



॥ सा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड - ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'B++' grade

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विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत
राष्ट्रीय शैक्षणिक धोरण-२०२० नुसार
पदवी तृतीय वर्षाचे अभ्यासक्रम
(Syllabus) शैक्षणिक वर्ष २०२६-२७
पासून लागू करण्याबाबत.

परिपत्रक

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक २२ एप्रिल २०२६ रोजी संपन्न झालेल्या मा.विद्यापरिषद बैठकीतील विषय क्र.०८/६४-२०२६ च्या ठरावानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील राष्ट्रीय शैक्षणिक धोरण-२०२० नुसार पदवी तृतीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२६-२७ पासून लागू करण्यास मा.विद्यापरिषदेने मान्यता प्रदान केली आहे. त्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील बी.एस्सी. तृतीय वर्षाचे खालील विषयाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२६-२७ पासून लागू करण्यात येत आहे.

01	B.Sc. III Year Computer Management (Single Major)
02	B.Sc. III Year Artificial Intelligence and Machine Learning (AI & ML) (Single Major)
03	B.Sc. III Year Software Development (Single Major)
04	B.Sc. III Year Data Science (Single Major)
05	B.Sc. III Year Information Technology (Single Major)
06	B.Sc. III Year Network Technology (Single Major)
07	B.Sc. III Year Software Engineering (Single Major)

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या www.srtmun.ac.in या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड - ४३१ ६०६.
जा.क्र.:शै-१/परिपत्रक/पदवी/बीएस्सी/२०२६-२७/ 110
दिनांक : २१.०७.२०२६


उपकुलसचिव
शैक्षणिक (१-अभ्यासमंडळे) विभाग

- प्रत माहिती व पुढील कार्यवाहीस्तव :-
- १) मा. कुलगुरू महोदयांचे कार्यालय, प्रस्तुत विद्यापीठ.
 - २) मा. प्र.कुलगुरू महोदयांचे कार्यालय, प्रस्तुत विद्यापीठ
 - ३) मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
 - ४) मा. संचालक, परिक्षा व मूल्यमापन मंडळ, प्रस्तुत विद्यापीठ.
 - ५) मा. प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.

**SWAMI RAMANAND TEERTH
MARATHWADA UNIVERSITY,
NANDED - 431 606 (MS)**



**(Credit Framework and Structure of
B. Sc. Computer Management (Single Major)
Third Year**

with Multiple Entry and Exit Options as per NEP-2020)

Effective From 2026-27

**UNDERGRADUATE PROGRAMME OF
SCIENCE & TECHNOLOGY**

Major in **CMG** and Minor in **DSM** (Subject)

Under the Faculty of Science & Technology



Swami Ramanand Teerth Marathwada University, Nanded
Faculty of Science and Technology (Three Optional in the First Year)

Credit Framework for Third Year with Multiple Entry and Exit

Subject: **CMG** (Major) / **DSM** (Minor 1)

B.Sc. Computer Management (Single Major) Third Year

Year & Level	Sem ester	Optional 1 (Major) <i>(From the same Faculty)</i>	Optional 2 (Minor 1) <i>(From the same Faculty)</i>	Optional 3 (Minor 2) <i>(From the same Faculty)</i>	Generic Elective (GE) <i>(select from Basket 3 of Faculties other than Science and Technology)</i>	Vocational & Skill Enhancement Course	Ability Enhancement Course (AEC) (Basket 4) Value Education Courses (VEC) / Indian Knowledge System (IKS) (Basket 5) <i>(Common across all faculties)</i>	Field Work / Project/Internship/ OJT/ Apprenticeship / Case Study Or Co-curricular Courses (CCC) (Basket 6 for CCC) <i>(Common across all faculties)</i>	Credits	Total Credits
1	2	3	4	5	6	7	8	9	10	11
2 (5.0)	V	SCMGCT1301 (T 3Cr) SCMGCT1302 (T 3Cr) SCMGIK1303 (T 2Cr) SCMGCP1304 (P 2Cr) SCMGCP1305 (P 2Cr) 12 Credits	SCMGET1301 (T 3Cr) SCMGEP1301 (P 1Cr) 4 Credits			SCMGVC1301 2 Credits		SCMGFP1301 4 Credits	22	44
	VI	SCMGCT1351 (T 3Cr) SCMGCT1352 (T 3Cr) SCMGCT1353 (T 2Cr) SCMGCP1354 (P 2Cr) SCMGCP1355 (P 2Cr) 12 Credits	SCMGET1351 (T 3Cr) SCMGEP1351 (P 1Cr) 4 Credits			SCMGVC1351 2 Credits		SCMGOJ1351 4 Credits	22	
	Cum. Cr.	24	08	00	00	06	00	06	44	

Abbreviations:

1. **DSC:** Department/Discipline Specific Core (Major)
 2. **DSE:** Department/Discipline Specific Elective (Major)
 3. **DSM:** Discipline Specific Minor
 4. **GE/OE:** Generic/Open Elective
 5. **VSEC:** Vocational Skill and Skill Enhancement Course
 6. **VSC:** Vocational Skill Courses
 7. **SEC:** Skill Enhancement Courses
 8. **AEC:** Ability Enhancement courses
 9. **MIL:** Modern Indian languages
 10. **IKS:** Indian Knowledge System
 11. **VEC:** Value Education Courses
 12. **OJT:** On Job Training: (Internship/Apprenticeship)
 13. **FP:** Field Projects
 14. **CEP:** Community Engagement and Service
 15. **CC:** Co-Curricular Courses
 16. **RM:** Research Methodology
 17. **RP:** Research Project/Dissertation
-



B. Sc. CM Third Year Semester V (Level 5.5)

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs./ week)	
			Theory	Practical	Total	Theory	Practical
Optional 1	SCMGCT1301 (3 Cr)	Web Development using J2EE	03	--	12	04	--
	SCMGCT1302 (3 Cr)	Data Visualization	03	--		04	--
	SCMGIK1303 (2 Cr)	Introduction to super computing	02	---		02	--
	SCMGCP1304 (2 Cr)	Web Development using J2EE (P)	--	02		--	02
	SCMGCP1305 (2 Cr)	Data Visualization (P)	--	02		--	02
Optional 2	SCMGET1301 (3 Cr)	Enterprise Infrastructure and Cloud Technologies - Part I	03	--	04	04	--
	SCMGEP1301 (1 Cr)	Enterprise Infrastructure and Cloud Technologies - Part I (P)	--	01		--	02
Vocational & Skill Enhancement Course	SCMGVC1301 (2 Cr)	Generative AI tools	--	02	02	--	02
Field Work / Project/Internship	SCMGFP1301 (4 Cr)	Project	--	04	04	--	04
Total Credits			11	11	22	14	12



B. Sc. CM Third Year Semester V(Level 5.5)

Examination Scheme

[40% Continuous Assessment (CA) and 60% End Semester Assessment (ESA)]

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Sum of T1 & T2 (6)	Total (7)	CA (8)	ESA (9)	
Optional 1	SCMGCT1301 (3 Cr)	Web Development using J2EE	15	15	30	45	--	--	75
	SCMGCT1302 (3 Cr)	Data Visualization	15	15	30	45	--	--	75
	SCMGIK1303 (2 Cr)	Introduction to super computing	10	10	20	30	--	--	50
	SCMGCP1304 (2 Cr)	Web Development using J2EE (P)	--	--	--	--	20	30	50
	SCMGCP1305 (2 Cr)	Data Visualization (P)	--	--	--	--	20	30	50
Optional 2	SCMGET1301 (3 Cr)	Enterprise Infrastructure and Cloud Technologies - Part I	15	15	30	45	--	--	75
	SCMGEP1301 (1 Cr)	Enterprise Infrastructure and Cloud Technologies - Part I (P)	--	--	--	--	10	15	25
Vocational & Skill Enhancement Course	SCMGVC1301 (2 Cr)	Generative AI tools	--	--	--	--	20	30	50
Field Work / Project/Internship	SCMGFP1301 (4 Cr)	Project	--	--	--	--	40	60	100



B. Sc. CM Third Year Semester VI (Level 5.5)

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs./ week)	
			Theory	Practical	Total	Theory	Practical
Optional 1	SCMGCT1351 (3 Cr)	Python for Data Science	03	--	12	04	--
	SCMGCT1352 (3 Cr)	React JS	03	--		04	--
	SCMGCT1353 (2 Cr)	Introduction to AIML	02	---		02	--
	SCMGCP1354 (2 Cr)	Python for Data Science (P)	--	02		--	02
	SCMGCP1355 (2 Cr)	React JS (P)	--	02		--	02
Optional 2	SCMGET1351 (3 Cr)	Enterprise Infrastructure and Cloud Technologies - Part II	03	--	04	04	--
	SCMGEP1351 (1 Cr)	Enterprise Infrastructure and Cloud Technologies - Part II (P)	--	01		--	02
Vocational & Skill Enhancement Course	SCMGVC1351 (2 Cr)	Internet of Things (IOT)	--	02	02	--	02
On Job Training: (Internship/Apprenticeship)	SCMGOJ1351 4 Credits	-----	--	04	04	--	04
Total Credits			11	11	22	14	12



B. Sc. CM Third Year Semester VI (Level 5.5)

Examination Scheme

[40% Continuous Assessment (CA) and 60% End Semester Assessment (ESA)]

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Sum of T1 & T2 (6)	Total (7)	CA (8)	ESA (9)	
Optional 1	SCMGCT1351 (3 Cr)	Python for Data Science	15	15	30	45	--	--	75
	SCMGCT1352 (3 Cr)	React JS	15	15	30	45	--	--	75
	SCMGCT1353 (2 Cr)	Introduction to AIML	10	10	20	30	--	--	50
	SCMGCP1354 (2 Cr)	Python for Data Science (P)	--	--	--	--	20	30	50
	SCMGCP1355 (2 Cr)	React JS (P)	--	--	--	--	20	30	50
Optional 2	SCMGET1351 (3 Cr)	Enterprise Infrastructure and Cloud Technologies - Part II	15	15	30	45	--	--	75
	SCMGEP1351 (1 Cr)	Enterprise Infrastructure and Cloud Technologies - Part II (P)	--	--	--	--	10	15	25
Vocational & Skill Enhancement Course	SCMGVC1351 (2 Cr)	Internet of Things (IOT)	--	--	--	--	20	30	50
On Job Training: (Internship/Apprentic eship)	SCMGOJ1351 4 Credits	-----	--	--	--	--	40	60	100

Detailed Curriculum

Course Structure:

Major 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCMGCT1301	Web Development using J2EE	45	--	03	--	03

Major 1 -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SCMGCT1301	Web Development using J2EE	15	15	30	45	--	--	75

SCMGCT1301: Web Development using J2EE (Major 1) Curriculum Details

Course pre-requisite:

1. Basic knowledge of programming
2. Basic knowledge of Core Java
3. Basic knowledge of HTML, CSS and JavaScript
4. Basic knowledge of SQL

Course Objectives:

1. To manage java objects using collection framework
2. To maintain database using JDBC
3. To create dynamic web pages using Servlet
4. To handle web form data
5. To create and design web page using JSP

Course Outcomes:

Students will be able to:

1. Design and build servlet web page
2. Build robust and maintainable web applications
3. Design web app for handling database
4. Do server side programming with java Servlets and JSP.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Collection Framework and Multithreading	15
	1.1	Collection interface, ArrayList and Vector	
	1.2	Generics and Iterator	
	1.3	HashSet, TreeSet and Comparable	
	1.4	HashMap and TreeMap	
	1.5	Creating Multiple Threads	
	1.6	Thread Life Cycle and Thread Priority	
	1.7	Thread Synchronization	
2.0		Java Database Connectivity	10
	2.1	JDBC Architecture and JDBC Drivers	
	2.2	Establishing Connection, Executing Query and Processing Results	
	2.3	Prepared Statement	
	2.4	Callable Statement	
	2.5	Metadata	
3.0		Servlets	10
	3.1	Introduction to Servlets & Deploying Servlet	
	3.2	Servlet Life Cycle	
	3.3	Request and Response Object	
	3.4	Accessing Data from HTML Form	
	3.5	Using JDBC in Servlet	
	3.6	Servlet Chaining	
	3.7	Cookies and Sessions	
4.0		JSP	10
	4.1	Introduction to JSP	
	4.2	JSP Scripting Elements	
	4.3	JSP Directives	
	4.4	JSP Action tags	
	4.5	Sessions in JSP	
		Total	45

Reference Books:

1. Santosh Kumar K, “JDBC, Servlet, and JSP: Black Book”, Kogent Solutions Inc., 2008
2. Herbert Schildt, “Java The Complete Reference 9th Edition”, McGraw Hill Education (India) Private Limited, New Delhi.
3. Bruce W. Perry, “Java Servlet & JSP Cookbook”, O'Reilly Publication3.

Course Structure:

Major 2 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCMGCT1302	Data Visualization	45	--	03	--	03

Major 2 -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SCMGCT1302	Data Visualization	15	15	30	45	--	--	75

SCMGCT1302: Data Visualization (Major 2) Curriculum Details

Course pre-requisite:

1. Knowledge of basic computer operations and data management tools.
2. Understanding of introductory statistics and data analysis concepts.

Course Objectives:

1. To understand the fundamentals and significance of data visualization.
2. To learn visual perception principles for effective data interpretation.
3. To study data types and appropriate visualization techniques.
4. To understand data storytelling and dashboard design principles.
5. To develop practical skills in creating visualizations using Power BI.

Course Outcomes:

1. Explain the fundamentals and applications of data visualization.
2. Analyze data and choose appropriate visualization techniques.
3. Design dashboards and visualizations using Power BI.
4. Apply data storytelling for effective visual communication.
5. Evaluate visualizations using design and usability principles.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		BASIC INTRODUCTION TO DATA VISUALIZATION	
	1.1	Definition of Data Visualization	12
	1.2	Importance of Data Visualization	
	1.3	Role of Data Visualization in Decision Making	
	1.4	Types of Data	
	1.5	Data Visualization Process Data Collection &Cleaning	
	1.6	Data Visualization Process Data Exploration Analysis	
	1.7	Data Visualization Process Visualization & Interpretation	
	1.8	Challenges in Data Visualization	
	1.9	Limitations of Data Visualization	
2.0		VISUALIZATION TOOLS & DATA STORYTELLING	
	2.1	Overview of Visualization Tools	10
	2.2	Microsoft Excel for Visualization	
	2.3	Power BI Overview	
	2.4	Python for Data Visualization	
	2.5	comparison of Visualization Tools	
	2.6	Introduction to Data Storytelling	
	2.7	Narrative and Context in Data Storytelling	
	2.8	Dashboard Design and Interactivity	
3.0		DESIGNING EFFECTIVE VISUALIZATIONS	
	2.1	Principles of Good Visualization Design	12
	2.2	Visual Hierarchy	
	2.3	Choosing Correct Chart Types	
	2.4	Understanding Color in Visualization	
	2.5	Best Practices in Color Usage	

	2.6	Importance of Data Modeling	
	2.7	Data Modeling Techniques	
	2.8	Common Design Mistakes	
	2.9	Effective Visualization Guidelines	
4.0		ADVANCED DATA VISUALIZATION CONCEPTS	
	4.1	Introduction to Advanced Data Visualization	
	4.2	Interactive Data Visualization Concepts	
	4.3	Real-time Data Visualization	
	4.4	Big Data Visualization Techniques	11
	4.5	Dashboard Development and Design Principles	
	4.6	Data Visualization for Business Intelligence (BI)	
	4.7	Future Trends in Data Visualization give me something simple to hard	
		Total	45

Text Books:

1. Cole Nussbaumer Knaflic, “Storytelling with Data: A Data Visualization Guide for Business Professionals”, 1st Edition, Wiley, 2015.
2. Edward R. Tufte, “The Visual Display of Quantitative Information”, 2nd Edition, Graphics Press, 2001.

Reference Books:

1. Kieran Healy, “Data Visualization: A Practical Introduction”, Princeton University Press, 2018.
2. Alberto Ferrari and Marco Russo, “Analyzing Data with Power BI and Power Pivot for Excel”, 1st Edition, Microsoft Press, 2017.

Course Structure:

Major 3 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCMGIK1303	Introduction to Super Computing	30	--	2	--	2

Major 3 -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SCMGIK1303	Introduction to Super Computing	10	10	20	30	--	--	50

SCMGIK1303: Introduction to Super Computing (Major 3) Curriculum Details

Course pre-requisite:

1. Basic knowledge of computer organization and architecture.
2. Familiarity with programming in C/C++ or Python.
3. Understanding of data structures and algorithms.
4. Introductory knowledge of operating systems and networking.

Course Objectives:

1. To introduce the fundamentals of supercomputing and high-performance computing (HPC), including architecture and evolution.
2. To understand the contributions of Dr. Vijay Bhatkar and India's PARAM supercomputers developed by Centre for Development of Advanced Computing.
3. To develop the ability to design and implement parallel programs using modern programming models (MPI, OpenMP, CUDA).
4. To analyze and evaluate performance metrics and optimization techniques in HPC systems.
5. To explore real-world applications and future trends in supercomputing.

Course Outcomes:

After completing this course, students will be able to:

1. Explain the architecture, evolution, and significance of supercomputers, including systems like PARAM series.
2. Apply parallel computing models and programming paradigms (MPI, OpenMP, CUDA) to solve computational problems.
3. Analyze performance metrics (FLOPS, latency, scalability laws) and optimize parallel programs.
4. Design and implement efficient parallel algorithms for scientific and engineering applications.
5. Evaluate the impact of national initiatives like the National Supercomputing Mission and emerging technologies such as AI-HPC convergence.
6. Demonstrate hands-on skills in executing and analyzing parallel programs on cluster-based systems.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Foundations of Supercomputing & Dr. Vijay Bhatkar's Contribution	
	1.1	Introduction to Supercomputing: Definition, need, evolution from mainframes to supercomputers	7
	1.2	History in India: Role of Dr. Vijay Bhatkar, PARAM series, C-DAC's mission	
	1.3	Supercomputer Architecture Basics: Vector processors, SIMD, MIMD, cluster computing	
	1.4	Performance Metrics: FLOPS, MIPS, latency, bandwidth, Amdahl's Law, Gustafson's Law	
2.0		Parallel Processing & High Performance Computing Architecture	
	2.1	Parallel Computing Models: Shared memory, distributed memory, hybrid models	8
	2.2	Interconnection Networks: Topologies – mesh, hypercube, torus, fat tree	
	2.3	Memory Hierarchy: Cache coherence, NUMA, distributed shared memory	

	2.4	Case Study: Architecture of PARAM 8000, PARAM Yuva, PARAM Siddhi-AI	
	2.5	Programming Paradigms: MPI, OpenMP, CUDA basics	
3.0		Software, Tools & Programming for Supercomputers	
	3.1	Operating Systems for HPC: Linux variants for clusters, scheduling	
	3.2	Parallel Algorithms: Matrix multiplication, sorting, graph algorithms	
	3.3	Programming Environments: MPI programming, OpenMP directives, GPU programming	
	3.4	Performance Optimization: Load balancing, profiling tools, debugging parallel code	
4.0		Applications & Future of Supercomputing	
	4.1	Scientific Applications: Weather forecasting, computational fluid dynamics, genomics	
	4.2	National Missions: National Supercomputing Mission, applications in defense, space, disaster management	
	4.3	Emerging Trends: Exascale computing, AI + HPC convergence, quantum computing overview	
	4.4	Ethical & Societal Impact: Digital divide, indigenous tech development, Bhatkar's vision for self-reliance	
		Total	30

Text Books:

1. Elements of Parallel Computing – Vijay P. Bhatkar
Covers fundamentals of parallel computing, architectures, and Indian supercomputing initiatives including PARAM.
2. Introduction to Parallel Processing – M. Sasikumar, D. Shikhare, P. Ravi Prakash
Provides a clear introduction to parallel algorithms, models, and programming techniques.
3. Parallel Computer Architecture: A Hardware/Software Approach – John L. Hennessy, David A. Patterson
Detailed coverage of modern parallel architectures, performance, and scalability.
4. Using MPI: Portable Parallel Programming with the Message Passing Interface – William Gropp, Ewing Lusk, Anthony Skjellum
Comprehensive guide to MPI programming for distributed memory systems.

Reference Books:

1. Elements of Parallel Computing_ by Vijay P. Bhatkar
2. Introduction to Parallel Processing_ by Sasikumar, Shikhare, Ravi Prakash
3. C-DAC whitepapers on PARAM series

Course Structure:

Major 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCMGCP1304	Web Development using J2EE (P)	--	20	--	2	2

Major 1 -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SCMGCP1304	Web Development using J2EE (P)	--	--	--	--	20	30	50

SCMGCP1304: Web Development using J2EE (Major 1) Curriculum Details

Course pre-requisite:

1. Basic knowledge of programming
2. Basic knowledge of Core Java
3. Basic knowledge of HTML, CSS and JavaScript
4. Basic knowledge of SQL

Course Objectives:

1. To manage java objects using collection framework
2. To maintain database using JDBC
3. To create dynamic web pages using Servlet
4. To handle web form data
5. To create and design web page using JSP

Course Outcomes:

Students will be able to:

1. Design and build servlet web page
2. Build robust and maintainable web applications
3. Design web app for handling database

4. Do server side programming with java Servlets and JSP.

Curriculum Details:

List of Practical

1. Write a program to demonstrate ArrayList class.
2. Write a program to demonstrate generics and iterator.
3. Write a program to demonstrate HashSet class.
4. Write a program to demonstrate Comparable interface.
5. Write a program to create multiple threads using Thread class.
6. Write a program to demonstrate thread priorities.
7. Write a program to demonstrate Statement interface.
8. Write a program to demonstrate PreparedStatement interface.
9. Write a program to demonstrate CallableStatement.
10. Write a program to create simple web page using Servlet.
11. Write a program to demonstrate HTML form data using Servlet
12. Write a program to demonstrate Servlet chaining.
13. Write a program to demonstrate sessions in Servlet.
14. Write a program to demonstrate JSP scripting elements
15. Write a program to demonstrate JSP useBean.

Reference Books:

1. Santosh Kumar K, “JDBC, Servlet, and JSP: Black Book”, Kogent Solutions Inc., 2008
2. Herbert Schildt, “Java The Complete Reference 9th Edition”, McGraw Hill Education (India) Private Limited, New Delhi.
3. Bruce W. Perry, “Java Servlet & JSP Cookbook”, O'Reilly Publication3.

Course Structure:

Major 2 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCMGCP1305	Data Visualization (P)	--	20	--	02	02

Major 2 -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA	CA	ESA	
		Test I	Test II	Sum of T1 & T2				
SCMGCP1305	Data Visualization (P)	--	--	--	--	20	30	50

SCMGCP1305: Data Visualization (P) (Major 2) Curriculum Details

Course pre-requisite:

1. Familiarity with basic computer operations and office productivity tools.
2. Introductory knowledge of data organization and analytical concepts.

Course Objectives:

1. To introduce students to the concepts and importance of data visualization.
2. To develop understanding of data preparation, transformation, and visualization techniques.
3. To build practical skills in designing dashboards and reports using Power BI.

Course Outcomes:

1. Explain the fundamental concepts and applications of data visualization.
2. Apply data transformation and visualization techniques for effective analysis.
3. Design interactive dashboards and reports using Power BI.

Curriculum Details:

List of Practical

1. Import data from Excel and CSV files into Microsoft Power BI Desktop.
2. Clean the imported dataset by removing duplicate records and handling missing values.
3. Change data types, rename columns, and split columns using Power Query Editor.
4. Create custom columns and transform data using Power Query functions.
5. Design basic visualizations using bar, column, line, and pie charts.
6. Format and customize visualizations using colours, labels, and themes.
7. Create relationships between multiple tables in the data model.
8. Merge two related tables using a common key.
9. Append multiple datasets into a single consolidated table.
10. Create calculated columns using DAX expressions.
11. Create measures for aggregate calculations such as Total, Average, and Count.
12. Apply slicers and filters to make reports interactive.
13. Implement drill-down and drill-through features in reports.
14. Design and develop an interactive dashboard using multiple visualizations.
15. Publish and share reports using Power BI Service.

Text Books:

1. Cole Nussbaumer Knaflitz, “Storytelling with Data”, Wiley, 2015.
2. Edward R. Tufte, “The Visual Display of Quantitative Information”, Graphics Press, 2001.
3. Alberto Ferrari and Marco Russo, “Analyzing Data with Power BI and Power Pivot for Excel”, Microsoft Press, 2017.

Reference Books:

1. Kieran Healy, “Data Visualization”, Princeton University Press, 2018.
2. Andy Kirk, “Data Visualisation”, Sage Publications, 2019.
3. Claus O. Wilke, “Fundamentals of Data Visualization”, O’Reilly Media, 2019.

Course Structure:

Minor 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCMGET1301	Enterprise Infrastructure and Cloud Technologies - Part I	45	--	03	--	03

Minor 1 -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA	CA	ESA	
		Test I	Test II	Sum of T1 & T2				
SCMGET1301	Enterprise Infrastructure and Cloud Technologies - Part I	15	15	30	45	--	--	75

SCMGET1301: Enterprise Infrastructure and Cloud Technologies - Part I (Minor 1) Curriculum Details

Course pre-requisite:

1. To provide a foundational understanding of Basic Computer Fundamentals.
2. To provide a foundational Understanding of Networking Basics.
3. To provide a Basic Knowledge of Operating Systems.
4. To enable learners Basic Security Concepts.

Course Objectives:

1. To provide a foundational understanding of networking devices, data centers, and enterprise storage technologies.
2. To introduce various server and client operating systems and their configuration and security.
3. To impart practical knowledge on Windows Server administration, storage management, and deployment techniques.
4. To enable learners to work with Active Directory, domain services, and secure authentication mechanisms.
5. To equip students with the ability to monitor, troubleshoot, and manage enterprise-level infrastructure.

Course Outcomes:

After completing this course, the student will be able to:

1. Understand the structure and functioning of networking devices, server form factors, and RAID based storage solutions.
2. Install and configure client and server operating systems, including handling file systems and firewall settings.
3. Manage and administer Windows Server environments, perform patching, clustering, and automated deployment.
4. Implement and secure Active Directory services, group policies, and authentication mechanisms.
5. Demonstrate the ability to monitor system performance and use tools to ensure availability and fault tolerance in enterprise IT infrastructure.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Networking and Server Infrastructure	09
	1.1	Introduction to Networking Devices and LAN/WAN - IPv4 and IPv6.	
	1.2	Routers and Switches Overview.	
	1.3	Datacenter Overview and Server Form Factors	
	1.4	Server Management Portals (IPMI/iLO/iDrac) and Events	
	1.5	Introduction to Storage: NAS, DAS, SAN	
	1.6	RAID Levels and Comparisons (Fibre Channel, iSCSI, FCoE)	
2.0		Operating Systems Overview (Server & Client)	09
	2.1	Introduction Operating Systems Overview (Server & Client)	
	2.2	Domain vs. Workgroup	
	2.3	File Systems: FAT, NTFS, ReFS, EXT3, EXT4	
	2.4	Installing and Managing OS (Windows Server, Linux)	
	2.5	Firewall Fundamentals (Hardware/Software)	
3.0		Windows Server Administration	15
	3.1	Windows Server Core Installation, Upgrades, Patch Management & Migrations	
	3.2	Storage Spaces, iSNS, DCB, and MPIO	
	3.3	Data Deduplication and Disk Management	
	3.4	High Availability: Failover Clustering, NLB	
	3.5	Deployment Images using MDT and WSUS	
	3.6	PowerShell DSC and Monitoring Tools	

	3.7	Performance Monitoring and Event Logs	
4.0		Active Directory & Security	
	4.1	AD DS DNS Server Role, Zones, and Transfers	
	4.2	AD DS Replication and Sites	
	4.3	Group Policy Management and Templates	
	4.4	Securing Domain Controllers and Accounts	
	4.5	Audit Authentication and Managed Service Accounts	
	4.6	Certificate Services (CAs, Templates, Revocation, Recovery)	
	4.7	AD FS, AD RMS, and Smart Cards	
	4.8	Backup & Restore of Active Directory	
		Total	45

Text Books:

1. Sara Perrott, "Windows Server 2019 & PowerShell All-in-One For Dummies", Wiley, 2021.
2. Sander van Vugt, "Red Hat RHCSA 8 Cert Guide: EX200", Pearson IT Certification, 2021.
3. Brian Desmond, Joe Richards, Robbie Allen, "Active Directory: Designing, Deploying, and Running Active Directory," O'Reilly Media, 5th Edition, 2019

Reference Books:

1. Computer Networks" by Andrew S. Tanenbaum and David J. Wetherall, 5th Edition, Pearson Education, 2011
2. William Stallings, "Operating Systems: Internals and Design Principles," Pearson Education, Vol:9th Edition, 2018
3. Tom Carpenter, "Microsoft Windows Server 2019 Administration Fundamentals," Sybex (Wiley), Volume: 1st Edition, 2019
4. Brian Ward, "How Linux Works: What Every Superuser Should Know," No Starch Press, 2nd Edition, 2014

Course Structure:

Minor 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCMGEP1301	Enterprise Infrastructure and Cloud Technologies - Part I (P)	--	10	--	01	01

Minor 1 -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SCMGEP1301	Enterprise Infrastructure and Cloud Technologies - Part I (P)	--	--	--	--	10	15	25

SCMGEP1301: Enterprise Infrastructure and Cloud Technologies - Part I (P) (Minor 1) Curriculum Details

Course pre-requisite:

1. To provide a foundational understanding of Basic Computer Fundamentals.
2. To provide a foundational Understanding of Networking Basics.
3. To provide a Basic Knowledge of Operating Systems.
4. To enable learners Basic Security Concepts

Course Objectives:

1. To provide a foundational understanding of networking devices, data centers, and enterprise storage technologies.
2. To introduce various server and client operating systems and their configuration and security.
3. To impart practical knowledge on Windows Server administration, storage management, and deployment techniques.
4. To enable learners to work with Active Directory, domain services, and secure authentication mechanisms.
5. To equip students with the ability to monitor, troubleshoot, and manage enterprise-level infrastructure

Course Outcomes:

After completing this course, the student will be able to:

1. Understand the structure and functioning of networking devices, server form factors, and RAID based storage solutions.
2. Install and configure client and server operating systems, including handling file systems and firewall settings.
3. Manage and administer Windows Server environments, perform patching, clustering, and automated deployment.
4. Implement and secure Active Directory services, group policies, and authentication mechanisms.

Curriculum Details:**List of Practical**

1. Windows Server Installation & Configuration, Install Windows Server (GUI).
2. Install Windows Server Core
3. Install & Configure Active Directory Domain Services (AD DS)
 - Promote server to DC, join clients to the domain.
4. Configure DNS zones and replication
5. Apply Group Policies
6. Enforce password policy,
7. Demonstrate AD security (users, permissions, auditing)
8. Restrict drives,
9. Implement backup and restore of AD
10. Desktop configuration.
11. Implement Failover Cluster
 - Build a high-availability cluster for file share service.
12. Implement Network Load Balancing (NLB)
 - Build a high-availability cluster for file share service.
13. PowerShell Scripting for Automation Tasks
14. Write scripts in PowerShell for log rotation, monitoring
15. Write scripts in PowerShell for Patching, Checking Stale Records

Text Books:

1. Sara Perrott, "Windows Server 2019 & PowerShell All-in-One For Dummies", Wiley, 2021.
2. Sander van Vugt, "Red Hat RHCSA 8 Cert Guide: EX200", Pearson IT Certification, 2021.
3. Brian Desmond, Joe Richards, Robbie Allen, "Active Directory: Designing, Deploying, and Running Active Directory," O'Reilly Media, 5th Edition, 2019

Reference Books:

1. Computer Networks" by Andrew S. Tanenbaum and David J. Wetherall, 5th Edition, Pearson Education, 2011.
2. William Stallings, "*Operating Systems: Internals and Design Principles*," Pearson Education, **Vol:**9th Edition, 2018.
3. Tom Carpenter, "Microsoft Windows Server 2019 Administration Fundamentals," Sybex (Wiley), **Volume:** 1st Edition, 2019.
4. Brian Ward, "How Linux Works: What Every Superuser Should Know," No Starch Press, 2nd Edition, 2014.

Course Structure:

Vocational Course -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCMGVC1301	Generative AI tools	--	20	--	02	02

Vocational Course -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SCMGVC1301	Generative AI tools	--	--	--	--	20	30	50

SCMGVC1301: Generative AI tools (Vocational Course) Curriculum Details

Course Pre-requisites:

1. Basic knowledge of programming (Python preferred)
2. Fundamentals of Artificial Intelligence and Machine Learning

Course Objectives:

1. To understand the fundamentals and working principles of Generative AI models
2. To develop skills in prompt engineering and usage of AI tools for content generation
3. To apply Generative AI techniques for solving real-world problems

Course Outcomes:

1. Students will be able to explain key concepts and models of Generative AI
2. Students will be able to design effective prompts and generate text, images, or code using AI tools
3. Students will be able to build simple Generative AI-based applications and evaluate their outputs

Curriculum Details:

List of Practical

1. Introduction to Generative AI tools (ChatGPT, Gemini, Claude) and basic prompt usage.
2. Design effective prompts using prompt engineering techniques.
3. Generate text content (essays, summaries, reports) using AI tools.
4. Create AI-generated images using tools like DALL·E or Midjourney.
5. Build a simple chatbot using ChatGPT API or similar platform.
6. Text-to-speech conversion using AI tools.
7. Speech-to-text conversion using AI tools.
8. Generate code snippets using AI (Python, SQL, etc.) and test execution.
9. Create a mini project: AI-based content generator (blog/article generator).
10. Fine-tuning prompts for domain-specific tasks (education, healthcare, etc.).
11. Explore AI hallucination and evaluate output accuracy.
12. Use AI tools for data cleaning and preprocessing tasks.
13. Generate presentations using AI tools (Canva AI, Tome, etc.).
14. Ethical considerations and bias analysis in Generative AI outputs.
15. Mini project: Build a Generative AI-based application (text/image chatbot or assistant).

Text Books:

1. **Generative AI with Python and TensorFlow** – Joseph Babcock & Raghav Bali, O'Reilly, 2023
2. **Deep Learning** – Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 2016
3. **Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow** – Aurélien Géron, O'Reilly, 2022

Reference Books:

1. **Natural Language Processing with Transformers** – Lewis Tunstall, Leandro von Werra, Thomas Wolf, O'Reilly, 2022
2. **Building Machine Learning Powered Applications** – Emmanuel Ameisen, O'Reilly, 2020
3. **Artificial Intelligence: A Modern Approach** – Stuart Russell & Peter Norvig, Pearson, 4th Ed., 2021
4. **Pattern Recognition and Machine Learning** – Christopher M. Bishop, Springer, 2006
5. **Machine Learning Yearning** – Andrew Ng, 2018

Course Structure:**Major 1 -Teaching Scheme**

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCMGCT1351	Python for Data Science	45	---	03	---	03

Major 1 -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SCMGCT1351	Python for Data Science	15	15	30	45	--	--	75

SCMGCT1351: Python for Data Science (Major 1) Curriculum Details**Course pre-requisite:**

1. Basic Python Programming Knowledge
2. Fundamentals of Statistics or Mathematics.
3. Familiarity with Excel or Data Handling Concepts

Course Objectives:

1. Introduce foundational concepts of data analytics using Python.
2. Develop proficiency in using Python libraries such as Pandas, NumPy, and Matplotlib.
3. Apply data analytics techniques to solve real-world problems.

Course Outcomes:*Students will be able to:*

1. Perform data cleaning, manipulation, and analysis using Python.
2. Visualize data using libraries like Matplotlib and Seaborn to derive meaningful insights.
3. Interpret analytical results to support data-driven decision making.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Introduction to Data Analytics and Python for Data Handling	12
	1.1	Introduction to Data Analytics – Definition, Need, and Applications	
	1.2	Python basics for Data Analytics: Variables, Data Types, Functions, Loops	
	1.3	Functions and Lambda Expressions	
	1.4	Introduction to Jupyter Notebook, Spyder, and VS Code	
	1.5	Data Structures in Python: Lists, Tuples, Dictionaries	
	1.6	File Handling in Python	
	1.7	Exception Handling – try, except, finally, raise	
	1.8	Modules and Packages	
	1.9	Introduction to Object Oriented Programming in Python	
	1.10	Iterators, Generators, and Decorators	
2.0		NumPy for Numerical Computing, and SciPy for Scientific Computing	11
	2.1	Introduction to NumPy – array() creation	
	2.2	Indexing, slicing, and iterating arrays	
	2.3	Array shape manipulation and broadcasting	
	2.4	Mathematical operations on arrays	
	2.5	Aggregation functions – mean(), sum(), min(), max()	
	2.6	Random number generation – random(), randint()	
	2.7	Linear algebra operations – dot(), inv(), eig()	
	2.8	Working with large datasets in memory	
	2.9	Introduction to SciPy and its submodules	
3.0		Data Manipulation using Pandas	12
	3.1	Introduction to Pandas	
	3.2	Series and DataFrame	
	3.3	Reading and Writing Data	
	3.4	Indexing and Selecting Data	
	3.5	Data Inspection and Summary	
	3.6	Filtering and Conditional Selection	
	3.7	Handling Missing Data	

	3.8	Data Transformation	
	3.9	Grouping and Aggregation	
	3.10	Merging, Joining, and Concatenation	
4.0		Data Analysis and Visualization using Pandas and Matplotlib	
	4.1	Sorting and Ranking in Pandas	
	4.2	Renaming Columns and Indexes	
	4.3	Creating Pivot Tables in Pandas	
	4.4	Handling Duplicate Data	
	4.5	Introduction to Data Visualization	
	4.6	Overview of Matplotlib Library	
	4.7	Plotting Line and Bar Charts using Pandas	
	4.8	Customizing Basic Plots (title, labels, legend)	
		Total	45

Reference Books:

- Python for Data Analysis – Wes McKinney (O'Reilly)
- Python Data Science Handbook – Jake VanderPlas (O'Reilly)
- Think Stats – Allen B. Downey (O'Reilly)
- Hands-On Data Analysis with Pandas – Stefanie Molin (Packt)
- Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow – Aurélien Géron (O'Reilly)
- Python Machine Learning – Sebastian Raschka (Packt)

Course Structure:

Major 2 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCMGCT1352	ReactJS	45	--	03	--	03

Major 2 -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA	CA	ESA	
		Test I	Test II	Sum of T1 & T2				
SCMGCT1352	ReactJS	15	15	30	45	--	--	75

SCMGCT1352: ReactJS (Major 2) Curriculum Details

Course pre-requisite:

1. Basic knowledge of HTML, CSS, and JavaScript.
2. Basic understanding of programming concepts.

Course Objectives:

1. To understand modern JavaScript (ES6+) concepts.
2. To learn fundamentals of React and component-based architecture.
3. To develop dynamic web applications using React features like hooks, routing, and state management.

Course Outcomes:

1. Understand and use modern JavaScript features like arrow functions, destructuring, async/await, etc.
2. Build reusable UI components using React concepts such as JSX, props, and state.
3. Develop interactive web applications using hooks, forms, routing, and state management libraries like Redux.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Introduction to JavaScript	
	1.1	Variables	10
	1.2	Arrow functions	
	1.3	Rest and spread	
	1.4	Object and array destructuring	
	1.5	Literals and Classes	
	1.6	Async/Await	
2.0		Basics of React Concepts	
	2.1	What is react?	12
	2.2	Benefits of using react	
	2.3	First react code	
	2.4	What is JSX, benefits and understanding JSX	
	2.5	React component states	
	2.6	Working with states	
	2.7	States and properties	
	2.8	Stateless components	
3.0		Styling and Hooks	
	3.1	CSS in React, Inline Styling	11
	3.2	SAAS, What is HOOK?	
	3.3	useState, useEffect, useContext, useRef, useReducer	
	3.4	useCallback, useMemo	
	3.5	Custom Hooks	
4.0		Working with Forms and Menus	
	4.1	Defining a form and its events, form elements	12
	4.2	Form validations, Building menu with JSX, Building menu without JSX	
	4.3	React router, router features	
	4.4	Flux Data Architecture	
	4.5	redux data library	
		Total	45

Text Books:

1. AZAT MARDAN (as appeared on the book), “React Quickly”, ISBN 9781617293344, ©2017 by Manning Publications, Edition First.

Reference Books:

1. Learning React
Functional Web Development with React and Redux, Alex Banks and Eve Porcello, isbn=9781491954553 f, First Edition, O’Reilly.

Course Structure:

Major 3 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCMGCT1353	Introduction to AIML	30	---	02	---	02

Major 3 -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SCMGCT1353	Introduction to AIML	10	10	20	30	---	----	50

SCMGCT1353: Introduction to AIML (Major 3) Curriculum Details

Course pre-requisite:

1. Programming Fundamentals
2. Basic Computer Science Knowledge
3. Database Fundamentals

Course Objectives:

1. To understand basic search techniques, problem-solving approaches, and knowledge representation methods used in AI systems.
2. To develop knowledge of supervised and unsupervised learning techniques used in machine learning.
3. To study and apply machine learning algorithms such as regression, classification, clustering, and decision trees.

Course Outcomes:

Students will be able to:

1. Apply supervised and unsupervised learning techniques to solve machine learning problems.
2. Implement machine learning algorithms such as regression, classification, clustering, and decision trees.
3. Analyse datasets using pre-processing, feature selection, and evaluation techniques to improve model performance.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Introduction to Artificial Intelligence	8
	1.1	What is AI? History and evolution	
	1.2	AI vs ML vs Deep Learning	
	1.3	Applications of AI (Healthcare, Finance, Education, etc.)	
	1.4	Intelligent agents and environments	
	1.5	Basics of problem-solving in AI	
2.0		Introduction to Machine Learning	7
	2.1	What is Machine Learning?	
	2.2	Types of ML:	
	2.3	Supervised Learning	
	2.4	Unsupervised Learning	
	2.5	Reinforcement Learning	
	2.6	ML pipeline	
3.0		Data Preprocessing & Exploration	7
	3.1	Data collection and cleaning	
	3.2	Handling missing values	
	3.3	Feature selection and feature engineering	
	3.4	Data visualization (Matplotlib, Seaborn basics)	
	3.5	Introduction to NumPy & Pandas	
4.0		Supervised Learning Algorithms	8
	4.1	Regression: Linear Regression, Polynomial Regression	
	4.2	Classification: Logistic Regression, K-Nearest Neighbors (KNN), Decision Trees, Support Vector Machines (SVM)	
	4.3	Model evaluation: Accuracy, Precision, Recall, F1-score	
		Total	30

Text Books:

1. Artificial Intelligence: A Modern Approach, by Stuart Russell, Peter Norvig
2. Pattern Recognition and Machine Learning, by Christopher M. Bishop

Reference Books:

1. Deep Learning by Ian Goodfellow, Ian Goodfellow, Yoshua Bengio, Aaron Courville.

Course Structure:

Major 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCMGCP1354	Python for Data Science (P)	--	20	--	02	02

Major 1 -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA	CA	ESA	
		Test I	Test II	Sum of T1 & T2				
SCMGCP1354	Python for Data Science (P)	--	--	--	--	20	30	50

SCMGCP1354: Python for Data Science (P) (Major 1) Curriculum Details

Course pre-requisite:

1. Basic Python Programming Knowledge
2. Fundamentals of Statistics or Mathematics.
3. Familiarity with Excel or Data Handling Concepts

Course Objectives:

1. Introduce foundational concepts of data analytics using Python.
2. Develop proficiency in using Python libraries such as Pandas, NumPy, and Matplotlib.
3. Apply data analytics techniques to solve real-world problems.

Course Outcomes:

Students will be able to:

1. Perform data cleaning, manipulation, and analysis using Python.
2. Visualize data using libraries like Matplotlib and Seaborn to derive meaningful insights.
3. Interpret analytical results to support data-driven decision making.

Curriculum Details:

List of Practical

1. Write a Python program using variables, data types, loops, and functions for basic data handling.
2. Create user-defined functions and lambda expressions for performing operations on lists and dictionaries.
3. Demonstrate basic file handling: read/write a text file and count word frequency.
4. Implement exception handling using try, except, else, finally, and raise.
5. Create and use modules and packages to structure a Python program.
6. Write a Python class for managing student data using Object-Oriented Programming concepts.
7. Develop a program using iterators, generators, and decorators for customized data processing.
8. Create NumPy arrays and perform basic operations: slicing, indexing, reshaping, and broadcasting.
9. Perform mathematical and statistical operations (mean, sum, min, max) on NumPy arrays.
10. Use NumPy for matrix multiplication, finding inverse and eigenvalues of a matrix.
11. Create a Pandas DataFrame from a CSV file and perform indexing, filtering, and selection.
12. Handle missing data in Pandas using fillna(), dropna(), and detect duplicates.
13. Perform grouping and aggregation operations using groupby(), and merge/join DataFrames
14. Create pivot tables, rank data, rename columns, and combine DataFrames using append() and concat().
15. Use Pandas and Matplotlib to plot line and bar charts with custom labels, titles, and legends.

Reference Books:

1. Python for Data Analysis – Wes McKinney (O'Reilly)
2. Python Data Science Handbook – Jake VanderPlas (O'Reilly)
3. Think Stats – Allen B. Downey (O'Reilly)
4. Hands-On Data Analysis with Pandas – Stefanie Molin (Packt)
5. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow – Aurélien Géron (O'Reilly)
6. Python Machine Learning – Sebastian Raschka (Packt)

Course Structure:

Major 2 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCMGCP1355	React JS (P)	--	04	--	02	02

Major 2 -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA	CA	ESA	
		Test I	Test II	Sum of T1 & T2				
SCMGCP1355	React JS (P)	--	--	--	--	20	30	50

SCMGCP1355: React JS (P) (Major 2) Curriculum Details

Course pre-requisite:

1. Basic knowledge of HTML, CSS, and JavaScript.
2. Basic understanding of programming concepts.

Course Objectives:

1. To understand modern JavaScript (ES6+) concepts.
2. To learn fundamentals of React and component-based architecture.
3. To develop dynamic web applications using React features like hooks, routing, and state management.

Course Outcomes:

1. Understand and use modern JavaScript features like arrow functions,
2. destructuring, async/await, etc.
3. Build reusable UI components using React concepts such as JSX,
4. props, and state.
5. Develop interactive web applications using hooks, forms, routing, and.
6. state management libraries like Redux.

Curriculum Details:

List of Practical

1. Implement Basic JavaScript Concepts
2. Implement Functions in JavaScript
3. Implement Array and Object Operations
4. Implement Promises and Async/Await
5. Create First React Application
6. Create Simple React Component
7. Implement Props in React
8. Implement State in React
9. Design a Simple Form in ReactJS
 - i. Validation of Form using JavaScript
10. Implement Various Types of Styling in React
11. Display JSX Elements in React
12. Using Different React Hooks
13. Build Menu using JSX
14. Learn React Router Navigation
15. Learn Basics of Redux / Next.js

Text Books:

1. AZAT MARDAN (as appeared on the book), “React Quickly”, ISBN 9781617293344, ©2017 by Manning Publications, Edition First.

Reference Books:

1. Learning React
Functional Web Development with React and Redux, Alex Banks and Eve Porcello, isbn=9781491954553 f, First Edition, O'Reilly

Course Structure:

Minor 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCMGET1351	Enterprise Infrastructure and Cloud Technologies - Part II	45	--	03	--	45

Minor 1 -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA	CA	ESA	
		Test I	Test II	Sum of T1 & T2				
SCMGET1351	Enterprise Infrastructure and Cloud Technologies - Part II (P)	15	15	30	45	--	--	75

SCMGET1351: Enterprise Infrastructure and Cloud Technologies - Part II (P) (Minor 1) Curriculum Details

Course pre-requisite:

1. To provide a foundational understanding of Basic Computer Fundamentals.
2. To provide a foundational Understanding of Networking Basics.
3. To provide a Basic Knowledge of Operating Systems.
4. To enable learners Basic Security Concepts.

Course Objectives:

1. To develop hands-on skills in Linux server administration, including file systems, package management, and backup.
2. To introduce virtualization concepts and tools like Hyper-V, VMware vSphere/vCenter, and resource management.
3. To provide in-depth knowledge of cloud computing models, services (IaaS, PaaS, SaaS), and platforms like AWS and Azure.
4. To enable learners to understand and apply cloud security principles and resource provisioning techniques.
5. To familiarize students with enterprise backup solutions and infrastructure monitoring tools.

Course Outcomes:

After completing this course, the student will be able to:

1. Configure and manage Linux servers, handle user permissions, backups, and system logging.
2. Deploy and operate virtual machines and manage virtual infrastructure using Hyper-V and VMware.
3. Understand and differentiate between various cloud service models and providers, and utilize core services on AWS and Azure.
4. Implement basic cloud security practices, manage virtual resources, and perform cloud-based deployments.
5. Use backup technologies and monitoring tools to ensure system availability and troubleshoot issues effectively.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Linux Server Administration	15
	1.1	RHEL/ Cent OS Overview, Boot Process, and GRUB2	
	1.2	Filesystem Hierarchy, Shell Environment, Text Editors.	
	1.3	User and Group Management, File Permissions, ACLs	
	1.4	RPM, YUM, Dependency Management, Patching	
	1.5	System Logging, Snapshots, Backup/Restore.	
	1.6	Basic Linux Command, Linux Administration command	
2.0		Virtualization	9
	2.1	Hypervisors, Hyper-V, VMware vSphere/vCenter	
	2.2	Configuring VMs, Networking, Storage, HA/DRS	
	2.3	vMotion, Templates, Resource Pools, dvSwitches	
3.0		Cloud Computing	12
	3.1	Cloud Computing Fundamentals, Deployment Models	
	3.2	SaaS, PaaS, IaaS and Key Providers (AWS, Azure, GCP)	
	3.3	Cloud Security, Navigation, and Resource Management	
	3.4	AWS EC2, S3, VPC, IAM;	
	3.5	Azure VM, Storage, Networking.	
4.0		Backup, and Monitoring	9

	4.1	Backup Technologies: Disk, Tape, Veeam, TSM, NetBackup	
	4.2	VM Backups, Restoration, Deduplication, Troubleshooting	
	4.3	Infra Monitoring Tools: Nagios.	
		Total	45

Text Books:

1. Sara Perrott, "Windows Server 2019 & PowerShell All-in-One For Dummies", Wiley, 2021.
2. Sander van Vugt, "Red Hat RHCSA 8 Cert Guide: EX200", Pearson IT Certification, 2021.
3. Brian Desmond, Joe Richards, Robbie Allen, "Active Directory: Designing, Deploying, and Running Active Directory," O'Reilly Media, 5th Edition, 2019.
4. Nick Marshall, "Mastering VMware vSphere 7", Wiley, 2021.
5. Mustafa Toroman, "Hands-On Cloud Administration in Azure", Packt, 2020.

Reference Books:

1. Computer Networks" by Andrew S. Tanenbaum and David J. Wetherall, 5th Edition, Pearson Education, 2011.
2. William Stallings, "Operating Systems: Internals and Design Principles," Pearson Education, **Vol:9th** Edition, 2018.
3. Tom Carpenter, "Microsoft Windows Server 2019 Administration Fundamentals," Sybex (Wiley), **Volume:** 1st Edition, 2019.
4. Brian Ward, "How Linux Works: What Every Superuser Should Know," No Starch Press, 2nd Edition, 2014.

Course Structure:

Minor 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCMGEP1351	Enterprise Infrastructure and Cloud Technologies - Part II (P)	--	10	--	01	01

Minor 1 -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SCMGEP1351	Enterprise Infrastructure and Cloud Technologies - Part II (P)	--	--	--	--	10	15	25

SCMGEP1351: Enterprise Infrastructure and Cloud Technologies - Part II (P)(Minor 1) Curriculum Details

Course pre-requisite:

1. To provide a foundational understanding of Basic Computer Fundamentals.
2. To provide a foundational Understanding of Networking Basics.
3. To provide a Basic Knowledge of Operating Systems.
4. To enable learners Basic Security Concepts.

Course Objectives:

1. To develop hands-on skills in Linux server administration, including file systems, package management, and backup.
2. To introduce virtualization concepts and tools like Hyper-V, VMware vSphere/vCenter, and resource management.
3. To provide in-depth knowledge of cloud computing models, services (IaaS, PaaS, SaaS), and platforms like AWS and Azure.
4. To enable learners to understand and apply cloud security principles and resource provisioning techniques.
5. To familiarize students with enterprise backup solutions and infrastructure monitoring tools.

Course Outcomes:

After completing this course, the student will be able to:

1. Configure and manage Linux servers, handle user permissions, backups, and system logging.
2. Deploy and operate virtual machines and manage virtual infrastructure using Hyper-V and VMware.
3. Understand and differentiate between various cloud service models and providers, and utilize core services on AWS and Azure.
4. Implement basic cloud security practices, manage virtual resources, and perform cloud-based deployments.
5. Use backup technologies and monitoring tools to ensure system availability and troubleshoot issues effectively.

Curriculum Details:

List of Practical

1. Install Linux (RHEL/CentOS) and Set Up Users & ACLs Partitioning, user creation, chmod, setfacl, etc.)
2. Demonstrate Linux patching.
3. Configuring Network interfaces – NUMTUI/NUMCLI
4. Server Troubleshooting- Boot, Package, Services, Discover Services
5. Service Monitoring and Patch Management using YUM
 - a. Enable repo, install updates, monitor with top, systemctl.
6. Create and Manage VMs in VMware vSphere or Hyper-V
 - a. Install hypervisor, create VM, snapshot, clone
7. Launch and Access EC2 Instances on AWS
 - a. Key pair creation, EC2 instance launch, inbound rules, remote access.
8. Configure S3 Bucket and Lifecycle Policies
 - a. Create bucket, enable versioning, lifecycle rule to archive/delete.
9. Create and Manage VPC with Subnets and Security Groups (AWS)
 - a. Design private/public subnets, attach IGW, and route tables.
10. Azure VM Deployment and Storage Blob Configuration
 - a. Create VM, configure VNet, attach a blob container for backup.
11. IAM Role and Policy Creation in AWS (Create custom IAM roles)
12. IN AWS, demonstrate how to attach to EC2 instance for access control.

13. Configure Cloud Backup using AWS
14. Configure Cloud Backup using Azure Services
15. Snapshot of EC2 instance / Azure VM backup vault.

Text Books:

1. Sara Perrott, "Windows Server 2019 & PowerShell All-in-One For Dummies", Wiley, 2021.
2. Sander van Vugt, "Red Hat RHCSA 8 Cert Guide: EX200", Pearson IT Certification, 2021.
3. Brian Desmond, Joe Richards, Robbie Allen, "Active Directory: Designing, Deploying, and Running Active Directory," O'Reilly Media, 5th Edition, 2019
4. Nick Marshall, "Mastering VMware vSphere 7", Wiley, 2021.
5. Mustafa Toroman , "Hands-On Cloud Administration in Azure" , Packt, 2020

Reference Books:

1. Computer Networks" by Andrew S. Tanenbaum and David J. Wetherall, 5th Edition, Pearson Education, 2011
2. William Stallings, "Operating Systems: Internals and Design Principles," Pearson Education, **Vol:9th** Edition, 2018
3. Tom Carpenter, "Microsoft Windows Server 2019 Administration Fundamentals," Sybex (Wiley), **Volume:** 1st Edition, 2019
4. Brian Ward, "How Linux Works: What Every Superuser Should Know," No Starch Press, 2nd Edition, 2014

Course Structure:

Vocational Course -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCMGVC1351	Internet of Things (IOT)	--	20	--	2	2

Vocational Course -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SCMGVC1351	Internet of Things (IOT)	--	--	--	--	20	30	50

SCMGVC1351: Internet of Things (IOT) (Vocational Course) Curriculum Details

Course pre-requisite:

1. Arduino UNO or Rasberry-Pie or ESP32 Board, Computer, USB Cable, Breadboard, Jumper Wires, Basic Electronic Components (LEDs, resistors, push buttons, potentiometer and etc.), **Optional** - “Arduino Starter Kit.
2. Basic programming concepts (e.g., variables, loops, conditionals in C/C++ or similar).
3. Fundamentals of electronics (e.g., resistors, LEDs, sensors, Ohm's law).
4. Fundamentals of microcontrollers and digital/analog I/O.

Course Objectives:

1. Introduce students to IoT characteristics, hardware platforms (Arduino, Raspberry Pi, ESP32), and simulation tools for rapid prototyping.
2. Enable hands-on interfacing of sensors, actuators, and modules with Arduino to build interactive embedded systems.
3. Develop skills in designing and implementing real-world IoT applications, such as detection systems and motor control.

Course Outcomes:

1. Students will be able to install, configure, and simulate Arduino IDE environments for IoT experimentation.
2. Students will demonstrate proficiency in interfacing and controlling sensors (e.g., LM35, photoresistor), actuators (e.g., servo, DC motor, relay), and output devices (e.g., RGB LED, buzzer).

3. Students will design and troubleshoot complete IoT projects, like intrusion detection systems, integrating multiple components.

Curriculum Details:

List of Practical

1. Explore Characteristics and Communications of the IOT.
2. Introduction of Arduino, Raspberry Pie and ESP32.
3. Installation of Arduino IDE and testing.
4. Demonstrate Online Simulator for doing Arduino based practical.
5. Study to different IOT based sensors and actuators.
6. Controlling the Light Emitting Diode (LED) with a push button.
7. Interfacing the RGB LED with the Arduino.
8. Controlling the LED blink rate with the potentiometer interfacing with Arduino.
9. Detection of the light using photo resistor.
10. Interfacing of temperature sensor LM35 with Arduino.
11. Interfacing Servo Motor with the Arduino.
12. Interfacing of the Active Buzzer with Arduino.
13. Interfacing of the Relay with Arduino.
14. Building Intrusion Detection System with Arduino and Ultrasonic Sensor.
15. Directional Control of the DC motor using Arduino.

Reference Books:

1. Introduction to IoT by Sudip Misra, Anandarup Mukherjee, Arijit Roy | Publication Cambridge University Press | ISBN 9781108842952, ISBN 9781108959742.
2. The Internet of things_ do-it-yourself projects with Arduino, Raspberry Pi, and BeagleBone Black | ISBN: 978-0-07-183521-3
3. "Arduino Cookbook" by Michael Margolis (O'Reilly Media) – Covers practical Arduino interfacing and IoT projects.

Web References:

1. <https://wokwi.com/>
2. <https://www.vlab.co.in/broad-area-computer-science-and-engineering>
3. Arduino Official Documentation: <https://www.arduino.cc/reference/en/> – For IDE setup, libraries, and code examples.
4. Tinkercad Circuits Simulator: <https://www.tinkercad.com/learn/circuits> – Free online Arduino simulator.

5. Random Nerd: <https://randomnerdtutorials.com/> – Tutorials on sensors, motors, and projects like intrusion detection.

Paper Format for 45 Marks

Time: 2:30 Hour

Marks :45

Note:

I Q.1 is compulsory.

II Solve any 2 Questions from Question number 2 to 5.

III Figures to the Right indicates Full Marks.

IV Assume suitable data whenever necessary.

Q.1 Attempt the following. (on all 4 Units) 15

- a)
- b)
- c)
- d)
- e)

Q. 2 Attempt the following. (on First Unit) 15

- a)
- b)
- c)

Q. 3 Answer the following. (on Second Unit) 15

- a)
- b)
- c)

Q. 4 Attempt the following. (on Third Unit) 15

- a)
- b)
- c)

Q .5 Write short note on. (on Forth Unit) 15

- a)
- b)
- c)

Paper Format for 30 Marks

Time: 2:00 Hour

Marks :30

Note:

I Q.1 is compulsory.

II Solve any 2 Questions from Question number 2 to 5.

III Figures to the Right indicates Full Marks.

IV Assume suitable data whenever necessary.

Q.1 Attempt the following. (on all 4 Units)

10

a)

b)

c)

d)

Q. 2 Attempt the following. (on First Unit)

10

a)

b)

Q. 3 Answer the following. (on Second Unit)

10

a)

b)

Q. 4 Attempt the following. (on Third Unit)

10

a)

b)

Q .5 Write short note on. (on Forth Unit)

10

a)

b)
