

Chaitanya Bharathi Institute of Technology
Department of Information Technology
Artificial Intelligence and Data Science



Criteria 3

Course Outcomes

**Course Outcome Statements of the
courses of Regulations**

R-20

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

INSTITUTE VISION AND MISSION:

Vision: To be a Centre of Excellence in Technical Education and Research

Mission: To address the emerging needs through quality technical education and advanced research

DEPARTMENT VISION AND MISSION:

Vision

To be a center of excellence in the field of Information Technology that yields pioneers and research experts who can contribute for the socio-economic development of the nation.

Mission:

- To impart state-of-the-art value based education in the field of Information Technology.
- To collaborate with industries and research organizations and excel in the emerging areas of research.
- To imbibe social responsibility in students.
- To motivate students to be trend setters and technopreneurs.

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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I. B.E. AI & DS Course Outcome Statements: R-20 Regulation

S.No	Course Code	Name of the Course	Course outcomes
2020-21 – I Semester			
1.	20MT C01	Linear Algebra & Calculus	<ol style="list-style-type: none"> 1. Apply the Matrix Methods to solve the system of linear equations 2. Test the convergence and divergence of the infinite Series. 3. Determine the extreme values of functions of two variables. 4. Apply the vector differential operator to scalar and vector functions 5. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.
2.	20EG C01	English	<ol style="list-style-type: none"> 1. Illustrate the nature, process and types of communication and communicate effectively without barriers. 2. Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette. 3. Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary. 4. Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports. 5. Critique passages by applying effective reading techniques
3.	20PY C01	Optics and Semiconductor Physics	<ol style="list-style-type: none"> 1. Demonstrate the physical properties of light. 2. Explain characteristic properties of lasers and fiber optics 3. Find the applications of quantum mechanics 4. Classify the solids depending upon electrical conductivity 5. Identify different types of semiconductors
4.	20CS C01	Programming for Problem Solving	<ol style="list-style-type: none"> 1. Identify and understand the computing environments for scientific and mathematical problems. 2. Formulate solutions to problems with alternate approaches and represent them using algorithms / Flowcharts. 3. Choose data types and control structures to solve mathematical and scientific problem. 4. Decompose a problem into modules and use functions to implement the modules. 5. Apply arrays, pointers, structures, and unions to solve mathematical and scientific problems. 6. Develop applications using file I/O.
5.	20MT C02	Linear Algebra & Calculus Lab	<ol style="list-style-type: none"> 1. Apply the Matrix operations in executing various programmes. 2. Test the convergence and divergence of the infinite Series. 3. Explore the extreme values of functions of two variables. 4. Determine the gradient, divergent and curl of scalar and vector point functions. 5. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems
6.	20EG C02	English lab	<ol style="list-style-type: none"> 1. Define the speech sounds in English and understand the nuances of pronunciation in English 2. Apply stress correctly and speak with the proper tone, intonation and rhythm. 3. Analyze IELTS and TOEFL listening comprehension texts to enhance their listening skills. 4. Determine the context and speak appropriately in various situations. 5. Design and present effective posters while working in teams, and discuss and participate in Group discussions.
7.	20PY C03	Optics and Semiconductor	<ol style="list-style-type: none"> 1. Interpret the errors in the results of an experiment.

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		Physics Lab	<ol style="list-style-type: none"> 2. Demonstrate physical properties of light experimentally 3. Make use of lasers and optical fibers for engineering applications 4. Explain the V-I characteristics of some optoelectronic and semiconductor devices 5. Find the applications thermistor
8.	20CS C02	Programming for problem Solving Lab	<ol style="list-style-type: none"> 1. Identify and setup program development environment. 2. Design and test programs to solve mathematical and scientific problems. 3. Identify and rectify the syntax errors and debug program for semantic errors 4. Implement modular programs using functions. 5. Represent data in arrays, pointers, structures and manipulate them through a program. 6. Create, read, and write to and from simple text files.
9.	20ME C01	CAD and Drafting	<ol style="list-style-type: none"> 1. Become conversant with appropriate use of CAD software for drafting. 2. Recognize BIS, ISO Standards and conventions in Engineering Drafting. 3. Construct the projections of points, lines, planes, solids 4. Analyse the internal details of solids through sectional views 5. Create an isometric projections and view
10	20MB C02	Community Engagement	<ol style="list-style-type: none"> 1. Gain an understanding of Rural life, Culture and Social realities. 2. Develop a sense of empathy and bonds of mutuality with Local Communities. 3. Appreciate significant contributions of Local communities to Indian Society and Economy. 4. Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements. 5. Utilise the opportunities provided by Rural Development Programmes.
2020-21 – II Semester			
1.	20MT C03	Differential Equations & Transform Theory	<ol style="list-style-type: none"> 1. Calculate the solutions of first order linear differential equations. 2. Calculate the solutions of higher order linear differential equations. 3. Examine the series solutions for higher order differential equations. 4. Evaluate the Improper integrals by Fourier Transform. 5. Solve the difference equations by Z-transforms
2.	20CY C01	Chemistry	<ol style="list-style-type: none"> 1. Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions. 2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells. 3. Illustrate the major chemical reactions that are used in the synthesis of organic molecules. 4. Classify the various methods used in treatment of water for domestic and industrial use. 5. Outline the synthesis of various Engineering materials & Drugs.
3.	20IT C01	Data Structures and Algorithm	<ol style="list-style-type: none"> 1. Analyse time complexity of both iterative and recursive functions. 2. Understand various sorting algorithms and their performance . 3. Build optimal solutions using linear and nonlinear data

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			structures. 4. Apply pattern matching. 5. Understand hash functions and collision handling
4.	20IT C02	Object Oriented Programming using Python	1. Understand the concepts Object-Oriented Programming 2. Make use of Python programming constructs to implement solutions to problems 3. Model the problem using OOP strategies and handle exceptions 4. Make use of files and perform file handling operations. 5. Develop GUI's
5.	20MT C04	Differential Equations & Transform Theory Lab	1. Explore all the possible solutions of first order differential equation. 2. Analyse the solutions of higher order linear differential equations. 3. Examine the series solutions for higher order differential equations. 4. Evaluate the Improper integrals by Fourier Transform. 5. Apply the Z-transform to solve the difference equations
6.	20CYC02	Chemistry Lab	1. Identify the basic chemical methods to analyse the substances quantitatively & qualitatively. 2. Estimate the amount of chemical substances by volumetric analysis. 3. Determine the rate constants of reactions from concentration of reactants/ products as a function of time. 4. Calculate the concentration and amount of various substances using instrumental techniques. 5. Develop the basic drug molecules and polymeric compounds.
7.	20IT C03	Data Structures and Algorithms Lab	1. Make use of predefined data structures of python to process data. 2. Evaluate the performance of Sorting algorithms 3. Demonstrate Arrays, Linked lists, Stacks, Queues, Binary Search Trees, Graphs 4. Make use of Hashing and perform data storing and retrieval 5. Build optimal solutions using linear and nonlinear data structures to real world problems.
8.	20IT C04	Object Oriented Programming using Python Lab	1. Make use of Python programming constructs to implement solutions to problems 2. Model the problem using OOP strategies and handle exceptions 3. Make use of files and perform file handling operations. 4. Develop GUI's 5. Build solutions to real world problems
9.	20MEC02	Workshop / Manufacturing Practice	1. Understand safety measures to be followed in workshop to avoid accidents. 2. Identify various tools used in fitting, carpentry, tin smithy, house wiring, welding, casting and machining processes. 3. Make a given model by using workshop trades including fitting, carpentry, tinsmithy and House wiring. 4. Perform various operations in welding, machining and casting processes. 5. Conceptualize and produce simple device/mechanism of their choice.
10.	20ME C03	Engineering Exploration	1. Understand the role of an engineer as a problem solver. 2. Identify multi-disciplinary approaches in solving an engineering problem.

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			<p>3. Build simple systems using engineering design process.</p> <p>4. Analyze engineering solutions from ethical and sustainability perspectives.</p> <p>5. Use basics of engineering project management skills in doing projects.</p>
2020-21 – III Semester			
1.	20ECC34	DC Circuits, Sensors and Transducers	<p>1. Understand about the basics of lower power systems, DC circuits.</p> <p>2. Use semiconductor devices in making circuits like rectifiers, filters, regulators, etc.</p> <p>3. Design transistorized circuits of amplifiers and oscillators</p> <p>4. Acquire the data from various sensors and transducers with the help of DAQ.</p> <p>5. Analyze usage of sensors/transducer for the development of real-time applications.</p>
2.	20MTC09	Probability and Statistics	<p>1. Use the principle of Least Squares approximating for estimating the value.</p> <p>2. Use the basic probability for fitting the Random phenomenon.</p> <p>3. Analyzing data using different methods of hypothesis testing.</p> <p>4. Use the Moving Averages Methods for trend analysis.</p> <p>5. Analyze the random phenomena of real world data.</p>
3.	20ITC08	Database Management Systems	<p>1. Understand the purpose of database systems and design any domain specific database using E-R model.</p> <p>2. Design and implement a database using Relational data model, formulate Relational algebra expressions. Use SQL for efficient data retrieval queries.</p> <p>3. Access databases from high level languages, define triggers and apply normalization.</p> <p>4. Understand the concepts of database transactions, locking protocols, concurrency control, backup and recovery.</p> <p>5. Efficiently organize and manage data using indexing and hashing.</p>
4.	20ADC01	Java Programming	<p>1. Understand object-oriented concepts.</p> <p>2. Create Java applications using best OOP practices e.g. Inheritance, interfaces, packages, and innerclasses.</p> <p>3. Implement the concepts of Exception Handling and Multi-threading.</p> <p>4. Develop applications using Collections framework and handle files.</p> <p>5. Use Regular expression and java 8 concepts in application development.</p>
5.	20ITC05	Digital Logic and Computer Architecture	<p>1. Understand simplification of logic gates, fundamentals of combinational and sequential logic gates.</p> <p>2. Design of registers, counters and representation of data using numbers.</p> <p>3. Understand the architecture and functionality of central processing unit.</p> <p>4. Discuss the techniques that computers use to communicate with I/O devices for data transfer.</p> <p>5. Comprehend memory hierarchy, cache memory and virtual memory.</p>
6.	20EG M01	Indian Constitution and Fundamental Principles	<p>1. Understand the making of the Indian Constitution, its features and learn the importance of Directive Principles</p>

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			<p>of State Policy.</p> <ol style="list-style-type: none"> Identify the difference between Right to Equality and Right to Freedom and know the relevance of Fundamental Duties. Analyze the structuring of the Indian Union, distribution of powers between the Union and the States, and the role and position of President in Union Government. Distinguish between the Lok Sabha and Rajya Sabha in law making process while appreciating the importance of Judiciary in interpretation of law and protection of citizens' rights. Differentiate between the Municipalities and Panchayats in their functioning and know the role of Collector in district administration.
7.	20EGM02	Indian Traditional Knowledge	<ol style="list-style-type: none"> Understand philosophy of Indian culture Distinguish the Indian languages and literature Learn the philosophy of ancient, medieval and modern India Acquire the information about the fine arts in India Know the contribution of scientists of different eras.
8.	20ITC10	Database Management Systems Lab	<ol style="list-style-type: none"> Design and implement database schemas by enforcing integrity constraints. Use SQL for database administration, data manipulation and retrieval. Develop PL/SQL programs and use cursors for the databases. Design triggers for database validation. Handle Exceptions in PL/SQL programs.
9.	20ADC02	Java Programming Lab	<ol style="list-style-type: none"> Develop Java applications using the concepts of Inheritance, interfaces, packages and access control modifiers. Implement the concepts of Exception Handling and Multithreading in java Applications Read and write data using different Java I/O streams. Develop applications using Collections framework. Validate inputs using regular expression and apply the knowledge of Java 8 new features in application Development.
10.	20ADC03	Artificial Intelligence & Machine Learning Tools, Techniques and Applications	<ol style="list-style-type: none"> Understand the importance of AI. Understand concepts of Machine Learning algorithms and their limitations. Develop Chatbots based on the requirements. Analyze complex problems involving image processing, such as quality control, visual surveillance, multimodal human-machine interfaces, and image compression. Understand the application of Reinforcement Learning.
11.	20ITC12	Mini Project - I	<ol style="list-style-type: none"> Interpret literature with the purpose of formulating a project proposal. Plan, Analyse, Design and Implement a project. Find the solution of identified problem with the help of modern Technology and give priority to real time scenarios. 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. Prepare and submit the Report and deliver presentation before the Departmental Committee.

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12.	20ADI01	MOOCS / TRAINING / INTERNSHIP	
2020-21 – IV Semester			
1.	20MTC10	Stochastic Process and Queueing Theory	<ol style="list-style-type: none"> 1. Estimate the marginal probabilities of statistical averages 2. Distinguish the random process of auto correlation and cross correlation 3. Characterize the random process of ensemble averages 4. Analyze the effect the thermal noise in the system 5. Analyze the queuing behavior of different queuing models.
2.	20ITC06	Discrete Mathematics and Applications	<ol style="list-style-type: none"> 1. Symbolize the given sentence using propositional logic and apply the onto and one-to-one functions between the sets. 2. Understand the mathematical induction and apply the modular arithmetic for cryptography and congruence applications. 3. Apply permutations and combinations to handle different types of objects, understand solving homogeneous and Non-homogeneous recurrence using generating functions. 4. Apply relations and graph concepts for basic problem solving. 5. Demonstrate Algebraic systems and their Properties.
3.	20ITC15	Design and Analysis of Algorithms	<ol style="list-style-type: none"> 1. Analyze best, average and worst case complexities of algorithms and choose appropriate data structure for designing algorithm. 2. Develop solutions using Divide and Conquer, Greedy techniques. 3. Design algorithms using dynamic programming approach, apply traversal and search techniques. 4. Apply backtracking, branch and bound techniques to solve problems. 5. Identify P, NP, NP-Complete and NP-Hard classes to which an algorithm belongs and design a feasible solution.
4.	20ADC 04	Machine Learning	<ol style="list-style-type: none"> 1. Understand basic concepts of machine learning models. 2. Apply tree models, perform classification and regression tasks. 3. Understand rule based learning and linear models. 4. Apply distance based and probabilistic models for clustering and classification of data. 5. Design and develop a neural network, use dimensionality reduction techniques, ensemble methods.
Professional Elective – I			
5.	20ITE01	Image Processing <i>Digital</i>	<ol style="list-style-type: none"> 1. Illuminate the fundamental concepts and applications of digital image processing techniques. 2. Demonstrate intensity transformations, spatial filtering, smoothing and sharpening in both spatial and frequency domains, image restoration concepts 3. Demonstrate image restoration and morphological image processing methods 4. Apply object recognition techniques by using image segmentation and image representation & description methods 5. Illustrate the various colour models and Application of image compression methods
6.	20ADE01	Data Analysis Visualization	<ol style="list-style-type: none"> 1. Efficiently store and manipulate dense data in arrays with Numpy 2. Apply high level mathematical functions to aggregate, broadcast, index and sort multidimensional arrays.

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			<ol style="list-style-type: none"> 3. Create Series and Data Frame objects to operate on datasets. 4. Perform Data cleaning, transformation, merging, aggregation on datasets. 5. Apply 2-D and 3-D plotting techniques on datasets
7.	20ITE02	Mobile Application Development with Android and Kotlin	<ol style="list-style-type: none"> 1. Understand the benefits of using Kotlin for Mobile application development 2. Understand the android project structure 3. Understand activity and fragment life cycles 4. Apply various styles, themes and material design to apps 5. Apply best practices to prepare and publish apps on Play store
8.	20ITE03	Fundamentals of Cryptography	<ol style="list-style-type: none"> 1. Demonstrate the key security concepts, security attacks and cryptography techniques. 2. Analyze block ciphers, symmetric encryption algorithms. 3. Describe the operations of asymmetric key cryptography and key exchange. 4. Comprehend cryptographic hash functions, message authentication codes. 5. Inspect the digital signature process, key distribution, user authentication.
9.	20ADE02	Theory of Automata	<ol style="list-style-type: none"> 1. Build Deterministic, Non deterministic Finite automata for Languages and show the acceptance of strings using Formal Machines. 2. Develop regular expressions and their equivalent finite automata for different languages. 3. Infer Context-free grammars for certain languages and Test for Closure Properties and Decision Properties of CFL's. 4. Construct pushdown automata for languages and analyse Equivalence of PDA's and CFG's. 5. Identify Recursively Enumerable Languages, Undecidable problems and Model Turing Machines for Simple Computational Problems.
10.	20ITE04	Data Warehousing and Data Mining	<ol style="list-style-type: none"> 1. Understand the concepts and issues of data mining, apply preprocessing techniques. 2. Build multidimensional data model and perform OLAP operations, generate association rules. 3. Evaluate various models for classification and prediction. 4. Analyze advanced classification methods and clustering techniques. 5. Understand outlier detection and real time applications of data mining.
11.	20MBC01	Engineering Economics and Accountancy	<ol style="list-style-type: none"> 1. Apply fundamental knowledge of Managerial Economics concepts and tools. 2. Analyze various aspects of Demand Analysis, Supply and Demand Forecasting. 3. Understand Production and Cost relationships to make best use of resources available. 4. Apply Accountancy Concepts and Conventions and preparation of Final Accounts. 5. Evaluate Capital and Capital Budgeting decision based on any technique.

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12.	20CEM01	Environmental Science	<ol style="list-style-type: none"> 1. Identify the natural resources and realise the importance of water, food, forest, mineral, energy, landresources and affects of over utilisation. 2. Understand the concept of ecosystems and realise the importance of interlinking of food chains. 3. Contribute for the conservation of bio-diversity. 4. Suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment. 5. Follow the environmental ethics and contribute to the mitigation and management of environmental disasters.
13.	20MTC11	Stochastic Process and Queueing Theory Lab	<ol style="list-style-type: none"> 1. Execute marginal probabilities of statistical averages. 2. Compute the auto correlation and cross correlation of random process. 3. Characterize the random process of ensemble averages. 4. Analyze the effect of the thermal noise in the system. 5. Analyze the queuing behavior of different queuing models.
14.	20ITC17	Design and Analysis of Algorithms Lab	<ol style="list-style-type: none"> 1. Implement Divide and Conquer Algorithms. 2. Build solutions using Greedy technique. 3. Apply Dynamic programming algorithms to solve problems. 4. Implement connected and biconnected components algorithms. 5. Design solutions using Backtracking technique.
15.	20ADC05	Machine Learning Lab	<ol style="list-style-type: none"> 1. Build decision trees for classification. 2. Perform dimensionality reduction of a dataset. 3. Apply distance based models for clustering and classification of data. 4. Design and build neural networks. 5. Build solutions using SVM, ensemble methods.
16.	20ITC18	Mini Project – II	<ol style="list-style-type: none"> 1. Interpret Literature with the purpose of formulating a project proposal. 2. Plan, Analyse, Design and Implement a project using SDLC model. 3. Find the solution of identified problem with the help of modern Technology and give priority to real timescenarios. 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. 5. Prepare and submit the Report and deliver presentation before the Departmental Committee.
2020-21 – V Semester			
1.	20ADC06	Artificial Intelligence	<ol style="list-style-type: none"> 1. Solve problems using Exhaustive and Heuristic Search Techniques. 2. Apply inference methods in propositional logic to prove statements. 3. Construct knowledge representation models. 4. Inspect probabilistic reasoning models on uncertain data. 5. Appraise the learning techniques on data.
2.	20ITC24	Embedded Systems and IoT	<ol style="list-style-type: none"> 1. Develop and design for Embedded computing using 8051 Microcontroller. 2. Describe the role of things and Internet in IoT and determine the IoT levels designing an IoT Systems. 3. Learn the methodology for IoT system design and interface with Raspberry Pi. 4. Design and Develop IoT computing and its applications. 5. Implement standard IoT to build large systems for industries.

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3.	20ITC19	Operating Systems	<ol style="list-style-type: none"> 1. Demonstrate operating system services, inter process communication and multithreaded Programming. 2. Apply suitable process scheduling, deadlocks handling algorithms and solve process-synchronization. 3. Make use of advanced techniques such as paging, segmentation and virtual memory for memorymanagement. 4. Illustrate file system interfaces and its implementation. 5. Identify the Operating System Security problems and Threats.
4.	20ADC07	Full Stack Development	<ol style="list-style-type: none"> 1. Create web pages with good aesthetic sense of design using HTML and CSS 2. Create real-world React web applications and related tools. 3. Become an agile practitioner with the ability to quickly complete projects 4. Build an end-to-end application from scratch using NODE JS 5. Understand and build logical relationships between documents using MongoDB.
5.	20ITC20	Computer Networks	<ol style="list-style-type: none"> 1. Summarize functions of each layer in the OSI and TCP/IP reference models and demonstrate the systematic understanding of data communication Techniques. 2. Solve problems related to Addressing, Routing, Interoperability among heterogeneous networks. 3. Identify issues in Internetwork Routing issues and Congestion in computer networks. 4. Appraise the functions and performance of Internet Transport Protocols TCP and UDP. 5. Analyze the operating principles of Domain Name System and Electronic Mail, WWW.
6.	20ADC08	Artificial Intelligence Lab	<ol style="list-style-type: none"> 1. Understand the types of informed and uninformed problems and apply search strategies to solve them. 2. Demonstrate Basic Prolog programming 3. Solve real-life problems using AI techniques like game search. 4. Apply probabilistic reasoning on data. 5. Analyze the Q-learning Algorithm.
7.	20ITC26	Embedded Systems and IoT Lab	<ol style="list-style-type: none"> 1. Program using Raspberry Pi. 2. Develop python programs that run on Raspberry Pi/Arduino 3. Write basic IoT Programs using Raspberry Pi/Arduino. 4. Implement Applications using Raspberry Pi / Arduino. 5. Develop simple IoT systems of different Case studies.
8.	20ADC09	Minor Project - I (Full Stack Development)	<ol style="list-style-type: none"> 1. Interpret Literature with the purpose of formulating a project proposal. 2. Plan, analyze, Design and implement a project. 3. Find the solution of identified problem ith of modern Technology and give priority to real time scenarios. 4. Plan to work as a team and to focus on getting working project done and submit a report within a stipulated period of time. 5. Prepare and submit the Report and deliver a presentation before the departmental Committee.
9.		Industrial / Rural Internship	

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Professional Elective – 2			
10.	20ADE03	Natural Language Processing	<ol style="list-style-type: none"> 1. Justify the various steps necessary for processing natural language 2. Suggest appropriate semantic modeling and sequence labeling techniques for a particular application. 3. Apply appropriate neural network-based models for a contextual application 4. Analyze existing encoder-decoder models and information extraction techniques. 5. Identify the significance of word net and analyze the applications of Natural Language Processing such as Question Answering and chatbots.
11.	20ADE04	No SQL Databases	<ol style="list-style-type: none"> 1. Define, compare and use the four types of NoSQL Databases 2. Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Key-Value Pair NoSQL databases. 3. Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases. 4. Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases. 5. Explain the detailed architecture, define objects, load data, query data and performance tune Graph NoSQL databases.
12.	20ITE13	Computer Vision	<ol style="list-style-type: none"> 1. Summarize the fundamentals of Image formation and describe the Geometric primitives and Transformations. 2. Describe different approaches to recognition of objects. 3. Inspect algorithms for feature detection and feature alignment. 4. Analyze images and videos for problems such as tracking and structure from motion. 5. Design recovered 3D structure for ill-posed scenes.
13.	20ITE08	Cyber Security	<ol style="list-style-type: none"> 1. Describe legal frameworks to handle cybercrimes. 2. Identify the functioning of different kinds of malware used in cybercrimes. 3. Examine the legal perspectives of cybercrimes in Indian and international context. 4. Describe the need of Digital Forensics and the importance of digital evidence in prosecution 5. Interpret the commercial activities in the event of significant information security incidents in the Organization.
14.	20ADE05	Compiler Design	<ol style="list-style-type: none"> 1. Identify the concepts related to translator, tokens, bootstrapping, porting and phases of the compiler and develop Lexical-Analyzer for Source Language. 2. Construct Top-down parsers and Bottom-up parsers. 3. Develop Syntax Directed Translation scheme and Generate Intermediate code for a language. 4. Translate Intermediate code into Target code. 5. Understand Data flow Analysis and apply the optimization techniques.

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15.	20ITE07	Augmented Reality and Virtual Reality	<ol style="list-style-type: none"> 1. Describe the basic concepts of Virtual Reality and 3D Computer Graphics. 2. Apply 3D manipulation techniques in Virtual Reality. 3. Analyze Development Tools and Frameworks in Virtual Reality. 4. Develop a Virtual Reality application. 5. Evaluate Augmented Reality Systems
2020-21 – V1 Semester			
16.	20ITC13	Software Engineering	<ol style="list-style-type: none"> 1. Identify the minimum requirements for the development of application. 2. Build a system, component, or process to meet desired needs of a customer. 3. Involve in analysis and design of UML models for various case studies. 4. Acquire thorough knowledge of standard UML notations. 5. Know the risks, formulate and implement software projects.
17.	20ADC10	Deep Learning	<ol style="list-style-type: none"> 1. Explain the basic principles of neural networks and deep learning. 2. Implement simple neural network algorithms. 3. Compare modeling aspects of various neural network architectures. 4. Evaluate Convolutional Neural Network models on real data sets. 5. Analyze and optimize Recurrent Neural Network models for various applications.
18.	20ADC11	Data Science with 'R'	<ol style="list-style-type: none"> 1. Explore data operations on files and databases using R programming. 2. Understand deployment of models on different datasets. 3. Apply supervised, unsupervised, ensembling and NLP models on different datasets. 4. Perform Sentiment analysis. 5. Build and evaluate the models.
19.	20ITC25	Cloud Computing	<ol style="list-style-type: none"> 1. Understand the basic ideas of Cloud Computing and its services. 2. Analyze the architecture, deployment models, and infrastructure models of Cloud Computing. 3. Realize distributed storage and performance for implementing virtualization. 4. Analyze cloud computing security, federation, presence, identity, and privacy. 5. Use IaaS / PaaS service offered by cloud service providers
20.	20ITC16	Software Engineering Lab	<ol style="list-style-type: none"> 1. Interpret user requirements using the UML notation. 2. Illustrate Dynamic models of a software system. 3. Analyze and develop class diagrams that model a software system. 4. Develop Activity and swimlane models. 5. Outline analysis and design models.
21.	20ADC12	Deep LearningLab	<ol style="list-style-type: none"> 1. Preprocess the data to train on Neural Networks 2. Design and Implement Multilayer Perceptron Networks. 3. Identify suitable Neural Network topology to solve a problem. 4. Evaluate and Tune the Convolutional Neural Network models on real dataset(s) 5. Analyze and Tune the Recurrent Neural Network models on real dataset(s)


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22.	20ADC13	Minor Project -II(Data Science)	<ol style="list-style-type: none"> 1. Interpret Literature with the purpose of formulating a project proposal. 2. Develop the ability to identify and formulate problems by applying diverse technical knowledge skills. 3. Apply the fundamental knowledge gained in the curriculum to model, design and implement a Data Science project. 4. Build a prototype by choosing appropriate technologies to meet the identified requirements. 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.
23.	20EGC03	Employability Skills	<ol style="list-style-type: none"> 1. Become effective communicators, participate in group discussions with confidence and be able to make presentations in a professional context. 2. Write resumes, prepare and face interviews confidently. 3. Be assertive and set short term and long term goals, learn to manage time effectively and deal with stress. 4. Make the transition smoothly from campus to work, use media with etiquette and understand the academic ethics. 5. Enrich their vocabulary, frame accurate sentences and comprehend passages confidently.
Professional Elective – 3			
24.	20ADE06	Microservices With Spring Boot	<ol style="list-style-type: none"> 1. Gain the basic concepts of the Spring Framework 2. Interact with databases using Spring's support for JDBC and JPA. 3. Build spring boot applications using Dependency Injection concept 4. Apply Transaction Management concepts of spring in Enterprise Application Development and develop the Spring-MVC based Applications to solve the real-world problems. 5. Use Spring Unit testing framework and configure security on Spring MVC Applications
25.	20ADE07	Explainable Artificial Intelligence	<ol style="list-style-type: none"> 1. Describe the context of the machine learning application and why explainability would help, but also scrutinize which kind of explainability technique is necessary. 2. Understand the concepts that are important in model validation, evaluation, and performance visualization for both supervised and unsupervised learning. 3. Install and set up one or more post hoc explain ability techniques through a self-chosen set of programming platforms. 4. Critically reflect on the results from Explainable deep learning techniques and suggest how it helps the problem context. 5. Demonstrate comprehension of challenges and future related to Explainable AI
26.	20ITE14	Applied Predictive Analytics	<ol style="list-style-type: none"> 1. Comprehend predictive modeling and assess the performance 2. Apply regression techniques and analyze the performance 3. Demonstrate Support Vector Machines and build an efficient networking model 4. Analyze ensemble methods by choosing Tree based classifiers 5. Select appropriate probabilistic Graphical models and identify topics through topic modeling

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27.	20ITE16	Fundamentals Of Block Chain Technology	<ol style="list-style-type: none"> 1. Describe the concepts of distributed systems and blockchain properties. 2. Identify the significance of the bitcoin ecosystem. 3. Examine the consensus mechanisms and technologies that support ethereum. 4. Inspect Hyperledger Fabric and its architecture. 5. Analyze blockchain use cases in various domains.
28.	20ADE08	Agile Project Management	<ol style="list-style-type: none"> 1. Describe the Agile Life cycle models. 2. Identify the scope and requirements for Agile project development 3. Appraise the Agile Planning and scheduling mechanisms for an enterprise Agile project. 4. Describe the Quality Principles in the Agile space. 5. Analyze Matrix Management in the Agile Space
29.	20ADE09	Social Network Analysis	<ol style="list-style-type: none"> 1. Understand the basics of social network analysis. 2. Analyze Ontology representation of social network data. 3. Apply supervised and unsupervised algorithms on social networks. 4. Interpret the semantic content of social media data. 5. Build social network model for real time applications.
2020-21 – VII Semester			
1.	20ADC14	Big Data Analytics	<ol style="list-style-type: none"> 1. Understand the processing large datasets in Hadoop framework and Apply MapReduce architecture to solve real world problems. 2. Develop scripts using Pig over large datasets and query using Hive. 3. Understand the fundamentals of Spark and the Scala programming. 4. Expertise in using Resilient Distributed Datasets (RDD) for creating applications in Spark and query using SparkSQL. 5. Understand NoSQL databases and Develop data models using MongoDB.
2.	20EGM03	Universal Human ValuesII: Understanding Harmony	<ol style="list-style-type: none"> 1. Students are expected to become more aware of themselves, and their surroundings (family, society, nature) 2. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. 3. They would have better critical ability. 4. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). 5. It is hoped that they would be able to apply what they have learnt to their own self in different day-to- day settings in real life, at least a beginning would be made in this direction.
3.	20EGMO4	Gender Sensitization	<ol style="list-style-type: none"> 1. Understand the difference between “Sex” and “Gender” and be able to explain socially constructed theories of identity. 2. Recognize shifting definitions of “Man” and “Women” in relation to evolving notions of “Masculinity” and “Femininity”. 3. Appreciate women’s contributions to society historically, culturally and politically. 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. 5. Demonstrate an understanding of personal life, the workplace, the community and active civic engagement through classroom learning.

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4.	20ADC15	Big Data Analytics Lab	<ol style="list-style-type: none"> 1. Explain Hadoop working environment and develop applications using MapReduce framework. 2. Develop scripts using Pig to solve real world problems and query the datasets using Hive. 3. Develop applications in Spark environment using RDDs. 4. Query real time data using SparkSQL. 5. Query large datasets using NoSQL.
5.	20ADC16	Project Part – 1	<ol style="list-style-type: none"> 1. Identify problem from literature survey in his/her area of interest. 2. Formulate possible solutions for the selected problem and compare with existing ones. 3. Prepare synopsis of the selected problem. 4. Gather the required information to set up the environment for the implementation of preliminary experimentation. 5. Communicate the work effectively in both oral and written forms.
6.		Internship	
Professional Elective – 4			
7.	20ITE15	Unmanned Aerial Vehicles	<ol style="list-style-type: none"> 1. Identify the parts and functions of UAV and drones 2. Demonstrate the concepts of Aerodynamics, Propulsion & Structures of Model Aircrafts 3. Determine the payload and its corresponding propeller's RPM to successfully fly the drone 4. Design a drone with an automatic recovery mechanism. 5. Understand Navigation of UAV.
8.	20ADE10	Robotic Process Automation	<ol style="list-style-type: none"> 1. To Understand the basic concepts of RPA 2. To Describe various components and platforms of RPA 3. To Describe the different types of variables, control flow and data manipulation techniques 4. To Understand various control techniques and OCR in RPA 5. To Describe various types and strategies to handle exception
9.	20ADE11	Business Intelligence	<ol style="list-style-type: none"> 1. Understand the concepts and components of Business Intelligence (BI) and Decision support systems. 2. Analyze how BI will help an organization and whether it will help yours. 3. Identify the technological architecture that makes up BI systems 4. Use the tools that make up BI (data science). 5. Plan the implementation of a BI system
10.	20ADE12	Serverless Computing	<ol style="list-style-type: none"> 1. Understand the evolution of computing and architectures. 2. Summarize the requirements of serverless computing. 3. Develop event driven applications. 4. Use AWS Lambda for serverless applications. 5. Develop Functions for serverless applications in AWS Lambda
11.	20ITE26	Digital Forensics	<ol style="list-style-type: none"> 1. Describe digital forensics and relate it to an investigative process. 2. Explain the legal issues of preparing for and performing digital forensic analysis based on the investigator's position and duty. 3. Interpret the cyber pieces of evidence, Digital forensic process model and their legal perspective. 4. Demonstrate various forensic tools to investigate the cybercrime and to identify the digital pieces of evidence. 5. Analyze the digital evidence used to commit cyber offenses.

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12.	20ADE13	Reinforcement Learning	<ol style="list-style-type: none"> 1. Explain the fundamental concepts of reinforcement learning and finite markov decision process. 2. Design a Reinforcement Learning system that knows how to make automated decisions 3. Illustrate the integration of model-based and model-free methods. 4. Analyse how a learning algorithm can be implemented in a different ways to obtain computational advantages. 5. Discuss parallels between reinforcement learning and neuroscience
Open Elective – 1			
13.	20MEO03	Research Methodologies	<ol style="list-style-type: none"> 1. Define research problem. 2. Review and assess the quality of literature from various sources. 3. Understand and develop various research designs. 4. Analyze problem by statistical techniques: ANOVA,F-test,Chi-square. 5. Improve the style and format of writing a report for technical paper/Journal report.
14.	20MEO12	3d Printing	<ol style="list-style-type: none"> 1. Understand the concept of 3D printing processes, advantages and limitations. 2. Evaluate real-life scenarios and recommend the appropriate 3D printing technology. 3. Analyze various pre-processing and post processing techniques. 4. Explain current and emerging 3D printing technologies in diversified applications. 5. Identify components required in construction of 3D printer.
15.	20ME O15	Principles Of Industry 4.0	<ol style="list-style-type: none"> 1. Understand the Basics and applications of Digital Manufacturing and Industry 4.0. 2. Understand the role of Additive Manufacturing, Virtual prototyping and Reverse Engineering processes and their adaptability to Digital Manufacturing. 3. Understand the concepts of digital manufacturing based product life cycle and its management. 4. Understand the concept of Industry 4.0 and allied technologies. 5. Understand the basics of Internet of things and cloud computing pertaining the fourth industrial revolution.
16.	20ECO14	Neural Networks And Fuzzy Logic	<ol style="list-style-type: none"> 1. Understand the principles of Neural Networks and Fuzzy Logic fundamentals. 2. Apply the basic concepts to model the Neural Networks and Fuzzy Logic systems. 3. Compare the Neural Network based systems and Fuzzy Logic based systems. 4. Analyze Fuzzy Logic controllers and its applications. 5. Explain the concepts of Fuzzy target tracing control systems.
17.	20EGO01	Technical Writing Skills	<ol style="list-style-type: none"> 1. Communicate effectively, without barriers and understand aspects of technical communication. 2. Differentiate between general writing and technical writing and write error free sentences using technology specific words 3. Apply techniques of writing in business correspondence and in writing articles. 4. Draft technical reports and technical proposals. 5. Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.

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2020-21 – VIII Semester			
1.	20ADC17	Technical Seminar	<ol style="list-style-type: none"> 1. Collect Organize, Analyze and Consolidate information about emerging technologies from the literature. 2. Exhibit effective communication skills, stage courage, and confidence. 3. Demonstrate intrapersonal skills. 4. Explain new innovations/inventions in the relevant field. 5. Prepare Seminar Report in a prescribed format.
2.	20ADC18	Project Part-2	<ol style="list-style-type: none"> 1. Demonstrate a sound technical knowledge of their selected topic. 2. Conduct investigations by using research-based knowledge and methods to provide valid conclusions. 3. Provide solutions to societal complex problems utilizing gained engineering knowledge as an individual or byteam work. 4. Create/select/use modern tools to overcome the limitation of complex engineering solutions. 5. Communicate with engineering experts and the community at large in written and oral forms.
Open Elective – 2			
3	20MEO04	Principles of Entrepreneurship	<ol style="list-style-type: none"> 1. Understand the concept and essence of entrepreneurship. 2. Identify business opportunities and nature of enterprise. 3. Analyze the feasibility of new business plan. 4. Apply project management techniques like PERT and CPM for effective planning and execution of projects. 5. Use behavioral, leadership and time management aspects in entrepreneurial journey
4.	20BTO04	Bio-Informatics	<ol style="list-style-type: none"> 1. Explain the basic concepts of biology and bioinformatics. 2. Identify various types of biological databases used for the retrieval and analysis of the information. 3. Explain the sequence analysis and data mining. 4. Discuss the methods used for sequence alignment and construction of the phylogenetic tree. 5. Describe the methods used for gene and protein structure prediction.
5.	20MEO10	Introduction to Operations Research	<ol style="list-style-type: none"> 1. Understand the concepts of linear programming problem. 2. Solve the given transportation problem. 3. Develop optimum pair of operations and resources by using assignment technique. 4. Analyze project management techniques like CPM and PERT to plan and execute projects successfully. 5. Apply sequencing concepts for industry applications.
6.	20ECO06	Principles Of VLSI	<ol style="list-style-type: none"> 1. Understand characteristic behavior of MOSFET 2. Describe various MOS layers and layout design rules. 3. Implement various CMOS logic circuits. 4. Design various MOS memories. 5. Understand the concepts of VLSI technology.
7.	20EEO04	Energy Conservation	<ol style="list-style-type: none"> 1. Know the current energy scenario and importance of energy conservation. 2. Understand the concepts of energy conservation. 3. Evaluate the performance of existing engineering systems. 4. Explore the methods of improving energy efficiency in different engineering systems. 5. Understanding different energy efficient devices.

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Open Elective – 3			
8	20MTO03	Quantum Computing	<ol style="list-style-type: none"> 1. Compute basic mathematical operations on Quantum bits. 2. Will be able to execute Quantum operations of Quantum computing 3. To built quantum programs 4. Develop quantum Logical gates and circuits. 5. Develop the quantum algorithm
9.	20MEO07	Intellectual Property Rights	<ol style="list-style-type: none"> 1. Understand the evolution of IP, working of organization's at global level to protect and promote IP. 2. Familiarize with the patent filing process at national and international level. 3. Draw the logical conclusion of research, innovation and patent filing. 4. Compare different kinds of IP and their patenting system. 5. Understand the techno-legal-business angle of IP, infringement and enforcement mechanisms for protection.
10	20ECO01	Remote Sensing And GIS	<ol style="list-style-type: none"> 1. Demonstrate the understanding of basic concepts of remote sensing and interpret energy interactions. 2. Choose an appropriate technique for a given scenario by appreciating the types of remote sensing. 3. Distinguish the principle behind the working of microwave and LiDAR sensing. 4. Apply Microwave remote sensing techniques 5. Explain the procedure for encoding data and geospatial data analysis.
11.	20CEO02	Disaster Risk Reduction and Management	<ol style="list-style-type: none"> 1. Identify and understand the concepts of hazards, causes and impacts of disasters. 2. Develop a critical capacity to evaluate the principles and practices of disaster risk reduction and management. 3. Develop a deep awareness of disaster resilience, risk mitigation, and recovery policies as they arise from natural hazards around the globe. 4. Apply knowledge about existing global frameworks and existing agreements and role of community in successful Disaster Risk Reduction. 5. Evaluate DM study including data search, analysis and presentation as a case study.
12.	20BTO05	Cognitive Neuro Science	<ol style="list-style-type: none"> 1. Gain familiarity and basic knowledge about brain systems and functions. 2. Understand brain's neuro-transmitter system. 3. Understanding the brain's methods gives rise to behaviour whether we engage in any activity (e.g., walking,talking, etc.). 4. Identify the patterns of varied activities in neurons that correspond to a person's attempts to move in particular ways. 5. Understand the feedback system and brain disorders.


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