2: Analyse various big data applications using map reduce programming module. CO 3: Analyse Spark capabilities such as distributed datasets, in-memory caching, and the interactive shell. CO 4: Summarize Spark's powerful built-in libraries, including Spark SQL, Spark Streaming. CO 5: Analyze Hadoop data with PIG and Hive. Interpret the applications and architecture of Mobile Computing and multiplexing techniques.	
AUTOMATION IN MANUFACTURING Code: R20ME4111 CO 1. Illustrate the basic concepts of automation in machine tools. CO 2. Analyze various automated flow lines, Explain assembly systems and line balancing methods. CO 3. Describe the importance of automated material handling and storage systems. CO 4. Interpret the importance of adaptive control systems and varies parameters. CO 5. Describe the importance of automated inspection systems. And machine vision.	
INDUSTRIAL ENGINEERING & MANAGEMENT Code: R20ME4112 CO1 Differentiate industrial engineering and industrial engineer, Taylor's and Fayol's principles CO2 Design a system of organizational structures to achieve desired needs. CO3 Understand the techniques, skills on how to provide wages and incentives for the labourers CO4 Evaluate the concept of resource management and job evaluation techniques and benefits. CO5 Apply concepts of operations management for design of industry layout.	

MECHANICAL VIBRATIONS **Code: R20ME4113** CO 1: Illustrate the natural frequency of free longitudinal vibrations of systems by using energy principles. CO 2: Determine Natural frequency of free transverse vibrations over a shaft under Point loads, uniform distributed load and several loads. CO 3: Analyze the damped vibrations and forced vibrations to the modelled mechanical vibration problems. CO 4: Analyze free and forced vibration analysis of a two degree of freedom system under the formulation of equations of motion. CO 5: Determine natural frequency of free torsional vibrations of one, two and three rotor systems by using energy principles.	
WASTE HEAT RECOVERY SYSTEMS **Code: R20ME4114** CO1: Analyze the waste heat recovery technologies developed for various thermal systems. CO2: Acquire knowledge on waste heat recovery in heat pump, thermoelectric and HVAC systems. CO3: Apply the economic analysis concepts for the effective implementation of waste heat recovery. CO4: Examine the concepts of low grade heat utilization CO5: Identify the need for various energy storage systems in waste heat recovery applications.	
PRODUCTION PLANNING AND CONTROL Code: R20ME4115 CO1 Apply the systems concept for the design of production and service systems. CO2 Make use of forecasts in the manufacturing and service sectors using selected quantitative and qualitative techniques. CO3 Understand the principles and techniques of inventory Management CO4 Choose routing procedure and able to prepare bill of material. CO5 Understand the importance and function of scheduling &Identify dispatching procedure and make use of computer in production planning and control	
ELECTRIC AND HYBRID VEHICLES **Code: R20ME4116** CO1: Tabulate different kinds HEVs CO2: Summarize the working of different components of HEV CO3: Demonstrate the components of Electric Drive Train CO4: Identify the functions and requirements of storage systems CO5: Illustrate the modelling aspects of HEVs	

BUSINESS MANAGEMENT CONCEPTS FOR ENGINEERS **Code: R20CC4101** CO1: Summarize fundamentals of Managerial economics for decision making (K2). CO2: Apply concepts of Financial Accounting and BEP for business decisions (K3). CO3: Evaluate fundamental concepts and principles of management (K5). CO4: Discuss functional areas of management like HR, marketing and finance (K6). CO5: Apply project management techniques for project planning and evaluation (K3).	
ENTREPRENEURSHIP & INNOVATION **Code: R20CC4117** CO1 : Outline the concepts of Entrepreneurship.[K2] CO2 : Create the awareness on creativity and innovation.[K6] CO3 : Adopt the Entrepreneurship Development programs[K6] CO4 : Evaluate the project planning and feasibility studies.[K5] CO5 : Analyze the concept of small and micro enterprises.[K4]	
MECHATRONICS & SIMULATION LAB **Code: R20ME41SC4** CO1: Interpret and operate on PLC and mechatronic systems CO2: Use of various analytical tools like ANSYS, Fusion 360 etc., for engineering simulation.	

R23-B.TECH. (CSE)-COURSE OUTCOMES

I-B.TECH

I SEMSTER	II SEMSTER
LINEAR ALGEBRA & CALCULUS **CODE: R23CC1101** CO1: Solve the system of linear equations and transformations. CO2: Analyze the applications of matrices in various fields and obtain Eigen values and Eigenvectors. CO3: Analyze mean value theorems to real life problems CO4: Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering CO5: Identify the area and volume by interlinking them to appropriate double and triple integrals.	**DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS** **CODE : R23CC1201** CO 1: Solve first order ordinary differential equations to real life situations. CO 2: Identify and apply suitable methods in solving the higher order differential equations CO 3: Solve the partial differentiation equations. CO 4: Interpret the physical meaning of different operators as gradient, curl and divergence. CO 5: Estimate the work done against a field, circulation and flux using vector calculus.
INTRODUCTION TO PROGRAMMING **CODE :R23CC1102** CO1: Infer the basic concepts of computers, algorithms and Flowcharts. CO2: Develop programs using appropriate control structures. CO3: Write programs using arrays and strings. CO4: Develop programs using structures and pointers. CO5: Make use of functions and file Operations in C programming for a given application.	**COMMUNICATIVE ENGLISH** **CODE: R23CC1206** CO1: Summarize texts based on the comprehension of the material provided. CO2: Create coherent and well-structured paragraphs, essays, and letters on a range of familiar topics CO3: Use a diverse array of grammatical structures with flexibility, striving to minimize errors. CO4: Use vocabulary adequately and appropriately to express and write on a variety of topics.
ENGINEERING PHYSICS **CODE:R23CC1106** CO 1: Analyze the intensity variation of Laser light and it's propagation in optical fibers. CO 2: Familiarize with the basics of crystals and their structures. CO 3: Summarize various types of Magnetic materials and Super conductors. CO 4: Explain the basic concepts of Quantum Mechanics and the band theory of solids. CO 5: Identify the type of semiconductor and smart materials.	**ENGINEERING CHEMISTRY** **CODE :R23CC1208** CO1:Understand the difference between soft and hard water and why it matters in daily life and industries. CO2:Apply electrochemical principles to real-problems, making informed decisions about materials selection, corrosion mitigation, and energy storage solutions CO3:Analyze the production, properties, and environmental implications of polymers, fuels and biofuels. CO4:Apply the knowledge of diverse engineering materials like composites, refractories, lubricants, and Portland cement, to make material selection and applications. CO5:Apply the Knowledge of various applications to synthesize colloids and characterize nano materials.
BASIC ELECTRICAL & ELECTRONICS ENGINEERING **CODE :R23CC1107** CO1: Explain the fundamental laws and concept of DC and AC circuits. CO2: Demonstrate the working and operating principles of electrical machines, measuring instruments. CO3: Demonstrate the working and operating principles of different power generation stations. CO4: Calculate electrical load, electricity bill of residential and commercial buildings and safety measures. CO5: Describe the working of diode and explore the operation of BJT and its applications. CO6: Describe the working of Rectifiers and	**ENGINEERING MECHANICS** **CODE: R23CC1209** CO 1: Apply the principles of mechanics to determine the resultant of several concurrent Forces acting on a particle. CO 2: Analyze the trusses using method of joints and method of sections; apply the basic Concepts of dry friction and wedges. CO 3: Solve the centroid and centre of gravity bodies and composite sections. CO 4: Solve the Area Moment of Inertia and Mass Moment of Inertia of areas bodies and Composite sections. CO 5: Apply the work-energy principle to particles and connected systems for engineering Applications.

amplifiers in electronic circuits. CO7: Manipulate numeric information in different forms, various codes such as ASCII, Gray, and BCD, simple Boolean expressions and Boolean Theorems CO8: Design and analyse combinational circuits, sequential circuits, flip flops Registers and Counters.	
ENGINEERING GRAPHICS **CODE : R23CC1108** CO1: Construct the principles of engineering drawing, including engineering curves, scales, Orthographic and isometric projections. CO2: Construct orthographic projections of points, lines, planes and solids in front, top and Side views. CO3: Analyze and draw projection of solids in various positions in first Quadrant. CO4: Develop the sections of Solids & Development of Surfaces. CO5: Compare & Draw isometric Views & Orthographic Views.	**BASIC CIVIL AND MECHANICAL ENGINEERING** **CODE: R23CC1212** CO1: Acquire knowledge on various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society. CO2: Apply the concepts of surveying to calculate distances, angles and levels. CO3: Realize the importance of transportation in nation's economy and to identify the importance of Water Storage and Conveyance Structures. CO4: Illustrate the role of mechanical engineering and its technologies in various sectors and knowledge of engineering materials. CO5: Explain the basics of various manufacturing processes and thermal engineering and its applications. CO6: Describe the working of different powerplants, mechanical power transmission systems and basics of robotics and its applications.
COMPUTER PROGRAMMING LAB **CODE:R23CC11L1** CO1: Analyze and trace the execution of programs written in C language CO2: Implement programs with appropriate control structures for solving the problems CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers CO4: Code, Debug and Execute programs to demonstrate the applications of arrays, functions, files and various other concepts in C	**ENGINEERING WORKSHOP** **CODE: R23CC12L9** CO1: Identify workshop tools and their operational capabilities. CO2: Make manufacturing of components using workshop trades including fitting, carpentry, foundry, welding and Plumbing. CO3: Apply fitting operations in various applications. CO4: Apply basic electrical engineering knowledge for House Wiring Practice.
IT WORKSHOP **CODE:R23CC11L5** CO1: Identify Hardware components and inter dependencies. CO2: Utilize Antivirus s/w to safeguard computer systems while using Internet CO3: Develop a Document or Presentation CO4: Make use of spreadsheets to perform calculations CO5: Utilize the AI Tool Chat GPT	**ENGINEERING MECHANICS LAB** **CODE: R23ME12L7** CO1 : Evaluate the coefficient of friction between two different surfaces and the roller. CO2 : Apply Law of Polygon of forces and Law of Moment using force polygon. CO3 : Determine the Centre of gravity and Moment of Inertia of different configurations. CO4 : Solve the equilibrium conditions of a rigid body under the action of different force systems.

ENGINEERING PHYSICS LAB **CODE: R23CC11L6** CO: 1 Operate optical instruments like travelling microscope and spectrometer CO: 2 Estimate the wavelengths of different colors using diffraction grating. CO: 3 Plot the intensity of the magnetic field of circular coil carrying current with distance. CO: 4 Calculate the band gap of a given semiconductor.	**ENGINEERING CHEMISTRY LAB** **CODE: R23CC12L11** CO 1: Develop and perform analytical chemistry techniques to address the water related problems. CO 2: Determine the strength of an acid, cell constant, potentials and conductance of solutions. CO 3: Prepare advanced polymer Bakelite and nanomaterials. CO 4: Explain the functioning of different analytical instruments
EEE WORKSHOP **CODE :R23CC11L7** CO1: Measure voltage, current and power in an electrical circuit. CO2: Measure of Resistance using Wheatstone bridge CO3: Discover critical field resistance and critical speed of DC shunt generators. CO4: Investigate the effect of reactive power and power factor in electrical loads. CO5: Analyze the characteristics of various electronic components. CO6: Implement Rectifiers circuits. CO7: Design Amplifiers circuit. CO8: Examine the operation of Logic gates.	**COMMUNICATIVE ENGLISH LAB** **CODE : R23CC12L12** CO 1: Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning. CO 2: Create a compelling resume, cover letter and Sop. CO 3: Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts. CO 4: Apply employability skills to confidently navigate job interviews
NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE **SCODE :R23CC11MC2** CO1: Understand the importance of discipline, character and service motto. CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques. CO3: Explore human relationships by analyzing social problems. CO4: Determine to extend their help for the fellow beings and downtrodden people. CO5: Develop leadership skills and civic responsibilities	**HEALTH AND WELLNESS, YOGA AND SPORTS** **CODE: R23CC12MC1** CO 1: Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning. CO 2: Create a compelling resume, cover letter and Sop. CO 3: Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts. CO 4: Apply employability skills to confidently navigate job interviews.

R23-B.TECH. (CSE)-COURSE OUTCOMES

II-B.TECH

I SEMSTER	II SEMSTER
DISCRETE MATHEMATICS & GRAPH THEORY: R23CC2101 **CO1:** Apply the logical statements, connectivity among the statements and different types of normal forms.[K3] **CO2:** Analyze the operations, properties and functions of sets.[K4]. **CO3:** Solve mathematical problems with recurrence relations using different methods. [K3]. **CO4:** Classify the types of graphs to formulate and solve computational problems.[K4].	**MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS: R23CC2201** **CO1:** Analyze the concepts related to Managerial Economics, financial accounting and management [K4]. **CO2:** Interpret the fundamentals of Economics viz., Demand, Production, cost, revenue and markets [K2]. **CO3:** Apply the Concept of Production cost and revenues for effective Business decision[K3] **CO4:** Analyze how to invest their capital and maximize returns [K4] **CO5:** Analyze the capital budgeting techniques. [K4] **CO6:** Examine the accounting statements and evaluate the financial performance of business entity [K4]
UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY: R23CC2102 **CO1:** Analyze various Value Education methods .[K2] **CO2:** Compare and Contrast various types of Harmony in the Human Being.[K4] **CO3:** Compare and Contrast various types of Harmony in the Family and Society [K4] **CO4:** Compare and Contrast various types of Harmony in the Nature/Existence. [K4] **CO5:** Analyze the various consequences of professional ethics. [K2]	**PROBABILITY AND STATISTICS: R23CC2202** **CO1:**.Classify the concepts of data science and its importance [K2]. **CO2:** Interpret the association of characteristics and through correlation and regression tools [K4] **CO3:** Apply discrete and continuous probability distributions [K3] **CO4:** Design the components of a classical hypothesis test [K3] **CO5:** Infer the statistical inferential methods based on small and large sampling tests [K4].
DIGITAL LOGIC & COMPUTER ORGANIZATION: R23CC2103 **CO1:** Analyze the data representation and digital logic circuits. [K4] **CO2:** Analyze the basic structure of computers.[K4] **CO3:** Analyze the computer arithmetic algorithms [K4] **CO4:** Analyze the processor, memory and input-output organizations.[K4]	**OPERATING SYSTEMS: R23CC2203** **CO 1:** Classify various operating system generations, functions and services. [K2] **CO 2:** Analyze process scheduling, management and synchronization. [K4] **CO 3:** Analyze deadlock prevention, detection, avoidance and recovery techniques [K4] **CO 4:** Analyze various memory management and storage management techniques [K4]. **CO 5:** Analyze the concepts of file system [K2]
ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS: R23CC2104 **CO1:** Apply asymptotic notations to measure the performance of algorithms. [K3] **CO2:** Apply divide and conquer paradigm when an algorithmic design situation calls for it.[K3] **CO3:** Construct greedy algorithms and dynamic programming techniques to solve problems.[K3] **CO4:** Utilize backtracking and branch and bound algorithms to solve combinatorial problems K3] **CO5:** Classify computational problems into NP, NP-Hard, and NP-Complete.[K4]	**DATABASE MANAGEMENT SYSTEMS: R23CC2204** **CO 1:** Interpret the fundamentals of DBMS. [K2] **CO 2:** Analyze relational database designing. [K4] **CO 3:** Develop queries in RDBMS [K3] **CO4:** Analyze database design methodology and normalization process [K4]. **CO 5:** Analyze transaction concepts and File indexing. [K2]

OBJECT ORIENTED PROGRAMMING THROUGH JAVA: R23CC2105 **CO1:** Interpret the syntax and semantics of java programming language and OOPs concepts. [K2] **CO2:** Make use of different predefined classes, packages and interfaces, develop programs using OOPs concepts. [K3] **CO3:** Apply exception handling and FILE I/O operations in java programming. [K3] **CO4:** Make use of Multithreading and String handling Functions to develop java programs. [K3] **CO5:** Make use of Java FX and Event-Handling to in the design of GUI Applications. [K3]	**SOFTWARE ENGINEERING: R23CC2205** **CO 1:** Analyze Software Life Cycle models. [K4] **CO 2:** Analyze the importance of software requirement and project management [K4] **CO 3:** Analyze various types of software design techniques [K4] **CO 4:** Analyze Software testing and quality management [K4]. **CO 5:** Analyze various CASE tools and software maintenance process models. [K4]
ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS LAB: R23CC21L1 **CO1:** Analyze different operations of tree traversal techniques. [K4] **CO2:** Analyze time complexity of algorithms to solve problems on graph [K4] **CO3**: Apply divide and conquer approaches for sorting the given elements [K3] **CO4**: Analyze the complexity of algorithms to evaluate the efficiency and effectiveness of greedy, dynamic programming, backtracking branch and bound techniques. [K4]	**OPERATING SYSTEMS & SOFTWARE ENGINEERING LAB: R23CS22L4** **CO 1:** Experiment with various Unix Commands and system calls [K3] **CO 2:** Experiment with various operating system concepts such as scheduling algorithms, page replacement algorithms. IPC mechanism, memory allocation, file allocation and handling deadlocks.[K3] **CO 3:** Design various S/W applications using E-R diagrams, DFD, CFD, Structured charts UML diagrams etc and estimate the effort using COCOMO model and FP oriented estimation model.[K5] **CO 4:** Design the test cases for e-Commerce and Mobile applications[K5]
OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB: R23CC21L2 **CO1**: Develop Java program, by using OOP concepts. [K3] **CO2**: Make use of inheritance and interface concepts in Java programs. [K3] **CO3**; Develop java programs using Exception handling and Multithreading concepts. [K3] **CO4**; Develop GUIs with JavaFX and JDBC programs. [K3]	**DATABASE MANAGEMENT SYSTEMS LAB: R23CC22L1** **CO1:** Apply SQL commands like DDL, DML, DCL and Indexing to perform different Database operations [K3]. **CO2:** Develop PL/SQL block statements, control statements and cursors. [K3] **CO3:** Develop PL/SQL programs using functions and procedures. [K3] **CO4:** Develop PL/SQL programs using packages and Triggers. [K3] **CO5:** Develop a Java Program to connect to a database. [K3].
PYTHON PROGRAMMING (SKILL ENHANCEMENT COURSE): R23CC21L3 **CO1:** Make use of control flow statements and functions to develop python programs.[K3]. **CO2:** Develop Python programs using strings, Lists, dictionaries, tuples and sets. [K3]. **CO3:** Develop Python programs on object oriented programming and regular expressions. [K3]. **CO4:** Develop Python programs using Nuimpy and Pandas. [K3].	**FULL STACK DEVELOPMENT – 1 (SKILL ENHANCEMENT COURSE): R23CC22L2** **CO1:** Develop static html pages by using HTML5 elements and attributes.[K3]. **CO2:** Construct a static html pages by using Cascading Style Sheets [K3]. **CO3:** Build webpages using Java Script [K3]. **CO4:** Develop a Web pages Using JQuery [K3]
ENVIRONMENTAL STUDIES: R23CC21MC **CO1:** Understand multi-disciplinary nature of environmental studies and Analyze the natural	**DESIGN THINKING & INNOVATION: R23CC22L3** **CO1**: Define the concepts related to design thinking.

resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources. L2 **CO2:** Explain the concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web. Explain the biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity L2 **CO3**: Distinguish various attributes of the pollution, their impacts and measures to reduce or control the pollution along with waste management L2 **CO4**: Understand the rainwater harvesting, watershed management, ozonelayer depletion and waste land reclamationL2 **CO5**: Illustrate the causes of population explosion, value education and welfare programmes.	[K1]. **CO2**: Infer the fundamentals of Design Thinking and innovation. [K2]. **CO3**: Apply the design thinking techniques for solving problems various sectors. [K3]. **CO4:** Analyze to work in a multidisciplinary environment.[K4]. **CO5:** Evaluate the value of creativity. [K4]

R20-B.TECH. (CSE)-COURSE OUTCOMES

III-B.TECH

I SEMSTER	II SEMSTER
DESIGN AND ANALYSIS OF ALGORITHMS **CO1:** Apply asymptotic notations to measure the performance of algorithms [K3] **CO2:** Apply divide-and-conquer paradigm when an algorithmic design situation calls for it [K3]. **CO3:** Identify all feasible solutions to get optimal solutions using greedy method [K3]. **CO4:** Apply dynamic-programming approach, to solve real world problems [K3]. **CO5:** Apply fundamental graph traversal techniques to solve various applications using Backtracking [K3]. **CO6:** Analyse least cost and FIFO branch and bound paradigms [K4].	**MACHINE LEARNING** **CO1:** Summarize the characteristics of Machine Learning that make it useful to real-world Problems. **CO2:** Evaluate and compare the performance of different supervised algorithms for typical learning problems and apply them. **CO3:** Outline the need and importance of pre-processing techniques and apply them. **CO4:** Analyze the performance of Association Rules **CO5:** Evaluate and compare the performance of different unsupervised algorithms for typical learning problems and apply them.
COMPUTER NETWORKS **CO1:** Summarize basic concepts of Data Communication and Networking. [K2] **CO2:** Compare and Contrast OSI and TCP/IP reference models. [K2] **CO3:** Interpret data link layer services and multiple access protocols. [K2] **CO4:** Analyse different routing protocols. [K4] **CO5:** Illustrate the essential principles of different transport layer protocols. [K2] **CO6:** Summarize various application layer protocols. [K2]	**ADVANCED JAVA AND WEB TECHNOLOGIES** CO1: Interpret Servlet Life Cycle and web servers. [K2] CO2: Illustrate JSP Life cycle. [K2] CO3: Apply Session Management for JSP applications. [K3] CO4: Illustrate the usage of JDBC in JSP applications. [K2] CO5: Make use of PHP for the development of web-based applications. [K3] CO6: Utilize JDBC in PHP web-based applications. [K3]
COMPILER DESIGN **CO1 :** Summarize different phases and passes of a compiler. [K2] **CO2 :** Compare and Contrast various Top-Down and Bottom-Up Parsing techniques. [K2] **CO3 :** Interpret different types of Intermediate Code representations. .[K2] **CO4 :** Illustrate the effective usage of register allocation and various Code-generation techniques. .[K2] **CO5 :** Apply different code-optimization techniques to optimize the target code. .[K3]	**CRYPTOGRAPHY & NETWORK SECURITY** **CO1:** Summarize the fundamentals of Cryptography. [K2] **CO2:** Analyze how security is achieved, and attacks can be countered by using symmetric/asymmetric algorithms. [K4] **CO3:** Apply Number Theoretic concepts in developing cryptographic algorithms to counter attacks. [K3] **CO4:** Interpret the role of hash functions and Digital Signatures in Information Security.[K2] **CO5:** Compare different network security designs using available secure solutions. [k2] **CO6:** Illustrate the use of encryption techniques to secure data in transit across data networks. [K2]

OPERATING SYSTEMS	BIG DATA ANALYTICS
CO1 : Classify various operating system functionalities and generations. [K2] **CO2 :** Interpret process management and exemplify the process synchronization techniques. [K2] **CO3 :** Apply various process scheduling algorithms. [K3] **CO4 :** Distinguish various memory management techniques and apply various deadlock techniques. [K4] **CO5 :** Compare and contrast various disk scheduling algorithms and can interpret the file system implementations. [K2]	**CO1:** Interpret the architectural elements of big data and Hadoop framework. [K2] **CO2:** Analyse various big data applications using map reduce programming module. [K4] **CO3:** Analyse Spark capabilities such as distributed datasets, in- memory caching, and the interactive shell. [K4] **CO4:** Summarize Spark's powerful built-in libraries, including Spark SQL, Spark Streaming. [K2] **CO5:** Analyze Hadoop data with PIG and Hive. Interpret the applications and architecture of Mobile Computing and multiplexing techniques. [K4]
DATA WAREHOUSING AND DATA MINING	**ADVANCED JAVA AND WEB TECHNOLOGIES LAB**
CO1 : Interpret the data mining terminology and types of data to be mined. [K2] **CO2:** Outline the need and importance of pre-processing techniques and apply them.[K2] **CO3:** Interpret data warehousing concepts and operations. [K2] **CO4:** Compare and contrast different dominant Data Mining Algorithms for Classification and Clustering and apply them. [K4] **CO5:** Analyze the performance of Association Rules. [K4]	**CO1:** Experiment with the installation of Web Servers. [K3] **CO2:** Make use of servlets in dynamic web pages. [K3] **CO3:** Develop web applications using JSP for effective data management. [K3] **CO4:** Construct the web based applications in PHP using effective data base access with rich client interaction. [K3]
DAA AND CD LAB	**MACHINE LEARNING LAB**
CO1: Develop programs for searching a given set of element and analyze its time complexity. **CO2:** Implement and analyze the complexity using dynamic algorithms. **CO3:** Solve and analyze the tree traversal techniques. **CO4:** Demonstrate and Develop Lexical Analyzer for a given language.[K3] **CO5:** Develop various bottom up parsers for a given language.[K3]	**CO1:** Analyse exploratory data analysis. [K4] **CO2:** Analyze the real word datasets presented in different formats Using python libraries to Perform exploratory data analysis.[K4] **CO3:** Apply the machine learning algorithms on various real time data sets. [K3] **CO4:** Analyze the data by using visualization tools or libraries. [K4].
CN AND OS LAB	**BIG DATA ANALYTICS LAB**
CO1: Implement routing algorithms. **CO2:** Do the error checking by using CRC polynomials. **CO 3:** Solve the experiments on scheduling Algorithms and page replacement algorithms. **CO4:** Handle the deadlocks, like prevention and detection.	**CO1:** Experiment with installation of Hadoop and develop applications using MapReduce framework. [K3] **CO2:** Experiment with installation of Spark and develop applications. [K3] **CO3:** Analyze Hadoop data with PIG. [K4] **CO4:** Develop NoSQL structures like Hive for processing and aggregating logs in the database. [K3]

ENGLISH EMPLOYABILITY SKILLS	Internet of Things (IoT)
CO 1: Write effective Resume for employment. **CO 2**: Make formal presentations using relevant technical style of communication and appropriate strategies for both academic and professional purpose. **CO 3**: Participate in Group Discussions using analytical and problem solving skills. **CO 4**: Face job interviews confidently and enhance employability.	**CO1:** Analyze the requirements, specifications to design home automation applications [K4]. CO2: Build smart city applications using Arduino[K4]. CO3: Develop agricultural applications using Raspberry pi [K4]. CO4: Utilize AutoBahn, Xively Cloud communication API's to exchange data [K4].
ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	**PROFESSIONAL ETHICS AND HUMAN VALUES**
CO1: Interpret the philosophy of Indian Culture [K2]. **CO2:** Interpret the Indian languages, Epics Ramayana and Mahabharata [K2]. **CO3:** Analyze the information about Indian arts and architecture [K4]. **CO4:** Analyze the spread of cultural exchange in abroad [K4]. **CO5:** Analyze the contributions of scientists in different eras [K4].	**CO1:** Learn necessary behavioural skills relating to the Ethics at Industrial sector and to gain fundamental knowledge [K2]. **CO2:** Acquaint with basic human values, responsibilities and rights of engineers which are very much necessary today [K2]. **CO3**: Equip with knowledge on basics of intellectual property rights and cyber law [K2]. **CO4:** Gain knowledge on the patents, trademark and copy rights [K2].

R20-B.TECH. (CSE)-COURSE OUTCOMES

IV-B.TECH

I SEMESTER	II SEMESTER
CYBER SECURITY **SUBCODE:R20CS4107** C01: Interpret Cyber Security architecture principles [K2]. C02: Identifying System and application security threats and vulnerabilities [K3]. C03: Identifying different classes of attacks [K3]. C04: Cyber Security incidents to apply appropriate response [K3]. C05: Describing risk management processes and practices [K3]. C06: Evaluation of decision-making outcomes of Cyber Security scenarios [K4].	
MOBILE ADHOC & SENSOR NETWORKS **SUBCODE:R20CC4108** CO 1: Analyse the routing protocols in MANET. [K4] CO 2: Interpret the TCP over Ad-hoc Networks. [K2] CO 3: Interpret the data transmission and data acquisitio in WSN. [K2] CO 4: Design and Develop the various heterogeneous architectures. [K6]	
SERVICE ORIENTED ARCHITECTURE **SUBCODE: R20CC4103** CO 1: Summarize primary concepts of SOA. [K2] CO 2: Identify the integration of SOA technological points with Web Services. [K3] CO 3: Implement of SOA in development cycle of Web Services. [K3]	
WEB AND MICRO SERVICES **SUBCODE: R20CS4109** CO 1: Compare and Contrast various web services [K2]. CO 2: Make use of web services in web applications [K2]. CO 3: Analyze SOAP web services in web applications [K4]. CO 4: Interpret the usage of WSDL and UDDI data model in the world of web service [K3]. CO 5: Analyze the REST based web services [K4].	
DEEP LEARNING **SUBCODE: R20CS4110** CO 1: Summarize the characteristics of Machine Learning and Deep Learning that make it useful to real world Problems. [K2] CO 2: Realign high dimensional data using reduction techniques. [K3] CO 3: Analyze optimization and generalization in deep learning. [K4] CO 4: Implement various deep learning models. [K3]	

DevOps **SUBCODE: R20CS4111** CO 1: Demonstrate the phases of software development life cycle. [K2] CO 2: Outline the basic Fundamentals of DevOps. [K2] CO 3: Adopt the DevOps technology into the project. [K6] CO 4: Evaluate the CI/CD concepts and metrics to track CI/CD practices. [K5] CO 5: Summarize the importance of DevOps maturity models. [K2]	
INTER-NETWORKING WITH TCP/IP **SUBCODE: R20CS4112** CO1 : Describe the architecture, design and behaviours of the internet [K2]. CO2 : Analyze the performance of TCP/IP suite of protocols [K3]. CO3 : Describe the concepts and techniques that have been used to design and implement the TCP/IP Internet technology [K2]. CO4 : Describe the issues that are driving the development of new protocols to broaden and enhance the operation of the Internet [K2].	
E – COMMERCE **SUBCODE: R20CC4104** CO 1: Interpret the E-commerce applications and Proces Model. [K2] CO 2: Compare and contrast various electronic Payment Systems. [K3] CO 3: Interpret the Intra Organizational Commerce. [K2 CO 4: Outline the corporate digital library and marketin research.	
SOCIAL MEDIA ANALYTICS **SUBCODE: R20CS4113** CO1: Describe the concepts of social media concepts an enlisting the python [K2]. CO2: Analyze the Harnessing Social Data - Connecting, Capturing, and Cleaning [K4]. CO3: Analyzing Twitter Using Sentiment Analysis and Entity Recognition, Scope and process [K4]. CO4: Analyze the Demystifying Pinterest through Network Analysis of Users Interests, Scope and process [K4]. CO5: Evaluate Social Data Analytics at Scale – Spark and Amazon Web Services [K4].	
NATURAL LANGUAGE PROCESSING **SUBCODE: R20CS4106** CO1: Describe the concepts of morphology, syntax, semantics, discourse &pragmatics of natural language. [K2]. CO2: Demonstrate understanding of the relationship between NLP and statistics &machine learning. [K4]. CO3: Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis. [K4]. CO4: Develop systems for various NLP problems with moderate complexity [K4]. CO5: Evaluate NLP systems, identify shortcomings and suggest solutions for these shortcomings [K4].	

SOFTWARE DEFINED NETWORKS **SUBCODE: R20CS4106** CO1: Analyze the evolution of software defined networks [K4]. CO2: Express the various components of SDN and their uses [K4]. CO3: Explain the use of SDN in the current networking scenario [K2]. CO4: Design and develop various applications of SDN [K4].	
SOFTWARE PROJECT MANAGEMENT **SUBCODE R20CC4102** CO 1: Illustrate the conventional software Management and economics [K2]. CO 2: Outline the software life cycle phases and artifact [K2]. CO 3: Illustrate the various workflows, check points and iterative process planning [K2]. CO 4: Analyze the project organizations, responsibilitie and control [K4].	
HUMAN COMPUTER INTERACTION **SUBCODE R20CC4102** CO 1: Outline knowledge about user interface design. [K2] CO 2: Summarize the importance of Graphical Use Interface. [K2] CO 3: Apply the strategies used in design process. [K3] CO 4: Summarize the importance of screen designing. [K2] CO 5: Apply the various operations of Windows. [K3]	
BUSINESS MANAGEMENT CONCEPTS FOR ENGINEERS **SUBCODE: R20CC4101** CO1: Summarize fundamentals of Managerial economic for decision making. [K2)] CO2: Apply concepts of Financial Accounting and BEP for business decisions. [K3]. CO3: Evaluate fundamental concepts and principles of management [K5]. CO4: Discuss functional areas of management like HR, marketing and finance [K6]. CO5: Apply project management techniques for project planning and evaluation [K3].	
ENTREPRENEURSHIP & INNOVATION **SUBCODE: R20CC4117** CO 1: Outline the concepts of Entrepreneurship.[K2] CO 2: Create the awareness on creativity and innovation.[K6] CO 3: Adopt the Entrepreneurship Development programs[K6] CO 4: Evaluate the project planning and feasibility studies.[K5] CO 5: Analyze the concept of small and micro enterprises.[K4]	

AGILE WITH SCRUM **SUBCODE: R20CC41SC1** CO 1: Outline the concepts of Agile. [K2] CO 2: Analyze the requirements, specifications to desig Agile Scrum Framework. [K4] CO 3: Summarize the benefits of different tools of Agile Testing. [K2] CO 4: Illustrate the Agile practices with respective principles to design and development. [K2] CO 5: Apply the Agile scenarios in terms of industry trends. [K3]	
MASSIVE OPEN ONLINE COURSES (MOOCs) **SUBCODE: R20CC41MC** CO1: Identify suitable course required for their carrier. [K3] CO2: Adapt effectively for changing conditions. [K5] CO3: Develop and refine oral communication skills. [K3 CO4: Take part in lifelong learning. [K3]	

R23-B.TECH. (CSE(AI)-COURSE OUTCOMES

I-B.TECH

I SEMSTER	II SEMSTER
LINEAR ALGEBRA & CALCULUS CODE: R23CC1101 CO1: Solve the system of linear equations and transformations. CO2: Analyze the applications of matrices in various fields and obtain Eigen values and Eigenvectors. CO3: Analyze mean value theorems to real life problems CO4: Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering CO5: Identify the area and volume by interlinking them to appropriate double and triple integrals.	**DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS CODE : R23CC1201** CO 1: Solve first order ordinary differential equations to real life situations. CO 2: Identify and apply suitable methods in solving the higher order differential equations CO 3: Solve the partial differentiation equations. CO 4: Interpret the physical meaning of different operators as gradient, curl and divergence. CO 5: Estimate the work done against a field, circulation and flux using vector calculus.
INTRODUCTION TO PROGRAMMING CODE :R23CC1102 CO1: Infer the basic concepts of computers, algorithms and Flowcharts. CO2: Develop programs using appropriate control structures. CO3: Write programs using arrays and strings. CO4: Develop programs using structures and pointers. CO5: Make use of functions and file Operations in C programming for a given application.	**COMMUNICATIVE ENGLISH CODE: R23CC1206** CO1: Summarize texts based on the comprehension of the material provided. CO2: Create coherent and well-structured paragraphs, essays, and letters on a range of familiar topics CO3: Use a diverse array of grammatical structures with flexibility, striving to minimize errors. CO4: Use vocabulary adequately and appropriately to express and write on a variety of topics.
ENGINEERING PHYSICS CODE:R23CC1106 CO 1: Analyze the intensity variation of Laser light and it's propagation in optical fibers. CO 2: Familiarize with the basics of crystals and their structures. CO 3: Summarize various types of Magnetic materials and Super conductors. CO 4: Explain the basic concepts of Quantum Mechanics and the band theory of solids. CO 5: Identify the type of semiconductor and smart materials.	**ENGINEERING CHEMISTRY CODE :R23CC1208** CO1:Understand the difference between soft and hard water and why it matters in daily life and industries. CO2:Apply electrochemical principles to real-problems, making informed decisions about materials selection, corrosion mitigation, and energy storage solutions CO3:Analyze the production, properties, and environmental implications of polymers, fuels and biofuels. CO4:Apply the knowledge of diverse engineering materials like composites, refractories, lubricants, and Portland cement, to make material selection and applications. CO5:Apply the Knowledge of various applications to synthesize colloids and characterize nano materials.

BASIC ELECTRICAL & ELECTRONICS ENGINEERING CODE :R23CC1107 CO1: Explain the fundamental laws and concept of DC and AC circuits. CO2: Demonstrate the working and operating principles of electrical machines, measuring instruments. CO3: Demonstrate the working and operating principles of different power generation stations. CO4: Calculate electrical load, electricity bill of residential and commercial buildings and safety measures. CO1: Describe the working of diode and explore the operation of BJT and its applications. CO2: Describe the working of Rectifiers and amplifiers in electronic circuits. CO3: Manipulate numeric information in different forms, various codes such as ASCII, Gray, and BCD, simple Boolean expressions and Boolean Theorems CO4: Design and analyse combinational circuits, sequential circuits, flip flops Registers and Counters.	**ENGINEERING MECHANICS CODE: R23CC1209** CO 1: Apply the principles of mechanics to determine the resultant of several concurrent Forces acting on a particle. CO 2: Analyze the trusses using method of joints and method of sections; apply the basic Concepts of dry friction and wedges. CO 3: Solve the centroid and centre of gravity bodies and composite sections. CO 4: Solve the Area Moment of Inertia and Mass Moment of Inertia of areas bodies and Composite sections. CO 5: Apply the work-energy principle to particles and connected systems for engineering Applications.
ENGINEERING GRAPHICS CODE : R23CC1108 CO1: Construct the principles of engineering drawing, including engineering curves, scales, Orthographic and isometric projections. CO2: Construct orthographic projections of points, lines, planes and solids in front, top and Side views. CO3: Analyze and draw projection of solids in various positions in first Quadrant. CO4: Develop the sections of Solids & Development of Surfaces. CO5: Compare & Draw isometric Views & Orthographic Views.	**BASIC CIVIL AND MECHANICAL ENGINEERING CODE: R23CC1212** CO1: Acquire knowledge on various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society. CO2: Apply the concepts of surveying to calculate distances, angles and levels. CO3: Realize the importance of transportation in nation's economy and to identify the importance of Water Storage and Conveyance Structures. CO1: Illustrate the role of mechanical engineering and its technologies in various sectors and knowledge of engineering materials. CO2: Explain the basics of various manufacturing processes and thermal engineering and its applications. CO3: Describe the working of different powerplants, mechanical power transmission systems and basics of robotics and its applications.
COMPUTER PROGRAMMING LAB CODE:R23CC11L1 CO1: Analyze and trace the execution of programs written in C language CO2: Implement programs with appropriate control structures for solving the problems CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers CO4: Code, Debug and Execute programs to demonstrate the applications of arrays, functions, files and various other concepts in C	**ENGINEERING WORKSHOP CODE: R23CC12L9** CO1: Identify workshop tools and their operational capabilities. CO2: Make manufacturing of components using workshop trades including fitting, carpentry, foundry, welding and Plumbing. CO3: Apply fitting operations in various applications. CO4: Apply basic electrical engineering knowledge for House Wiring Practice.

IT WORKSHOP CODE:R23CC1 1L5 CO1: Identify Hardware components and inter dependencies. CO2: Utilize Antivirus s/w to safeguard computer systems while using Internet CO3: Develop a Document or Presentation CO4: Make use of spreadsheets to perform calculations CO5: Utilize the AI Tool Chat GPT	**ENGINEERING MECHANICS LAB CODE: R23ME12L7** CO1 : Evaluate the coefficient of friction between two different surfaces and the roller. CO2 : Apply Law of Polygon of forces and Law of Moment using force polygon. CO3 : Determine the Centre of gravity and Moment of Inertia of different configurations. CO4 : Solve the equilibrium conditions of a rigid body under the action of different force systems.
ENGINEERING PHYSICS LAB CODE: R23CC11L6 CO: 1 Operate optical instruments like travelling microscope and spectrometer CO: 2 Estimate the wavelengths of different colors using diffraction grating. CO: 3 Plot the intensity of the magnetic field of circular coil carrying current with distance. CO: 4 Calculate the band gap of a given semiconductor.	**ENGINEERING CHEMISTRY LAB CODE: R23CC12L11** CO 1: Develop and perform analytical chemistry techniques to address the water related problems. CO 2: Determine the strength of an acid, cell constant, potentials and conductance of solutions. CO 3: Prepare advanced polymer Bakelite and nanomaterials. CO 4: Explain the functioning of different analytical instruments
EEE WORKSHOP CODE :R23CC11L7 CO1: Measure voltage, current and power in an electrical circuit. CO2: Measure of Resistance using Wheatstone bridge CO3: Discover critical field resistance and critical speed of DC shunt generators. CO4: Investigate the effect of reactive power and power factor in electrical loads. CO1: Analyze the characteristics of various electronic components. CO2: Implement Rectifiers circuits. CO3: Design Amplifiers circuit. CO4: Examine the operation of Logic gates.	**COMMUNICATIVE ENGLISH LAB CODE : R23CC12L12** CO 1: Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning. CO 2: Create a compelling resume, cover letter and Sop. CO 3: Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts. CO 4: Apply employability skills to confidently navigate job interviews
NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE SCODE :R23CC11MC2 CO1: Understand the importance of discipline, character and service motto. CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques. CO3: Explore human relationships by analyzing social *problems*. CO4: Determine to extend their help for the fellow beings and downtrodden people. CO5: Develop leadership skills and civic responsibilities	**HEALTH AND WELLNESS, YOGA AND SPORTS CODE: R23CC12MC1** CO 1: Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning. CO 2: Create a compelling resume, cover letter and Sop. CO 3: Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts. CO 4: Apply employability skills to confidently navigate job interviews.

R23-B.TECH. (CSE(AI)-COURSE OUTCOMES

II-B.TECH

I SEMSTER	II SEMSTER
DISCRETE MATHEMATICS & GRAPH THEORY: R23CC2101 **CO1:** Apply the logical statements, connectivity among the statements and different types of normal forms.[K3] **CO2:** Analyze the operations, properties and functions of sets.[K4]. **CO3:** Solve mathematical problems with recurrence relations using different methods. [K3]. **CO4:** Classify the types of graphs to formulate and solve computational problems.[K4].	**OPTIMIZATION TECHNIQUES: R23CC2208** **CO1. Formulate** the optimization problem, without and with constraints, by using design variables from an engineering design problem. **CO2. Apply** classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution. **CO3.** Apply and Solve transportation and assignment problem by using Linear programming Simplex method. **CO4. Apply** gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions **CO5. Formulate** Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.
UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY: R23CC2102 **CO1:** Analyze various Value Education methods .[K2] **CO2:** Compare and Contrast various types of Harmony in the Human Being.[K4] **CO3:** Compare and Contrast various types of Harmony in the Family and Society [K4] **CO4:** Compare and Contrast various types of Harmony in the Nature/Existence. [K4] **CO5:** Analyze the various consequences of professional ethics. [K2]	**PROBABILITY AND STATISTICS: R23CC2202** **CO1:**.Classify the concepts of data science and its importance [K2]. **CO2:** Interpret the association of characteristics and through correlation and regression tools [K4] **CO3:** Apply discrete and continuous probability distributions [K3] **CO4:** Design the components of a classical hypothesis test [K3] **CO5:** Infer the statistical inferential methods based on small and large sampling tests [K4].
ARTIFICIAL INTELLIGENCE:R23CC2103 **CO1:**Analyze and Design Intelligent Agents[K4] **CO2:** Apply Search Algorithms to Problem Solving[K3] **CO3:** Apply techniques for Constraint propagation and reasoning under uncertainty[K3] **CO4:** Utilize inductive learning decision trees, and explanation-based learning for Learning from observation[K3] **CO5:** Analyze and computer typical expert systems such as MYCIN, DART, and XCON[K4]	**MACHNIE LEARNING : R23CC2206** **CO1:**Analyze and Design Intelligent Agents[K4] **CO2:** Apply Search Algorithms to Problem Solving[K3] **CO3:** Apply techniques for Constraint propagation and reasoning under uncertainty[K3] **CO4:** Utilize inductive learning decision trees, and explanation-based learning for Learning from observation[K3] **CO5:** Analyze and computer typical expert systems such as MYCIN, DART, and XCON[K4]
ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS: R23CC2104 **CO1:** Apply asymptotic notations to measure the performance of algorithms. [K3] **CO2:** Apply divide and conquer paradigm when an algorithmic design situation calls for it.[K3] **CO3:** Construct greedy algorithms and dynamic programming techniques to solve problems.[K3] **CO4:** Utilize backtracking and branch and bound algorithms to solve combinatorial problems K3] **CO5:** Classify computational problems into NP, NP-Hard, and NP-Complete.[K4]	**DATABASE MANAGEMENT SYSTEMS: R23CC2204** **CO 1:** Interpret the fundamentals of DBMS. [K2] **CO 2:** Analyze relational database designing. [K4] **CO 3:** Develop queries in RDBMS [K3] **CO 4:** Analyze database design methodology and normalization process [K4]. **CO 5:** Analyze transaction concepts and File indexing. [K2]

OBJECT ORIENTED PROGRAMMING THROUGH JAVA: R23CC2105 **CO1:** Interpret the syntax and semantics of java programming language and OOPs concepts. [K2] **CO2:** Make use of different predefined classes, packages and interfaces, develop programs using OOPs concepts. [K3] **CO3:** Apply exception handling and FILE I/O operations in java programming. [K3] **CO4:** Make use of Multithreading and String handling Functions to develop java programs. [K3] **CO5:** Make use of Java FX and Event-Handling to in the design of GUI Applications. [K3]	**DIGITAL LOGIC & COMPUTER ORGANIZATION: R23CC2107** **CO1:** Analyze the data representation and digital logic circuits. [K4] **CO2:** Analyze the basic structure of computers.[K4] **CO3:** Analyze the computer arithmetic algorithms [K4] **CO4:** Analyze the processor, memory and input-output organizations.[K4]
ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS LAB: R23CC21L1 **CO1:** Analyze different operations of tree traversal techniques. [K4] **CO2:** Analyze time complexity of algorithms to solve problems on graph [K4] **CO3**: Apply divide and conquer approaches for sorting the given elements [K3] **CO4**: Analyze the complexity of algorithms to evaluate the efficiency and effectiveness of greedy, dynamic programming, backtracking branch and bound techniques. [K4]	**AI&ML LAB :R23AI22L4** **CO1:** Analyze the use of the Pandas library to create and manipulate Series and Data Frames. [K4] **CO2:** Develop various search algorithms in Python. [K3] **CO3:** Apply preprocessing techniques for preparing datasets for machine learning process. [K3] **CO4:** Develop machine learning models using algorithms. [K3]
OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB: R23CC21L2 **CO1**: Develop Java program, by using OOP concepts. [K3] **CO2**: Make use of inheritance and interface concepts in Java programs. [K3] **CO3**; Develop java programs using Exception handling and Multithreading concepts. [K3] **CO4**; Develop GUIs with JavaFX and JDBC programs. [K3]	**DATABASE MANAGEMENT SYSTEMS LAB: R23CC22L1** **CO1:** Apply SQL commands like DDL, DML, DCL and Indexing to perform different Database operations [K3]. **CO2:** Develop PL/SQL block statements, control statements and cursors. [K3] **CO3:** Develop PL/SQL programs using functions and procedures. [K3] **CO4:** Develop PL/SQL programs using packages and Triggers. [K3] **CO5:** Develop a Java Program to connect to a database. [K3].
PYTHON PROGRAMMING (SKILL ENHANCEMENT COURSE): R23CC21L3 **CO1:** Make use of control flow statements and functions to develop python programs.[K3]. **CO2:** Develop Python programs using strings, Lists, dictionaries, tuples and sets. [K3]. **CO3:** Develop Python programs on object oriented programming and regular expressions. [K3]. **CO4:** Develop Python programs using Nuimpy and Pandas. [K3].	**FULL STACK DEVELOPMENT – 1 (SKILL ENHANCEMENT COURSE): R23CC22L2** **CO1:** Develop static html pages by using HTML5 elements and attributes. [K3]. **CO2:** Construct a static html pages by using Cascading Style Sheets [K3]. **CO3:** Build webpages using Java Script [K3]. **CO4:** Develop a Web pages Using JQuery [K3]

ENVIRONMENTAL STUDIES: R23CC21MC	DESIGN THINKING & INNOVATION: R23CC22L3
CO1: Understand multi-disciplinary nature of environmental studies and Analyze the natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources. L2 **CO2:** Explain the concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web. Explain the biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity L2 **CO3**: Distinguish various attributes of the pollution, their impacts and measures to reduce or control the pollution along with waste management L2 **CO4**: Understand the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamationL2 **CO5**: Illustrate the causes of population explosion, value education and welfare programmes.	**CO1**: Define the concepts related to design thinking. [K1]. **CO2**: Infer the fundamentals of Design Thinking and innovation. [K2]. **CO3**: Apply the design thinking techniques for solving problems various sectors. [K3]. **CO4:** Analyze to work in a multidisciplinary environment.[K4]. **CO5:** Evaluate the value of creativity. [K4]

R20-B.TECH. (CSE(AI)-COURSE OUTCOMES

III B.TECH

I SEMSTER	II SEMSTER
OPERATING SYSTEMS CO 1: Classify various operating system functionalities and generations. [K2] CO 2: Interpret process management and exemplify the process synchronization techniques. [K2] CO 3: Apply various process scheduling algorithms. [K3] CO 4: Distinguish various memory management techniques and apply various deadlock techniques. [K4] CO 5: Compare and contrast various disk scheduling algorithms and can interpret the file system implementations. [K2]	**DEEP LEARNING** CO1: Summarize the characteristics of Machine Learning and Deep Learning that make it useful CO 2: Interpret process management and exemplify the process CO3: Analyze optimization and generalization in deep learning. [K4] CO4: Implement various deep learning models. [K3]
COMPUTER NETWORKS CO 1: Summarize basic concepts of Data Communication and Networking. [K2] CO 2: Compare and Contrast OSI and TCP/IP reference models. [K2] CO 3: Interpret data link layer services and multiple access protocols. [K2] CO 4: Analyse different routing protocols. [K4] CO 5: Illustrate the essential principles of different transport layer protocols. [K2] CO 6: Summarize various application layer protocols.[K2]	**NATURAL LANGUAGE PROCESSING** CO 1: Describe the concepts of morphology, syntax, semantics, discourse &pragmatics of natural language.[K2] CO 2: Demonstrate understanding of the relationship between NLP and statistics &machine learning.[K2] CO 3: Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis.[K4] CO 4: Develop systems for various NLP problems with moderate complexity. [K4] CO 5: Evaluate NLP systems, identify shortcomings and suggest solutions for these shortcomings.[K4]
MACHINE LEANING CO 1: Summarize the characteristics of Machine Learning that make it useful to real-world Problems. [K2] CO 2: Outline the need and importance of preprocessing techniques and apply them. [K2] CO 3: Evaluate and compare the performance of different unsupervised algorithms for typical learning problems and apply them. [K5] CO 4: Analyze the performance of Association Rules. [K4] CO 5: Evaluate and compare the performance of different supervised algorithms for typical learning problems and apply them. [K5]	**ADVANCED JAVA AND WEB TECHNOLOGIES** CO 1: Interpret Servlet Life Cycle and web servers. [K2] CO 2: Illustrate JSP Life cycle. [K2] CO 3: Apply Session Management for JSP applications. [K3] CO 4: Illustrate the usage of JDBC in JSP applications. [K2] CO 5: Make use of PHP for the development of web-based applications. [K3] CO 6: Utilize JDBC in PHP web-based applications. [K3]

DESIGN AND ANALYSIS OF ALGORITHMS	CRYPTOGRAPHY & NETWORK SECURITY
CO 1: Apply asymptotic notations to measure the performance of algorithms [K3] CO 2: Apply divide-and-conquer paradigm when an algorithmic design situation calls for it [K3]. CO 3: Identify all feasible solutions to get optimal solutions using greedy method [K3]. CO 4: Apply dynamic-programming approach, to solve real world problems [K3]. CO 5: Apply fundamental graph traversal techniques to solve various applications using Backtracking [K3]. CO 6: Analyse least cost and FIFO branch and bound paradigms [K4].	CO 1: Summarize the fundamentals of Cryptography. [K2] CO 2: Analyze how security is achieved, and attacks can be countered by using symmetric/asymmetric algorithms. [K4] CO 3: Apply Number Theoretic concepts in developing cryptographic algorithms to counter attacks. [K3] CO 4: Interpret the role of hash functions and Digital Signatures in Information Security.[K2] CO 5: Compare different network security designs using available secure solutions. [k2] CO 6: Illustrate the use of encryption techniques to secure data in transit across data networks. [K2]
DATA WAREHOUSING AND DATA MINING	**MOBILE COMPUTING**
CO 1: Interpret the data mining terminology and types of data to be mined. [K2] CO 2: Outline the need and importance of preprocessing techniques and apply them.[K2] CO 3: Interpret data warehousing concepts and operations. [K2] CO 4: Compare and contrast different dominant Data Mining Algorithms for Classification and Clustering and apply them. [K4] CO 5: Analyze the performance of Association Rules. [K4]	CO 1: Interpret the applications and architecture of Mobile Computing and multiplexing Techniques. [K2] CO 2: Analyze the Mobile IP issues. [K4] CO 3: Analyze the various Mobile TCP Variants. [K4] CO 4: Analyze the various routing protocols in MANET. [K4]
COMPUTER GRAPHICS	**HIGH SPEED NETWORKS**
CO 1: Summarize graphics applications, architectures, and open GL program structure. [K2] CO 2: Apply basic transformations on objects. [K3] CO 3: Apply line and polygon clipping algorithms. [K3] CO 4: Identify different projections.[K3] CO 5: Design interactive programs using openGL. [K6]	CO1: Ability to understand the introduction about ATM and Frame relay [K2] CO2: Ability to understand an up-to-date survey of developments in High Speed Networks.. [K2] CO3: Analyze techniques involved to support real-time traffic and congestion control. [K4] CO4: Analyze different levels of quality of service (Q.S) to different applications.. [K4]
CN & OS LAB	**AJWT LAB**
CO1 : Understand fundamental underlying principles of computer networking..[K2]. CO2 : Understand details and functionality of layered network architecture.[K3]. CO3 :. Describe and demonstrate the functions and features of current operating systems [K3]. CO4 : Demonstrate skills that meet industry standards and certification requirements in the use of system hardware, operating systems technologies, and application systems. [K3].	CO 1: Experiment with the installation of Web Servers. [K3] CO 2: Make use of servlets in dynamic web pages. [K3] CO 3: Develop web applications using JSP for effective data management. [K3] CO 4: Construct the web based applications in PHP using effective data base access with rich client interaction. [K3]
MACHINE LEARNING LAB	**DEEP LEARNING LAB**
CO 1: Analyse exploratory data analysis. [K4] CO 2: Analyze the real word datasets presented in different formats using python libraries to Perform exploratory data analysis.[K4] CO 3: Apply the machine learning algorithms on various real time data sets. [K3] CO 4: Analyze the data by using visualization tools or libraries. [K4]	CO 1: Analyze exploratory data analysis. [K4] CO 2: Analyze the real word datasets presented in different formats using python libraries to Perform exploratory data analysis.[K4] CO 3: Apply the deep learning algorithms on various real time data sets. [K3] CO 4: Analyze the data by using visualization tools or libraries. [K4]

ENGLISH EMPLOYABILITY SKILLS (SOC)	NATURAL LANGUAGE PROCESSING LAB
CO1: Write effective Resume for employment.. CO2: Make formal presentations using relevant technical style of communication and appropriate strategies for both academic and professional purpose. CO3: Participate in Group Discussions using analytical and problem solving skills . CO4: Face job interviews confidently and enhance employability.	CO1: Describe the concepts of morphology, syntax, semantics, discourse &pragmatics of natural language. CO2: Demonstrate relationship between NLP and statistics &machine learning. CO3: Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis. CO4: Develop systems for various NLP problems with moderate complexity. CO5: Evaluate NLP systems, identify shortcomings and suggest solutions for these shortcomings.
ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	**PROFESSIONAL ETHICS & HUMAN VALUES**
CO1: Understand the philosophy of Indian Culture CO2: Know the Indian languages, Epics Ramayana and Mahabharata CO3:Acquire the information about Indian arts and architecture CO4:Know the spread of cultural exchange in abroad CO5:Know the contributions of scientists in different eras	CO1: Interpret the fundamentals of Human values. [K2] CO2: Analyse the ethical issues and role of engineers in industry. [K4] CO3: Develop the principles of harmony in value education. [K3] CO4: List out the duties and rights of engineers. [K4] CO5: Summarise the engineer's responsibilities towards safety and risk. [K2]

R20-B.TECH. (CSE(AI)-COURSE OUTCOMES

IV B.TECH

I SEMSTER	II SEMSTER
SENTIMENT ANALYSIS **SUBCODE: R20AI4103** CO1: Organize and understanding of concepts and theories of Sentiment Analysis.[K3] CO2: Examine related concepts in machine learning, data mining, and natural language processing.[K4] CO3: Develop proficiency in Python programming, and specifically the use of the Natural Language Toolkit to solve problems in Sentiment Analysis.[K3] CO4: Analyse research approaches in Sentiment Analysis through conducting experiments and writing up results in research paper form.[K4]	**MAJOR PROJECT** CO1: Acquire practical knowledge within the chosen area of technology for project development. CO2: Identify, analyze, formulate and handle programming projects with a comprehensive and systematic approach.
COMPUTER VISION AND PERCEPTION **SUBCODE: R20AI4106** CO1: Summarize image representation and modelling.[K2] CO2: Apply image transformation methods.[K3] CO3: Interpret image processing algorithms.[K3] CO4: Analyze transformation, pose consistency and segmentation algorithms.[K4] CO5: Analyze and implement computer vision techniques by means of Python using the OPENCV library.[K4]	
ARTIFICIAL NEURAL NETWORKS **SUBCODE: R20AI4107** CO1 : Summarize the similarity of Biological networks and Neural networks.[K2] CO2 : Organize the training of neural networks using various learning rules.. [K3] CO3 : Analyze the concepts of forward and backward propagations.[K4] CO4 : Analyze and Construct the Hopfield models.[K4]	

REINFORCEMENT LEARNING **SUBCODE: R20AI4108** CO1: Summarize the relevance of Reinforcement Learning and how does it complement other ML Techniques.[K2] CO2: Analyze various RL algorithms.[K4] CO3: Formulate a problem as a Reinforcement Learning problem and solve it [K3] CO4: Implement RL algorithms using Python [K3]	
SOFTWARE PROJECT MANAGEMENT **SUBCODE: R20CC4105** CO 1: Illustrate the conventional software Management and economics [K2]. CO 2: Outline the software life cycle phases and artifacts [K2]. CO 3: Illustrate the various workflows, check points and iterative process planning [K2]. CO 4: Analyze the project organizations, responsibilities and control [K4]	
HUMAN COMPUTER INTERACTION **SUBCODE: R20CC4102** CO 1: Outline knowledge about user interface design. [K2] CO 2: Summarize the importance of Graphical User Interface. [K2] CO 3: Apply the strategies used in design process. [K3] CO 4: Summarize the importance of screen designing. [K2] CO 5: Apply the various operations of Windows.[K3]	
E-COMMERCE **SUBCODE: R20CC4104** CO 1: Interpret the E-commerce applications and Process Model. [K2] CO 2: Compare and contrast various electronic Payment Systems. [K3] CO 3: Interpret the Intra Organizational Commerce. [K2] CO 4: Outline the corporate digital library and marketing research. [K2] CO 5: Analyze resource discovery and information filtering. [K4]	
HUMANS AND INTELLIGENT MACHINES **SUBCODE: R20AI4109** CO1: Summarize the basics of human and computational abilities and limitations.[K2] CO2: Outline basic theories, tools and techniques in HMI.[K2] CO3: Analyze the fundamental aspects of designing and evaluating interfaces.[K4] CO4: Examine a variety of simple methods for evaluating the quality of a user interface.[K4] CO5: Apply appropriate HMI techniques to design systems that are usable by people.[K3]	
SPEECH PROCESSING **SUBCODE: R20AI4110** CO1: Create new algorithms with speech processing.[K4] CO2: Derive new speech models.[K4] CO3: Perform various language phonetic analysis.[K3] CO4: Create a new speech identification system.[K5] CO5: Generate a new speech recognition system.[K3]	

BUSINESS MANAGEMENT CONCEPTS FOR ENGINEERS **SUBCODE: R20CC4101** CO1: Summarze fundamentals of Managerial economics for decision making (K2). CO2: Apply conceTpts of Financial Accounting and BEP for business decisions (K3). CO3: Evaluate fundamental concepts and principles of management (K5). CO4: Discuss functional areas of management like HR, marketing and finance (K6). CO5: Apply project management techniques for project planning and evaluation (K3).	
ENTREPRENEURSHIP AND INNOVATION **SUBCODE: R20CC4117** CO1 : Outline the concepts of Entrepreneurship.[K2] CO2 : Create the awareness on creativity and innovation.[K6] CO3 : Adopt the Entrepreneurship Development programs[K6] CO4 : Evaluate the project planning and feasibility studies.[K5] CO5 : Analyze the concept of small and micro enterprises.[K4]	
AGILE WITH SCRUM (SOC) **SUBCODE: R20CC41L1** CO1: Summarize awareness of scrum with Jira software [K2] CO2: Apply step-by-step instructions on how to drive a scrum project. [K3] CO3: Develop scrum project with sprints. [K3]	

R23-B.TECH. (IT)-COURSEOUTCOMES

I B.TECH

I SEMSTER	II SEMSTER
INEAR ALGEBRA & CALCULUS CODE: R23CC1101 CO1: Solve the system of linear equations and transformations. CO2: Analyze the applications of matrices in various fields and obtain Eigen values and Eigenvectors. CO3: Analyze mean value theorems to real life problems CO4: Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering CO5: Identify the area and volume by interlinking them to appropriate double and triple integrals.	**DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS CODE : R23CC1201** CO 1: Solve first order ordinary differential equations to real life situations. CO 2: Identify and apply suitable methods in solving the higher order differential equations CO 3: Solve the partial differentiation equations. CO 4: Interpret the physical meaning of different operators as gradient, curl and divergence. CO 5: Estimate the work done against a field, circulation and flux using vector calculus.
INTRODUCTION TO PROGRAMMING CODE :R23CC1102 CO1: Infer the basic concepts of computers, algorithms and Flowcharts. CO2: Develop programs using appropriate control structures. CO3: Write programs using arrays and strings. CO4: Develop programs using structures and pointers. CO5: Make use of functions and file Operations in C programming for a given application.	**COMMUNICATIVE ENGLISH CODE: R23CC1206** CO1: Summarize texts based on the comprehension of the material provided. CO2: Create coherent and well-structured paragraphs, essays, and letters on a range of familiar topics CO3: Use a diverse array of grammatical structures with flexibility, striving to minimize errors. CO4: Use vocabulary adequately and appropriately to express and write on a variety of topics.
ENGINEERING PHYSICS CODE:R23CC1106 CO 1: Analyze the intensity variation of Laser light and it's propagation in optical fibers. CO 2: Familiarize with the basics of crystals and their structures. CO 3: Summarize various types of Magnetic materials and Super conductors. CO 4: Explain the basic concepts of Quantum Mechanics and the band theory of solids. CO 5: Identify the type of semiconductor and smart materials.	**ENGINEERING CHEMISTRY CODE :R23CC1208** CO1:Understand the difference between soft and hard water and why it matters in daily life and industries. CO2:Apply electrochemical principles to real-problems, making informed decisions about materials selection, corrosion mitigation, and energy storage solutions CO3:Analyze the production, properties, and environmental implications of polymers, fuels and biofuels. CO4:Apply the knowledge of diverse engineering materials like composites, refractories, lubricants, and Portland cement, to make material selection and applications. CO5:Apply the Knowledge of various applications to synthesize colloids and characterize nano materials.

BASIC ELECTRICAL & ELECTRONICS ENGINEERING CODE :R23CC1107 CO1: Explain the fundamental laws and concept of DC and AC circuits. CO2: Demonstrate the working and operating principles of electrical machines, measuring instruments. CO3: Demonstrate the working and operating principles of different power generation stations. CO4: Calculate electrical load, electricity bill of residential and commercial buildings and safety measures. CO1: Describe the working of diode and explore the operation of BJT and its applications. CO2: Describe the working of Rectifiers and amplifiers in electronic circuits. CO3: Manipulate numeric information in different forms, various codes such as ASCII, Gray, and BCD, simple Boolean expressions and Boolean Theorems CO4: Design and analyse combinational circuits, sequential circuits, flip flops Registers and Counters.	**ENGINEERING MECHANICS CODE: R23CC1209** CO 1: Apply the principles of mechanics to determine the resultant of several concurrent Forces acting on a particle. CO 2: Analyze the trusses using method of joints and method of sections; apply the basic Concepts of dry friction and wedges. CO 3: Solve the centroid and centre of gravity bodies and composite sections. CO 4: Solve the Area Moment of Inertia and Mass Moment of Inertia of areas bodies and Composite sections. CO 5: Apply the work- energy principle to particles and connected systems for engineering Applications.
ENGINEERING GRAPHICS CODE : R23CC1108 CO1: Construct the principles of engineering drawing, including engineering curves, scales, Orthographic and isometric projections. CO2: Construct orthographic projections of points, lines, planes and solids in front,top and Side views. CO3: Analyze and draw projection of solids in various positions in first Quadrant. CO4: Develop the sections of Solids & Development of Surfaces. CO5: Compare & Draw isometric Views & Orthographic Views.	**BASIC CIVIL AND MECHANICAL ENGINEERING CODE: R23CC1212** CO1: Acquire knowledge on various sub-divisions of Civil Engineering and to appreciate their role inensuring better society. CO2: Apply the concepts of surveying to calculate distances, anglesand levels. CO3: Realize the importance of transportation in nation's economy and to identify the importance of Water Storage and Conveyance Structures. CO1: Illustrate the role of mechanical engineering and its technologies in various sectors and knowledge of engineering materials. CO2: Explain the basics of various manufacturing processes and thermal engineering and its applications. CO3: Describe the working of different powerplants, mechanical power transmission systems and basics of robotics and its applications.
COMPUTER PROGRAMMING LAB CODE:R23CC11L1 CO1: Analyze and trace the execution of programs written in C language CO2: Implement programs with appropriate control structures for solving the problems CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers CO4: Code, Debug and Execute programs to demonstrate the applications of arrays, functions, files and various other concepts in C.	**ENGINEERING WORKSHOP CODE: R23CC12L9** CO1: Identify workshop tools and their operational capabilities. CO2: Make manufacturing of components using workshop trades including fitting, carpentry, foundry, welding and Plumbing. CO3: Apply fitting operations in various applications. CO4: Apply basic electrical engineering knowledge for House Wiring Practice.

IT WORKSHOP CODE:R23CC11L5 CO1: Identify Hardware components and inter dependencies. CO2: Utilize Antivirus s/w to safeguard computer systems while using Internet CO3: Develop a Document or Presentation CO4: Make use of spreadsheets to perform calculations CO5: Utilize the AI Tool Chat GPT	**ENGINEERING MECHANICS LAB CODE: R23ME12L7** CO1 : Evaluate the coefficient of friction between two different surfaces and the roller. CO2 : Apply Law of Polygon of forces and Law of Moment using force polygon. CO3 : Determine the Centre of gravity and Moment of Inertia of different configurations. CO4 : Solve the equilibrium conditions of a rigid body under the action of different force systems.
ENGINEERING PHYSICS LAB CODE: R23CC11L6 CO: 1 Operate optical instruments like travelling microscope and spectrometer CO: 2 Estimate the wavelengths of different colors using diffraction grating. CO: 3 Plot the intensity of the magnetic field of circular coil carrying current with distance. CO: 4 Calculate the band gap of a given semiconductor.	**ENGINEERING CHEMISTRY LAB CODE: R23CC12L11** CO 1: Develop and perform analytical chemistry techniques to address the water related problems. CO 2: Determine the strength of an acid, cell constant, potentials and conductance of solutions. CO 3: Prepare advanced polymer Bakelite and nanomaterials. CO 4: Explain the functioning of different analytical instruments
EEE WORKSHOP CODE :R23CC11L7 CO1: Measure voltage, current and power in an electrical circuit. CO2: Measure of Resistance using Wheatstone bridge CO3: Discover critical field resistance and critical speed of DC shunt generators. CO4: Investigate the effect of reactive power and power factor in electrical loads. CO1: Analyze the characteristics of various electronic components. CO2: Implement Rectifiers circuits. CO3: Design Amplifiers circuit. CO4: Examine the operation of Logic gates.	**COMMUNICATIVE ENGLISH LAB CODE : R23CC12L12** CO 1: Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning. CO 2: Create a compelling resume, cover letter and Sop. CO 3: Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts. CO 4: Apply employability skills to confidently navigate job interviews
NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE SCODE :R23CC11MC2 CO1: Understand the importance of discipline, character and service motto. CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques. CO3: Explore human relationships by analyzing social problems. CO4: Determine to extend their help for the fellow beings and downtrodden people. CO5: Develop leadership skills and civic responsibilities	**HEALTH AND WELLNESS, YOGA AND SPORTS CODE: R23CC12MC1** CO 1: Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning. CO 2: Create a compelling resume, cover letter and Sop. CO 3: Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts. CO 4: Apply employability skills to confidently navigate job interviews.

R23-B.TECH. (IT)-COURSEOUTCOMES

II B.TECH

I SEMSTER	II SEMSTER
DISCRETE MATHEMATICS & GRAPH THEORY: R23CC2101 **CO1:** Apply the logical statements, connectivity among the statements and different types of normal forms.[K3] **CO2:** Analyze the operations, properties and functions of sets.[K4]. **CO3:** Solve mathematical problems with recurrence relations using different methods. [K3]. **CO4:** Classify the types of graphs to formulate and solve computational problems.[K4].	**OPTIMIZATION TECHNIQUES: R23CC2208** **CO1. Formulate** the optimization problem, without and with constraints, by using design variables from an engineering design problem. **CO2. Apply** classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution. **CO3.** Apply and Solve transportation and assignment problem by using Linear programming Simplex method. **CO4. Apply** gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions **CO5. Formulate** Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.
UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY: R23CC2102 **CO1:** Analyze various Value Education methods .[K2] **CO2:** Compare and Contrast various types of Harmony in the Human Being.[K4] **CO3:** Compare and Contrast various types of Harmony in the Family and Society [K4] **CO4:** Compare and Contrast various types of Harmony in the Nature/Existence. [K4] **CO5:** Analyze the various consequences of professional ethics. [K2]	**PROBABILITY AND STATISTICS: R23CC2202** **CO1:**.Classify the concepts of data science and its importance [K2]. **CO2:** Interpret the association of characteristics and through correlation and regression tools [K4] **CO3:** Apply discrete and continuous probability distributions [K3] **CO4:** Design the components of a classical hypothesis test [K3] **CO5:** Infer the statistical inferential methods based on small and large sampling tests [K4].
DIGITAL LOGIC & COMPUTER ORGANIZATION: R23CC2103 **CO1:** Analyze the data representation and digital logic circuits. [K4] **CO2:** Analyze the basic structure of computers.[K4] **CO3:** Analyze the computer arithmetic algorithms [K4] **CO4:** Analyze the processor, memory and input-output organizations.[K4]	**OPERATING SYSTEMS: R23CC2203** **CO 1:** Classify various operating system generations, functions and services. [K2] **CO 2:** Analyze process scheduling, management and synchronization. [K4] **CO 3:** Analyze deadlock prevention, detection, avoidance and recovery techniques [K4] **CO 4:** Analyze various memory management and storage management techniques [K4]. **CO 5:** Analyze the concepts of file system [K2]
ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS: R23CC2104 **CO1:** Apply asymptotic notations to measure the performance of algorithms. [K3] **CO2:** Apply divide and conquer paradigm when an algorithmic design situation calls for it.[K3] **CO3:** Construct greedy algorithms and dynamic programming techniques to solve problems.[K3] **CO4:** Utilize backtracking and branch and bound algorithms to solve combinatorial problems K3] **CO5:** Classify computational problems into NP, NP-Hard, and NP-Complete.[K4]	**DATABASE MANAGEMENT SYSTEMS: R23CC2204** **CO 1:** Interpret the fundamentals of DBMS. [K2] **CO 2:** Analyze relational database designing. [K4] **CO 3:** Develop queries in RDBMS [K3] **CO 4:** Analyze database design methodology and normalization process [K4]. **CO 5:** Analyze transaction concepts and File indexing. [K2]

OBJECT ORIENTED PROGRAMMING THROUGH JAVA: R23CC2105 **CO1:** Interpret the syntax and semantics of java programming language and OOPs concepts. [K2] **CO2:** Make use of different predefined classes, packages and interfaces, develop programs using OOPs concepts. [K3] **CO3:** Apply exception handling and FILE I/O operations in java programming. [K3] **CO4:** Make use of Multithreading and String handling Functions to develop java programs. [K3] **CO5:** Make use of Java FX and Event-Handling to in the design of GUI Applications. [K3]	**SOFTWARE ENGINEERING: R23CC2205** **CO 1:** Analyze Software Life Cycle models. [K4] **CO 2:** Analyze the importance of software requirement and project management [K4] **CO 3:** Analyze various types of software design techniques [K4] **CO 4:** Analyze Software testing and quality management [K4]. **CO 5:** Analyze various CASE tools and software maintenance process models. [K4]
ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS LAB: R23CC21L1 **CO1:** Analyze different operations of tree traversal techniques. [K4] **CO2:** Analyze time complexity of algorithms to solve problems on graph [K4] **CO3**: Apply divide and conquer approaches for sorting the given elements [K3] **CO4**: Analyze the complexity of algorithms to evaluate the efficiency and effectiveness of greedy, dynamic programming, backtracking branch and bound techniques. [K4]	**OPERATING SYSTEMS & SOFTWARE ENGINEERING LAB: R23IT22L4** **CO 1:** Experiment with various Unix Commands and system calls [K3] **CO 2:** Experiment with various operating system concepts such as scheduling algorithms, page replacement algorithms. IPC mechanism, memory allocation, file allocation and handling deadlocks.[K3] **CO 3:** Design various S/W applications using E-R diagrams, DFD, CFD, Structured charts UML diagrams etc and estimate the effort using COCOMO model and FP oriented estimation model.[K5] **CO 4:** Design the test cases for e-Commerce and Mobile applications[K5]
OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB: R23CC21L2 **CO1**: Develop Java program, by using OOP concepts. [K3] **CO2**: Make use of inheritance and interface concepts in Java programs. [K3] **CO3**; Develop java programs using Exception handling and Multithreading concepts. [K3] **CO4**; Develop GUIs with JavaFX and JDBC programs. [K3]	**DATABASE MANAGEMENT SYSTEMS LAB: R23CC22L1** **CO1:** Apply SQL commands like DDL, DML, DCL and Indexing to perform different Database operations [K3]. **CO2:** Develop PL/SQL block statements, control statements and cursors. [K3] **CO3:** Develop PL/SQL programs using functions and procedures. [K3] **CO4:** Develop PL/SQL programs using packages and Triggers. [K3] **CO5:** Develop a Java Program to connect to a database. [K3].
PYTHON PROGRAMMING (SKILL ENHANCEMENT COURSE): R23CC21L3 **CO1:** Make use of control flow statements and functions to develop python programs.[K3]. **CO2:** Develop Python programs using strings, Lists, dictionaries, tuples and sets. [K3]. **CO3:** Develop Python programs on object oriented programming and regular expressions. [K3]. **CO4:** Develop Python programs using NumPy and Pandas. [K3].	**PYTHON WITH DJANGO (SKILL ENHANCEMENT COURSE): R23IT22L2** **CO1:** Develop Web Applications using Python Libraries. [K3] **CO2:** Create applications using MVC architecture, interacting bootstrap, tables, grids and carousels Django.[K5] **CO3:** Crate applications using interacting accounts and authentication on Django.[K5] **CO4:** Create Apps by SQLite with Django.[K5] **CO5:** Develop website and deploy Django web applications on cloud.[K3]

ENVIRONMENTAL STUDIES: R23CC21MC	DESIGN THINKING & INNOVATION: R23CC22L3
CO1: Understand multi-disciplinary nature of environmental studies and Analyze the natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources. L2 **CO2:** Explain the concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web. Explain the biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity L2 **CO3**: Distinguish various attributes of the pollution, their impacts and measures to reduce or control the pollution along with waste management L2 **CO4**: Understand the rainwater harvesting, watershed management, ozonelayer depletion and waste land reclamationL2 **CO5**: Illustrate the causes of population explosion, value education and welfare programmes.	**CO1**: Define the concepts related to design thinking. [K1]. **CO2**: Infer the fundamentals of Design Thinking and innovation. [K2]. **CO3**: Apply the design thinking techniques for solving problems various sectors. [K3]. **CO4:** Analyze to work in a multidisciplinary environment.[K4]. **CO5:** Evaluate the value of creativity. [K4]

R20-B.TECH. (IT)-COURSEOUTCOMES

III B.TECH

I SEMSTER	II SEMSTER
OPERATING SYSTEMS CO 1: Classify various operating system functionalities and generations. [K2] CO 2: Interpret process management and exemplify the process synchronization techniques. [K2] CO 3: Apply various process scheduling algorithms. [K3] CO 4: Distinguish various memory management techniques and apply various deadlock techniques. [K4] CO 5: Compare and contrast various disk scheduling algorithms and can interpret the file system implementations. [K2]	**MACHINE LEARNING** CO 1: Summarize the characteristics of Machine learning that make it useful to real-world Problems. [K2] CO 2: Outline the need and importance of preprocessing techniques and apply them. [K2] CO 3: Evaluate and compare the performance of different unsupervised algorithms for typical learning problems and apply them. [K5] CO 4: Analyze the performance of Association Rules. [K4] CO 5: Evaluate and compare the performance of different supervised algorithms for typical learning problems and apply them. [K5]
AUTOMATA AND COMPILER DESIGN CO1: Summarize the concept of Automata and Construct Finite Automata Machines to recognize the languages. [K3] CO2: Ability to implement practical aspects of automata theory. [K4] CO3: Analyze Different parsing techniques and should be position to solve the problems. [K3] CO4: Ability to design of a compiler given features of the languages. [K3] CO5: Analyze the program and minimize the code by using optimizing techniques which helps in reducing the no. of instructions in a program. [K3]	**AGILE METHODOLOGIES** CO1: Realize the importance of interacting with business stakeholders in determining the requirements for a software system CO2: Perform iterative software development processes: how to plan them, how to execute them. CO3: Point out the impact of social aspects on software development success. CO4: Develop techniques and tools for improving team collaboration and software quality. CO5: Perform Software process improvement as an ongoing task for development teams. CO6: Show how agile approaches can be scaled up to the enterprise level.
ADVANCED WEB TECHNOLOGIES CO 1: Interpret Servlet Life Cycle and web servers. [K2] CO 2: Illustrate JSP Life cycle. [K2] CO 3: Apply Session Management for JSP applications. [K3] CO 4: Illustrate the usage of JDBC in JSP applications. [K2] CO 5: Make use of PHP for the development of web-based applications. [K3] CO 6: Utilize JDBC in PHP web-based applications. [K3]	**CRYPTOGRAPHY&NETWORK SECURITY** CO 1: Summarize the fundamentals of Cryptography. [K2] CO 2: Analyze how security is achieved, and attacks can be countered by using symmetric/asymmetric algorithms. [K4] CO 3: Apply Number Theoretic concepts in developing cryptographic algorithms to counter attacks. [K3] CO 4: Interpret the role of hash functions and Digital Signatures in Information Security.[K2] CO 5: Compare different CO 6: Illustrate the use of encryption techniques to secure data in transit across data networks. [K2] network security designs using available secure solutions. [k2]
DATA WAREHOUSING AND DATA MINING CO 1: Interpret the data mining terminology and types of data to be mined. [K2]	**BIG DATA ANALYTICS** CO 1: Interpret the architectural elements of big data and Hadoop framework. [K2] CO 2: Analyse

CO 2: Outline the need and importance of preprocessing techniques and apply them.[K2] CO 3: Interpret data warehousing concepts and operations. [K2] CO 4: Compare and contrast different dominant Data Mining Algorithms for Classification and Clustering and apply them. [K4] CO 5: Analyze the performance of Association Rules. [K4]	various big data applications using map reduce programming module. [K4] CO 3: Analyse Spark capabilities such as distributed datasets, in-memory caching, and the interactive shell. [K4] CO 4: Summarize Spark's powerful built-in libraries, including Spark SQL, Spark Streaming. [K2] CO 5: Analyze Hadoop data with PIG and Hive. Interpret the applications and architecture of Mobile Computing and multiplexing techniques. [K4]
COMPUTER GRAPHICS CO 1: Summarize graphics applications, architectures, and open GL program structure. [k2] CO 2: Apply basic transformations on objects. [k3] CO 3: Apply line and polygon clipping algorithms.[k3] CO 4: Identify different projections. [k3] CO 5: Design interactive programs using OpenGL. [k6]	**DESIGN PATTERNS** CO1 Construct a design consisting of a collection of modules. [K4] CO2 Exploit well-known design patterns. [K4] CO3 Distinguish between different categories of design patterns. [K4] CO4 Apply common design patterns to incremental/iterative development. [K3] CO5 Identify appropriate patterns for design of given problem. [K3]
SOFTWARE TESTING METHODOLOGY CO 1: Outline the software testing terminology. [K2] CO 2: Compare and contrast various behavioral testing methodologies. [K2] CO 3: Summarize various dynamic testing techniques. [K2] CO 4: Summarize the importance of validation activities. [K2] CO 5: Interpret software testing and quality management. [K2]	**MOBILE COMPUTING** CO 1: Interpret the applications and architecture of Mobile Computing and multiplexing Techniques. [K2] CO 2: Analyze the Mobile IP issues. [K4] CO 3: Analyze the various Mobile TCP Variants. [K4] CO 4: Analyze the various routing protocols in MANET. [K4]
NOSQL DATABASE SYSTEMS CO1: Identify what type of NoSQL database to implement based on business Requirements.[K2] CO2: Apply NoSQL data modeling from application specific queries.[K3] CO3: Use Atomic Aggregates and denormalization as data modelling techniques to Optimize q overprocessing.[K2]	**MACHINE LEARNING LAB** CO 4: Analyse exploratory data analysis. [K4] CO 5: Analyze the real word datasets presented in different formats using python libraries to Perform exploratory data analysis.[K4] CO 6: Apply the machine learning algorithms on various real time data sets. [K3] CO 7: Analyze the data by using visualization tools or libraries. [K4]

ADVANCED WEB TECHNOLOGIES LAB CO 1: Experiment with the installation of Web Servers. [K3] CO 2: Make use of servlets in dynamic web pages. [K3] CO 3: Develop web applications using JSP for effective data management. [K3] CO 4: Construct the web based applications in PHP using effective data base access with rich client interaction. [K3]	**AGILE LAB** CO1: Summarize the importance of DevOps tools used in software development life cycle.[K2] CO2: Summarize the importance of Jenkins to Build, Deploy and Test Software Applications.[K2] CO3: Examine the different Version Control strategies.[K3] CO4: Analyze& Illustrate the Containerization of OS images and deployment of applications over Docker.[K4] CO5: Synthesize the provisioning using Chef/Puppet/Ansible or Salt stack. [K4]
OS & CN LAB CO1 : Understand fundamental underlying principles of computer networking..[K2]. CO2 : Understand details and functionality of layered network architecture.[K3]. CO3 :. Describe and demonstrate the functions and features of current operating systems [K3]. CO4 : Demonstrate skills that meet industry standards and certification requirements in the use of system hardware, operating systems technologies, and application systems. [K3].	**BIGDATA LAB** CO 1: Experiment with installation of Hadoop and develop applications using MapReduce framework. [K3] CO 2: Experiment with installation of Spark and develop applications. [K3] CO 3: analyze Hadoop data with PIG. [K4] CO 4: Develop NoSQL structures like Hive for processing and aggregating logs in the database. [K3]
ENGLISH EMPLOYABILITY SKILLS (SOC) CO 1: Write effective Resume for employment.. CO 2: Make formal presentations using relevant technical style of communication and appropriate strategies for both academic and professional purpose. CO 3: Participate in Group Discussions using analytical and problem solving skills. CO 4: Face job interviews confidently and enhance employability	**IOT (SOC)** CO 1: Analyze the requirements, specifications to design home automation applications. CO 2: Build smart city applications using Arduino. CO 3: Analyze domain specific applications using Arduino and Raspberry pi. CO 4: Influence the revolution of Internet in Mobile Devices.
ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE CO1: Understand the philosophy of Indian Culture CO2: Know the Indian languages, Epics Ramayana and Mahabharata CO3:Acquire the information about Indian arts and architecture CO4:Know the spread of cultural exchange in abroad CO5:Know the contributions of scientists in different eras	**PROFESSIONAL ETHICS & HUMAN VALUES** CO1:Interpret the fundamentals of Human values. [K2] CO2: Analyse the ethical issues and role of engineers in industry. [K4] CO3: Develop the principles of harmony in value education. [K3] CO4: List out the duties and rights of engineers. [K4] CO5: Summarize the engineer's responsibilities towards safety and risk. [K2]

R20-B.TECH. (IT)-COURSEOUTCOMES

IV B.TECH

I SEMSTER	II SEMSTER
DEEP LEARNING **SUBCODE: R20IT4105** CO 1: Summarize the characteristics of Machine Learning and Deep Learning that make it useful to real-world Problems. [K2] CO 2: Realign high dimensional data using reduction techniques. [K3] CO 3: Analyze optimization and generalization in deep learning. [K4] CO 4: Implement various deep learning models. [K3]	**MAJOR PROJECT** CO1: Acquire practical knowledge within the chosen area of technology for project development. CO2: Identify, analyze, formulate and handle programming projects with a comprehensive and systematic approach.
NATURAL LANGUAGE PROCESSING **SUBCODE: R20CC4106** CO 1: Describe the concepts of morphology, syntax, semantics, discourse &pragmatics of natural language.[K2] CO 2: Demonstrate understanding of the relationship between NLP and statistics &machine learning.[K2] CO 3: Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis.[K4] CO 4: Develop systems for various NLP problems with moderate complexity. [K4] CO 5: Evaluate NLP systems, identify shortcomings and suggest solutions for these shortcomings.[K4]	
SERVICE ORIENTED ARCHITECTURE **SUBCODE: R20CC4103** CO 1: Summarize primary concepts of SOA. [K2] CO 2: Identify the integration of SOA technological points with Web Services. [K3] CO 3: Implement of SOA in development cycle of Web Services. [K3]	
BLOCK CHAIN TECHNOLOGIES **SUBCODE: R20IT4107** CO 1 : Summarize the fundamentals of Blockchain.[K2] CO 2 :Analyze the working of Blockchain.[K4] CO 3 :Interpret how business can be easily made with Blockchain.[K4] CO 4 : Summarize how Block Chain can be integrated with various current technologies.[K2] CO 5 :Get familiarity about the Blockchain strength in providing solutions.[K3] CO 6 :Investigate and understand the Problems with Blockchain.[K4]	

MEDICAL IMAGE DATA PROCESSING **SUBCODE: R20IT4109** CO1: Analyze the basic principles of Digital Image Processing applied to medical images.[K4] CO2: Apply the different methods of image processing both in the time and transform domains..[K4] CO3: Identify the importance of medical hybrid imaging and its role in different medical applications.[K2] CO4: Apply the Image restoration and Image analysis methods to medical images.[K3] CO5: Formulate the research problems of hybrid and super resolution medical images.[K2]	
DevOps **SUBCODE: R20IT4110** CO 1: Demonstrate the phases of software development life cycle. [K2] CO 2: Outline the basic Fundamentals of DevOps. [K2] CO 3: Adopt the DevOps technology into the project. [K6] CO 4: Evaluate the CI/CD concepts and metrics to track CI/CD practices. [K5] CO 5: Summarize the importance of DevOps maturity models. [K2]	
DATA VISUALIZATION TECHNIQUES **SUBCODE: R20IT4111** CO1:Summarize principles of visual perception[K2] CO2:Apply core skills for visual analysis[K3] CO3:Apply visualization techniques for various data analysis tasks[K3] CO4:Design information dashboard[K4	
BIOMETRIC SECURITY **SUBCODE: R20IT4112** CO1: Implement basic security algorithms required by the biometric system. [K3] CO2: Analyze the vulnerabilities in biometric system and hence be able to design a security Solution. [K4] CO3: Analyze the possible security attacks in complex real time systems and their effective Countermeasures. [K4] CO4: Identify the security issues in the network and resolve it. [K3] CO5: Formulate research problems in the biometric security field. [K6]	
HUMAN COMPUTER INTERACTION SUBCODE: R20IT4102 CO 1: Outline knowledge about user interface design. [K2] CO 2: Summarize the importance of Graphical User Interface. [K2] CO 3: Apply the strategies used in design process. [K3] CO 4: Summarize the importance of screen designing. [K2] CO 5: Apply the various operations of Windows.[K3]	

BUSINESS MANAGEMENT CONCEPTS FOR ENGINEERS SUBCODE: R20CC4101 CO1: Summarize fundamentals of Managerial economics for decision making (K2). CO2: Apply concepts of Financial Accounting and BEP for business decisions (K3). CO3: Evaluate fundamental concepts and principles of management (K5). CO4: Discuss functional areas of management like HR, marketing and finance (K6). CO5: Apply project management techniques for project planning and evaluation (K3).	
ENTREPRENEURSHIP AND INNOVATION SUBCODE: R20CC4117 CO1: Outline the concepts of Entrepreneurship.[K2] CO2: Create the awareness on creativity and innovation.[K6] CO3: Adopt the Entrepreneurship Development programs[K6] CO4: Evaluate the project planning and feasibility studies.[K5] CO5: Analyze the concept of small and micro enterprises.[K4]	
AGILE WITH SCRUM (SOC) SUBCODE: R20IT41L1 CO1: Summarize awareness of scrum with Jira software [K2] CO2: Apply step-by-step instructions on how to drive a scrum project. [K3] CO3: Develop scrum project with sprints. [K3]	

R23-B.TECH. (AIML)-COURSEOUTCOMES

I B.TECH

I SEMSTER	II SEMSTER
LINEAR ALGEBRA & CALCULUS SUB CODE: R23CC1101 CO1: Solve the system of linear equations and transformations. [K3] CO2: Analyze the applications of matrices in various fields and obtain Eigen values and Eigenvectors. [K4] CO3: Utilize mean value theorems to real life problems. [K3] CO4: Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering. [K3] CO5: Identify the area and volume by interlinking them to appropriate double and triple integrals. [K3]	**DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS SUB CODE : R23CC1201** CO 1: First order ordinary differential equations to real life situations. [K3] CO 2: Identify and apply suitable methods in solving the higher order differential equations [K3] CO 3: Solve the partial differentiation equations. [K3] CO4: Interpret the physical meaning of different operators as gradient, curl and divergence. [K3] CO 5: Estimate the work done against a field, circulation and flux using vector calculus. [K5]
INTRODUCTION TO PROGRAMMING SUB CODE : R23CC1102 CO1: Infer the basic concepts of computers, algorithms and Flowcharts [K3]. CO2: Develop programs using appropriate control structures [K3]. CO3: Write programs using arrays and strings [K3]. CO4: Develop programs using structures and pointers. [K3]. CO5: Make use of functions and file Operations in C programming for a given application [K3].	**DATA STRUCTURES SUB CODE : R23CC1202** CO1: Analyze the role of linear data structures in organizing and accessing data efficiently [K4]. CO2: Design, implement, and apply linked lists for dynamic data storage [K6]. CO3: Analyze the implementation of stacks queues and dequeues using arrays and linked lists [K3]. CO4: Identify and implement novel solutions to small scale programming challenges involving data structures such as Graphs and Trees [K3]. CO5: Identify scenarios where hashing is advantageous, and design hash-based solutions forspecific problems [K3].
ENGINEERING PHYSICS SUB CODE: R23CC1106 CO 1: Analyze the intensity variation of Laser light and it's propagation in optical fibers.[K4] CO 2: Familiarize with the basics of crystals and their structures. [K3] CO 3: Summarize various types of Magnetic materials and Super conductors.[K2] CO 4: Explain the basic concepts of Quantum Mechanics and the band theory of solids.[K2] CO 5: Identify the type of semiconductor and smart materials. [K3]	**COMMUNICATIVE ENGLISH SUB CODE: R23CC1206** CO1: Summarize texts based on the comprehension of the material provided. [K3] CO2: Create coherent and well-structured paragraphs, essays, and letters on a range of familiar topics. [K5] CO3: Utilize a diverse array of grammatical structures with flexibility, striving to minimize errors. [K3] CO4: Use vocabulary adequately and appropriately to express and write on a variety of topics. [K3]
BASIC ELECTRICAL & ELECTRONICS ENGINEERING SUB CODE : R23CC1107 CO1: Explore the fundamental laws and concept of DC and AC circuits. [K3] CO2: Demonstrate the working and operating principles of electrical machines, measuring instruments. [K3] CO3: Demonstrate the working and operating principles of different power generation stations. [K3] CO4: Calculate electrical load, electricity bill of residential and commercial buildings and safety measures. [K3]	**CHEMISTRY SUB CODE: R23CC1207** CO 1: Explain the concept of electron delocalization and its importance in chemical bonding. [K2] CO 2: Solve problems and utilize modern materials in practical engineering scenarios. [K6] CO 3: Apply scientific concepts, experimental findings and applications related to electrochemistry. [K3] CO 4: Explore the synthesis of polymers, with specific polymer structures, properties and applications. [K3] CO 5: Summarize the concepts of Instrumental methods. [K2]

ENGINEERING GRAPHICS SUB CODE : R23CC1108 CO1: Construct the principles of engineering drawing, including engineering curves, scales, Orthographic and isometric projections. [K3] CO2: Construct orthographic projections of points, lines, planes and solids in front,top and Side views. [K3] CO3: Analyze and draw projection of solids in various positions in first Quadrant. [K4] CO4: Develop the sections of Solids & Development of Surfaces. [K3] CO5: Compare & Draw isometric Views & Orthographic Views. [K2]	**BASIC CIVIL AND MECHANICAL ENGINEERING SUB CODE: R23CC1212** PART A: BASIC CIVIL ENGINEERING CO1: Acquire knowledge on various sub-divisions of Civil Engineering and to appreciate their role inensuring better society. [K3] CO2: Apply the concepts of surveying to calculate distances, anglesand levels. . [K3] CO3: Realize the importance of transportation in nation's economy and to identify the importance of Water Storage and Conveyance Structures. . [K2] PART B: BASIC MECHANICAL ENGINEERING CO1: Illustrate the role of mechanical engineering and its technologies in various sectors and knowledge of engineering materials. [K2] CO2: Explain the basics of various manufacturing processes and thermal engineering and its applications. [K2] CO3: Describe the working of different powerplants, mechanical power transmission systems and basics of roboticsand its applications. [K3]
COMPUTER PROGRAMMING LAB SUB CODE: R23CC11L1 CO1: Analyze and trace the execution of programs written in C language [K4]. CO2: Implement programs with appropriate control structures for solving the problems [K3]. CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers [K3]. CO4: Code, Debug and Execute programs to demonstrate the applications of arrays, functions, files and various other concepts in C [K3].	**DATA STRUCTURES LAB SUB CODE: R23CC12L1** CO1: Analyze and develop the role of linear data structures in organizing and accessing data efficiently in algorithms [K4]. CO2: Design, implement and apply linked lists for dynamic data storage [K6]. CO3: Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems [K3]. CO4: Apply queue-based algorithms for efficient task scheduling and distinguish between deques and priority queues and apply them appropriately to solve data management challenges [K3]. CO5: Develop hash-based solutions for specific problems [K3].
IT WORKSHOP SUB CODE: R23CC11L5 CO1: Identify Hardware components and inter dependencies [K3]. CO2: Utilize Antivirus s/w to Safe guard computer systems while using Internet [K3]. CO3: Develop a Document or Presentation. CO4: Make use of spreadsheets to perform calculations [K3]. CO5: Utilize the AI Tool Chat GPT [K3].	**ENGINEERING WORKSHOP SUB CODE: R23CC12L9** CO1: Identify workshop tools and their operational capabilities. [K3] CO2: Compare Manufacturing Components used in workshop trades including fitting, carpentry, foundry, welding and Plumbing. [K2] CO3: Apply fitting operations in various applications. [K3] CO4: Apply basic electrical engineering knowledge for House Wiring Practice [K3]

ENGINEERING PHYSICS **LAB SUB CODE:** **R23CC11L6** CO1: Operate optical instruments like travelling microscope and spectrometer. [K3] CO2: Estimate the wavelengths of different colors using diffraction grating. [K2] CO3: Plot the intensity of the magnetic field of circular coil carrying current with distance. [K3] CO4: Calculate the band gap of a given semiconductor. [K3]	**CHEMISTRY** **LAB SUB CODE:** **R23CC12L10** CO 1: Develop and perform analytical chemistry techniques to address the water related problems. [K6] CO 2: Determine the strength of an acid, cell constant, potentials and conductance of solutions. [K5] CO 3: Prepare advanced polymer Bakelite and nanomaterials. [K4] CO 4: Explain the functioning of different analytical instruments. [K3]
EEE **WORKSHOP SUB** **CODE : R23CC11L7** CO1: Measure voltage, current and power in an electrical circuit. [K3] CO2: Measure of Resistance using Wheatstone bridge [K4] CO3: Discover critical field resistance and critical speed of DC shunt generators. [K4] CO4: Investigate the effect of reactive power and power factor in electrical loads. [K5]	**COMMUNICATIVE** **ENGLISH LAB SUB** **CODE: R23CC12L12** CO 1: Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning. [K3] CO 2: Create a compelling resume, cover letter and Sop. [K6] CO 3: Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts. [K3] CO 4: Apply employability skills to confidently navigate job interviews. [K3]
NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE **SUB CODE : R23CC11MC2** CO1: Understand the importance of discipline, character and service motto. [K3] CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques. [K6] CO3: Explore human relationships by analyzing social problems. [K4] CO4: Determine to extend their help for the fellow beings and downtrodden people. [K5] CO5: Develop leadership skills and civic responsibilities. [K6]	**HEALTH AND WELLNESS, YOGA AND SPORTS SUB CODE:** **R23CC12MC1** CO1: Understand the importance of yoga and sports for Physical fitness and sound health. [K2] CO2: Demonstrate an understanding of health-related fitness components. [K2] CO3: Compare and contrast various activities that help enhance their health. [K2] CO4: Assess current personal fitness levels. [K5] CO5: Develop Positive Personality. [K6]

R23-B.TECH. (CSE(AIML)-COURSE OUTCOMES

II-B.TECH

I SEMSTER	II SEMSTER
DISCRETE MATHEMATICS & GRAPH THEORY: R23CC2101 **CO1:** Apply the logical statements, connectivity among the statements and different types of normal forms.[K3] **CO2:** Analyze the operations, properties and functions of sets.[K4]. **CO3:** Solve mathematical problems with recurrence relations using different methods. [K3]. **CO4:** Classify the types of graphs to formulate and solve computational problems.[K4].	**OPTIMIZATION TECHNIQUES: R23CC2208** **CO1. Formulate** the optimization problem, without and with constraints, by using design variables from an engineering design problem. **CO2. Apply** classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution. **CO3.** Apply and Solve transportation and assignment problem by using Linear programming Simplex method. **CO4. Apply** gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions **CO5. Formulate** Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.
UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY: R23CC2102 **CO1:** Analyze various Value Education methods .[K2] **CO2:** Compare and Contrast various types of Harmony in the Human Being.[K4] **CO3:** Compare and Contrast various types of Harmony in the Family and Society [K4] **CO4:** Compare and Contrast various types of Harmony in the Nature/Existence. [K4] **CO5:** Analyze the various consequences of professional ethics. [K2]	**PROBABILITY AND STATISTICS: R23CC2202** **CO1:**.Classify the concepts of data science and its importance [K2]. **CO2:** Interpret the association of characteristics and through correlation and regression tools [K4] **CO3:** Apply discrete and continuous probability distributions [K3] **CO4:** Design the components of a classical hypothesis test [K3] **CO5:** Infer the statistical inferential methods based on small and large sampling tests [K4].
ARTIFICIAL INTELLIGENCE:R23CC2106 **CO1:**Analyze and Design Intelligent Agents[K4] **CO2:** Apply Search Algorithms to Problem Solving[K3] **CO3:** Apply techniques for Constraint propagation and reasoning under uncertainty[K3] **CO4:** Utilize inductive learning decision trees, and explanation-based learning for Learning from observation[K3] **CO5:** Analyze and computer typical expert systems such as MYCIN, DART, and XCON[K4]	**MACHNIE LEARNING : R23CC2206** **CO1:**Analyze and Design Intelligent Agents[K4] **CO2:** Apply Search Algorithms to Problem Solving[K3] **CO3:** Apply techniques for Constraint propagation and reasoning under uncertainty[K3] **CO4:** Utilize inductive learning decision trees, and explanation-based learning for Learning from observation[K3] **CO5:** Analyze and computer typical expert systems such as MYCIN, DART, and XCON[K4]
ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS: R23CC2104 **CO1:** Apply asymptotic notations to measure the performance of algorithms. [K3] **CO2:** Apply divide and conquer paradigm when an algorithmic design situation calls for it.[K3] **CO3:** Construct greedy algorithms and dynamic programming techniques to solve problems.[K3] **CO4:** Utilize backtracking and branch and bound algorithms to solve combinatorial problems K3] **CO5:** Classify computational problems into NP, NP-Hard, and NP-Complete.[K4]	**DATABASE MANAGEMENT SYSTEMS: R23CC2204** **CO1:** Interpret the fundamentals of DBMS. [K2] **CO2:** Analyze relational database designing. [K4] **CO3:** Develop queries in RDBMS [K3] **CO4:** Analyze database design methodology and normalization process [K4]. **CO 5:** Analyze transaction concepts and File indexing. [K2]

OBJECT ORIENTED PROGRAMMING THROUGH JAVA: R23CC2105 **CO1:** Interpret the syntax and semantics of java programming language and OOPs concepts. [K2] **CO2:** Make use of different predefined classes, packages and interfaces, develop programs using OOPs concepts. [K3] **CO3:** Apply exception handling and FILE I/O operations in java programming. [K3] **CO4:** Make use of Multithreading and String handling Functions to develop java programs. [K3] **CO5:** Make use of Java FX and Event-Handling to in the design of GUI Applications. [K3]	**DIGITAL LOGIC & COMPUTER ORGANIZATION: R23CC2207** **CO1:** Analyze the data representation and digital logic circuits. [K4] **CO2:** Analyze the basic structure of computers.[K4] **CO3:** Analyze the computer arithmetic algorithms [K4] **CO4:** Analyze the processor, memory and input-output organizations.[K4]
ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS LAB: R23CC21L1 **CO1:** Analyze different operations of tree traversal techniques. [K4] **CO2:** Analyze time complexity of algorithms to solve problems on graph [K4] **CO3**: Apply divide and conquer approaches for sorting the given elements [K3] **CO4**: Analyze the complexity of algorithms to evaluate the efficiency and effectiveness of greedy, dynamic programming, backtracking branch and bound techniques. [K4]	**AI&ML LAB :R23AM22L5** **CO1:** Analyze the use of the Pandas library to create and manipulate Series and Data Frames. [K4] **CO2:** Develop various search algorithms in Python. [K3] **CO3:** Apply preprocessing techniques for preparing datasets for machine learning process. [K3] **CO4:** Develop machine learning models using algorithms. [K3]
OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB: R23CC21L2 **CO1**: Develop Java program, by using OOP concepts. [K3] **CO2**: Make use of inheritance and interface concepts in Java programs. [K3] **CO3**; Develop java programs using Exception handling and Multithreading concepts. [K3] **CO4**; Develop GUIs with JavaFX and JDBC programs. [K3]	**DATABASE MANAGEMENT SYSTEMS LAB: R23CC22L1** **CO1:** Apply SQL commands like DDL, DML, DCL and Indexing to perform different Database operations [K3]. **CO2:** Develop PL/SQL block statements, control statements and cursors. [K3] **CO3:** Develop PL/SQL programs using functions and procedures. [K3] **CO4:** Develop PL/SQL programs using packages and Triggers. [K3] **CO5:** Develop a Java Program to connect to a database. [K3].
PYTHON PROGRAMMING (SKILL ENHANCEMENT COURSE): R23CC21L3 **CO1:** Make use of control flow statements and functions to develop python programs.[K3]. **CO2:** Develop Python programs using strings, Lists, dictionaries, tuples and sets. [K3]. **CO3:** Develop Python programs on object oriented programming and regular expressions. [K3]. **CO4:** Develop Python programs using NumPy and Pandas. [K3].	**FULL STACK DEVELOPMENT – 1 (SKILL ENHANCEMENT COURSE): R23CC22L2** **CO1:** Develop static html pages by using HTML5 elements and attributes. [K3]. **CO2:** Construct a static html pages by using Cascading Style Sheets [K3]. **CO3:** Build webpages using Java Script [K3]. **CO4:** Develop a Web pages Using jQuery [K3]
	DESIGN THINKING & INNOVATION: R23CC22L3 **CO1**: Define the concepts related to design thinking. [K1]. **CO2**: Infer the fundamentals of Design Thinking and innovation. [K2]. **CO3**: Apply the design thinking techniques for solving problems various sectors. [K3]. **CO4:** Analyze to work in a multidisciplinary environment.[K4]. **CO5:** Evaluate the value of creativity. [K4]

	ENVIRONMENTAL STUDIES: R23CC22MC **CO1:** Understand multi-disciplinary nature of environmental studies and Analyze the natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources. L2 **CO2:** Explain the concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web. Explain the biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity L2 **CO3**: Distinguish various attributes of the pollution, their impacts and measures to reduce or control the pollution along with waste management L2 **CO4**: Understand the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamationL2 **CO5**: Illustrate the causes of population explosion, value education and welfare programmes.

R23-B.TECH. (CSE(AIML)-COURSE OUTCOMES

III-B.TECH

I SEMSTER	II SEMSTER
PRINCIPLES OF MACHINE LEARNING: R20CC3110 **CO1:** Analyze practical issues in machine learning application. [K4] **CO2:** Apply decision tree algorithms for appropriate problem domains. [K3] **CO3:** Apply and interpret statistical techniques. [K4] **CO4:** Apply ML techniques to solve classification. [K3] **CO5:**Apply ML techniques to solve regression problems. [K3]	**DEEP LEARNING TECHNIQUES: R20AM3203** **CO1:** Demonstrate the fundamental concepts learning techniques of Artificial Intelligence, Machine Learning and Deep Learning. [K2] **CO2:** Analyze the Neural Network training, various random models.[K4] **CO3:** Apply the Techniques of Kera's, Tensor Flow, Theano and CNTK [K3] **CO4:** Classify the Concepts of CNN and RNN [K2] **CO5:** Analyze Interactive Applications of Deep Learning [K4]
DATA WAREHOUSING AND DATA MINING: R20CC3102 **CO 1:** Interpret the data mining terminology and types of data to be mined. [K2] **CO 2:** Outline the need and importance of pre-processing techniques and apply them.[K2] **CO 3:** Interpret data warehousing concepts and operations. [K2] **CO 4:** Compare and contrast different dominant Data Mining Algorithms for Classification and Clustering and apply them. [K4] **CO 5:** Analyze the performance of Association Rules. [K4]	**DESIGN AND ANALYSIS OF ALGORITHMS: R20CC3208** **CO 1:** Apply asymptotic notations to measure the performance of algorithms [K3] **CO 2:** Apply divide-and-conquer paradigm when an algorithmic design situation calls for it [K3]. **CO 3:** Identify all feasible solutions to get optimal solutions using greedy method [K3]. **CO 4:** Apply dynamic-programming approach, to solve real world problems [K3]. **CO 5:** Analyze fundamental graph traversal techniques to solve various applications using Backtracking, Branch and bound paradigms [K4].
COMPUTER NETWORKS: R20CC3104 **CO1:** Summarize basic concepts of Data Communication and Networking. [K2] **CO2:** Analyse the issues in data link layer. [K4] **CO3:** Interpret data link layer services and multiple access protocols. [K2] **CO4:** Analyse different routing protocols. [K4] **CO5:** Illustrate the essential principles of different transport layer, application layer protocols. [K2]	**SOFT COMPUTING: R20CC3204** **CO1 :** Understand the concepts of uncertainty and evidence in decision-making. [K2] **CO2 :** Differentiate between supervised and unsupervised learning and apply them to realworld problems. [K4] **CO3 :** Apply the structure and functioning of adaptive neural networks. [K3] **CO4 :** Analyze the concept of neuro-fuzzy systems and their advantages. [K4] **CO5 :** Apply the encoding, fitness functions, and reproduction mechanisms in genetic algorithms. [K3]
COMPILER DESIGN: R20CS3105 **CO 1:** Summarize different phases and passes of a compiler. [K2] **CO 2:** Compare and Contrast various Top-Down and Bottom-Up Parsing techniques. [K2] **CO 3:** Interpret different types of Intermediate Code representations. [K2] **CO 4:** Illustrate the effective usage of register allocation and various Code-generation techniques. [K2] **CO 5:** Apply different code-optimization techniques to optimize the target code. .[K3]	**SOFTWARE PROJECT MANAGEMENT: R20AM3205** **CO1 :** Illustrate the conventional software Management and economics [K2] **CO2:** Outline the software life cycle phases and artifacts [K2]. **CO3:** Illustrate the various workflows, check points and iterative process planning [K2]. **CO4:** Analyze the project organizations, responsibilities and control [K4]. **CO5:** Apply project control and process instrumentation methodologies. [K3]
DEVOPS: R20CC3109 **CO1:** Demonstrate the phases of software development life cycle. [K2] **CO2:** Outline the basic Fundamentals of DevOps. [K2] **CO3:** Adopt the DevOps technology into the project. [K6] **CO4:** Evaluate the CI/CD concepts and metrics to track CI/CD practices.	**ARTIFICIAL NEURAL NETWORKS: R20CC3209** **CO1:** Understand comprehension of Artificial Neural Network (ANN) fundamentals, including the structure of ANNs, biological and artificial neurons, and common activation functions used in ANNs. [K2] **CO2:** Apply their knowledge to understand single-layer perceptron's, their role as pattern classifiers, and the limitations of perceptron's in solving complex problems. [K3]

CO5: [K5] Summarize the importance of DevOps maturity models. [K2]	**CO3:** Apply their knowledge to grasp the concepts of multilayer perceptron's, batch and online learning, and the derivation of the back propagation algorithm, including its application in solving problems like the XOR problem. [K3] **CO4:** Analyze the structures of multi-layer feed-forward networks, the back propagation algorithm for training, and the practical and design considerations in implementing feed forward ANNs. [K4] **CO5:** Apply their understanding to perform function approximation, explore techniques like cross-validation and network pruning, and comprehend advanced concepts such as convolutional networks and non-linear filtering in ANN applications. [K3]
COMPUTER VISION: R20AM3101 **CO1 :** Identify basic concepts, terminology, theories, models and methods in the field of computer vision [K2] **CO2 :** Analyze known principles of human visual system [K4] **CO3 :** Analyze basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition [K4] **CO4 :** Analyze and Suggest a design of a computer vision system for a specific problem [K4]	**CRYPTOGRAPHY AND NETWORK SECURITY: R20CC3201** **CO1:** Summarize the fundamentals of Cryptography. [K2] **CO2:** Analyze how security is achieved, and attacks can be countered by using symmetric/asymmetric algorithms. [K4] **CO3:** Apply Number Theoretic concepts in developing cryptographic algorithms to counter attacks. [K3] **CO4 :** Interpret the role of hash functions and Digital Signatures in Information Security.[K2] **CO5:** Illustrate the use of encryption techniques to secure data in transit across data networks. [K2]
HIGH PERFORMANCE COMPUTING: R20CC3103 **CO1 :** Interpret the terminology of high performance computing [K2]. **CO2 :** Make use of MPI based parallel programs in distributed Memory architectures [K2]. **CO3 :** Analyze parallel programs using Pthreads and Open MP [K3]. **CO4 :** Apply OpenMP parallel programming concepts, including reduction clauses. [K3] **CO5 :** Summarize the concept of GP-GPU [K2].	**DISTRIBUTED SYSTEMS: R20AM3207** **CO1:** Outline the benefits of distributed systems. [K2] **CO2:** Interpret synchronization techniques in distributed systems. [K2] **CO3:** Summarize process scheduling techniques, threads and fault tolerance in distributed environments. Analyze various distributed deadlock detection and prevention techniques. [K4] **CO4:** Interpret distributed file system implementations and shared memory. [K2] **CO5 :** Relationship of distributed system functions in MACH. [K4]
MEAN STACK TECHNOLOGIES:R20CC10E17 **CO1 :** Apply Angular8 to develop web applications. [K3] **CO2 :** Make use of Forms and Services. [K3] **CO3 :** Utilize Node.js to create Server Side Applications. [K3] **CO4 :** Make use of Express to deploy web applications. [K3] **CO5 :** Experiment with NoSQL using MongoDB. [K3]	**DIGITAL MARKETING:R20CC20E13** **CO1:** Outline the basic concepts of Digital Marketing. [K2] **CO2:** Analyze different channels of digital marketing according to the changing requirements of the markets. [K4] **CO3:** Construct different digital marking plans on situational basis. **CO4:** Improve Marketing through search engine and online advertising. [K6] **CO5:** Compare different avenues of social media for marketing and advertising products for effective sales. [K4]
MACHINE LEARNING LAB: R20CC31L4 **CO1:** Implement procedures for the machine learning algorithms [K3] **CO2:** Design and Develop Python programs for various Learning algorithms [K6] **CO3:** Apply appropriate data sets to the Machine Learning algorithms [K3] **CO4:** Develop Machine Learning algorithms to solve real world problems [K6] **CO5:** Design and Develop Python programs using	**DEEP LEARNING LAB: R20AM32L1** **CO1 :** Make use of deep learning APIs like Keras [K3] **CO2** : Implement multiple conversions for Analysis [K3] **CO3 :** Apply deep learning techniques for object identification and segmentation [K3] **CO4 :** Implement RNN and CNN for multiple problems [K3] **CO5:** Implement Auto encoders and GAN. [K3]

predefined libraries [K6]	
DATA WAREHOUSING AND DATA MINING LAB : R20CC31L1 **CO 1:** Apply data preprocessing techniques on the given data. [K3] **CO 2:** Construct classification model for the given data. **[K6]** **CO 3:** Identify Association Rules for the given data. [K3] **CO 4:** Apply the clustering techniques on the given data. [K3]	**SOFT COMPUTING LAB :R20AM32L2** **CO1:** Perform set operations, including Union, Intersection, and Complement. [K2] **CO2:** Implement De-Morgan's Law with an application level of understanding. [K5] **CO3:** Capable of plotting various membership functions. [K5] **CO4:** Implement a Fuzzy Inference System (FIS) using a FIS Editor to model and predict tip values based on quality and service parameters. [K5] **CO5:** Implement and fine-tuning fuzzy inference systems. [K5]
MEAN STACK TECHNOLOGIES LAB: R20AM31SC1 **CO1 :** Build a component-based application using Angular components and enhance their functionality using directives.[K3] **CO2 :** Utilize data binding for developing Angular forms and bind them with model data.[K3] **CO3 :** Apply Angular built-in or custom pipes to format the rendered data. [K3] **CO4 :** Develop a single page application by using synchronous or asynchronous Angular routing. [K6] **CO5 :** Make use of MongoDB queries to perform CRUD operations on document database. [K3]	**ARTIFICIAL NEURAL NETWORKS LAB : R20AM32L3** **CO1:** Implement an Artificial Neural Network using the Back-propagation algorithm. [K5] **CO2 :** Analyzing a naïve Bayesian classifier for a training dataset stored as a .CSV file and computing the classifier's accuracy on test datasets.[K4] **CO3 :** Building a single-layer perceptron.[K5] **CO4 :** Construct a multi-layer perceptron to solve the XOR problem, building a network with multiple hidden layers.[K6] **CO5:** Implementing non-linearly separable problems using neural networks [K5].
PROFESSIONAL ETHICS AND HUMAN VALUES : R20CC31MC01 **CO1:** Learn necessary behavioural skills relating to the Ethics at industrial sector and to gain fundamental knowledge [K2]. **CO2:** Acquaint with basic human values, responsibilities and rights of engineers which are very much necessary today [K2]. **CO3:** Equip with knowledge on basics of intellectual property rights and cyber law [K2]. **CO4:** Gain knowledge on the patents, trademark and copy rights [K2].	**ENGLISH EMPLOYABILITY SKILLS : R20CC32SC1** **CO1:** Write effective Resume for employment. **CO2:** Make formal presentations using relevant technical style of communication and appropriate strategies for both academic and professional purpose. **CO3:** Participate in Group Discussions using analytical and problem solving skills. **CO4:** Face job interviews confidently and enhance employability.
	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE: R20CC32MC1 **CO1 :** Interpret the philosophy of Indian Culture [K2].Interpret the Indian languages, Epics **CO2:** Ramayana and Mahabharata [K2]. **CO3:** Analyze the information about Indian arts and architecture [K4]. **CO4:** Analyze the spread of cultural exchange in abroad [K4]. **CO5:** Analyze the contributions of scientists in different eras [K4].

R23-B.TECH. (DS)-COURSEOUTCOMES

I B.TECH

I SEMSTER	II SEMSTER
LINEAR ALGEBRA & CALCULUS SUB CODE: R23CC1101 CO1: Solve the system of linear equations and transformations. [K3] CO2: Analyze the applications of matrices in various fields and obtain Eigen values and Eigenvectors. [K4] CO3: Utilize mean value theorems to real life problems. [K3] CO4: Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering. [K3] CO5: Identify the area and volume by interlinking them to appropriate double and triple integrals. [K3]	**DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS SUB CODE : R23CC1201** CO 1: First order ordinary differential equations to real life situations. [K3] CO 2: Identify and apply suitable methods in solving the higher order differential equations [K3] CO 3: Solve the partial differentiation equations. [K3] CO4: Interpret the physical meaning of different operators as gradient, curl and divergence. [K3] CO 5: Estimate the work done against a field, circulation and flux using vector calculus. [K5]
INTRODUCTION TO PROGRAMMING SUB CODE : R23CC1102 CO1: Infer the basic concepts of computers, algorithms and Flowcharts [K3]. CO2: Develop programs using appropriate control structures [K3]. CO3: Write programs using arrays and strings [K3]. CO4: Develop programs using structures and pointers. [K3]. CO5: Make use of functions and file Operations in C programming for a given application [K3].	**DATA STRUCTURES SUB CODE : R23CC1202** CO1: Analyze the role of linear data structures in organizing and accessing data efficiently [K4]. CO2: Design, implement, and apply linked lists for dynamic data storage [K6]. CO3: Analyze the implementation of stacks queues and dequeues using arrays and linked lists [K3]. CO4: Identify and implement novel solutions to small scale programming challenges involving data structures such as Graphs and Trees [K3]. CO5: Identify scenarios where hashing is advantageous, and design hash-based solutions forspecific problems [K3].
ENGINEERING PHYSICS SUB CODE: R23CC1106 CO 1: Analyze the intensity variation of Laser light and it's propagation in optical fibers.[K4] CO 2: Familiarize with the basics of crystals and their structures. [K3] CO 3: Summarize various types of Magnetic materials and Super conductors.[K2] CO 4: Explain the basic concepts of Quantum Mechanics and the band theory of solids.[K2] CO 5: Identify the type of semiconductor and smart materials. [K3]	**COMMUNICATIVE ENGLISH SUB CODE: R23CC1206** CO1: Summarize texts based on the comprehension of the material provided. [K3] CO2: Create coherent and well-structured paragraphs, essays, and letters on a range of familiar topics. [K5] CO3: Utilize a diverse array of grammatical structures with flexibility, striving to minimize errors. [K3] CO4: Use vocabulary adequately and appropriately to express and write on a variety of topics. [K3]
BASIC ELECTRICAL & ELECTRONICS ENGINEERING SUB CODE : R23CC1107 CO1: Explore the fundamental laws and concept of DC and AC circuits. [K3] CO2: Demonstrate the working and operating principles of electrical machines, measuring instruments. [K3] CO3: Demonstrate the working and operating principles of different power generation stations. [K3] CO4: Calculate electrical load, electricity bill of residential and commercial buildings and safety measures. [K3]	**CHEMISTRY SUB CODE: R23CC1207** CO 1: Explain the concept of electron delocalization and its importance in chemical bonding. [K2] CO 2: Solve problems and utilize modern materials in practical engineering scenarios. [K6] CO 3: Apply scientific concepts, experimental findings and applications related to electrochemistry. [K3] CO 4: Explore the synthesis of polymers, with specific polymer structures, properties and applications. [K3] CO 5: Summarize the concepts of Instrumental methods. [K2]

working and operating principles of electrical machines, measuring instruments. [K3] CO3: Demonstrate the working and operating principles of different power generation stations. [K3] CO4: Calculate electrical load, electricity bill of residential and commercial buildings and safety measures. [K3]	
ENGINEERING GRAPHICS **SUB CODE : R23CC1108** CO1: Construct the principles of engineering drawing, including engineering curves, scales, Orthographic and isometric projections. [K3] CO2: Construct orthographic projections of points, lines, planes and solids in front,top and Side views. [K3] CO3: Analyze and draw projection of solids in various positions in first Quadrant. [K4] CO4: Develop the sections of Solids & Development of Surfaces. [K3] CO5: Compare & Draw isometric Views & Orthographic Views. [K2]	**BASIC CIVIL AND MECHANICAL ENGINEERING SUB CODE: R23CC1212** PART A: BASIC CIVIL ENGINEERING CO1: Acquire knowledge on various sub-divisions of Civil Engineering and to appreciate their role inensuring better society. [K3] CO2: Apply the concepts of surveying to calculate distances, anglesand levels. . [K3] CO3: Realize the importance of transportation in nation's economy and to identify the importance of Water Storage and Conveyance Structures. . [K2] PART B: BASIC MECHANICAL ENGINEERING CO1: Illustrate the role of mechanical engineering and its technologies in various sectors and knowledge of engineering materials. [K2] CO2: Explain the basics of various manufacturing processes and thermal engineering and its applications. [K2] CO3: Describe the working of different powerplants, mechanical power transmission systems and basics of robotics and its applications. [K3]
COMPUTER PROGRAMMING LAB **SUB CODE: R23CC11L1** CO1: Analyze and trace the execution of programs written in C language [K4]. CO2: Implement programs with appropriate control structures for solving the problems [K3]. CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers [K3]. CO4: Code, Debug and Execute programs to demonstrate the applications of arrays, functions, files and various other concepts in C [K3].	**DATA STRUCTURES LAB SUB CODE: R23CC12L1** CO1: Analyze and develop the role of linear data structures in organizing and accessing data efficiently in algorithms [K4]. CO2: Design, implement and apply linked lists for dynamic data storage [K6]. CO3: Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems [K3]. CO4: Apply queue-based algorithms for efficient task scheduling and distinguish between deques and priority queues and apply them appropriately to solve data management challenges [K3]. CO5: Develop hash-based solutions for specific problems [K3].
IT WORKSHOP SUB CODE: R23CC11L5 CO1: Identify Hardware components and inter dependencies [K3]. CO2: Utilize Antivirus s/w to Safe guard computer systems while using Internet[K3]. CO3: Develop a Document or Presentation. CO4: Make use of spreadsheets to perform calculations [K3]. CO5: Utilize the AI Tool Chat GPT [K3].	**ENGINEERING WORKSHOP SUB CODE: R23CC12L9** CO1: Identify workshop tools and their operational capabilities. [K3] CO2: Compare Manufacturing Components used in workshop trades including[K3]. CO3: Develop a Document or Presentation. CO4: Make use of spreadsheets to perform calculations [K3]. CO5: Utilize the AI Tool Chat GPT[K3].

ENGINEERING PHYSICS LAB SUB CODE: R23CC11L6 CO1: Operate optical instruments like travelling microscope and spectrometer. [K3] CO2: Estimate the wavelengths of different colors using diffraction grating. [K2] CO3: Plot the intensity of the magnetic field of circular coil carrying current with distance. [K3] CO4: Calculate the band gap of a given semiconductor. [K3]	**CHEMISTRY LAB SUB CODE: R23CC12L10** CO 1: Develop and perform analytical chemistry techniques to address the water related problems. [K6] CO 2: Determine the strength of an acid, cell constant, potentials and conductance of solutions. [K5] CO 3: Prepare advanced polymer Bakelite and nanomaterials. [K4] CO 4: Explain the functioning of different analytical instruments. [K3]
EEE WORKSHOP SUB CODE : R23CC11L7 CO1: Measure voltage, current and power in an electrical circuit. [K3] CO2: Measure of Resistance using Wheatstone bridge [K4] CO3: Discover critical field resistance and critical speed of DC shunt generators. [K4] CO4: Investigate the effect of reactive power and power factor in electrical loads. [K5]	**COMMUNICATIVE ENGLISH LAB SUB CODE: R23CC12L12** CO 1: Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning. [K3] CO 2: Create a compelling resume, cover letter and Sop. [K6] CO 3: Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts. [K3] CO 4: Apply employability skills to confidently navigate job interviews. [K3]
NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE SUB CODE : R23CC11MC2 CO1: Understand the importance of discipline, character and service motto. [K3] CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques. [K6] CO3: Explore human relationships by analyzing social problems. [K4] CO4: Determine to extend their help for the fellow beings and downtrodden people. [K5] CO5: Develop leadership skills and civic responsibilities. [K6]	**HEALTH AND WELLNESS, YOGA AND SPORTS SUB CODE: R23CC12MC1** CO1: Understand the importance of yoga and sports for Physical fitness and sound health. [K2] CO2: Demonstrate an understanding of health-related fitness components. [K2] CO3: Compare and contrast various activities that help enhance their health. [K2] CO4: Assess current personal fitness levels. [K5] CO5: Develop Positive Personality. [K6]

R23-B.TECH. (DS)-COURSE OUTCOMES

II-B.TECH

I SEMSTER	II SEMSTER
DISCRETE MATHEMATICS & GRAPH THEORY: R23CC2101 **CO1:** Apply the logical statements, connectivity among the statements and different types of normal forms.[K3] **CO2:** Analyze the operations, properties and functions of sets.[K4]. **CO3:** Solve mathematical problems with recurrence relations using different methods. [K3]. **CO4:** Classify the types of graphs to formulate and solve computational problems.[K4].	**OPTIMIZATION TECHNIQUES: R23CC2208** **CO1. Formulate** the optimization problem, without and with constraints, by using design variables from an engineering design problem. **CO2. Apply** classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution. **CO3.** Apply and Solve transportation and assignment problem by using Linear programming Simplex method. **CO4. Apply** gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions **CO5. Formulate** Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.
UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY: R23CC2102 **CO1:** Analyze various Value Education methods .[K2] **CO2:** Compare and Contrast various types of Harmony in the Human Being.[K4] **CO3:** Compare and Contrast various types of Harmony in the Family and Society [K4] **CO4:** Compare and Contrast various types of Harmony in the Nature/Existence. [K4] **CO5:** Analyze the various consequences of professional ethics. [K2]	**STATISTICAL METHODS FOR DATA SCIENCE : R23DS2201** **CO1:** Analyze data and draw conclusion about collection of data and fitting of distributions [K4] **CO2:** Analyzing the testing of hypothesis for Large and Small samples.[K4] **CO3:** Applying skills in problem solving of the regression analysis [K3] **CO4:** Applying the significance of Time Series data in various fields [K3 **CO5:** Understanding the classification using Logistic Regression [K2]
INTRODUCTION TO DATA SCIENCE: R23DS2107 **CO1:** Understand and articulate the foundational concepts of data science, and the overall data science process. [K2] **CO2:** Apply machine learning techniques using Python tools Analyze case studies on predicting malicious URLs and building. [K4] **CO3:** Apply NoSQL databases for managing big data. [K3] **CO4:** Make use of advanced data science tools for graph databases. [K3] **CO5:** Develop interactive dashboards for data visualization. [K3]	**DATA ENGINEERING: R23DS2202** **CO1:** Interpret the fundamental concepts and roles within data engineering. [K2] **CO2:** Analyze the stages and major considerations of the data engineering life cycle. [K4] **CO3:** Analyze data structures and generate data from various source systems. [K4] **CO4:** Evaluate and implement effective data storage and ingestion strategies. [K5] **CO5:** Analyze and optimize data queries and serve data analytics for machine learning. [K4]
ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS: R23CC2104 **CO1:** Apply asymptotic notations to measure the performance of algorithms. [K3] **CO2:** Apply divide and conquer paradigm when an algorithmic design situation calls for it.[K3] **CO3:** Construct greedy algorithms and dynamic programming techniques to solve problems.[K3] **CO4:** Utilize backtracking and branch and bound algorithms to solve combinatorial problems K3] **CO5:** Classify computational problems into NP, NP-	**DATABASE MANAGEMENT SYSTEMS: R23CC2204** **CO 1:** Interpret the fundamentals of DBMS. [K2] **CO 2:** Analyze relational database designing. [K4] **CO 3:** Develop queries in RDBMS [K3] **CO 4:** Analyze database design methodology and normalization process [K4]. **CO 5:** Analyze transaction concepts and File indexing. [K2]

Hard, and NP-Complete.[K4]	
OBJECT ORIENTED PROGRAMMING THROUGH JAVA: R23CC2105 **CO1:** Interpret the syntax and semantics of java programming language and OOPs concepts. [K2] **CO2:** Make use of different predefined classes, packages and interfaces, develop programs using OOPs concepts. [K3] **CO3:** Apply exception handling and FILE I/O operations in java programming. [K3] **CO4:** Make use of Multithreading and String handling Functions to develop java programs. [K3] **CO5:** Make use of Java FX and Event-Handling to in the design of GUI Applications. [K3]	**COMPUTER ORGANIZTION AND ARCHITECTURE: R23DS2203** **CO1:** Demonstrate an understanding of the different number systems, codes and relate postulates of Boolean algebra and minimize combinational functions. [K2] **CO2:** Evaluate and learn different combinational circuits, sequential circuits and able to design them. [K5] CO3: Organize, determine and learns basic structure of components register through language, micro operations and able to write micro programs. [K3] **CO4:** Determine and able to learn micro programme control and central processing unit. [K3] **CO5:** Able to learns the internal organization of computers and able to analyze performance of them. [K4]
DATA SCIENCE LAB: R23DS21L1 **CO1:** Perform various operations on NumPy arrays. [K3] **CO2:** Apply various techniques to extract data from web sources and usage of Pandas for different file formats. [K3] **CO3:** Explore various preprocessing techniques to handle Data Sets. [K3] **CO4:** Draw different types of charts using matplotlib. [K4]	**DATA ENGINEERING LAB: R23DS22L2** **CO1:** Build our Data Engineering Infrastructure **CO2:** Demonstrate Reading and Writing files **CO3:** Build Data Pipelines and integrate with Dashboard **CO4:** Deploy the Data Pipeline in production
OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB: R23CC21L2 **CO1**: Develop Java program, by using OOP concepts. [K3] **CO2**: Make use of inheritance and interface concepts in Java programs. [K3] **CO3**; Develop java programs using Exception handling and Multithreading concepts. [K3] **CO4**; Develop GUIs with JavaFX and JDBC programs. [K3]	**DATABASE MANAGEMENT SYSTEMS LAB: R23CC22L1** **CO1:** Apply SQL commands like DDL, DML, DCL and Indexing to perform different Database operations [K3]. **CO2:** Develop PL/SQL block statements, control statements and cursors. [K3] **CO3:** Develop PL/SQL programs using functions and procedures. [K3] **CO4:** Develop PL/SQL programs using packages and Triggers. [K3] **CO5:** Develop a Java Program to connect to a database. [K3].
PYTHON PROGRAMMING (SKILL ENHANCEMENT COURSE): R23CC21L3 **CO1:** Make use of control flow statements and functions to develop python programs.[K3]. **CO2:** Develop Python programs using strings, Lists, dictionaries, tuples and sets. [K3]. **CO3:** Develop Python programs on object oriented programming and regular expressions. [K3]. **CO4:** Develop Python programs using NumPy and Pandas. [K3].	**EXPLORATORY DATA ANALYSIS USING PYTHON (SKILL DEVELOPMENT COURSE): R23DS22L4** **CO1:** Enumerate the fundamentals of Exploratory Data Analysis. **CO2:** Visualize the data using basic graphs and plots. **CO3:** Apply different Data Transformation Techniques. **CO4:** Summarize the data using descriptive statistics, evaluate and select the best model

	DESIGN THINKING & INNOVATION: R23CC22L3 **CO1**: Define the concepts related to design thinking. [K1]. **CO2**: Infer the fundamentals of Design Thinking and innovation. [K2]. **CO3**: Apply the design thinking techniques for solving problems various sectors. [K3]. **CO4:** Analyze to work in a multidisciplinary environment.[K4]. **CO5:** Evaluate the value of creativity. [K4]
	ENVIRONMENTAL STUDIES: R23CC22MC **CO1:** Understand multi-disciplinary nature of environmental studies and Analyze the natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources. L2 **CO2:** Explain the concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web. Explain the biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity L2 **CO3**: Distinguish various attributes of the pollution, their impacts and measures to reduce or control the pollution along with waste management L2 **CO4**: Understand the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamationL2 **CO5**: Illustrate the causes of population explosion, value education and welfare programmes.

R23-B.TECH. (DS)-COURSE OUTCOMES

III-B.TECH

I SEMSTER	II SEMSTER
OPERATING SYSTEMS: R20CC3101 **CO 1:** Classify various operating system functionalities and generations. [K2] **CO 2:** Interpret process management and exemplify the process synchronization techniques. [K2] **CO 3:** Apply various process scheduling algorithms. [K3] **CO 4:** Distinguish various memory management techniques and apply various deadlock techniques. [K4] **CO 5:** Compare and contrast various disk scheduling algorithms and can interpret the file system implementations. [K2]	**DATA ANALYTICS & VISUALIZATION:R20DS3201** **CO1 :** Interpreting the Importance of Data and its importance [K2] **CO2 :** Illustrating various ANOVA methods and Regression methods [K2] **CO3:** Analyze various data types and visualization types to extract meaningful insights. [K4] **CO4:** Apply visualization techniques to address specific problems using datasets and derive valuable insights, especially for large datasets.[K3] **CO5 :** Make use of Power BI tool for applying various functions. [K3]
BIG DATA ANALYTICS: R20DS3102 **CO 1:** Interpret the architectural elements of big data and Hadoop framework. [K2] **CO 2:** Analyse various big data applications using map reduce programming module. [K4] **CO 3:** Analyse Spark capabilities such as distributed datasets, in-memory caching, and the interactive shell. [K4] **CO 4:** Summarize Spark's powerful built-in libraries, including Spark SQL, Spark Streaming. [K2] **CO 5:** Analyze Hadoop data with PIG and Hive. Interpret the applications and architecture of Mobile Computing and multiplexing techniques. [K4]	**DESIGN AND ANALYSIS OF ALGORITHMS: R20CC3208** **CO 1:** Apply asymptotic notations to measure the performance of algorithms [K3] **CO 2:** Apply divide-and-conquer paradigm when an algorithmic design situation calls for it [K3]. **CO 3:** Identify all feasible solutions to get optimal solutions using greedy method [K3]. **CO 4:** Apply dynamic-programming approach, to solve real world problems [K3]. **CO 5:** Analyze fundamental graph traversal techniques to solve various applications using Backtracking, Branch and bound paradigms [K4].
COMPUTER NETWORKS: R20CC3104 **CO 1:** Summarize basic concepts of Data Communication and Networking. [K2] **CO 2:** Compare and Contrast OSI and TCP/IP reference models. [K2] **CO 3:** Interpret data link layer services and multiple access protocols. [K2] **CO 4:** Analyze different routing protocols. [K4] **CO 5:** Illustrate the essential principles of different transport layer and application protocols. [K2]	**PRINCIPLES OF MACHINE LEARNING: R20DS3202** **CO1:** Analyze practical issues in machine learning application. [K4] **CO2:** Apply decision tree algorithms for appropriate problem domains. [K3] **CO3:** Apply and interpret statistical techniques. [K4] **CO4:** Apply ML techniques to solve classification. [K3] **CO5:** Apply ML techniques to solve regression problems. [K3]
OBJECT ORIENTED ANALYSIS AND DESIGN: R20DS3103 **CO1:** Analyze the nature of complex system and its solutions. [K4] **CO2:** Illustrate & relate the conceptual model of the UML, identify & design the classes and Relationships Analyze &Design Class and Object Diagrams that represent Static Aspects of a Software System and apply basic and Advanced Structural Modeling Concepts for designing real time applications. [K2] **CO3:** Analyze & Design behavioral aspects of a Software System using Use Case, Interaction and Activity Diagrams. [K3] **CO4:** Analyze & Apply techniques of State Chart Diagrams and Implementation Diagrams to model behavioral aspects and Runtime environment of Software Systems. [K4] **CO5:** Analyze & Apply techniques of Architectural modeling. [K4]	**RECOMMENDER SYSTEMS: R20DS3203** **CO1 :** To understand basic techniques and problems in the field of recommender systems [K2] **CO2 :** Evaluate Types of recommender systems: non-personalized, content based, collaborative filtering [K3] **CO3 :** Apply algorithms and techniques to develop Recommender Systems that are widely used in the Internet industry [K3] **CO4:** Apply knowledge based and hybrid recommender systems for designing models. [K3] **CO5 :** To develop state-of-the-art recommender systems [K3]

DEVOPS: R20CC3109 **CO 1:** Demonstrate the phases of software development life cycle. [K2] **CO 2:** Outline the basic Fundamentals of DevOps. [K2] **CO 3:** Adopt the DevOps technology into the project. [K6] **CO 4:** Evaluate the CI/CD concepts and metrics to track CI/CD practices. [K5] **CO 5:** Summarize the importance of DevOps maturity models. [K2]	**WEB DEVELOPMENT USING REACT JS: R20DS3203** **CO1 :** Understand and apply modern JavaScript and ES6 features for web development. [K2] **CO2 :** Analyze and debug React applications, including setting up a React project.[K4] **CO3 :** Create templates and components using JSX in React, demonstrating an understanding of component architecture.[K2] **CO4 :** Proficiently handle forms and routing in React, including dynamic routes and navigation.[K3] **CO5 :** Make use of Redux for state management in React applications, integrating React with Redux.[K3]
SOFTWRE TESTING METHODOLOGIES: R20CC3107 **CO 1:** Outline the software testing terminology. [K2] **CO 2:** Compare and contrast various behavioural testing methodologies. [K2] **CO 3:** Summarize various dynamic testing techniques. [K2] **CO 4:** Summarize the importance of validation activities. [K2] **CO 5:** Interpret software testing and quality management. [K2]	**ETL PRINCIPLES: R20DS3205** **CO1** : Understand the different data structures used in ETL systems, such as flat files, XML data sets, and relational tables, and understand the principles of staging data. [K2] **CO2 :** Apply tools and techniques to build logical data maps, extract data from diverse sources, and integrate heterogeneous data, ensuring data quality and adherence to business rules. [K3] **CO3 :** Apply data quality standards and cleansing techniques to handle data anomalies, design conformed dimensions, and deliver dimension tables for data integrity. [K3] **CO4 :** Analyze different fact table structures, manage indexes, and efficiently load and maintain fact data, optimizing ETL performance.[K4] **CO5 :** Apply ETL operations, including scheduling, migration, and performance optimization, while minimizing risks and enhancing data security, ensuring efficient ETL processes. [K3]
DISTRIBUTED SYSTEMS : R20CS3108 **CO1:** Outline the benefits of distributed systems. [K2] **CO2:** Interpret synchronization techniques in distributed systems. [K2] **CO3:** Summarize process scheduling techniques, threads and fault tolerance in distributed environments. Analyze various distributed deadlock detection and prevention techniques. [K4] **CO4:** Interpret distributed file system implementations and shared memory. [K2] **CO5 :** Relationship of distributed system functions in MACH. [K4]	**ARTIFICIAL NEURAL NETWORKS: R20CC3209** **CO1:** Understand comprehension of Artificial Neural Network (ANN) fundamentals, including the structure of ANNs, biological and artificial neurons, and common activation functions used in ANNs. [K2] **CO2:** Apply their knowledge to understand single-layer perceptrons, their role as pattern classifiers, and the limitations of perceptrons in solving complex problems. [K3] **CO3:** Apply their knowledge to grasp the concepts of multilayer perceptrons, batch and online learning, and the derivation of the back propagation algorithm, including its application in solving problems like the XOR problem. [K3] **CO4:** Analyze the structures of multi-layer feed-forward networks, the back propagation algorithm for training, and the practical and design considerations in implementing feed-forward ANNs. [K4] **CO5:** Apply their understanding to perform function approximation, explore techniques like cross-validation and network pruning, and comprehend advanced concepts such as convolutional networks and non-linear filtering in ANN applications. [K3]
MEAN STACK TECHNOLOGIES:R20CC10E17 **CO1**: Apply Angular8 to develop web applications. [K3]	**DIGITAL MARKETING:R20CC20E13** **CO1:** Outline the basic concepts of Digital Marketing. [K2] **CO2:** Analyze different channels of digital marketing

CO2: Make use of Forms and Services. [K3] **CO3:**Utilize Node.js to create Server Side Applications. [K3] **CO4:** Make use of Express to deploy web applications. [K3] **CO5:** Experiment with NoSQL using MongoDB. [K3]	according to the changing requirements of the markets. [K4] **CO3:** Construct different digital marking plans on situational basis. **CO4:** Improve Marketing through search engine and online advertising. [K6] **CO5:** Compare different avenues of social media for marketing and advertising products for effective sales. [K4]
BIG DATA ANALYTICS LAB: R20DS31L1 **CO 1:** Experiment with installation of Hadoop and develop applications using Map Reduce framework. [K3] **CO 2:** Experiment with installation of Spark and develop applications. [K3] **CO 3:** Analyze Hadoop data with PIG. [K4] **CO 4:** Develop NoSQL structures like Hive for processing and aggregating logs in the database. [K3]	**DATA ANALYTICS & VISUALIZATION LAB: R20DS32L1** **CO1 :** Understand the features and architecture of Tableau.[K2] **CO2:** Analyze different data sources, distinguish between live and extract connections. [K4] **CO3:** Demonstrate comprehension of different products within the Power BI Suite and will be able to install Power BI Desktop. [K3] **CO4:** Apply data transformation techniques, create calculated columns, measures, and perform data summarization, joining data tables, and data hierarchy to prepare data for analysis. [K3] **CO5 :** Apply their knowledge to visualize data using various chart types, tables, and filtering methods in Power BI, allowing them to present data effectively. [K3]
COMPUTER NETWORKS & OPERATING SYSTEMS LAB : R20CC31L2 **CO1:** Implement routing algorithms. [K6] **CO2:** Do the error checking by using CRC polynomials. [K6] **CO3:** Solve the experiments on scheduling Algorithms. **CO4:** Solve the experiments on page replacement Aalgorithms. [K6] **CO5:** Handle the deadlocks, like prevention and detection. [K6]	**MACHINE LEARNING LAB: R20DS32L2** **CO1:** Implement procedures for the machine learning algorithms [K3] **CO2:** Design and Develop Python programs for various Learning algorithms [K6] **CO3:** Apply appropriate data sets to the Machine Learning algorithms [K3] **CO4:** Develop Machine Learning algorithms to solve real world problems [K6] **CO5:** Design and Develop Python programs using predefined libraries [K6]
MEAN STACK TECHNOLOGIES LAB: R20DS31SC1 **CO1:** Build a component-based application using Angular components and enhance their functionality using directives.[K3] **CO2:** Utilize data binding for developing Angular forms and bind them with model data. [K3] **CO3:** Apply Angular built-in or custom pipes to format the rendered data. [K3] **CO4:** Develop a single page application by using synchronous or asynchronous Angular routing. [K6] **CO5:** Make use of Mongo DB queries to perform CRUD operations on document database. [K3]	**REACT JS LAB : R20DS32L3** **CO1:** Creating new React projects, gaining the ability to set up the development environment, project structure, and initial configurations. [K6] **CO2:** Demonstrate the ability to develop React components, including creating data structures, handling data communication, and responding to events, ensuring they can build functional and interactive user interfaces. [K3] **CO3:** Apply CSS styles to react components, ensuring that they can create visually appealing and responsive user interfaces for their web applications. [K4] **CO4:** Make use of React components work together, allowing them to create complex and interactive applications. [K3]
PROFESSIONAL ETHICS AND HUMAN VALUES : R20CC31MC1 **CO1:** Learn necessary behavioural skills relating to the Ethics at industrial sector and to gain fundamental knowledge [K2]. **CO2:** Acquaint with basic human values, responsibilities and rights of engineers which are very much necessary today [K2]. **CO3:** Equip with knowledge on basics of intellectual	**ENGLISH EMPLOYABILITY SKILLS : R2032CC3SC1** **CO1:** Write effective Resume for employment. **CO2:** Make formal presentations using relevant technical style of communication and appropriate strategies for both academic and professional purpose. **CO3:** Participate in Group Discussions using analytical and problem solving skills. **CO4:** Face job interviews confidently and enhance

property rights and cyber law [K2]. **CO4:** Gain knowledge on the patents, trademark and copy rights [K2].	employability.
	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE: R20CC32MC1 **CO1:** Interpret the philosophy of Indian Culture [K2]. **CO2:** Interpret the Indian languages, Epics Ramayana and Mahabharata [K2]. **CO3:** Analyze the information about Indian arts and architecture [K4]. **CO4:** Analyze the spread of cultural exchange in abroad [K4]. **CO5:** Analyze the contributions of scientists in different eras [K4].

R23-B.TECH. (CS)-COURSEOUTCOMES

I B.TECH

I SEMSTER	II SEMSTER
LINEAR ALGEBRA & CALCULUS SUB CODE: R23CC1101 CO1: Solve the system of linear equations and transformations. [K3] CO2: Analyze the applications of matrices in various fields and obtain Eigen values and Eigenvectors. [K4] CO3: Utilize mean value theorems to real life problems. [K3] CO4: Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering. [K3] CO5: Identify the area and volume by interlinking them to appropriate double and triple integrals. [K3]	**DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS SUB CODE : R23CC1201** CO 1: First order ordinary differential equations to real life situations. [K3] CO 2: Identify and apply suitable methods in solving the higher order differential equations [K3] CO 3: Solve the partial differentiation equations. [K3] CO4: Interpret the physical meaning of different operators as gradient, curl and divergence. [K3] CO 5: Estimate the work done against a field, circulation and flux using vector calculus. [K5]
INTRODUCTION TO PROGRAMMING SUB CODE : R23CC1102 CO1: Infer the basic concepts of computers, algorithms and Flowcharts [K3]. CO2: Develop programs using appropriate control structures [K3]. CO3: Write programs using arrays and strings [K3]. CO4: Develop programs using structures and pointers. [K3]. CO5: Make use of functions and file Operations in C programming for a given application [K3].	**DATA STRUCTURES SUB CODE : R23CC1202** CO1: Analyze the role of linear data structures in organizing and accessing data efficiently [K4]. CO2: Design, implement, and apply linked lists for dynamic data storage [K6]. CO3: Analyze the implementation of stacks queues and dequeues using arrays and linked lists [K3]. CO4: Identify and implement novel solutions to small scale programming challenges involving data structures such as Graphs and Trees [K3]. CO5: Identify scenarios where hashing is advantageous, and design hash-based solutions for specific problems [K3].
ENGINEERING PHYSICS SUB CODE: R23CC1106 CO 1: Analyze the intensity variation of Laser light and it's propagation in optical fibers.[K4] CO 2: Familiarize with the basics of crystals and their structures. [K3] CO 3: Summarize various types of Magnetic materials and Super conductors.[K2] CO 4: Explain the basic concepts of Quantum Mechanics and the band theory of solids.[K2] CO 5: Identify the type of semiconductor and smart materials. [K3]	**COMMUNICATIVE ENGLISH SUB CODE: R23CC1206** CO1: Summarize texts based on the comprehension of the material provided. [K3] CO2: Create coherent and well-structured paragraphs, essays, and letters on a range of familiar topics. [K5] CO3: Utilize a diverse array of grammatical structures with flexibility, striving to minimize errors. [K3] CO4: Use vocabulary adequately and appropriately to express and write on a variety of topics. [K3]
BASIC ELECTRICAL & ELECTRONICS ENGINEERING SUB CODE : R23CC1107 CO1: Explore the fundamental laws and concept of DC and AC circuits. [K3] CO2: Demonstrate the working and operating principles of electrical machines, measuring instruments. [K3] CO3: Demonstrate the working and operating principles of different power generation stations. [K3] CO4: Calculate electrical load, electricity bill of residential and commercial buildings and safety measures. [K3]	**CHEMISTRY SUB CODE: R23CC1207** CO 1: Explain the concept of electron delocalization and its importance in chemical bonding. [K2] CO 2:Solve problems and utilize modern materials in practical engineering scenarios. [K6] CO 3: Apply scientific concepts, experimental findings and applications related to electrochemistry. [K3] CO 4: Explore the synthesis of polymers, with specific polymer structures, properties and applications. [K3] CO 5: Summarize the concepts of Instrumental methods. [K2]

working and operating principles of electrical machines, measuring instruments. [K3] CO5: Demonstrate the working and operating principles of different power generation stations. [K3] CO6: Calculate electrical load, electricity bill of residential and commercial buildings and safety measures. [K3]	Solve problems and utilize modern materials in practical engineering scenarios. [K6] CO 6: Apply scientific concepts, experimental findings and applications related to electrochemistry. [K3] CO 7: Explore the synthesis of polymers, with specific polymer structures, properties and applications. [K3] CO 8 : Summarize the concepts of Instrumental methods. [K2]
ENGINEERING GRAPHICS SUB CODE : R23CC1108 CO1: Construct the principles of engineering drawing, including engineering curves, scales, Orthographic and isometric projections. [K3] CO2: Construct orthographic projections of points, lines, planes and solids in front, top and Side views. [K3] CO3: Analyze and draw projection of solids in various positions in first Quadrant. [K4] CO4: Develop the sections of Solids & Development of Surfaces. [K3] CO5: Compare & Draw isometric Views & Orthographic Views. [K2]	**BASIC CIVIL AND MECHANICAL ENGINEERING SUB CODE: R23CC1212** PART A: BASIC CIVIL ENGINEERING CO1: Acquire knowledge on various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society. [K3] CO2: Apply the concepts of surveying to calculate distances, angles and levels. . [K3] CO3: Realize the importance of transportation in nation's economy and to identify the importance of Water Storage and Conveyance Structures. . [K2] PART B: BASIC MECHANICAL ENGINEERING CO1: Illustrate the role of mechanical engineering and its technologies in various sectors and knowledge of engineering materials. [K2] CO2: Explain the basics of various manufacturing processes and thermal engineering and its applications. [K2] CO3: Describe the working of different powerplants, mechanical power transmission systems and basics of robotics and its applications. [K3]
COMPUTER PROGRAMMING LAB SUB CODE: R23CC11L1 CO1: Analyze and trace the execution of programs written in C language [K4]. CO2: Implement programs with appropriate control structures for solving the problems [K3]. CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers [K3]. CO4: Code, Debug and Execute programs to demonstrate the applications of arrays, functions, files and various other concepts in C [K3].	**DATA STRUCTURES LAB SUB CODE: R23CC12L1** CO1: Analyze and develop the role of linear data structures in organizing and accessing data efficiently in algorithms [K4]. CO2: Design, implement and apply linked lists for dynamic data storage [K6]. CO3: Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems [K3]. CO4: Apply queue-based algorithms for efficient task scheduling and distinguish between deques and priority queues and apply them appropriately to solve data management challenges [K3]. CO5: Develop hash-based solutions for specific problems [K3].
IT WORKSHOP SUB CODE: R23CC11L5 CO1: Identify Hardware components and inter dependencies [K3]. CO2: Utilize Antivirus s/w to Safe guard computer systems while using Internet [K3]. CO3: Develop a Document or Presentation. CO4: Make use of spreadsheets to perform	**ENGINEERING WORKSHOP SUB CODE: R23CC12L9** CO1: Identify workshop tools and their operational capabilities. [K3] CO2: Compare Manufacturing Components used in workshop trades including fitting, carpentry, foundry, welding and Plumbing. [K2] CO3: Apply fitting operations in various applications.

calculations [K3]. CO5: Utilize the AI Tool Chat GPT [K3].	[K3] CO4: Apply basic electrical engineering knowledge for House Wiring Practice [K3]
ENGINEERING PHYSICS LAB SUB CODE: R23CC11L6 CO1: Operate optical instruments like travelling microscope and spectrometer. [K3] CO2: Estimate the wavelengths of different colors using diffraction grating. [K2] CO3: Plot the intensity of the magnetic field of circular coil carrying current with distance. [K3] CO4: Calculate the band gap of a given semiconductor. [K3]	**CHEMISTRY LAB SUB CODE: R23CC12L10** CO 1: Develop and perform analytical chemistry techniques to address the water related problems. [K6] CO 2: Determine the strength of an acid, cell constant, potentials and conductance of solutions. [K5] CO 3: Prepare advanced polymer Bakelite and nanomaterials. [K4] CO 4: Explain the functioning of different analytical instruments. [K3]
EEE WORKSHOP SUB CODE : R23CC11L7 CO1: Measure voltage, current and power in an electrical circuit. [K3] CO2: Measure of Resistance using Wheatstone bridge [K4] CO3: Discover critical field resistance and critical speed of DC shunt generators. [K4] CO4: Investigate the effect of reactive power and power factor in electrical loads. [K5]	**COMMUNICATIVE ENGLISH LAB SUB CODE: R23CC12L12** CO 1: Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning. [K3] CO 2: Create a compelling resume, cover letter and Sop. [K6] CO 3: Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts. [K3] CO 4: Apply employability skills to confidently navigate job interviews. [K3]
NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE SUB CODE : R23CC11MC2 CO1: Understand the importance of discipline, character and service motto. [K3] CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques. [K6] CO3: Explore human relationships by analyzing social problems. [K4] CO4: Determine to extend their help for the fellow beings and downtrodden people. [K5] CO5: Develop leadership skills and civic responsibilities. [K6]	**HEALTH AND WELLNESS, YOGA AND SPORTS SUB CODE: R23CC12MC1** CO1: Understand the importance of yoga and sports for Physical fitness and sound health. [K2] CO2: Demonstrate an understanding of health-related fitness components. [K2] CO3: Compare and contrast various activities that help enhance their health. [K2] CO4: Assess current personal fitness levels. [K5] CO5: Develop Positive Personality. [K6]

R23-B.TECH. (CS)-COURSE OUTCOMES

II-B.TECH

I SEMSTER	II SEMSTER
DISCRETE MATHEMATICS & GRAPH THEORY: R23CC2101 **CO1:** Apply the logical statements, connectivity among the statements and different types of normal forms.[K3] **CO2:** Analyze the operations, properties and functions of sets.[K4]. **CO3:** Solve mathematical problems with recurrence relations using different methods. [K3]. **CO4:** Classify the types of graphs to formulate and solve computational problems.[K4].	**MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS: R23CC2201** **CO1:** Analyze the concepts related to Managerial Economics, financial accounting and management [K4]. **CO2:** Interpret the fundamentals of Economics viz., Demand, Production, cost, revenue and markets [K2]. **CO3:** Apply the Concept of Production cost and revenues for effective Business decision[K3] **CO4:** Analyze how to invest their capital and maximize returns [K4] **CO5:** Analyze the capital budgeting techniques. [K4] **CO6:** Examine the accounting statements and evaluate the financial performance of business entity [K4]
UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY: R23CC2102 **CO1:** Analyze various Value Education methods .[K2] **CO2:** Compare and Contrast various types of Harmony in the Human Being.[K4] **CO3:** Compare and Contrast various types of Harmony in the Family and Society [K4] **CO4:** Compare and Contrast various types of Harmony in the Nature/Existence. [K4] **CO5:** Analyze the various consequences of professional ethics. [K2]	**NUMBER THEORY & APPLICATIONS: R23CY2202** **CO1:** Apply the knowledge of GCD and Prime Factorization. [K3] **CO2:** Explain principles on congruence [K2] **CO3:** Develop the knowledge of congruence applications [K3] **CO4:** Make use of finite fields and primality [K3] CO5: Develop various encryption methods and its applications. [k3]
DIGITAL LOGIC & COMPUTER ORGANIZATION: R23CC2103 **CO1:** Analyze the data representation and digital logic circuits. [K4] **CO2:** Analyze the basic structure of computers.[K4] **CO3:** Analyze the computer arithmetic algorithms [K4] **CO4:** Analyze the processor, memory and input-output organizations.[K4]	**OPERATING SYSTEMS: R23CC2203** **CO 1:** Classify various operating system generations, functions and services. [K2] **CO 2:** Analyze process scheduling, management and synchronization. [K4] **CO 3:** Analyze deadlock prevention, detection, avoidance and recovery techniques [K4] **CO 4:** Analyze various memory management and storage management techniques [K4]. **CO 5:** Analyze the concepts of file system [K2]
ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS: R23CC2104 **CO1:** Apply asymptotic notations to measure the performance of algorithms. [K3] **CO2:** Apply divide and conquer paradigm when an algorithmic design situation calls for it.[K3] **CO3:** Construct greedy algorithms and dynamic programming techniques to solve problems.[K3] **CO4:** Utilize backtracking and branch and bound algorithms to solve combinatorial problems K3] **CO5:** Classify computational problems into NP, NP-Hard, and NP-Complete.[K4]	**DATABASE MANAGEMENT SYSTEMS: R23CC2204** **CO 1:** Interpret the fundamentals of DBMS. [K2] **CO 2:** Analyze relational database designing. [K4] **CO 3:** Develop queries in RDBMS [K3] **CO 4:** Analyze database design methodology and normalization process [K4]. **CO 5:** Analyze transaction concepts and File indexing. [K2]

OBJECT ORIENTED PROGRAMMING THROUGH JAVA: R23CC2105 **CO1:** Interpret the syntax and semantics of java programming language and OOPs concepts. [K2] **CO2:** Make use of different predefined classes, packages and interfaces, develop programs using OOPs concepts. [K3] **CO3:** Apply exception handling and FILE I/O operations in java programming. [K3] **CO4:** Make use of Multithreading and String handling Functions to develop java programs. [K3] **CO5:** Make use of Java FX and Event-Handling to in the design of GUI Applications. [K3]	**COMPUTER NETWORKS: R23CY2205** **CO1:** Summarize the basics of Computer Networks and its types. [K2] **CO2:** Illustrate the routing algorithms. [K2] **CO3:** Identify error detection and correction in data link layer. [K3] **CO4:** Explain and formulate IP addresses and subnetting. [K2] **CO5:** Outline the application layer protocols. [K2]
ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS LAB: R23CC21L1 **CO1:** Analyze different operations of tree traversal techniques. [K4] **CO2:** Analyze time complexity of algorithms to solve problems on graph [K4] **CO3**: Apply divide and conquer approaches for sorting the given elements [K3] **CO4**: Analyze the complexity of algorithms to evaluate the efficiency and effectiveness of greedy, dynamic programming, backtracking branch and bound techniques. [K4]	**OPERATING SYSTEMS & COMPUTER NETWORKS LAB: R23CY22L4** **CO1:** Experiment with various Unix Commands and system calls [K3] **CO 2:** Experiment with various operating system concepts such as scheduling algorithms. [K3] **CO3:** Manage and configure network ports, set bandwidth limits, and establish both wired and wireless connections. [K5] **CO4:** Analyze and evaluate network performance using various tools and software. [K4]
OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB: R23CC21L2 **CO1**: Develop Java program, by using OOP concepts. [K3] **CO2**: Make use of inheritance and interface concepts in Java programs. [K3] **CO3**; Develop java programs using Exception handling and Multithreading concepts. [K3] **CO4**; Develop GUIs with JavaFX and JDBC programs. [K3]	**DATABASE MANAGEMENT SYSTEMS LAB: R23CC22L1** **CO1:** Apply SQL commands like DDL, DML, DCL and Indexing to perform different Database operations [K3]. **CO2:** Develop PL/SQL block statements, control statements and cursors. [K3] **CO3:** Develop PL/SQL programs using functions and procedures. [K3] **CO4:** Develop PL/SQL programs using packages and Triggers. [K3] **CO5:** Develop a Java Program to connect to a database. [K3].
PYTHON PROGRAMMING (SKILL ENHANCEMENT COURSE): R23CC21L3 **CO1:** Make use of control flow statements and functions to develop python programs.[K3]. **CO2:** Develop Python programs using strings, Lists, dictionaries, tuples and sets. [K3]. **CO3:** Develop Python programs on object oriented programming and regular expressions. [K3]. **CO4:** Develop Python programs using Nuimpy and Pandas. [K3].	**FULL STACK DEVELOPMENT – 1 (SKILL ENHANCEMENT COURSE): R23CC22L2** **CO1:** Develop static html pages by using HTML5 elements and attributes.[K3]. **CO2:** Construct a static html pages by using Cascading Style Sheets [K3]. **CO3:** Build webpages using Java Script [K3]. **CO4:** Develop a Web pages Using JQuery [K3]
	DESIGN THINKING & INNOVATION: R23CC22L3 **CO1**: Define the concepts related to design thinking. [K1]. **CO2**: Infer the fundamentals of Design Thinking and innovation. [K2]. **CO3**: Apply the design thinking techniques for solving

	problems various sectors. [K3]. **CO4:** Analyze to work in a multidisciplinary environment.[K4]. **CO5:** Evaluate the value of creativity. [K4]
	ENVIRONMENTAL STUDIES: R23CC22MC **CO1:** Understand multi-disciplinary nature of environmental studies and Analyze the natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources. L2 **CO2:** Explain the concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web. Explain the biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity L2 **CO3**: Distinguish various attributes of the pollution, their impacts and measures to reduce or control the pollution along with waste management L2 **CO4**: Understand the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamationL2 **CO5**: Illustrate the causes of population explosion, value education and welfare programmes.

R23-B.TECH. (CS)-COURSE OUTCOMES

III-B.TECH

I SEMSTER	II SEMSTER
CRYPTOGRAPHY AND NETWORK SECURITY: R20CY3101 **CO1:** Summarize the fundamentals of Cryptography. [K2] **CO2:** Analyze how security is achieved, and attacks can be countered by using symmetric/asymmetric algorithms. [K4] **CO3:** Apply Number Theoretic concepts in developing cryptographic algorithms to counter attacks. [K3] **CO4:** Interpret the role of hash functions and Digital Signatures in Information Security.[K2] **CO5 :** Illustrate the use of encryption techniques to secure data in transit across data networks. [K2]	**INTRODUCTION TO CYBER SECURITY: R20CY3201** **CO1**: Interpret Cyber Security architecture principles [K2]. **CO2:** Identifying System and application security threats and vulnerabilities [K3]. **CO3:** Identifying different classes of attacks [K3]. **CO4:** Cyber Security incidents to apply appropriate response [K3]. **CO5:** Describing cyber forensics and digital evidence [K3].
DESIGN AND ANALYSIS OF ALGORITHMS: R20CC3103 **CO 1:** Apply asymptotic notations to measure the performance of algorithms [K3] **CO 2:** Apply divide-and-conquer paradigm when an algorithmic design situation calls for it [K3]. **CO 3:** Identify all feasible solutions to get optimal solutions using greedy method [K3]. **CO 4:** Apply dynamic-programming approach, to solve real world problems [K3]. **CO 5:** Analyze fundamental graph traversal techniques to solve various applications using Backtracking, Branch and bound paradigms [K4].	**MALWARE ANALYSIS & REVERSE ENGINEERING: R20CY3202** **CO1:** Demonstrate the concept of malware and reverse engineering. [K2] **CO2:** Apply various tools and techniques of malware analysis to examine malicious software. [K3] **CO3:** Analyse and evaluate various techniques for used in malware analysis & reverse engineering to identify vulnerabilities. [K4] **CO4:** Utilize the python language for development & analysis of anti-malwares. [K4] **CO5:** Setup an environment for malware analysis & recognize common malware characteristics. [K1]
PRINCIPLES OF MACHINE LEARNING: R20CC3110 **CO1:** Analyze practical issues in machine learning application. [K4] **CO2:** Apply decision tree algorithms for appropriate problem domains. [K3] **CO3:** Apply and interpret statistical techniques. [K4] **CO4:** Apply ML techniques to solve classification. [K3] **CO5:** Apply ML techniques to solve regression problems. [K3]	**ETHICAL HACKING: R20CY3203** **CO1:** Classify the elements of information security and its challenges and role of security and penetration testing [K2] **CO2:** Analyze different attacks and hacking methods [K4] **CO3:** Exemplify different techniques in hacking [K2] **CO4:** Analyze network protection system and hacking web servers. [K4] **CO5:** Apply Ethical hacking techniques and understand the Ethical Hacking Laws [K3]
SOFTWARE TESTING METHODOLOGIES: R20CC3107 **CO 1**: Outline the software testing terminology. [K2] **CO 2:** Compare and contrast various behavioural testing methodologies. [K2] **CO 3:** Summarize various dynamic testing techniques. [K2] **CO 4:** Summarize the importance of validation activities. [K2] **CO 5:** Interpret software testing and quality management. [K2]	**DATA ANALYTICS FOR FRAUD DETECTION: R20CY3204** **CO 1:** Explain the reason behind the utilization of data analysis as a method of fraud detection. [K2] **CO 2:** Assess the completeness of data by describing the characteristics and components of data relevant to fraud detection. [K3] **CO 3:** Analyze data to identify both known fraud symptoms and previously unidentified fraud symptoms through the use of digital analysis. [K4] **CO 4:** Evaluate and apply automation techniques to streamline the fraud detection process. [K5] **CO 5:** Create a process to verify the accuracy of results. [K6]
DATA ANALYTICS & VISUALIZATION: R20CY3102 **CO1 :** Interpreting the Importance of Data and its importance [K2] **CO2 : Illustrating various ANOVA methods and Regression methods [K2]**	**BLOCK CHAIN TECHNOLOGIES: R20CY3205** **CO 1:** Summarize the fundamentals of Blockchain. [K2] **CO 2:** Analyze the working of Blockchain. [K4] **CO 3:** Interpret how business can be easily made with Blockchain. [K4]

CO3: Analyze various data types and visualization types to extract meaningful insights. [K4] **CO4 :** Apply visualization techniques to address specific problems using datasets and derive valuable insights, especially for large datasets.[K3] **CO5:** Make use of powerbi tool for applying various functions. [K3]	**CO 4:** Summarize how Block Chain can be integrated with various current technologies. [K2] **CO 5:** Get familiarity about the Blockchain strength in providing solutions. [K3]
DEVOPS : R20CC3109 **CO 1:** Demonstrate the phases of software development life cycle. [K2] **CO 2:** Outline the fundamentals of DevOps. [K2] **CO 3:** Adopt the DevOps technology into the project. [K6] **CO 4:** Evaluate the CI/CD concepts and metrics to track CI/CD practices. [K5] **CO 5:** Summarize the importance of DevOps maturity models. [K2]	**BIG DATA ANALYTICS: R20CC3206** **CO 1:** Interpret the architectural elements of big data and Hadoop framework. [K2] **CO 2:** Analyse various big data applications using map reduce programming module. [K4] **CO 3:** Analyse Spark capabilities such as distributed datasets, in-memory caching, and the interactive shell. [K4] **CO 4:** Summarize Spark's powerful built-in libraries, including Spark SQL, Spark Streaming. [K2] **CO 5:** Analyze Hadoop data with PIG and Hive. Interpret the applications and architecture of Mobile Computing and multiplexing techniques. [K4]
COMPILER DESIGN: R20CS3105 **CO 1:** Summarize different phases and passes of a compiler. [K2] **CO 2:** Compare and Contrast various Top-Down and Bottom-Up Parsing techniques. [K2] **CO 3:** Interpret different types of Intermediate Code representations. [K2] **CO 4:** Illustrate the effective usage of register allocation and various Code-generation techniques. .[K2] **CO 5:** Apply different code-optimization techniques to optimize the target code. .[K3]	**SECURE CODING: R20CY3207** **CO 1:** Implement security as a culture and show mistakes that make applications vulnerable to attacks. [K5] **CO 2:** Understand various attacks like DoS, buffer overflow, web specific, database specific web-spoofing attacks. [K2] **CO 3:** Analyze and demonstrate skills necessary to address common programming errors that lead to security issues and to learn how to develop secure applications. [K4] **CO 4:** Analyze the nature of the threats to software and incorporate secure coding practices throughout the planning and development of the product. [K4] **CO 5:** Apply proper techniques for handling application faults, implement secure authentication, authorization and data validation controls used to prevent common vulnerabilities. [K3]
CLOUD COMPUTING:R20CC10E19 **CO1 :** Interpret various types of Virtualization. [K2] **CO2 :** Outline the Cloud Computing Architectures and Models. [K2] **CO3 :** Analyze the Cloud Infrastructure Management and Migration and Disaster Management in Cloud. [K4] **CO4 :** Analyze AWS and MS Azure services. [K4]	**DIGITAL MARKETING:R20CC20E13** **CO1:** Outline the basic concepts of Digital Marketing. [K2] **CO2:** Analyze different channels of digital marketing according to the changing requirements of the markets. [K4] **CO3:** Construct different digital marking plans on situational basis. **CO4:** Improve Marketing through search engine and online advertising. [K6] **CO5:** Compare different avenues of social media for marketing and advertising products for effective sales. [K4]
CRYPTOGRAPHY AND NETWORK SECURITY LAB: R20CY31L1 **CO 1:** Develop code for classical Encryption Techniques to solve the problems. [K3] **CO 2:** Build cryptosystems by applying symmetric and public key encryption algorithms. [K4] **CO 3:** Construct code for authentication algorithms. [K3] **CO 4:** Develop a signature scheme using Digital signature standard. [K3] **CO 5:** Demonstrate the network security using various tools. [K3]	**CYBER SECURITY LAB : R20CY32L1** **CO 1:** Analyse and implement Audit security policy in windows environment, create a Demilitarized zone creation in Network environment [K3] **CO 2:** Apply knowledge and illustrate the Resource harvesting attack and mitigation, Window Patch management policy, Trojans and mitigation strategies. [K3] **CO 3:** Apply the knowledge of metasploit, Access control list creation and content filtering limiting the traffic. [K3] **CO 4:** Understand the concept of data leakage in a

	website database, Password policy and verification, Patch management using MBSA tool on windows machine. [K2] **CO 5:** Analyze audit records by log analysis. [K4]
MACHINE LEARNING LAB: R20CC31L4 **CO1:** Implement procedures for the machine learning algorithms [K3] **CO2:** Design and Develop Python programs for various Learning algorithms [K6] **CO3:** Apply appropriate data sets to the Machine Learning algorithms [K3] **CO4:** Develop Machine Learning algorithms to solve real world problems [K6] **CO5:** Design and Develop Python programs using predefined libraries [K6]	**MALWARE ANALYSIS AND REVERSE ENGINEERING LAB: R20CY32L2** **CO 1:** Demonstrate the cyber security challenges posed by malicious software attacks. [K2] **CO 2:** Analyze security risks, threats and potential vulnerabilities in enterprise networks environment. [K3] **CO 3:** Independently to conduct in-depth analysis of modern malware samples using behavioural, code analysis and memory forensic techniques. [K3] **CO 4:** Apply the techniques learned to proactively protect computer systems and networks, reduce security risks and mitigate the potential for malicious software attacks. [K5] **CO 5:** Apply immunity debugger for reverse engineering [K3]
DATA ANALYTICS & VISUALIZATION LAB: R20CY31SC1 **CO1:** Understand the features and architecture of Tableau.[K2] **CO2:** Analyze different data sources, distinguish between live and extract connections. [K4] **CO3:** Demonstrate comprehension of different products within the Power BI Suite and will be able to install Power BI Desktop. [K3] **CO4:** Apply data transformation techniques, create calculated columns, measures, and perform data summarization, joining data tables, and data hierarchy to prepare data for analysis. [K3] **CO5 :** Apply their knowledge to visualize data using various chart types, tables, and filtering methods in Power BI, allowing them to present data effectively. [K3]	**MEAN STACK TECHNOLOGIES LAB : R20CY32L3** **CO1:** Build a component-based application using Angular components and enhance their functionality using directives.[K3] **CO2:** Utilize data binding for developing Angular forms and bind them with model data. [K3] **CO3:** Apply Angular built-in or custom pipes to format the rendered data. [K3] **CO4:** Develop a single page application by using synchronous or asynchronous Angular routing. [K6] **CO5:** Make use of MongoDB queries to perform CRUD operations on document database. [K3]
PROFESSIONAL ETHICS AND HUMAN VALUES: R20CC31MC01 **CO1:** Learn necessary behavioral skills relating to the Ethics at industrial sector and to gain fundamental knowledge [K2]. **CO2:** Acquaint with basic human values, responsibilities and rights of engineers which are very much necessary today [K2]. **CO3:** Equip with knowledge on basics of intellectual property rights and cyber law [K2]. **CO4:** Gain knowledge on the patents, trademark and copy rights [K2].	**ENGLISH EMPLOYABILITY SKILLS: R20CC32SC1** **CO 1:** Write effective Resume for employment. **CO 2:** Make formal presentations using relevant technical style of communication and appropriate strategies for both academic and professional purpose. **CO 3:** Participate in Group Discussions using analytical and problem solving skills. **CO 4:** Face job interviews confidently and enhance employability.
	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE: R20CC32MC1 **CO1:** Interpret the philosophy of Indian Culture [K2]. **CO2:** Interpret the Indian languages, Epics Ramayana and Mahabharata [K2]. **CO3:** Analyze the information about Indian arts and architecture [K4]. **CO4:** Analyze the spread of cultural exchange in abroad [K4]. **CO5:** Analyze the contributions of scientists in different eras [K4].

R24-MBA-COURSE OUTCOMES

I-MBA

I SEMESTER	II SEMESTER
MANAGEMENT AND ORGANIZATIONAL BEHAVIOR **CO1:** Examine the management concepts and functions [K4] **CO2:** Apply the concepts of controlling [K3] **CO3:** Apply the concepts of personality and attitude in real life situations [K3] **CO4:** Analyze leadership styles and challenges in globalized era [K4] **CO5:** Evaluate the basic concept of organizational conflicts and climate [K5]	**FINANCIAL MANAGEMENT** **CO1:** Outline the basic concepts of Financial Management. [K1] **CO2:** Adapt the concepts of cost of capital, capital structure and leverage for the long term and short term financing decision of the firm [K6] **CO3:** Apply various techniques of capital budgeting for investment analysis. [K3] **CO4:** Appraise the valuation methods of dividends and the dividend policies of Indian corporates. [K5] **CO5:** Assess the working capital requirement of a firm and comprehend the nitty-gritty of current assets management. [K5]
MANAGERIAL ECONOMICS **CO1:** Explain the economic meaning of price, elasticity, and production costs. Describe the cause and effect of changes in all of these variables.[K1] **CO2:** Draw and analyze cost and revenue curves that maximize profit. [K3] **CO3:** Discuss differences and critically analyze the pros and cons of different market structures, including competitive, monopolistic and oligopolistic markets. [K3] **CO4:** Pricing strategies to achieve and applicability in the market conditions [K2] **CO5:** Knowledge about macroeconomics conditions and learn to applicable in the present context. [K1]	**HUMAN RESOURCE MANAGEMENT** **CO1: CO1:** Cite evolution and emerging trends of HRM. [K1] **CO2:** Critically analyze Investment and HRD concepts. [K4] **CO3:** List different appraisal and Compensation system.[K2] **CO4:** Evaluate incentive payment system and welfare measures given to employees.[K5] **CO5:** Interpret industrial relations in organization.[K2]
ACCOUNTING FOR MANAGEMENT **CO1**: Prepare the basic books of accounting and financial statement of the company to ascertain profit or loss and to understand the financial position of the company [K3] **CO2**: Apply financial analysis techniques of funds flow analysis, cash flow analysis and ratio analysis for the assessment of financial performance of the company. [K3] **CO3**: Apply the cost concepts for preparation of cost sheet and inventory valuation methods [K3] **CO4**: Evaluate the use of budgetary control in the managerial decision making [K5] **CO5**: Differentiate Standard costing and Marginal costing K3]	**OPERATIONS MANAGEMENT** CO1: Apply the basic concepts of production and operations management and identify types of manufacturing processes. [K3] CO2: Analyzing the effectiveness of plant location and plant layout. [K3] CO3: Design strategies to improve productivity. [K6] CO4: Evaluate purchasing function and inventory management function. [K5] CO5: Develop the quality control system and quality control strategies. [K6]
QUANTITATIVE ANALYSIS FOR BUSINESS DECISIONS **CO1:** Explain the importance and applications of various quantitative techniques and their role in problem- solving. (K2) **CO2:** Analyze various measures of probability and their applicability in statistical contexts. (K4) **CO3:** Evaluate decision-making processes using principles of decision theory and justify optimal decisions. (K5) **CO4:** Apply different sampling distribution techniques to solve real-world problems. (K3)	**MARKETING MANAGEMENT** CO1: Outline the concepts of marketing and its information system. [K2] CO2: Analyze the segmentation, targeting and positioning in marketing. [K4] CO3: Analyze various phases of product life cycle. [K4] CO4: Evaluate marketing communication strategies. [K5]

CO5: Formulate and test hypotheses to draw valid conclusions and inferences in statistical analysis. (K5)	
ENTREPRENEURSHIP DEVELOPMENT **CO1:** students should have a foundational understanding of entrepreneurship, its driving forces, challenges, and the value it brings to economies, especially those in the developing world.(K1) **CO2:** students should be equipped to navigate and leverage institutional support, recognize and manage startup challenges, and understand the crucial role of government and financial institutions in fostering entrepreneurial growth.(K2) **CO3:** students should be able to differentiate types of entrepreneurs, evaluate the role of professionalism in entrepreneurship, understand the factors contributing to industry sickness, and identify key mechanisms and institutions involved in the revival of distressed businesses.(K1) **CO4:** students should be equipped to define and classify projects, understand their life cycles, evaluate feasibility, and effectively document project planning and analysis through structured reports.(K2) **CO5:** students should be able to understand the process of developing an enterprise, make informed startup decisions, assess market potential, and prepare a project report that supports a strategic approach to enterprise establishment.(K2)	**RESEARCH METHODS FOR BUSINESS DECISIONS** **CO1:** Understand advanced design, methodologies and analysis in business research methods, including key terms, classifications and systematic applications to the research data and design of a research project [K2] **CO2:** Apply knowledge in collecting data from various sources. [K3] **CO3:** Demonstrate knowledge in data analysis and interpretation. [K3] **CO4:** Applying appropriate statistical techniques in the analysis of data [K3] **CO5:** Demonstrate the abilities in preparing research reports. [K3]
BUSINESS ENVIRONMENT **CO1:** Outline the basic concepts of business environment and its components. [K2] **CO2:** Measure the impact of legal environment [K5] **CO3:** Analyze the structure of five year plans and resolutions in India [K4] **CO4:** Evaluate different trade related policies. [K5] **CO5:** Assess the impact of the concepts relating to the technological and natural environment in India	**BUSINESS ANALYTICS** **CO1:** To provide learners with a foundational understanding of data analytics, preparing them for further study and application in data-driven environments. **CO2:** To equip learners with the necessary skills and knowledge to utilize different tools and techniques for effective data analysis, preparing them for practical applications in real-world scenarios. **CO3:** To equip learners with essential skills in data cleaning and visualization, enabling them to transform raw data into meaningful insights that drive informed decision-making. **CO4:** To provide learners with a solid understanding of descriptive analytics, equipping them with the skills needed to summarize and analyze data effectively. **CO5:** To equip learners with essential skills in predictive analytics, enabling them to develop models that forecast future trends and make data-driven decisions.
INFORMATION TECHNOLOGY FOR BUSINESS **CO1**: Clear understanding of Information Technology in business scenarios. **CO2:** Importance of Technology in business processes. **CO3:** Significance of intelligent systems in business. **CO4:** Usage of various digital platforms across the business. **CO5:** exploring e-commerce and ERP scenario.	**CROSS CULTURAL MANAGEMENT** **CO1:** Students will gain proficiency in analyzing organizational culture and business stakeholders' cultural backgrounds through analytical frameworks.[K1] **CO2:** Students will understand global business cultural dynamics and develop effective cross-cultural communication strategies for multinational teams.[K2] **CO3:** Students will master cross-cultural negotiation skills and decision-making processes across different international business contexts.[K1] **CO4:** Students will learn to manage global HR

	operations and develop high-performance teams across cultural boundaries through effective expatriate management.[K2] **CO5:** Students will be able to diagnose, design, and implement organizational culture change strategies while measuring their effectiveness.[K1]
RURAL DEVELOPMENT **CO1:** Describe the key aspects of rural society in India [K2] **CO2:** Describe the rural local administration [K2] **CO3:** Analyze the dynamics of local rural population and local rural economy [K3] **CO4:** Explain the processes and challenges of agriculture in India[K2]	**PROJECT MANAGEMENT** **CO1**: Best practice for increase profit and cost advantage **CO2:** Enhance ability to planed implement and control the projects. **CO3**: It's a technical toll for managing project completion **CO4**: To provide investment strategies the project proposals. **CO5**: Strength and relevant behavioral and leadership capabilities
INTELLECTUAL PROPERTY RIGHTS& PATENTS **CO1:** Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP. (K3) **CO2: To** improve the students f o r getting awareness of acquiring the patent. (K6) **CO3**: To analyze the registration of copyright for their innovative works. (K4) **CO4**: Analyze rights and responsibilities of holder of Patent, Copyright, Trademark, Industrial Design etc. (K4) **CO5:** To k n o w the importance of plagiarism in their innovations which can be questioned legally. (K5)	**LEAN MANAGEMENT** **CO1**: Identify key requirements and concepts in lean manufacturing [K1] **CO2:** Initiate a continuous improvement change program in a manufacturing organization [K2] **CO3**: Apply the tools in lean manufacturing to analyze a manufacturing system and plan for its improvements [K3] **CO4**: Manage the manufacturing systems to achieve six sigma quality and suitability [K3] **CO5**: To develop and execute strategic Hoshin Planning and Lean activities, fostering a culture of continuous improvement and employee involvement that aligns with organizational goals. [K2]
PACE UP **CO1:** Demonstrate an understanding of professionalism in terms of workplace behaviors and Workplace relationships.[K2] **CO2:** Adopt attitudes and behaviors consistent with standard workplace expectations. [K3] **CO3:** Presenting oneself with finesse and making others comfortable in a business setting.[K3] **CO4:** Developing basic life skills or etiquettes in order to succeed in corporate culture.[K4]	**DATA BASE MANAGEMENT SYSTEM** **CO1**: Interpret the fundamentals of DBMS. [K2] **CO2:** Analyze relational database designing. [K4] **CO3**: Develop queries in RDBMS. [K3] **CO4**: Analyze database design methodology and normalization process. [K4] **CO5**: Analyze transaction concepts and File indexing. [K2]
TALLY LAB **CO1**: To provide a solid foundation in Tally.ERP9, enabling students to effectively use the software for various accounting tasks. **CO2**: To equip learners with the necessary skills to manage inventory effectively using Tally.ERP9, preparing them for real-world accounting and inventory management scenarios. **CO3**: To equip learners with advanced skills necessary for managing intricate accounting and inventory processes within Tally.ERP9, preparing them for diverse business environments. **CO4**: To provide learners with a comprehensive understanding of tax management in Tally.ERP9, equipping them with the skills needed for effective compliance and financial oversight in various business contexts. **CO5**: To equip learners with the skills needed to generate and analyze various reports in Tally.ERP9, enabling them to make informed business decisions and maintain effective financial oversight.	**R-PROGRAMMING LAB** **CO1:** Apply the all basic operators on various data types. [K3] **CO2**: Develop programs using Conditional Statements and various types of loops. [K3] **CO3:** Develop programs using Functions, Math functions and Statistical functions in R. [K3] **CO4:** Develop programs using Graphs. [K3] **CO5:** Apply appropriate distribution tests using R [K3]

	IT LAB (SPREAD SHEETS AND SQL) **CO1:** Develop a Document or Presentation. [K3] **CO2:** Develop spreadsheets to perform calculations. [K3] **CO3:** Create various advanced MS-Excel functions & applications. [K6] **CO4:** Apply Various Mathematical & Statistical Operations Using MS-Excel. [K3] **CO5:** Outline the concepts of SQL and constraints. [K2]

R19-MBA-COURSE OUTCOMES

II-MBA

II MBA - I SEMESTER	II MBA - II SEMESTER
STRATEGIC MANAGEMENT CO1: Develop vision, mission and objectives of the organization. [K3] CO2: Analyse industry and develop techniques of competitive analysis. [K4] CO3: Appraise strategic leadership styles and actions. [K5] CO4: Formulate effective strategies in business. [K6] CO5: Develop a frame work for the implementation strategies in business. [K3] CO6: Evaluate the strategy controls by measuring performance of organization. [K5]	**LOGISTICS AND SUPPLY CHAIN MANAGEMENT** CO1: Outline the basic concepts of Logistics and Supply Chain. (K1) CO2: Analyze different logistics strategies to get competitive advantage. (K4) CO3: Assess the profitability by measuring the logistics performance and maintaining supply chain relationships. (K5) CO4: Adapt new and global strategies to compete with the rivals by selecting effective source of suppliers and pricing of the products. (K6)
BUSINESS ETHICS AND CORPORATE GOVERNANCE CO1: Outline fundamentals of Values and ethics. [K2] CO2: Evaluate the global issues with respect to busines ethics. [K6] CO3: Analyse manager's responsibilities in business ethics [K4] CO4: Apply Corporate Governance Theories into Practice [K6] CO5: Apply the Corporate Governance Scenario in India [K6] CO6: Elaborate of Media in Indian Corporate Governance [K6]	**ENTREPRENEURSHIP DEVELOPMENT** CO1: Identify the importance of entrepreneurship. [K2] CO2: Analyse entrepreneurship development programs in India and contents for training for entrepreneurial competencies. [K4] CO3: Develop creativity in entrepreneurship. [K6] CO4**:** Design the project reports & make project evaluation. [K6] CO5: Analyse the policies and procedures of small and micro enterprises. [K4] CO6: Appraise the institutional support to small and medium enterprises. [K5]
BUSINESS ANALYTICS CO1: Outline fundamentals of Business Analytics. [K2] CO2: Demonstrate different classifications of Business Analytics. [K2] CO3: Analyse and prepare reports on Business Analytics. [K4] CO4: Apply Business Analytics in different areas like Finance, HR and Marketing. [K3]	**FINANCIAL RISK MANAGEMENT & DERIVATIVES** CO1: Analyse the different types of risks and its impact on financial institutions. [K4] CO2: Measure different type's risks by applying various tools and techniques. [K5] CO3: Appraise the role and importance of derivatives. [K5] CO4: Evaluate the forward and future contracts and its pricing. [K4] CO5: Minimise the risk of financial institutions by using Swaps. [K6] CO6: Build the option strategies in order to minimise the risk. [K6]

INVESTMENT AND PORTFOLIO MANAGEMENT CO1: Analyse various investment alternatives for effective investment decision [K4]. CO2: Discuss the importance of security analysis in investment decision process [K6]. CO3: Design bond management strategies to realise good return on bond investment [K6]. CO4: Apply different equity valuation methods for the valuation of securities [K3]. CO5: Construct optimal portfolio for higher return at lower risk [K6]. CO6: Analyse different schemes of mutual funds for better investment decision [K4].	**FINANCIAL INSTITUTIONS & SERVICES** CO1: Outline the overview of financial system. [K2] CO2: Assess the performance of various types of financial institutions. [K5] CO3: Analyse the commercial banks and its roles. [K4] CO4: Appraise the activities of various non-banking financial institutions. [K5] CO5: Analyse the impact of insurance regulations on the Insurance Industry. [K4] CO6: Create awareness on different financial services. [K6]
CORPORATE TAXATION CO1: Conclude the fundamentals of Taxation [K5]. CO2: Discuss taxation methods of companies [K6]. CO3: Analyse income sources from business through taxation [K4]. CO4: Determine taxation techniques to reduce tax burden to the company [K5]. CO5: Evaluate Tax management strategies [K5]. CO6: Develop procedure for filing the tax for individuals and corporate [K6].	**INTERNATIONAL FINANCIAL MANAGEMENT** CO1: Evaluate the functioning of international financial system and monetary system [K5]. CO2: Analyse the international financial markets and the various international financial instruments [K4]. CO3: Analyse the advantages of foreign exchange market [K4]. CO4: Evaluate foreign direct investments [K3]. CO5: Develop strategies to deal with different types of risks associated with MNC's [K6]. CO6: Deign strategies to deal with international tax environment [K6].
BANKING & INSURANCE CO1: Analyse the Indian financial system and role of commercial banks [K2] CO2: Develop better understanding on different types of deposits, their benefits as well as on advances [K6] CO3: Analyze the regulations in banking system. [K4] CO4: Make up on new banking innovations. [K6] CO5: Develop skills to facilitate the basic concepts of Risk and Insurance. [K6] CO6: Outline the principles of Insurance and classifications of Insurance. [K2]	**STRATEGIC INVESTMENT AND FINANCIAL DECISIONS** CO1: Analyse the concept of investment decisions & its process. [K2] CO2: Applying the various investment decisions under different situations. [K3] CO3: Evaluating the different types of investment & decisions. [K5] CO4: Analyse different kinds of investment decisions. [K4] CO5: Evaluate strategic analysis of selected investment decisions. [K5] CO6: Distinguish on various theories of international capital structures. [K4]
PERSONAL FINANCIAL PLANNING CO1: List out steps in financial planning process [K4]. CO2: Design the process for preparation and filing of tax returns [K6]. CO3: Evaluate investment decisions in capital goods [K5]. CO4: Analyse various insurance policies which are suitable for investor needs [K4]. CO5: Develop effective investment strategies related to various financial securities [K6]. CO6: Evaluate alternate investment options [K5].	**INTERNATIONAL HUMAN RESOURCE MANAGEMENT** CO1: Identify the challenges of global HRM& strategic role of Global HRM. [K3] CO2: Adapt different methods of selection and process of Expatriate and Repatriate. [K6] CO3: Analyze the cross-cultural management problems and build skill building methods in cross culture teams. [K4] CO4: Make use of factors affecting on compensation and method of compensation. [K3] CO5: Measure the Global HRD climate and frame strategies to overcome challenges. [K5] CO6: Develop the global labour relations and international standards in organizations. [K6]

MANAGEMENT OF INDUSTRIAL RELATIONS CO1: Analyse the basic concepts and importance of industrial relations management. [K4] CO2: Identify the concept of Trade Unions. [K3] CO3: Appraise the collective bargaining power. [K5] CO4: Evaluate the benefits of quality of work life. [K5] CO5: Analyse the concepts of labour safety measures. [K4] CO6: Design the grievance management procedures. [K6]	**LEADERSHIP** CO1: Identify the leadership qualities to run an organization successfully. [K3] CO2: Appraise the various behavioural concepts. [K5] CO3: Develop the organisational structures in decision making. [K3] CO4: Analyse the interpersonal behaviour and barriers of communication in leadership styles. [K4] CO5: Assess the impact of group conflicts in the organisation. [K5] CO6: Adopt different kinds of inspirational leadership styles to lead teams in effective way. [K6]
COMPENSATION AND REWARD MANAGEMENT CO1: Outline basic concepts, framework and theories of compensation. [K2] CO2: Develop a strategic plan for making compensation as a competitive advantage to the organization. [K6] CO3: Contrast different types of incentive plans and determine which plan suit best to organization. [K2] CO4: List the different types of employee benefits. [K1] CO5: Design different methods of wage determination applicable to different cadres of employees. [K6] CO6: Evaluate the mechanism of wage boards and its role in fixation of wage. [K5]	**HUMAN RESOURCE DEVELOPMENT** CO1: Analyze the fundamental concepts of HRM and functions of HRD. [K4] CO2: Elaborate various perspectives of HRD. [K6] CO3: Develop sub-systems of HRD. [K3] CO4: Apply training and development practices. [K3] CO5: Identify the issues in employee counseling and wellness. [K3] CO6: Evaluate recent trends of HRD. [K5]
PERFORMANCE MANAGEMENT CO1: Adapt the basics of performance management system. [K6] CO2: Identify the performance system best fit to organization. [K3] CO3: Develop a mechanism to meet the performance expectations set by the organization. [K6] CO4: Apply the monitoring principles. [K3] CO5: Design the audit system for all types of jobs existed in different organizations. [K6] CO6: Analyze performance appraisal system and determining the best system of appraisal for the needs of the organization. [K4]	**INDUSTRIAL JURISPRUDENCE & LABOUR LEGISLATIONS** CO1: Examine the basic concepts and importance of employee legislations in India. [K4] CO2: Apply the concept of industrial disputes Act. [K3] CO3: Illustrate the importance of payment of bonus Act. [K2] CO4: Evaluate the benefits provided by the payment of Gratuity Act to the employees. [K5] CO5: Analyse the legal formalities under minimum wages Act. [K4] CO6: Determine the various provisions of the Factories Act. [K5]
EMPLOYEE ENGAGEMENT & RETENTION MANAGEMENT CO1: Analyse the fundamentals of Employee engagement practices. [K6] CO2: Develop the employee engagement strategies. [K6] CO3: Analyze the employee turnover rates in different sectors. [K4] CO4: Evaluate the employee retention and retention success mantras. [K5] CO5: Apply the retention strategies. [K3] CO6: Develop practices to retain talent/skilled employee. [K6]	**SERVICES MARKETING** CO1: Analyse the basic concepts of services marketing. [K4] CO2: Identify the customer needs and expectations. [K2] CO3: Develop market segmentation process in services marketing. [K6] CO4: Assess the pricing strategies of services marketing. [K5] CO5: Analysing the impact of marketing communication in service promotion. [K4] CO6: Evaluate the consumer grievance recovery strategies. [K5]

RURAL MARKETING CO1: Assess the problems in rural marketing. [K4] CO2: Analyse the lifestyle, personality and rural marketing strategies. [K4] CO3: Apply brand building strategies in rural areas. [K3] CO4: Categorize the various channels of distribution in rural marketing. [K4] CO5: Adapt marketing communication in rural marketing. [K6] CO6: Evaluate the recent trends in rural marketing. [K5]	**CUSTOMER RELATIONSHIP MANAGEMENT & CONSUMER BEHAVIOUR** CO1: Illustrate the basic concepts of Customer Relationship Management. [K2] CO2: Appraise the customer profile and perception of customer behaviour in relationship perspectives. [K4] CO3: Analyse strategies for customer acquisition models of CRM. [K4] CO4: Evaluate the consumer behaviour and business strategies. [K5] CO5: Apply the various consumer behaviour models. [K3] CO6: Build the psychological process and develop the effective strategy in terms of impact on consumer behaviour. [K6]
DECISION SUPPORT SYSTEMS CO1: Define the role of information systems in DSSs. [K1] CO2: Define the role of managers in making decisions within IT organizations. [K1] CO3: Design and formulate management problems using DSSs models. [K6] CO4: Apply linear and integer programming techniques for scheduling and optimization problems that require decision making using MSEXCEL. [K3]	**EVENT MANAGEMENT** CO1: Outline of the role and purpose of various events in the organizations. [K2] CO2: Analyzing the techniques and strategies required to plan successful events. [K4] CO3: Develop competencies required to promote, implement and conduct distinct events. [K6] CO4: Develop knowledge and competencies required to assess the quality and success of different events. [K6]
DATA WAREHOUSING & DATA MINING CO1: Organize raw data to make it suitable for various data mining algorithms. [K2] CO2: Measure interesting patterns from different kinds of databases. [K5] CO3: Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data. [K3]	**RETAIL MARKETING** CO1: Outline fundamentals of Retailing. [K2] CO2: Identify the general strategies of retailing. [K3] CO3: Formulate location strategies of retailing. [K6] CO4: Develop layout designs. [K6] CO5: Analyse various pricing strategies and develop location strategies. [K4] CO6: Formulate different types of franchising and its impact on the business. [K6]
SOFTWARE PROJECT MANAGEMENT CO1: Outline the issues and challenges faced while doing the Software project Management. [K1] CO2: Identify the software projects fails and that failure probability can be reduced effectively. [K3] CO3: Student will be able to do the Project Scheduling, tracking, Risk analysis and Quality management. [K] CO4: Cost estimation using different techniques. [K5]	**CYBER LAW & SECURITY** CO1: Outline key terms and concepts in cyber law, intellectua property and cybercrimes, trademarks and domain theft. [K2] CO2: Determine computer technologies, digital evidence collection, and evidentiary reporting in forensic acquisition [K5] CO3: Defend both clean and corrupted systems, protecting personal data, securing simple computer networks, and safe Internet usage. [K5] CO4: Create approaches for incident analysis and response [K6]
E-BUSINESS **CO1:** Compare and evaluate alternative e-business strategies and technologies. [K4] **CO2:** Justify and promote strategic initiatives, such as adopting a new e-business system. [K4] **CO3:** Demonstrate systems architecture and technologies for systems integration. [k2] **CO4:** Plan and deliver senior management reports and presentations. [K3]	**DIGITAL MARKETING** CO1: Outline the basic concepts of Digital Marketing. [K2] CO2: Analyze different channels of digital marketing according to the changing requirements of the markets. [K4] CO3: Construct different digital marketing plans on situational basis. CO4: Adapt changes through market research for attainment of news goals. [K6] CO5: Compare different avenues of social media for marketing and advertising products for effective sales. [K4]

BRAND MANAGEMENT	ADVERTISEMENTMANAGEMENT
CO1: Analyse the importance of brand image in marketing [K4]. CO2: Formulate brand vision which communicates better the organisations' policy on Branding [K6]. CO3: Analyse brand promotion methods in brand communication [K4]. CO4: Analyse factors influencing brand extension decisions [K4]. CO5: Design brand marketing programmes and for better brand performance [K6]. CO6: Evaluate emerging trends in brand management [K5].	CO1: Outline the basic concepts of advertising for better understanding the challenges and opportunities in advertising [K6]. CO2: Analyse the relations of advertising with segmentation and budget decision [K4]. CO3: Design better advertising strategies for the company [K6]. CO4: Identify media options which are suitable for the company for better promotion [K3]. CO5: Develop an effective advertising campaign for the company [K6]. CO6: Evaluate the role of AD agencies for the successful advertising management [k5].

R24-MCA-COURSE OUTCOMES

I-MCA

I SEMESTER	II SEMESTER
DATA STRUCTURES **CO1:** Make use of control structures and arrays in developing modular programs. [K3] **CO2:** Make use of functions, structures, pointers and files to write well-structured programs. [K3] **CO3:** Analyze basic data structures and Linked List. [K4] **CO4:** Analyze Stacks, Queues and Hashing techniques to solve problems. [K3] **CO5:** Apply Sorting techniques to solve problems and involve advanced concepts of Tr	**COMPUTER NETWORKS** **CO1:** Summarize basic concepts of Data Communication and Networking. [K2] **CO2:** Compare and Contrast OSI and TCP/IP reference models. [K2] **CO3:** Interpret data link layer services and multiple access protocols. [K2] **CO4:** Analyse different routing protocols. [K4] **CO5:** Illustrate the essential principles of different transport layer and application layer protocols. [K2]
COMPUTER ORGANIZATION **CO1:** Interpret the basic structure of computers and its operational concepts. [K2] **CO2:** Develop the assembly language programming and demonstrate the addressing modes used in instructions. [K3] **CO3:** Interpret various I/O interface devices. [K2] **CO4:** Develop Main Memory Interfacing Circuit and can apply various cache memory mapping techniques. [K3] **CO5:** Summarize the parallel processing and pipelining concepts. [K2]	**NETWORK SECURITY AND CYBER SECURITY** **CO1:** Summarize the fundamentals of Cryptography. [K2] **CO2:** Analyse how security is achieved, and attacks can be countered by using asymmetric algorithms. [K4] **CO3:** Interpret the role of hash functions and Digital Signatures in Information Security.[K2] **CO4:** Interpret Cyber Security architecture principles [K2]. **CO5:** Identifying different classes of attacks [K3].
DATABASE MANAGEMENT SYSTEMS **CO1:** Interpret the fundamentals of DBMS. [K2] **CO2:** Analyze DB design methodology and normalization process. [K4] **CO3:** Develop Queries in RDBMS. [K3] **CO4:** Compare and Contrast various transaction and concurrency management techniques. [K2] **CO5:** Analyze various file organizations and indexing techniques. [K4]	**OBJECT ORIENTED PROGRAMMING USING JAVA** **CO1:** Interpret the syntax and semantics of java programming language and OOPs concepts [K2]. **CO2:** Make use of different predefined classes and packages to develop programmes using OOPs concepts [K3]. **CO3:** Apply exception handling and multithreading on java programs [K3]. **CO4:** Develop Java Programmes using collection frame work & I/O [K3]. **CO5:** Make use of Applets, AWT and event-handling to develop GUI [K3]
OPERATING SYSTEMS **CO1:** Classify various operating system functionalities and generations. [K2] **CO2:** Interpret process management and Apply various process scheduling algorithms. [K3] **CO3:** Interpret process synchronization techniques and apply various deadlock techniques. [K4] **CO4:** Distinguish various memory management techniques and disk scheduling algorithms and can interpret the file system implementations. [K4] **CO5:** Experiment with the installation and use of different software like Windows 7 and Linux [K3]	**SOFTWARE ENGINEERING** **CO1:** Analyze Software Life Cycle models. [K4] **CO2:** Analyze the importance of software requirement and project management [K4] **CO3:** Analyze various types of software design techniques [K4] **CO4:** Analyze Software testing and quality management [K4]. **CO5:** Analyze various CASE tools and software maintenance process models. [K4]
Mathematical and Statistical Foundations **CO1:** Apply Random variables and continuous probability distributions [K3] **CO2:** Infer the statistical inferential methods based on small and large sampling tests [K4]. **CO3:** Design the components of a classical hypothesis test [K3] **CO4:** Apply Number Theory concepts and Algebraic structures to solve problems. [K3]	**ARTIFICIAL INTELLIGENCE** **CO1:** Analyse and Design Intelligent Agents [K4] **CO2:** Apply Search Algorithms to Problem Solving [K3] **CO3:** Apply techniques for constraint propagation and reasoning under uncertainty [K3] **CO4:** Utilize inductive learning, decision trees, and explanation-based learning for learning from observation [K3]

CO5: Classify the types of graphs to formulate and solve computational problems. [K4].	**CO5:** Analyse and compare typical expert systems such as MYCIN, DART, and XCON [K4]
DATABASE MANAGEMENT SYSTEM LAB **CO1:** Apply SQL commands like DDL, DML and DCL to perform different Database operations [K3]. **CO2:** Develop PL/SQL block statements, control statements and cursors. [K3] **CO3:** Develop PL/SQL programs using functions and procedures. [K3] **CO4:** Develop PL/SQL programs using packages and Triggers. [K3]	**DESIGN AND ANALYSIS OF ALGORITHMS** **CO1:** Apply asymptotic notations to measure the performance of algorithms [K3] **CO2:** Apply divide-and-conquer paradigm when an algorithmic design situation calls for it [K3]. **CO3:** Apply dynamic-programming approach, to solve real world problems [K3]. **CO4:** Apply fundamental graph traversal techniques to solve various applications using Backtracking [K3]. **CO5:** Analyse least cost and FIFO branch and bound paradigms [K4].
DATASTRUCTURE USING C LAB **CO1:** Analyze the use of conditional and looping statements to solve problems associated with conditions and repetitions. [K4] **CO2:** Analyze algorithms, Searching, Sorting and hashing Techniques [K4]. **CO3:** Make use of elementary data structures such as stacks, Queues and linked list to develop their applications. **CO4:** Examine different tree traversal techniques.	**ADVANCED UNIX PROGRAMMING** **CO1:** Summarize the internal structure of the UNIX operating system, including the kernel, file systems, processes, and memory management. [K2] **CO2:** Interpret complex shell scripts for automating system tasks and processes in UNIX environments. [K2] **CO3:** Make use of system calls for low-level programming tasks such as file handling, process control, and communication between programs. [K3] **CO4:** Apply IPC techniques, including pipes, message queues, shared memory, and semaphores, to facilitate communication between processes [K4] **CO5:** Utilize and manage process scheduling techniques and synchronization Compare various Memory Management Schemes [K3]
OPERATING SYSTEMS AND LINUX LAB **CO1:** Apply the fundamental UNIX utilities and Utilize the Unix file system[K3] **CO2:** Experiment with shell and UNIX filters. [K3] **CO3:** Implement routing algorithms. **CO4:** Solve the experiments on scheduling Algorithms and page replacement algorithms. **CO5:** Handle the deadlocks, like prevention and detection.	**DATA WAREHOUSING AND DATA MINING** **CO1:** Interpret the data mining terminology and types of data to be mined. [K2] **CO2:** Compare and contrast different dominant Data Mining Algorithms for Classification and apply them. [K4] **CO3:** Analyze the performance of Association Rules. [K4] **CO4:** Compare and contrast different dominant Data Mining Algorithms for Clustering and apply them. [K4] **CO5:** Interpret web data miming concepts and operations. [K2]
	FRONT END WEB TECHNOLOGIES **CO1:** Interpret a webpage and identify its elements and attributes.[K2]. **CO2:** Build webpages using HTML5 [K3]. **CO3:** Make use of Cascading Style Sheets on webpages [K3]. **CO4:** Make use of Java Script to write nteractive webpages [K3]. **CO5:** Build dynamic webpages with JQuery [K3]. **CO6:** Make use of JQuery UI to develop dynamic webpages [K3]
	OBJECT ORIENTED PROGRAMMING USING JAVA LAB **CO1:** Develop java programs by using OOP concepts [K3]. **CO2:** Make use of interfaces, threads, applets in developinging JAVA programmers [K3]. **CO3:** Make use of exception handling and collections in Java Programming [K3].

	CO4: Develop java components [K3].
	NETWORKS AND SECURITY LAB **CO1:** Analyze security concepts and type of attacks and network security algorithms. [K4] **CO2:** Apply symmetric and asymmetric key cryptography technique to encrypt and decrypt text. [K4] **CO3:** Apply Cryptography Hash Function for message authentication and to solve other applications. [K3]

R20-MCA-COURSE OUTCOMES

II-MCA

II MCA - I SEMESTER	II MCA - II SEMESTER
MACHINE LEARNING WITH PYTHON CO1: Identify machine learning techniques suitable for a given problem CO2:Solve the problems using various machine learning techniques CO3:Apply Dimensionality reduction techniques CO4:Design application using machine learning techniques	**BLOCKCHAIN TECHNOLOGY** CO 1: Interpret the working procedure of Bitcoins CO 2: Analyze the Transactions in Bitcoin Network CO 3: Analyze the Block Chain and Bitcoin Network CO 4: Analyze the Mining and Consensus in Block Chain
WEB TECHNOLOGIES CO 1: Acquaint with necessary fundamental skills for creating web applications. CO 2: Install and manage web server software and study server side scripting languages like servlets and JSP. CO 3: Acquire the concepts of java beans. CO 4: Understand database access and use it in JSP and servlets	**DESIGN PATTERNS** CO1: Identify the appropriate design patterns to solve object oriented design problems. CO2: Develop design solutions using creational patterns. CO3: Apply structural patterns to solve design problems. CO4: Construct design solutions by using behavioural patterns. CO5: Demonstrate about Advanced Patterns like Pattern Catalogs
NETWORK SECURITY AND CRYPTOGRAPHY CO1: Analyze the vulnerabilities in any computing system and hence be able to design a security solution. CO2: Identify the security issues in the network and resolve it. CO3: Evaluate security mechanisms using rigorous approaches, including theoretical. CO4: Compare and Contrast different IEEE standards and Electronic mail security. CO5: Understand and use Security & Privacy mechanisms in EDI like E-mail.	**E-COMMERCE** CO 1: Demonstrate an understanding of the foundations and importance of E-commerce. CO 2: Demonstrate an understanding of retailing in E-commerce. CO 3: Analyse the impact of E-commerce on business models and strategy. CO 4: Describe Internet trading relationships including Business to Consumer, Business to-Business & Intra-organizational.
CLOUD COMPUTING CO 1: Understand the Virtualization and applications for the state-of-the-art cloud computing. CO 2: Carry out the Cloud Scale and value of Cloud Computing. CO 3: Analyze the infrastructure of cloud computing including public, private and hybrid clouds and various services like PaaS, SaaS, IaaS etc. CO 4: Monitor the Security in cloud.	**BIG DATA ANALYTICS** CO 1: Preparing for data summarization, query, and analysis. CO 2: Applying data modelling techniques to large data sets. CO 3: Creating applications for Big Data analytics. CO 4: Building a complete business data analytic solution.
DIGITAL IMAGE PROCESSING CO1: Process, quantize and to perform sampling on given images. CO2: Transform and filter the digital image for improving the image quality. CO3: Generate Color images by applying different image characteristics using different colour models. CO4: Compress the digital images by applying different lossless and loss compression techniques. CO5: Identify different representations and restoration of digital images.	**CYBER SECURITY** CO 1: Possess a fundamental knowledge of Cyber Security. CO 2: Understand what vulnerability is and how to address most common vulnerabilities. CO 3: Know basic and fundamental Computer Forensics principles as it relates to Cyber Security. CO 4: Have the knowledge needed to practice safer computing and safeguard your information. CO 5: Understand basic technical controls in use today, such as firewalls and Intrusion Detection systems.

INTERNET OF THINGS CO 1: Demonstrate knowledge and understanding of the security and ethical issues of the Internet of Things CO 2: Conceptually identify vulnerabilities involving the Internet of Things CO 3: Develop critical thinking skills CO 4: Conceptually identify recent security	
UNIFIED MODELING LANGUAGE CO1: Analyze software requirements and document those using Use Cases. CO2: Utilize the notation of the UML diagrams such as Use Case, Class, Sequence, Activity, State chart, Deployment and Package Diagrams. CO3: Acquire the knowledge of Library Files, Executable Files, Processors and Devices for a system. CO4: Build the Forward and Reverse Engineering using UML notations.	
HUMAN RESOURCE MANAGEMENT CO1: Outline the functions and challenges of HRM. [K4] CO2: Apply different concepts of HR Planning, Recruitment, Selection, Training, Interviewing Techniques and Executive Development Programs. [K3] CO3: Apply the uses of job analysis, job description, job specification, ergonomics industry and the methods of job evaluation. [K3] CO4: Utilize the various methods of performance appraisal. [K3] CO5: Develop a sound compensation mechanism at global level, determinants of payment of wages and incentive plans. [K6] CO6: Examine the role of trade unions, Grievance Handling Procedures, Industrial Disputes Resolution Mechanisms and stress management at work place. [K4]	
WEB TECHNOLOGIES LAB CO 1: Get practical exposure on HTML, XHTML, CSS, JavaScript, XML and other web technologies. CO 2: Get practical exposure to develop XML Technologies such as XML Schemas,XSLT. CO 3: Get practical exposure to develop Server-Side Programming using ServletsandJSP's. CO 4: Develop a web page & web site using AJAX and PHP.	
MACHINE LEARNING WITH PYTHON LAB CO1: Make use of Data sets in implementing the machine learning algorithms CO2: Implement the machine learning concepts and algorithms in any suitable language of choice.	
NETWORK SECURITY, CRYPTOGRAPHY & UNIFIED MODELING LANGUAGE LAB CO 1: Understand how to model requirements with Use Cases. CO 2: Utilize the principles to design packages for large scale software projects. CO 3: Design the Dynamic Behaviour and Structure of the design. CO 4: Apply the pragmatic approach to Software Design and Development.	

EMPLOYABILITY SKILLS-2 CO1: Effectively use UML for Analysis of a given problem. CO2: Effectively use UML for Design of a given problem. CO3: Effectively use Android Studio for the development of Android application. CO4: Automate testing using Selenium or any other tool	

R24- M.TECH (CSE) COURSE OUTCOMES

I-M.TECH

I Semester	II Semester
MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE **CO1:** Apply the logical statements, connectivity among the statements and different types of normal forms.[K3] **CO2:** Analyze the operations, properties and functions of sets.[K4]. **CO3:** Solve mathematical problems with recurrence relations using different methods. [K3]. **CO4:** Classify the types of graphs to formulate and solve computational problems.[K4].	**MACHINE LEARNING** **CO 1:** Summarize the characteristics of Machine Learning that make it useful to real-world Problems. **CO 2:** Evaluate and compare the performance of different supervised algorithms for typical learning problems and apply them. **CO 3:** Outline the need and importance of pre-processing techniques and apply them. **CO 4:** Analyze the performance of Association Rules **CO 5:** Evaluate and compare the performance of different unsupervised algorithms for typical learning problems and apply them.
ADVANCED DATA STRUCTURES & ALGORITHMS **CO1:** Apply asymptotic notations to measure the performance of algorithms. [K3] **CO2:** Apply divide and conquer paradigm when an algorithmic design situation calls for it.[K3] **CO3:** Construct greedy algorithms and dynamic programming techniques to solve problems.[K3] **CO4:** Utilize backtracking and branch and bound algorithms to solve combinatorial problems K3] **CO5:** Classify computational problems into NP, NP-Hard, and NP-Complete.[K4]	**DIGITAL MARKETING** **CO1:** Develop insight on Current Trends – Digital and Social Statistics (Infographics) (K6) **CO2:** Analyze the Digital Marketing Platforms like Face book, Twitter, YouTube etc.(K4) **CO3:** Analyze the basics of Search Engine Optimization (SEO) and Mobile Marketing.(K4) **CO4:** Design the various strategies involved in Marketing products and Services Digitally.(k6)
BIG DATA ANALYTICS **CO1:** Interpret the architectural elements of big data and Hadoop framework. [K2] **CO 2:** Analyse various big data applications using map reduce programming module. [K4] **CO 3:** Analyse Spark capabilities such as distributed datasets, in-memory caching, and the interactive shell. [K4] **CO 4:** Summarize Spark's powerful built-in libraries, including Spark SQL, Spark Streaming. [K2] **CO 5:** Analyze Hadoop data with PIG and Hive. Interpret the applications and architecture of Mobile Computing and multiplexing techniques. [K4]	**DATABASES AND MINING** **CO1:** Analyze on normalization techniques. **CO2:** Elaborate on concurrency control techniques and query optimization. **CO3:** Summarize the concepts of data mining, data warehousing and data preprocessing strategies. **CO4:** Apply data mining algorithms. Assess various classification & cluster techniques.
DIGITAL IMAGE PROCESSING **CO1:** Demonstrate the components of image processing **CO2:** Explain various filtration techniques. **CO3:** Apply image compression techniques. **CO4:** Discuss the concepts of wavelet transforms. **CO 5:** Analyze the concept of morphological image processing.	**AD HOC & SENSOR NETWORKS** **CO1:** Explain the Fundamental Concepts and applications of ad hoc and wireless sensor networks **CO2:** Discuss the MAC protocol issues of ad hoc networks **CO3:**Enumerate the concept of routing protocols for ad hoc wireless networks with respect to TCP design issues **CO4:** Analyze & Specify the concepts of network architecture and MAC layer protocol for WSN **CO 5:** Discuss the WSN routing issues by considering QoS measurements

ADVANCED OPERATING SYSTEMS	SOFT COMPUTING
CO1: Illustrate on the fundamental concepts of distributed operating systems, its architecture and distributed mutual exclusion. **CO2:** Analyze on deadlock detection algorithms and agreement protocols. **CO3:** Make use of algorithms for implementing DSM and its scheduling. **CO4:** Apply protection and security in distributed operating systems. **CO5:** Elaborate on concurrency control mechanisms in distributed database systems.	**CO1:** Elaborate fuzzy logic and reasoning to handle uncertainty in engineering problems. **CO2:** Make use of genetic algorithms to combinatorial optimization problems. **CO3:** Distinguish artificial intelligence techniques, including search heuristics, knowledge representation, planning and reasoning. **CO4:** Formulate and apply the principles of self-adopting and self-organizing neuro fuzzy inference systems. **CO5:** Evaluate and compare solutions by various soft computing approaches for a given problem
COMPUTER GRAPHICS	**CRYPTOGRAPHY & NETWORK SECURITY**
CO 1: Summarize graphics applications, architectures, and open GL program structure. [k2] **CO 2:**Apply basic transformations on objects. [k3] **CO 3:**Apply line and polygon clipping algorithms. [k3] **CO 4:**Identify different projections. [k3] **CO 5:** Design interactive programs using openGL. [k6]	**CO1 :**Summarize the fundamentals of Cryptography. [K2] **CO2 :**Analyze how security is achieved, and attacks can be countered by using symmetric/asymmetric algorithms. [K4] **CO3 :**Apply Number Theoretic concepts in developing cryptographic algorithms to counter attacks. [K3] **CO4 :**Interpret the role of hash functions and Digital Signatures in Information Security.[K2] **CO5 :**Compare different network security designs using available secure solutions. [k2] **CO6 :**Illustrate the use of encryption techniques to secure data in transit across data networks. [K2]
ADVANCED COMPUTER NETWORKS	**CLOUD COMPUTING**
CO1: Illustrate reference models with layers, protocols and interfaces. **CO2:** Describe the routing algorithms, Sub netting and Addressing of IP V4and IPV6. **CO3:** Describe and Analysis of basic protocols of computer networks, and how they can be used to assist in network design and implementation. **CO4:** Describe the concepts Wireless LANS, WIMAX, IEEE 802.11, Cellular telephony and Satellite networks **CO5:** Describe the emerging trends in networks-MANETS and WSN.	**CO1**: Interpret various types of Virtualization. **CO2**: Outline the Cloud Computing Architectures and Models. **CO3**: Analyze the Cloud Infrastructure Management and Migration and Disaster Management in Cloud **CO4**: Analyze AWS and MS Azure services.
INTERNET OF THINGS	**PRINCIPLES OF COMPUTER SECURITY**
CO 1: Outline the concepts of Internet of Things. [K2] **CO 2:** Analyze the requirements, specifications to design IoT applications. [K4] **CO 3:** Analyze domain specific applications using Arduino and Raspberry pi. [K4] **CO 4:** Interpret cloud storage models and communication APIs for IoT. [K2]	**CO1:** Describe the key security requirements of confidentiality, integrity, and availability, types of security threats and attacks and summarize the functional requirements for computer security. **CO2:** Explain the basic operation of symmetric block encryption algorithms, use of secure hash functions for message authentication, digital signature mechanism. **CO3:** Discuss the issues involved and the approaches for user authentication and explain how access control fits into the broader context that includes authentication, authorization, and audit. **CO4:** Explain the basic concept of a denial-of-service attack, nature of flooding attacks, distributed denial- of-service attacks and describe how computer security vulnerabilities are a result of poor programming practices. **CO5:** List the steps used to secure the base operating system, specific aspects of securing Unix/Linux systems, Windows systems, and security in virtualized systems and describe the security threats and countermeasures for wireless networks.

OBJECT ORIENTED SOFTWARE ENGINEERING **CO1:** Apply the Object Oriented Software-Development Process to design software **CO2:** Analyze and Specify software requirements through a SRS documents. **CO3:** Design and Plan software solutions to problems using an object-oriented strategy. **CO4:** Model the object oriented software systems using Unified Modeling Language (UML) **CO5:** Estimate the cost of constructing object oriented software.	**HIGH PERFORMANCE COMPUTING** **CO1:** Design, formulate, solve and implement high performance versions of standard single threaded algorithms. **CO2:** Demonstrate the architectural features in the GPU and MIC hardware accelerators. **CO3:** Design programs to extract maximum performance in a multicore, shared memory execution environment processor. **CO4:** Analyze Symmetric and Distributed architectures. **CO5:** Develop and deploy large scale parallel programs on tightly coupled parallel systems using the message passing paradigm.
ARTIFICIAL INTELLIGENCE **CO1:** Summarize the characteristics of AI that make it useful to real-world problems. [K2] **CO2:** Analyse different search techniques and predicate logic in artificial Intelligence. [K4] **CO3:** Interpret knowledge representation and symbolic reasoning using different rules. [K2] **CO4:** Apply the basic knowledge on learning and reinforcement learning. [K3] **CO5:** Make use of the power of AI in Natural language processing as an advanced Application of AI. [K3]	**E – COMMERCE** **CO 1:** Interpret the E-commerce applications and Process Model. [K2] **CO 2:** Compare and contrast various electronic Payment Systems. [K3] **CO 3:** Interpret the Intra Organizational Commerce. [K2] **CO 4:** Outline the corporate digital library and marketing research. [K2]
RESEARCH METHODOLOGY AND IPR **CO1:** Understand the fundamentals of research design **CO2:** Identify and formulate research problems **CO3:** Understanding various statistics concepts related to research.. **CO4:** Understanding various IPRs **CO5:** Evaluate patent Laws and industry designs	**MACHINE LEARNING WITH PYTHON LAB** **CO1:**Implement procedures for the machine learning algorithms **CO2:**Design Python programs for various Learning algorithms **CO3:** Apply appropriate data sets to the Machine Learning algorithms **CO4:** Identify and apply Machine Learning algorithms to solve real world problems
ADVANCED DATA STRUCTURES AND ALGORITHMS LAB **CO1:** Analyze different operations of tree traversal techniques. [K4] **CO2:** Analyze time complexity of algorithms to solve problems on graph [K4] **CO3**: Apply divide and conquer approaches for sorting the given elements [K3] **CO4**: Analyze the complexity of algorithms to evaluate the efficiency and effectiveness of greedy, dynamic programming, backtracking branch and bound techniques. [K4]	**TABLEAU AND POWER BI LAB** **CO1:**Understand the features and architecture of Tableau.[K2] **CO2:** Analyze different data sources, distinguish between live and extract connections. [K4] **CO3:** Demonstrate comprehension of different products within the Power BI Suite andwill be able to install Power BI Desktop. [K3] **CO4:** Apply data transformation techniques, create calculated columns, measures, and perform data summarization, joining data tables, and data hierarchy to prepare data for analysis. [K3] **CO5:** Apply their knowledge to visualize data using various chart types, tables, and filtering methods in Power BI, allowing them to present data effectively. [K3]
ADVANCED COMPUTING LAB **CO1:** The student should have hands on experience in using various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi. **CO2:** Development and use of s IoT technology in Societal and Industrial Applications. **CO3:** Skills to undertake high quality academic and industrial research in Sensors and IoT. **CO4:** To classify Real World IoT Design Constraints, Industrial Automation in IoT.	

R19, II Year - III& IV SEMESTERS

Project Work

CO 1: Identify a topic in advanced areas of Engineering in CSE.
CO 2: Develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
CO 3: Create a professional report as per recommended format and defend the work.

R24- M.TECH -EEE (PID) COURSE OUTCOMES

I-M.TECH

I- I SEMESTER	I- II SEMESTER
ELECTRICAL MACHINE MODELING AND ANALYSIS **CO 1:** Derive Kron's Primitive machine as a unified electrical machine model. **CO 2:** Derive the mathematical model of a separately excited DC motor & Self Excited DC Motor. **CO 3:** Derive linear transformation and Active Transformation Techniques. **CO 4:** Derive the mathematical model and control a 3- phase & 1-phase Induction motor under transient /steady state conditions. **CO 5:** Analyze the mathematical model and control of synchronous Machines.	**CONTROL OF DC & AC DRIVES** **CO 1:** Identify the basics of DC Machine. **CO 2:** Analyze power supplies for DC Machines Loads. **CO 3:** Acquire the knowledge on Chopper controlled DC Drives. **CO 4:** Identify the basics of AC Machines **CO 5:** Acquire knowledge on the operation of CSI and VSI fed Induction Motor drives
ANALYSIS OF POWER ELECTRONIC CONVERTERS & INVERTERS **CO 1:** Acquire and apply knowledge of mathematics for the analysis of power converters. **CO 2:** Capable to model, analyze and explicate the power electronics systems **CO 3:** Expertise in the working modes and operation of power converters. **CO 4:** Design a Resonant Converter.	**POWER SYSTEM DEREGULATION** **CO 1:** Explain the operation of deregulated electricity market systems **CO 2:** Examine the cost-effective methods to supply quality power **CO 3:** Analyze price based unit commitment problems **CO 4:** Evaluate the transmission costing and congestion management methods **CO 5:** Analyze various operational and control issues of electricity market
POWER SEMICONDUCTOR DEVICES AND PROTECTION **CO 1:** Design switching using power semiconductor devices. **CO 2:** Specify design criteria (power, efficiency, ripple voltage and current, harmonic distortions, power factor) for a given application. **CO 3:** Select components; interpret terminal characteristics of the components, model components, design circuit, and understanding operation of power electronics circuits. **CO 4:** Design the heat sink for better performance of the circuit.	**SMART GRID** **CO 1:** Demonstrate knowledge in Smart grid initiatives and technologies **CO 2:** Explain Information and communication technologies for the smart grid Sensing, Measurement, control and automation. **CO 3:** Apply skills in fault calculation and state estimation. **CO 4:** Apply various information security tools in the smart grid technology. **CO 5:** Demonstrate the power quality issues of grid connected renewable energy sources and Power quality conditioners for smart grid
Programmable Logic Controllers & Applications **CO1**: Understand the PLCs and their I/O modules. **CO2**: Develop control algorithms to PLC using ladder logic etc. **CO3**: Manage PLC registers for effective utilization in different applications. **CO4**: Handle data functions and control of two axis and their axis robots with PLC. **CO5**: Design PID controller with PLC.	**POWER QUALITY** **CO 1:** Demonstrate the power quality problem in power system. **CO 2:** Analyze the harmonic distortion due to commercial and industrial loads. **CO 3:** Identify suitable device for power quality measurements. **CO 4:** Explain the mitigation techniques for power quality issues. **CO 5:** Apply skills in design of various custom power devices.

MICROCONTROLLER AND ITS APPLICATIONS **CO 1:** Design interfacing circuits for input output to microcontrollers. **CO 2:** Operating ports and handling the devices connected to ports with use of ALP. **CO 3:** Embed the code in flash memory for stand-alone system for embedded system designs. **CO 4:** Designing PWM controls for power electronic circuits.	**CONTROL & INTEGRATION OF RENEWABLE ENERGY SYSTEMS** **CO1:** Gain knowledge on different renewable energy sources and storage devices **CO2:** Recognize, model and simulate different renewable energy sources **CO3:**Analyze, model and simulate basic control strategies required for grid connection **CO4**:Implement a complete system for standalone/grid connected system
MODERN CONTROL THEORY **CO 1:** Develop the modelling of a real system using modern control theory **CO 2:** Apply modern engineering tools for modelling of physical system using state space Approach. **CO 3:** Analyze non-linear system stability using modern control techniques **CO 4:** Design modern controllers to meet the desired needs **CO 5:** Apply optimal control for designing state feedback controllers	**REACTIVE POWER COMPENSATION & MANAGEMENT** **CO 1:** Acquire knowledge on various load compensations. **CO 2:** Develop the mathematical model of reactive power compensating devices **CO 3:** Analyze the Distribution Side and user Side Reactive Power management **CO 4:** Apply the concept of reactive power compensation in electrical traction & arc furnaces.
ARTIFICIAL INTELLIGENCE TECHNIQUES **CO 1:** Distinguish between Soft Computing and Hard computing. **CO 2:** Define the branches Artificial Neural Networks, Fuzzy Logic, and Support Vector machine **CO 3:** Analyze concepts of Fuzzy Logics & Classical Sets **CO 4:** Analyze the concepts of Fuzzy operators and Classical Logic controls **CO 5:** Analyze the concepts of Genetic Algorithms.	**CUSTOM POWER DEVICES** **CO 1:** Define the power quality problems **CO 2:** List the different methods to mitigate the power quality issues **CO 3:** Identify the different voltage regulating devices for the Voltage changes **CO 4:** Identify the Harmonic Compensation Devices **CO 5:** Define the DG Technologies
SPECIAL MACHINES AND CONTROL **CO 1:** Analyze the characteristics of different types of PM type Brushless DC motors and to design suitable controllers **CO 2:** Apply the knowledge of sensors used in PMSM which can be used for controllers and Synchronous machines. **CO 3:** Evaluate the steady state and transient behavior linear induction motors **CO 4:** Analyze the different controllers used in electrical machines to propose the suitability of drives for different industrial applications **CO 5:** Classify the types of DC Linear motors and apply the knowledge of controllers to propose Their applications in real world.	**DIGITAL CONTROL SYSTEMS** **CO 1:** Design the models of dynamic systems and obtain pulse transfer functions used in real time control applications. **CO 2:** Analyze stability of linear time-invariant systems along with their properties and characteristics. **CO 3:** Design a controller based on time domain and frequency domain approaches. **CO 4:** Analyze the stability of a system using bilinear transformation, Jury's stability and Liapunov theorems. **CO 5:** Design the digital PID Controller and discrete data control systems.
FLEXIBLE A.C. TRANSMISSION SYSTEMS **CO 1:** Explain the concept and working principles of various FACTS devices. **CO 2:** Analyze various control schemes used for UPFC **CO 3:** Utilize the steady state model of static voltage regulators **CO 4:** Choose appropriate FACTS controllers for power system applications.	**HIGH VOLTAGE DC TRANSMISSION** **CO 1:** Analyze the operation of power converters. **CO 2:** Define the control principles of HVDC converters and analyze the harmonics of converters. **CO 3:** Evaluate the importance of MTDC systems. **CO 4:** Apply the Modeling of HVDC system and analysis of converter faults, protection, AC-DC Interactions.

APPLICATIONS OF POWER CONVERTERS **CO1**: Analyze power electronic application requirements. **CO2**: Identify suitable power converter from the available configurations. **CO3**: Develop improved power converters for any stringent application requirements. **CO4**:Improvise the existing control techniques to suit the application. Design of Bi-directional Converters for charge/discharge application.	**POWER SYSTEM STABILITY** **CO 1:** Acquire the knowledge about the stability of power system. **CO 2:** Acquire the knowledge on small-signal stability, transient stability and voltage stability. **CO 3:** Explain the dynamic behaviour of synchronous generator for different disturbances. **CO 4:** Analyze the various methods to enhance the stability of a power system
RESEARCH METHODOLOGY AND IPR **CO1:** Understand the fundamentals of research design **CO2:** Identify and formulate research problems **CO3:** Understanding various statistics concepts related to research. **CO4:** Understanding various IPRs **CO5:** Evaluate patent Laws and industry designs.	**ELECTRIC DRIVES SIMULATION LABORATORY** **CO1**: The student should analyze the performance of different electrical machines and drives
POWER ELECTRONICS SIMULATION LABORATORY **CO 1:** Analyze the characteristics of power electronic switches. **CO 2:** Develop switching pattern for the switches in a convertor. **CO 3:** Design convertor for machine and load specifications. **CO 4:** Apply various load phenomenon's' to analyze the converters.	**ELECTRIC DRIVES LABORATORY** **CO1**: The student should Understand the performance of DC & AC drives
POWER CONVERTERS LAB **CO 1:** Determine the various parameters of three phase converters and provide valid conclusions on the performance of these different power converters **CO 2:** Select suitable DC drive for specific application **CO 3:** Analyze the various causes of harmonic and design a PWM converter **CO 4:** Design converter fed dc drives and chopper fed dc drives	

II Year - III& IV SEMESTERS
EEE- M.TECH (PID)

Project Work

CO 1: Identify a topic in advanced areas of Engineering in PID.
CO 2: Develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
CO 3: Create a professional report as per recommended format and defend the work.

R24- M.TECH (Machine Design) COURSE OUTCOMES

I-M.TECH

I Semester	II Semester
ADVANCED MECHANICS OF SOLIDS **CO1: Compare** various failure criteria in engineering problems. **CO2: Solve** for stresses and deflection beam under unsymmetrical loading. **CO3: Analyze** circumferential stress and radial stress in curved beams **CO4: Analyze** axisymmetric problems of rotating discs. **CO5: Solve** torsion problems in bars and thin walled methods.	**FINITE ELEMENT METHODS AND APPLICATIONS** **CO1:** Understand the concept of finite element method for solving machine design problems. Formulate and solve manually problems in 1-D structural systems involving bars, trusses, beams and frames. **CO2:** Develop 2-D FE formulations involving triangular, quadrilateral elements and higher order elements. **CO3:** Apply the knowledge of FEM for stress analysis, model analysis, heat transfer analysis and flow analysis. **CO4:** Understand the various types and Higher of elements. **CO5:** Analyze vibration problems for frequencies and mode shapes of various elements.
MECHANICAL VIBRATIONS **CO1: Interpret** the role of damping, stiffness and inertia in mechanical systems. **CO2: Analyze** the free vibration analysis of single degree of freedom systems. **CO3: Analyze** the forced vibration analysis of single degree of freedom systems. **CO4: Analyze** the damped and undamped vibrations of two degree of freedom system **CO5: Evaluate** the Torsional vibrations of one, two and three rotor systems.	**EXPERIMENTAL STRESS ANALYSIS** **CO1:** Measure strains using different types of strain gauges **CO2:** Evaluate stresses using modern techniques of experimental methods
THEORY OF ELASTICITY AND PLASTICITY **CO1: Analyze** the two dimensional stress analysis and Saint Venent's principles **CO2: Analyze** stress distribution and strain components in polar coordinates. **CO3: Explain** about the bending of prismatic bars. **CO4: Determine** the shear stresses and strain energy by applying the concepts of plasticity	**ADVANCE OPTIMIZATION TECHNIQUES** **CO1:** Classify the optimization problems. **CO2:** Solve the design issues by using techniques of classical optimization. **CO3:** Design various mechanical elements. **CO4:** Apply genetic algorithm for solving the design problems.
TRIBOLOGY **CO1: Select** the appropriate bearing materials. **CO2: Select** the rolling element bearing for the given conditions. **CO3: Design** hydrostatic air lubrication systems used in bearings. **CO4: Design** hydrodynamic air lubrication systems used in bearings. **CO5:** Analyze the failure of tribological components.	**DESIGN OF EXPERIMENTS** **CO1:** Understand the various statistical concepts, statistical design and sampling distribution Illustrate various factorial designs for different curves and surfaces **CO2:** Experiment with Prediction of new response observations **CO3:** Identify Error variance and application using ANOVA **CO4:** Experiment with Orthogonal array experiments by using Analysis of Mean (ANOM).
ROTOR DYNAMICS **CO1: Analyze** vibrations in rotating machinery and laval-jeffcott rotor model. **CO2: Determination** of natural frequencies and mode shapes of branched systems. **CO3: Analyze** the gyroscopic effect on rotor dynamics and whirling of a rotor. **CO4: Identify** the effect of bearings on rotor vibrations. **CO5: Analyze** the balancing and condition monitoring of rotors.	**CONDITION MONITORING** **CO1:** Develop an appreciation for the need of modern technological approach for plant maintenance to reduce the maintenance expenditure. **CO2:** Carry out lubrication oil analysis and temperature analysis in vibrating systems. **CO3:** Analyze for machinery condition monitoring and explain how this compliments monitoring the condition. **CO4:** Emphasizes on case studies that require gathering information using the modern testing equipment and processing it to identify the malfunction in that system.

DESIGN FOR MANUFACTURING AND ASSEMBLY **CO1: Analyze** the process constraints & other influencing factors for design. **CO2: Design** a metal casting product considering trouble shooting elements. **CO3: Design** a defect free weldment. **CO4: Select** appropriate material and manufacturing process for product development. **CO5: Plan** an assembly for ease of manufacture and automation.	**RAPID TOOLING AND PROTOTYPING** **CO1:** Assess the need of RPT in Product development. **CO2:** Use appropriate RT Software for development of Prototype model. **CO3:** Judge the correct RP Process for Product/Prototype development. **CO4:** Predict the technical challenges in 3D printing. **CO5:** List the applications of RPT.
GEAR ENGINEERING **CO1: Select** and design appropriate gear for the given application and against the failure. **CO2: Design** of spur gears considering Lewis beam strength, Buckingham's dynamic load and wear load **CO3: Design** of helical gears considering Lewis beam strength, Buckingham's dynamic load and wear load **CO4: Design** of bevel and worm gears considering Lewis beam strength, Buckingham's dynamic load and wear load **CO5: Design** the gear box to an automobile.	**INDUSTRIAL ROBOTICS** **CO1:** Define and Classify Robots and Structures of Robotic Systems **CO2:** Define Drives & Control Systems of Robots. Explain Hydraulic Power supply, Hydraulic Motor, Direct Current Servomotors **CO3:** Define Kinematic Analysis, Direct Kinematic Problem in Robotics. Describe Three dimensional Homogeneous Transformations, Denavit-Hartenberg Convention, Applications of DH method **CO4:** Define and Classify Autonomous Mobile Robots. **CO5:** Describe Mobile Robot Kinematics Describe Mobile Robot Maneuverability- Degree of mobility, Degree of steerability, Motion Control. Explain Mobile Robot Planning & Navigation.
NON-DESTRUCTIVE EVALUATION **CO1: Analyze** the ultra-sonic hardness testing and holography **CO2: Analyze** the Radiographic process, X-Ray and Gamma ray Sources. **CO3: Interpret** the Process control, the processing Room and Special Processing techniques. **CO4: Evaluate** the Flaw sizing in ultrasonic inspection.	**MECHANICS OF COMPOSITE MATERIALS** **CO1:** Apply stress-strain relationships in fiber reinforced composite materials. **CO2:** Explain failure theories related to composite materials **CO3:** Explain stress-strain characteristics of laminates. **CO4:** Explain elastic properties of laminates **CO5:** Explain strength characteristics of laminates
MECHATRONICS SYSTEMS DESIGN **CO1: Analyze** the multi-disciplinary nature of modern engineering systems. **CO2: Interpret** the electrical actuation systems**.** **CO3: Explain** about the Signal conditioning and digital system processing **CO4: Analyze** the microelectronics and mechanical systems **CO5: Evaluate** the issues of design, fabrication, and packaging issues of Microsystems.	**COMPUTER INTEGRATED MANUFACTURING** **CO1:** Understand the use of computers in the area of manufacturing. **CO2:** Understand group technology, Robotics, Flexible manufacturing systems. **CO3:** Design automated material handling and storage systems for a typical production system. **CO4:** Understand the Automated Inspection & Testing.
MATERIAL TECHNOLOGY **CO1: Analyze** the mechanism of plastic deformation and strengthening mechanism. **CO2: Interpret** about the Poly phasemixture, precipitation, particle, fiber and dispersion strengthening **CO3: Explain** the structure, properties and applications of modern metallic materials. **CO4: Explain** the smart materials non-metallic materials and advanced structural ceramics. **CO5: Analyze** the importance of advanced composite materials.	**PRESSURE VESSEL DESIGN** **CO1:** Analyse thin plates and shells for various types of stresses. **CO2:** Design shells, end closures and nozzles of pressure vessels using ASME codes. **CO3:** Analyse piping systems.
MACHINE DYNAMICS LAB **CO1: Determine** gyroscopic effect of rotating body. **CO2: Estimate** the natural frequency of undamped torsional vibration of rotor. **CO3: Perform** dynamic balancing of rotating and reciprocating masses.	

DESIGN PRACTICE LAB – I **CO1: Apply** the necessary commands to model the component. **CO2: Apply** various concepts of modelling, Assembly and Drafting for projects.	
RESEARCH METHODOLOGY AND IPR **CO1:** Understand the fundamentals of research design. **CO2:** Identify and formulate research problems **CO3:** Understanding various statistics concepts related to research.. **CO4:** Understanding various IPRs **CO5:** Evaluate patent Laws and industry designs.	

R19- M.TECH (Machine Design) COURSE OUTCOMES

II Year - III& IV SEMESTERS

Project Work

CO 1: Identify a topic in advanced areas of Engineering in Machine Design.
CO 2: Develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
CO 3: Create a professional report as per recommended format and defend the work.

R-24 M.TECH-ECE (VLSI) -COURSE OUTCOMES

I-M.TECH

I Semester	II Semester
RTL SIMULATION AND SYNTHESIS WITH PLDs **CO1:** Develop the Verilog HDL to design a digital circuit. **CO2:** Appreciate the analysis of finite state machine of a controlling circuit **CO3:** Understand the Static Timing Analysis and clock issues in digital circuits **CO4:** Verify the functionality of the digital designs using PLDs.	**ANALOG AND DIGITAL CMOS VLSI DESIGN** **CO1:** Appreciate the trade-offs involved in analog integrated circuit design. **CO2:** Understand and appreciate the importance of noise and distortion in analog circuits. **CO3:** Analyze complex engineering problems critically in the domain of analog IC design for conducting research. **CO4:** Demonstrate advanced knowledge in Static and dynamic characteristics of CMOS, AlternativeCMOS Logics, Estimation of Delay and Power, Adders Design. **CO5:** Solve engineering problems for feasible and optimal solutions in the core area of digital ICs.
MICROCONTROLLERS AND PROGRAMMABLE DIGITAL SIGNAL PROCESSORS **CO1:** Compare and select ARM processor core based SoC with several features/peripherals based on requirements of embedded applications. **CO2:** Identify and characterize architecture of Programmable DSP Processors **CO3:** Develop small applications by utilizing the ARM processor core and DSP processor based platform.	**REAL TIME OPERATING SYSTEMS** **CO1:** Illustrate real time programming concepts. **CO2:** Apply RTOS functions to implement embedded applications **CO3:** Understand fundamentals of design consideration for embedded applications
PARALLEL PROCESSING **CO1:** Identify limitations of different architectures of computer **CO2:** Analysis quantitatively the performance parameters for different architectures **CO3:** Investigate issues related to compilers and instruction set based on type of architectures.	**SOC DESIGN** **CO1:** Identify and formulate a given problem in the framework of SoC based design approaches DesignSoC based system for engineering applications **CO2:** Realize impact of SoC on electronic design philosophy and Macro-electronics there by incline towards entrepreneurship & skill development.
VLSI SIGNAL PROCESSING CO1: Ability to modify the existing or new DSP architectures suitable for VLSI. **CO2:** Understand the concepts of folding and unfolding algorithms and applications. **CO3:** Ability to implement fast convolution algorithms. **CO4:** Low power design aspects of processors for signal processing and wireless applications.	**LOW POWER VLSI DESIGN** **CO1:** Identify the sources of power dissipation in digital IC systems & understand the impact of power on system performance and reliability. **CO2:** Characterize and model power consumption & understand the basic analysismethods. Understand leakage sources and reduction techniques
VLSI TECHNOLOGY AND DESIGN **CO1:** Design various logic circuits using MOS and CMOS transistors. **CO2:** Analyze chip design methods. **CO3:** Synthesize digital circuits using VHDL. **CO4:** Design logic circuit layouts for both static CMOS **CO5:** Compute the power consumption of a VLSI chip.	**CMOS ANALOG AND DIGITAL IC DESIGN** **CO1:** Design MOS devices and estimate their Electrical behavior. **CO2:** Design Combinational MOS logic circuits. **CO3:** Design Sequential MOS logic circuits. **CO4:** Use the Dynamic logic circuits and Memories. **CO5:** Extend the Analog Circuit Design to Different Applications in Real Time. **CO6:** Measure characteristics of CMOS amplifiers.
PROGRAMMING LANGUAGES FOR EMBEDDED SYSTEMS **CO1:** Write an embedded C application of moderate	**COMMUNICATION BUSSES AND INTERFACES** CO1: Select a particular serial bus suitable for a particular application.

complexity. **CO2:** Develop and analyze algorithms in C++. **CO3:** Differentiate interpreted languages from compiled languages	**CO2:** Develop APIs for configuration, reading and writing data onto serial bus. **CO3:** Design and develop peripherals that can be interfaced to desired serial bus.
SYSTEM DESIGN WITH EMBEDDED LINUX CO1: Get the familiarity about embedded Linux development model. **CO2:** Write and debug applications and drivers in embedded Linux. **CO3:** Understand and create Linux BSP for a hardware platform **CAD OF DIGITAL SYSTEM** **CO1:** Fundamentals of CAD tools for modelling, design, test and verification of VLSI systems. **CO2:** Understand various phases of CAD, including simulation, physical design, test andverification. **CO3:** Demonstrate knowledge of computational algorithms and tools for CAD.	**NETWORK SECURITY AND CRYPTOGRAPHY** **CO1:** Identify and utilize different forms of cryptography techniques. **CO2:** Incorporate authentication and security in the network applications. **CO3:** Distinguish among different types of threats to the system and handle the same.
STATISTICALSIGNALPROCESSING **CO1:**Analysesignalsanddeveloptheirstatisticalmodelsforefficientprocessing **CO2:**Formulate filtering problems from real life applications and design Filtering solution red signal from a given mixture by minimizing a cost function **CO3:**Designandanalyseefficientalgorithmsforestimationofvariousparametersofsignalswithdifferent constraints **CO4:**Developefficientmethodsforspectrumandfrequencyestimationsuitingtherequirementsderivedfrompractical problems	**PHYSICAL DESIGN AUTOMATION** **CO1:** Understand the relationship between design automation algorithms and Various constraints posed by **CO2:** VLSI fabrication and design technology. Adapt the design algorithms to meet the critical design parameters. **CO3:** Identify layout optimization techniques and map them to the algorithms **CO4:**Develop proto-type EDA tool and test its efficacy
RTL SIMULATION AND SYNTHESIS WITH PLDS LAB **CO1:** Identify, formulate, solve and implement problems in signal processing,communication Systems etc using RTL design tools. **CO2:** Use EDA tools like Cadence, Mentor Graphics and Xilinx.	**IOT and its Applications** **CO1:** Apply the Knowledge in IOT Technologies and Data management. **CO2:** Determine the values chains Perspective of M2M to IOT. **CO3:** Implement the state of the Architecture of an IOT. Compare IOT Applications in Industrial & real world. **CO4:** Demonstrate knowledge and understanding the security and ethical issues of an IOT.
Microcontrollers and Programmable Digital Signal Processors Lab **CO1:** Compare and select ARM processor core based SoC with several features/peripherals based on requirements of embedded applications. **CO2:** Identify and characterize architecture of Programmable DSP Processors **CO3:** Develop small applications by utilizing the ARM processor core and DSPprocessor based platform.	**Hardware Software Co-Design** **CO1:** About the Hardware-Software Code sign Methodology. **CO2:** How to select a target architecture and how a prototype is built and how emulation of aprototype is done. **CO3:** Brief view about compilation technologies and compiler development environment. **CO4:** Understand the importance of system level specification languages and multi-language co-simulation.
	DIGITAL DESIGN USING HDL **CO1:** Demonstrate the use and application of signals, variables. **CO2:** Demonstrates the application of combinational logic circuit design using VHDL. **CO3:** Simulate sequential logic circuit described using VHDL. Simulate digital logic circuits using Verilog HDL. **CO4:** Synthesize digital circuits at several level of

	abstractions. **CO5:** Test digital logic using CAD tools
	BUSINESS ANALYTICS **CO1:** Students will demonstrate knowledge of data analytics. **CO2:** Students will demonstrate the ability of think critically in making decisions based on data anddeep analytics. **CO3:** Students will demonstrate the ability to use technical skills in predicative and prescriptivemodeling to support business decision-making. **CO4:** Students will demonstrate the ability to translate data into clear, actionable insights
	OPERATIONS RESEARCH **CO1:** Students should able to apply the dynamic programming to solve problemsof discreet and continuous variables. **CO2:** Students should able to apply the concept of non-linear programming **CO3:** Students should able to carry out sensitivity analysis **CO4:** Student should able to model the real world problem and simulate it.

R-19 M.TECH- ECE (VLSI)-COURSE OUTCOMES

II-M.TECH

III & IV Semester

PROJECT WORK

CO 1: Identify a topic in advanced areas of VLSI

CO 2: Develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.

CO 3: Create a professional report as per recommended format and defend the work.

R-24 M.TECH- ECE (DSCE) -COURSE OUTCOMES

I-M.TECH

I Semester	II Semester
VLSI TECHNOLOGY AND DESIGN • Apply a mathematical methods and circuit analysis models in analysis of CMOS circuits. • Create models of ASIC,FPGA that realize specified digital functions. • Apply design issues for testability. • Demonstrate the characteristics of BiCMOS circuit • Design and draw various subsystems and layouts. • Comprehend the chip design and floor planning methods.	**INTERNET OF THINGS & APPLICATIONS** • UnderstandtheconceptofIOTandM2M • Study IOT architecture and applications in various fields Study the security and privacy issues in IOT
DIGITAL DATA COMMUNICATIONS • Explains the different digital modulation schemes. • Comprehend the different concepts of data communication. • Extend the different error correction codes. • Express the different data link protocols. • Extend the different networks and multiple access techniques. **DIGITAL SYSTEM DESIGN** • Apply the minimization of switching functions in different methods. • Implement the CAMP Algorithm. • Synthesizes the logic and state machines using a PLA design and minimization • Implement the state machines using Field-Programmable Gate Arrays. • Design a fault-tolerant for combinational and sequential circuits circuits.	**DSP PROCESSORS AND ARCHITECTURES** • Comprehends the knowledge & concepts of digital signal processing techniques, basic building blocks, implementation of DSP & FFT algorithms • Estimate their computational accuracies in DSP implementation. • Design Programmable DSP devices • Use the DSP processors TMS 320C 54XX for implementation of DSP algorithms & its interfacing techniques with various I/O peripherals. Use various Analog Device Family of DSP Devices • Interface Memory and I/O Peripherals to DSP processors.
WIRELESS COMMUNICATIONS AND NETWORKS • Comprehend the concepts of spectrum allocation, basic cellular system, frequency reuse, channel assignment strategies, handoff strategies, interference, improving coverage and capacity, cell splitting. • Describe the Mobile radio propagation large scale path loss. • Extent the different outdoor propagation models. • Express the mobile radio propagation for small scale fading and multipath. • Describe the different equalizers and diversity techniques. • Development of the different wireless networks.	**SYSTEM ON CHIP DESIGN** • Explain the system architectural concepts • Discuss the concepts processor micro architecture instructional handling. • Extend the SoC memory concepts and models of simple processor memory Instructions • Discuss the interconnection concepts and So Ccustomization. • Comprehend the applications of SoC ,AES algorithms and image compression

INTERNET PROTOCOLS • Describe the architecture of the • Internet and able to describe IP addressing with assigned addresses. • Describe the Internet Protocol (IP) and Trans mission Control Protocol (TCP) • Describe the intra and inter routing protocols (Ex. RIP, OSPF and BGP) • Describe the Domain Name System (DNS), Network virtual terminal (NVT) and File transfer Protocol (FTP). • Comprehend of multimedia concepts. • Extend the computer networked system organization and architecture.	**SOFT COMPUTING TECHNIQUES** • The intelligent control architecture and rule based systems. • Realize the concepts of artificial neural network sand basic mathematical. • Demonstrate fuzzy logic system, basic operation and approximate reasoning.. • Explain the fuzzy logic modeling and control schemes. • Comprehend the basic concepts of Genetic algorithms and its detailed steps. . • Extend the applications of genetic algorithm.
TRANSFORM TECHNIQUES • The student will learn basics of two-dimensional transforms. • Understand the definition, properties and applications of various two-dimensional transform. • Understand the basic concepts of wavelet transform. • Understand the special topics such as wavelet packets, Bi-orthogonal wavelets e.t.c.	**CYBER SECURITY** • Evaluate the computer network and information security needs of an organization. • Assess cyber security risk management policies in order to adequately protect an organization's critical information and assets. • Measure the performance of security systems within an enterprise-level information system. • Troubleshoot, maintain and update an enterprise-level information security system. • Implement continuous network monitoring and provide real-time security solutions. • Formulate, update and communicate short- and long-term organizational cyber security strategies and policies. **DETECTION AND ESTIMATION THEORY** • Understand the mathematical background of signal detection an destimation • Use classical and Bayesian approaches to formulate and solve problems for signal detection and parameter estimation from noisy signals. • Derive and apply filtering methods for parameter estimation.
NETWORK SECURITY AND CRYPTOGRAPHY • Design various logic circuits using MOS and CMOS transistors. • Analyze chip design methods. • Synthesize digital circuits using VHDL. • Design logic circuit layouts for both static CMOS • Compute the power consumption of a VLSI chip.	**CMOS ANALOG AND DIGITAL IC DESIGN** • Design MOS devices and estimate their Electrical behavior. • Design Combinational MOS logic circuits. • Design Sequential MOS logic circuits. • Use the Dynamic logic circuits and Memories. • Extend the Analog Circuit Design to Different Applications in Real Time. • Measure characteristics of CMOS amplifiers.

PROGRAMMING LANGUAGES FOR EMBEDDED SYSTEMS • Explain the Security and classical encryption Techniques. • Conduct research in Network Security. • Apply Security principles in System design. • Encrypt and Decrypt the messages using Cipher Algorithms. • Use Hash and MAC algorithms in Authentication principles. • Use firewall design concepts and IP security.	**EMBEDDED REAL TIME OPERATING SYSTEMS** • Design embedded systems and real-time systems for real time systems. • Identify the general structure and unique characteristics of real -time systems • Evaluate the need for real-time operating system. Implement the real-time operating system principles • Define the unique design problems and challenges of real-time systems • Apply real-time systems design techniques to various software programs. • Program an embedded system. Design, implement and test an embedded system.
STATISTICALSIGNALPROCESSING ▪ Analysesignalsanddeveloptheirstatisticalmodelsforefficientprocessing ▪ Formulatefilteringproblemsfromreallifeapplicationsanddesignfilteringsolutionstoestimateadesi redsignal from a given mixture by minimizing a cost function ▪ Designandanalyseefficientalgorithmsforestimationof variousparametersofsignalswithdifferent constraints ▪ Developefficientmethodsforspectrumandfrequencyestimationsuitingtherequirementsderivedfr ompractical problems	**RADAR SIGNAL PROCESSING** • By the end of the course, the student will be able to • Describe operation of radar systems and discuss their main design parameters and components. • Describe signals and waveforms used in radar systems. • Discuss problems and design challenges in radar signaling and waveforms. • Use various tools (or simulators) for signal and system level simulations in radar systems • Discuss various signal processing techniques for various radar operations including • MTI, pulse Doppler and SAR radars. • Use various pulse Coding Techniques.
STATISTICAL SIGNAL PROCESSING • Analyse signals and develop their statistical models for efficient processing • Formulate filtering problems from real life applications and design filtering solutions to estimate a desired signal from a given mixture by minimizing a cost function • Design and analyse efficient algorithms for estimation of various parameters of signals with different constraints • Develop efficient methods for spectrum and frequency estimation suiting the requirements derived from practical problems.	**MINIPROJECT** ▪ Under stand of contemporary/emerging technology forvarious processesandsystems. ▪ Shareknowledgeeffectivelyin oral and written formand formulate documents
	DIGITAL DESIGN USING HDL • Demonstrate the use and application of signals, variables. • Demonstrates the application of combinational logic circuit design using • VHDL. • Simulate sequential logic circuit described using VHDL. • Simulate digital logic circuits using Verilog HDL. • Synthesize digital circuits at several level of abstractions. • Test digital logic using CAD tools

	DIGITAL DESIGN USING HDL • Demonstrate the use and application of signals, variables. • Demonstrates the application of combinational logic circuit design using VHDL. • Simulate sequential logic circuit described using VHDL. • Simulate digital logic circuits using Verilog HDL. • Synthesize digital circuits at several level of abstractions. • Test digital logic using CAD tools
	CMOS ANALOG AND DIGITAL IC DESIGN • Design MOS devices and estimate their Electrical behavior. • Design Combinational MOS logic circuits. • Design Sequential MOS logic circuits. • Use the Dynamic logic circuits and Memories. • Extend the Analog Circuit Design to Different Applications in Real Time. • Measure characteristics of CMOS amplifiers.
	ADVANCED COMPUTER ARCHITECTURE • Explain the classes of computers and new trends and developments in computer design. • Extend the pipelining, RISC processor, cache memory performance. • Exploit the various techniques of a processors ability in instruction level parallelism (ILP) and its challenges. • Comprehend the architecture of Very large instruction word(VLIW). • Describe the concept of systematic and distributed shared memory architecture. • Extend the performance of interconnection network and intel architecture.
	OBJECT ORIENTED PROGRAMMING • The model of object oriented programming: abstract data types, encapsulation, inheritance and polymorphism. • Fundamental features of an object oriented language like Java: object classes and interfaces, exceptions and libraries of object collections. • How to take the statement of a business problem and from this determine suitable logic for solving the problem; then be able to proceed to code that logic as a program written in Java.

	• How to test, document and prepare a professional looking package for each business project using java doc.
	OPERATIONS RESEARCH • Students should able to apply the dynamic programming to solve problems of discreet and continuous variables. • Students should able to apply the concept of non-linear programming • Students should able to carry out sensitivity analysis • Student should able to model the real world problem and simulate it.

R-19 M.TECH- ECE (DSCE)-COURSE OUTCOMES

II-M.TECH

III & IV Semester

PROJECT WORK

CO 1: Identify a topic in advanced areas of DSCE

CO 2: Develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.

CO 3: Create a professional report as per recommended format and defend the work.

R24- M.TECH- CE-STRUCTURAL ENGINEERING -COURSE OUTCOMES

I.MTECH

I- I SEMESTER	I- II SEMESTER
THEORY OF ELASTICITY CO1, Know the definition of stress and deformation and how to determine the components of the , stress and strain tensors. CO2, Applythe conditions of compatibility and equations of equilibrium. CO3, Understand how to express the mechanical characteristics of materials, constitutive , equations and generalized Hook law. CO4, Use the equilibrium equations stated by the displacements and compatibility conditions , stated by stresses CO5, Understand index notation of equations, tensor and matrix notation and define state of , plane stress, state of plane strain.	**FINITE ELEMENT METHODS IN STRUCTURAL ENGINEERING** CO1:Develop finite element formulations of 1 degree of freedom problems and solve them CO2:Understand any Finite Element software to perform stress, thermal and modal analysis CO3:Compute the stiffness matrices of different elements and system CO4:Interpret displacements, strains and stress resultants
STRUCTURAL DYNAMICS CO1:Understand the response of structural systems to dynamic loads CO2:Realize the behavior and response of linear and nonlinear SDOF and MDOF structures :with various dynamic loading CO3:Understand the behavior and response of MDOF structures with various dynamic :Loading. CO4:Possess the ability to find out suitable solution for continuous system CO5:Understand the behavior of structures subjected to dynamic loads under free vibration.	**THEORY OF PLATES AND SHELLS** CO1:Have a knowledge about various plate theories due to bending CO2:Gain the knowledge of Navier's solution, Levy's solution and solve for the rectangular and square Plates CO3:Analyze circular plates with various boundary conditions. CO4:Focus on the finite difference method of solving plate problems. CO5:Abilityto realize the potential energy principle and find the solution of rectangular plates for various loadings.
MATRIX ANALYSIS OF STRUCTURES CO1:Perform the structural analysis of determinate and indeterminate structures using classical :compatibility methods, such as method of consistent displacements, force and equilibrium :Methods CO2:Perform structural analysis using the stiffness method. CO3:Solve multiple degree of freedom two and three dimensional problems involving trusses, :beams, frames and plane stress CO4:Understand basic finite element analysis	**STABILITY OF STRUCTURES** CO1:Analyze different types of structural instabilities CO2:Execute and work out the inelastic buckling using various methodologies. CO3:Examine the behavior of beam columns and frames with and without side sway using classical and stiffness methods CO4:To be well versed in the lateral buckling, torsional buckling, Flexural torsional buckling of various beams and non-circular sections.
ANALYTICAL & NUMERICAL METHODS FOR STRUCTURAL CO1:Understand the fundamentals of the theory of elasticity CO2:Implement the principles and techniques of photo elastic measurement CO3:Obtain the principles and techniques of strain gage measurement CO4:Adopt the principles and techniques of moiré analysis CO5:Apply the principles and techniques of holographic interferometer.	**ANALYSIS OF OFFSHORE STRUCTURES** CO1:Perform concept development of offshore structure CO2:Find the wave force on vertical cylinder CO3:Perform static and dynamic analysis of fixed offshore structure

DESIGN OF REINFORCED CONCRETE FOUNDATIONS CO1, Attain the perception of site investigation to select suitable type of foundation based on , soil category CO2, Capable of ensuring design concepts of shallow foundation CO3, Can be efficient in selecting suitable type of pile for different soil stratum and in , evaluation of group capacity by formulation CO4, Design different types of well foundation	**EARTHQUAKE RESISTANT DESIGN OF BUILDING** CO1:To learn the fundamentals of seismology and basic earthquake mechanisms, tectonics types of Ground motion, and propagation of ground motion. CO2:Understand qualitative and quantitative representations of earthquake magnitude CO3:Determine the natural frequency of a single degree of freedom dynamic system for given mass, Stiffness and damping properties. CO4:Determine the maximum dynamic response of an elastic vibrating structure to a given forcing Function CO5:Learn the fundamentals of building code based structural design
ADVANCED STRUCTURAL ENGINEERING CO 1:Achieve Knowledge of design and development of problem solving skills CO 2:Understand the principles of Structural Dynamics CO 3:Design and develop analytical skills CO 4:Summarize the Solution techniques for dynamics of Multi-degree freedom systems	**PRECAST AND PREFABRICATED STRUCTURES** CO1:Analyze the prefabricated load carrying members CO2:Analyze the production technology of prefabrication CO3:Design and detailing of precast UNIT for factories CO4:Design single storied simple frames
BRIDGE ENGINEERING CO1:Design theories for super structure and substructure of bridges CO2:Design Culvert, R.C.C T Beam Bridge. CO3:Understand the behavior of continuous bridges, box girder bridges. CO4:Possess the knowledge to design prestressed concrete bridges. CO5:Design Railway bridges, Plate girder bridges, different types of bearings, abutments, :piers and various types of foundations for Bridges	**EARTH RETAINING STRUCTURES** CO1:Quantifythe lateral earth pressures associated with different earth systems CO2:Evaluate the mechanical properties of geosynthetics used for soil reinforcement CO3:Identify the merits and demerits of different earth retaining systems. CO4:Select the most technically appropriate type of retaining wall for the application from a thorough knowledge of available systems CO5:Design of retaining structures using appropriate design methods, factors of safety, earth pressure diagrams and field verification methods
REPAIR & REHABILITATION OF STRUCTURES CO1:Recognize the mechanisms of degradation of concrete structures and to design durable :Concrete structures. CO2:Conduct field monitoring and non-destructive evaluation of concrete structures. CO3:Design and suggest repair strategies for deteriorated concrete structures including repairing :With composites. CO4:Understand the methods of strengthening methods for concrete structures CO5:Assessment of the serviceability and residual life span of concrete structures by Visual :inspection and in situ tests.	**PLASTIC STRUCTURAL ANALYSIS** CO1:Inspect basic difference between elastic and plastic analysis and construct shape factorsfor the various practical sections CO2:Analyze the basic theorems of Limit Analysis, and apply the same to grids and portal Frames. CO3:Prove limit design theorems and design beams and frames using the theorem. CO4:Assess loads & deflections for various beams and portal frames. CO5:Design beam to column Moment resisting connections for various load considerations.
ADVANCED REINFORCED CONCRETE DESIGN CO1:Estimate the deflection of Concrete beams and slabs CO2:Estimate crack width and its affects CO3:Design flat slabs, bunkers, silos and chimneys CO4:Understand the thermal effect on concrete members	**COMPUTER AIDED DESIGN LABORATOR** CO1:Develop Computer Programs for Analysis and Design of various Structural Elements CO2:Use different Structural Engineering software's to solve various civil Engineering programs.

DESIGN OF TALL STRUCTURES CO1:Classify the different loading conditions CO2:Evaluate the structures by different design methods CO3:Design framed structures. CO4:Summarize the behavior of various structural systems.	**STRUCTURAL DESIGN LABORATORY** CO1:Develop Computer Programs for Analysis and Design of various Structural Elements CO2:Use different Structural Engineering software's to solve various civil Engineering programs
RESEARCH METHODOLOGY AND IPR CO1:Understand the fundamentals of research design CO2:Identify and formulate research problems CO3:Understanding various statistics concepts related to research CO4:Understanding various IPRs CO5:Evaluate patent Laws and industry designs	
ADVANCED CONCRETE TECHNOLOGY LABORATORY CO1:Conduct various laboratory tests on Cement, Aggregates C02:Know strain measurement C03:Non-destructive testing C04:Chemical analysis on concrete and Aggregate and Sand	
ADVANCED STRUCTURAL ENGINEERING LABORATORY CO1:conduct various laboratory tests on Cement, Aggregates C02:Know strain measurement C03:Non-destructive testing C04:Chemical analysis on concrete and Aggregate and Sand	

R19- M.TECH- CE-STRUCTURAL ENGINEERING -COURSE OUTCOMES
II&III SEMSTERS
PROJECT WORK

M.TECH ECE (DECS)
COURSE OUTCOMES

R24, I M. TECH I & II SEMESTER

I Semester	II Semester
DIGITAL SYSTEM DESIGN Perform minimization of switching functions in different methods. Implement CAMP Algorithm. Synthesize logic and state machines using a PLA design and minimization Design state machines using Field-Programmable Gate Arrays. Construct a computer to be fault-tolerant for combinational circuits. Design a computer to be fault-tolerant for sequential circuits.	**IMAGE AND VIDEO PROCESSING** • Know digital image, representation of digital image, importance of image resolution, applications in image processing, the advantages of representation of digital images in transform domain, application of various image transforms. • Understand and analyze the image enhancement and image degradation, image restoration techniques using spatial filters and frequency domain. • Understand and analyze the detection of point, line and edges in images, edge linking and various segmentation techniques and the redundancy in images, various image compression techniques. • Describe the video technology from analog color TV systems to digital video systems, how video signal is sampled and filtering operations in video processing. Describe the general methodologies for 2D motion estimation, various coding used in video processing.
DIGITAL DATA COMMUNICATIONS • Examine the different digital modulation schemes. • Familiarize the different concepts of data communication. • Analyze the different error correction codes. • Develop the different data link protocols. • Design the different networks and multiple access techniques.	**CMOS ANALOG AND DIGITAL IC DESIGN** • Design MOS devices and estimate their Electrical behavior. • Design Combinational MOS logic circuits. • Design Sequential MOS logic circuits. • Use the Dynamic logic circuits and Memories. • Extend the Analog Circuit Design to Different Applications in Real Time. Measure characteristics of CMOS amplifiers.
TRANSFORM TECHNIQUES • The student will learn basics of two-dimensional transforms. • Understand the definition, properties and applications of various two-dimensional transform. • Understand the basic concepts of wavelet transform. • Understand the special topics such as wavelet packets, Bi-orthogonal wavelets e.t.c.	**ADVANCED COMPUTER ARCHITECTURE** • Explain the classes of computers and new trends and developments in computer design. • Extend the pipelining, RISC processor, cache memory performance. • Exploit the various techniques of a processors ability in instruction level parallelism (ILP) and its challenges. • Comprehend the architecture of Very large instruction word (VLIW). • Describe the concept of systematic and distributed shared memory architecture. • Extend the performance of interconnection network and intel architecture.

VLSI TECHNOLOGY AND DESIGN • Design various logic circuits using MOS and CMOS transistors. • Analyze chip design methods. • Synthesize digital circuits using VHDL. • Design logic circuit layouts for both static CMOS Compute the power consumption of a VLSI chip.	**SOFT COMPUTING TECHNIQUES** • Understand the basic concepts of Artificial neural network systems. • Understand the McCulloch-Pitts neuron model, simple and multilayer Perception, Adeline andMadeline concepts. • Data processing, Hopfield and self-organizing network. • Difference between crisp sets to fuzzy sets, fuzzy models, fuzzification, inference,membership functions, rule based approaches and defuzzification. • Self – organizing fuzzy logic control, non linear time delay systems. • Understand the concept of Genetic Algorithm steps. Tabu, anD-colony search techniques for solvingoptimization problems. • GA applications to power system optimization problems, identification and control of linear andnonlinear dynamic systems using MATLAB-Neural network toolbox. Know the application and importance stability analysis.
RADAR SIGNAL PROCESSING • By the end of the course, the student will be able to • Describe operation of radar systems and discuss their main design parameters and components. • Describe signals and waveforms used in radar systems. • Discuss problems and design challenges in radar signaling and waveforms. • Use various tools (or simulators) for signal and system level simulations in radar systems • Discuss various signal processing techniques for various radar operations including • MTI, pulse Doppler and SAR radars. • Use various pulse Coding Techniques.	**SYSTEM ON CHIP DESIGN** • Explain the system architectural concepts. • Discuss the concepts processor micro architecture instructional handling. • Extend the SoC memory concepts and models of simple processor memory instructions. • Discuss the interconnection concepts and So Ccustomization. • Comprehend the applications of SoC ,AES algorithms and image compression.
INTERNET PROTOCOLS • Describe the architecture of the Internet and able to describe IP addressing with assigned addresses. • Describe the Internet Protocol (IP) and Trans mission Control Protocol (TCP). • Describe the intra and inter routing protocols (Ex. RIP, OSPF and BGP). • Describe the Domain Name System (DNS), Network virtual terminal (NVT) and File transfer Protocol (FTP). • Comprehend of multimedia concepts. • Extend the computer networked system organization and architecture.	**OBJECT ORIENTED PROGRAMMING** • The model of object oriented programming: abstract data types, encapsulation, inheritance and polymorphism. • Fundamental features of an object oriented language like Java: object classes and interfaces, exceptionsand libraries of object collections. • How to take the statement of a business problem and from this determine suitable logic for solving the problem; then be able to proceed to code that logic as a program

	written in Java. • How to test, document and prepare a professional looking package for each business projectusing java doc.
STATISTICAL SIGNAL PROCESSING • Analyse signals and develop their statistical models for efficient processing • Formulate filtering problems from real life applications and design filtering solutions to estimate a desired signal from a given mixture by minimizing a cost function • Design and analyse efficient algorithms for estimation of various parameters of signals with different constraints • Develop efficient methods for spectrum and frequency estimation suiting the requirements derived from practical problems	**EMBEDDED REAL TIME OPERATING SYSTEMS** • Design embedded systems and real-time systems for real time systems. • Identify the general structure and unique characteristics of real -time systems. • Evaluate the need for real-time operating system. Implement the real-time operating system principles. • Define the unique design problems and challenges of real-time systems. • Apply real-time systems design techniques to various software programs. • Program an embedded system. Design, implement and test an embedded system.
OPTICAL COMMUNICATION TECHNOLOGY • Design a complete optical fiber communication system, to enable the design of data transmission optical systems. • Demonstrate optical fiber propagation characteristics and transmission properties. • Demonstrate light sources including the principles of laser action in semiconductors. • The characteristics of optical transmitters based on semiconductor and external modulation techniques, and the characteristics of optical amplifiers. • Describe the principles of photo detection and optical receiver sensitivity to the extent of the material presented. Demonstrate of fiber devices and multiple wavelength division multiplexing techniques to the extent of the material presented	**ADVANCED COMMUNICATIONS LAB** • Identify the different types of network devices and their functions within a network. • Understand and build the skills of sub-netting and routing mechanisms. Understand basic protocols of computer networks, and how they can be used to assist in networkdesign and implementation
NETWORK SECURITY AND CRYPTOGRAPHY o Identify and utilize different forms of cryptography techniques. o Incorporate authentication and security in the network applications. Distinguish among different types of threats to the system and handle the same.	**Advanced Digital Image and Video Processing lab** 1. Perform and analyze image and video enhancement and restoration. 2. Perform and analyze image and video segmentation and compression. work and process viz., detection, extraction on the image/video.

SYSTEM DESIGN USING VERILOG HDL LABORATORY 1. Identify, formulate, solve and implement problems in signal processing, communication systemsetc using RTL design tools. 2. Use EDA tools like Cadence, Mentor Graphics and Xilinx.	
Research Methodology and IPR • Understand the fundamentals of research design • Identify and formulate research problems • Understanding various statistics concepts related to research.. • Understanding various IPRs **Evaluate patent Laws and industry designs**	
II Year - III& IV SEMESTERS	
Project Work Seminar Comprehensive Viva-Voce Project	

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

INSTITUTE VISION AND MISSION

VISION:

To emerge as a **Centre of excellence** in technical education with a blend of effective **student centric teaching learning** practices as well as **research** for the transformation of **lives and community**.

MISSION:

1. Provide the best class infrastructure to explore the field of engineering and research
2. Build a passionate and a determined team of faculty with student centric teaching, imbibing experiential and innovative skills.
3. Imbibe lifelong learning skills, entrepreneurial skills and ethical values in students for addressing societal problems.

PROGRAM OUTCOMES (POs):

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. 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 the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. 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.

7. 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.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with 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.

11. 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.

12. 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.