



॥ 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 मुल्यमापन 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. Information Technology (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 **INT** 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: **INT** (Major) / **DSM** (Minor 1)

B.Sc. Information Technology (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	SINTCT1301 (T 3Cr) SINTCT1302 (T 3Cr) SINTIK1303 (T 2Cr) SINTCP1304 (P 2Cr) SINTCP1305 (P 2Cr) 12 Credits	SINTET1301 (T 3Cr) SINTEP1301 (P 1Cr) 4 Credits			SINTVC1301 2 Credits		SINTFP1301 4 Credits	22	44
	VI	SINTCT1351 (T 3Cr) SINTCT1352 (T 3Cr) SINTCT1353 (T 2Cr) SINTCP1354 (P 2Cr) SINTCP1355 (P 2Cr) 12 Credits	SINTET1351 (T 3Cr) SINTEP1351 (P 1Cr) 4 Credits			SINTVC1351 2 Credits		SINTOJ1351 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
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B. Sc. IT 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	SINTCT1301 (3 Cr)	Hibernate and Spring Framework	03	--	12	04	--
	SINTCT1302 (3 Cr)	Python for Data Science	03	--		04	--
	SINTIK1303 (2 Cr)	Introduction to super computing	02	---		02	--
	SINTCP1304 (2 Cr)	Hibernate and Spring Framework (P)	--	02		--	02
	SINTCP1305 (2 Cr)	Python for Data Science (P)	--	02		--	02
Optional 2	SINET1301 (3 Cr)	Enterprise Infrastructure and Cloud Technologies - Part I	03	--	04	04	--
	SINTEP1301 (1 Cr)	Enterprise Infrastructure and Cloud Technologies - Part I (P)	--	01		--	01
Vocational & Skill Enhancement Course	SINTVC1301 (2 Cr)	Mongo DB	--	02	02	--	02
Field Work / Project/Internship	SINTFP1301 (4 Cr)	Project	--	04	04	--	04
Total Credits			11	11	22	14	11



B. Sc. IT 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	SINTCT1301 (3 Cr)	Hibernate and Spring Framework	15	15	30	45	--	--	75
	SINTCT1302 (3 Cr)	Python for Data Science	15	15	30	45	--	--	75
	SINTIK1303 (2 Cr)	Introduction to super computing	10	10	20	30	--	--	50
	SINTCP1304 (2 Cr)	Hibernate and Spring Framework (P)	--	--	--	--	20	30	50
	SINTCP1305 (2 Cr)	Python for Data Science (P)	--	--	--	--	20	30	50
Optional 2	SINET1301 (3 Cr)	Enterprise Infrastructure and Cloud Technologies - Part I	15	15	30	45	--	--	75
	SINTEP1301 (1 Cr)	Enterprise Infrastructure and Cloud Technologies - Part I (P)	--	--	--	--	10	15	25
Vocational & Skill Enhancement Course	SINTVC1301 (2 Cr)	Mongo DB	--	--	--	--	20	30	50
Field Work / Project/Internship	SINTFP1301 (4 Cr)	Project	--	--	--	--	40	60	100



B. Sc. IT 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	SINTCT1351 (3 Cr)	Mobile Application Development using Kotlin	03	--	12	04	--
	SINTCT1352 (3 Cr)	Computer Vision and Image Analysis	03	--		04	--
	SINTCT1353 (2 Cr)	Introduction to AIML	02	---		02	--
	SINTCP1354 (2 Cr)	Mobile Application Development using Kotlin (P)	--	02		--	02
	SINTCP1355 (2 Cr)	Computer Vision and Image Analysis (P)	--	02		--	02
Optional 2	SINET1351 (3 Cr)	Enterprise Infrastructure and Cloud Technologies - Part II	03	--	04	04	--
	SINTEP1351 (1 Cr)	Enterprise Infrastructure and Cloud Technologies - Part II (P)	--	01		--	01
Vocational & Skill Enhancement Course	SINTVC1351 (2 Cr)	Data Visualization	--	02	02	--	02
On Job Training: (Internship/Apprenticeship)	SINTOJ1351 4 Credits	-----	--	04	04	--	04
Total Credits			11	11	22	14	11



B. Sc. IT 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	SINTCT1351 (3 Cr)	Mobile Application Development using Kotlin	15	15	30	45	--	--	75
	SINTCT1352 (3 Cr)	Computer Vision and Image Analysis	15	15	30	45	--	--	75
	SINTCT1353 (2 Cr)	Introduction to AIML	10	10	20	30	--	--	50
	SINTCP1354 (2 Cr)	Mobile Application Development using Kotlin (P)	--	--	--	--	20	30	50
	SINTCP1355 (2 Cr)	Computer Vision and Image Analysis (P)	--	--	--	--	20	30	50
Optional 2	SINET1351 (3 Cr)	Enterprise Infrastructure and Cloud Technologies - Part II	15	15	30	45	--	--	75
	SINTEP1351 (1 Cr)	Enterprise Infrastructure and Cloud Technologies - Part II (P)	--	--	--	--	10	15	25
Vocational & Skill Enhancement Course	SINTVC1351 (2 Cr)	Data Visualization	--	--	--	--	20	30	50
On Job Training: (Internship/Apprenticeship)	SINTOJ1351 4 Credits	-----	--	--	--	--	40	60	100

Curriculum Details

Course Structure:

Major 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SINTCT1301	Hibernate and Spring Framework	45	--	03	--	03

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				
SINTCT1301	Hibernate and Spring Framework	15	15	30	45	--	--	75

SINTCT1301: Hibernate and Spring Framework (Major 1) Curriculum Details

Course pre-requisite:

1. Basic knowledge of Java programming (Core Java).
2. Familiarity with database concepts and SQL.
3. Basic knowledge of HTML, CSS and JavaScript.
4. Understanding of servlets and JSP.

Course Objectives:

1. To Understand ORM using Hibernate.
2. To Learn Spring Core (IoC, DI, Beans).
3. To Develop web applications using Spring MVC.
4. To Build modern REST APIs using Spring Boot.
5. To Integrate all frameworks for enterprise applications.

Course Outcomes:

Students will be able to:

1. Understand ORM concepts and implement database operations using Hibernate.
2. Apply Hibernate features such as mapping, associations and HQL.

3. Implement core concepts of Spring Framework.
4. Develop web applications using Spring MVC architecture.
5. Build and deploy RESTful applications using Spring Boot.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Hibernate (ORM Framework)	
	1.1	Introduction to ORM and Hibernate	12
	1.2	Features and Advantages of Hibernate	
	1.3	Hibernate Architecture	
	1.4	Hibernate Setup and Configuration	
	1.5	Mapping Techniques	
	1.6	Hibernate Object Lifecycle	
	1.7	CRUD Operations	
	1.8	Hibernate Query Language	
2.0		Spring Core	
	2.1	Introduction to Spring Framework	11
	2.2	Spring Architecture & Modules	
	2.3	Inversion of Control (IoC)	
	2.4	Dependency Injection (DI)	
	2.5	Bean Configuration	
	2.6	Bean Scope & Lifecycle	
	2.7	Autowiring	
	2.8	Spring Expression Language (SpEL)	
3.0		Spring MVC	
	3.1	Introduction to Web Frameworks	12
	3.2	Spring MVC Architecture	
	3.3	Application Flow	
	3.4	Configuration of Spring MVC	
	3.5	Controllers & Request Mapping	
	3.6	View Technologies (JSP, Thymeleaf - Intro)	
	3.7	Form Handling	
	3.8	RESTful Services using Spring MVC	
4.0		Spring Boot	
	4.1	Introduction to Spring Boot, Advantages & Features	10
	4.2	Spring Boot Architecture	
	4.3	Creating Applications	
	4.4	Spring Boot Starters	

	4.5	application.properties / YAML	
	4.6	Spring Boot + Hibernate (JPA)	
	4.7	REST API Development	
		Total	45

Reference Books:

1. Spring in Action, Sixth Edition, Author: Craig Walls
2. Spring Boot in Action, Author: Craig Walls
3. Java Persistence with Hibernate, Authors: Gavin King, Christian Bauer.
4. Spring Persistence with Hibernate, Authors: Paul Fisher, Brian Murphy
5. Java Persistence with Spring Data and Hibernate, Author: Catalin Tudose

Course Structure:

Major 2 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SINTCT1302	Python for Data Science	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	
SINTCT1302	Python for Data Science	15	15	30	45	--	--	75

SINTCT1302: Python for Data Science (Major 2) 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 3 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SINTIK1303	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	
SINTIK1303	Introduction to Super Computing	10	10	20	30	--	--	50

SINTIK1303: 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	7
	1.1	Introduction to Supercomputing: Definition, need, evolution from mainframes to supercomputers	
	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	8
	2.1	Parallel Computing Models: Shared memory, distributed memory, hybrid models	
	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
SINTCP1304	Hibernate and Spring Framework (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	
SINTCP1304	Hibernate and Spring Framework (P)	--	--	--	--	20	30	50

SINTCP1304: Hibernate and Spring Framework (P) (Major 1) Curriculum Details

Course pre-requisite:

1. Basic knowledge of Java programming (Core Java).
2. Familiarity with database concepts and SQL.
3. Basic knowledge of HTML, CSS and JavaScript.
4. Understanding of servlets and JSP.

Course Objectives:

1. To Understand ORM using Hibernate.
2. To Learn Spring Core (IoC, DI, Beans).
3. To Develop web applications using Spring MVC.
4. To Build modern REST APIs using Spring Boot.
5. To Integrate all frameworks for enterprise applications.

Course Outcomes:

Students will be able to:

1. Understand ORM concepts and implement database operations using Hibernate.
2. Apply Hibernate features such as mapping, associations and HQL.

3. Implement core concepts of Spring Framework.
4. Develop web applications using Spring MVC architecture.
5. Build and deploy RESTful applications using Spring Boot

Curriculum Details:

List of Practical

1. Write a program to create a simple Hibernate application to perform CRUD operations.
2. Write a program to implement annotation-based mapping for an entity class.
3. Write a program to demonstrate Hibernate Query Language (HQL).
4. Write a program to create a Spring application using XML-based configuration.
5. Write a program to implement Dependency Injection (DI) using constructor injection.
6. Write a program to implement Dependency Injection (DI) using setter injection.
7. Write a program to demonstrate Bean lifecycle methods.
8. Write a program to implement Autowiring using annotations.
9. Write a program to develop a basic Spring MVC web application (Hello World).
10. Write a program to create a web application using Controller and Request Mapping
11. Write a program to create a form-based application with form handling.
12. Write a program to create application using Spring MVC and Hibernate.
13. Write a program to Create a Spring Boot application with basic REST endpoint.
14. Write a program to develop RESTful APIs for CRUD operations using Spring Boot + Hibernate (JPA).
15. Build a mini project (Student/Employee/Library Management System) using Spring Boot, Spring MVC concepts, and Hibernate integration.

Reference Books:

1. Spring in Action, Sixth Edition, Author: Craig Walls
2. Spring Boot in Action, Author: Craig Walls
3. Java Persistence with Hibernate, Authors: Gavin King, Christian Bauer.
4. Spring Persistence with Hibernate, Authors: Paul Fisher, Brian Murphy
5. Java Persistence with Spring Data and Hibernate, Author: Catalin Tudose

Course Structure:

Major 2 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SINTCT1305	Python for Data Science (P)	--	20	--	02	02

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	
SINTCT1305	Python for Data Science (P)	--	--	--	--	20	30	50

SINTCT1305: Python for Data Science (P) (Major 2) 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:

Minor 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SINETET1301	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			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SINTET1301	Enterprise Infrastructure and Cloud Technologies - Part I	15	15	30	45	--	--	75

SINETET1301: 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
SINTEP1301	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	CA	ESA	
		Test I	Test II	Sum of T1 & T2				
SINTEP1301	Enterprise Infrastructure and Cloud Technologies - Part I (P)	--	--	--	--	10	15	25

SINTEP1301: 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
SINTVC1301	Mongo DB	--	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	
SINTVC1301	Mongo DB	--	--	--	--	20	30	50

SINTVC1301: Mongo DB (Vocational Course) Curriculum Details

Course pre-requisite:

1. Familiarity with JSON structures specifically key-value pairs and arrays
2. Basic comfort using a terminal or command prompt is necessary for running the MongoDB Shell (mongosh)

Course Objectives:

1. MongoDB course would enable the students in understanding Basics of NoSQL Databases to design the queries.
2. Learn how to design Queries
3. Learn fundamental concepts of Mongo DB such as. secondary indexes, range queries, sorting and aggregations

Course Outcomes:

1. To covers aspects on Big Data, NOSQL and details on architecture and development on MongoDB.
2. To use sorting, aggregations, geospatial indexes and server-side rendering
3. To design program using MongoDB

Curriculum Details:

B.Sc. Information Technology (Single Major) Third Year under the Faculty of Sci. & Tech of S.R.T.M.U., Nanded

List of Practical

1. Install MongoDB and MongoDB Compass
2. Explore MongoDB Shell Commands (Use show dbs, use database_name, show collections)
3. Create studentdb inside Create student collection and Insert sample student records
4. Create documents using String, Number, Boolean, Array, Object, Date, Null data types
5. Use of insertMany() for multiple student records
6. Use of deleteOne() and deleteMany()
7. Update Documents with Modifiers \$set, \$unset, \$inc, \$rename
8. Return Updated Documents from collection
9. Retrieve all documents from collection
10. Retrieve documents with conditions
11. write query to use Use projection {name:1, age:1}
12. Query Conditionals \$gt, \$lt, \$eq, \$ne, \$in, \$or
13. Use sort() ascending/descending Use limit() Use skip()
14. Indexing in MongoDB
15. Use aggregate() pipeline with Aggregation Pipeline Operations

Text Books:

1. Schwarzmüller, Maximilian, “*MongoDB: The Complete Developer’s Guide: Become a MongoDB Development Expert: CRUD, Indexes, Aggregation Framework – All-in-One!*”, Vol. 1, 1st Edition, Packt Publishing, 2018.
2. Bradshaw, Shannon; Brazil, Eoin; Chodorow, Kristina, “*MongoDB: The Definitive Guide*”, Vol. 3, 3rd Edition, O’Reilly Media, Inc., 2019

Reference Books:

1. Chodorow, Kristina, “*MongoDB: The Definitive Guide: Powerful and Scalable Data Storage*”, Vol. 2, 2nd Edition, O’Reilly Media, 2013.
2. Practical MongoDB: Architecting, Developing, and Administering MongoDB Shakuntala Gupta Edward NavinSabharwal Published by APRESS, First Edition

Course Structure:

B.Sc. Information Technology (Single Major) Third Year under the Faculty of Sci. & Tech of S.R.T.M.U., Nanded

Major 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SINTCT1351	Mobile Application Development using Kotlin	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	
SINTCT1351	Mobile Application Development using Kotlin	15	15	30	45	--	--	75

SINTCT1351: Mobile Application Development with kotlin (Major 1) Curriculum Details

Course pre-requisite:

1. Understanding of any programming language (C, C++, or Java preferred)
2. Ability to write, compile, and debug simple programs

Course Objectives:

1. Understand the fundamentals of mobile application development and the architecture of Android using Android Studio.
2. Learn and apply programming concepts using Kotlin for building Android applications.
3. Design and develop user-friendly interfaces using Android UI components, layouts, and Material Design principles.

Course Outcomes:

1. Design and implement user interfaces using layouts, widgets, and event handling mechanisms, and analyze UI performance.
2. Explain the fundamentals of Android architecture, components, and development environment using Android Studio.
3. Analyze and implement different data storage techniques such as SQLite, Shared Preferences.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Introduction to Android	10
	1.1	Basic components of Android.	
	1.2	Activity life cycle.	
	1.3	Android Application Structure.	
	1.4	Working with AndroidManifest.xml.	
	1.5	Layouts.	
	1.6	Intents.	
2.0		Introduction to Kotlin and Its Features:	11
	2.1	Program Structure, Variables, Data Type.	
	2.2	Operators, Input /Output, Control Statements.	
	2.3	Looping Statements.	
	2.4	Arrays.	
	2.5	Functions.	
3.0		Classes and Exception Handling	12
	3.1	Classes and Objects	
	3.2	Constructor, Visibility Modifiers,	
	3.3	Inheritance,	
	3.4	Exception Handling, try, catch, finally.	
4.0		User Interface and Managing Database	12
	4.1	TextView, EditText, Buttons, Checkboxes, Radio Buttons, Toggle Buttons.	
	4.2	Spinners, TimePicker, DatePicker.	
	4.3	List View, WebView.	
	4.4	Menus, Toast, Dialogs.	
	4.5	Shared Preferences, SQLite Databases.	
		Total	45

Text Books:

1. Android Programming with Kotlin for Beginners, by John Horton
2. Kotlin in Action, by Sebastian Aigner, Roman Elizarov, Svetlana Isakova, and Dmitry Jemerov
3. Learn Android App Development, by Wallace Jackson

Reference Books:

1. Android Programming: The Big Nerd Ranch Guide, by Bryan Sills, Brian Gardner.

2. Android Development For SPPU B.E. E &TC Engineering Sem 8 by Prof. Ashwini Mane (Author), Prof. Vikram P. Deokate (Author), Prof. Nikhilesh P. Mankar (Author).
3. Android Recipes: A Problem-solution Approach, by Dave Smith, 2011.

Course Structure:

Major 2 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SINTCT1352	Computer Vision and Image Analysis	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				
SINTCT1352	Computer Vision and Image Analysis	15	15	30	45	--	--	75

SINTCT1352: Computer Vision and Image Analysis (Major 2) Curriculum Details

Course pre-requisite:

1. To understand Image Processing Fundamentals: Knowledge of filtering, color spaces, geometric transformations, and Fourier transforms is critical.
2. To understand Machine Learning (ML): Basic knowledge of supervised learning and neural networks is necessary to understand modern approaches.
3. To understand Libraries and Frameworks: Familiarity with OpenCV (for computer vision tasks) and numerical computing libraries like NumPy or frameworks like PyTorch/TensorFlow is highly recommended.

Course Objectives:

1. To understand digital image processing principles.
2. To apply image processing techniques and to implement image enhancement and restoration.
3. Perform image segmentation and object detection, & To extract features for analysis and classification. To develop Python applications for image processing tasks.

Course Outcomes:

1. Acquire proficiency in digital image processing fundamentals.
2. Demonstrate competence in utilizing Python for image processing
3. Execute techniques for image enhancement and restoration effectively.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Introduction to Digital Image Processing	12
	1.1	Basics of digital images	
	1.2	Image representation (grayscale, RGB, etc.), Image acquisition and sampling, Histogram Processing and equalization	
	1.3	Spatial domain methods (e.g., filtering)	
	1.4	Frequency domain methods (e.g., Fourier transform)	
2.0		Image Restoration	12
	2.1	Image degradation models, Noise reduction techniques	
	2.2	Image Blurring and sharpening, Thresholding techniques	
	2.3	Edge detection of Image, Region-based segmentation	
	2.4	Texture analysis, Shape descriptors, Corner detection	
3.0		Introduction to Python Libraries for Image Processing	08
	3.1	Overview of OpenCV	
	3.2	Scikit-image, and NumPy	
	3.3	Installation and setup	
	3.4	Loading and displaying images	
4.0		Feature Extraction & Applications of Image Processing.	13
	4.1	Introduction to feature extraction	
	4.2	Texture analysis using gray-level co-occurrence matrix (GLCM	
	4.3	Medical image processing: MRI and CT image analysis	
	4.4	Remote sensing applications: satellite image processing	
		Total	45

Text Books:

1. Gonzalez, R.C., Woods, R.E., & Eddins, S.L. (2018). Digital Image Processing Using MATLAB.
2. Szeliski, R. (2010). Computer Vision: Algorithms and Applications

Reference Books:

1. Burger, W., & Burge, M.J. (2016). Digital Image Processing: An Algorithmic Approach with MATLAB.
2. Sonka, M., Hlavac, V., & Boyle, R. (2014). Image Processing, Analysis, and Machine Vision

Course Structure:

Major 3 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SINTCT1353	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	
SINTCT1353	Introduction to AIML	10	10	20	30	---	----	50

SINTCT1353: 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	7
2.0		Introduction to Machine Learning	
	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	7
3.0		Data Preprocessing & Exploration	
	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	8
4.0		Supervised Learning Algorithms	
	4.1	Regression: Linear Regression, Polynomial Regression	
	4.2	Classification: Logistic Regression, K-Nearest Neighbors (KNN), Decision Trees, Support Vector Machines (SVM)	8
	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
SINTCP1354	Mobile Application Development using Kotlin (P)	--	20	--	02	02

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	
SINTCP1354	Mobile Application Development using Kotlin (P)	--	--	--	--	20	30	50

SINTCP1354: Mobile Application Development using Kotlin (P) (Major 1) Curriculum Details

Course pre-requisite:

1. Understanding of any programming language (C, C++, or Java preferred)
2. Ability to write, compile, and debug simple programs

Course Objectives:

1. Understand the fundamentals of mobile application development and the architecture of Android using Android Studio.
2. Learn and apply programming concepts using Kotlin for building Android applications.
3. Design and develop user-friendly interfaces using Android UI components, layouts, and Material Design principles.

Course Outcomes:

1. Design and implement user interfaces using layouts, widgets, and event handling mechanisms, and analyze UI performance.
2. Explain the fundamentals of Android architecture, components, and development environment using Android Studio.
3. Analyze and implement different data storage techniques such as SQLite, Shared Preferences.

Curriculum Details:

List of Practical

1. Create a Hello World App in Kotlin.
2. Handle Activity Lifecycle methods.
3. Design UI using LinearLayout, RelativeLayout, ConstraintLayout.
4. Design simple UI using TextView, Button, EditText.
5. Handle button click events in Kotlin.
6. Create a Login Form (Validation).
7. WAP to implement menus.
8. Implement Explicit Intent (navigate between activities).
9. Implement Implicit Intent (call).
10. Pass data between activities using Intent.
11. WAP to implement toggle button.
12. Implement ListView.
13. WAP to implements webview.
14. Store data using SharedPreferences.
15. Implement SQLite Database (CRUD operations).

Text Books:

1. Android Programming with Kotlin for Beginners, by John Horton
2. Kotlin in Action, by Sebastian Aigner, Roman Elizarov, Svetlana Isakova, and Dmitry Jemerov
3. Learn Android App Development, by Wallace Jackson

Reference Books:

1. Android Programming: The Big Nerd Ranch Guide, by Bryan Sills, Brian Gardner.
2. Android Development For SPPU B.E. E &TC Engineering Sem 8 by Prof. Ashwini Mane (Author), Prof. Vikram P. Deokate (Author), Prof. Nikhilesh P. Mankar (Author).
3. Android Recipes: A Problem-solution Approach, by Dave Smith, 2011.

Course Structure:

Major 2 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SINTCP1355	Computer Vision and Image Analysis (P)	--	20	--	02	02

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	
SINTCP1355	Computer Vision and Image Analysis (P)	--	--	--	--	20	30	50

SINTCP1355: Computer Vision and Image Analysis (P) (Major 2) Curriculum Details

Course pre-requisite:

1. To understand Image Processing Fundamentals: Knowledge of filtering, color spaces, geometric transformations, and Fourier transforms is critical.
2. To understand Machine Learning (ML): Basic knowledge of supervised learning and neural networks is necessary to understand modern approaches.
3. To understand Libraries and Frameworks: Familiarity with OpenCV (for computer vision tasks) and numerical computing libraries like NumPy or frameworks like PyTorch/TensorFlow is highly recommended.

Course Objectives:

1. To understand digital image processing principles.
2. To apply image processing techniques and to implement image enhancement and restoration.
3. Perform image segmentation and object detection, & To extract features for analysis and classification. To develop Python applications for image processing tasks.

Course Outcomes:

1. Acquire proficiency in digital image processing fundamentals.
2. Demonstrate competence in utilizing Python for image processing
3. Execute techniques for image enhancement and restoration effectively.

Curriculum Details:

List of Practical

1. Basics of Digital Images-what a **pixel, resolution** (e.g., 512×512)
2. Image Acquisition & Sampling
3. Draw a histogram for a small set of pixel values
4. Plot histogram and apply histogram equalization
5. Plot Image Degradation Models & Noise
6. Plot Noise Reduction Techniques
7. Show Image Blurring & Sharpening & Thresholding Techniques
8. Region-Based Segmentation
9. Use of python of Libraries
10. Show Loading and Displaying Images (OpenCV)
11. Show Edge Detection
12. Loading Image using scikit-image
13. Show Installation & Setup (OpenCV)
14. Introduction to Feature Extraction
15. Texture Analysis using GLCM

Text Books:

1. Gonzalez, R.C., Woods, R.E., & Eddins, S.L. (2018). Digital Image Processing Using MATLAB.
2. Szeliski, R. (2010). Computer Vision: Algorithms and Applications

Reference Books:

1. Burger, W., & Burge, M.J. (2016). Digital Image Processing: An Algorithmic Approach with MATLAB.
2. Sonka, M., Hlavac, V., & Boyle, R. (2014). Image Processing, Analysis, and Machine Vision.

Course Structure:

Minor 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SINTET1351	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			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SINET1351	Enterprise Infrastructure and Cloud Technologies - Part II (P)	15	15	30	45	--	--	75

SINTET1351: 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	
	1.1	RHEL/ Cent OS Overview, Boot Process, and GRUB2	15
	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	
	2.1	Hypervisors, Hyper-V, VMware vSphere/vCenter	9
	2.2	Configuring VMs, Networking, Storage, HA/DRS	
	2.3	vMotion, Templates, Resource Pools, dvSwitches	
3.0		Cloud Computing	
	3.1	Cloud Computing Fundamentals, Deployment Models	12
	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
SINTEP1351	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	CA	ESA	
		Test I	Test II	Sum of T1 & T2				
SINTEP1351	Enterprise Infrastructure and Cloud Technologies - Part II (P)	--	--	--	--	10	15	25

SINTEP1351: 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
SINTVC1351	Data Visualization	--	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	
SINTVC1351	Data Visualization	--	--	--	--	20	30	50

SINTVC1351: Data Visualization (Vocational Course) 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 Knaflic, “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.

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)
