R20Series JNTUK CO's

COURSE	CODE	C.O CODE	COURSE OUTCOME DESCRIPTION
Communicative English	HS1101	CO1	Apply the four languages learning skills-listening, speaking, reading, writing (LSRW) for professional success.
		CO2	Employ knowledge of grammatical structures and vocabulary in speech and writing
		CO3	Apply effective communication skills to enhance professional possibilities.
		CO4	Develop acceptable personality traits suitable for chosen profession.
Mathematics - I (Calculus And Differential Equations)	BS1101	CO1	Examine the convergence of series and apply mean value theorem to real life problem.
		CO2	Solve the Differential Equations of first and higher order related to various engineering applications.
		CO3	Apply the partial differentiation technique to solve physical problem
		CO4	Apply double and triple integrals to find areas and volumes.
Applied Physics	BS1102	CO1	Apply the knowledge of different optical phenomena in daily life.
		CO2	Distinguish between laser sources and conventional sources and study the propagation of light through optical fibers.
		CO3	Explain fundamental concepts of quantum mechanics and analyze the behavior of electron in metals according to various theories
		CO4	Summarize magnetic & dielectric material properties and recognize their need in engineering applications.
		CO5	Understand electrons& holes behavior in semiconductors and extraordinary behavior of materials at various transition temperatures

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Programming for Problem Solving using C	ES1101	CO1	Apply the basic concepts of C Programming for problem-solving and different number systems.
		CO2	To use different operators, write programs that use control statements for a given problem.
		CO3	Illustrate the concepts of Homogeneous and heterogeneous data types, pointers and file system for solving mathematical and engineering problems.
		CO4	Decompose a given problem into functions and to develop modular reusable code.
Computer Engineering Workshop	ES1102	CO1	Apply knowledge for Computer Assembling and Software installation
		CO2	Understand and implement Unix commands
		CO3	Ability to effectively use Internet, World Wide Web(WWW) and Web browsers
		CO4	Apply the tools for MS-Word, PowerPoint , Excel and PDF documentation
English Communication Skills Laboratory	HS1102	CO1	Recognize the sounds of English with the help of audio visual aids
		CO2	Build confidence and overcome inhibitions while speaking in English.
		CO3	Demonstrate acquired language skills in performing the designated activity.
Applied Physics Lab	BS1103	CO1	Apply the knowledge of different phenomena of light like interference, diffraction and handle various optical measuring instruments.
		CO2	Analyze various electronic circuits and study the temperature dependence of semiconductors.
		CO3	Apply the knowledge of phenomena like LASER diffraction and measure the numerical aperture of an optical fibre
Programming for Problem Solving using C Lab	ES1103	CO1	Describe the basics of computer and understand the problem-solving aspect.
		CO2	Design and develop C program to evaluate simple expressions and logical operations.
		CO3	Develop & Implement C programs with suitable modules to solve the given problem.
		CO4	Demonstrate the concept of pointer and perform I/O operations in files.
Mathematics – II (Linear Algebra And Numerical Methods)	BS1201	CO1	Solve system of linear algebraic equations and apply Eigen value computation technics to reduce a given quadratic to canonical form
		CO2	Solve algebraic and Transcendental equations by using Numerical methods
		CO3	Apply Newton 's forward and backward interpolation and Lagrange's formula for equal and unequal intervals.
		CO4	Compute numerical solutions of differential equations.

Course	Code	CO	Course Outcome
Applied Chemistry	BS1202	CO1	Identify the advantages and limitations of Plastic materials, Elastomers and their use in day to day life.
		CO2	Select the suitable methods of corrosion control and gain the knowledge of applications of batteries.
		CO3	Recognize the need of nano materials, liquid crystals, semiconductors and super conductors.
		CO4	Gain the knowledge of applications of different analytical instruments and generation of electricity from various Non-Conventional energy sources.
		CO5	Obtain the knowledge of computational chemistry and molecular machines.
Computer Organization	ES1201	CO1	Recall the internal organization of computers, CPU,I/O and its main components
		CO2	Relate postulates of Boolean algebra and basic computer organization design
		CO3	Design and analyze combinational and sequential circuits and basics of I/O organization
Python Programming	ES1202	CO1	Understand the need for learning basic concepts of Python programming language
		CO2	Apply various data structures in developing solutions to real time scenarios
		CO3	Analyze various concepts of functions, make use of packages, object oriented concepts in python programming and Outline Exception handling concepts.
		CO4	Apply the usage of pattern matching, GUI in python programming.
Data Structures	CS1201	CO1	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.
		CO2	Apply the different linear data structures like stack and queue to various computing problems
		CO3	Implement different types of trees, heaps and apply them to problem solutions
		CO4	Identify different non linear data structures to analyze the performance of an algorithm.
Applied Chemistry Lab	BS1203	CO1	Obtain the knowledge of acid-base titrations to determine the strength of acid and base solutions.
		CO2	Gain the knowledge of Redox titrations to determine the concentration of samples such as Ores, KMnO4 and Copper using different indicators.
		CO3	Obtain the knowledge of complexometry titrations to determine the hardness of given water sample by EDTA method.
		CO4	Gain the knowledge of commonly used instruments such as pH meter, Conductivity meter and Potentiometer to determine the strength of given acid solutions.
Python Programming Lab	ES1203	CO1	Understand the need for learning basic concepts of Python programming language
		CO2	Apply various data structures in developing solutions to real time scenarios
		CO3	Analyze various concepts of functions, make use of packages, object oriented concepts in python programming and Outline Exception handling concepts.

		CO4	Design the usage of pattern matching, GUI in python programming.
Data Structures Lab	CS1202	CO1	Implement different sorting and searching algorithms
		CO2	Implement the stack, Queue and their applications
		CO3	Implement various types of linked lists and their applications
		CO4	Perform basic operations on trees and graphs and determine minimum spanning tree
Mathematics III	R2021011	CO1	Apply the concepts of vector calculus to the problems of work done by a force, circulation and flux
		CO2	Apply Laplace Transforms to solve linear differential equations with constant coefficients.
		CO3	Compute Fourier series of the periodic function and apply Fourier transform to a range of non-periodic function.
		CO4	Solve the first and higher order of partial differential equations and apply to various engineering problems
		CO5	
		CO6	
Object Oriented Programming through C++	R2021051	CO1	Apply the basics of programming in the C++ language and differentiate object-oriented programming and procedural programming.
		CO2	Apply C++ features such as composition of objects, operator overloading, dynamic memory allocation and inheritance.
		CO3	Apply virtual and pure virtual function & complex programming situations
		CO4	Apply generic programming and exception handling techniques.
		CO5	Build C++ classes using appropriate encapsulation and design principles.
		CO6	
Operating Systems	R2021052	CO1	Understand the basic principles of operating systems.
		CO2	Analyze the process management policies and its scheduling by CPU.
		CO3	Analyze the memory management and its allocation policies and file systems.
		CO4	Analyze the mechanisms used for process synchronization, deadlock prevention and detection.
		CO5	Understand system security and protection mechanisms in operating systems like UNIX/LINUX and Windows.
		CO6	
Software Engineering	R2021053	CO1	understands the basics concepts of software engineering, evolution of software and process pattern
		CO2	Apply various agile software models and principles
		CO3	Analyze the principles of requirements engineering
		CO4	create architectural designs and components for a given project

Course	Code	CO	Course Outcome
		CO5	Apply different testing techniques
		CO6	
Mathematical Foundations of Computer Science	R2021054	CO1	Apply the mathematical logic and different proof methods to validate the arguments.
		CO2	Identify and apply operations on discrete structures such as sets, relations and algebraic structures in different areas of computing.
		CO3	Apply the counting techniques and principles of number theory to solve Combinatorial and problems of computer science.
		CO4	Solve the complex problems using the recurrence relations.
		CO5	Apply concepts of graphs and trees to Design algorithms for real world problems and find Solutions with optimal complexity.
		CO6	
Object Oriented Programming through C++ Lab	R2021055	CO1	Develop programming skills in computer programming concepts in C++ language
		CO2	Solve coding problems in C++ language
		CO3	Solve coding problems related to OOP in C++language
		CO4	
		CO5	
		CO6	
Operating Systems Lab	R2021056	CO1	Make use of Linux environment for Unix Utilities and perform basic shell and file access control.
		CO2	Solve various CPU scheduling and page replacement algorithms.
		CO3	Analyze tasks of multiprogramming and file allocation strategies.
		CO4	Classify Bankers algorithm implementation for deadlock avoidance and prevention.
		CO5	Examine process communication, process synchronization and usage of pthread library.
		CO6	
Software Engineering Lab	R2021057	CO1	Ability to develop Software Architectures
		CO2	To Implement Creational and Structural patterns
		CO3	To Create behavioural patterns in structures.
		CO4	
		CO5	
		CO6	
Python-NumPy Lab	R2021058	CO1	Explain how data is collected, managed and stored for processing
		CO2	Understand the workings of various numerical techniques, different descriptive measures of Statistics, correlation and regression to solve the engineering problems

		CO3	Understand how to apply some linear algebra operations to n-dimensional arrays
		CO4	Use NumPy perform common data wrangling and computational tasks in Python.
		CO5	
		CO6	
Constitution of India	R2021010	CO1	Understand Historical Back Ground of Constitution Making and Its Importance for Building Democratic India.
		CO2	Understand the Functioning of Three Wings of Government.
		CO3	Understand the Value of Fundamental Rights and Duties for becoming good citizen of India
		CO4	Analyze the Decentralization of power between state central and local Government
		CO5	Apply the knowledge in strengthening of constitutional Institutions like Election Commission and UPSC for sustaining Democracy.
		CO6	
Probability and Statistics	R2022051	CO1	Analyse Statistical data using measures of central tendency, dispersion and location.
		CO2	Calculate and interpret the correlation between two variables.
		CO3	Apply various probability distribution for both discrete and continuous random variables
		CO4	Apply the terms of sampling distribution and test the hypothesis for small and large samples.
		CO5	
		CO6	
Database Management Systems	R2022052	CO1	Interpret the fundamentals of DBMS.
		CO2	Apply the concepts of relational model and use of SQL for database management.
		CO3	Understand ER concepts and Develop Queries in RDBMS.
		CO4	Analyze DB design methodology and normalization process.
		CO5	Compare and Contrast various transaction, concurrency management, file organizations and indexing techniques.
		CO6	
Formal Languages and Automata Theory	R2022053	CO1	Students can Able to Design Finite Automata for different language classes and can apply techniques to find the equivalency and minimal forms of a Finite Automata.
		CO2	Students can Able To Design Regular Expressions for different set of Languages and can construct Finite Automaton for the languages. And also can apply pumping lemma to identify non regular languages.
		CO3	Students can Able To Construct context free grammar for various languages and apply Context Free Grammars to solve problems in computer science.
		CO4	Students can Able To solve various problems in computer science by applying normal form techniques and push down automata.
		CO5	Students can Able To design Turing machines and apply them to solve complex problems. Can also able to identify the different computational problems and their associated complexity.

Course	Code	CO	Description
		CO6	
		CO1	Apply OOPs Concepts and basics of java programming to simplify software development.
		CO2	Solve the inter-disciplinary applications using the concept of inheritance and interfaces.
Java Programming	R2022054	CO3	Illustrate error free applications using exception handling mechanisms and multi tasking applications using multithreading concepts.
		CO4	Understand interactive JDBC for standalone and Internet applications.
		CO5	
		CO6	
		CO1	Understand the fundamental concepts of Economics, estimating the Demand and Demand elasticity & Supply for a product.
		CO2	Apply the basic concepts of production, cost & break-even analysis.
Managerial Economics and Financial Accountancy	R2022055	CO3	Have Knowledge on forms of Business organization & conditions of different market structure & pricing policies.
		CO4	Utilize the knowledge on Accounting & Financing Analysis for preparation and interpretation of Financial Statements.
		CO5	Make use of the concepts related to Capital & Capital Budgeting.
		CO6	
		CO1	Able to create database with different types of integrity constraints and use the SQL commands.
		CO2	Able to use database security and authorization in order to access database for the different kinds of the user.
Database Management Systems Lab	R2022056	CO3	Develop an Entity-Relationship Model with the appropriate entireties, attributes, relationships and connectivity.
		CO4	Able to access and manipulate data using PL/SQL blocks
		CO5	Able to connect database to front end using JDBC and ODBC driver.
		CO6	
		CO1	Import, review, manipulate and summarize data by using R programming.
		CO2	Explore data-sets to create testable hypotheses and identify appropriate statistical tests.
R Programming Lab	R2022057	CO3	Perform appropriate statistical tests using R.
		CO4	Create and edit visualizations with R.
		CO5	
		CO6	
Java Programming Lab	R2022058	CO1	Develop programming skills in computer programming concepts in Java programming language.
		CO2	Solve coding problems in Java language.

		CO3	Solve coding problems related to OOP in Java language
		CO4	
		CO5	
		CO6	
Python-Pandas Lab	R2022059	CO1	Create and manipulate data structures like Series and Data Frames
		CO2	Create Data Frame structures for cleaning and processing and manipulating files
		CO3	Creates an pandas SQL table from the Pandas Data frame of interest and allow users to query from the SQLite table using SQL.
		CO4	Create different plots for basic exploratory data analysis
		CO5	
		CO6	
Computer Networks	R2031051	CO1	Illustrate OSI and TCP/IP Models and basics of physical layer and their issues.
		CO2	Demonstrate Data Link layer issues and MAC sub layers concepts
		CO3	Demonstrate the basic concepts of Error Detection and LAN & PAN Technologies.
		CO4	Analyze and implement the algorithms of network and transport layers and concerned services
		CO5	Apply and execute the concepts of TCP, UDP and the application layer conceptions
		CO6	
Design and Analysis of Algorithms	R2031052	CO1	Understand fundamentals of algorithms and analyse efficiency of algorithms.
		CO2	Apply Divide & Conquer and Greedy methods to design an algorithm for a problem.
		CO3	Apply Dynamic Programming technique to design an algorithm for a problem.
		CO4	Analyse algorithms for problems using various algorithmic methods such as backtracking.
		CO5	Apply NP completeness theory to design an algorithm for problem.
		CO6	
Data Warehousing and Data Mining	R2031053	CO1	Illustrate the importance of Data Warehousing, Data Mining and its functionalities and Design schema for real time data warehousing applications.
		CO2	Demonstrate on various Data Preprocessing Techniques viz. data cleaning, data integration, data transformation and data reduction and Process raw data to make it suitable for various data mining algorithms
		CO3	Choose appropriate classification technique to perform classification, model building and evaluation.
		CO4	Make use of association rule mining techniques viz. Apriori and FP Growth algorithms and analyze on frequent itemsets generation.
		CO5	Identify and apply various clustering algorithm (with open source tools), interpret, evaluate and report the result.

		CO6	
Fundametals of Micro Processors and MIcro Controllers	R203104I	CO1	Explain the Architectural features of 8085 & 8086 Microprocessor
		CO2	Develop the assembly language program for 8086 Microprocessor and 8051 Microcontroller
		CO3	Analyze the concepts of 8086 Microprocessor and 8051 Microcontroller interfacing with peripherals
		CO4	Describe the architectural features of 8051 Microcontroller & its applications
		CO5	
		CO6	
Software Project Management	R203105B	CO1	Knowledge on software development life cycle and improving economics and methodologies are useful in software project development as a software developer.
		CO2	Knowledge on artifacts of the process and different life cycle phases like inception, elaboration, construction, and transition etc. are required for software project development
		CO3	Knowledge on a various embedded firmware design approach, development languages and interrupts is necessary in the design of software project development
		CO4	Knowledge on management perspective and technical perspective architectures, automations, quality indicators are useful in the design of embedded applications
		CO5	
		CO6	
Data Warehousing and Data Mining Lab	R2031054	CO1	Apply data mining concepts for analysis of data
		CO2	To implement the knowledge on Association Rules Mining.
		CO3	Implement and Analyze on knowledge flow application on data sets and Apply the suitable visualization techniques to output analytical results
		CO4	
		CO5	
		CO6	
Computer Networks Lab	R2031055	CO1	Apply the Basics of Phycical layer and Transport layer in Real time applications.
		CO2	Apply Data link layer concepts, design issues and Protocols.
		CO3	Apply Network layer routing protocols and IP Addressing.
		CO4	Analyze the functions of Application layer and Presentation layer paradigms and Protocols.
		CO5	
		CO6	

Continuous Integration and Continuous Delivery using DevOps	R2031057	CO1	Understand thevarious phases of SDLC and agile software development
		CO2	Understand the fundamentals of Devops, adoption in projects, CI/CD and Devops maturity models
		CO3	Implement an automated CICD pipeline using a stack of tools by individual or group
		CO4	
		CO5	
		CO6	
Employability Skills-I	R2031058	CO1	Understand individual skill assessments and different types of Communication.
		CO2	Develop and practice self management skills and corporate etiquette.
		CO3	Apply presentation techniques effectively with appropriate body language
		CO4	Improve their verbal, written and other skills by performing mock sessions.
		CO5	Prepare for different types of interviews and be prepared for HR and technical interviews.
		CO6	
Machine Learning	R2032051	CO1	Demonstrate the fundamental usage of the concept Machine Learning system.
		CO2	Apply various Supervised Learning techniques in problem solving.
		CO3	Analyze the Ensemble Learning Methods.
		CO4	Apply the Clustering Techniques and Dimensionality Reduction Models in Machine Learning.
		CO5	understand the Neural Network Models and concepts of Deep Learning.
		CO6	
Compiler Design	R2032052	CO1	Explain different phases of compilation with Design of lexical analyzer for a language.
		CO2	Compare top down with bottom up parsers, and develop appropriate parser to produce parse tree representation of the input.
		CO3	Apply optimization techniques to intermediate code for statements and generate machine code for high level language program.
		CO4	Design syntax directed translation schemes for a given context free grammar and generate symbol tables for runtime environment
		CO5	
		CO6	
Cryptography and Network Security	R2032053	CO1	Analyze the basic principles of Cryptography.
		CO2	Apply the functionality of Secret and Public Key Cryptography.
		CO3	Analyze various Message Authentication functions and Secure Algorithms.
		CO4	Examine the Layers of various Security Services.

		CO5	
		CO6	
Object Oriented Analysis and Design	**R203205C**	CO1	Analyze the nature of complex systems and its solutions.
		CO2	Understands the conceptual UML model, classes, and relationships.
		CO3	Understand the modeling of Class and Object Diagram and able to apply for real time applications.
		CO4	Understand basic behavioral modeling and designs Diagrams.
		CO5	Gain the Knowledge on advanced behavioral and architectural modeling and applies the techniques for Diagrams.
		CO6	
MEAN Stack Development	**R203205E**	CO1	Build static web pages using HTML 5 elements.
		CO2	Apply JavaScript to embed programming interface for web pages and to perform Client-side validations.
		CO3	Build a basic web server using Node.js and recognize the need for Express.js.
		CO4	Develop JavaScript applications using Typescript and work with document database using MongoDB.
		CO5	Design dynamic and responsive single-page web applications using Angular.
		CO6	
Employability skills-II	**R2032059**	CO1	Demonstrate the fundamental usage of the different methods to solve basic mathematical problems.
		CO2	Apply various strategies in minimizing time consumption in problem solving.
		CO3	Analyze the mathematical problems and utilize these mathematical skills both in their professionals as well as personal life.
		CO4	Illustrate the present information in quantitative forms including table, graphs and formulas.
		CO5	
		CO6	
Machine Learning using Python Lab	**R2032054**	CO1	Apply the hypothesis concepts on various Learning Models.
		CO2	Construct Machine learning programs for Supervised learning models
		CO3	Construct Machine learning programs for unsupervised learning models
		CO4	Create an Artificial Neural Network by implementing the Back propagation algorithm
		CO5	Analyse the graphical outcomes of learning algorithms with specific datasets
		CO6	
Compiler Design Lab	**R2032055**	CO1	Design and implement Lexical analyzer using C programs and LEX tools.
		CO2	Design and implement various types of top down and Bottom up parsers.
		CO3	Apply Lex and Yacc Tools.

		CO4	Implementation of Three address code and code generation Algorithms.
		CO5	
		CO6	
Cryptography and Network Security Lab	R2032056	CO1	Use C language to develop simple XOR operation for encryption of data
		CO2	Make use of C/Java to implement Symmetric cryptography
		CO3	Choose C/Java to develop Asymmetric cryptography
		CO4	Implement Diffie-Hellman Key exchange using HTML and Javascript
		CO5	Develop java programs on MD-5 and SHA-1 algorithms
		CO6	
MEAN Stack Technologies-Module I	R2032058	CO1	Develop professional web pages of an application using HTML elements like lists, navigations, tables, various form elements, embedded media which includes images, audio, video, and CSS Styles.
		CO2	Utilize JavaScript for developing interactive HTML web pages and validate form data.
		CO3	Build a basic web server using Node.js and working with Node Package Manager (NPM).
		CO4	Build a web server using Express.js.
		CO5	Make use of Typescript to optimize JavaScript code by using the concept of strict type checking.
		CO6	
Cloud Computing	R204105A	CO1	Understand knowledge of different aspects of Cloud Computing such as: Services, Models, and Challenges.
		CO2	Identify the Infrastructure of Cloud Computing and also Analyze the different Cloud Computing Applications and Paradigms.
		CO3	Analyze the importance of Cloud Resourcing Virtualization and Cloud Resourcing and Scheduling.
		CO4	Understand Cloud based Storage and need of Security in Cloud Computing
		CO5	Understand the Development of Cloud-based applications like Google and Microsoft.
		CO6	
Deep Learning Techniques	R204105E	CO1	Demonstrate the fundamental concepts learning techniques of Artificial Intelligence, Machine Learning and Deep Learning.
		CO2	Discuss the Neural Network training, various random models.
		CO3	Develop Keras, TensorFlow, Theano and CNTK based deep learning models for solving problems.
		CO4	Analyze different Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN)
		CO5	Implement Interactive Applications of Deep Learning.
		CO6	

Wireless Network Security	R204105J	CO1	Identify and describe the security threats and vulnerabilities of wireless networks.
		CO2	Understand the purpose and functions of various wireless protocols and cryptography.
		CO3	Implement the security considerations of wireless devices from unauthorized access.
		CO4	Analyse the various wireless data networks.
		CO5	Implement the various Wireless Deployment Strategies
		CO6	
API and Microservices (Job Oriented Course)	R204105M	CO1	Understand fundamentals of Spring Framework.
		CO2	Create and Develop Spring Boot Application.
		CO3	Develop a Spring Data JPA application with Spring Boot.
		CO4	Write RESTful service using Spring REST.
		CO5	Create secure RESTful endpoints using Spring Security Document.
		CO6	
Secure Coding Techniques (Job Oriented Course)	R204105U	CO1	understand the trend,reasons and impact of recent cyber attacks.
		CO2	Understand OWASP design principles while designing a web application.
		CO3	Understand Threat modeling.
		CO4	Importance of security in all phases of SDLC
		CO5	Write secure coding using some of practices in C/C++/JAVA and python programming languages.
		CO6	
Universal Human Values 2: Understanding Harmony	R2041011	CO1	Understand the essentials of human values and skills, self-exploration, happiness and prosperity
		CO2	Apply the role of a human being in ensuring harmony in self and family
		CO3	Interpret the role of a human being in ensuring harmony in society and nature
		CO4	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.
		CO5	
		CO6	
Skill Oriented Course - V PYTHON: Deep Learning Lab	R2041052	CO1	Implement deep learning models for image analysis
		CO2	Build a convolutional neural network, and understand its application to build a recurrent neural network.
		CO3	Apply various optimization algorithms to comprehend different activation functions to understand hyper parameter tuning
		CO4	Design auto encoders in real time application.
		CO5	Building a simple Generative Adversarial Network (GAN) using TensorFlow
		CO6	Develop the ability to present and communicate outcomes of deep learning projects

Course	Code	CO	Description
Industrial/Research Internship	R2041055	CO1	
		CO2	
		CO3	
		CO4	
		CO5	
		CO6	
Major Project Work, Seminar Internship	Project	CO1	Identify the complex engineering problems relevant to the society and industry.
		CO2	Apply modern technologies, tools and systems in the field of information technology to analyze the identified problem.
		CO3	Design and implement a viable solution to the problem.
		CO4	Apply communication, report writing skills and Presentation skills.
		CO5	Develop the team work and leadership skills with professional and ethical values.
		CO6	

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