JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech. in COMPUTER SCIENCE AND ENGINEERING (AI & ML)
COURSE STRUCTURE, I & II YEAR SYLLABUS (R22 Regulations)

Applicable from AY 2022-23 Batch

I YEAR I SEMESTER

S. No.	Course Code	Course	L	T	P	Credits
1.		Matrices and Calculus	3	1	0	4
2.		Applied Physics	3	1	0	4
3.		Programming for Problem Solving	3	0	0	3
4.		Engineering Workshop	0	1	3	2.5
5.		English for Skill Enhancement	2	0	0	2
6.		Elements of Computer Science & Engineering	0	0	2	1
7.		Applied Physics Laboratory	0	0	3	1.5
8.		Programming for Problem Solving Laboratory	0	0	2	1
9.		English Language and Communication Skills Laboratory	0	0	2	1
		Total	**11**	**3**	**12**	**20**

I YEAR II SEMESTER

S. No.	Course Code	Course	L	T	P	Credits
1.		Ordinary Differential Equations and Vector Calculus	3	1	0	4
2.		Engineering Chemistry	3	1	0	4
3.		Computer Aided Engineering Graphics	1	0	4	3
4.		Basic Electrical Engineering	2	0	0	2
5.		Electronic Devices and Circuits	2	0	0	2
6.		Engineering Chemistry Laboratory	0	0	2	1
7.		Basic Electrical Engineering Laboratory	0	0	2	1
8.		Python Programming Laboratory	0	1	2	2
9.		IT Workshop	0	0	2	1
		Total	**11**	**3**	**12**	**20**

II YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Discrete Mathematics	3	0	0	3
2		Data Structures	3	0	0	3
3		Computer Organization and Architecture	3	0	0	3
4		Software Engineering	3	0	0	3
5		Operating Systems	3	0	0	3
6		Data Structures Lab	0	0	3	1.5
7		Operating Systems Lab	0	0	3	1.5
8		Software Engineering Lab	0	0	2	1
9		Constitution of India	3	0	0	0
		Skill Development Course (Node JS/ React JS/ Django)	0	0	2	1
		Total	**18**	**0**	**10**	**20**

II YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Mathematical and Statistical Foundations	3	0	0	3
2		Automata Theory and Compiler Design	3	0	0	3
3		Database Management Systems	3	0	0	3
4		Introduction to Artificial Intelligence	3	0	0	3
5		Object Oriented Programming through Java	3	0	0	3
6		Database Management Systems Lab	0	0	2	1
7		Java Programming Lab	0	0	2	1
8		Real-time Research Project/Field-Based Research Project	0	0	4	2
9		Gender Sensitization Lab	0	0	2	0
10		Skill Development Course (Prolog/ Lisp/ Pyswip)	0	0	2	1
		Total	**15**	**0**	**12**	**20**

III YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Design and Analysis of Algorithms	3	1	0	4
2		Machine Learning	3	0	0	3
3		Computer Networks	3	0	0	3
4		Business Economics & Financial Analysis	3	0	0	3
5		Professional Elective-I	3	0	0	3
6		Machine Learning Lab	0	0	2	1
7		Computer Networks Lab	0	0	2	1
8		Advanced Communication Skills lab	0	0	2	1
9		Intellectual Property Rights	3	0	0	0
10		Skill Development Course (UI design- Flutter)	0	0	2	1
		Total	**18**	**1**	**08**	**20**

III YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Knowledge Representation and Reasoning	3	0	0	3
2		Data Analytics	3	0	0	3
3		Natural Language Processing	3	0	0	3
4		Professional Elective – II	3	0	0	3
5		Open Elective-I	3	0	0	3
6		Natural Language Processing Lab	0	0	3	1.5
7		Data Analytics Lab	0	0	3	1.5
8		Industrial Oriented Mini Project/ Internship/Skill Development Course (DevOps)	0	0	4	2
9		Environmental Science	3	0	0	0
		Total	**18**	**0**	**10**	**20**

Environmental Science in III Yr II Sem Should be Registered by Lateral Entry Students Only.

IV YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Deep Learning	3	0	0	3
2		Nature Inspired Computing	2	0	0	2
3		Professional Elective -III	3	0	0	3
4		Professional Elective -IV	3	0	0	3
5		Open Elective - II	3	0	0	3
6		Professional Practice, Law & Ethics	0	0	4	2
7		Professional Elective - III Lab	0	0	2	1
8		Project Stage - I	0	0	6	3
		Total Credits	**14**	**0**	**12**	**20**

IV YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Professional Elective - V	3	0	0	3
2		Professional Elective – VI	3	0	0	3
3		Open Elective – III	3	0	0	3
4		Project Stage – II including Seminar	0	0	22	9+2
		Total Credits	**9**	**0**	**22**	**20**

***MC – Satisfactory/Unsatisfactory**

#Skill Course - 1 credit with 2 Practical Hours

Professional Elective-I

	Graph Theory
	Introduction to Data Science
	Web Programming
	Image Processing
	Computer Graphics

Professional Elective - II

	Software Testing Methodologies
	Information Retrieval Systems
	Pattern Recognition
	Computer Vision and Robotics
	Data Warehousing and Business Intelligence

Professional Elective - III

	Internet of Things
	Data Mining
	Scripting Languages
	Mobile Application Development
	Cloud Computing

 # Courses in PE - III and PE - III Lab must be in 1-1 correspondence.

Professional Elective -IV

	Quantum Computing
	Expert Systems
	Semantic Web
	Game Theory
	Mobile Computing

Professional Elective - V

	Social Network Analysis
	Federated Machine Learning
	Augmented Reality & Virtual Reality
	Web Security
	Ad-hoc & Sensor Networks

Professional Elective – VI

	Speech and Video Processing
	Robotic Process Automation
	Randomized Algorithms
	Cognitive Computing
	Conversational AI

NAME OF THE PROGRAM: R22 B.Tech. COMPUTER SCIENCE AND ENGINEERING (AI & ML)					
S.No.	**Semester**	**Course Code**	**Course Name**	**CO No.**	**Course outcome (Cos)**
1	1 SEM	MA101BS	Matrices and Calculus	C01	Write the matrix representation of a set of linear equations and to analyse the solution of the system of equations
				C02	Find the Eigenvalues and Eigen vectors
				C03	Reduce the quadratic form to canonical form using orthogonal transformations.
				C04	Solve the applications on the mean value theorems.
				C05	Evaluate the improper integrals using Beta and Gamma functions
				C06	Find the extreme values of functions of two variables with/ without constraints.
				C07	Evaluate the multiple integrals and apply the concept to find areas, volumes
2		PH102BS	Applied Physics	C01	Understand physical world from fundamental point of view by the concepts of Quantum mechanics and visualize the difference between conductor, semiconductor, and an insulator by classification of solids.
				C02	Identify the role of semiconductor devices in science and engineering Applications.
				C03	Explore the fundamental properties of dielectric, magnetic materials and energy for their applications.
				C04	Appreciate the features and applications of Nanomaterials.
				C05	Understand various aspects of Lasers and Optical fiber and their applications in diverse fields.
3		CS103ES	Programming for Problem Solving	C01	To write algorithms and to draw flowcharts for solving problems.
				C02	To convert the algorithms/flowcharts to C programs.
				C03	To code and test a given logic in the C programming language.
				C04	To decompose a problem into functions and to develop modular reusable code.
				C05	To use arrays, pointers, strings and structures to write C programs.
				C06	Searching and sorting problems.
4		EN105HS	English for Skill Enhancement	C01	Understand the importance of vocabulary and sentence structures.
				C02	Choose appropriate vocabulary and sentence structures for their oral and written communication.
				C03	Demonstrate their understanding of the rules of functional

					grammar.
				C04	Develop comprehension skills from the known and unknown passages.
				C05	Take an active part in drafting paragraphs, letters, essays, abstracts, précis and reports in various contexts.
				C06	Acquire basic proficiency in reading and writing modules of English.
5		CS106ES	Elements of Computer Science & Engineering	C01	Know the working principles of functional units of a basic Computer
				C02	Understand program development, the use of data structures and algorithms in problem solving.
				C03	Know the need and types of operating system, database systems.
				C04	Understand the significance of networks, internet, WWW and cyber security.
				C05	Understand Autonomous systems, the application of artificial intelligence.
6	2 SEM	MA201BS	Ordinary Differential Equations and Vector Calculus	C01	Identify whether the given differential equation of first order is exact or not
				C02	Solve higher differential equation and apply the concept of differential equation to real world problems.
				C03	Use the Laplace transforms techniques for solving ODE's.
				C04	Evaluate the line, surface and volume integrals and converting them from one to another
7		CH202BS	Engineering Chemistry	C01	Students will acquire the basic knowledge of electrochemical procedures related to corrosion and its control.
				C02	The students are able to understand the basic properties of water and its usage in domestic and industrial purposes.
				C03	They can learn the fundamentals and general properties of polymers and other engineering materials.
				C04	They can predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs.
8		ME203ES	Computer Aided Engineering Graphics	C01	Apply computer aided drafting tools to create 2D and 3D objects
				C02	sketch conics and different types of solids
				C03	Appreciate the need of Sectional views of solids and Development of surfaces of solids
				C04	Read and interpret engineering drawings
				C05	Conversion of orthographic projection into isometric view and vice versa manually and by using computer aided drafting
9		EE204ES	Basic Electrical Engineering	C01	Understand and analyze basic Electrical circuits
				C02	Study the working principles of Electrical Machines and Transformers

				C03	Introduce components of Low Voltage Electrical Installations.
10		EC205ES	Electronic Devices and Circuits	C01	Acquire the knowledge of various electronic devices and their use on real life.
				C02	Know the applications of various devices.
				C03	Acquire the knowledge about the role of special purpose devices and their applications.
11	3 SEM		Data Structures	C01	Ability to select the data structures that efficiently model the information in a problem.
				C02	Ability to assess efficiency trade-offs among different data structure implementations or combinations.
				C03	Implement and know the application of algorithms for sorting and pattern matching.
				C04	Design programs using a variety of data structures, including hash tables, binary and general tree structures, search trees, tries, heaps, graphs, and AVL-trees.
12			Operating Systems	C01	Will be able to control access to a computer and the files that may be shared
				C02	Ability to recognize and resolve user problems with standard operating environments.
13			Software Engineering	C01	Ability to translate end-user requirements into system and software requirements, using e.g. UML, and structure the requirements in a Software Requirements Document (SRD).
				C02	Identify and apply appropriate software architectures and patterns to carry out high level design of a system and be able to critically compare alternative choices.
				C03	Will have experience and/or awareness of testing problems and will be able to develop a simple testing report
14			Constitution of India	C01	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
				C02	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
				C03	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution
				C04	Discuss the passage of the Hindu Code Bill of 1956
15			Computer Organization	C01	Demonstrate an understanding of the design of the functional units of a digital computer system.

			and Architecture	C02	Evaluate cost performance and design trade-offs in designing and constructing a computer processor including memory.
				C03	Design a pipeline for consistent execution of instructions with minimum hazards.
				C04	Recognize and manipulate representations of numbers stored in digital computers
18			Mathematical and Statistical Foundations	C01	Apply the number theory concepts to cryptography domain
				C02	Apply the concepts of probability and distributions to some case studies
				C03	Correlate the material of one unit to the material in other units
				C04	Resolve the potential misconceptions and hazards in each topic of study
16	4 SEM		Discrete Mathematics	C01	Apply logic and set theory to formulate precise statements
				C02	Analyze and solve counting problems on finite and discrete structures
				C03	Understand and construct precise mathematical proofs
				C04	Describe and manipulate sequences
				C05	Apply graph theory in solving computing problems
17			Automata Theory & Complex Design	C01	Able to employ finite state machines for modeling and solving computing problems.
				C02	Able to design context free grammars for formal languages.
				C03	Able to distinguish between decidability and undecidability.
					Acquire skills in using lex tool and design LR parsers
				C04	Demonstrate the knowledge of patterns, tokens & regular expressions for lexical analysis.
18			Object Oriented Programming through Java	C01	Demonstrate the behavior of programs involving the basic programming constructs like control structures, constructors, string handling and garbage collection.
				C02	Demonstrate the implementation of inheritance (multilevel, hierarchical and multiple) by using extend and implement keywords
				C03	Use multithreading concepts to develop inter process communication.
				C04	Understand the process of graphical user interface design and implementation using AWT or swings.

19			Introduction to Artificial Intelligence	C01	Learn the distinction between optimal reasoning Vs human like reasoning and formulate an efficient problem space for a problem expressed in natural language. Also select a search algorithm for a problem and estimate its time and space complexities.
				C02	Apply AI techniques to solve problems of game playing, theorem proving, and machine learning.
				C03	Analyze Supervised Learning Vs. Learning Decision Trees
				C04	Learn different knowledge representation techniques.
				C05	Comprehend the applications of Probabilistic Reasoning and Bayesian Networks.
				C06	Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
20			Database Management System	C01	Gain knowledge of fundamentals of DBMS, database design and normal forms
				C02	Master the basics of SQL for retrieval and management of data.
				C03	Be acquainted with the basics of transaction processing and concurrency control.
				C04	Familiarity with database storage structures and access techniques