# R.M.K. COLLEGE OF ENGINEERING AND TECHNOLOGY
## RSM Nagar, Puduvoyal – 601 206

## Department of Artificial Intelligence and Data Science Course

### Outcomes

### ODD Semester 2024-25

| Sl. No. | Semester | Theory/ Practical | Course Code | Course Name |
|---|---|---|---|---|
| 1) | 3 | Theory | 22GE302 | Universal Human Values 2: Understanding Harmony |
| 2) | 3 | Theory | 22MA301 | Discrete Mathematics |
| 3) | 3 | Theory + Lab | 22AI301 | Artificial Intelligence |
| 4) | 3 | Theory + Lab | 22AI302 | Data Science using Python |
| 5) | 3 | Theory + Lab | 22CS305 | Advanced Java Programming |
| 6) | 3 | Theory + Lab | 22CS306 | Design and Analysis of Algorithms |
| 7) | 3 | Practical | 22CS313 | Product Development Lab 3 |
| 8) | 3 | Practical | 22CS311 | Aptitude and Coding Skills I |
| 9) | 3 | Practical | 22AI313 | Internship |
| 10) | 5 | Theory | 22CS006 | Open Elective I – Introduction to Computer Networks |
| 11) | 5 | Theory | 22CS911 | Professional Elective II – Data Engineering in Cloud |
| 12) | 5 | Theory | 22AI912 | Professional Elective III– Multi-Core Architecture and Programming |
| 13) | 5 | Theory + Lab | 22AI501 | Deep Learning |
| 14) | 5 | Theory + Lab | 22AI502 | Data Exploration, Feature Engineering and Visualization |
| 15) | 5 | Practical | 22CS511 | Advanced Aptitude and Coding Skills I |
| 16) | 5 | Practical | 22AI512 | Internship and Career Readiness Course |
| 17) | 7 | Theory + Lab | 21AI701 | Deep Learning Techniques |
| 18) | 7 | Theory | 2IAI702 | Natural Language Processing |
| 19) | 7 | Theory | 21ME002 | Open Elective II - Design Thinking |
| 20) | 7 | Theory | 21CS905 | Professional Elective IV –Computer Vision |
| 21) | 7 | Theory + Lab | 21AI923 | Professional Elective V –Distributed and Cloud Computing |
| 22) | 7 | Practical | 21CS917 | Professional Elective VI –Professional Readiness for Innovation, Employability and Entrepreneurship |

**EVEN Semester 2024-25**

| Sl. No. | Semester | Theory/ Practical | Course Code | Course Name |
|---|---|---|---|---|
| 1) | 4 | Theory | 22CS302 | Computer Organization and Architecture |
| 2) | 4 | Theory | 22AI901 | Professional Elective I - Business Intelligence and Analytics |
| 3) | 4 | Theory + Lab | 22MA401 | Probability and Statistics |
| 4) | 4 | Theory + Lab | 22CS304 | Operating Systems |
| 5) | 4 | Theory + Lab | 22AI402 | Machine Learning |
| 6) | 4 | Theory + Lab | 22CS403 | Web Development Frameworks |
| 7) | 4 | Practical | 22CS413 | Product Development Lab-4 |
| 8) | 4 | Practical | 22CS411 | Aptitude and Coding Skills II |
| 9) | 6 | Theory | 22EC012 | Open Elective II – Industrial IoT Applications |
| 10) | 6 | Theory | 22AI602 | Automata Theory and Compiler Design |
| 11) | 6 | Theory | 22AI903 | Professional Elective IV - Text and Speech Analytics |
| 12) | 6 | Theory | 22AI911 | Professional Elective V - Generative AI |
| 13) | 6 | Theory + Lab | 22CS602 | Object Oriented Software Engineering |
| 14) | 6 | Theory + Lab | 22AI601 | Reinforcement Learning |
| 15) | 6 | Practical | 22CS611 | Advanced Aptitude and Coding Skills II |
| 16) | 6 | Practical | 22AI611 | Mini Project |
| 17) | 8 | Practical | 21AI812 | Project Work |

## ODD Semester 2024-25

### 3rd Semester – B.Tech. Artificial Intelligence and Data Science

| 22GE302 - UNIVERSAL HUMAN VALUES II | |
|---|---|
| COs | Course Outcome : The students, after the completion of the course, are expected to |
| CO1 | Would become more aware of themselves, and their surroundings (family, society, nature). |
| CO2 | Would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. |
| CO3 | Would have better critical ability. |
| CO4 | Would become sensitive to their commitment towards what they have understood (human values, human relationship, and human society). |
| CO5 | Would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction. |

| 22MA301- DISCRETE  MATHEMATICS | |
|---|---|
| COs | Course Outcome : The students, after the completion of the course, are expected to |
| CO1 | Examine the validity of the arguments. |
| CO2 | Apply various proof techniques and principles using analytic and combinatorial methods. |
| CO3 | Develop the recurrence relation for the given problems. |
| CO4 | Implement graph theory techniques to solve real time problems. |
| CO5 | Understand groups, Rings and Fields. |
| CO6 | Solve problems in Lattices and Boolean algebra. |

| 22AI301 - ARTIFICAL INTELIGENCE | |
|---|---|
| COs | Course Outcome : The students, after the completion of the course, are expected to |
| CO1 | Illustrate the structure of agents and to implement various Intelligent agents. |
| CO2 | Apply search strategies in problem solving and game playing using heuristic function. |
| CO3 | Implement logical agents and first-order logic problems. |
| CO4 | Apply problem-solving strategies with knowledge representation mechanism for solving hard problems. |
| CO5 | Demonstrate the basics of expert systems and to develop models using machine learning techniques. |
| CO6 | Apply AI algorithms to solve real-world problems. |

## 22AI302 - DATA SCIENCE USING PYTHON

| COs | Course Outcome : The students, after the completion of the course, are expected to |
|-----|--------------------------------------------------------------------------------------|
| CO1 | Explain the fundamentals of data science. |
| CO2 | Experiment python libraries for data science. |
| CO3 | Apply and implement basic classification algorithms. |
| CO4 | Implement clustering and outlier detection approaches. |
| CO5 | Present and interpret data using visualization tools in Python. |
| CO6 | Use various data science algorithms to analyze data. |


## 22CS305 – ADVANCED JAVA PROGRAMMING

| COs | Course Outcome : The students, after the completion of the course, are expected to |
|-----|--------------------------------------------------------------------------------------|
| CO1 | Implement various data structures by utilizing core Java features and libraries |
| CO2 | Demonstrate proficiency in handling Java I/O operations, including file manipulation for efficient data storage and retrieval. |
| CO3 | Apply and Analyze the Stream API for functional programming and data processing. |
| CO4 | Implement advanced object serialization for complex data structures. |
| CO5 | Utilize regular expressions for text parsing and string manipulation. |
| CO6 | Build applications using advanced Java programming techniques. |


## 22CS306 - DESIGN AND ANALYSIS OF ALGORITHAM

| COs | Course Outcome : The students, after the completion of the course, are expected to |
|-----|--------------------------------------------------------------------------------------|
| CO1 | Understand the different algorithm design paradigms. |
| CO2 | Design algorithms for real world problems using algorithmic design techniques. |
| CO3 | Analyse the efficiency of simple recursive and non-recursive algorithms. |
| CO4 | Analyse the algorithm's worst, best and average case behaviour in terms of time and space. |
| CO5 | Apply the limits of algorithms and how to cope with them. |
| CO6 | Develop applications by selecting suitable design technique in an efficient way. |


### **Laboratory**


## 22CS313-Product Development Lab 3

| COs | Course Outcome : The students, after the completion of the course, are expected to |
|-----|--------------------------------------------------------------------------------------|
| CO1 | Enhance their skills in design concepts, rules and procedures. |
| CO2 | Develop their cognitive strategy to think, organize, learn and behave. |
| CO3 | Demonstrate the ability to provide conceptual design strategies for a product. |
| CO4 | Describe the procedure for designing a Mock-up model. |
| CO5 | Recognize and apply appropriate interdisciplinary and integrative strategies for solving complex problems. |

| 22CS311-Aptitude and Coding Skills I | |
|---|---|
| **COs** | **Course Outcome : The students, after the completion of the course, are expected to** |
| **CO1** | Develop vocabulary for effective communication skills. |
| **CO2** | Build the logical reasoning enhance critical thinking. |
| **CO3** | Develop error correction and debugging skills in programming. |
| **CO4** | Apply programming skills to develop programs efficiently |
| **CO5** | Solve problems using quantitative skills |
| **CO6** | Develop effective reading and listening skills. |

# 5th Semester – B.Tech. Artificial Intelligence and Data Science

| 22CS006- Introduction to Computer Networks | |
|---|---|
| **COs** | **Course Outcome : The students, after the completion of the course, are expected to** |
| **CO1** | Understand the fundamental concepts of computer networks. |
| **CO2** | Apply the various routing protocols to solve real-world problems. |
| **CO3** | Understand the layered architecture. |
| **CO4** | Apply the simulation tools to implement various protocols used in the various layers. |
| **CO5** | Analyze the various application layer protocols. |
| **CO6** | Apply the mathematical knowledge to do performance analysis of various routing protocols. |

| 22CS911 – Data Engineering In Cloud | |
|---|---|
| **COs** | **Course Outcome : The students, after the completion of the course, are expected to** |
| **CO1** | Understand data engineering, pipelines & access data in the cloud. |
| **CO2** | Build secure & scalable data pipelines using AWS services. |
| **CO3** | Choose the right data storage & secure your data pipelines. |
| **CO4** | Process big data for machine learning with cloud tools. |
| **CO5** | Analyze & visualize data and automate data pipelines. |
| **CO6** | Apply best practices in data governance, compliance, and ethics throughout the data engineering process, ensuring responsible handling and usage of data |

| 22AI912 – Multi-Core Architecture And Programming | |
|---|---|
| **COs** | **Course Outcome : The students, after the completion of the course, are expected to** |
| **CO1** | Illustrate multicore architectures and identify their characteristics and challenges. |
| **CO2** | Identify the issues in programming Parallel Processors. |
| **CO3** | Write programs using OpenMP and MPI. |
| **CO4** | Design parallel programming solutions to common problems. |
| **CO5** | Compare and contrast programming for serial processors and programming for parallel processors. |
| **CO6** | Elaborate on various concepts of multi-core architectures. |

| 22AI501 – Deep Learning ||
|---|---|
| COs | Course Outcome : The students, after the completion of the course, are expected to |
| CO1 | Demonstrate the basics of deep neural networks to solve real world problems. |
| CO2 | Implement deep learning models. |
| CO3 | Elaborate CNN and RNN architectures of deep neural networks. |
| CO4 | Use autoencoders in neural networks. |
| CO5 | Illustrate the various deep generative models. |
| CO6 | Apply deep generative models to solve real world problems. |

| 22AI502 – Data Exploration, Feature Engineering And Visualization ||
|---|---|
| COs | Course Outcome : The students, after the completion of the course, are expected to |
| CO1 | Outline exploratory data analysis and the phases involved in data analysis. |
| CO2 | Demonstrate various statistical techniques for data analysis. |
| CO3 | Present the basics of feature engineering on different types of data. |
| CO4 | Perform data analysis and apply visualization techniques. |
| CO5 | Apply the methods of time series analysis. |
| CO6 | Develop dashboards using different datasets by applying data engineering and feature extraction techniques. |

**Laboratory**

| 22CS511 – ADVANCED APTITUDE AND CODING SKILLS I ||
|---|---|
| COs | Course Outcome : The students, after the completion of the course, are expected to |
| CO1 | Develop advanced vocabulary for effective communication skills. |
| CO2 | Build an enhanced level of logical reasoning and quantitative skills. |
| CO3 | Develop error correction and debugging skills in programming. |
| CO4 | Apply advanced data structures and algorithms in problem solving. |
| CO5 | Develop coding solutions for real-world problems. |
| CO6 | Develop advanced vocabulary for effective reading skills. |

## 7<sup>th</sup> Semester – B.Tech. Artificial Intelligence and Data Science

7$^{th}$ Semester – B.Tech. Artificial Intelligence and Data Science

| 21AI701-DEEP LEARNING  TECHNIQUES ||
|---|---|
| COs | Course Outcome : The students, after the completion of the course, are expected to |
| CO1 | Explain the basics of deep neural networks. |
| CO2 | Describe advanced deep learning models. |
| CO3 | Understand and Implement CNN and RNN architectures of deep neural networks. |
| CO4 | Learn autoencoders in neural networks. |
| CO5 | Apply deep generative models to solve real world problems. |

| 21AI702-NATURAL LANGUAGE PROCESS | |
|---|---|
| COs | Course Outcome : The students, after the completion of the course, are expected to |
| CO1 | Apply the fundamentals of natural language processing. |
| CO2 | Perform word level analysis. |
| CO3 | Analyze the syntax using various methods. |
| CO4 | Understand the role of semantics and pragmatics. |
| CO5 | Use discourse algorithms and various lexical resources |

| 21ME002 – DESIGN THINKING | |
|---|---|
| COs | Course Outcome : The students, after the completion of the course, are expected to |
| CO1 | Describe the various techniques adopted for stimulating creativity. |
| CO2 | Discuss the thinking and visualization concepts |
| CO3 | Describe the various tools used for creativity. |
| CO4 | Apply the techniques to the design and development of new products. |
| CO5 | Explain the innovative products as required by the customers. |
| CO6 | Summarize the Design thinking and innovation concepts. |

| 21CS905 – COMPUTER VISION | |
|---|---|
| COs | Course Outcome : The students, after the completion of the course, are expected to |
| CO1 | Describe the concepts related to Image formation and processing. |
| CO2 | Compare the concepts related to feature detection, matching and detection. |
| CO3 | Understanding feature based alignment and motion estimation. |
| CO4 | Study of 3D Reconstruction. |
| CO5 | Perform image based rendering and recognition. |
| CO6 | Develop applications using image processing techniques. |

| 21AI923 – DISTRIBUTED AND CLOUD COMPUTING | |
|---|---|
| COs | Course Outcome : The students, after the completion of the course, are expected to |
| CO1 | Articulate the main concepts and key technologies of cloud computing. |
| CO2 | Learn various cloud services and platforms to cater the requirements in the growth of the businesses. |
| CO3 | Develop the ability to understand the cloud infrastructure and virtualization that help in the development of cloud. |
| CO4 | Explain the high-level automation and orchestration systems that manage the virtualized infrastructure. |
| CO5 | Summarizes the programming paradigms used in cloud and how cloud software deployments scale to large numbers of users. |

**Laboratory**

| COs | 21CS917 - PROFESSIONAL READINGNESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP |
|-----|-----------------------------------------------------------------------------------------|
| | **Course Outcome : The students, after the completion of the course, are expected to** |
| **CO1** | Upskill in emerging technologies and apply to real industry-level use cases |
| **CO2** | Understand agile development process |
| **CO3** | Develop career readiness competencies, Team Skills / Leadership qualities |
| **CO4** | Develop Time management, Project management skills and Communication Skills |
| **CO5** | Use Critical Thinking for Innovative Problem Solving |
| **CO6** | Develop entrepreneurship skills to independently work on products |

**4th Semester – B.Tech. Artificial Intelligence and Data Science**

| 22CS302 – COMPUTER ORGANIZATION AND ARCHITECTURE | |
|---|---|
| **COs** | **Course Outcome : The students, after the completion of the course, are expected to** |
| **CO1** | Explain the basic principles and operations of digital computers. |
| **CO2** | Analyse the performance of computers by identifying factors that contribute to performance. |
| **CO3** | Compare various I/O methods and understand memory management principles. |
| **CO4** | Explain data flow in arithmetic algorithms. |
| **CO5** | Demonstrating the concept of parallelism in hardware and software. |
| **CO6** | Develop software to solve computationally intensive problems. |

| 22AI901 - Business Intelligence and Analytics | |
|---|---|
| **COs** | **Course Outcome : The students, after the completion of the course, are expected to** |
| **CO1** | Understand the business intelligence (BI) methodology and concepts. |
| **CO2** | Learn about descriptive, inferential statistics and data warehousing operations. |
| **CO3** | Analyze wide range of applications of data mining. |
| **CO4** | Analyze the various prescriptive analytics methods. |
| **CO5** | Develop and deploy Business Analytic Models. |
| **CO6** | Perform various analysis on different business models. |

| 22MA401 - Probability and Statistics | |
|---|---|
| **COs** | **Course Outcome : The students, after the completion of the course, are expected to** |
| **CO1** | Calculate the statistical measures of standard distributions. |
| **CO2** | Compute the correlation & regression for two dimensional random variables. |
| **CO3** | Apply the concept of testing the hypothesis. |
| **CO4** | Implement the concept of analysis of variance for various experimental designs. |
| **CO5** | Demonstrate the control charts for variables and attributes. |

| 22CS304 – OPERATING SYSTEMS | |
|---|---|
| **COs** | **Course Outcome : The students, after the completion of the course, are expected to** |
| **CO1** | Demonstrate the basic concepts of operating systems and process. |
| **CO2** | Implement process management techniques using inter-process communication. |
| **CO3** | Implement the concepts of process synchronization and deadlocks. |
| **CO4** | Apply various memory management schemes for the suitable scenario. |
| **CO5** | Describe various I/O and file management techniques. |
| **CO6** | Develop practical skills in developing system-level programming. |

## 22AI402 - MACHINE LEARNING

| COs | Course Outcome : The students, after the completion of the course, are expected to |
|------|-----------------------------------------------------------------------------------|
| CO1 | Explain the basics of Machine Learning and model evaluation. |
| CO2 | Study dimensionality reduction techniques. |
| CO3 | Understand and implement various classification algorithms. |
| CO4 | Understand and implement various unsupervised learning techniques. |
| CO5 | Build Neural Networks and understand the different types of learning. |
| CO6 | Use Machine Learning Algorithms to build applications. |

## 22CS403 - WEB DEVELOPMENT FRAMEWORKS

| COs | Course Outcome : The students, after the completion of the course, are expected to |
|------|-----------------------------------------------------------------------------------|
| CO1 | Personalize web pages using text formatting, graphics, audio, and video. |
| CO2 | Hands on knowledge on Rest API, propTypes |
| CO3 | Able to develop a web application using latest React Framework |
| CO4 | Apply various React features including functions, components, and services. |
| CO5 | Able to develop application using ReactJshooks. |
| CO6 | Design and integrate complex web components to enhance user interface and |

## Laboratory

## 22CS413 - PRODUCT DEVELOPMENT LAB-4

| COs | Course Outcome : The students, after the completion of the course, are expected to |
|------|-----------------------------------------------------------------------------------|
| CO1 | Identify the real-time problems through literature. |
| CO2 | Develop feasible solutions for the problems. |
| CO3 | Evaluate the methods to develop solutions to the problem. |
| CO4 | Analyze the business opportunities for a new product. |
| CO5 | Prepare a detailed report for the experimental dissemination. |

## 22CS411 – APTITUDE AND CODING SKILLS II

| COs | Course Outcome : The students, after the completion of the course, are expected to |
|------|-----------------------------------------------------------------------------------|
| CO1 | Develop advanced vocabulary for effective communication skills. |
| CO2 | Build an enhanced level of logical reasoning and quantitative skills. |
| CO3 | Develop error correction and debugging skills in programming. |
| CO4 | Apply data structures and algorithms in problem solving. |
| CO5 | Develop advanced vocabulary for effective reading skills |
| CO6 | Apply advanced algorithm design techniques to develop programs |

**6th Semester – B.Tech. Artificial Intelligence and Data Science**

| COs | 22EC012 - INDUSTRIAL IOT APPLICATIONS |
| --- | --- |
| | **Course Outcome : The students, after the completion of the course, are expected to** |
| **CO1** | Describe IOT, IIOT |
| **CO2** | Understand various IoT Layers and their relative importance |
| **CO3** | Interpret the requirements of IIOT sensors and understand the role of actuators. |
| **CO4** | Study various IoT platforms and Security |
| **CO5** | Realize the importance of Data Analytics in IoT |
| **CO6** | Design various applications using IIoT in manufacturing sector |

| COs | 22AI602 – AUTOMATA THEORY AND COMPILER DESIGN |
| --- | --- |
| | **Course Outcome : The students, after the completion of the course, are expected to** |
| **CO1** | Construct deterministic and non-deterministic finite automata. |
| **CO2** | Design context free grammars for formal languages using regular expressions. |
| **CO3** | Use PDA and Turing Machines for recognizing context-free languages. |
| **CO4** | Design a lexical analyzer. |
| **CO5** | Design syntax analyzer. |
| **CO6** | Design a simple code generator and apply different code optimizations. |

| COs | 22AI903 - Text and Speech Analytics |
| --- | --- |
| | **Course Outcome : The students, after the completion of the course, are expected to** |
| **CO1** | Apply the fundamental techniques in text processing for various NLP tasks. |
| **CO2** | Implement advanced language models and improve text classification accuracy. |
| **CO3** | Designing text processing systems using state-of-the-art techniques. |
| **CO4** | Design, implement, and evaluate ASR and TTS systems. |
| **CO5** | Apply advanced speech recognition methodologies in practical applications. |
| **CO6** | Use information Retrieval Techniques to build and evaluate text processing systems. |

| COs | 22AI911 - Generative AI |
| --- | --- |
| | **Course Outcome : The students, after the completion of the course, are expected to** |
| **CO1** | Understand the basic concepts of Generative AI. |
| **CO2** | Build Generative AI systems to generate outputs of different domains. |
| **CO3** | Deploy Generative AI Models. |
| **CO4** | Compare and use the various Large Language Models. |
| **CO5** | Understand the basics of Prompt Engineering. |
| **CO6** | Apply Generative AI to solve real world applications. |

| 22CS602 – OBJECT ORIENTED SOFTWARE ENGINEERING | |
|---|---|
| COs | Course Outcome : The students, after the completion of the course, are expected to |
| CO1 | Summarize software engineering principles and activities involved in building large software programs |
| CO2 | Describe the different phases of software development. |
| CO3 | Explain the basics of OOAD and develop software using object oriented design. |
| CO4 | Illustrate the different stages of the design process with a case study. |
| CO5 | Develop mini-projects using the application of object oriented analysis and design. |
| CO6 | Apply different testing strategies to develop efficient projects. |

| 22AI601 - REINFORCEMENT LEARNING | |
|---|---|
| COs | Course Outcome : The students, after the completion of the course, are expected to |
| CO1 | Outline the concepts of Reinforcement Learning. |
| CO2 | Solve problems using Dynamic Programming and Monte Carlo Decision Process. |
| CO3 | Implement the concept of Temporal difference Learning (TML) to solve real world problems. |
| CO4 | Apply functional approximation in reinforcement learning. |
| CO5 | Implement Deep Reinforcement Learning to solve real world problems. |
| CO6 | Solve real-world problems using Reinforcement Learning |

**Laboratory**

| 22CS611 – ADVANCED APTITUDE AND CODING SKILLS II | |
|---|---|
| COs | Course Outcome : The students, after the completion of the course, are expected to |
| CO1 | Develop advanced vocabulary for effective communication and reading skills. |
| CO2 | Build an enhanced level of logical reasoning and quantitative skills. |
| CO3 | Develop error correction and debugging skills in programming. |
| CO4 | Apply data structures and algorithms in problem solving. |
| CO5 | Develop coding solutions for real-world problems. |
| CO6 | Engage in collaborative projects and provide constructive feedback during code reviews. |