



॥ 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. Software Development (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 **SFD** 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: **SFD** (Major) / **DSM** (Minor 1)

B.Sc. Software Development (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	SSF DT1301 (T 3Cr) SSF DT1302 (T 3Cr) SSF DIK1303 (T 2Cr) SSF DCP1304 (P 2Cr) SSF DCP1305 (P 2Cr) 12 Credits	SSF DET1301 (T 3Cr) SSF DEP1301 (P 1Cr) 4 Credits			SSF DVC1301 2 Credits		SSF DFP1301 4 Credits	22	44
	VI	SSF DT1351 (T 3Cr) SSF DT1352 (T 3Cr) SSF DT1353 (T 2Cr) SSF DCP1354 (P 2Cr) SSF DCP1355 (P 2Cr) 12 Credits	SSF DET1351 (T 3Cr) SSF DEP1351 (P 1Cr) 4 Credits			SSF DVC1351 2 Credits		SSF DOJ1351 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. SD 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	SSFDCT1301	Hibernate and Spring Framework	03	--	12	04	--
	SSFDCT1302	Mobile Application Development using Kotlin	03	--		04	--
	SSFDIK1303	Introduction to super computing	02	--		02	--
	SSFDCP1304	Hibernate and Spring Framework (P)	--	02		--	02
	SSFDCP1305	Mobile Application Development using Kotlin (P)	--	02		--	02
Optional 2	SSFDET1301	Enterprise Infrastructure and Cloud Technologies Part I	03	--	04	04	--
	SSFDEP1301	Enterprise Infrastructure and Cloud Technologies Part I (P)	--	01		--	02
Vocational & Skill Enhancement Course	SSFDVC1301	Introduction to AIML	--	02	02	--	02
Field Work / Project/Internship	SSFDFP1301	Project	--	04	04	--	04
Total Credits			11	11	22	14	12



B. Sc. SD 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	SSFDCT1301	Hibernate and Spring Framework	15	15	30	45	--	--	75
	SSFDCT1302	Mobile Application Development using Kotlin	15	15	30	45	--	--	75
	SSFDIK1303	Introduction to super computing	10	10	20	30	--	--	50
	SSFDCP1304	Hibernate and Spring Framework (P)	--	--	--	--	20	30	50
	SSFDCP1305	Mobile Application Development using Kotlin (P)	--	--	--	--	20	30	50
Optional 2	SSFDET1301	Enterprise Infrastructure and Cloud Technologies Part I	15	15	30	45	--	--	75
	SSFDEP1301	Enterprise Infrastructure and Cloud Technologies Part I (P)	--	--	--	--	10	15	25
Vocational & Skill Enhancement Course	SSFDVC1301	Introduction to AIML	--	--	--	--	20	30	50
Field Work / Project/Internship	SSFD FP1301	Project	--	--	--	--	40	60	100



B. Sc. SD 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	SSFDC1351	ASP.net MVC Core	03	--	12	04	--
	SSFDC1352	Mango DB	03	--		04	--
	SSFDC1353	DevOps Fundamentals	02	--		02	--
	SSFDCP1354	ASP.net MVC Core (P)	--	02		--	02
	SSFDCP1355	Mango DB (P)	--	02		--	02
Optional 2	SSFDET1351	Enterprise Infrastructure and Cloud Technologies Part II	03	--	04	04	--
	SSFDEP1351	Enterprise Infrastructure and Cloud Technologies Part II (P)	--	01		--	02
Vocational & Skill Enhancement Course	SSFDVC1351	IOT	--	02	02	--	02
Field Work / Project/Internship	SSDFOJ1351	OJT	--	04	04	--	04
Total Credits			11	11	22	14	12



B. Sc. SD 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	SSFDC1351	ASP.net MVC Core	15	15	30	45	--	--	75
	SSFDC1352	Mango DB	15	15	30	45	--	--	75
	SSFDC1353	DevOps Fundamentals	10	10	20	30	--	--	50
	SSFDCP1354	ASP.net MVC Core (P)	--	--	--	--	20	30	50
	SSFDCP1355	Mango DB (P)	--	--	--	--	20	30	50
Optional 2	SSFDET1351	Enterprise Infrastructure and Cloud Technologies Part II	15	15	30	45	--	--	75
	SSFDEP1351	Enterprise Infrastructure and Cloud Technologies Part II (P)	--	--	--	--	10	15	25
Vocational & Skill Enhancement Course	SSFDVC1351	IOT	--	--	--	--	20	30	50
Field Work / Project/Internship	SSDFOJ1351	OJT	--	--	--	--	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
SSFDCT1301	Hibernate and Spring Framework	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	
SSFDCT1301	Hibernate and Spring Framework	15	15	30	45	--	--	75

SSFDCT1301: 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)	12
	1.1	Introduction to ORM and Hibernate	
	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	11
	2.1	Introduction to Spring Framework	
	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	12
	3.1	Introduction to Web Frameworks	
	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	10
	4.1	Introduction to Spring Boot, Advantages & Features	
	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
SSFDCT1302	Mobile Application Development with kotlin	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	
SSFDCT1302	Mobile Application Development with kotlin	15	15	30	45	--	--	75

SSFDCT1302: Mobile Application Development with kotlin (Major 2) 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	15
	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:	10
	2.1	Program Structure, Variables, Data Type.	
	2.2	Operators, Input /Output, Control Statements.	
	2.3	Looping Statements.	
	2.4	Arrays, Functions.	
3.0		Classes and Exception Handling	10
	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	10
	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 3 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme (Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SSFDIK1303	Introduction to Super Computing	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	
SSFDIK1303	Introduction to Super Computing	10	10	20	30	--	--	50

SSFDIK1303: 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	7
	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	8
	4.2	National Missions: National Supercomputing Mission, applications in defence, 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
SSFDCP1304	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		
SSFD	CP1304	Hibernate and Spring Framework(P)	--	--	--	--	20	30	50

SSFDCP1304: 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
SSFD	CP1305 Mobile Application Development with kotlin(P)	--	20	--	01	01

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		
SSFD	CP1305	Mobile Application Development with kotlin(P)	-	-	-	-	20	30	50

SSFD

CP1305: Mobile Application Development with kotlin (Major 2) 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:

Minor 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SSFDET1301	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	
SSFDET1301	Enterprise Infrastructure and Cloud Technologies Part I	15	15	30	45	--	--	75

SSFDET1301: 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	9
	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)	9
	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
SSFDEP1301	Enterprise Infrastructure and Cloud Technologies Part I	--	20	--	01	01

Minor 1 -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	1Test II	Sum of T1 & T2		CA	ESA	
SSFDEP1301	Enterprise Infrastructure and Cloud Technologies Part I	--	--	--	--	10	15	25

SSFDEP1301: 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.
5. Demonstrate the ability to monitor system performance and use tools to ensure availability and fault tolerance in enterprise IT infrastructure

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:

VSC -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SSFDVC1301	Introduction to AIML	--	20	--	02	02

VSC -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA	CA	ESA	
		Test I	Test II	Sum of T1 & T2				
SSFDVC1301	Introduction to AIML	-	-	-	-	20	30	50

SSFDVC1301: Introduction to AIML (VSC) 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:

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:**List of Practical**

1. AI Problem Formulation.
2. Intelligent Agent Simulation
3. ML Workflow Demonstration
4. Supervised vs Unsupervised Learning
5. Data Splitting & Validation.
6. Data Cleaning.
7. Data Visualization.
8. Feature Engineering.
9. Exploratory Data Analysis (EDA).
10. Linear Regression.
11. Logistic Regression.
12. K-Nearest Neighbors (KNN)
13. Decision Tree Classifier.

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
SSFDCT1351	ASP.net MVC Core	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	
SSFDCT1351	ASP.net MVC Core	15	15	30	45	--	--	75

SSFDCT1351: ASP.net MVC Core (Major 1) Curriculum Details

Course pre-requisite:

1. Programming Fundamentals for OOP's
2. Knowledge of C# Programming Language.
3. Web Development Basics
4. Basic Knowledge of Relational Database Management System

Course Objectives:

1. Get Knowledge ASP.NET Core framework, including its features, architecture, IDE environment, and project structure.
2. To develop understanding of ASP.NET Core MVC architecture and enable students to design web applications using Models, Views, Controllers, routing, and Razor pages.
3. To provide practical knowledge of form creation, user input handling, validation techniques.
4. To familiarize students with database connectivity and management using Entity Framework Core, including migrations, CRUD operations, and LINQ.

Course Outcomes:

1. Understand the fundamentals of .NET and ASP.NET Core framework, its architecture, features, IDE components, and project structure.
2. Develop web applications using ASP.NET Core MVC architecture by implementing Models, Views, Controllers, routing, Razor syntax, and layout pages.
3. Implement database-driven web applications using Entity Framework Core, including DbContext, migrations, CRUD operations, and LINQ queries.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0	1	Introduction to ASP.NET Core	10
	1.1	Introduction to .NET and ASP.NET Core	
	1.2	IDE Components	
	1.3	Features of ASP.NET Core	
	1.4	.NET CLI and Project Structure	
	1.5	Middleware and Request Pipeline	
2.0	2	MVC Architecture in ASP.NET Core	11
	2.1	Models, Views, and Controllers	
	2.2	Routing in ASP.NET Core	
	2.3	Razor Syntax and Layout Pages	
	2.4	ViewData, ViewBag, TempData	
3.0	3	Working with Forms, Validation and Controls	12
	3.1	HTML Helpers and Tag Helpers	
	3.2	Form Handling (GET/POST)	
	3.3	Model Binding	
	3.4	Data Annotations Validation	
4.0	4	Database Access with Entity Framework Core	12
	4.1	Introduction to EF Core	
	4.2	DbContext and Models	
	4.3	Migrations	
	4.4	CRUD Operations, LINQ Queries	
		Total	45

Text Books:

1. Pro ASP.NET Core 6: Develop Cloud-Ready Web Applications Using MVC, Blazor, and Razor Pages 9th ed. Edition -Adam Freeman
2. High Performance Enterprise Apps using C# 10 and .NET 6 Ockert J. du Preez

Reference Books:

1. Programming ASP.NET Core Paperback – 1 January 2019 by Dino Esposito (Author).
2. Programming ASP.NET Core By Dino EspositoPart of the Developer Reference series.1st Edition

Course Structure:

Major 2 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme (Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SSFDCT1352	Mango DB	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				
SSFDCT1352	Mango DB	15	15	30	45	--	--	75

SSFDCT1352: Mango DB (Major 2) 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:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0	1	Introduction to MongoDB	10
	1.1	Introduction to MongoDB	
	1.2	Features of MongoDB	
	1.3	Creating Collections and Documents	
	1.4	Basic Data Types in MongoDB	
2.0	2	Creating, Updating, and Deleting Documents	11
	2.1	Inserting and single Document and Batch Insert	
	2.2	Removing Documents and Removing Documents	
	2.3	Updating Documents with Using Modifiers	
	2.4	Returning Updated Documents	
3.0	3	Querying	12
	3.1	Introduction to find	
	3.2	Specifying Which Keys to Return	
	3.3	Query Conditionals	
	3.4	Limits, Skips, and Sorts	
4.0	4	Indexing and Aggregation	12
	4.1	Introduction to Indexing	
	4.2	Types of Indexes	
	4.3	The Aggregation Framework	
	4.4	Pipeline Operations \$match, \$project, \$group, \$unwind, \$sort and \$limit	
		Total	

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:

Major 3 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SSFDCT1353	DevOps Fundaments	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	
SSFDCT1353	DevOps Fundaments	10	10	20	30	--	--	50

SSFDCT1353: DevOps Fundaments (Major 3) Curriculum Details

Course pre-requisite:

1. To learn DevOps fundamentals as a mix of development operations automation.
2. Understanding Basic Technical Foundations Operating Systems
3. Network in version Control SystemsGit,

Course Objectives:

1. DevOps Fundamental course would enable the students in understanding
2. Basics of DevOps, Its Life Cycle, Integration and Deployments.
3. To Introduces Cloud Infrastructure with Terraform and Deployment with Packer.
4. Understanding DevOps CI/DI Pileline Version Control it, Git, Jenkins Maven Integration,

Course Outcomes:

1. Understands the basics of DevOps and it
2. Learns Terraform and Deployment with Packer, Understands the differ Git, Jenkins Maven.
3. Learns NuGet, Docker and Kubernetes Understands the use of Postmans

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Introduction to Devops	7
	1.1	What Is Devops, Benefits of working in a DevOps environment.	
	1.2	History of Devops.	
	1.3	DevOps and Software Development Life Cycle: Waterfall Model, Agile Model.	
	1.4	DevOps Stages Continuous Integration & Deployment: Jenkins Containers and Virtual Development: Docker, Vagrant.	
2.0		Provisioning Cloud Infrastructure with Terraform and Deployment with Packer	8
	2.1	Technical Requirements Installing Terraform.	
	2.2	Configuring Terraform for Azure Writing a Terraform scripts to deploy Azure Infrastructure.	
	2.3	Deploying the Infrastructure with Terraform.	
	2.4	Terraform Command Line and Life Cycle. DevOps Delivery Pipeline Understanding IAC Practices	
3.0		DevOps CI/CD Pipeline Version Control with Git, Git, Jenkins & Maven Integration	7
	3.1	Version Control Preview Git Introduction Preview Git Installation	
	3.2	Commonly used commands in Git Working with Remote repository	
	3.3	Stashing, Rebasing, Reverting and Resetting Git Workflows	
	3.4	Introduction to CI/Introduction to Jenkins Jenkins Architecture. Introduction to Maven ,Maven Architecture	
4.0		Containerized Application With Docker and Kubernetes	8
	4.1	Creating Docker file Building and Running Container on a Local Machine	
	4.2	Deploying a Container to ACI with a CI/CD Pipeline	
	4.3	Managing Containers Effectively Kubernetes-Installing Kubernetes Kubernetes Architecture Overview Installing Kubernetes Dashboard	
	4.4	Installing Kubernetes Dashboard First Example of Kubernetes Application Deployments	
		Total	30

Text Books:

1. "Fundamentals of DevOps and Software Delivery" by Yevgeniy Brikman (O'Reilly Media, 2025)
2. "The DevOps Handbook" by Gene Kim, Jez Humble, Patrick Debois, and John Willis: A widely recognized gold standard.
3. "DevOps Fundamentals: A Beginner's Guide" by Dr. N. Shanmuga Priya, et al.: An introductory book focusing on basic principles.

Reference Books:

1. "Learning DevOps: The complete guide to accelerate collaboration with Jenkins" By Mikael Krief.
2. "The DevOps Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations" Kindle Edition
3. "Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale" 1st Edition, Kindle Edition

Course Structure:

Major 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SSFDCP1354	ASP.net MVC Core (P)	--	--	--	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	
SSFD CP 1354	ASP.net MVC Core (P)	--	--	--	--	20	30	50

SSFDCP1354: ASP.net MVC Core (P) (Major 1) Curriculum Details

Course pre-requisite:

1. Programming Fundamentals for OOP's
2. Knowledge of C# Programming Language.
3. Web Development Basics
4. Basic Knowledge of Relational Database Management System

Course Objectives:

1. Get Knowledge ASP.NET Core framework, including its features, architecture, IDE environment, and project structure.
2. To develop understanding of ASP.NET Core MVC architecture and enable students to design web applications using Models, Views, Controllers, routing, and Razor pages
3. To provide practical knowledge of form creation, user input handling, validation techniques.
4. To familiarize students with database connectivity and management using Entity Framework Core, including migrations, CRUD operations, and LINQ.

Course Outcomes:

1. Understand the fundamentals of .NET and ASP.NET Core framework, its architecture, features, IDE components, and project structure.
2. Develop web applications using ASP.NET Core MVC architecture by implementing Models, Views, Controllers, routing, Razor syntax, and layout pages.
3. Implement database-driven web applications using Entity Framework Core, including DbContext, migrations, CRUD operations, and LINQ queries.

List of Practical

1. Install .NET SDK and Visual Studio / Visual Studio Code
2. Study project structure (Program.cs, appsettings.json, wwwroot, Controllers, Views, Models)
3. Use .NET CLI commands to create, build, run, and publish applications
4. Create MVC project and understand MVC folder structure
5. Build a simple Controller with multiple actions
6. Pass data from Controller to View using ViewData
7. Pass data using ViewBag
8. Pass temporary messages using TempData
9. Create Razor Views with Layout Pages
10. Design a shared layout using _Layout.cshtml
11. Create navigation links using Tag Helpers
12. Design HTML form using HTML Helpers
13. Perform model binding with form data
14. Apply Data Annotation validations
15. Connect ASP.NET Core app with SQL Server database
16. Create database automatically using migrations
17. Create application Insert records into database and Display records using List View.
18. Filter records using LINQ Where clause

Text Books:

1. Pro ASP.NET Core 6: Develop Cloud-Ready Web Applications Using MVC, Blazor, and Razor Pages 9th ed. Edition -Adam Freeman
2. High Performance Enterprise Apps using C# 10 and .NET 6 Ockert J. du Preez

Reference Books:

1. Programming ASP.NET Core Paperback – 1 January 2019 by Dino Esposito (Author).
2. Programming ASP.NET Core By Dino Esposito Part of the Developer Reference series. 1st Edition

Course Structure:

Major 2 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SSFDCP1355	Mango DB (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				
SSFDCP1355	Mango DB (P)	--	--	--	--	20	30	50

SSFDCP1355: Mango DB (P) (Major 2) 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

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:

Minor 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SSFDET1351	Enterprise Infrastructure and Cloud Technologies Part II	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				
SSFD ET 1351	Enterprise Infrastructure and Cloud Technologies Part II	15	15	30	45	--	--	75

SSFDET1351: Enterprise Infrastructure and Cloud Technologies Part II (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
SSFDEP1351	Enterprise Infrastructure and Cloud Technologies Part II	--	20	--	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				
SSFDEP1351	Enterprise Infrastructure and Cloud Technologies Part II	--	--	--	--	10	15	25

SSFDEP1351: 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:

VSC -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SSFDVC1351	IOT	-	20	-	2	2

VSC -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA	CA	ESA	
		Test I	Test II	Sum of T1 & T2				
SSFDVC1351	IOT	-	-	-	-	20	30	50

SSFDVC1351: IOT (VSC) Curriculum Details

Course pre-requisite:

1. Arduino UNO or Raspberry-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 Reference:

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)
