

AC – 28/03/2025

Item No. – 6.3 (N) (2ab) Sem. III & IV

As Per NEP 2020

University of Mumbai



Syllabus for Minor Vertical 2

Faculty of Science and Technology

Board of Studies in Information Technology

Second Year Programme in Minor (Information Technology)

Semester	III & IV	
Title of Paper	Sem.	Total Credits 4
I) Data Analytics tools	III	2
II) Introduction to Big Data		2
Title of Paper		Credits
I) Introduction to Artificial Intelligence	IV	2
II) Introduction to IT Service Management		2
From the Academic Year		2025-26

Sem. - III

Syllabus

B.Sc. (Information Technology)

(Sem.- III)

Title of Paper: Data Analytics tools

Sr.No.	Heading	Particulars
1	Description the course: Including but Not limited to:	The Data Analytics Tools course introduces the essential tools used in analyzing and interpreting data. It covers a variety of software and platforms such as Excel, SQL, Python, R, and Tableau, helping students understand how to manipulate and visualize data effectively. The course emphasizes hands-on experience, with practical exercises that allow learners to apply their knowledge to real-world datasets. Students will also explore techniques for data cleaning, statistical analysis, and creating visualizations that communicate insights clearly. By the end, learners will have the skills to leverage these tools to make data-driven decisions in various industries.
2	Vertical :	Minor (for others)
3	Type :	Theory
4	Credits :	2 credits (1 credit = 15 Hours for Theory in a semester, Total 30 hours)
5	Hours Allotted :	30 Hour
6	Marks Allotted:	50
7	Course Objectives(CO): CO 1. To Identify and recall the key features and functions of data analytics tools such as Excel, Python, R, and Tableau. CO 2. To Apply data manipulation and visualization techniques using different software tools to analyze real-world datasets and derive meaningful insights. CO 3. To Break down complex datasets to identify patterns, trends, and relationships, utilizing statistical methods and analytical tools.	
8	Course Outcomes (OC): OC1: Students will be able to proficiently use a range of data analytics tools (Excel, Python, R, Tableau) to manipulate, analyze, and visualize data in various contexts. OC2: Learners will develop the ability to draw actionable insights from complex datasets and make informed decisions based on data analysis. OC3: Students will gain the skills to critically evaluate different data analysis methods and tools, choosing the most suitable ones for specific analytical tasks and business needs.	
9	Modules: - Module 1: Data Cleaning and Preparation Tools: Introduction to Excel and SQL,Importing, cleaning, and transforming data in Excel/SQL, Statistical Analysis: Using R and Python libraries (e.g., pandas, NumPy, SciPy) , Data Visualization: Introduction to Power BI and Tableau,Creating charts, graphs, and dashboards, Introduction to Python for Data Analytics: Overview of Python libraries for data analytics (pandas, NumPy, Matplotlib)	
		15 Hrs

	Module 2:	
	Advanced Data Visualization: Advanced techniques in Power BI and Tableau (Creating complex dashboards, predictive analysis), Introduction to Machine Learning: Overview of machine learning algorithms (regression, classification, clustering) in Python and R, Data Analytics in the Cloud: Using cloud-based tools (e.g., Google BigQuery, AWS, Azure) , Advanced Python Libraries: Deep dive into machine learning with Scikit-learn, TensorFlow,Time series analysis, data scraping, and advanced data visualization using libraries like Plotly, Data Analytics Automation: Automating workflows and analytics pipelines using Python, SQL, and cloud technologies	Hrs
10	Books and References: • Python Data Science Essentials • Data Analytics made accessible • "Python for Data Analysis" by Wes McKinney- https://wesmckinney.com/book/numpy-basics • Mastering Data Visualization with Tableau by Dr. Arpana Chaturvedi Prof. Praveen Malik	
12	Internal Continuous Assessment: 40%	Semester End Examination: 60%
13	Continuous Evaluation through: Class test of 1 of 15 marks Class test of 2 of 15 marks Average of the two: 15 marks Quizzes/ Presentations/ Assignments: 5 marks Total: 20 marks	Format of Question Paper: External Examination (30 Marks)– 1 hr duration
14	Format of Question Paper: (Semester End Examination : 30 Marks. Duration:1 hour) Q1: Attempt any two (out of four) from Module 1 (15 marks) Q2: Attempt any two (out of four) from Module 2 (15 marks) Or Q1: Attempt any three (out of five) from Module 1 (15 marks) Q2: Attempt any three (out of five) from Module 2 (15 marks)	

Syllabus

B.Sc. (Information Technology)

(Sem.- III)

Title of Paper: Introduction to Big Data

Sr.No.	Heading	Particulars
1	Description the course : Including but Not limited to:	The Introduction to Big Data course provides a foundational understanding of big data concepts, technologies, and applications. It explores how organizations collect, process, and analyze massive volumes of data to gain insights and make data-driven decisions.
2	Vertical :	Minor (For Others)
3	Type :	Theory
4	Credits :	2 credits (1 credit = 15 Hours for Theory in a semester, Total 30 hours)
5	Hours Allotted :	30 Hours
6	Marks Allotted:	50
7	Course Objectives (CO): CO1.To understand what is BIG DATA, applications of BIG DATA. CO2. To understand programming models for Big Data. CO3. To identify key differences between NOSQL and relational databases.	
8	Course Outcomes (OC): Learner will :- OC 1. learn the tools used in Big Data. OC2. understand scalable computing over the internet. OC3. describe the major types of NOSQL databases and their features.	
9	Module 1:	
	Introduction What is Big Data, Big Data characteristics, Tools used in BIG DATA, examples of Big Data Foundations for Big Data Introduction to File System and Distributed File System, Scalable Computing Over the internet, Models for the Big Data	15 Hrs
	Module 2:	
	Data Models Types of data format, Data Model types, Benefits of Appropriate Models and Storage Environments to Big Data, Different types of data mart, Difference between Data warehouse and Data mart, Big Data Streaming Mean, Data Streaming, Use Cases for Real-Time and Streaming Data, Data Lake, DataLake vs. Data warehouse, The essential elements of a Data Lake and Analytics solution, challenges of Data Lakes, Streaming sensor data, Uses of sensor data NOSQL Management RDBMS vs. NOSQL , Types of NOSQL Databases ,Data Model , Introduction to NOSQL ,Relational Model vs Aggregate Data Model ,Introduction to NOSQL ,Types of NOSQL Databases ,Introduction to Distribution Models , Introduction to Hadoop Partitioner	15 Hrs
10	Books and References: 1 .Big Data and Hadoop, V.K Jain, Khanna Publishing, First edition, 2018 2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Big Data Series, Edition, 2017. 3.Radha Shankarmani, M Vijayalakshmi, "Big Data Analytics", Wiley, Second Edition, 2016. 4. Alex Holmes, "Hadoop in Practice", Manning Press, Dreamtech Press, Second Edition, 2015. 5. Holden Karau, Andy Konwinski, Matei Zaharia, "Learning Spark" O'Reilly, Second Edition, 2015	

12	Internal Continuous Assessment: 40%	Semester End Examination: 60%
13	Continuous Evaluation through: Class test of 1 of 15 marks Class test of 2 of 15 marks Average of the two: 15 marks Quizzes/ Presentations/ Assignments: 5 marks Total: 20 marks	Format of Question Paper: External Examination (30 Marks)– 1 hr duration
14	Format of Question Paper: (Semester End Examination :((30 Marks. Duration:1 hour) Q1: Attempt any two (out of four) from Module 1 (15 marks) Q2: Attempt any two (out of four) from Module 2 (15 marks) Or Q1: Attempt any three (out of five) from Module 1 (15 marks) Q2: Attempt any three (out of five) from Module 2 (15 marks)	

Sem. - IV

Syllabus

B.Sc. (Information Technology)

(Sem.- IV)

Title of Paper : Introduction to Artificial Intelligence

Sr.No.	Heading	Particulars
1	Description the course : Including but Not limited to:	This course covers a basic introduction to AI and its foundations, different agent architectures and properties of the environment. It also provides insights into basic principles of AI towards problem solving, knowledge representation and learning. It helps to understand the current scope, limitations and implications on intelligent systems
2	Vertical :	Open Elective for others
3	Type :	Theory
4	Credits :	2 credits (1 credit = 15 Hours for Theory in a semester, Total 30 hours)
5	Hours Allotted :	30
6	Marks Allotted:	50
7	Course Objectives(CO): CO 1. To gain perspective of AI and its foundations. CO 2. To study different agent architectures and properties of the environment CO 3. To understand the basic principles of AI towards problem solving, inference, perception, knowledge representation, and learning CO 4. To explore the current scope, potential, limitations, and implications of intelligent systems	
8	Course Outcomes (OC): OC 1. Identify the characteristics of the environment and differentiate between various agent architectures. OC 2: Apply the most suitable search strategy to design problem solving agents. OC 3: Comprehend various learning techniques OC 4: Describe the various building blocks of an expert system for a given real world problem.	
9	Modules:- Module 1:	
	Artificial Intelligence (AI), AI Perspectives: Acting and Thinking humanly, Acting and Thinking rationally. Introduction of agents, Structure of Intelligent Agent, Characteristics of Intelligent Agents Types of Agents: Simple Reflex, Model Based, Goal Based, Utility Based Agents. Environment Types: Deterministic, Stochastic, Static, Dynamic, Observable, Semi-observable, Single Agent, Multi Agent. Definition, State space representation, Problem as a state space search. Problem formulation, Well-defined problem.	15 Hrs
	Module 2: Solving Problems by Searching	
	Solving Problems by Searching, Performance evaluation of search strategies, Time Complexity, Space Complexity, Completeness and Optimality.	15 Hrs

	Uninformed Search: Depth First Search, Breadth First Search, Informed Search: Heuristic Function, Admissible Heuristic, Informed Search Technique, Greedy Best First Search, A* Search The planning problem, Partial order planning, total order planning. Learning in AI, Learning Agent, and Concepts of Supervised, Unsupervised, Semi-Supervised Learning, Reinforcement Learning, Ensemble Learning. Expert Systems, Components of Expert System: Knowledge base, Inference engine, user interface, working memory, Development of Expert Systems	
10	Books and References: 1) Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach —Second Edition" Pearson Education 2) A First Course in Artificial Intelligence, Deepak Khemani TMH First 2017	
12	Internal Continuous Assessment: 40%	Semester End Examination: 60%
13	Continuous Evaluation through: Class test of 1 of 15 marks Class test of 2 of 15 marks Average of the two: 15 marks Quizzes/ Presentations/ Assignments: 5 marks Total: 20 marks	Format of Question Paper: External Examination (30 Marks)– 1 hr duration
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Syllabus

B.Sc. (Information Technology)

(Sem.- IV)

Title of Paper : Introduction to IT Service Management

Sr.No.	Heading	Particulars
1	Description the course : Including but Not limited to:	The course provides a set of practices for IT service management (ITSM) that focuses on aligning IT services with the needs of businesses. Key Features of the Course • Foundation Level: Understand the key concepts, terminologies, and principles of ITIL v4. • Service Value System (SVS): Learn about the SVS, which introduces a holistic approach to service management. • Four Dimensions of Service Management: Explore the four dimensions: Organizations & People, Information & Technology, Partners & Suppliers, and Value Streams & Processes. • Guiding Principles: Grasp the guiding principles that organizations can use to adopt and adapt ITIL guidance. • Continuous Improvement: Emphasize the importance of continual improvement in the delivery of services. The Course is for • IT professionals looking to enhance their knowledge of ITSM. • Managers seeking to implement best practices in their teams. Benefits • Improved alignment between IT services and business needs. • Enhanced efficiency and effectiveness of IT operations. • Better customer satisfaction through optimized service delivery.
2	Vertical :	Minor
3	Type :	Theory
4	Credits :	2 credits (1 credit = 15 Hours for Theory in a semester, Total 30 hours)
5	Hours Allotted :	30 hours
6	Marks Allotted:	50
7	Course Objectives(CO):	CO 4. Understand IT Service Management in the Modern World: Grasp the relevance and importance of IT service management in today's digital landscape. CO 5. Explore the ITIL 4 Framework: Learn about the structure, components, and benefits of the latest ITIL 4 framework, including the Service Value System (SVS) and the Four Dimensions Model.

	CO 6. Comprehend Key Concepts of Service Management: Gain insights into foundational service management concepts like value co-creation, stakeholder roles, and service relationships. CO 7. Master the Four Dimensions of Service Management: Dive into the four dimensions—organizations and people, information and technology, partners and suppliers, and value streams and processes. CO 8. Implement ITIL Practices and Principles: Apply ITIL guiding principles and practices to enhance IT service delivery and management in real-world scenarios.	
8	Course Outcomes (OC): OC 1. Proficiency in ITIL Terminology and Concepts: Demonstrate a clear understanding of ITIL terminology, concepts, and their application in service management. OC 2. Ability to Apply ITIL's Four Dimensions Model: Use the Four Dimensions Model to align service management practices with organizational goals. OC 3. Enhanced Service Management Skills: Develop the skills to manage IT services effectively, focusing on value creation and co-creation with stakeholders. OC 4. Knowledge of ITIL Service Value System: Explain and implement the ITIL Service Value System (SVS), including its components like guiding principles, service value chain, and continual improvement. OC 5. Capability to Optimize IT Operations: Utilize ITIL's framework to optimize IT operations, improve service delivery, and manage costs and risks effectively.	
9	Modules:- Module 1: 1. Introduction: IT service management in the modern world, About ITILv4, Structure and benefits of ITILv4 2. Key Concepts of Service Management: Value and value co-creation, Organizations, service providers, service consumers and other stakeholders, Products and Services, Service relationships, Value: Outcomes, costs and risks, 3. Four Dimensions of Service Management: Organisations and people, Partners and Suppliers, Value streams and processes, External Factors 4. The ITIL Value Service System: Service Value System Overview, Opportunity, Demand and Value, The ITIL guiding principles, Governance, Service Value Chain, Continual Improvement, Practices Module 2: 1. ITIL Management Practices: General Management Practices, Service Management Practices, Technical Management Practices	
		15 Hrs
		15 Hrs
10	Books and References: 1. Roman Jouravlev, Akashay Anand, et. al, ITIL Foundation ITILv4, Best Practice, TSO Axelos Publisher 2. Akashay Anand, Dan Ashby, et. al, ITIL 4 High-Velocity IT, TSO Axelos Publisher 3. Claire Agutter, ITIL 4 Create, Delivery and Support (CDS), TSO Axelos Publisher 4. Roman Jouravlev, Pavel Demin, et. al, ITIL 4 Drive Stakeholder Value, TSO Axelos Publisher 5. Akashay Anand, Mauricio Corona, et. al, ITIL 4 Direct, Plan and Improve, TSO Axelos Publisher	
12	Internal Continuous Assessment: 40%	Semester End Examination: 60%
13	Continuous Evaluation through: Class test of 1 of 15 marks Class test of 2 of 15 marks Average of the two: 15 marks Quizzes/ Presentations/ Assignments: 5 marks Total: 20 marks	Format of Question Paper: External Examination (30 Marks)– 1 hr duration

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QUESTION PAPER PATTERN (External and Internal)

Internal Continuous Assessment: 40%	Semester End Examination: 60%
Continuous Evaluation through: Class test of 1 of 15 marks Class test of 2 of 15 marks Average of the two: 15 marks Quizzes/ Presentations/ Assignments: 5 marks Total: 20 marks	Format of Question Paper: External Examination (30 Marks)– 1 hr duration
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Sd/-

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Chairman
Dr. Srivaramangai R
BOS in Information
Technology**

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**Sign of the
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Dr. Madhav R. Rajwade
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