



॥ 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

Fax : (02462) 215572

Academic-1 (BOS) Section

website: srtmun.ac.in

Phone: (02462)215542

E-mail: bos@srtmun.ac.in

शैक्षणिक वर्ष २०२६-२७ पासून राष्ट्रीय
शैक्षणिक धोरणानुसार लागू केलेल्या विज्ञान
व तंत्रज्ञान विद्याशाखेतील पदवी तृतीय
वर्षाचा सुधारित (दुरुस्ती)
अभ्यासक्रमाबाबत.

प रि प त्र क

संदर्भ : १) शै-१/परिपत्रक/पदवी/बीएस्सी/२०२६-२७/६० दि.१९.०६.२०२६

२) शै-१/परिपत्रक/पदवी/बीएस्सी/२०२६-२७/९३ दि.१०.०७.२०२६

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, संदर्भीय परिपत्रकान्वये दिनांक २२ एप्रिल २०२६ रोजी संपन्न झालेल्या मा.विद्या परिषद बैठकीतील विषय क्र.०८/६४-२०२६ अन्वये मान्यता दिल्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरणानुसार पदवी तृतीय वर्षाचे अभ्यासक्रम शैक्षणिक वर्ष २०२६-२७ पासून लागू करण्यात आलेले आहेत.

तथापि, वरील संदर्भीय परिपत्रकान्वये प्रकाशित केलेल्या अभ्यासक्रमामध्ये अभ्यास मंडळ अध्यक्षांनी किरकोळ दुरुस्ती करून अभ्यासक्रम सादर केला असून, मा.अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा यांच्या मान्यतेने दुरुस्ती केलेला खालील सुधारित अभ्यासक्रम (Syllabus) लागू करण्यात येत आहे.

01	B.Sc. III Year Computer Science (Single major)
02	B.Sc. III Year Mathematics

सदरील परिपत्रक व अभ्यासक्रम (Syllabus) 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/सुधारित/२०२६-२७/
दिनांक : ०७.०८.२०२६




उपकुलसचिव
शैक्षणिक (१-अभ्यास मंडळे) 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.
- ६) सिस्टीम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. यांना देवून कळविण्यात येते की, परिपत्रक अभ्यासक्रम संकेतस्थळावर प्रसिध्द करण्यात यावेत.

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



**(Credit Framework and Structure of
B. Sc. Computer Science (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 **CSC** 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: **CSC** (Major) / **DSM** (Minor 1)

B.Sc. Computer Science (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	SCSCCT1301 (T 3Cr) SCSCCT1302 (T 3Cr) SCSCIK1303 (T 2Cr) SCSCCP1304 (P 2Cr) SCSCCP1305 (P 2Cr) 12 Credits	SCSCET1301 (T 3Cr) SCSCEP1301 (P 1Cr) 4 Credits			SCSCVC1301 2 Credits		SCSCFP1301 4 Credits	22	44
	VI	SCSCCT1351 (T 3Cr) SCSCCT1352 (T 3Cr) SCSCCT1353 (T 2Cr) SCSCCP1354 (P 2Cr) SCSCCP1355 (P 2Cr) 12 Credits	SCSCET1351 (T 3Cr) SCSCEP1351 (P 1Cr) 4 Credits			SCSCVC1351 2 Credits		SCSCOJ1351 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. CS 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	SCSCCT1301 (3 Cr)	Windows Programming Using C#.NET	03	--	12	04	--
	SCSCCT1302 (3 Cr)	Python for Data Science	03	--		04	--
	SCSCIK1303 (2 Cr)	IKS in CS	02	---		02	--
	SCSCCP1304 (2 Cr)	Windows Programming Using C#.NET (P)	--	02		--	02
	SCSCCP1305 (2 Cr)	Python for Data Science (P)	--	02		--	02
Optional 2	SCSCET1301 (3 Cr)	a) Basics of Linux b) Artificial Intelligence c) Enterprise Infrastructure and Cloud Technologies - Part I	03	--	04	04	--
	SCSCEP1301 (1 Cr)	a) Basics of Linux(P) b) Artificial Intelligence(P) c) Enterprise Infrastructure and Cloud Technologies - Part I (P)	--	01		--	01
Vocational & Skill Enhancement Course	SCSCVC1301 (2 Cr)	Data Analysis using Power BI	--	02	02	--	02
Field Work / Project/Internship	SCSCFP1301 (4 Cr)	Project	--	04	04	--	04
Total Credits			11	11	22	14	11



B. Sc. CS 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	SCSCCT1301 (3 Cr)	Windows Programming Using C#.NET	15	15	30	45	--	--	75
	SCSCCT1302 (3 Cr)	Python for Data Science	15	15	30	45	--	--	75
	SCSCIK1303 (2 Cr)	IKS in CS	10	10	20	30	--	--	50
	SCSCCP1304 (2 Cr)	Windows Programming Using C#.NET (P)	--	--	--	--	20	30	50
	SCSCCP1305 (2 Cr)	Python for Data Science (P)	--	--	--	--	20	30	50
Optional 2	SCSCET1301 (3 Cr)	a) Basics of Linux b) Artificial Intelligence c) Enterprise Infrastructure and Cloud Technologies - Part I	15	15	30	45	--	--	75
	SCSCPE1301 (1 Cr)	a) Basics of Linux(P) b) Artificial Intelligence(P) c) Enterprise Infrastructure and Cloud Technologies - Part I (P)	--	--	--	--	10	15	25
Vocational & Skill Enhancement Course	SCSCVC1301 (2 Cr)	Data Analysis using Power BI	--	--	--	--	20	30	50
Field Work / Project/Internship	SCSCFP1301 (4 Cr)	Project	--	--	--	--	40	60	100



B. Sc. CS 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	SCSCCT1351 (3 Cr)	Mobile Application Development using Kotlin	03	--	12	04	--
	SCSCCT1352 (3 Cr)	Computer Vision and Image Analysis	03	--		04	--
	SCSCCT1353 (2 Cr)	Mathematics for Computing	02	---		02	--
	SCSCCP1354 (2 Cr)	Mobile Application Development using Kotlin (P)	--	02		--	02
	SCSCCP1355 (2 Cr)	Computer Vision and Image Analysis (P)	--	02		--	02
Optional 2	SCSCET1351 (3 Cr)	a) Linux Administration b) Cloud Computing c) Enterprise Infrastructure and Cloud Technologies - Part II	03	--	04	04	--
	SCSCEP1351 (1 Cr)	a) Linux Administration(P) b) Cloud Computing(P) c) Enterprise Infrastructure and Cloud Technologies - Part II(P)	--	01		--	01
Vocational & Skill Enhancement Course	SCSCVC1351 (2 Cr)	NoSQL with MongoDB	--	02	02	--	02
On Job Training: (Internship/Apprenticeship)	SCSCOJ1351 4 Credits	-----	--	04	04	--	04
Total Credits			11	11	22	14	11



B. Sc. CS 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	SCSCCT1351 (3 Cr)	Mobile Application Development using Kotlin	15	15	30	45	--	--	75
	SCSCCT1352 (3 Cr)	Computer Vision and Image Analysis	15	15	30	45	--	--	75
	SCSCCT1353 (2 Cr)	Mathematics for Computing	10	10	20	30	--	--	50
	SCSCCP1354 (2 Cr)	Mobile Application Development using Kotlin (P)	--	--	--	--	20	30	50
	SCSCCP1355 (2 Cr)	Computer Vision and Image Analysis (P)	--	--	--	--	20	30	50
Optional 2	SCSCET1351 (3 Cr)	a) Linux Administration b) Cloud Computing c) Enterprise Infrastructure and Cloud Technologies - Part II	15	15	30	45	--	--	75
	SCSCPE1351 (1 Cr)	a) Linux Administration(P) b) Cloud Computing(P) c) Enterprise Infrastructure and Cloud Technologies - Part II(P)	--	--	--	--	10	15	25
Vocational & Skill Enhancement Course	SCSCVC1351 (2 Cr)	NoSQL with MongoDB	--	--	--	--	20	30	50
On Job Training: (Internship/Apprenticeship)	SCSCOJ1351 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
SCSCCT1301	Windows Programming Using C#.NET	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				
SCSCCT1301	Windows Programming Using C#.NET	15	15	30	45	--	--	75

SCSCCT1301: Windows Programming Using C#.NET (Major 1) Curriculum Details

Course pre-requisite:

1. Basic knowledge of computer programming concepts.
2. Understanding of Object-Oriented Programming fundamentals.
3. Familiarity with C/C++ or Java programming language.
4. Basic knowledge of database concepts and SQL.

Course Objectives:

1. To introduce students to the .NET framework and C#.NET programming environment.
2. To develop skills in designing Windows-based applications using various controls
3. To understand functions, arrays, strings, delegates, interfaces, and exception handling.
4. To provide knowledge of object-oriented programming concepts using C#.NET.
5. To enable students to develop database-driven applications using ADO.NET.

Course Outcomes:

Students will be able to:

1. Understand the architecture and components of the .NET framework
2. Design and develop Windows-based applications using controls, menus & dialog boxes
3. Implement object-oriented concepts such as properties, delegates & interfaces
4. Develop database applications using ADO.NET for performing data retrieval, updating.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Introduction to .Net	10
	1.1	Introduction to .Net Technology & Framework	
	1.2	.Net Architecture	
	1.3	Common Language Runtime(CLR)	
	1.4	IDE Components	
	1.5	Intellisense	
	1.6	Java vs C#.NET	
2.0		Windows Controls, Functions, Arrays and Strings	13
	2.1	Creating and Customizing Windows Form	
	2.2	TextBox, Label Control, Button & CheckBox	
	2.3	RadioButton, ListBox and ComboBox	
	2.4	Menus and Dialog Boxes	
	2.5	C# Function and Call by Value & Call by Reference and out parameters	
	2.6	Array, ArrayList class and Jagged Array	
	2.7	String and StringBuffer class	
3.0		Properties, Delegates, interface & Exception handling	12
	3.1	Properties and Indexers	
	3.2	Delegates and Custom Events	
	3.3	Creating & using interface	
	3.4	Try Catch and Finally Block	
	3.5	Custom Exception	
4.0		Database Connectivity	10
	4.1	Introduction ADO.Net	
	4.2	Developing a Simple ADO.NET Based Application	
	4.3	Retrieving & Updating Data From Tables	
	4.4	Disconnected Data Access Through Dataset Objects	
		Total	45

Reference Books:

1. Programming in C# – E. Balagurusamy, Programming in C#, Tata McGraw Hill Education.
2. C# 5.0 Complete Reference – Herbert Schildt, C# 5.0: The Complete Reference, McGraw Hill Education.
3. Pro C# and the .NET Platform – Andrew Troelsen, Pro C# and the .NET Platform, Apress Publication.
4. Beginning Visual C# – Karli Watson, Christian Nagel, Jacob Hammer Pedersen, Beginning Visual C#, Wiley India.
5. ADO.NET in a Nutshell – Bill Hamilton, Matthew MacDonald, ADO.NET in a Nutshell, O'Reilly Media.

Course Structure:

Major 2 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCSCCT1302	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	
SCSCCT1302	Python for Data Science	15	15	30	45	--	--	75

SCSCCT1302: 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:

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

Course Structure:

Major 3 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCSCEIK1303	IKS in Computer Science	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	
SCSCEIK1303	IKS in Computer Science	10	10	20	30	--	--	50

SCSCEIK1303: IKS in Computer Science (Major 3) Curriculum Details

Course pre-requisite:

1. Basic knowledge of Mathematics.
2. Basic knowledge of Machine Learning.

Course Objectives:

1. To understand foundational concepts and contributions of Indian Mathematics and Machine Learning.
2. To implement mathematical principles in solving machine learning problems.
3. To assess the integration of Indian mathematical techniques into modern machine learning models.
4. To develop innovative machine learning algorithms inspired by Indian Mathematics.

Course Outcomes:

After completing this course, students will be able to:

1. Gain in-depth knowledge of Indian Mathematics and its relevance in modern computational techniques.
2. Develop the ability to apply mathematical foundations to design and optimize machine learning models.
3. Explore innovative methodologies by combining traditional Indian Mathematics with cutting-edge machine learning tools.
4. Evaluate and analyze real-world applications and future trends of AI in the Indian context.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Foundation of Indian Mathematics	
	1.1	Vedic Mathematics: Speed Mathematics Techniques	7
	1.2	Contributions of Aryabhata	
	1.3	Brahma gupta, and Bhaskara II	
	1.4	Concepts of Zero and Infinity in Indian Mathematics	
	1.5	Ancient Algebra and Geometry: Sulba Sutras and their Applications	
2.0		Ancient of AI	
	2.1	Artificial Neural Networks: Concepts and Applications	8
	2.2	Ensemble Methods: Random Forests, Bagging, and Boosting	
3.0		Machine Learning	
	3.1	Optimization Techniques in Machine Learning: Gradient Descent	7
	3.2	Handling Large Datasets: Scalability and Big Data Integration	
4.0		Neural Network	
	4.1	Artificial Neural Networks: Concepts and Applications	8
	4.2	Support Vector Machines (SVMs) and Kernel Methods	
		Total	30

Text Books:

1. The Great Indian Mathematicians: 15 Pioneers Who Put Indian Mathematics on the World Map by Gaurav Tekriwal.
2. Mathematics in India by Kim Plofker
3. Vedic Mathematics Made Easy by Dhaval Bathia.
4. Introduction to Machine Learning with Python by Andreas C. Müller and Sarah Guido
5. Machine Learning: A Probabilistic Perspective by Kevin P. Murphy
6. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig.

Course Structure:

Major 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCSCCP1304	Windows Programming Using C#.NET (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	
SCSCCP1304	Windows Programming Using C#.NET (P)	--	--	--	--	20	30	50

SCSCCP1304: Windows Programming Using C#.NET (P) (Major 1) Curriculum Details

Course pre-requisite:

1. Basic knowledge of computer programming concepts.
2. Understanding of Object-Oriented Programming fundamentals.
3. Familiarity with C/C++ or Java programming language.
4. Basic knowledge of database concepts and SQL.

Course Objectives:

1. To introduce students to the .NET framework and C#.NET programming environment.
2. To develop skills in designing Windows-based applications using various controls
3. To understand functions, arrays, strings, delegates, interfaces, and exception handling.
4. To provide knowledge of object-oriented programming concepts using C#.NET.
5. To enable students to develop database-driven applications using ADO.NET.

Course Outcomes:

Students will be able to:

1. Understand the architecture and components of the .NET framework
2. Design and develop Windows-based applications using controls, menus & dialog boxes
3. Implement object-oriented concepts such as properties, delegates & interfaces
4. Develop database applications using ADO.NET for performing data retrieval, updating.

Curriculum Details:

List of Practical

1. Study and installation of Visual Studio IDE and exploration of .NET framework components.
2. Write a C#.NET program demonstrating different data types and operators.
3. Create a Windows Form application using Label, TextBox, and Button controls for student information entry.
4. Develop a calculator application using Button controls and event handling.
5. Design a Windows Form using RadioButton and CheckBox controls for online survey/feedback form.
6. Create an application demonstrating ListBox and ComboBox controls with item addition and deletion operations.
7. Develop a menu-driven Windows application using MenuStrip and Dialog Boxes.
8. Write a program demonstrating call by value, call by reference, and out parameters in C#.NET.
9. Implement programs using one-dimensional, multidimensional, and jagged arrays.
10. Develop an application demonstrating String and StringBuilder class operations.
11. Create a program to demonstrate properties and indexers in C#.NET.
12. Implement delegates and custom events in a Windows application.
13. Write a program demonstrating interface implementation in C#.NET.
14. Develop an application to demonstrate exception handling using try-catch-finally and custom exceptions.
15. Create an ADO.NET application for database connectivity to perform insert, update, delete, and display operations using DataSet objects.

Reference Books:

1. Programming in C# – E. Balagurusamy, Programming in C#, Tata McGraw Hill Education.
2. C# 5.0 Complete Reference – Herbert Schildt, C# 5.0: The Complete Reference, McGraw Hill Education.
3. Pro C# and the .NET Platform – Andrew Troelsen, Pro C# and the .NET Platform, Apress Publication.
4. Beginning Visual C# – Karli Watson, Christian Nagel, Jacob Hammer Pedersen, Beginning Visual C#, Wiley India.
5. ADO.NET in a Nutshell – Bill Hamilton, Matthew MacDonald, ADO.NET in a Nutshell, O'Reilly Media.

Course Structure:

Major 2 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCSCCT1305	Python for Data Science (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				
SCSCCT1305	Python for Data Science (P)	--	--	--	--	20	30	50

SCSCCT1305: 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
SCSCET1301	a) Basics of Linux	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	
SCSCET1301	a) Basics of Linux	15	15	30	45	--	--	75

SCSCET1301: a) Basics of Linux (Minor 1) Curriculum Details

Course pre-requisite:

1. Basic knowledge of computer fundamentals.
2. Familiarity with operating systems concepts.
3. Basic understanding of files and directories.

Course Objectives:

1. To introduce the fundamentals of Linux operating system and its architecture.
2. To develop understanding of Linux environment, commands, and file management.
3. To familiarize students with Linux boot process and system initialization.
4. To provide practical knowledge of Linux utilities, filters, and shell operations.
5. To develop skills in using VI editor for text editing and file manipulation.

Course Outcomes:

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

1. Understand Linux operating system concepts, architecture, distributions, and installation process.
2. Use Linux commands for handling files, directories, mathematical operations, and system information.
3. Apply Linux filters and utilities for processing and managing text and files effectively.
4. Understand Linux boot process, boot loaders, and system initialization procedures.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Introduction to Linux	
	1.1	Operating system, What is Linux?, Advantages of Linux, Disadvantages of Linux, Distributions of Linux	09
	1.2	Functions of Operating system ,History and development of of Linux, Features of Linux	
	1.3	Installation steps of Linux	
	1.4	Difference between Linux and Windows, Difference between Linux and Unix	
2.0		Handling Linux Environment	
	2.1	Basic Commands, Linux standard directories, Hardware requirement for Linux	09
	2.2	Commands for files and directories, File processing commands, Mathematical Commands	
	2.3	Login, Logout and Remote Login, different GPU (cal, date, wc, who)	
	2.4	Basic filters –head, tail, sort, grep, different options and expressions for grep	
3.0		Linux boot process	
	3.1	Boot Loaders (LILO and GRUB), System Initiazation	15
	3.2	inittab	
	3.3	rc. sysinit, rc	
	3.4	Printing files: Print Spool directory, sending files to Printer	
4.0		VI Editors	
	4.1	Editors, use of VI, features of VI	12
	4.2	VI basics, Different modes and working with VI	
	4.3	Command mode-Curser movements(k,j,h,l),delete (character, line, word),Screen up, down use of repeat factor, Joining lines(J)	
	4.4	Input Mode-switching with (I,o,r,s,a,I,O,R,S) Ex mode-saving(w,x,q),writing selecting lines to another	
		Total	45

Reference Books:

1. LINUX complete reference by Richard Peterson
2. RedHalt Linux 718 by billball, David Pitts
3. Unix concept and applications by Sumitabha Das
4. Fedora 7 Unleashed by Andrew Hudson and Paul Hudson (SAMS publication)

Course Structure:

Minor 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCSCEP1301	a) Basics of Linux(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				
SCSCEP1301	a) Basics of Linux(P)	--	--	--	--	10	15	25

SCSCET1301: a) Basics of Linux(P) (Minor 1) Curriculum Details

Course pre-requisite:

1. Basic knowledge of computer fundamentals.
2. Familiarity with operating systems concepts.
3. Basic understanding of files and directories.

Course Objectives:

1. To introduce the fundamentals of Linux operating system and its architecture.
2. To develop understanding of Linux environment, commands, and file management.
3. To familiarize students with Linux boot process and system initialization.
4. To provide practical knowledge of Linux utilities, filters, and shell operations.
5. To develop skills in using VI editor for text editing and file manipulation.

Course Outcomes:

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

1. Understand Linux operating system concepts, architecture, distributions, and installation process.
2. Use Linux commands for handling files, directories, mathematical operations, and system information.
3. Apply Linux filters and utilities for processing and managing text and files effectively.
4. Understand Linux boot process, boot loaders, and system initialization procedures.

Curriculum Details:

List of Practical

1. Study and installation of Linux operating system.
2. Demonstration of Linux login, logout, and remote login commands.
3. Practice of basic Linux commands such as cal, date, wc, and who.
4. Working with Linux standard directories and directory navigation commands.
5. Create, copy, move, rename, and delete files and directories using Linux commands.
6. Perform file processing operations using commands like cat, more, less, and touch.
7. Execute mathematical commands using Linux shell utilities.
8. Study and implementation of Linux filters using head, tail, and sort.
9. Practice of grep command with different options and expressions.
10. Study of Linux boot process and configuration of GRUB/LILO boot loaders.
11. Study of Linux system initialization files such as inittab, rc.sysinit, and rc.
12. Configure and manage printing operations and print spool directory in Linux.
13. Practice VI editor basics and switching between command, input, and ex modes.
14. Perform editing operations in VI editor such as cursor movement, deletion, joining lines, and repeat factor usage.
15. Create and edit text files in VI editor using save, write, and quit commands (:w, :q, :x).

Reference Books:

1. LINUX complete reference by Richard Peterson
2. RedHalt Linux 718 by billball, David Pitts
3. Unix concept and applications by Sumitabha Das
4. Fedora 7 Unleashed by Andrew Hudson and Paul Hudson (SAMS publication)

Course Structure:

Minor 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCSCET1301	b) Artificial Intelligence	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	
SCSCET1301	b) Artificial Intelligence	15	15	30	45	--	--	75

SCSCET1301: b) Artificial Intelligence (Minor 1) Curriculum Details

Course pre-requisite:

1. Basic knowledge of computer fundamentals and programming concepts
2. Understanding of data structures and algorithms
3. Familiarity with mathematical reasoning and logic
4. Basic knowledge of probability and discrete mathematics.

Course Objectives:

1. Understand the fundamentals, concepts, and applications of Artificial Intelligence.
2. Analyse intelligent agents, rational behaviour, and problem-solving techniques in AI.
3. Apply uninformed and informed search algorithms to solve real-world problems.
4. Understand adversarial search, game playing strategies, and constraint satisfaction problems.

Course Outcomes:

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

1. Analyse intelligent agents, environments, rationality, and knowledge-based systems.
2. Apply uninformed and informed search techniques for solving AI problems efficiently.
3. Implement adversarial search techniques such as Minimax and Alpha-Beta pruning in game environments.
4. Demonstrate logical reasoning using propositional and first-order predicate logic with inference techniques.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Introduction to AI	
	1.1	What is AI? Intelligent Agents: Agents and environment	09
	1.2	The concept of Rationality, the nature of environment, the structure of Agents.	
	1.3	Knowledge-Based Agents: Introduction to Knowledge-Based Agents	
		The Wumpus World as an Example World	
	1.4	Problem-solving: Problem-solving agents	
2.0		Advanced Search Techniques	
	2.1	Uninformed Search: DFS, BFS, Iterative Deepening Search	09
	2.2	Informed Search: Best First Search, A* search	
	2.3	Adversarial Search & Games: Two-player zero-sum games, Minimax Search, Alpha-Beta pruning	
	2.4	Constraints and Constraint Satisfaction Problems (CSPs)	
3.0		Logical Reasoning and Uncertainty	
	3.1	Logic: Propositional logic, First-order predicate logic	15
	3.2	Propositional versus first-order inference, Unification and lifting	
	3.3	Inference: Forward chaining, Backward chaining, Resolution, Truth maintenance systems	
	3.4	Introduction to Planning: Blocks World problem	
4.0		Domains and Applications of AI	
	4.1	Domains in AI: Introduction to Machine Learning, Computer Vision, Robotics	12
	4.2	Natural Language Processing, Deep Neural Networks, and their applications	
	4.3	Expert Systems: The architecture and role of expert systems include two case studies	
	4.4	Legal and Ethical Issues: Concerns related to AI	
		Total	45

Reference Books:

1. . M.C. Trivedi, Introduction to AI and Machine Learning, Khanna Book Publishing Company, 2024.
2. 2. Russell, S. and Norvig, P., “Artificial Intelligence - A Modern Approach”, 3rd edition, Prentice Hall
3. 3. Van Hirtum, A. &Kolski, C. (2020). Constraint Satisfaction Problems: Algorithms and Applications. Springer
4. 4. Rajiv Chopra, Machine Learning and Machine Intelligence, Khanna Book Publishing Company, 2024.

Course Structure:

Minor 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCSCEP1301	b) Artificial Intelligence(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				
SCSCEP1301	b) Artificial Intelligence(P)	--	--	--	--	10	15	25

SCSCET1301: b) Artificial Intelligence(P) (Minor 1) Curriculum Details

Course pre-requisite:

1. Basic knowledge of computer fundamentals and programming concepts
2. Understanding of data structures and algorithms
3. Familiarity with mathematical reasoning and logic
4. Basic knowledge of probability and discrete mathematics.

Course Objectives:

1. Understand the fundamentals, concepts, and applications of Artificial Intelligence.
2. Analyse intelligent agents, rational behaviour, and problem-solving techniques in AI.
3. Apply uninformed and informed search algorithms to solve real-world problems.
4. Understand adversarial search, game playing strategies, and constraint satisfaction problems.

Course Outcomes:

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

1. Analyse intelligent agents, environments, rationality, and knowledge-based systems.
2. Apply uninformed and informed search techniques for solving AI problems efficiently.
3. Implement adversarial search techniques such as Minimax and Alpha-Beta pruning in game environments.
4. Demonstrate logical reasoning using propositional and first-order predicate logic with inference techniques.

Curriculum Details:

List of Practical

1. Study and implementation of simple intelligent agents and environment models
2. Write a program to simulate the Wumpus World problem
3. Implementation of Breadth First Search (BFS) algorithm
4. Implementation of Depth First Search (DFS) algorithm
5. Implementation of Iterative Deepening Search algorithm
6. Implementation of Best First Search algorithm
7. Implementation of A* Search algorithm for path finding
8. Develop a Tic-Tac-Toe game using Minimax algorithm
9. Implement Alpha-Beta pruning for adversarial search problems
10. Solve a Constraint Satisfaction Problem such as Map Coloring or N-Queen problem
11. Implement propositional logic representation and truth table generation
12. Write a program for Forward Chaining and Backward Chaining inference
13. Implement unification and resolution techniques in First-Order Logic
14. Simulate Blocks World planning problem
15. Mini project/case study on AI applications such as Expert Systems, NLP, Robotics, or Machine Learning

Reference Books:

1. . M.C. Trivedi, Introduction to AI and Machine Learning, Khanna Book Publishing Company, 2024.
2. 2. Russell, S. and Norvig, P., “Artificial Intelligence - A Modern Approach”, 3rd edition, Prentice Hall
3. 3. Van Hirtum, A. &Kolski, C. (2020). Constraint Satisfaction Problems: Algorithms and Applications. Springer
4. 4. Rajiv Chopra, Machine Learning and Machine Intelligence, Khanna Book Publishing Company, 2024.

Course Structure:

Minor 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCSCET1301	c) 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	
SCSCET1301	c) Enterprise Infrastructure and Cloud Technologies - Part I	15	15	30	45	--	--	75

SCSCET1301: c) Enterprise Infrastructure and Cloud Technologies - Part I (Minor 1) Curriculum Details

Course pre-requisite:

5. To provide a foundational understanding of Basic Computer Fundamentals.
6. To provide a foundational Understanding of Networking Basics.
7. To provide a Basic Knowledge of Operating Systems.
8. To enable learners Basic Security Concepts.

Course Objectives:

5. To provide a foundational understanding of networking devices, data centers, and enterprise storage technologies.
6. To introduce various server and client operating systems and their configuration and security.
7. To impart practical knowledge on Windows Server administration, storage management, and deployment techniques.
8. To enable learners to work with Active Directory, domain services, and secure authentication mechanisms.
9. 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:

5. Understand the structure and functioning of networking devices, server form factors, and RAID based storage solutions.
6. Install and configure client and server operating systems, including handling file systems and firewall settings.
7. Manage and administer Windows Server environments, perform patching, clustering, and automated deployment.
8. Implement and secure Active Directory services, group policies, and authentication mechanisms.
9. 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	12

	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:

5. Computer Networks" by Andrew S. Tanenbaum and David J. Wetherall, 5th Edition, Pearson Education, 2011
6. William Stallings, "Operating Systems: Internals and Design Principles," Pearson Education, **Vol:9th** Edition, 2018
7. Tom Carpenter, "Microsoft Windows Server 2019 Administration Fundamentals," Sybex (Wiley), **Volume:** 1st Edition, 2019
8. 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
SCSCEP1301	c) 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				
SCSCEP1301	c) Enterprise Infrastructure and Cloud Technologies - Part I (P)	--	--	--	--	10	15	25

SCSCEP1301: c) 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

16. Windows Server Installation & Configuration, Install Windows Server (GUI).
17. Install Windows Server Core
18. Install & Configure Active Directory Domain Services (AD DS)
 - Promote server to DC, join clients to the domain.
19. Configure DNS zones and replication
20. Apply Group Policies
21. Enforce password policy,
22. Demonstrate AD security (users, permissions, auditing)
23. Restrict drives,
24. Implement backup and restore of AD
25. Desktop configuration.
26. Implement Failover Cluster
 - Build a high-availability cluster for file share service.
27. Implement Network Load Balancing (NLB)
 - Build a high-availability cluster for file share service.
28. PowerShell Scripting for Automation Tasks
29. Write scripts in PowerShell for log rotation, monitoring
30. 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
SCSCVC1301	Data Analysis using Power BI (P)	--	20	--	02	02

Vocational Course -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA	CA	ESA	
		Test I	Test II	Sum of T1 & T2				
SCSCVC1301	Data Analysis using Power BI (P)	--	--	--	--	20	30	50

SCSCVC1301: Data Analysis using Power BI (P) (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.

Publish and share reports using Power BI Service

Text Books:

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

Reference Books:

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

Course Structure:

Major 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCSCCT1351	Mobile Application Development using Kotlin	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				
SCSCCT1351	Mobile Application Development using Kotlin	15	15	30	45	--	--	75

SCSCCT1351: 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
SCSCCT1352	Computer Vision and Image Analysis	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	
SCSCCT1352	Computer Vision and Image Analysis	15	15	30	45	--	--	75

SCSCCT1352: 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		
		Theor y	Practical	Theory	Practical	Total
SCSCCT1353	Mathematics for 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	
SCSCCT1353	Mathematics for Computing	10	10	20	30	---	----	50

SCSCCT1353: Mathematics for Computing (Major 3) Curriculum Details

Course pre-requisite:

1. Basic knowledge of Mathematics

Course Objectives:

1. To provide a basic understanding of fundamental mathematical concepts such as sets, functions, matrix algebra, and discrete mathematics.
2. To use mathematical models and techniques to analyse and understand problems in computer science.
- 3.To demonstrates how the mathematical principles give succinct abstraction of computer science problems and help them to efficiently analyse.

Course Outcomes:

Students will be able to:

1. Solve problems with mathematical approach.
2. Understand and apply the concept of Mathematics.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		Set Theory	7
	1.1	Definition and types of set	
	1.2	Set operations	
	1.3	Venn Diagrams	
	1.4	Problems on set Operations	
2.0		Mathematical Logic	8
	2.1	Proposition and Statements	
	2.2	Logical Connectives	
	2.3	Tautology, Contradiction and Contingency	
	2.4	Logical Equivalence	
	2.5	Problems on Mathematical Logic	
3.0		Introduction to Matrix Algebra	8
	3.1	Definition and types of matrices	
	3.2	Operation on Matrices	
	3.3	Determination and inverse of matrices	
	3.4	Symmetric, Skew-symmetric, Orthogonal matrices	
	3.5	Rank of matrices	
	3.6	Application of matrices to solve system of linear equations in two variables	
4.0		Function and Relation	7
	4.1	Definition of functions	
	4.2	Types of functions	
	4.3	Definition of Relation	
	4.4	Types of Relation	
	4.5	Cartesian Products	
	4.6	Problems on function and Relation	
		Total	30

Text Books:

1 C.L. Liu, Elements of Discrete Mathematics

2. Mittal and Agrawal, Basic Mathematics

Reference Books:

1. Discrete Mathematics, Olympia Nicodemi

2. Garg Reena, Advanced Engineering Mathematics, Khanna Book Pub Co.2023.

Course Structure:

Major 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCSCCP1354	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	
SCSCCP1354	Mobile Application Development using Kotlin (P)	--	--	--	--	20	30	50

SCSCCP1354: 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
SCSCCP1355	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	
SCSCCP1355	Computer Vision and Image Analysis (P)	--	--	--	--	20	30	50

SCSCCP1355: 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
SCSCET1351	a) Linux Administration	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	
SCSCET1351	a) Linux Administration	15	15	30	45	--	--	75

SCSCET1351: a) Linux Administration (P) (Minor 1) Curriculum Details

Course pre-requisite:

1. Operating System concepts
2. Linux basic commands
3. File and directory handling
4. Computer hardware fundamentals.

Course Objectives:

1. Understand the concepts and responsibilities of system administration in Linux/Unix environments.
2. Learn user and group account management techniques.
3. Configure file permissions, passwords, and administrative privileges for system security.
4. Understand disk quota management and task automation techniques.

Course Outcomes:

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

1. Understand system administration concepts and manage Linux user and group accounts effectively.
2. Configure user permissions, passwords, administrative privileges, and disk quotas for secure system operation.
3. Automate administrative tasks and manage system startup services and boot processes.
4. Monitor, schedule, and control system processes using command-line and graphical administration tools.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		System Administration	
	1.1	Managing User Accounts, Managing Groups.	15
	1.2	Managing Users, Managing Permissions	
	1.3	Managing Passwords	
	1.4	Granting System Administrator Privileges to Regular Users , Disk Quotas	
2.0		Automating Tasks	
	2.1	Running Services at Bootup:- Beginning the Boot Loading Process, Booting into the Default Run level,	9
	2.2	Understanding init Scripts and the Final Stage of Initialization, Controlling Services at Boot with Administrative Tools	
	2.3	Starting and Stopping Services Manually	
	2.4	Scheduling Tasks	
3.0		System-Monitoring Tools	
	3.1	Console-Based Monitoring, Using the kill Command to Control Processes	12
	3.2	Using Priority Scheduling and Control.	
	3.3	Graphical Process and System Management Tools	
	3.4	KDE Process- and System-Monitoring Tools	
4.0		Backing Up	
	4.1	Choosing a Backup Strategy	9
	4.2	Choosing Backup Hardware and Media	
	4.3	Using Backup Software	
	4.4	Copying Files.	
		Total	45

Reference Books:

1. Fedora 7 Unleashed by Andrew Hudson and Paul Hudson (SAMS publication).
2. UNIX and Linux System Administration Handbook — Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Pearson Education.
3. Linux Administration: A Beginner's Guide — Wale Soyinka, McGraw-Hill Education.
4. Red Hat Linux System Administration — Mohammed J. Kabir, Wiley Publishing.
5. Beginning Linux Programming — Wrox Publication.

Minor 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCSCEP1351	a) Linux Administration (P)	--	10	--	01	01

Minor 1 -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SCSCEP1351	a) Linux Administration (P)	--	--	--	--	10	15	25

SCSCET1351: a) Linux Administration (P) (Minor 1) Curriculum Details

Course pre-requisite:

1. Operating System concepts
2. Linux basic commands
3. File and directory handling
4. Computer hardware fundamentals.

Course Objectives:

1. Understand the concepts and responsibilities of system administration in Linux/Unix environments.
2. Learn user and group account management techniques.
3. Configure file permissions, passwords, and administrative privileges for system security.
4. Understand disk quota management and task automation techniques.

Course Outcomes:

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

1. Understand system administration concepts and manage Linux user and group accounts effectively.
2. Configure user permissions, passwords, administrative privileges, and disk quotas for secure system operation.
3. Automate administrative tasks and manage system startup services and boot processes.
4. Monitor, schedule, and control system processes using command-line and graphical administration tools.

Curriculum Details:

List of Practical

1. Study and configure Linux user accounts using `useradd`, `usermod`, and `userdel` commands.
2. Create and manage groups using `groupadd`, `groupmod`, and `groupdel` commands.
3. Configure file and directory permissions using `chmod`, `chown`, and `chgrp` commands.
4. Implement password management and password aging policies for users.
5. Grant and revoke administrative privileges using `sudo` configuration.
6. Configure and verify disk quotas for users and groups.
7. Create shell scripts for automating routine administrative tasks.
8. Study and analyze the Linux booting process and run levels.
9. Configure services to start automatically during system boot.
10. Start, stop, restart, and check the status of system services manually.
11. Schedule tasks using `cron` and `at` commands.
12. Monitor system performance using `top`, `ps`, `vmstat`, and `free` commands.
13. Manage processes using `kill`, `nice`, and `renice` commands.
14. Study graphical system-monitoring and process-management tools in KDE/Linux environment.
15. Perform backup and restore operations using `tar`, `rsync`, and backup utilities.

Reference Books:

1. Fedora 7 Unleashed by Andrew Hudson and Paul Hudson (SAMS publication).
2. UNIX and Linux System Administration Handbook — Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Pearson Education.
3. Linux Administration: A Beginner's Guide — Wale Soyinka, McGraw-Hill Education.
4. Red Hat Linux System Administration — Mohammed J. Kabir, Wiley Publishing.
5. Beginning Linux Programming — Wrox Publication.

Course Structure:

Minor 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCSCET1351	b) Cloud Computing	45	--	03	--	03

Minor 1–Assessment Scheme

Course Code (1)	Course Name (Paper Title) (2)	Theory				Practical		Total [Col (5+6) Or Col (7+8)]
		CA			ESA (6)			
		Test I (3)	Test II (4)	Sum of T1 & T2 (5)		CA (7)	ESA (8)	
SCSCET1351	b) Cloud Computing	15	15	30	45	--	--	75

SCSCET1351: b) Cloud Computing (Minor 1) Curriculum Details

Course pre-requisite:

1. Fundamentals of Computer Systems
2. Operating System Basics
3. Computer Networks (Basic Level)
4. Basic Database Knowledge

Course Objectives:

1. To introduce the fundamental concepts of cloud computing, including cloud models, service types, and the shared responsibility model.
2. To familiarize students with the basics of Microsoft Azure and its core architectural components.
3. To understand various Azure services such as computer, networking, storage, identity, and security.

Course Outcomes:

1. Apply Azure services to create, configure, and manage cloud resources such as virtual machines, storage accounts, and virtual networks.
2. Analyse factors affecting cost in Azure and utilize tools like pricing calculator and cost management for optimization.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0	1	Introduction cloud computing concepts	13
	1.1	Introduction to Microsoft Azure Fundamentals	
	1.2	Introduction to cloud computing	
	1.3	What is cloud computing and Define cloud models?	
	1.4	shared responsibility model	
	1.5	Benefits of using cloud services	
	1.6	Cloud service types	
2.0	2	Describe Azure architecture and services	12
	2.1	Core Architectural components of Azure	
	2.2	Azure compute services	
	2.3	Azure networking services	
	2.4	Azure storage services	
	2.5	Azure identity, access, and security	
3.0	3	Azure management and governance	10
	3.1	Describe factors that can affect costs in Azure, Explore the pricing calculator	
	3.2	Microsoft Cost Management tool	
	3.3	What is purpose of tags?	
	3.4	Cost Optimization options in Azure	
4.0	4	Features and tools for managing and deploying Azure resources	10
	4.1	Tools for interacting with Azure	
	4.2	Azure Resource Manager and Azure ARM templates	
	4.3	Azure Advisor	
	4.4	Azure Service Health	
	4.5	Concept of Azure Monitor	
		Total	45

Text Books:

1. Thomas Erl, Ricardo Puttini, Zaigham Mahmood, “Cloud Computing: Concepts, Technology & Architecture”, First Edition, Pearson, 2013.
2. Anthony Puca, Michael Washam, “Exam Ref AZ-900 Microsoft Azure Fundamentals”, Second Edition, Microsoft Press, 2022.
3. Rajkumar Buyya, James Broberg, Andrzej Goscinski, “Cloud Computing: Principles and Paradigms”, First Edition, Wiley, 2011.

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, “Mastering Cloud Computing”, First Edition, McGraw Hill Education, 2013.

Course Structure:

Minor 1-Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCSCEP1351	b) Cloud Computing (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				
SCSCEP1351	b) Cloud Computing (P)	--	--	--	--	10	15	25

SCSCEP1351: b) Cloud Computing (P) (Minor 1) Curriculum Details

Course pre-requisite:

1. Fundamentals of Computer Systems
2. Operating System Basics
3. Computer Networks (Basic Level)
4. Basic Database Knowledge

Course Objectives:

4. To introduce the fundamental concepts of cloud computing, including cloud models, service types, and the shared responsibility model.
5. To familiarize students with the basics of Microsoft Azure and its core architectural components.
6. To understand various Azure services such as computer, networking, storage, identity, and security.

Course Outcomes:

1. Apply Azure services to create, configure, and manage cloud resources such as virtual machines, storage accounts, and virtual networks.
2. Analyse factors affecting cost in Azure and utilize tools like pricing calculator and cost management for optimization.

Curriculum Details:

List of Practical

1. Demonstrate the Shared Responsibility Model using a diagram.
2. Create an account on Microsoft Azure portal.
3. Create and manage a Resource Group.
4. Create a Virtual Machine (VM) in Azure.
5. Configure VM (CPU, RAM, OS selection).
6. Create and configure Virtual Network (VNet)
7. Create a Storage Account and upload/download files.
8. Working with Blob Storage (upload images/files).
9. Configure access control using IAM (Identity and Access Management).
10. Implement basic security using Network Security Groups (NSG)
11. Analyze billing using Azure Cost Management tool.
12. Create and apply tags to resources.
13. Azure CLI / PowerShell to create resources
14. Deploy resources using Azure Resource Manager (ARM) templates.
15. Create alerts for resource usage..

Text Books:

4. Thomas Erl, Ricardo Puttini, Zaigham Mahmood, “Cloud Computing: Concepts, Technology & Architecture”, First Edition, Pearson, 2013.
5. Anthony Puca, Michael Washam, “Exam Ref AZ-900 Microsoft Azure Fundamentals”, Second Edition, Microsoft Press, 2022.
6. Rajkumar Buyya, James Broberg, Andrzej Goscinski, “Cloud Computing: Principles and Paradigms”, First Edition, Wiley, 2011.

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, “Mastering Cloud Computing”, First Edition, McGraw Hill Education, 2013.

Course Structure:

Minor 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SCSCET1351	c) 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	
SCSCET1351	c) Enterprise Infrastructure and Cloud Technologies - Part II	15	15	30	45	--	--	75

SCSCET1351: c) 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
SCSCEP1351	c) 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				
SCSCEP1351	c) Enterprise Infrastructure and Cloud Technologies - Part II (P)	--	--	--	--	10	15	25

SCSCEP1351: c) 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.
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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
SCSCVC1351	NoSQL with MongoDB	--	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	
SCSCVC1351	NoSQL with MongoDB	--	--	--	--	20	30	50

SCSCVC1351: NoSQL with MongoDB (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:

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

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)
