DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

INSTITUTE VISION

"To be the center of excellence in technical education and research".

INSTITUTE MISSION

"To address the emerging needs through quality technical education and advanced research".

DEPARTMENT VISION

"To be a globally recognized center of excellence in the field of Artificial Intelligence and Data Science that produces innovative pioneers and research experts capable of addressing complex real-world challenges and contributing to the socio-economic development of the nation."

DEPARTMENT MISSION

1. **To provide cutting-edge education in the field of Artificial Intelligence and Data Science that is rooted in ethical and moral values.**
2. **To establish strong partnerships with industries and research organizations in the field of Artificial Intelligence and Data Science, and to excel in the emerging areas of research by creating innovative solutions.**
3. **To cultivate a strong sense of social responsibility among students, fostering their inclination to utilize their knowledge and skills for the betterment of society.**
4. **To motivate and mentor students to become trailblazers in Artificial Intelligence and Data Science, and develop an entrepreneurial mindset that nurtures innovation and creativity.**

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

Graduates of AI & DS will be able to:

1. Adapt emerging technologies of Artificial Intelligence & Data Science and develop state of the art solutions in the fields of Manufacturing, Agriculture, Health-care, Education, and Cyber Security.
2. Exhibit professional leadership qualities to excel in interdisciplinary domains.
3. Possess human values, professional ethics, application-oriented skills, and engage in lifelong learning.
4. Contribute to the research community to meet the needs of public and private sectors.

PROGRAM SPECIFIC OUTCOMES (PSOs):

After successful completion of the program, students will be able to:

1. Exhibit proficiency of Artificial Intelligence and Data Science in providing sustainable solutions by adapting to societal, environmental and ethical concerns to real world problems.
2. Develop professional skills in the thrust areas like ANN and Deep learning, Robotics, Internet of Things and Big Data Analytics.
3. Pursue higher studies in Artificial Intelligence and Data Science in reputed Universities and to work in research establishments.

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Programme Outcomes

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for 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 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.

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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 the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
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.

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Course Outcomes

Academic Year 2023-2024

S. No.	Year/ Sem	Name of the Course	
1	I/I	**22MTC01 : LINEAR ALGEBRA & CALCULUS**	
		22MTC01.1	Determine the extreme values of functions of two variables.
		22MTC01.2	Apply the vector differential operator to scalar and vector functions
		22MTC01.3	Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.
		22MTC01.4	Determine the basis and dimension of a vector space, compute linear transformation.
		22MTC01.5	Apply the Matrix Methods to solve the system of linear equations
2	I/I	**22PYC01: OPTICS AND SEMICONDUCTOR PHYSICS**	
		22PYC01.1	Demonstrate the physical properties of light.
		22PYC01.2	Explain characteristic properties of lasers and fiber optics
		22PYC01.3	Find the applications of quantum mechanics
		22PYC01.4	Classify the solids depending upon electrical conductivity
		22PYC01.5	Identify different types of semiconductors
3	I/I	**22CSC01: PROBLEM SOLVING AND PROGRAMMING**	
		22CSC01.1	Understand real world problems and develop computer solutions for those problems. 6. Handle data using files.
		22CSC01.2	Understand the basics of Python.
		22CSC01.3	Apply Python for solving basic programming solutions.
		22CSC01.4	Create algorithms/flowcharts for solving real-time problems.

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		22CSC01.5	Build and manage dictionaries to manage data.
		22CSC01.6	Handle data using files.
4	I/I	**22EGC01: ENGLISH**	
		22EGC01.1	Illustrate the nature, process and types of communication and communicate effectively without barriers.
		22EGC01.2	Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
		22EGC01.3	Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary.
		22EGC01.4	Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.
		22EGC01.5	Critique passages by applying effective reading techniques.
5	I/I	**22PYC03 : OPTICS AND SEMICONDUCTOR PHYSICS LAB**	
		22PYC03.1	Interpret the errors in the results of an experiment.
		22PYC03.2	Demonstrate physical properties of light experimentally
		22PYC03.3	Make use of lasers and optical fibers for engineering applications
		22PYC03.4	Explain the V-I characteristics of some optoelectronic and semiconductor devices
		22PYC03.5	Find the applications of thermistor
6	I/I	**22EGC02 : ENGLISH LAB**	
		22EGC02.1	Define the speech sounds in English and understand the nuances of pronunciation in English
		22EGC02.2	Apply stress correctly and speak with the proper tone, intonation and rhythm.
		22EGC02.3	Analyze listening comprehension texts to enhance their listening skills.
		22EGC02.4	Determine the context and speak appropriately in various situations.
		22EGC02.5	Design and present effective posters while working in teams, and discuss and participate in Group discussions.
7	I/I	**22CSC02 : PROBLEM SOLVING AND PROGRAMMING LAB**	

		22CSC02.1	Understand various Python program development Environments.
		22CSC02.2	Demonstrate the concepts of Python.
		22CSC02.3	Implement algorithms/flowcharts using Python to solve real-world problems.
		22CSC02.4	Build and manage dictionaries to manage data.
		22CSC02.5	Write Python functions to facilitate code reuse. 6. Use Python to handle files and memory.
		22CSC02.6	Use Python to handle files and memory.
8	**I/I**	**22MEC01 : CAD AND DRAFTING**	
		22MEC01.1	Become conversant with appropriate use of CAD software for drafting.
		22MEC01.2	Recognize BIS, ISO Standards and conventions in Engineering Drafting.
		22MEC01.3	Construct the projections of points, lines, planes, solids
		22MEC01.4	Analyse the internal details of solids through sectional views
		22MEC01.5	Create an isometric projections and views
9	**I/I**	**22MEC38 : DIGITAL FABRICATION LAB**	
		22MEC38.1	Understand safety measures to be followed in workshop to avoid accidents.
		22MEC38.2	Identify various tools used in carpentry, house wiring and plumbing.
		22MEC38.3	Make a given model by using workshop trades like carpentry, plumbing, House wiring and 3d modeling using solid works software for Additive Manufacturing.
		22MEC38.4	Perform pre-processing operations on STL files for 3D printing, also understand reverse engineering process.
		22MEC38.5	Conceptualize and produce simple device/mechanism of their choice.
10	**I/II**	**22MTC04 : Differential Equations & Numerical Methods**	
		22MTC04.1	Calculate the solutions of first order linear differential equations.
		22MTC04.2	Calculate the solutions of higher order linear differential equations.

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		22MTC04.3	Solve the algebraic, transcendental and system of equations.
		22MTC04.4	Apply interpolation and numerical differentiation techniques for given data.
		22MTC04.5	Test the convergence and divergence of Infinite series.
11	**I/II**	**22CYC01 : CHEMISTRY**	
		22CYC01.1	Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
		22CYC01.2	Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
		22CYC01.3	Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
		22CYC01.4	Classify the various methods used in treatment of water for domestic and industrial use.
		22CYC01.5	Outline the synthesis of various Engineering materials & Drugs.
12	**I/II**	**22EEC01 : BASIC ELECTRICAL ENGINEERING**	
		22EEC01.1	Understand the concepts of Kirchhoff's laws and their application various theorems to get solution of simple dc circuits.
		22EEC01.2	Predict the steady state response of RLC circuits with AC single phase/three phase supply.
		22EEC01.3	Infer the basics of single phase transformer
		22EEC01.4	Describe the construction, working principle of DC machine and 3-phase Induction motor.
		22EEC01.5	Acquire the knowledge of electrical wires, cables, earthing, Electrical safety precautions to be followed in electrical installations and electric shock and its safety and energy calculations.
13	**I/II**	**22CSC03 : OBJECT ORIENTED PROGRAMMING**	
		22CSC03.1	Understand the concepts of Object-Oriented features.
		22CSC03.2	Apply OOPs concepts and different libraries to solve programming problems.
		22CSC03.3	Understand the advanced concepts of Python.
		22CSC03.4	Develop programs to access databases and web data.

		22CSC03.5	Understand APIs and third-party libraries to be used with Python.
14	**I/II**	**22CYC02 : CHEMISTRY LAB**	
		22CYC02.1	Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
		22CYC02.2	Estimate the amount of chemical substances by volumetric analysis.
		22CYC02.3	Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
		22CYC02.4	Calculate the concentration and amount of various substances using instrumental techniques.
		22CYC02.5	Develop the basic drug molecules and polymeric compounds.
15	**I/II**	**22MBC02 : COMMUNITY ENGAGEMENT**	
		22MBC02.1	Gain an understanding of Rural life, Culture and Social realities.
		22MBC02.2	Develop a sense of empathy and bonds of mutuality with Local Communities.
		22MBC02.3	Appreciate significant contributions of Local communities to Indian Society and Economy.
		22MBC02.4	Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
		22MBC02.5	Utilise the opportunities provided by Rural Development Programmes.
16	**I/II**	**22MEC37 : ROBOTICS AND DRONES LAB**	
		22MEC37.1	Demonstrate knowledge of the relationship between mechanical structures of robotics and their operational workspace characteristics
		22MEC37.2	Understand mechanical components, motors, sensors and electronic circuits of robots and build robots.
		22MEC37.3	Demonstrate knowledge of robot controllers.
		22MEC37.4	Use Linux environment for robotic programming.
		22MEC37.5	Write Python scripts to control robots using Python and Open CV.
17	**I/II**	**22EEC02 : BASIC ELECTRICAL ENGINEERING LAB**	
		22EEC02.1	Comprehend the circuit analysis techniques using various circuital laws and theorems.

		22EEC02.2	Analyse the parameters of the given coil and measurement of power and energy in AC circuits
		22EEC02.3	Determine the turns ration/performance parameters of single-phase transformer
		22EEC02.4	Infer the characteristics of DC shunt motor different tests.
		22EEC02.5	Illustrate different parts and their function of electrical components, equipment and machines.
18	**I/II**	**22MTC07 : Mathematical and Statistical Foundations**	
		22MTC07.1	Apply the statistical averages for identifying behaviour of the data.
		22MTC07.2	Analyse the data using probabilistic models.
		22MTC07.3	Apply the probability function to characterise the random phenomenon.
		22MTC07.4	Analyse data using different methods of hypothesis testing.
		22MTC07.5	Apply the number theory concept to cryptography domain.
19	**II/I**	**22CSC15 : OPERATING SYSTEMS**	
		22CSC15.1	Understand the basics of Operating systems and its major components.
		22CSC15.2	Illustrate the concepts related to process management. Operating system.
		22CSC15.3	Distinguish various memory management techniques.
		22CSC15.4	Apply concepts of process synchronization and deadlocks to a given situation.
		22CSC15.5	Evaluate various file allocation methods and Apply security as well as recovery features in the design
20	**II/I**	**22CSC11 : DATA BASE MANAGEMENT SYSTEMS**	
		22CSC11.1	Design database schema for an application using RDBMS concepts.
		22CSC11.2	Write SQL queries for tasks of various complexities.
		22CSC11.3	Build applications using database system as backend.
		22CSC11.4	Understand internal working of a DBMS including data storage, indexing, query processing, transaction processing, concurrency control and recovery mechanisms.

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		22CSC11.5	Analyze non-relational and parallel/distributed data management systems with a focus on scalability.
21	II/I	**22ITC01 : DIGITAL LOGIC AND COMPUTER ARCHITECTURE**	
		22ITC01.1	Apply Boolean algebra for simplification and learn representation of data using numbers.
		22ITC01.2	Understand fundamentals of combinational & sequential logic gates, registers and counters.
		22ITC01.3	Infer the architecture and functionality of the central processing unit.
		22ITC01.4	Explore the techniques that computers use to communicate with I/O devices for data transfer.
		22ITC01.5	Comprehend memory hierarchy, cache memory and virtual memory.
22	II/I	**22ITC02 : JAVA PROGRAMMING**	
		22ITC02.1	Apply the concept of OOP to design, implement and execute programs.
		22ITC02.2	Use the strings, interfaces, packages and inner classes for application development.
		22ITC02.3	Apply the exception handling mechanisms and multithreading for the development.
		22ITC02.4	Develop applications using collection framework.
		22ITC02.5	Develop database applications using SQL package.
23	II/I	**22CSC05 : DATA STRUCTURES**	
		22CSC05.1	Understand the basic concepts and types of data structures.
		22CSC05.2	Analyze various linear and nonlinear data structures.
		22CSC05.3	Identify the applications of linear and nonlinear data structures and significance of balanced search trees, hashing.
		22CSC05.4	Evaluate various searching and sorting techniques.
		22CSC05.5	Use appropriate data structures to design efficient algorithms.
24	II/I	**22EGM01 : INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES**	
		22EGM01.1	Understand the history of framing of the Indian Constitution and its features.

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		22EGM01.2	Assess the realization of Fundamental Rights and Directive Principles of State Policy.
		22EGM01.3	Analyze the challenges to federal system and position of the President and the Prime Minister in the Union Government.
		22EGM01.4	Underline the role of the Legislature and the Judiciary in Union Government and their mutual relations.
		22EGM01.5	Evolve the development of the local governments in India and assess the role of Collector in district administration.
25	**II/I**	**22CSC33 : DATA BASE MANAGEMENT SYSTEMS LAB**	
		22CSC33.1	Outline the built-in functions of SQL and apply these functions to write simple and complex queries usingSQL operators.
		22CSC33.2	Demonstrate Queries to Retrieve and Change Data using Select, Insert, Delete and Update. ConstructQueries using Group By, Order By and Having Clauses.
		22CSC33.3	Demonstrate Commit, Rollback, Save point commands, SQL Plus Reports and formulate the Queries forCreating, Dropping and Altering Tables, Views, constraints.
		22CSC33.4	Develop queries using Joins, Sub-Queries and Working with Index, Sequence, Synonym, ControllingAccess and Locking Rows for Update, Creating Password and Security features.
		22CSC33.5	Develop PL/SQL code using Cursors, Exception, Composite Data Types and Procedures, Functions andPackages.
26	**II/I**	**22ITC03 : JAVA PROGRAMMING LAB**	
		22ITC03.1	Practice the basics of OOPs to develop java applications.
		22ITC03.2	Use the inheritance and interfaces for application development.
		22ITC03.3	Apply the exception handling and multithreading to handle multiple flows of execution.
		22ITC03.4	Develop applications using collection framework.
		22ITC03.5	Apply the SQL concepts for application development.
27	**II/I**	**22CSC31 : DATA STRUCTURES LAB**	
		22CSC31.1	Implement the abstract data type.
		22CSC31.2	Implement linear and non-linear data structures.
		22CSC31.3	Evaluate various sorting techniques.

		22CSC31.4	Analyze various algorithms of linear and nonlinear data structures.
		22CSC31.5	Choose or create appropriate data structures to solve real world problems.
28	II/I	**22ADI01 : MOOCS / TRAINING / INTERNSHIP**	
		22ADI01.1	Learn new technologies and solve real time projects.
		22ADI01.2	Expose to the industrial environment problems and technologies
		22ADI01.3	Gain knowledge on contemporary technologies industrial requirements.
		22ADI01.4	Identify, Design and Develop solutions for real world problems
		22ADI01.5	Communicate their ideas and learning experiences through reports and presentation.
29	II/II	**22MTC16 : Stochastic Process and Queueing Theory**	
		22MTC16.1	Estimate the marginal probabilities of statistical averages.
		22MTC16.2	Distinguish the random process of auto correlation and cross correlation.
		22MTC16.3	Characterize the random process of ensemble averages.
		22MTC16.4	Analyze the effect the thermal noise in the system.
		22MTC16.5	Analyze the queuing behavior of different queuing models.
30	II/II	**22ECC39 : SYSTEMS AND SIGNAL PROCESSING**	
		22ECC39.1	Classify signals, analyse the signals using Transform techniques.
		22ECC39.2	Evaluate signal characteristics in frequency domain.
		22ECC39.3	Assess the system stability and causality using ROC and Pole-Zero Plot.
		22ECC39.4	Classify systems and analyse the signals using Transform techniques
		22ECC39.5	Describe and analyse the DT Signal/systems using DFT, DCT, DWT, FFT and Z-Transform
31	II/II	**22CSC14 : DESIGN AND ANALYSIS OF ALGORITHMS**	
		22CSC14.1	Analyzing performance of algorithms using asymptotic notations.

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		22CSC14.2	Demonstrate familiarity with major algorithms and importance of algorithm design techniques.
		22CSC14.3	Apply algorithm design techniques on different problems.
		22CSC14.4	Analyze the efficiency of the algorithms.
		22CSC14.5	Understanding limits of efficient computation with the help of complexity classes.
32	**II/II**	**22ADC01 : FUNDAMENTALS OF MACHINE LEARNING**	
		22ADC01.1	Explain the types of machine learning and handle the challenges of machine learning.
		22ADC01.2	Construct Decision Trees, Measure performance of classifiers.
		22ADC01.3	Apply Regression, Logistic Regression and gradient descent to solve problems.
		22ADC01.4	Design solutions using Bayesian classifier, SVMs and Ensemble methods.
		22ADC01.5	Perform Dimensionality reduction and clustering of data
33	**II/II**	**22MBC01 : ENGINEERING ECONOMICS AND ACCOUNTANCY**	
		22MBC01.1	Apply fundamental knowledge of Managerial Economics concepts and tools.
		22MBC01.2	Analyze various aspects of Demand Analysis, Supply and Demand Forecasting.
		22MBC01.3	Understand Production and Cost relationships to make best use of resources available.
		22MBC01.4	Apply Accountancy Concepts and Conventions and preparation of Final Accounts.
		22MBC01.5	Evaluate Capital and Capital Budgeting decision based on any technique.
34	**II/II**	**22CEM01 : ENVIRONMENTAL SCIENCE (MANDATORY COURSE)**	
		22CEM01.1	Identify the natural resources and realise the importance of water, food, forest, mineral, energy, land resources and effects of over utilisation.
		22CEM01.2	Understand the concept of ecosystems and realise the importance of interlinking of food chains.
		22CEM01.3	Contribute for the conservation of bio-diversity.
		22CEM01.4	Suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.

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		22CEM01.5	Follow the environmental ethics and contribute to the mitigation and management of environmental disasters.
35	II/II	**22ITE02 : DIGITAL IMAGE PROCESSING**	
		22ITE02.1	Illuminate the fundamental concepts and applications of digital image processing techniques.
		22ITE02.2	Demonstrate intensity transformations, spatial filtering, smoothing and sharpening in both spatial and frequency domains, image restoration concepts.
		22ITE02.3	Demonstrate image restoration and morphological image processing methods.
		22ITE02.4	Apply object recognition techniques by using image segmentation and image representation & description methods.
		22ITE02.5	Illustrate the various colour models and Application of image compression methods.
36	II/II	**22ITE04 : MOBILE APPLICATION DEVELOPMENT**	
		22ITE04.1	Understand the benefits of using Kotlin for Mobile application development.
		22ITE04.2	Design user interface for mobile applications.
		22ITE04.3	Use Intent, Broadcast receivers and Internet services in Android App.
		22ITE04.4	Use multimedia, camera and Location based services in Android App.
		22ITE04.5	Apply best practices to implement databases and publish apps on Playstore.
37	II/II	**22ITC17 : WEB TECHNOLOGIES**	
		22ITC17.1	Create web pages with good aesthetic sense of design using HTML CSS3, Bootstrap and popular themes.
		22ITC17.2	Use JS in Validations and DOM manipulation.
		22ITC17.3	Design Schema and perform CRUD operations from UI components.
		22ITC17.4	Become an agile practitioner with the ability to quickly complete projects using ReactJS.
		22ITC17.5	Build an end-to-end application from scratch using React JS, NODE JS, Express JS and Mongo DB.
38	II/II	**22ADE01 : DATA ANALYSIS AND VISUALIZATION**	

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		22ADE01.1	Use Numpy library utilities for various numerical operations.
		22ADE01.2	Apply pandas library functions for handling data frames.
		22ADE01.3	Perform various preprocessing operations on datasets using Pandas Series and DataFrame objects.
		22ADE01.4	Analyze the given dataset and derive conclusions using inferential statistics.
		22ADE01.5	Apply 2-D and 3-D plotting techniques on datasets using matplotlib and seaborn
39	**II/II**	**22ADE02 : DATA WAREHOUSING AND DATA MINING**	
		22ADE02.1	Understand the concepts and issues of data mining, apply preprocessing techniques.
		22ADE02.2	Build multidimensional data model and perform OLAP operations, generate association rules.
		22ADE02.3	Evaluate various models for classification and prediction.
		22ADE02.4	Analyze advanced classification methods and clustering techniques.
		22ADE02.5	Understand outlier detection and real time applications of data mining.
40	**II/II**	**22MTC17 : STOCHASTIC PROCESS AND QUEUEING THEORY LAB**	
		22MTC17.1	Interpret the plots of statistical averages
		22MTC17.2	Compute the measures of variation for stochastic data
		22MTC17.3	Characterize the bivariate probability distribution of averages
		22MTC17.4	Analyze the probabilities using probability functions.
		22MTC17.5	Analyze the queuing behavior of different queuing models.
41	**II/II**	**22CSC34 : DESIGN AND ANALYSIS OF ALGORITHMS LAB**	
		22CSC34.1	Implement greedy, dynamic programming, backtracking and branch and bound techniques.
		22CSC34.2	Demonstrate various algorithmic design techniques.
		22CSC34.3	Analyze the performance of various algorithms.
		22CSC34.4	Compare various design strategies.
		22CSC34.5	Formulate solutions to solve real world problems use acquired knowledge.
42	**II/II**	**22ADC02 : MACHINE LEARNING LAB**	

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		22ADC02.1	Perform dimensionality reduction of a dataset.
		22ADC02.2	Build decision trees for classification.
		22ADC02.3	Design solutions using SVM, KNN, Regression algorithms.
		22ADC02.4	Perform clustering of data.
		22ADC02.5	Use principle Component Analysis for feature Extraction.
43	**II/II**	**22ADC04 : LINUX AND LATEX LAB**	
		22ADC04.1	Run various UNIX commands on a standard UNIX/LINUX Operating system
		22ADC04.2	Understand the shell programming on UNIX OS
		22ADC04.3	Typing of text including roman letters, alphabets, special symbols and mathematical symbols in LaTeX.
		22ADC04.4	Display of equations in LaTeX.
		22ADC04.5	Creating a table and drawing a figure in LateX
44	**III/I**	**20ADC06 : ARTIFICIAL INTELLIGENCE**	
		20ADC06.1	Define the role of agents and interaction with the environment to establish goals.
		20ADC06.2	Identify and formulate search strategies to solve problems by applying suitable search strategy.
		20ADC06.3	Understand probabilistic reasoning and Markov decision process to solve real world problems.
		20ADC06.4	Design applications using Reinforcement Learning.
		20ADC06.5	Apply AI concepts to solve the real-world problems.
45	**III/I**	**20ITC24 : EMBEDDED SYSTEMS AND IOT**	
		20ITC24.1	Develop and design for Embedded computing using 8051 Microcontroller.
		20ITC24.2	Describe the role of things and Internet in IoT and determine the IoT levels designing an IoT Systems.
		20ITC24.3	Learn the methodology for IoT system design and interface with Raspberry Pi.
		20ITC24.4	Design and Develop IoT computing and its applications.
		20ITC24.5	Implement standard IoT to build large systems for industries.
46	**III/I**	**20ITC19 : OPERATING SYSTEMS**	

		20ITC19.1	Demonstrate operating system services, inter process communication and multithreaded Programming.
		20ITC19.2	Apply suitable process scheduling, deadlocks handling algorithms and solve process-synchronization.
		20ITC19.3	Make use of advanced techniques such as paging, segmentation and virtual memory for memory management.
		20ITC19.4	Illustrate file system interfaces and its implementation.
		20ITC19.5	Identify the Operating System Security problems and Threats.
47	**III/I**	**20ADC07 : FULL STACK DEVELOPMENT**	
		20ADC07.1	Create web pages with good aesthetic sense of design using HTML and CSS
		20ADC07.2	Create real-world React web applications and related tools.
		20ADC07.3	Become an agile practitioner with the ability to quickly complete projects
		20ADC07.4	Build an end-to-end application from scratch using NODE JS
		20ADC07.5	Understand and build logical relationships between documents using MongoDB
48	**III/I**	**20ITC20 : COMPUTER NETWORKS**	
		20ITC20.1	Summarize functions of each layer in the OSI and TCP/IP reference models and demonstrate the systematic understanding of data communication Techniques.
		20ITC20.2	Solve problems related to Addressing, Routing, Interoperability among heterogeneous networks.
		20ITC20.3	Identify issues in Internetwork Routing issues and Congestion in computer networks.
		20ITC20.4	Appraise the functions and performance of Internet Transport Protocols TCP and UDP.
		20ITC20.5	Analyze the operating principles of Domain Name System and Electronic Mail, WWW.
48	**III/I**	**20ADE03 : NATURAL LANGUAGE PROCESSING**	
		20ADE03.1	Justify the various steps necessary for processing natural language
		20ADE03.2	Suggest appropriate semantic modeling and sequence labeling techniques for a particular application.
		20ADE03.3	Apply appropriate neural network-based models for a contextual application

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		20ADE03.4	Analyze existing encoder-decoder models and information extraction techniques.
		20ADE03.5	Identify the significance of word net and analyze the applications of Natural Language Processing such as Question Answering and chatbots.
49	**III/I**	**20ADE04 : NO SQL DATABASES**	
		20ADE04.1	Define, compare and use the four types of NoSQL Databases.
		20ADE04.2	Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Key-Value Pair NoSQL databases.
		20ADE04.3	Explain the detailed architecture, define objects, load data, query data and performance tune Document oriented NoSQL databases.
		20ADE04.4	Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
		20ADE04.5	Explain the detailed architecture, define objects, load data, query data and performance tune Graph NoSQL databases.
50	**III/I**	**20ITE13 : COMPUTER VISION**	
		20ITE13.1	Summarize the fundamentals of Image formation and describe the Geometric primitives and Transformations.
		20ITE13.2	Describe different approaches to recognition of objects.
		20ITE13.3	Inspect algorithms for feature detection and feature alignment.
		20ITE13.4	Analyze images and videos for problems such as tracking and structure from motion.
		20ITE13.5	Design recovered 3D structure for ill-posed scenes.
51	**III/I**	**20ITE08 : CYBER SECURITY**	
		20ITE08.1	Describe legal frameworks to handle cybercrimes.
		20ITE08.2	Identify the functioning of different kinds of malware used in cybercrimes.
		20ITE08.3	Examine the legal perspectives of cybercrimes in Indian and international context.
		20ITE08.4	Describe the need of Digital Forensics and the importance of digital evidence in prosecution
		20ITE08.5	Interpret the commercial activities in the event of significant information security incidents in the Organization

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52	III/I	**20ADE05 : COMPILER DESIGN (Professional Elective #2)**	
		20ADE05	Identify the concepts related to translator, tokens, bootstrapping, porting and phases of the compiler and develop Lexical-Analyzer for Source Language.
		20ADE05	Construct Top-down parsers and Bottom-up parsers.
		20ADE05	Develop Syntax Directed Translation scheme and Generate Intermediate code for a language.
		20ADE05	Translate Intermediate code into Target code.
		20ADE05	Understand Data flow Analysis and apply the optimization techniques.
53	III/I	**20ITE07 : AUGMENTED AND VIRTUAL REALITY (Professional Elective #2)**	
		20ITE07.1	Describe the basic concepts of Virtual Reality and 3D Computer Graphics.
		20ITE07.2	Apply 3D manipulation techniques in Virtual Reality.
		20ITE07.3	Analyze Development Tools and Frameworks in Virtual Reality.
		20ITE07.4	Develop a Virtual Reality application.
		20ITE07.5	Evaluate Augmented Reality Systems
54	III/I	**20ADC08 : ARTIFICIAL INTELLIGENCE LAB**	
		20ADC08.1	Understand the types of informed and uninformed problems and apply search strategies to solve them.
		20ADC08.2	Demonstrate Basic Prolog programming
		20ADC08.3	Solve real-life problems using AI techniques like game search.
		20ADC08.4	Apply probabilistic reasoning on data.
		20ADC08.5	Analyze the Q-learning Algorithm.
55	III/I	**20ITC26 : EMBEDDED SYSTEMS AND IoT LAB**	
		20ITC26.1	Program using Raspberry Pi.
		20ITC26.2	Develop python programs that run on Raspberry Pi/Arduino
		20ITC26.3	Write basic IoT Programs using Raspberry Pi/Arduino.
		20ITC26.4	Implement Applications using Raspberry Pi / Arduino.
		20ITC26.5	Develop simple IoT systems of different Case studies.

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56	III/I	**20ADC09 : MINOR PROJECT-I (Full Stack Development)**	
		20ADC09.1	Interpret Literature with the purpose of formulating a project proposal.
		20ADC09.2	Plan, analyze, Design and implement a project.
		20ADC09.3	Find the solution of identified problem with the help of modern Technology and give priority to real time scenarios.
		20ADC09.4	Plan to work as a team and to focus on getting a working project done and submit a report within a stipulated period of time.
		20ADC09.5	Prepare and submit the Report and deliver a presentation before the departmental Committee.
57	III/II	**20ITC13 : SOFTWARE ENGINEERING**	
		20ITC13.1	Identify the minimum requirements for the development of application.
		20ITC13.2	Build a system, component, or process to meet desired needs of a customer.
		20ITC13.3	Involve in analysis and design of UML models for various case studies.
		20ITC13.4	Acquire thorough knowledge of standard UML notations.
		20ITC13.5	Know the risks, formulate and implement software projects.
58	III/II	**20ADC10: DEEP LEARNING**	
		20ADC10.1	Explain the basic principles of neural networks and deep learning.
		20ADC10.2	Implement simple neural network algorithms.
		20ADC10.3	Compare modeling aspects of various neural network architectures.
		20ADC10.4	Evaluate Convolutional Neural Network models on real data sets.
		20ADC10.5	Analyze and optimize Recurrent Neural Network models for various application
59	III/II	**20ADC11: DATA SCIENCE WITH 'R'**	
		20ADC11.1	Explore data operations on files and databases using R programming.
		20ADC11.2	Understand deployment of models on different datasets.
		20ADC11.3	Apply supervised, unsupervised, ensembling and NLP models

			on different datasets.
		20ADC11.4	Perform Sentiment analysis.
		20ADC11.5	Build and evaluate the models.
60	**III/II**	**20ITC25 : CLOUD COMPUTING**	
		20ITC25.1	Understand the basic ideas of Cloud Computing and its services.
		20ITC25.2	Analyze the architecture, deployment models, and infrastructure models of Cloud Computing.
		20ITC25.3	Realize distributed storage and performance for implementing virtualization.
		20ITC25.4	Analyze cloud computing security, federation, presence, identity, and privacy.
		20ITC25.5	Use IaaS / PaaS service offered by cloud service providers
61	**III/II**	**20ADE06 : MICROSERVICES WITH SPRING BOOT**	
		20ADE06.1	Gain the basic concepts of the Spring Framework
		20ADE06.2	Interact with databases using Spring's support for JDBC and JPA.
		20ADE06.3	Build spring boot applications using Dependency Injection concept
		20ADE06.4	Apply Transaction Management concepts of spring in Enterprise Application Development and develop the Spring-MVC based Applications to solve the real-world problems.
		20ADE06.5	Use Spring Unit testing framework and configure security on Spring MVC Applications
62	**III/II**	**20ADE07 : EXPLAINABLE ARTIFICIAL INTELLIGENCE**	
		20ADE07.1	Describe the context of the machine learning application and why explainability would help, but also scrutinize which kind of explainability technique is necessary.
		20ADE07.2	Understand the concepts that are important in model validation, evaluation, and performance visualization for both supervised and unsupervised learning.
		20ADE07.3	Install and set up one or more post hoc explain ability techniques through a self-chosen set of programming platforms.
		20ADE07.4	Critically reflect on the results from Explainable deep learning techniques and suggest how it helps the problem context.

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		20ADE07.5	Demonstrate comprehension of challenges and future related to Explainable AI
63	**III/II**	**20ITE14 : APPLIED PREDICTIVE ANALYTICS**	
		20ITE14.1	Comprehend predictive modeling and assess the performance
		20ITE14.2	Apply regression techniques and analyze the performance
		20ITE14.3	Demonstrate Support Vector Machines and build an efficient networking model
		20ITE14.4	Analyze ensemble methods by choosing Tree based classifiers
		20ITE14.5	Select appropriate probabilistic Graphical models and identify topics through topic modeling
64	**III/II**	**20ITE16 : FUNDAMENTALS OF BLOCK CHAIN TECH**	
		20ITE16.1	Describe the concepts of distributed systems and blockchain properties.
		20ITE16.2	Identify the significance of the bitcoin ecosystem.
		20ITE16.3	Examine the consensus mechanisms and technologies that support ethereum.
		20ITE16.4	Inspect Hyperledger Fabric and its architecture.
		20ITE16.5	Analyze blockchain use cases in various domains.
65	**III/II**	**20ADE08 : AGILE PROJECT MANAGEMENT**	
		20ADE08.1	Describe the Agile Life cycle models.
		20ADE08.2	Identify the scope and requirements for Agile project development
		20ADE08.3	Appraise the Agile Planning and scheduling mechanisms for an enterprise Agile project.
		20ADE08.4	Describe the Quality Principles in the Agile space.
		20ADE08.5	Analyze Matrix Management in the Agile Space
66	**III/II**	**20ADE09 : SOCIAL NETWORK ANALYSIS**	
		20ADE09.1	Understand the basics of social network analysis.
		20ADE09.2	Analyze Ontology representation of social network data.
		20ADE09.3	Apply supervised and unsupervised algorithms on social networks.
		20ADE09.4	Interpret the semantic content of social media data.

		20ADE09.5	Build social network model for real time applications.
		20ITC16 : SOFTWARE ENGINEERING LAB	
67	**III/II**	**20ITC16.1**	Interpret user requirements using the UML notation.
		20ITC16.2	Illustrate Dynamic models of a software system.
		20ITC16.3	Analyze and develop class diagrams that model a software system.
		20ITC16.4	Develop Activity and swimlane models.
		20ITC16.5	Outline analysis and design models.
68	**III/II**	**20ADC12 :DEEP LEARNING LAB**	
		20ADC12.1	Preprocess the data to train on Neural Networks
		20ADC12.2	Design and Implement Multilayer Perceptron Networks.
		20ADC12.3	Identify suitable Neural Network topology to solve a problem.
		20ADC12.4	Evaluate and Tune the Convolutional Neural Network models on real dataset(s)
		20ADC12.5	Analyze and Tune the Recurrent Neural Network models on real dataset(s)
69	**III/II**	**20ADC13 : MINOR PROJECT-II (Data Science)**	
		20ADC13.1	Interpret Literature with the purpose of formulating a project proposal.
		20ADC13.2	Develop the ability to identify and formulate problems by applying diverse technical knowledge skills.
		20ADC13.3	Apply the fundamental knowledge gained in the curriculum to model, design and implement a Data Science project.
		20ADC13.4	Build a prototype by choosing appropriate technologies to meet the identified requirements.
		20ADC13.5	Plan to work as a team and to focus on getting a working project done and submit a report within a stipulated period of time to the departmental Committee.
70	**III/II**	**20EGC03 : EMPLOYABILITY SKILLS**	
		20EGC03.1	Become effective communicators, participate in group discussions with confidence and be able to make presentations in a professional context.
		20EGC03.2	Write resumes, prepare and face interviews confidently. passages confidently.

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		20EGC03.3	Be assertive and set short term and long term goals, learn to manage time effectively and deal with stress.
		20EGC03.4	Make the transition smoothly from campus to work, use media with etiquette and understand the academic ethics.
		20EGC03.5	Enrich their vocabulary, frame accurate sentences and comprehend
71	**IV/I**	**20ADC14 : BIG DATA ANALYTICS**	
		20ADC14.1	Understand the processing large datasets in Hadoop framework and Apply MapReduce architecture to solve real world problems.
		20ADC14.2	Develop scripts using Pig over large datasets and query using Hive.
		20ADC14.3	Understand the fundamentals of Spark and the Scala programming.
		20ADC14.4	Expertise in using Resilient Distributed Datasets (RDD) for creating applications in Spark and query using SparkSQL.
		20ADC14.5	Understand NoSQL databases and Develop data models using MongoDB.
72	**IV/I**	**20ITE15 : UNMANNED AERIAL VEHICLES (Professional Elective – 4)**	
		20ITE15.1	Identify the parts and functions of UAV and drones
		20ITE15.2	Demonstrate the concepts of Aerodynamics, Propulsion & Structures of Model Aircrafts
		20ITE15.3	Determine the payload and its corresponding propeller's RPM to successfully fly the drone
		20ITE15.4	Design a drone with an automatic recovery mechanism.
		20ITE15.5	Understand Navigation of UAV.
73	**IV/I**	**20ADE10 : ROBOTIC PROCESS AUTOMATION (Professional Elective – 4)**	
		20ADE10.1	To Understand the basic concepts of RPA
		20ADE10.2	To Describe various components and platforms of RPA
		20ADE10.3	To Describe the different types of variables, control flow and data manipulation techniques
		20ADE10.4	To Understand various control techniques and OCR in RPA
		20ADE10.5	To Describe various types and strategies to handle exception
74	**IV/I**	**20ADE11 : BUSINESS INTELLIGENCE (Professional Elective – 4)**	

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		20ADE11.1	Understand the concepts and components of Business Intelligence (BI) and Decision support systems.
		20ADE11.2	Analyze how BI will help an organization and whether it will help yours.
		20ADE11.3	Identify the technological architecture that makes up BI systems
		20ADE11.4	Use the tools that make up BI (data science).
		20ADE11.5	Plan the implementation of a BI system
75	**IV/I**	**20ADE12 : SERVERLESS COMPUTING (Professional Elective – 4)**	
		20ADE12.1	Understand the evolution of computing and architectures.
		20ADE12.2	Summarize the requirements of serverless computing.
		20ADE12.3	Develop event driven applications.
		20ADE12.4	Use AWS Lambda for serverless applications.
		20ADE12.5	Develop Functions for serverless applications in AWS Lambda
76	**IV/I**	**20ITE26 : DIGITAL FORENSICS (Professional Elective – 4)**	
		20ITE26.1	Describe digital forensics and relate it to an investigative process.
		20ITE26.2	Explain the legal issues of preparing for and performing digital forensic analysis based on the investigator's position and duty.
		20ITE26.3	Interpret the cyber pieces of evidence, Digital forensic process model and their legal perspective.
		20ITE26.4	Demonstrate various forensic tools to investigate the cybercrime and to identify the digital pieces of evidence.
		20ITE26.5	Analyze the digital evidence used to commit cyber offenses.
77	**IV/I**	**20ADE13 : REINFORCEMENT LEARNING (Professional Elective – 4)**	
		20ADE13.1	Explain the fundamental concepts of reinforcement learning and finite markov decision process.
		20ADE13.2	Design a Reinforcement Learning system that knows how to make automated decisions
		20ADE13.3	Illustrate the integration of model-based and model-free methods.
		20ADE13.4	Analyze how a learning algorithm can be implemented in a different ways to obtain computational advantages.

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		20ADE13.5	Discuss parallels between reinforcement learning and neuroscience
78	**IV/I**	**20EGMO3 : UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY**	
		20EGMO3.1	Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
		20EGMO3.2	They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
		20EGMO3.3	They would have better critical ability.
		20EGMO3.4	They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
		20EGMO3.5	It is hoped that they would be able to apply what they have learnt to their own self in different day-today settings in real life, at least a beginning would be made in this direction.
79	**IV/I**	**20EGMO4 : GENDER SENSITIZATION**	
		20EGMO4.1	Understand the difference between "Sex" and "Gender" and be able to explain socially constructed theories of identity.
		20EGMO4.2	Recognize shifting definitions of "Man" and "Women" in relation to evolving notions of "Masculinity" and "Femininity".
		20EGMO4.3	Appreciate women's contributions to society historically, culturally and politically.
		20EGMO4.4	Analyze the contemporary system of privilege and oppressions, with special attention to the ways gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality.
		20EGMO4.5	Demonstrate an understanding of personal life, the workplace, the community and active civic engagement through classroom learning.
80	**IV/I**	**20ADC15 : BIG DATA ANALYTICS LAB**	
		20ADC15.1	Explain Hadoop working environment and develop applications using MapReduce framework.
		20ADC15.2	Develop scripts using Pig to solve real world problems and query the datasets using Hive.
		20ADC15.3	Develop applications in Spark environment using RDDs.
		20ADC15.4	Query real time data using SparkSQL.
		20ADC15.5	Query large datasets using NoSQL.

81	IV/I	**20ADC16 : PROJECT PART–I**	
		20ADC16.1	Identify problem from literature survey in his/her area of interest
		20ADC16.2	Formulate possible solutions for the selected problem and compare with existing ones
		20ADC16.3	Prepare synopsis of the selected problem
		20ADC16.4	Gather the required information to set up the environment for the implementation of preliminary experimentation
		20ADC16.5	Communicate the work effectively in both oral and written forms
82	IV/I	**20MEO03 : RESEARCH METHODOLOGIES (Open Elective-1)**	
		20MEO03.1	Define research problem.
		20MEO03.2	Review and assess the quality of literature from various sources.
		20MEO03.3	Understand and develop various research designs.
		20MEO03.4	Analyze problem by statistical techniques: ANOVA,F-test,Chi-square.
		20MEO03.5	Improve the style and format of writing a report for technical paper/Journal report.
83	IV/I	**20MEO12 : 3D PRINTING (Open Elective-1)**	
		20MEO12.1	Understand the concept of 3D printing processes, advantages and limitations.
		20MEO12.2	Evaluate real-life scenarios and recommend the appropriate 3D printing technology.
		20MEO12.3	Analyze various pre-processing and post processing techniques.
		20MEO12.4	Explain current and emerging 3D printing technologies in diversified applications.
		20MEO12.5	Identify components required in construction of 3Dprinter.
84	IV/I	**20MEO15 : PRINCIPLES OF INDUSTRY 4.0 (Open Elective-1)**	
		20MEO15.1	Understand the Basics and applications of Digital Manufacturing and Industry 4.0.
		20MEO15.2	Understand the role of Additive Manufacturing, Virtual prototyping and Reverse Engineering processes and their adaptability to Digital Manufacturing.

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		20MEO15.3	Understand the concepts of digital manufacturing based product life cycle and its management.
		20MEO15.4	Understand the concept of Industry 4.0 and allied technologies.
		20MEO15.5	Understand the basics of Internet of things and cloud computing pertaining the fourth industrial revolution.
85	**IV/I**	**20ECO14 : NEURAL NETWORKS AND FUZZY LOGIC (Open Elective-1)**	
		20ECO14.1	Understand the principles of Neural Networks and Fuzzy Logic fundamentals.
		20ECO14.2	Apply the basic concepts to model the Neural Networks and Fuzzy Logic systems.
		20ECO14.3	Compare the Neural Network based systems and Fuzzy Logic based systems.
		20ECO14.4	Analyze Fuzzy Logic controllers and its applications.
		20ECO14.5	Explain the concepts of Fuzzy target tracing control systems.
86	**IV/I**	**20EGO01 : TECHNICAL WRITING SKILLS (Open Elective-1)**	
		20EGO01.1	Communicate effectively, without barriers and understand aspects of technical communication.
		20EGO01.2	Differentiate between general writing and technical writing and write error free sentences using technology specific words
		20EGO01.3	Apply techniques of writing in business correspondence and in writing articles.
		20EGO01.4	Draft technical reports and technical proposals.
		20EGO01.5	Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.
87	**IV/II**	**20ADC17 : TECHNICAL SEMINAR**	
		20ADC17.1	Collect Organize, Analyze and Consolidate information about emerging technologies from the literature.
		20ADC17.2	Exhibit effective communication skills, stage courage, and confidence.
		20ADC17.3	Demonstrate intrapersonal skills.
		20ADC17.4	Explain new innovations/inventions in the relevant field.
		20ADC17.5	Prepare Seminar Report in a prescribed format.
88	**IV/II**	**20ADC18 : PROJECT PART-2**	

		20ADC18.1	Demonstrate a sound technical knowledge of their selected topic.
		20ADC18.2	Conduct investigations by using research-based knowledge and methods to provide valid conclusions.
		20ADC18.3	Provide solutions to societal complex problems utilizing gained engineering knowledge as an individual or by team work.
		20ADC18.4	Create/select/use modern tools to overcome the limitation of complex engineering solutions.
		20ADC18.5	Communicate with engineering experts and the community at large in written and oral forms.
89	**IV/II**	**20MEO04 : PRINCIPLES OF ENTREPRENEURSHIP (Open Elective-2)**	
		20MEO04.1	Understand the concept and essence of entrepreneurship.
		20MEO04.2	Identify business opportunities and nature of enterprise.
		20MEO04.3	Analyze the feasibility of new business plan.
		20MEO04.4	Apply project management techniques like PERT and CPM for effective planning and execution of projects.
		20MEO04.5	Use behavioral, leadership and time management aspects in entrepreneurial journey
90	**IV/II**	**20BTO04 : BIO-INFORMATICS (Open Elective-2)**	
		20BTO04.1	Explain the basic concepts of biology and bioinformatics.
		20BTO04.2	Identify various types of biological databases used for the retrieval and analysis of the information.
		20BTO04.3	Explain the sequence analysis and data mining.
		20BTO04.4	Discuss the methods used for sequence alignment and construction of the phylogenetic tree.
		20BTO04.5	Describe the methods used for gene and protein structure prediction.
91	**IV/II**	**20MEO10 : INTRODUCTION TO OPERATIONS RESEARCH (OE-2)**	
		20MEO10.1	Understand the concepts of linear programming problem.
		20MEO10.2	Solve the given transportation problem.
		20MEO10.3	Develop optimum pair of operations and resources by using assignment technique.
		20MEO10.4	Analyze project management techniques like CPM and PERT to plan and execute projects successfully.

		20MEO10.5	Apply sequencing concepts for industry applications.
92	**IV/II**	**20ECO06 : PRINCIPLES OF VLSI (Open Elective-2)**	
		20ECO06.1	Understand characteristic behavior of MOSFET
		20ECO06.2	Describe various MOS layers and layout design rules.
		20ECO06.3	Implement various CMOS logic circuits.
		20ECO06.4	Design various MOS memories.
		20ECO06.5	Understand the concepts of VLSI technology.
93	**IV/II**	**20EEO04 : ENERGY CONSERVATION (Open Elective-2)**	
		20EEO04.1	Know the current energy scenario and importance of energy conservation.
		20EEO04.2	Understand the concepts of energy conservation.
		20EEO04.3	Evaluate the performance of existing engineering systems.
		20EEO04.4	Explore the methods of improving energy efficiency in different engineering systems.
		20EEO04.5	Understanding different energy efficient devices.
94	**IV/II**	**20MTO03 : QUANTUM COMPUTING (Open Elective-3)**	
		20MTO03.1	Compute basic mathematical operations on Quantum bits.
		20MTO03.2	Will be able to execute Quantum operations of Quantum computing
		20MTO03.3	To built quantum programs
		20MTO03.4	Develop quantum Logical gates and circuits.
		20MTO03.5	Develop the quantum algorithm
95	**IV/II**	**20MEO07 : INTELLECTUAL PROPERTY RIGHTS (Open Elective-3)**	
		20MEO07.1	Understand the evolution of IP, working of organization's at global level to protect and promote IP.
		20MEO07.2	Familiarize with the patent filing process at national and international level.
		20MEO07.3	Draw the logical conclusion of research, innovation and patent filing.
		20MEO07.4	Compare different kinds of IP and their patenting system.
		20MEO07.5	Understand the techno-legal-business angle of IP, infringement and enforcement mechanisms forprotection.

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96	IV/II	**20ECO01 : REMOTE SENSING and GIS (Open Elective-3)**	
		20ECO01.1	Demonstrate the understanding of basic concepts of remote sensing and interpret energy interactions.
		20ECO01.2	Choose an appropriate technique for a given scenario by appreciating the types of remote sensing.
		20ECO01.3	Distinguish the principle behind the working of microwave and LiDAR sensing.
		20ECO01.4	Apply Microwave remote sensing techniques
		20ECO01.5	Explain the procedure for encoding data and geospatial data analysis.
97	IV/II	**20CEO02: DISASTER RISK REDUCTION AND MANAGEMENT (OE-3)**	
		20CEO02.1	Identify and understand the concepts of hazards, causes and impacts of disasters.
		20CEO02.2	Develop a critical capacity to evaluate the principles and practices of disaster risk reduction and management.
		20CEO02.3	Develop a deep awareness of disaster resilience, risk mitigation, and recovery policies as they arise from natural hazards around the globe.
		20CEO02.4	Apply knowledge about existing global frameworks and existing agreements and role of community in successful Disaster Risk Reduction.
		20CEO02.5	Evaluate DM study including data search, analysis and presentation as a case study.
	IV/II	**20BTO05 : COGNITIVE NEURO SCIENCE (Open Elective-3)**	
		20BTO05.1	Gain familiarity and basic knowledge about brain systems and functions.
		20BTO05.2	Understand brain's neuro-transimitter system.
		20BTO05.3	Understanding the brain's methods gives rise to behaviour whether we engage in any activity (e.g., walking, talking, etc.)
		20BTO05.4	Identify the patterns of varied activities in neurons that correspond to a person's attempts to move in particular ways.
		20BTO05.5	Understand the feedback system and brain disorders.

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