ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech. Scheme of Examination & Syllabus 2024-25

COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

SEMESTER III

Sr No	Course Category	Course Code	Course Title	Hours per Week			Credits	Maximum Marks				No. of Hrs for ESE
				L	T	P		Mid-Sem Examination	Continual Assessment	End Sem Examination	Total	
1.	PCC	**24DS301T**	Mathematics for Data Science	**3**	**-**	**-**	**3**	**20**	**20**	**60**	**100**	**3**
2.	PCC	**24DS302T**	Computer Architecture and Organization	**3**	**-**	**-**	**3**	**20**	**20**	**60**	**100**	**3**
3.	PCC	**24DS303T**	Database Management Systems	**3**	**-**	**-**	**3**	**20**	**20**	**60**	**100**	**3**
4.	PCC	**24DS303P**	Database Management Systems Lab	**-**	**-**	**2**	**1**	**-**	**25**	**25**	**50**	**-**
5.	PCC	**24DS304P**	Data Acquisition and Internet of Things Lab	**-**	**-**	**2**	**1**	**-**	**25**	**25**	**50**	**-**
6.	PCC	**24DS305P**	Web Technology Lab	**-**	**-**	**4**	**2**	**-**	**25**	**25**	**50**	**-**
7.	PCC	**24DS306P**	Data Science Workshop – III	**-**	**-**	**4**	**2**	**-**	**25**	**25**	**50**	**-**
8.	VEC	**24ES301T**	Value Education Course	**3**	**-**	**-**	**3**	**20**	**20**	**60**	**100**	**3**
9.	MDM	**24DS331M**	MDM-I	**2**	**-**	**-**	**2**	**10**	**10**	**30**	**50**	**1.5**
10.	**SEC**	**24DS341P**	Career Development III	**-**	**-**	**2**	**1**		**50**	**-**	**50**	**-**
11.	ELC	**24DS307P**	Micro Project I*	**-**	**-**	**2**	**1**		**50**	**--**	**50**	**-**
			Total	14		16	22	90	290	370	750	**12**

*** Field Project or Community engagement project in the major discipline**

MDM-I	
24DS331M	**MDM-I Data Analytics with Excel**

		July 2025	2.1	Applicable for 2025-26
Chairman - BoS	Dean – Academics	Date of Release	Version	

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B. Tech. Scheme of Examination & Syllabus 2024-25

COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24DS301T	Mathematics for Data Science	3			3	20	20	60	100

Course Objectives	Course Outcomes
This course is intended • To familiarize the students with concepts of logic & sets. • To introduce the essential concepts of vector spaces • To derive the inference using concepts of descriptive and inferential Statistics	**Students will be able to** • Recognize when Logic, sets, functions are appropriate to formulate & solve real world problems • Apply the concepts of vector spaces to Data Science. • Use the concepts of sampling & estimation theory in the field of data science. • Learn the techniques of testing hypothesis and apply it to test the significance of various data samples • Use statistical methods and tools in engineering problems

Unit I	**[9Hrs]**
Mathematical logic & Set theory: Review of propositions and logical operations, Review of sets, Types and operations on sets, Inclusion Exclusion Principle **Relations and functions:** Ordered pairs and n-tuples, Types of relations, Composite relation, Definition of function, Composition of functions, Types of functions.	
Unit II	**[9Hrs]**
Vector Spaces: Definition, Sub spaces, Basis, dimension, Range Space and Rank; Null Space and Nullity; Rank nullity theorem. Linear transformation; Matrix Representation of a linear transformation Linear Operators on R^n and their representation as square matrices Invertible linear operator, Inverse of non-singular matrices.	
Unit III	**[9Hrs]**
Sampling & Estimation Theory: Population and sample, Statistical inference, Sampling with and without replacement, Population parameters, sample statistics, Sampling distribution of means, Sampling distribution of proportions. Unbiased and efficient estimates, Point estimates and interval estimates, Confidence interval for means, Confidence interval for proportions.	
Unit IV	**[9Hrs]**
Hypothesis testing: Introduction, Level of significance, Confidence limits,, Hypothesis, Null hypothesis, Alternative hypothesis, Type-I and Type-II errors, , Testing a hypothesis,, t-Test, Z-test, F-test, chi-square test.	
Unit V	**[9Hrs]**
Statistics: Mean, Median, Mode, Mean deviation, Standard deviation, Quartile, Decile, Percentiles, Residual MSE and MAE, , Root Mean Square error, Coefficient of determination R^2.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Discrete Mathematical Structures with Applications to Computer Science (TMH)	Tremblay and Manohar	35th	Tata McGraw Hill
2	Linear Algebra And Its Applications	Gilbert Strang	5th	Nelson Engineering
3	Theory & problems of Probability and Statistics	Murray R. Spiegel	4th	Schaum Series

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Discrete Mathematical Structures	Kolman, Busby & Ross	3rd	PHI
2	Linear Algebra	Seymour Lipschutz et al:	3rd	Schaum outline series.
3	Higher Engineering Mathematics	by B.S. Grewal	, 40th	Khanna Publication
4	Advanced Engineering Mathematics	Erwin Kreysizig	8th Edition,	Wiley India

		JULY 2025	2.1	Applicable for 2025-26
Chairman - BoS	Dean – Academics	Date of Release	Version	

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24DS302T	Computer Architecture and Organization	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
This course is intended • Explore the fundamental architecture, components, and instruction sets of modern computers. • Apply knowledge of arithmetic operations, instruction processing, memory hierarchy, and GPU architecture • Explore New Computing Approaches.	**Students will be able to** • Explain the basic structure and working principles of computer systems • Illustrate binary arithmetic operations using various algorithms • Demonstrate the functioning of instruction cycles, instruction pipelining, and control units in processing units • Apply knowledge of I/O organization and memory hierarchy concepts like cache memory, virtual memory, and DMA • Analyse the architecture and parallelism in GPUs

Unit I	**[9Hrs]**
Basic structure of computers: A Brief History of computers, Designing for Performance Von Neumann Architecture Computer Components - Interconnection Structures - Bus Interconnection - Addressing modes - Instruction Set Architecture i.e. RISC vs CISC Comparison.	
Unit II	**[9Hrs]**
Arithmetic Unit- Binary Addition and Subtraction using Ist Complement method, Binary Multiplication: Booth's algorithm - Unsigned Integer multiplication and division algorithm - Floating point operations.	
Unit III	**[9Hrs]**
Processing unit: Machine Instruction characteristics, types of operands, types of operations - Instruction formats- Instruction types - Processor organization - Register Organization - Instruction cycles -Instruction Pipelining, Control unit - Hardwired control - Micro programmed control – Hazards.	
Unit IV	**[9Hrs]**
I/O Organization and Memory Hierarchy: Input/output Systems - Programmed I/O, Interrupt Driven I/O- Direct Memory Access (DMA) Memory Systems: locality of reference principle - Memory Hierarchy Cache memory – Main Memory - Virtual memory - Secondary storage.	
Unit V	**[9Hrs]**
Introduction to GPU Architecture- Types of Parallelism in GPUs, Key GPU Components, GPU Computing for Data Science- Parallel Computing, GPU Programming, Applications of GPUs in Modern Computing. Future Trends(Case Study).	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Computer Organization & Architecture	William stalkings	8th edition	Prentice Hall
2	Computer Organization	Carl Hamacher	5th Edition	Tata McGraw Hill

Reference Books

S. N	Title	Authors	Edition	Publisher
1.	Computer Organization	J. P. Hayes	5th Edition	Tata McGraw-Hill
2.	Computer Architecture:A Quantitative Approach	John L. Hennessy	6th Edition	Elsevier Science

		JULY 2025	2.1	Applicable for 2025-26
Chairman - BoS	Dean – Academics	Date of Release	Version	

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24DS303T	Database Management Systems	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
This course is intended ● Understand the fundamentals of database systems and relational models. ● Learn SQL for data definition and manipulation. ● Understand normalization, indexing, transactions, and recovery. ● Introduce NoSQL, cloud databases, and data lake architectures.	**students will be able to** ● Model different databases and implement them using relational algebra & Relational calculus ● Apply SQL for data definition and manipulation. ● Criticize a database design and improve the design using normalization process ● Use the concepts of concurrency control, transaction management, scheduling, recovery while working in a database environment ● Recognize the issues and concepts of Big Data and NoSQL databases.

Unit I	**[9Hrs]**
Introduction to DBMS & Data Modeling : DBMS vs File Systems,Data Models: Hierarchical, Network, Relational, Object Oriented,3-Tier Architecture, Data Independence,Database Users and Roles,ER Modeling: Entities, Relationships, Attributes, ER Diagrams,ER to Relational Mapping	
Unit II	**[11Hrs]**
Relational Model: SQL & Indexing ,Relational Algebra: Select, Project, Join, Union, Difference, Relational Constraints, Keys,SQL: DDL, DML, Joins, Sub queries, Aggregate Functions, Views, Indexing: Types, B+ Tree, Hash Index, Query Optimization Role	
Unit III	**[9Hrs]**
Normalization and Database Design : Functional Dependencies, Normalization: 1NF to BCNF, 4NF,Decomposition & Dependency Preservation, Denormalization, Design Guidelines and Integrity Constraints	
Unit IV	**[7Hrs]**
Transactions & Recovery :Transactions and ACID Properties, Concurrency: Locking, Time Stamp, Deadlocks, Recovery: Logging, Checkpointing, Shadow Paging, ARIES	
Unit V	**[9Hrs]**
Modern Data Architectures & Trends : NoSQL Databases: Document, Columnar, Graph DBs, CAP Theorem Data Lake Concepts: Definition and comparison with Data Warehouse, Architecture: Raw, Refined, Curated Zones,Integration with Hadoop and Cloud, Use in Data Science Workflows Cloud and Distributed Databases: DBaaS, MongoDB Atlas, Firebase, Database Security: Access Control, Authentication, Encryption	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Database System Concepts	Henry F. Korth, Abraham Silberschatz,S.Sudarsha n	4th	Mcgraw Hill Education
2	Database Systems: Models, Languages, Design And Application Programming	Ramez Elmasri, Shamkant B. Navathe,	2nd	Pearson
3	An Introduction to Database Systems	C.J. Date	2nd	Pearson

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24DS303P	Database Management Systems Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended • To provide ability to the student to design & implement an application based database management system and manipulate using SQL. • To enable the student to work conveniently on modern tools of database management	**Students will be able to** • Analyze data storage problem and derive an data model expressed in the form of an entity relationship or relational model • Use a SQL relational DBMS package to create, secure, populate, maintain, and query a database. • Implement an application to access a database using ODBC/JDBC connectivity

Expt . No.	Title of the experiment
1	Introduction to SQL and DML query solving using SQL simulator sql-ex.ru
2	Data definition, constraints, and schema design.
3	Design, develop, and implement the specified queries for the above design using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
4	Demonstration of Views , Procedures, Functions & Triggers
5	Mini project on case study using Database Connectivity with Front End Tools

Text Books

S.N	Title	Authors	Edition	Publisher
1	Database System Concepts	Henry Korth	4th	Mcgraw Hill Education
2	Learning SQL	Alan Beaulieu	2nd	O'Reilly Publication
3	Art of SQL	Peter Robson	2nd	O'Reilly Publication

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24DS304P	Data Acquisition and Internet of Things Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended ● To understand and implement the integration of Raspberry Pi and Arduino platforms, enabling students to interface various sensors ● To develop wireless control systems using Arduino for real-time data monitoring and device control through Bluetooth communication,	**Students will be able to** ● Install, configure, and interface both Raspberry Pi and Arduino platforms for sensor-based real-time monitoring and wireless communication ● Write and implement code to control hardware components ● Interface and program various sensors, ● Establish Bluetooth communication using Arduino to wirelessly control devices

Syllabus (Key Content)- Unit 1: Introduction to Embedded Systems and Basic Control.

Unit 2: Sensor Interfacing and Data Collection

Unit 3: Wireless Communication and Performance Testing

Unit 4: IoT Integration and Advanced Sensor Interfacing

Expt. No.	Title of the experiment
1	To study and interface Raspberry Pi (Installation and Description) and Arduino Platform
2	Write code to control the LED and SSD.
3	Write code to read temperature values from the sensor
4	Understand the working principle of a 7-segment display **and** learn how to control and display numerical values
5	Understand how an LDR (Light Dependent Resistor) works and how it detects light intensity.
6	Test and assess the performance of the sensor interface for real-time environmental monitoring.
7	Write code to establish a Bluetooth connection and control devices wirelessly.
8	To interface ADXL345 accelerometer with Arduino using IOT simulator

Text Books

S.N	Title	Authors	Edition	Publisher
1	Internet of Things: Principles and Paradigms"	Rajkumar Buyya	6th edition	MorganPublishers

Reference Books

S. N	Title	Authors	Edition	Publisher
1.	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things	David Hanes, Gonzalo Salgueiro	5th Edition	Tata McGraw-Hill

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24DS305P	Web Technology Lab	-	-	4	2	25	25	50

Course Objectives	Course Outcomes
This course is intended ● Gain hands-on experience with web technologies such as HTML, CSS, JavaScript, and front-end frameworks. ● Learn to create responsive and interactive web pages using CSS frameworks ● Develop complete web applications integrating front-end, back-end, and database management.	**Students will be able to** ● Develop static and dynamic web pages using HTML, CSS, and JavaScript to create responsive user interfaces ● Implement client-side scripting to manipulate the Document Object Model (DOM) ● Design and build backend web services using Flask ● Analyse web application workflows and deploy secure web applications incorporating user authentication and database management

Syllabus (Key Content)- Unit 1: Introduction to HTML

Unit 2: Introduction to JavaScript

Unit 3: DOM manipulation

Unit 4: Introduction to backend development using Flask

Unit 5: Handling Form Submissions with Flask

Expt. No.	Title of the experiment
1	Build a simple static webpage using HTML and CSS..
2	Add Interactivity with JavaScript
3	Using JavaScript to Update Content Dynamically
4	Introduce Flask and server web pages using Python.
5	Handling Form Submission with Flask
6	Store Data in a Database (SQLite)
7	Add User Authentication (Login & Signup)
8	Deploy the Web App

Text Books

S.N	Title	Authors	Edition	Publisher
1	" "Web Technologies: A Computer Science Perspective"	Jeffrey C. Jackson	1st Edition	Pearson Education

Reference Books

S. N	Title	Authors	Edition	Publisher
1	Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics	Jennifer Robbins	5th Edition	O'Reilly Media

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24DS306T	Data Science Workshop – III	-	-	4	2	25	25	50

Course Objectives	Course Outcomes
This course is intended ● Understand data ingestion, transformation, and storage techniques. ● Gain hands-on experience with data engineering tools and platforms. ● Develop skills for processing and managing big data efficiently. ● Implement cloud-based and on-premise data solutions.	**Students will be able to** ● Design and implement data pipelines. ● Utilize SQL and NoSQL databases for data storage and retrieval. ● Work with distributed computing frameworks. ● Secure, monitor, and optimize data storage and data processing. ● Use cloud-based services for data engineering tasks.

Syllabus (Key Content)- Unit 1: Introduction to Data Engineering and Modern Data Ecosystem, Unit 2: Data Loading and Exploration with Db2 and SQL, Unit 3: Data Analytics and Processing with Azure Synapse, Unit 4: Data Transformation and Pipeline Orchestration, Unit 5: Cloud Storage, BigQuery, and Real-Time Data Visualization

Expt. No.	Title of the experiment
1	Introduction to Data Engineering – Modern Data Ecosystem and key players.
2	Hands-on Lab: Load data into the Db2 Database from a CSV file and Explore Your Dataset Using SQL Queries in DB2.
3	Build data analytics solutions using Azure Synapse serverless SQL pools.
4	Perform data engineering with Azure Synapse Apache Spark Pools.
5	Work with Data Warehouses using Azure Synapse Analytics.
6	Implement transformation of data with Azure Synapse Analytics pipelines.
7	Google Cloud Storage & Mage Installation with BigQuery Data Analysis.
8	Create a Dashboard for an application using a real-time dataset.

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Fundamentals of Data Engineering	Joe Reis, Matt Housley		O'Reilly

Reference Books

S. N	Title	Authors	Edition	Publisher
1.	Python Data Science Handbook: Essential Tools for Working with Data.	Joel Grus		O'Reilly

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24ES301T	Value Education Course-I	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
This course is intended • Development of a holistic perspective through self-exploration and development of clarity about harmony between self, family, society and nature.	**students will be able to:** 1. Demonstrate awareness about self and their surroundings and its interdependence. 2. Learning the concepts of aspirations and happiness. 3. Recognize and explain the nine universal values in relationship and their application in visualizing a harmonious society. 4. Discuss concepts of conservation of nature and harmony and reusability. 5. Identify the scope of eco-friendly systems for enriching institutions.

Unit I : Introduction	**[9Hrs]**
Purpose and motivation for the course, Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations , Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority , Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario , Method to fulfill the above human aspirations: understanding and living in harmony at various levels.	
Unit II : Understanding Harmony	**[9Hrs]**
Understanding human being as a co-existence of the sentient 'I' and the material 'Body' , Understanding the needs of Self ('I') and 'Body' - happiness and physical facility , Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) ,Understanding the characteristics and activities of 'I' and harmony in 'I' , Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail , Programs to ensure Sanyam and Health.	
Unit III : Values in relationships	**[9Hrs]**
Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship , Understanding the meaning of Trust; Difference between intention and competence , Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship , Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals , Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.	
Unit IV : Co-existing with nature	**[9Hrs]**
Understanding the harmony in Nature , Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature , Understanding Existence as Coexistence of mutually interacting units in all-pervasive space ,Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.	
Unit V : Holistics approach for engineers	**[9Hrs]**
Natural acceptance of human values , Definitiveness of Ethical Human Conduct , Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order , Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. ,Case studies of typical holistic technologies, management models and production systems , Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations ,Sum up.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Human Values and Professional Ethics	Gaur, Sangal, Bagaria	2010	Excel Books, New Delhi

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Jeevan Vidya: Ek Parichaya	A. Nagaraj	1999	Jeevan Vidya Prakashan, Amarkantak
2.	Human Values	A.N. Tripathi	2004	New Age Intl. Publishers, New Delhi
3.	The Story of My Experiments with Truth	M.K.Gandhi	2009	Fingerprint! Publishers

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24DS331M	MDM-I Data Analytics with Excel	2	-	-	2	10	10	30	50

Course Objectives	Course Outcomes
This course is intended to provide • Students with introductory knowledge of several excel techniques that can be used for data analysis.	**Student will be able to:** • Apply fundamentals of excel functions to perform and interpret basic data analysis • Perform data visualization in excel • Analyze data and make use of hypothesis testing

Unit I	**[10Hrs]**
Reading Data into Excel, Basic Data Manipulation in Excel, Arithmetic Manipulation in Excel, Basic Functions in Excel. Basic Excel Formulas, Structuring Data in Excel, Intermediate Excel Functions, Descriptive Statistics.	
Unit II	**[10Hrs]**
Introduction to Visualizations and Pie Charts, Histograms, Bar Charts, Line Charts, Box and Whisker, Radial Charts, Combo Charts, Scatter Plots, Conditional Formatting, Sparklines, Control Charts, Introduction to Pivot Tables, Pivot Charts and Slicers.	
Unit III	**[10Hrs]**
Root Cause Analysis, Comparative Analysis, Types of Data, Fundamentals of Sampling, Distributions, Introduction to Hypothesis Testing, T-tests, Chi-Squared Test Part 1 Test for Normality, ANOVA, Simple Regression.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Modern Data Analytics in Excel	George Mount	2nd	O'Reilly home

Reference Books

S.N	Title	Authors	Edition	Publisher
1	DATA ANALYSIS AND BUSINESS MODELLING USING MICROSOFT EXCEL	MANOHAR, HANSA LYSANDER	2nd	PHI