Koneru Lakshmaiah Education Foundation

(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Y21-B.TECH

Course	Course title	S.No	CO	Description of Course Outcome
20UC1101	Integrated Professional English (IPE)	1	1	Understand the concepts of grammar to improve communication, reading, and writing skills
		2	2	Demonstrate required knowledge over Dos and Don'ts of speaking in the corporate context . Demonstrate ability to face formal situations / interactions.
		3	3	Understand the varieties of reading and comprehend the tone and style of the author. Skim and scan effectively and appreciate
		4	4	Apply the concepts of writing to draft corporate letters, emails and
20UC1202	English Proficiency (EP)	5	1	Demonstrating different interpersonal skills for employability
		6	2	Distinguishing Business essential skills
		7	3	Classifying social media and corporate communication skills.
		8	4	Applying analytical thinking skills.
21UC2103	Essential Skills for Employability	9	1	Developing basic grammar
		10	2	Discovering and practicing functional grammar
		11	3	Developing Intrapersonal skills
		12	4	Developing Speaking and Writing Skills
21UC2204	Corporate Readiness Skills	13	1	Extend word power for developing effective speaking and writing
		14	2	Interpret Interpersonal Skills
		15	3	Differentiate critical and general reading skills
		16	4	Demonstrate necessary skills to be employable
		17	1	Model a system of equations for real world applications in engineering, physical and biological sciences, computer science, finance, economics and solve them through matrix algebra

20MT1101	Mathematics for Computing	18	2	Model basic and computational techniques on discrete structures like relations, orders, functions & FSM, Lattices, and propositional
		19	3	Model real world structures and their related applications using advanced discrete structures like graphs and trees.
		20	4	Model the given Statistical data for real world applications in Engineering science, Economics and Management.
		21	5	Demonstrate the Aptitude and Reasoning skills (Tests in skilling
21MT2102	Mathematics for Engineers	22	1	Apply differential, integral and vector calculus to find maxima & minima of functions, evaluate the integrals and also decompose the
		23	2	Apply the first and second order ordinary differential equations for engineering problem including the Laplace transforms.
		24	3	Apply the probability distributions and Morkov process to predict the output, describe the solutions of first order partial differential equations and Fourier series.
		25	4	Apply the complex variables for flow problems and demonstrate the Algebraic structures.
21UC1203	DESIGN THINKING & INNOVATION	26	1	Understand the importance of Design thinking process for contextualized problems
		27	2	Analyse, define, and ideate for solutions
		28	3	Develop and test the prototype made
		29	4	Explore the fundamentals of entrepreneurship skills for transforming the challenge into an opportunity
21MT2103	OBABILITY, STATISTIC & QUEUEING THEO	30	1	To understand the importance of probabilistic concepts in a wide spectrum of problems arising in engineering applied science.
		31	2	Identify the relationship between two variables using correlation and regression analysis
		32	3	Apply the statistical test of significance for drawing the conclusion about the hypothesis
		33	4	To formulate the Stochastic process in terms of Markov chains and solve problems in queueing systems, and networks
		34	1	Apply various methods for finding the optimal solution of Linear Programming Problem.
		35	2	Apply Integer and Fractional programming approaches for solving optimization problems.

21CS2204	MATHEMATICAL PROGRAMMING	36	3	To express a practical problem, such as an engineering analysis or design problem and to optimize a multivariate quadratic function subject to linear constraints on the variables.
		37	4	To understand the search and optimization methodologies applicable to the resolution of multi-disciplinary decision problems, under a decision support framework.
21SC1101	UTATIONAL THINKING FOR STRUCTURED I	38	1	Design Basic and Complex Building Blocks for real world problems using structured programming paradigm
		39	2	Apply Computational Thinking for designing solutions to real world
		40	3	Develop and Analyze CRUD operations on arrays
		41	4	Develop and Analyze CRUD operations on Linear Data Structures
		42	5	Apply the structured programming paradigm with logic building skills on Basic and Linear Data Structures for solving real world problems
		43	6	Skill the students in such a way that students will be able to develop logic that help them to create programs as well as applications in C
20ME1103	DESIGN TOOLS WORKSHOP - I	44	1	Understand the concept of Engineering Design Process, Visualize and complete his/her innovative design by final drafting using 3D modeling in Auto Desk Fusion 360
		45	2	Understand the concept of web page, web browser, web server, and able to create Static webpages. Apply the HTML5 and CSS knowledge in building static web pages. Introduction to building social profiles through web blogging and video blogging.
		46	3	Understand the concept of report writing using a markup language Latex. Build reports using Latex and apply templates and Bibliography in latex for various documentation purposes.
		47	4	Understand the concept of data visualization and apply visualization techniques in creating data visualization dashboards with tools like
20EC1101	DIGITAL LOGIC AND PROCESSORS	48	1	Ability to understand the logic and design concepts of processor, CPU and digital combinational blocks
		49	2	Ability to design memory and timing & control modules for digital processor operations.
		50	3	Ability to design programmable and reprogrammable (CPLD/FPGA) digital logic modules using Verilog HDL
		51	4	Ability to design the digital logic and circuits using optimization

		52	5	Design of Digital Logic modules using Verilog HDL and optimized
21SC1203	ATIONAL THINKING FOR OBJECT ORIENTE	53	1	Apply Object oriented paradigm for code reusability.
		54	2	Design object-oriented solutions to the real-world problems through SOLID design principles
		55	3	Build Abstract Data Types by applying generic classes and java API.
		56	4	Demonstrate Exception handling and String manipulation techniques
		57	5	Demonstrate Exception handling and String manipulation techniques
21SC1202	DATA STRUCTURES	58	1	Understand various sorting algorithms and analyze the efficiency of the algorithms
		59	2	Implement and evaluate Linear Data Structures and Demonstrate their applications.
		60	3	Implement and evaluate tree data structures and Understand hashing techniques
		61	4	Understand graph data structures and apply graphs to solve
		62	5	Design, Develop and evaluate common practical applications for linear and nonlinear data structures.
21SC1209	DESIGN TOOLS WORKSHOP - II (DTW2)	63	1	Understand 3D printing and 3D scanning techniques
		64	2	Visualize the design ideology by incorporating VR technique, AR technique and Hologram
		65	3	Apply the concepts of various sensors in modelling tool
		66	4	Build different sensors interfacing with Arduino board
21EC1202	)MPUTER ORGANIZATION & ARCHITECTU	67	1	Understand the functionality of CPU functional units - control unit, registers, the arithmetic and logic unit, instruction execution unit
		68	2	Understand the concepts of CPU and the operation of main, cache and virtual memory organizations
		69	3	Understand the concepts of the different types of I/O modules and I/O transfer techniques in computer modules
		70	4	Apply the concept of pipelining in instruction execution and design issues of RISC, CISC and parallel computing architectures
		71	1	Understand the concepts of Linear Equations, concepts of Ratios, Averages, Partnership, Percentages and Interest to solve the problems related to Ages, Ratio & Proportion, Variation& Partnership, Percentages, Profit, Loss& Discounts, Simple &

21UC3105	PROBLEM SOLVING SKILLS-I	72	2	Understand the concepts of Co-primes, Divisibility rules, LCM & HCF concepts to solve problems in Numbers, Apply the concepts of Algebra to solve the problems based on Sets, Relations, Functions, Surds & Indices, Logarithms, Quadratic Equations, Inequalities &
		73	3	Understand Venn diagrams and other applicable diagrams to solve questions in Syllogism, Logical Venn Diagrams, Cubes & Dice. Understand the principles used in forming Number& letter series, Number, letter & word Analogy, Odd man out, coding & decoding
		74	4	Understand the underlying assumptions in the arguments presented in the topics: Statements & conclusions, statements & Arguments (Critical Reasoning), statements & Assumptions, logical connectives,
21CS2109	OPERATING SYSTEMS	75	1	Understanding the basic algorithms for subsystem components
		76	2	Understand and applies memory and process virtualization , Paging
		77	3	Applies Deadlocks, Redundant disk arrays, File System and
		78	4	Understands and Applies methodologies to solve Concurrency and Threads code
		79	5	Use C Programming Language to study Operating System Concepts
21CS2116	VANCED OBJECT ORIENTED PROGRAMMI	80	1	Apply Design Patterns & Test-Driven Development with Clean coding Techniques.
		81	2	Understand the Collections & Generics over Object-oriented
		82	3	Apply the various Concurrent Programming methodologies in Object-oriented Programming
		83	4	Develop the applications using JDBC, Servlets, JSP
		84	5	Analyze the various design techniques to solve any real-world
21CS2110	DATABASE MANAGEMENT SYSTEMS	85	1	Illustrate the functional components of DBMS and Design an ER Model for a database.
		86	2	Design a relational model for a database & Implement SQL concepts and relational algebra.
		87	3	Implement and Analyze PL/SQL programs, normalization techniques, indexing to construct and access database.
		88	4	Analyze the importance of transaction Processing, concurrency control and recovery techniques.
		89	5	Design a database and implement SQL queries and PL/SQL programs to do various operations on data.

21CS2111	SOFTWARE ENGINEERING	90	1	Understand the software development life cycle and associated process models and Reverse Engineering.
		91	2	Applying Requirement modeling and Agile and Extreme Programming, Other Agile Process Models.
		92	3	Examine Requirement Modeling, Agile Models such as Scrum, kanban and SAFe Methodology.
		93	4	Categorize various Design Concepts, testing strategies, Test Driven Development and CMMI, Six Sigma techniques
		94	5	Develop UML Specification for software designs and programs.
21CS2215	UTOMATA THEORY & FORMAL LANGUAGI	95	1	Make use of Finite State Machines for Modeling and Solving computing problems for different languages.
		96	2	Construct regular expressions for different languages.
		97	3	Model Push Down Automata for CFLs and constructs a PDA for
		98	4	Make use of Context-Free languages and Turing Machines for different unrestricted languages.
21CS2212	COMPUTER NETWORKS & SECURITY	99	1	Apply error detection and correction mechanisms to compute codewords for the source code and outline the working of OSI &
		100	2	Infer Channel allocation problem and algorithms to avoid it and compute the optimal path in a network using various static and
		101	3	Identify the IP addresses of a network using IPV4 classful & classless addressing schemes and outline the functionalities of the transport layer like TCP Connection management and congestion control.
		102	4	Apply different symmetric and asymmetric encryption algorithms to compute ciphertext and identify the functionality of application layer
21CS2213	AI FOR DATA SCIENCE	103	1	Apply Uninformed search strategies and Heuristic Search techniques to solve well defined problems
		104	2	Apply optimization techniques to solve game playing and Constraint satisfaction problems
		105	3	Apply knowledge representation. to provide inference using resolution, forward and backward techniques
		106	4	Analyze and visualize the real time data for AI applications
		107	5	Implement Problem solving, EDA techniques for AI applications
		108	1	Apply concepts of mathematics to find space and time complexities of various algorithms including string matching algorithms

21CS2214	DESIGN & ANALYSIS OF ALGORITHMS	109	2	Analyze the problems that can be solved by using Divide and Conquer and Greedy Method
		110	3	Analyze the problems that can be solved by using Dynamic Programming and Backtracking
		111	4	Analyze the problems that can be solved by using Branch and Bound and NP-Hard Graph problems
		112	5	Analyze the various design techniques to solve any real-world
21CS4115	PARALLEL & DISTRIBUTED COMPUTING	113	1	Analyse Distributed Computations, Graph Algorithms, Causality and Time, Message Ordering and group communication
		114	2	Analyse Coordination Algorithms, Consistency and Replication, Global state and snapshot recording algorithms, Self-stabilization, Fault-Tolerant Message-Passing Distributed Systems
		115	3	Understand parallel algorithm design. Demonstrate the ability to differentiate among parallel architectures and interconnection networks models by analyzing parallel sorting algorithms
		116	4	Design and analyze Parallel Computational algorithms
		117	5	Develop Parallel and Distributed computing programs using Hadoop Software tool and MapReduce Frame work
21IE3041	TECHNICAL INTERNSHIP	122	1	Ability to identify when new engineering knowledge is required, and
		123	2	Ability to integrate existing and new technical knowledge for industrial application
		124	3	Ability to demonstrate the impact of the internship on their learning and professional development
		125	4	Demonstrate the ability to harness resources by analyzing challenges
21TS2101	l Skilling - 1 (PYTHON FULL STACK DEVELO	127	5	Analyze and apply suitable design technique to solve given real world problems.
21TS2202	cal Skilling-2 (MERN STACK WEB DEVELOP	128	5	Experiments to design Full Stack development using MERN Stack.
21TS3103	nical Skilling-3 (JAVA Full Stack Developm	129	1	Build Web and Enterprise Level Applications using Maven by applying Hibernate JPA Framework.
		130	2	Build Enterprise Level Applications using Spring Framework.
		131	3	Build Enterprise Level Applications using Spring Boot Framework with Spring Cloud
		132	4	Build Enterprise Level Applications using Spring Boot with

21CS3060RA/21CS3060PA	CONTINUOUS DELIVERY & DEVOPS	154	CO 1	Identify the Need of DevOps in SDLC and Cloud Infrastructure in DevOps, Apply Version Control System to track the latest version of
		155	CO 2	Apply Continuous Integration and Continuous Deployment using Infrastructure as Code, Build in Cloud native Applications using Pipeline and Examine the Software and Automation Testing
		156	CO 3	Analyze need of Containerization in SDLC and Examine the Kubernetes Pod Configuration.
		157	CO 4	Inspect Configuration Management using Infrastructure as Code, Analyze Continuous Monitoring and Container Orchestration
		158	CO 5	To Build and Inspect the Tools associated to DevOps Life Cycle.
21CS3116RA/21CS3116PA	SIGNAL PROCESSING	159	CO 1	Understand the various types of signals, systems and their frequency domain transformation.
		160	CO 2	Understand the design methodology of different filters and their
		161	CO 3	Apply signal processing approaches for extraction of information present in the natural signals.
		162	CO 4	Apply machine learning approaches for processing of signals.
		163	CO 5	Apply above signal processing approaches in tutorial problems related to transformation, filtering, feature extraction, machine learning for signal processing
21CS3015RA/21CS3015PA	EMBEDDED SYSTEMS	173	CO 1	Understand C for Embedded Systems. Analyse ARM processor and interrupt architecture
		174	CO 2	Apply Modern Assembly Language Programming with the ARM
		175	CO 3	Apply I/O Synchronization and Interrupt Programming. Program the STM32F4xx chip peripherals: I/O ports, ADCs,
		176	CO 4	Understand Analog Interfacing and Program the STM32F4xx chip peripherals: DACs, SPIs, and I2Cs
		177	CO 5	Apply Embedded Systems Programming on ARM Cortex-M3/M4
21CS3133RA/21CS3133PA	DATA VISUALIZATION TECHNIQUES	183	CO 1	Understand the modelling of various types of data and the Visualization fundamentals
		184	CO 2	Apply methods and tools for Non-Spatial Data Visualization
		185	CO 3	Apply methods for Scientific / Spatial Data Visualization and Web data visualization

		186	CO 4	Understand the Dashboard and its categories and Apply visual analytics on dashboards
		187	CO 5	Evaluate data visualization through Python & Tableau /Power BI
21CS3234RA/21CS3234PA	APPLICATION DEVELOPMENT ON CLOUD	193	CO 1	Analyze, predict and apply the server based computing for hosting the web application with appropriate database and storage.
		194	CO 2	Implement the cloud services to monitor and secure the cloud
		195	CO 3	Analyze, predict and apply the CI/CD services for hosting the web
		196	CO 4	Analyze, predict and apply appropriate serverless, container based, work flow and messaging based services.
		197	CO 5	Apply the knowledge and implement the cloud concepts in real time.
21CS3235RA/21CS3235PA	SOLUTIONS ARCHITECTING ON CLOUD	198	CO 1	Design Resilient Architectures
		199	CO 2	Design High-Performing Architectures
		200	CO 3	Design Secure Applications and Architectures
		201	CO 4	Design Cost-Optimized Architectures
		202	CO 5	Designing solutions to the architecture of Cloud
21CS3045RA/21CS3045PA	INTRODUCTION TO BLOCKCHAIN AND CRYPTO CURRENCIES	213	CO 1	Understand the basic concepts of cryptography for Blockchain
		214	CO 2	Understand the basics of Blockchain and mining process
		215	CO 3	Apply about the different types of Blockchain and consensus
		216	CO 4	Apply the different types of crypto currencies & its importance and Blockchain applications
		217	CO 5	Apply and analyze basic cryptography concepts and smart contracts applications using soft wallet
21CS3042RA/21CS3042PA	NETWORK & INFRASTRUCTURE SECURITY	218	CO 1	Understand security concepts, Infrastructure security techniques and securing enterprise networks. Understand router and switching
		219	CO 2	Understand hardware procedures for digital certificate and techniques of user authentication.
		220	CO 3	Appy the standardization schemes to maintain security in Web application and secured payment system. Identify security
		221	CO 4	Apply security concepts in Email and Internet Protocol. Understand and apply security principles of firewall, gateways and IDS.
		222	CO 5	Analyze various security concepts and their performance using networking tools
		223	CO 1	To design a Lexical analyzer for a given source code.

21CS3204RA/21CS3204PA	COMPILER DESIGN	224	CO 2	To design different types of parsers and perform comparative
		225	CO 3	To design an efficient syntax-directed translator and intermediate code generator.
		226	CO 4	To optimize and generate the translated code for the target
		227	CO 5	To design a compiler for any given language using compiler
21CS3036RA/21CS3036PA	FUNCTIONAL & CONCURRENT PROGRAMMING	228	CO 1	Apply Functions and Lambdas on purely functional programs using generic types, recursion, pattern matching and higher-order
		229	CO 2	Apply Algebraic Data Types to model and use infinite sequences with lazy evaluation, functional programming with objects and classes
		230	CO 3	Apply Functional Data Structures, collections, Parallel Collections, Futures and Promises
		231	CO 4	Apply the functional design of concurrent systems
		232	CO 5	Apply the functional design of concurrent systems
21CS3065RA/21CS3065PA	QUANTUM COMPUTING	233	CO 1	To introduce basics of quantum computing
		234	CO 2	Implementing Quantum computing algorithms
		235	CO 3	Applying concepts of Quantum computing using QISKIT
		236	CO 4	Analyze and Discuss Quantum Machine learning and deep learning concepts with applications
		237	CO 5	Practicals on all algorithms discussed above
21CS3066RA/AA/PA	SOFTWARE VERIFICATION & VALIDATION	238	CO 1	To Understand test cases suitable for a software development for different domains.
		239	CO 2	To Identify and apply suitable tests to be carried out. Conduct an inspection or review of software source code for a small or medium
		240	CO 3	Prepare and apply test planning based on the document using automatic testing tools.
		241	CO 4	To Document test plans and apply test cases designed
		242	CO 5	To Test the software application completely and make it sure that it's performing well and as per the specifications
21CS3020RA 21CS3020AA 21CS3020PA	MACHINE LEARNING	184	CO 1	Understand the basic terminology and measurements of Machine Learning and Apply Machine Learning techniques using Tree and Bayesian models.
		185	CO 2	Apply and analyze Neural Network and SVM Models for solving Classification and Prediction problems
		186	CO 3	Apply Dimensionality reduction methods, Evolutionary learning and Ensembled methods to solve classification problems

		187	CO 4	Illustrate different unsupervised models, Analytical, Explanation-Based and reinforcement learning methods
		188	CO 5	Implement Machine Learning Techniques using Python Language
21CS3022RA 21CS3022PA	SOFT COMPUTING	189	CO 1	Interpret fuzzy logic system
		190	CO 2	Analyze Artificial Neural Network Models
		191	CO 3	Demonstrate Swarm and Evolutionary Algorithms
		192	CO 4	Illustrate Hybrid Fuzzy-Neural- Evolutionary- Swarm Models
		193	CO 5	Demonstration of neuro, fuzzy, evolutionary, and swarm algorithms using open-source tools
21CS3026RA 21CS3026PA	ARTIFICIAL NEURAL NETWORKS	194	CO 1	models
		195	CO 2	Apply various techniques for training and optimizing neural networks
		196	CO 3	Analyze different techniques related to network stochastics
		197	CO 4	Analyze different techniques related to learning algorithms for neural networks and develop knowledge on emerging software, tools and technologies related to these algorithms
		198	CO 5	neural networks and their applications using python and develop knowledge on emerging software, tools and technologies related to these approaches
21CS3269RA 21CS3269AA 21CS3269PA	DEEP LEARNING	199	CO 1	Able to understand Deep learning and remember the concepts of Perception, Back Propagation,
		200	CO 2	Able to understand auto encoders- and apply Regularization, and CNN techniques to generate Deep learning models
		201	CO 3	Apply Long Short Term Memory (LSTM) Restricted BoltzmannMachines,
		202	CO 4	Build Markov models, Markov networks, Markov chains,
		203	CO 5	Implement basic Neural Networks, optimization algorithms
21CS3270RA 21CS3270PA	COGNITIVE COMPUTING	204	CO 1	approaches
		205	CO 2	Applying the primary tools associated with cognitive computing
		206	CO 3	Develop a project that leverages cognitive computing
		207	CO 4	Analyse and discuss the business implications of cognitive computing
		208	CO 5	able to implement cognitive computing programs using IBM Watson
21CS3271RA 21CS3271PA	PERCEPTION AND COMPUTER VISION	209	CO 1	Understand image representation and modeling.
		210	CO 2	Understand image transformation methods.
		211	CO 3	Apply and Interpret image processing algorithms.
		212	CO 4	Build and evaluate face detection and recognition algorithms.
		213	CO 5	Evaluate a multitude of image processing techniques and algorithms.

21CS3278RA 21CS3278PA	DIGITAL VIDEO PROCESSING	214	CO 1	Understanding the video signals and its characteristics
		215	CO 2	Understanding the motion analysis, its detection and restoration of video with quality
		216	CO 3	Understanding video segmentation and motion segmentation using different methods
		217	CO 4	Learning to analyse the signals using different algorithms
		218	CO 5	Applying the machine learning algorithms to video signals for the analysis, segmentation and restoration.
21CS3272RA 21CS3272PA	COMPUTATIONAL EPIDEMIOLOGY	219	CO 1	Understand the models of Epidemiology and applications of computational science in Epidemiology
		220	CO 2	Apply computational model on sparse disease incidence data to infer transmission probability, period of infectivity and reproduction number
		221	CO 3	Design a low cost surveillance and infection control policy using an efficient computational model
		222	CO 4	Design a computational model for epidemic spread using Machine Learning concepts
		223	CO 5	Build and Inspect tools associated Epidemiology using R
21CS3273RA 21CS3273PA	NATURAL LANGUAGE PROCESSING	224	CO 1	Understand approaches to syntax and semantics in NLP
		225	CO 2	Apply the statistical estimation and statistical alignment models
		226	CO 3	Analyze grammar formalism and context free grammars
		227	CO 4	Apply Rule based Techniques, Statistical Machine translation (SMT), word alignment
		228	CO 5	Inspect and Evaluate Language Processing Methods using python
21CS3274RA 21CS3274PA	SPEECH PROCESSING	229	CO 1	Understand the speech production and perception mechanism, acoustic phonetics and phonology, speech prosody, and speech sound units.
		230	CO 2	Understand the speech signal processing in time and frequency domain, discrete Fourier transform, short-time analysis of speech, linear prediction and cepstral analysis of speech.
		231	CO 3	Gaussian mixture models (GMM), Hidden Markov models (HMM), Support vector machines (SVM) and state of art Deep Neural Network (DNN) models, for speech processing.
		232	CO 4	Apply machine learning approaches for various application of speech processing such as Speech and Speaker recognition, Speech synthesis and Speech enhancement, Language identification etc.

		233	CO 5	Apply above speech processing approaches in laboratory experiments related to feature extraction, and development of machine learning models for speech processing.
21CS3275RA 21CS3275AA 21CS3275PA	DATA VISUALISATION TECHNIQUES	244	CO 1	Understand the modelling of various types of data
		245	CO 2	Understand the Visualization fundamentals
		246	CO 3	Apply methods and tools for Non-Spatial Data Visualization
		247	CO 4	Apply methods for Scientific / Spatial Data Visualization and Web data visualization
		248	CO 5	Evaluate data visualization through Python & Tableau.
21CS3052RA 21CS3052PA	DATA WAREHOUSING & MINING	249	CO 1	Understand Data Warehousing Techniques and apply different data processing techniques.
		250	CO 2	Implementation of Data Pre-Processing Techniques.
		251	CO 3	Apply mining Algorithms for classifying data into different classes using labeled data.
		252	CO 4	Applying unsupervised learning algorithm for data categorization.
		253	CO 5	Implement mining algorithms using modern tolls and techniques for data processing.
21CS3051RA 21CS3051AA 21CS3051PA	BIG DATA ANALYTICS	254	CO 1	Understand the concepts of big data, Initial exploration of analysis of data and Data visualization
		255	CO 2	R
		256	CO 3	Apply advanced algorithms & Statistical modeling for big data using HDFS, HIVE, and PIG.
		257	CO 4	Apply advanced SQL functions for in-database analytics by MADlib, Greenplum along with common deliverables of analytics life cycle project
		258	CO 5	Build and Evaluate the Big Data Analytical problem using R, Hadoop, HIVE Programming concepts.
21CS3276RA 21CS3276PA	BIG DATA OPTIMIZATION	259	CO 1	Understand optimization methods and Apply analytics using R
		260	CO 2	problems
		261	CO 3	Analyz population-based search and develop query processing strategies
		262	CO 4	Apply and Analyze applications like Travelling Salesman Problem.
		263	CO 5	Applying functionalities of R
21CS3277RA 21CS3277PA	BIOINFORMATICS	264	CO 1	Understand the Overview of Bioinformatics, biological databases, and comparing a data network to a living organism.
		265	CO 2	Select online resources in biological database
		266	CO 3	Apply concepts of microarrays and datamining methods.

		267	CO 4	identification
		268	CO 5	Implement the lab experiments to store and analysis of biological data
21CS3279RA 21CS3279PA	ADVANCED DATABASES	269	CO 1	Understand the fundamentals of query optimization and database recovery protocols.
		270	CO 2	Apply emerging database technologies and distributed databases.
		271	CO 3	Analyze and Discriminate object oriented and relational database systems.
		272	CO 4	Analyze multimedia databases.
		273	CO 5	Build and Evaluate advanced database applications
21CS3280RA 21CS3280PA	GRAPH & WEB ANALYTICS	274	CO 1	Networks
		275	CO 2	Make use of Web Analytics: - Data sources, tools, Web traffic data.
		276	CO 3	Analysing Web Analytics Strategy- website traffic analysis, audience identification and segmentation analysis, Emerging Analytics
		277	CO 4	Compare Email Testing Analysis, competitive Intelligence Analysis, and Social, Mobile, Video Analysis.
		278	CO 5	Implementing Python programing for graph and web analytics
21CS3037RA 21CS3037AA 21CS3037PA	CLOUD INFRASTRUCTURE & SERVICES	284	CO 1	Understand IaaS Architectures and Implementation Guidelines. Apply on-demand compute services
		285	CO 2	Analyze applications and frameworks for data analysis and Content delivery in the cloud
		286	CO 3	Understand Cloud Service Availability, Resiliency and dynamic scaling
		287	CO 4	Management
		288	CO 5	Developing Cloud services using Open Cloud Architectures-EUCALYPTUS
21CS3032RA 21CS3032PA	ADVANCED OPERATING SYSTEMS	289	CO 1	Understand the design of multiprocessor and distributed Operating Systems. Analyze distributed file system.
		290	CO 2	Analyze the scheduling Real time and Parallel Applications on Heterogeneous Distributed Systems. Analyze three basic approaches for implementing distributed mutual exclusion
		291	CO 3	Understand Replication – preventing and accepting divergence. Analyze Deadlock detection in distributed systems.
		292	CO 4	Analyze the algorithms for Checkpointing and rollback recovery, Consensus and agreement algorithms, and Failure detectors
		293	CO 5	Implement the Concepts of multiprocessor Threads, distributed mutual exclusion, distributed scheduling, Distributed deadlocks, Distributed consensuses and Fault Handling.

21CS3036RA 21CS3036PA	FUNCTIONAL & CONCURRENT PROGRAMMING	294	CO 1	Apply Functions and Lambdas on purely functional programs using generic types, recursion, pattern matching and higher-order functions.
		295	CO 2	Apply Algebraic Data Types to model and use infinite sequences with lazy evaluation, functional programming with objects and classes
		296	CO 3	Apply Functional Data Structures, collections, Parallel Collections, Futures and Promises
		297	CO 4	Apply the functional design of concurrent systems
		298	CO 5	Apply the functional design of concurrent systems
21CS3281RA 21CS3281AA 21CS3281PA	CLOUD & SERVERLESS COMPUTING	299	CO 1	hierarchy.
		300	CO 2	Understand Functions-as-a-service and Event-driven programming. Develop Scalable ModelsUsing Serverless Architectures.
		301	CO 3	Manage application functionalities using Serverless runtimes and Serverless databases.
		302	CO 4	Apply Serverless Programming Practices and Patterns. Architect, Build, and Operateserverless applications.
		303	CO 5	technologies
21CS3251RA 21CS3251PA	ADVANCED COMPUTER ARCHITECTURE	304	CO 1	Understand fundamentals of computer design
		305	CO 2	Understand instruction level parallelism
		306	CO 3	Apply thread level parallelism
		307	CO 4	Analyse memory and I/O
		308	CO 5	Develop programs on computer architectures
21CS3252RA 21CS3252PA	PARALLEL ALGORITHMS	309	CO 1	Understand fundamental principles behind parallel algorithm design and demonstrate the ability to differentiate among interconnection networks models and communication operations.
		310	CO 2	Analyze parallel algorithms for sorting and Computational Geometry
		311	CO 3	Design and Analysis of Parallel Computational algorithms
		312	CO 4	Apply parallel algorithms for Graphs and Search problems and analyze its performance
		313	CO 5	Develop parallel algorithms using OpenMP, MPI and OpenCL
21CS3287RA 21CS3287PA	CLOUD SECURITY	314	CO 1	Understand the principles of cryptography and apply various cryptographic algorithms
		315	CO 2	Analyze various security issues and system vulnerabilities in virtualization
		316	CO 3	Analyze the technologies for virtualization-based security enhancements
		317	CO 4	standards
		323	CO 1	challenges

21CS3253RA 21CS3253PA	EDGE COMPUTING	324	CO 2	Examine the Architecture of Edge Computing and explore the issues that are being addressed by the industry
		325	CO 3	Interpret the Middleware needed for Edge Computing and its Security Requirements
		326	CO 4	Assess the need for Edge/Fog Computing in various real-time projects
		327	CO 5	computing paradigms using various applications in Edge Computing
21CS3038RA 21CS3038PA	HIGH PERFORMANCE COMPUTING	328	CO 1	Analyze the performance of GPU memory hierarchy and MPI programming
		329	CO 2	Develop parallel programs using OpenCL library and understand FPGA-Based Supercomputer
		330	CO 3	Develop mixed mode programs for Multicore, GPU and cluster optimization systems
		331	CO 4	Generate parallel programs for matrix, graph and sorting problems using Cuda, OpenMP library
21CS3041RA 21CS3041AA 21CS3281PA	CRYPT ANALYSIS & CYBER DEFENSE	332	CO 1	Understand the principles of cryptography by analyzing various attacks and apply different classic encryption techniques.
		333	CO 2	AES.
		334	CO 3	Understand and apply different algorithms of public key crypto system for ensuring secured communication and authentication.
		335	CO 4	Understand the concept of elliptic curve and its applications to cryptography. Apply hash algorithms for security.
		336	CO 5	Implement various cryptographic algorithms so as to analyze the achievability of security goals like Confidentiality, integrity, authentication and also Justify the possibility of cryptanalysis attack with each algorithm.
21CS3042RA 21CS3042PA	NETWORK & INFRASTRUCTURE SECURITY	337	CO 1	securing enterprise networks. Understand router and switching security mechanism.
		338	CO 2	Understand hardware procedures for digital certificate and techniques of user authentication.
		339	CO 3	Appy the standardization schemes to maintain security in Web application and secured payment system. Identify security vulnerability in the system.
		340	CO 4	Apply security concepts in Email and Internet Protocol.
		341	CO 5	Understand and apply security principles of firewall, gateways and IDS.
21CS3045RA	INTRODUCTION TO BLOCKCHAIN & CRYPTO	342	CO 1	Understand the basic concepts of cryptography for Blockchain
		343	CO 2	Understand the basics of Blockchain and mining process
		344	CO 3	Apply about the different types of Blockchain and consensus algorithms

21CS3045RA 21CS3045PA	INTRODUCTION TO BLOCKCHAIN & CRYPTO CURRENCIES	345	CO 4	Apply the different types of crypto currencies & its importance and Blockchain applications
		346	CO 5	Apply and analyze basic cryptography concepts and smart contracts applications using soft wallet
21CS3259RA 21CS3259AA 21CS3259PA	DIGITAL FORENSICS	347	CO 1	Apply Forensic Science and Digital Forensics
		348	CO 2	Apply OS and File System Forensics
		349	CO 3	Analyze Digital Evidence and Network Forensics
		350	CO 4	Analyze Web Forensics and Mobile Device Forensics
		351	CO 5	Implementing the concepts of Digital Forensics
21CS3260RA 21CS3260PA	DATABASE & SYSTEM SECURITY	352	CO 1	Understand Database Users, Roles related to User Administration and Java concepts
		353	CO 2	Apply Data Encryption and Database Vaults
		354	CO 3	Apply secret password Encryption & Decryption.
		355	CO 4	Apply Data Encryption for the Data in Transit.
		356	CO 5	Design Secure Database Schema
21CS3261RA 21CS3261PA	PROGRAMMING FOR SMART CONTRACTS	357	CO 1	network
		358	CO 2	Learn and use solidity programming language to build smart contracts
		359	CO 3	Building advanced smart contracts with various test setups and try-catch assertions.
		360	CO 4	patterns.
		361	CO 5	Implement lab experiments through project-based learning on building smart contracts
21CS3262RA 21CS3262PA	SECURE SOFTWARE ENGINEERING	362	CO 1	Explain about threats and its properties that target software and illustrate the resources that addresses these issues.
		363	CO 2	Illustrate the process of analysing and validating security requirements.
		364	CO 3	Apply software testing methods to analyse the software code to improve the quality and describe the assembly changes for system design.
		365	CO 4	Apply the governance security policy to ensure enterprise security in project management
		366	CO 5	Analyse the security principles and apply the techniques to develop a secure software.
		367	CO 1	Students should be able to understand the basic concepts of web security
		368	CO 2	Students should be able to identify different techniques in protecting privacy and principles of web security

21CS3264RA 21CS3264PA	WEB SECURITY	369	CO 3	Students should be able to deploy SSL server certificates, Clint side digital certificates and Microsoft authenticode.
		370	CO 4	Students should be able to determine security for content providers through privacy policies and security legislations.
		371	CO 5	Students should be able to test software/ tools application completely and make sure that it' s performing well and as per the security specifications.
21CS3291RA 21CS3291PA	SECURITY GOVERNANCE & MANAGEMENT	372	CO 1	Fundamentals of information security management
		373	CO 2	Understand the principles of cryptography by analyzing various attacks and apply different classic encryption techniques
		374	CO 3	To analyse basic number theory, cryptography concepts and smart contracts applications using soft walltet.
		375	CO 4	Apply security concepts in Email and Internet Protocol. Understand and apply security principles of firewall, gateways and IDS
		376	CO 5	Analyse various security concepts and their performance using networking tools
21CS3062RA 21CS3062AA 21CS3062PA	SOFTWARE VERIFICATION & VALIDATION	377	CO 1	To Understand test cases suitable for a software development for different domains.
		378	CO 2	or review of software source code for a small or medium sized software project.
		379	CO 3	Prepare and apply test planning based on the document using automatic testing tools.
		380	CO 4	To Document test plans and apply test cases designed
		381	CO 5	To Test the software application completely and make it sure that it’s performing well and as per the specifications
21CS3064RA 21CS3064PA	UX DESIGN	382	CO 1	Perceive and discuss about User Experience design process.
		383	CO 2	Recognize User Interface and differentiate from User Experience and principles of User Interface.
		384	CO 3	Focusing and distinguishing about Components of UI design process with Interactive Devices.
		385	CO 4	Experience
		386	CO 5	Designing wire frames using Adobe XD, UXPressia and Whimsical

21CS3065RA 21CS3065PA	DESIGN PATTERNS & CLEAN CODING TECHNIQUES	387	CO 1	Illustrate how Test-Driven Development and Refactoring work in software design and maintenance.
		388	CO 2	system
		389	CO 3	design
		390	CO 4	Understanding the design patterns in an object-oriented language along with clean coding principles to a real world application.
		391	CO 5	Develop Programs on concepts of Design patterns in JAVA
21CS3256RA 21CS3256AA 21CS3256PA	CONTINUOUS DELIVERY & DEVOPS	392	CO 1	Identify the Need of DevOps in SDLC and Cloud Infrastructure in DevOps, Apply Version Control System to track the latest version of Software
		393	CO 2	Apply Continuous Integration and Continuous Deployment using Infrastructure as Code, Build in Cloud native Applications using Pipeline and Examine the Software and Automation Testing Frameworks.
		394	CO 3	Analyze need of Containerization in SDLC and Examine the Kubernetes Pod Configuration.
		395	CO 4	Inspect Configuration Management using Infrastructure as Code, Analyze Continuous Monitoring and Container Orchestration process.
		396	CO 5	To Build and Inspect the Tools associated to DevOps Life Cycle.
21CS3257RA 21CS3257PA	VISUAL PROGRAMING	397	CO 1	Apply the concepts of C#.Net and Build console and desktop applications.
		398	CO 2	Build C#.net desktop applications using ADO.NET and also implementing GUI applications using Event handling
		399	CO 3	management techniques to Build the Web applications using ASP.NET Web forms.
		400	CO 4	Apply the Asp.Net MVC concepts to Build the Web MVC applications
		401	CO 5	Develop the programs for Visual Programming application development.
21CS3231RA 21CS3231PA	SOFTWARE PROJECT MANAGEMENT	402	CO 1	Understanding the concept of software project management process
		403	CO 2	Illustrate the various rules and guidelines that involved to improve the time, Cost, Quality, management aspects in software project management.
		404	CO 3	Identify the guidelines that are involved to improve the Configuration, Human Resource time, Communications management aspects in software project management.
		405	CO 4	Build the techniques that are involved in the Phases of SPM such as Initiating, planning, executing & controlling projects.
		406	CO 5	Apply various estimation levels of cost and effort
		407	CO 1	Able to Understand about software architecture and architectural drivers.
		408	CO 2	Able to analyze the quality attributes and their scenarios.

21CS3295RA 21CS3295PA	SOFTWARE ARCHITECTURE & DESIGN	409	CO 3	Able to Understand architectural styles and apply the knowledge various real time applications.
		410	CO 4	Able to Analyze and create the documenting the architecture and apply to web services
		411	CO 5	Evaluate Lab experiments using UML diagrams
21CS3258RA 21CS3258PA	SOFTWARE RELIABILITY	412	CO 1	Understand Software Reliability and develop a software project from requirement gathering to implementation.
		413	CO 2	Analyze software system failures and develop convincing solutions
		414	CO 3	Estimate Software Reliability parameters using Markovian Modelling, Maximum Likelihood and Least Square Method
		415	CO 4	Evaluate performance of Binomial-Type, Poison-Type and Markovian Models and Predict Software Reliability using SQA Intelligent Techniques
21CS3255RA 21CS3255PA	CROSS-PLATFORM DEVELOPMENT FRAMEWORKS	416	CO 1	Gaining Knowledge on Kotlin basics and to Design on Android Layouts, Views and Navigations
		417	CO 2	Apply techniques on various devices, internet and to connect with various databases
		418	CO 3	overview on DART and Flutter Technologies
		419	CO 4	Develop and deploy dynamic Flutter applications
		420	CO 5	Design and work on various platforms
21CS3071RA 21CS3071PA	PROGRAMMING FOR GAME DEVELOPMENT	421	CO 1	Illustrate the concepts of Game design and development.
		422	CO 2	Understanding the use of mathematical and geometrical concepts in Game Programming.
		423	CO 3	Explain the Core architectures of Game Programming.
		424	CO 4	Relate above advance concepts in game development and explain various platforms and frameworks for Game Programming
		425	CO 5	Implement Games using Course with Code in Unity
21CS3266RA 21CS3266AA 21CS3266PA	AR & VR APPLICATION DEVELOPMENT	426	CO 1	To understand Basics of Augmented Reality and Interactions. Fundamentals of Augmented, Mixed Reality and its features P
		427	CO 2	To understand Basics of Virtual Reality and Interactions. Fundamental Concept and Components of Virtual Reality
		428	CO 3	To understand Graphics Pipelines, Creating a sample augmented reality apps in android
		429	CO 4	To apply Unity development Environment, IDE Basics, Sprites, User Interfaces, Simple 3D animation Creation
		430	CO 5	Develop applications through Lab experiments

21CS3296RA 21CS3296PA	COMPUTER GRAPHICS	431	CO 1	Apply techniques of computer graphics for the generation of objects.
		432	CO 2	Model 2D objects using 2D Transformations.
		433	CO 3	Identify clipping algorithms that are used to remove objects, lines, or line segments that are outside the viewing pane.
		434	CO 4	Inspect algorithms to find out visible surfaces
		435	CO 5	Develop graphical objects with modeling.
21CS3268RA 21CS3268PA	PRINCIPLES OF GAME DESIGN	436	CO 1	Remembering the definition of Video Games and Design Components
		437	CO 2	Understand the Game Concepts and its world
		438	CO 3	Applying the Story telling Character and user interface Design
		439	CO 4	Analyzing the Game Play to its mechanics and balancing
21CS3267RA 21CS3267PA	BUSINESS OF GAMES & ENTREPRENEURSHIP	440	CO 1	Understanding the flow of money in the game industry & how to protect ideas to make the craft of making games an economically justifiable activity.
		441	CO 2	Explore the mechanism behind gaming production and teamwork with foundation in some of the project management tools and techniques
		442	CO 3	Understand and work out some of the presentation skills to pitch the gaming ideas in front of investor groups
		443	CO 4	Explore the skills required to be an entrepreneur and know the rules and regulations to start a company
		444	CO 5	Explore and Understand Pitching tools & Business Plan Development tools for Gaming startup
21CS3117RA 21CS3117AA 21CS3117PA	IOT SENSING AND ACTUATING DEVICES	445	CO 1	Understand the role of sensor and actuators in real time aspects and Analog and Digital Actuators
		446	CO 2	circuits
		447	CO 3	Analyze different generation of sensors for the development of IoT based Networks
		448	CO 4	Analyse the role of different Energy sources and power management in IoT
		449	CO 5	Implement and Evaluate the practical IoT
21CS3118RA 21CS3118PA	INTERNET OF THINGS: ARCHITECTURES AND PROTOCOLS	450	CO 1	Understand the Architectural Overview of IoT
		451	CO 2	Constraints
		452	CO 3	Apply the various IoT Protocols in Datalink and Network layers
		453	CO 4	Apply the various IoT Protocols in Transport and Session Layers
		454	CO 5	Create IoT based applications using IoT protocols
21CS3298RA 21CS3298AA	CYBER PHYSICAL SYSTEMS	455	CO 1	Apply mathematical concepts for modeling to design automation
		456	CO 2	Apply Middle and High Level Design Decisions to design the automation
		457	CO 3	Analyze the Human interaction with CPS by making use of IoT Sensors

21CS3298PA	CYBER PHYSICAL SYSTEMS	458	CO 4	Analyze AADL and make use of it for modelling the automation
		459	CO 5	Implement the models and design smart models for automobiles, medical devices and home appliances.
21CS3299RA 21CS3299PA	FOUNDATIONS OF HYBRID AND EMBEDDED SYSTEMS	460	CO 1	Understand the History of Embedded &Hybrid System concepts, Purpose of Embedded & Hybrid Systems. Characteristics and Quality Attributes of Embedded & Hybrid Systems
		461	CO 2	selection for Embedded Systems & Hybrid Systems, Communication Interface
		462	CO 3	Apply the Embedded & Hybrid Firmware tools, Embedded & Hybrid Firmware Design Approaches and Development Languages.
		463	CO 4	Apply Operating System Basics (RTOS) Understand and apply Multiprocessing and Multitasking, Task Scheduling.
		464	CO 5	Design and Prototype Embedded Computer Systems. Implement a recommender system by using Hybrid Approach
21CS3250RA 21CS3250PA	CLOUD COMPUTING FOR IOT ENGINEERS	465	CO 1	To understand the differences between traditional deployment and cloud computing
		466	CO 2	virtualization
		467	CO 3	Apply the concept of Data Analytics by using AWS cloud
		468	CO 4	Analyze the statistical data analysis and methods for evaluation
		469	CO 5	Able to evaluate the communication between IoT devices and cloud (AWS).by measuring parameters
21CS3265RA 21CS3265PA	WIRELESS SENSOR NETWORKS	470	CO 1	Understand challenges and technologies for wireless networks
		471	CO 2	Understand architecture and sensors.
		472	CO 3	Apply the communication, energy efficiency, computing, storage, and transmission strategies.
		473	CO 4	Build the infrastructure and simulations.
		474	CO 5	Apply the concept of programming the in WSN environment
21CS3060RA 21CS3060PA	CONTINUOUS DELIVERY & DEVOPS	475	CO 1	Identify the Need of DevOps in SDLC and Cloud Infrastructure in DevOps, Apply Version Control System to track the latest version of Software
		476	CO 2	Apply Continuous Integration and Continuous Deployment using Infrastructure as Code, Build in Cloud native Applications using Pipeline and Examine the Software and Automation Testing Frameworks.
		477	CO 3	Analyze need of Containerization in SDLC and Examine the Kubernetes Pod Configuration.

		478	CO 4	Inspect Configuration Management using Infrastructure as Code, Analyze Continuous Monitoring and Container Orchestration process.
		479	CO 5	To Build and Inspect the Tools associated to DevOps Life Cycle.
21CS3116RA 21CS3116PA	SIGNAL PROCESSING	480	CO 1	Understand the various types of signals, systems and their frequency domain transformation.
		481	CO 2	Understand the design methodology of different filters and their realizations.
		482	CO 3	Apply signal processing approaches for extraction of information present in the natural signals.
		483	CO 4	Apply machine learning approaches for processing of signals.
		484	CO 5	Apply above signal processing approaches in tutorial problems related to transformation, filtering, feature extraction, machine learning for signal processing
21CS3040RA 21CS3040PA	CRYPT ANALYSIS & CYBER DEFENSE	485	CO 1	To Understand the Concept of Business Analytics in detail from domains perspective.
		486	CO 2	To analyze the application of R using Descriptive Statistics and Correlation concepts.
		487	CO 3	To analyze the application of Data Visualization techniques in Business Analytics using R.
		488	CO 4	To analyze the application of select Multivariate Analytical tools using R.
21CS3015RA 21CS3015PA	EMBEDDED SYSTEMS	489	CO 1	Understand C for Embedded Systems. Analyse ARM processor and interrupt architecture
		490	CO 2	Apply Modern Assembly Language Programming with the ARM Processor
		491	CO 3	Apply I/O Synchronization and Interrupt Programming. Program the STM32F4xx chip peripherals: I/O ports, ADCs,
		492	CO 4	Understand Analog Interfacing and Program the STM32F4xx chip peripherals: DACs, SPIs, and I2Cs
		493	CO 5	Apply Embedded Systems Programming on ARM Cortex-M3/M4 Processor
21CS3232RA 21CS3232PA	MACHINE LEARNING	494	CO 1	Apply Machine Learning Techniques using Decision Trees to solve Real World Problems
		495	CO 2	Build Bayesian models for solving Classification and Prediction problems
		496	CO 3	Apply Neural Network and Genetic Algorithm techniques to solve Classification, Prediction problems
		497	CO 4	Demonstrates Learning First Order Rules, Analytical Learning Explanation-Based Learning and reinforcement learning
		498	CO 5	Implement Machine Learning Techniques using Python Language

21CS3133RA 21CS3133PA	DATA VISUALIZATION TECHNIQUES	499	CO 1	Understand the modelling of various types of data and the Visualization fundamentals
		500	CO 2	Apply methods and tools for Non-Spatial Data Visualization
		501	CO 3	Apply methods for Scientific / Spatial Data Visualization and Web data visualization
		502	CO 4	Understand the Dashboard and its categories and Apply visual analytics on dashboards
		503	CO 5	Evaluate data visualization through Python & Tableau /Power BI
21CS3286RA 21CS3286PA	CROSS-PLATFORM DEVELOPMENT FRAMEWORKS	504	CO 1	Gaining Knowledge on Kotlin basics and to Design on Android Layouts, Views and Navigations
		505	CO 2	Apply techniques on various devices, internet and to connect with various databases
		506	CO 3	overview on DART and Flutter Technologies
		507	CO 4	Develop and deploy dynamic Flutter applications
		508	CO 5	Design and work on various platforms
21CS3234RA 21CS3234AA 21CS3234PA	APPLICATION DEVELOPMENT ON CLOUD	509	CO 1	Analyze, predict and apply the server based computing for hosting the web application with appropriate database and storage.
		510	CO 2	Implement the cloud services to monitor and secure the cloud infrastructure.
		511	CO 3	Analyze, predict and apply the CI/CD services for hosting the web application.
		512	CO 4	Analyze, predict and apply appropriate serverless, container based, work flow and messaging based services.
		513	CO 5	Apply the knowledge and implement the cloud concepts in real time.
21CS3235RA 21CS3235PA 21CS3235AA	SOLUTIONS ARCHITECTING ON CLOUD	514	CO 1	Design Resilient Architectures
		515	CO 2	Design High-Performing Architectures
		516	CO 3	Design Secure Applications and Architectures
		517	CO 4	Design Cost-Optimized Architectures
		518	CO 5	Designing solutions to the architecture of Cloud
21CS3263RA 21CS3263PA	VISUAL PROGRAMING	519	CO 1	Apply the concepts of C#.Net and Build console and desktop applications.
		520	CO 2	Build C#.net desktop applications using ADO.NET and also implementing GUI applications using Event handling
		521	CO 3	Applying the concepts of ASP.NET Standard Server controls and State management techniques to Build the Web applications using ASP.NET Web forms.
		522	CO 4	Apply the Asp.Net MVC concepts to Build the Web MVC applications
		523	CO 5	Develop the programs for Visual Programming application development.

21CS3204RA 21CS3204PA	COMPILER DESIGN	524	CO 1	To design a Lexical analyzer for a given source code.
		525	CO 2	To design different types of parsers and perform comparative analysis.
		526	CO 3	To design an efficient syntax-directed translator and intermediate code generator
		527	CO 4	To optimize and generate the translated code for the target machine.
		528	CO 5	To design a compiler for any given language using compiler generation tools
21CS3061RA 21CS3061RB 21CS3061AA 21CS3061PA	AUTOMATA THEORY AND FORMAL LANGUAGES	529	CO 1	To design finite machines, regular expressions and regular grammar for regular languages and to prove existence of non-regular languages.
		530	CO 2	To design Context Free Grammars for Context Free Languages and simplify them for optimization
		531	CO 3	To design Push Down Automata for CFL and to prove existence of non-Context Free languages
		532	CO 4	To design a Turing machine for a given problem and to prove the existence of Non-Turing acceptable languages.
21CS3065RA	Quantum Computing	533	CO 1	To introduce basics of quantum computing
		534	CO 2	Implementing Quantum computing algorithms
		535	CO 3	Applying concepts of Quantum computing using QISKIT
		536	CO 4	Analyze and Discuss Quantum Machine learning and deep learning concepts with applications
		537	CO 5	Practicals on all algorithms discussed above
21CS3066RA 21CS3066AA 21CS3066PA	SOFTWARE VERIFICATION & VALIDATION	538	CO 1	To Understand test cases suitable for a software development for different domains.
		539	CO 2	To identify and apply suitable tests to be carried out. Conduct an inspection or review of software source code for a small or medium sized software project
		540	CO 3	Prepare and apply test planning based on the document using automatic testing tools.
		541	CO 4	To Document test plans and apply test cases designed
		542	CO 5	To Test the software application completely and make it sure that it's performing well and as per the specifications
21CS3016RA 21CS3016AA 21CS3016PA	.NET PROGRAMMING (EPAM)	543	CO 1	Understanding the basic concepts of ., C#.Net and Build console and desktop applications using C#.net framework
		544	CO 2	Build C#.net desktop applications using ADO.NET
		545	CO 3	Applying the concepts of ASP.NET Standard Server controls for application development
		546	CO 4	Build the applications using Web forms, Web Pages and MVC, Page and State management and master pages.

		547	CO 5	Develop the programs for desktop, web and enterprise application development using .NET Techniques.
21CS3017RA 21CS3017AA 21CS3017PA	FRONT END WEB DEVELOPMENT (EPAM)	548	CO 1	Apply the concepts of HTML5 and CSS3 for static web application.
		549	CO 2	Pertaining concepts of javascript to build client-side web application
		550	CO 3	Apply concepts of advanced UI Designing using extended Javascript
		551	CO 4	Apply concepts of ngx, npm, typescript to build dynamic web application
		552	CO 5	Develop the webapplication using various technologies like html, css, javascript, typescript
21CS3018RA 21CS3018AA 21CS3018PA	SOFTWARE TESTING (EPAM)	553	CO 1	Create test scenarios that are appropriate for software development in many fields
		554	CO 2	Determine the appropriate tests that should be run. Conduct a small- to medium-sized software proposal's source code inspection or review
		555	CO 3	Applying automated testing tools, create test plans based on the document.
		556	CO 4	Make test plans dependent on the document leveraging test automation tools
		557	CO 5	Using automated testing tools, make test plans contingent on the document
21CS3019RA 21CS3019AA 21CS3019PA	CLOUD DEVOPS (EPAM)	558	CO 1	Understanding the basic concepts of Cloud and Devops
		559	CO 2	Identify the Need of DevOps in SDLC and Cloud Infrastructure in DevOps, Apply Version Control System to track the latest version of Software
		560	CO 3	Inspect Configuration Management using Infrastructure as Code
		561	CO 4	Analyze need of Containerization in SDLC and Examine the Kubernetes Pod Configuration.
		562	CO 5	Build and Inspect the Tools associated to DevOps Life Cycle.
21CS40A7	FUNDAMENTALS OF SOFTWARE ENGINEERING	558	CO1	Comprehend software development life cycle and prepare SRS document
		559	CO2	Implementing software design and development techniques using UML
		560	CO3	Identify verification and validation methods in a software engineering project
		561	CO4	Optimize the development process using CMMI Levels
21CS40A6	FUNDAMENTALS OF DBMS	562	CO1	Understand the fundamentals of Database Management Systems.
		563	CO2	Construct database tables using SQL
		564	CO3	Apply various Normalization techniques and develop procedures and functions in PL/SQL
		565	CO4	Apply the file storage structures in the Database Management and Transaction processing.
		566	CO1	Understand the architectural design of a computer and various basic concepts of operating systems

21CS40A8	FUNDAMENTALS OF INFORMATION TECHNOLOGY	567	CO2	Understand programming fundamentals Analyse various software development methodologies
		568	CO3	Undestanding of database design and Apply various SQL commands and Transaction Processing.
		569	CO4	Apply OOP and model for different case studies using UML
21UC0012M	GENDER SENSITIZATION	570	CO1	Students will have developed a better understanding of important issues related to gender in contemporary India
		571	CO2	Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through group discussions.
		572	CO3	Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
		573	CO4	Students will acquire insight into the gendered division of labor and its relation to politics and economics.
21UC0010	UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS	574	CO1	Realize and Understand the basic aspiration, harmony in thehuman being.
		575	CO2	Envisage the roadmap to fulfill the basic aspiration of humanbeings.
		576	CO3	Analyze the profession and his role in this existence
		577	CO4	Understand the profession and his role in this existence
21UC0008	INDIAN CONSTITUTION	578	CO1	To acquire knowledge of the historical developments that culminated in the drafting of the Indian Constitution.
		579	CO2	To understand the basic features of the Indian Constitution.
		580	CO3	To understand the structure of the Federal government as defined by the Indian Constitution.
		581	CO4	To understand the Indian Judicial system and election commission of india
21UC0007	INDIAN HERITAGE & CULTURE	582	CO1	Familiarizing students with various aspects of Indian culture and how they contribute to the concept of Unity in Diversity
		583	CO2	Understand the beginnings of Indian History and the developments during the Ancient period
		584	CO3	Understand the developments in India during the Medieval Age along with how they contributed to Indian civilization
		585	CO4	Understand the reasons for colonial rule over India and how independence was achieved from British rule
21IE2040	SOCIAL INTERNSHIP (SI)	586	CO1	Industrial Training
21IE3042	RESEARCH SEMINAR	587	CO5	Analyze Research work
21IE3043	TERM PAPER	588	CO5	Analyze Research work

21IE4051	INTERNSHIP	589	CO1	Internship
		590	CO2	Understanding the importance of production training
		591	CO3	Applying the techniques in the live projects
		592	CO4	Analyzing the achieved output, compared to production requirments