



॥ 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 पदव्युत्ती द्वितीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२५-२६ पासून लागू करण्याबाबत.

## प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक २७ मे २०२५ रोजी संपन्न झालेल्या मा. विद्यापरिषद बैठकीतील विषय क्रमांक ४२/६१-२०२५ च्या ठरावानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील राष्ट्रीय शैक्षणिक धोरण-२०२० नुसारचे पदव्युत्तर द्वितीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२५-२६ पासून लागू करण्यास मा. विद्यापरिषदेने मान्यता प्रदान केली आहे. त्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील एम. एस्सी द्वितीय वर्षाचे खालील विषयाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२५-२६ पासून लागू करण्यात येत आहेत.

01	M. Sc. II year Data Science (Affiliated College )
02	M. Sc. II year Computer Application (Affiliated College)

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या [www.srtmun.ac.in](http://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/एनइपी/विवत्रविपदवी/२०२५-२६/१५

दिनांक २९.०७.२०२५

सहाय्यक कुलसचिव

शैक्षणिक (१-अभ्यासमंडळ) विभाग

प्रत : माहितीस्तव तथा कार्यवाहीस्तव.

१) मा. कुलगुरू महोदयांचे कार्यलय, प्रस्तुत विद्यापीठ.

२) मा. प्र. कुलगुरू महोदयांचे कार्यलय, प्रस्तुत विद्यापीठ.

३) मा. आधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.

४) मा. संचालक, परीक्षा व मुल्यमापन मंडळ, प्रस्तुत विद्यापीठ.

५) मा. प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.

६) सिस्टीम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. याना देवून कळविण्यात येते की, परिपत्रक अभ्यासक्रम संकेतस्थळावर प्रसिध्द करण्यात यावेत.

**SWAMI RAMANAND TEERTH**

**MARATHWADA UNIVERSITY, NANDED - 431 606**



**(Structure and Syllabus of Two Years PG Degree Program with  
Multiple Entry and Exit Option)**

**TWO YEAR MASTERS PROGRAMME IN**  
**SCIENCE**

**Subject Computer Application**

**Under the Faculty of**

**Science and Technology**

**Effective from Academic year 2024 – 2025**

**(As per NEP-2020)**

**Swami Ramanand Teerth Marathwada University**  
**Nanded**  
**Affiliated Colleges**



**Faculty of Science and Technology**

**NEP-2020 Oriented Structure of Post Graduate Programs**

(as per Govt. of Maharashtra GR dated 16-05-2023)

**M.Sc. Computer Application (Affiliated Colleges)**

**(Second Year)**

***Introduced from Academic Year 2024-2025***

# Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

NEP-2020 oriented Structure of Two Years Post Graduate Program

**Subject: Computer Application (Affiliated Colleges) Second Year**

Introduced from Academic Year 2025-2026 (as per Govt. of Maha. GR dated 16-05-2023)

Program Year and Sem	Level	Semester		Faculty			Other courses				
Second Year is program for PG programs in the affiliated colleges			<b>Major / Mandatory / SDSC</b>		<b>Electives / SDSC</b>		<b>RM /others</b>	<b>OJT/FP/</b>	<b>RP</b>	<b>Total Sem. credits</b>	<b>Cumu. Credits</b>
			<b>Theory</b>	<b>Practical</b>	<b>Theory</b>	<b>Practical</b>					
			<b>(04 credits)</b>	<b>(01credits)</b>	<b>(04 credits)</b>	<b>(03+01)</b>	<b>(02 credits)</b>	<b>(04 credits)</b>	<b>(04 credits)</b>		
M.Sc. CA	6.5	Third Semester	SCMPAC-501 SCMPAC-502 SCMPAC-503	SCMPAP-501 SCMPAP-502	SCMPAE-501 (FROM SAME SCHOOL/DEPT)	-----	-----	-----	SCMPAR-501	22	66
M.Sc. CA	6.5	Fourth Semester	SCMPAC-551 SCMPAC-552	SCMPAP-551 SCMPAP-552	SCMPAE-551 (FROM SAME SCHOOL/DEPT)	-----	SVECP -551 Publication ethics	-----	SCMPAR-551 ( 06 credits)	22	88
<b>Exit Option: After completion of Second year as above with cumulative 88 credits, student will be awarded M.Sc. in Computer Science Degree depending upon enrollment and completion of program specific core and electives courses **</b> <b>**( for students who have done 03 years UG program)</b>											

**Program Specific Syllabus: Third Semester  
Computer Application**

<b>Core Courses Code</b>	<b>Title</b>	<b>Remarks Credits</b>
SCMPAC-501	Image Processing using Python	04
SCMPAC-502	Hibernate and Spring Framework	04
SCMPAC-503	Block Chain Technology	04
SCMPACP-501	Lab 7:IP Using Python Lab	01
SCMPACP-502	Lab 8: Hibernate and Spring Lab	01
SCMPAE-501	<b>Chose any one</b> A. Data Science with Python B. Linux Administration C. Advanced Computer Networks D. Internet of Things	03 Theory and 01 Lab
SCMPAR-501	Research Project	04

**Program Specific Syllabus: Fourth Semester  
Computer Application**

<b>Core Courses Code</b>	<b>Title</b>	<b>Remarks Credits</b>
SCMPAC-551	Programming in C#	04
SCMPAC-552	Introduction to AI and ML	04
SCMPACP-551	Lab 9: Programming in C# Lab	01
SCMPACP-552	Lab 10: ML Lab	01
SCMPAE-551	<b>Chose any one</b> A. Database Administration B. Data Mining and Data Warehousing C. DevOps Fundamental	03 Theory and 01 Lab
SVECP -551	Publication Ethics	02
SCMPAR-551	Research Project	06

**M. Sc. CA Second Year, Semester III (Level 6.5): Teaching Scheme**

	Course Code	Course Name	Credits Assigned per course			Teaching Scheme (Hrs./ week) per course	
			Theory	Practical	Total	Theory	Practical
Major	SCMPA-501 to SCMPAC-503	All Core Course	12	--	12	12	--
Elective	SCMPAE-501 and SCMPAE-551	All Elective Courses	03	--	03	03	--
Special Courses	SCMPAR-501	Research Project	--	04	04	--	02
Major Practical	SCMPACP-501 to SCMPACP-502	All Core labs	--	02	02	--	02
Elective Practical	SCMPAE-501	Elective lab	--	01	01	--	01
<b>Total Credits per semester</b>			<b>15</b>	<b>07</b>	<b>22</b>	<b>15</b>	<b>05</b>

**M. Sc. CA Second Year, Semester IV (Level 6.5): Teaching Scheme**

	Course Code	Course Name	Credits Assigned per course			Teaching Scheme (Hrs./ week) per course	
			Theory	Practical	Total	Theory	Practical
Major	SCMPAC-551 to SCMPAC-552	All Core Course	08	--	08	08	--
Elective	SCMPAE-551	All Elective Courses	03	--	03	03	--
Special Courses	SCMPAR-551	Research Project	--	06	06	--	04
Special Courses	SVECP -C551	Publication ethics	02	--	02	02	--
Major Practical	SCMPACP -551 and SCMPACP -552	All Core labs	--	02	02	--	02
Elective Practical	SCMPAE-551	Elective lab	--	01	01	--	01
<b>Total Credits per semester</b>			<b>13</b>	<b>09</b>	<b>22</b>	<b>13</b>	<b>07</b>

**M. Sc. CA Second Year, Semester III and IV (Level 6.5): Examination Scheme**

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)	Avg of (T1+T2)/2 (6)	Total (7)	CA (8)	ESA (9)	
SCMPAC-501 to SCMPAC-503 and SCMPAC-551 to SCMPAC-552	All core courses	20	20	20	80	--	--	100
SCMPAE-501 and SCMPAE-551	All elective courses	15	15	15	60	--	--	75
Special Courses	SCMPAR-501	--	--	--	--	25	75	100
Special Courses	SCMPAR-551	--	--	--	--	50	100	150
Special Courses	SVECP -C551	10	10	10	40	--	--	50
SCMPACP-501 to SCMPACP-502 SCMPACP -551 and SCMPACP -552	All Core Labs	--	--	--	--	05	20	25
SCMPAE-501and SCMPAE-551	All Elective labs	--	--	--	--	05	20	25

## **Guidelines for Course Assessment:**

**A. Continuous Assessment (CA) (20% of the Maximum Marks):** This will form 20% of the Maximum Marks and will be carried out throughout the semester. It may be done by conducting **Two Tests** (Test I on 40% curriculum) and **Test II** (remaining 40% syllabus). Average of the marks scored by a student in these two tests of the theory paper will make his **CA** score (col. 6).

**B. End Semester Assessment (80% of the Maximum Marks):** *(For illustration we have considered a paper of 04 credits, 100 marks and need to be modified depending upon credits of an individual paper)*

1. **ESA Question paper** will consist of 6 questions, each of 20 marks.
2. **Students** are required to solve a total of 4 Questions.
3. **Question No.1** will be compulsory and shall be based on entire syllabus.
4. Students need to solve **ANY THREE** of the remaining Five Questions (Q.2 to Q.6) and shall be based on entire syllabus.

**C. Question paper of campus and affiliated colleges shall be different**

**Note:** Number of lectures required to cover syllabus of a course depends on the number of credits assigned to a particular course. One credit of theory corresponds to 15 Hours lecturing and for practical course one credit corresponds to 30 Hours. For example, for a course of two credits 30 lectures of one-hour duration are assigned, while that for a three credit course 45 lectures.

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**M.Sc. Computer Application**  
**M.Sc.(CA) S. Y. (Semester III)**  
**SCMPAC-501 Image Processing using Python**

**Learning Objectives:**

- i. To understand digital image processing principles.
- ii. To apply image processing techniques and to implement image enhancement and restoration.
- iii. Perform image segmentation and object detection.
- iv. To extract features for analysis and classification.
- v. To develop Python applications for image processing tasks

**Course Outcomes:**

Upon successful completion of this course, students will be able to:

- Acquire proficiency in digital image processing fundamentals.
- Demonstrate competence in utilizing Python for image processing.
- Execute techniques for image enhancement and restoration effectively.
- Successfully perform image segmentation and object detection.
- Employ feature extraction methods for analysis and classification tasks.
- Create functional Python applications tailored for image processing purposes.

**Unit I: Introduction to Digital Image Processing** **8 Hrs.**

Basics of digital images, Image representation (grayscale, RGB, etc.), Image acquisition and sampling, Histogram equalization, Spatial domain methods (e.g., filtering), Frequency domain methods (e.g., Fourier transform)

**Unit II: Image Restoration** **8 Hrs.**

Image degradation models, Noise reduction techniques, Image Blurring and sharpening, Thresholding techniques, Edge detection of Image, Region-based segmentation, Texture analysis, Shape descriptors, Corner detection

**Unit III: Introduction to Python Libraries for Image Processing** **8 Hrs.**

Overview of OpenCV, scikit-image, and NumPy, Installation and setup

**Unit IV: Image Processing with OpenCV and scikit-image** **8 Hrs.**

Loading and displaying images, Basic image operations, Filtering and convolution, Image manipulation and transformation, Segmentation algorithms, Feature extraction

**Unit V: Feature Extraction** **8 Hrs.**

Introduction to feature extraction, Texture analysis using gray-level co-occurrence matrix (GLCM), Shape descriptors: Hu moments, Fourier descriptors

**Unit VI: Applications of Image Processing** **8 Hrs.**

Medical image processing: MRI and CT image analysis, Remote sensing applications: satellite image processing, Computer vision applications: object detection and recognition

**References:**

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

**M.Sc. Computer Application**  
**M.Sc.(CA) S. Y. (Semester III)**  
**SCMPACP-501 Image Processing using Python**

**Note:** Conduct at least 15 practical based on given syllabus.

**M.Sc. Computer Application**  
**M.Sc.(CA) S. Y. (Semester III)**  
**SCMPAC-502- Hibernate and Spring Framework**

**Learning Objectives:**

- i. To Access databases with JDBC and Hibernate.
- ii. To Acquire knowledge on creation of software components using Spring Framework.
- iii. To Learn safe and maintainable techniques for programming with AOP.
- iv. To Understand REST, and use Spring MVC to build RESTful services.
- v. To learn the creation of pure Dynamic Web Application using Spring MVC.
- vi. To understand how to build complex UIs using Spring Boot.
- vii. To be familiar with using Spring Boot starters and start.spring.io to easily create new applications.

**Course Outcomes:**

After successful completion of this course, students should be able to:

- Implement the web based applications using JDBC and Hibernate.
- Implement web based applications using features of Spring Framework.
- Apply the concepts of server side technologies for dynamic web applications using Spring MVC.
- Use the core principles of Spring, and of Dependency Injection (DI) / Inversion of Control.
- Integrate Spring MVC with technologies such as Hibernate.
- Learn how to build a simple MVC application using Spring Boot
- Configure database connectivity via Spring Boot

**Unit I: ORM and Hibernate**

**10 Hrs.**

Introduction to ORM Framework, ORM advantages, Hibernate Introduction, Hibernate Architecture, Hibernate Session, Hibernate SessionFactory, Hibernate Configuration, Mapping, Mapping with Annotations, Hibernate Aggregation, Hibernate Named Queries, Hibernate Native SQL, HQL- Hibernate Query Language

**Unit II: Working with Hibernate Objects**

**12 Hrs.**

Hibernate Object States, Insert Object, Retrieve Object, CRUD Operations, hibernate with annotations, Hibernate Query Language, Criteria Query, Native SQL, Hibernate Mapping

**Unit III: Introduction to Spring**

**8 Hrs.**

Spring Features, Spring Architecture, Spring Core, Bean Configuration file, Inversion of Control, Dependency Injection, Auto Wiring

**Unit IV: Spring MVC**

**8 Hrs.**

MVC Overview, Introduction to Spring MVC, Work flow in Spring MVC, Components of Spring MVC, Spring Annotations, First Spring MVC Application

**Unit V: Spring MVC and Hibernate****6 Hrs.**

Spring MVC Form Handling, Spring MVC Application with Form Handling, Spring-Hibernate Application

**Unit VI: Introduction to Spring Boot****12 Hrs.**

Overview of Spring Boot, Spring Boot Layers, Spring Boot Flow Architecture, Hello World example, Spring Boot Dependency Injection, Singleton Scope, Prototype Scope, Auto wiring, Spring Boot Web App, Spring Boot MVC and JPA H2

**References:**

1. Beginning Hibernate: For Hibernate 5, Fourth Edition, Joseph B. Ottinger Jeff Linwood Dave Minter, APress Publication
2. Spring Framework Cookbook, Java Code Geeks.
3. Introducing Spring Framework, Felipe Gutierrez, APress Publication
4. Spring MVC: A Tutorial, Second Edition, Paul Deck, Brainy Software.
5. Spring MVC Beginner's Guide, Second Edition, Amuthan Ganeshan, Packt Publishing Ltd

**M.Sc. Computer Application**  
**M.Sc.(CA) S. Y. (Semester III)**  
**SCMPACP-502- Hibernate and Spring Framework**

**Note:** Conduct at least 15 practical based on given syllabus.

**M.Sc. Computer Application**  
**M.Sc.(CA) S. Y. (Semester III)**  
**SCMPAC-503- Block Chain Technology**

**Learning Objectives:**

- i. This course is intended to study the basics of Block chain technology.
- ii. During this course student will explore various aspects of Block chain technology like application in various domains.
- iii. Students will be able to understand Bitcoin, Ethereum, Hyper ledger, Solidity Programming
- iv. By implementing learner will have idea about private and public Blockchain, and smart contract.

**Course Outcomes:**

After the completion of this course, student will be able to

- Understand and explore the working of Block chain technology (Understanding)
- Analyze the working of Smart Contracts (Analyze)
- Understand and analyze the working of Hyperledger (Analyze).
- Apply the learning of solidity and de-centralized apps on Ethereum (Apply).

**Unit I: Introduction of Cryptography and Blockchain**

**10 Hrs.**

Model of decentralization, What is Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions And Blocks, P2P Systems, Basics of Cryptography, Keys As Identity, Digital Signatures, Hashing, and public key cryptosystems, Private vs. public Blockchain.

**Unit II: BitCoin and Cryptocurrency**

**12 Hrs.**

What is Bitcoin, The Bitcoin Network, The Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree, Double-Spend Problem, Blockchain And Digital Currency, Transactional Blocks, Impact Of Blockchain Technology On Cryptocurrency

**Unit III: Introduction to Ethereum**

**10 Hrs.**

What is Ethereum, Introduction to Ethereum, Consensus Mechanisms, How Smart Contracts Work, Metamask Setup, Ethereum Accounts, Receiving Ether's What is a Transaction? Smart Contracts.

**Unit IV Introduction to Hyperledger**

**12 Hrs.**

Permission less model and Open Consensus, Proof of Work(PoW) and its Limitation, Beyond PoW, Introduction to Hyperledger: What is Hyperledger? Distributed Ledger Technology & its

Challenges, Hyperledger & Distributed Ledger Technology, Hyperledger Fabric, Hyperledger Composer, Enterprise Block-Chain

**Unit V: Solidity Programming:**

**08 Hrs.**

Solidity - Language of Smart Contracts, Installing Solidity & Ethereum Wallet, Basics of Solidity, Layout of a Solidity Source File & Structure of Smart Contracts, General Value Types (Int, Real, String, Bytes, Arrays, Mapping, Enum, address)

**Unit VI: Blockchain Security and Applications**

**08 Hrs.**

Hyper ledger Aries, Blockchain Security, Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain, Alt Coins

**References:**

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction Antonopoulos and G. Wood, Mastering Ethereum.
2. D. Drescher, Blockchain Basics. Apress, 2017.
3. Hyperledger Tutorials - <https://www.hyperledger.org/use/tutorials>
4. Ethereum Development Resources - <https://ethereum.org/en/developers>



**M.Sc. Computer Application**  
**M.Sc.(CA) S. Y. (Semester III)**  
**SCMPAE-501- A Data Science with Python**

**Objectives:**

- i. This course's goal is to expose undergraduate students to data science using Python.
- ii. To develop the abilities necessary to manage, examine, and visualize data, use fundamental machine learning strategies, and comprehend real-world data science applications.

**Outcomes:**

- Students are able to Use Python for data processing, analysis, and visualization.
- Use exploratory data analysis to uncover new information in datasets.
- Students understand to Utilize scikit-learn to implement core machine learning algorithms.
- Real-world case studies can help Student better comprehend the actual use of data science in many fields.

**Unit I: Introduction to Data Science and Python**

**8Hrs.**

What is data science and its applications? Introduction to Python and Jupyter Notebooks. Basic Python data types, variables, and operators.

**Unit II: Data Handling with Python**

**10Hrs.**

Working with data structures: lists, dictionaries, and tuples. Data manipulation using NumPy and Pandas. Data cleaning, handling missing values, and data transformation.

**Unit III: Data Visualization with Matplotlib and Seaborn**

**8Hrs.**

Introduction to data visualization. Creating basic and advanced plots using Matplotlib and Seaborn. Data presentation and storytelling through visualizations.

**Unit IV: Exploratory Data Analysis (EDA)**

**8Hrs.**

Conducting EDA to understand datasets. Descriptive statistics and data profiling. Data distribution, outliers, and correlation analysis.

**Unit V: Introduction to Machine Learning with Python**

**8Hrs.**

Understanding supervised and unsupervised learning. Building and evaluating machine learning models in scikit-learn, Linear regression and logistic regression for predictive modeling.

## **Unit VI: Data Science Applications and Case Studies**

**8Hrs.**

Introduction to Data Science Applications, Case Studies and Use Cases, Hands-On Analysis  
Ethical Considerations

### **References:**

1. "Python for Data Analysis" by Wes McKinney
2. "Data Science for Dummies" by Lillian Pierson and Jake VanderPlas
3. "Introduction to Machine Learning with Python" by Andreas C. Müller & Sarah Guido
4. "Python Data Science Handbook" by Jake VanderPlas

**M.Sc. Computer Application**  
**M.Sc.(CA) S. Y. (Semester III)**  
**SCMPAE-501-A Data Science with Python**

**Note:** Conduct at least 15 practical based on given syllabus.

**M.Sc. Computer Application**  
**M.Sc.(CA) S. Y. (Semester III)**  
**SCMPAE-501 B Linux Administration**

**Course Objectives:**

- i. To describe the relationship between GNU and Linux
- ii. To describe various operating system concepts such as multitasking, virtual memory and multiuser environments as they apply to Linux.

**Course Outcome:**

- Students will be able carry the duties of a Unix system administer.
- Students will learn to do file processing, process management, IO management, queues management, networking, storage backup, account management, proper system start-up and shutting down, as well as other tasks.

**Unit I: Introduction to RED Hat LINUX**

**8 Hrs.**

Hardware Requirements, Red Hat LINUX Installation, Advantages of LINUX, Other LINUX distributions, Concept of Linux loader

**Unit II: Working with Linux**

**8 Hrs.**

LINUX file system, Shells, Text editors, Changing User Information, File Permissions, Virtual Consoles

**Unit III: The X Window System**

**8 Hrs.**

Basic X window system, Configuring X window systems, Starting X, Selecting & using X window.

**Unit IV: Managing Services, Software & System Resources**

**8 Hrs.**

LINUX Boot Process, System services and run levels, controlling services at boot with administrative tools, Starting and stopping services manually

**Unit V: Managing Software & System Resources**

**8 Hrs.**

Using RPM for software management, Using RPM on the command line, extracting a single file from & RPM file, Graphical Package Management, System monitoring tools

**Unit VI: Printing with Linux**

**8 Hrs.**

Configuring & managing print services, Local printer installation, Network printer installation, LINUX printing commands, Using the Common UNIX Printing System (CUPS), Console print control, Introduction to Network Connectivity Networking with TCP/IP Reference Books:

**References:**

1. Red Hat Linux Unleashed, Edition illustrated reprint, “Bill Ball, David Pitts”, Sams, 2001, ISBN 0672319853, 9780672319853.
2. Red Hat Fedora 2 Unleashed, Edition illustrated, “Bill Ball, David Pitts”, Sams, 2005, ISBN 067232721X, 9780672327216.

**M.Sc. Computer Application**

**M.Sc.(CA) S. Y. (Semester III)**

**SCMPAE-501 B Linux Administration**

**Note:** Conduct at least 15 practical based on given syllabus.

**M.Sc. Computer Application**  
**M.Sc.(CA) S. Y. (Semester III)**  
**SCMPAE-501 C Advanced Computer Networks**

**Course Objectives:**

- i. Describe the role of dynamic routing protocols and place these protocols in the context of
- ii. modern network design
- iii. Understand N/W protocols like RIP, OSPF & EIGRP according to industry requirement
- iv. Study of reference models.

**Course Outcome:**

- Practical hands-on will help to interconnect the N/W components & design industrial N/w
- Best Practices for configuring dynamic routing protocols
- Best Practices for network troubleshooting.

**Unit I: Network Fundamentals** **8 Hrs.**

Compare network topologies, Networking cables, LAN vs VPN, OSI Model, TCP/IP Model, Compare OSI and TCP/IP models, Configure IP, verify and troubleshoot IPv4, addressing, Need for private IPv4 addressing, IPv4 vs IPv6

**Unit II: Routing Protocol Concepts** **8 Hrs.**

Interior and Exterior Routing Protocols, Connected Routes, Static Routes, Extended ping Command, Default Routes, RIP Protocol, RIP-2 Basic Concepts, Comparing and Contrasting IP Routing Protocols.

**Unit III: OSPF** **8 Hrs.**

Compare and contrast distance vector and link state routing protocols, OSPF Protocols and Operation, OSPF Neighbors, OSPF Topology Database Exchange, OSPF Configuration

**Unit IV: EIGRP** **8 Hrs.**

EIGRP Concepts and Operation, Exchanging EIGRP Topology Information, EIGRP Configuring and Verification.

**Unit V: WAN Technologies** **8 Hrs.**

Satellite communication, VSAT, PPP Concepts, PPP Protocol Field, PPP Link Control Protocol, PPP Configuration

**Unit VI: Troubleshooting IP Routing** **8 Hrs.**

The Ping and trace route Commands, Internet Control Message Protocol, Troubleshooting the Packet Forwarding Process, Host Troubleshooting Tips Interface Status, Extended Ping.

#### **Reference Books**

1. CCENT/CCNA ICND1 (Second Edition) - Wendell Odom

**M.Sc. Computer Application**

**M.Sc.(CA) S. Y. (Semester III)**

**SCMPAE-501 C Advanced Computer Networks**

**Note:** Conduct at least 15 practical based on given syllabus.

**M.Sc. Computer Application**  
**M.Sc.(CA) S. Y. (Semester III)**  
**SCMPAE-501- D Internet of Things (IoT)**

**Learning Objectives:**

- i. To study the fundamentals about IoT
- ii. To study about IoT Access technologies
- iii. To study the design methodology and different IoT hardware platforms.
- iv. To study the basics of IoT supporting services.
- v. To study about various IoT case studies and industrial applications.

**Course Outcomes:**

After successful completion of this course, students should be able to:

- Understand the basics of IoT.
- Implement the state of the Architecture of an IoT.
- Understand design methodology and hardware platforms involved in IoT.

**Unit I: Basics of IoT Networking** **8 Hrs.**

Overview of Internet of Things, Wireless Sensor Networks, Machine-to-Machine Communications  
Cyber Physical Systems

**Unit II: Introduction to Internet of Things** **8 Hrs.**

Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT  
Networking Components, Addressing Strategies in IoT

**Unit III: IoT Sensors, Actuators and Microcontroller devices** **8 Hrs.**

Sensors, Sensor Characteristics, Sensing Types, Actuators, Actuator Characteristics, Actuator  
Types, Arduino, Raspberry Pi

**Unit IV: Processing in IoT** **8 Hrs.**

Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and  
Selection Considerations

**Unit V: IoT Connectivity Technologies** **8 Hrs.**



IEEE 802.15.4, Zigbee, RFID, DASH7, NFC, Z-Wave, Cloud Computing, Virtualization, Cloud Models, Sensor-Cloud: Sensors-as-a-Service, Fog Computing and Its Applications

### **Unit VI: Application Areas and Futures of IoT**

**8 Hrs.**

Agricultural IoT, Components of an agricultural IoT, Advantages of IoT in agriculture, Smart irrigation management system, Vehicular IoT, Components of vehicular IoT, Advantages of vehicular IoT, Healthcare IoT, Components of healthcare IoT, Advantages and risk of healthcare IoT, Evolution of New IoT Paradigms, Challenges Associated with IoT, Emerging Pillars of IoT

#### **References:**

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. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012.| ISBN 978-1-11999435-0

**M.Sc. Computer Application**  
**M.Sc.(CA) S. Y. (Semester III)**  
**SCMPAE-501-D Internet of Things (IoT)**

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**Note:** Conduct at least 15 practical based on given syllabus.

**M.Sc. Computer Application**  
**M.Sc.(CA) S. Y. (Semester III)**  
**SCMPAR-551 Research Project**

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**Note:**

**Students have to complete the research project under the guidance of a research guide.**

## **M.Sc. Computer Application**

### **M.Sc.(CA) S. Y. (Semester IV)**

#### **SCMPAC-551 Programming using C#**

##### **Course Objectives:**

- To learn the concept of .NET architecture
- To understand the concepts of The Common Language Runtime(CLR) & Visual Studio
- To understand the applications of C#.
- 

##### **Course Outcomes:**

Students will able to:

- Learn the distinction between programming language Vs .NET.
- Learn different programming representation techniques.
- Learn basics of multithreading, windows programming, database handling in windows Application

##### **UNIT I: Introducing C#**

**9 Hrs**

What is c#, Why C# & Evolution of C#, Character tics of C#, How C# differs from C++ & Java, Introduction to .Net Technology & Framework, Exploring Some Key Benefits of the .NET Platform, Understanding the .NET Support Lifecycle, The Common Language Runtime(CLR), Overview of .NET, Integrated Development environment, Building .NET Core Applications with Visual Studio.

##### **UNIT II: Languages Basics**

**9 Hrs**

Breaking Down a Simple C# Program, Using the System. Console Class, working with System, Data, Types and Corresponding C# Keywords, Data Types, Operators, Control Statements, Looping, Statements, Arrays, Jagged Arrays, Array List class, String class, and String Manipulations, Understanding Method Parameters, Understanding the enum Type, Understanding Value Types and Reference Types, Boxing & Unboxing variable.

##### **UNIT III: Lambda Expressions, Namespace, Exception handling**

**8 Hrs**

Understanding Lambda Expressions, Processing Arguments Within Multiple Statements, Lambda Expressions with Multiple (or Zero) Parameters, using static with Lambda Expressions, Discards with Lambda Expressions, Creating & using Namespace (DLL library), Exception

##### **UNIT IV Multithreading**

**8 Hrs**

Understanding System. Threading Namespace, Creating & starting Thread, Threading synchronization & Pooling

### **UNIT V Windows Application**

**8Hrs**

Event Driven Programming Model, Important classes used in windows application, TextBox&LabelControl, Button, CheckBox, RadioButton&GroupBox Control, ListBox&ComboBox control, MonthCalendar Control, Docking Control, Tree View Control, Menu & Toolbar control, Dialog Boxes

### **UNIT VI Database Connectivity**

**8 Hrs**

Advantages of ADO.NET, Managed Data providers, developing a Simple ADO.NET Based Application, Retrieving & Updating Data from Tables

### **References: -**

1. Programming in C#, E Balagurusamy, McGraw Hill
2. Visual C#.Net, C Muthu, McGraw Hill

**M.Sc. Computer Application**

**M.Sc.(CA) S. Y. (Semester IV)**

**SCMPACP-551 Programming using C#**

**Note:** Conduct at least 15 practical based on given syllabus.

## **M.Sc. Computer Application**

### **M.Sc.(CA) S. Y. (Semester IV)**

#### **SCMPAC-552 Introduction to AI and ML**

##### **Learning Objectives:**

- i. To understand the basic concept of AI & ML.
- ii. To understand strength and weakness of problem solving and search algorithms.
- iii. To know about basic concepts of knowledge, and reasoning, Machine Learning.
- iv. To optimize the different linear methods of regression and classification.
- v. To interpret the different supervised classification methods of support vector machine and tree based models

##### **Course Outcomes:**

After successful completion of this course, students should be able to:

- Evaluate Artificial Intelligence (AI) methods and describe their foundations.
- Analyse and illustrate how search algorithms play vital role in problem solving, inference, perception, knowledge representation and learning.
- Demonstrate knowledge of reasoning and knowledge representation for solving real world problems
- Recognize the characteristics of machine learning that makes it useful to real-world problems
- Apply the different supervised learning methods of support vector machine and tree based models.
- Use different linear methods for regression and classification with their optimization through different regularization techniques.

##### **Unit I: Introduction to AI**

**10 Hrs**

Basic Definitions and terminology, Foundation and History of AI, Overview of AI problems, Evolution of AI, Applications of AI, Classification/Types of AI. Artificial Intelligence vs Machine learning. Intelligent Agent: Types of AI Agent, Concept of Rationality, nature of environment, structure of agents. Turing Test in AI.

##### **Unit II: Problem Solving**

**10 Hrs**

Search Algorithms in Artificial Intelligence: Terminologies, Properties of search Algorithms, Types of search algorithms: uninformed search and informed search, State Space search Heuristic Search Techniques: Generate-and-Test; Hill Climbing; Properties of A\* algorithm, Best-first Search; Beyond Classical Search: Local search algorithms and optimization problem, local search in continuous spaces, online search agent

### **Unit III: Knowledge and Reasoning**

**10 Hrs**

Knowledge-Based Agent in Artificial intelligence: Architecture, Approaches to designing a knowledge-based agent, knowledge representation: Techniques of knowledge representation, Propositional logic, Rules of Inference, First-Order Logic, Forward Chaining and backward chaining in AI, Reasoning in Artificial intelligence: Types of Reasoning and Probabilistic reasoning, Uncertainty.

### **Unit IV: Introduction to ML**

**10 Hrs**

Introduction to Machine Learning: History of ML Examples of Machine Learning Applications, Learning Types, ML Life cycle, AI & ML, dataset for ML, Data Pre-processing, Training versus Testing, Positive and Negative Class, Cross-validation.

### **Unit V: Learning**

**10 Hrs**

Types of Learning: Supervised, Unsupervised and Semi-Supervised Learning. Supervised: Learning a Class from Examples, Types of supervised Machine Learning Algorithms, Unsupervised: Types of Unsupervised Learning Algorithm, Dimensionality Reduction: Introduction to Dimensionality Reduction, Subset Selection, and Introduction to Principal Component Analysis.

### **Unit VI: Classification & Regression**

**10 Hrs**

Classification: Binary and Multiclass Classification: Assessing Classification Performance, Handling more than two classes, Multiclass Classification-One vs One, One vs Rest. Regression: Assessing performance of Regression – Error measures, Overfitting and Underfitting

### **References:**

1. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall
2. J. Gabriel, Artificial Intelligence: Artificial Intelligence for Humans (Artificial Intelligence, Machine Learning), Create Space Independent Publishing Platform, First edition , 2016
3. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
4. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI., 2010 S Kaushik, Artificial Intelligence, Cengage Learning, 1st ed.2011.
5. Ric, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw Hill.
6. Luger, G.F. 2008. Artificial Intelligence -Structures and Strategies for Complex Problem Solving, 6th edition, Pearson.
7. Alpaydin, E. 2010. Introduction to Machine Learning. 2nd edition, MIT.
8. Ethem Alpaydin: Introduction to Machine Learning, PHI 2nd Edition-2013.
9. Nilsson Nils J, "Artificial Intelligence: A new Synthesis, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4

**M.Sc. Computer Application**

**M.Sc.(CA) S. Y. (Semester IV)**

**SCMPACP-552 Introduction to AI and ML**

**Note:** Conduct at least 15 practical based on given syllabus.



## **M.Sc. Computer Application**

### **M.Sc.(CA) S. Y. (Semester IV)**

#### **SCMPAE-551 Database Administration**

##### **Learning Objectives:**

- i. To Introduce the students physical and Logical Structure of database
- ii. To aware the students the role of the database administrator

##### **Course Outcomes:**

After successful completion of this course, students should be able to:

- Explain and evaluate the fundamental theories and requirements that influence the design of modern database systems.
- Analyze the background processes involved in queries and transactions, and explain how these impact on database operation and design

##### **Unit I: Database Architecture**

**8 Hrs.**

Overview of database, pfile, spfile, Instance, Tablespaces, Datafiles, Other files, Oracle managed Files, Users, Schemas, Indexes, View, Sequences, Synonyms, Privileges, Roles, Clusters, Hash Clusters, Internal memory structure, SGA, PGA, Background processes, External structure, Redo logs, Control files, Trace files, Alert logs, Creating database manually.

##### **Unit II: Hardware configuration and consideration**

**8 Hrs.**

Architectural overview, Standalone hosts, Standalone hosts with disk array, Standalone, Hosts with disk shadowing, Multiple databases, Networked hosts, Networks of databases, Remote updates, Remote application options, Real application, Clusters, Multiple processors, The parallel query and parallel load options, Client/server databases application, Standby databases

##### **Unit III: Physical databases layouts**

**10 Hrs.**

Database file layouts, I/O connections among data files, I/O bottlenecks among all data files, Concurrent I/O among background processes, Defining recoverability and performance goals for the system, Defining the system hardware and mirroring architecture, Database space using overview, Implementation of the storage clause, Locally managed Tablespaces, Dictionary managed Tablespaces, Table segments, Index segments, Rollback segments, Temporary, Free space, Resizing Datafiles, Control files, Online redo log Files Deallocate space from segments, Shrinking Datafiles, Shrinking Tables, Clusters and indexes, Oracle managed files(OFA)

##### **Unit IV: Logical Database Layouts**

**10 Hrs.**

Describe logical structure of a database, Different types of Tablespaces, Changing the Tablespaces size, allocating segments for temporary segments, Temporary segments in permanents

Tablespaces, changing tablespace status, changing tablespace storage settings, Oracle Managed Files (OMFs), Oracle Flexible Architecture (OFA), Different segments types and relationships, Extent usages, Block space utilization.

#### **Unit V: Backup and Recovery**

**8 Hrs.**

Types of Logical and Physical backups, Implementations, Integrations of backup procedures, NOARCHIVELOG Mode, ARCHIVELOG Mode, Backup Methods –Closed Database Backup, Open Database Backup, Recovery in NOARCHIVELOG Mode, Recovery in ARCHIVELOG Mode, Recovery manager architecture, Recovery Manager Features, Using Recovery manager & RMAN, Using OEM backup manager, Generating lists and reports.

#### **Unit V: Networked ORACLE**

**8 Hrs.**

Overview of SQL \*Net and Net8, connect descriptors, Service names and Listeners, Net8 assistants, the multi-protocol interchange, Dedicated Server Processes, Oracle Shared Server, Benefits of Oracle Shared Server, Client Server application, Database links.

#### **Reference Books:**

1. Oracle 9i DBA Handbook, Eighth Reprint - Kevin Lonely, Marlene Theriault Oracle Press, Tata McGraw Hill Publication ISBN-0- 07-048674-3.
2. OCA Oracle 9i Associate DBA Certification Exam Guide, Sixth Reprint, Jason Couchman, Sudheer N. Marish Oracle Press, Tata McGraw Hill Publication, 2005, ISBN-0-07-049893-8

**M.Sc. Computer Application**

**M.Sc.(CA) S. Y. (Semester IV)**

**SCMPAE-551 Database Administration**

**Note:** Conduct at least 15 practical based on given syllabus.

## **M.Sc. Computer Application**

### **M.Sc.(CA) S. Y. (Semester IV)**

#### **SCMPAE-551 Data Mining and Data Warehousing**

##### **Learning Objectives:**

- i. To understand the principles of Data warehousing and Data Mining.
- ii. To be familiar with the Data warehouse architecture and its Implementation.
- iii. To know the Architecture of a Data Mining system.
- iv. To understand the various Data Preprocessing Methods.
- v. To perform classification and prediction of data.

##### **Course Outcomes:**

After successful completion of this course, students should be able to:

- Understand the usage, need and cost of Data Warehouse
- Learn various techniques for Data Warehouse and Data Mining
- Understand Market Basket Analysis

##### **Unit I: Introduction**

Basic Data Mining task, Data Mining Vs Knowledge discovery in databases, Data mining metrics, Social Implication of Data Mining.

##### **Unit II: Related Concepts and Data Mining Techniques**

Database/OLTP systems, Information Retrieval, Decision Support Systems, Dimensional Modelling, OLAP, Web Search Engines, Statistical perspective on Data Mining, Decision Tree, Neural networks

##### **Unit III: Classification**

Introduction, Statistical based algorithms, Distance based algorithms, Decision tree-based algorithms, Neural network-based algorithm.

##### **Unit IV: Clustering and Association Rules**

Introduction, Hierarchical algorithms, Partitioned algorithms, clustering large databases, Basic algorithms, Parallel and distributed algorithms

##### **Unit V: Web Mining**

Introduction, Web content mining, Web structure mining, Web usage mining

##### **Unit VI: Data Warehousing**

Data warehousing Components, building a Data warehouse, Data Warehouse Architecture, DBMS Schemas for Decision Support, Data Extraction, Clean-up, and Transformation Tools

**Reference Books:**

1. Data Mining Introductory and Advanced Topics, 2008, Margaret H.Dunham and S. Sridhar, Pearson Education, ISBN 81-7758-785-4
2. Data Warehousing Fundamentals, 2009, PaulrajPonniah, Wiley India Publication, ISBN 978-81-265-0919-5
3. Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Tenth Reprint 2007.
4. K.P. Soman, Shyam Diwakar and V. Ajay “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.
5. G. K. Gupta “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.
6. Pang-Ning Tan, Michael Steinbach and Vipin Kumar “Introduction to Data Mining”, Pearson Education, 2007.

**M.Sc. Computer Application**

**M.Sc.(CA) S. Y. (Semester IV)**

**SCMPAE-551 Data Mining and Data Warehousing**

**Note:** Conduct at least 15 practical based on given syllabus.

## **M.Sc. Computer Application**

### **M.Sc.(CA) S. Y. (Semester IV)**

#### **SCMPAE-551 DevOps Fundamental**

##### **Learning Objectives:**

- vi. DevOps Fundamental course would enable the students in understanding Basics of DevOps, Its Life Cycle, Integration and Deployments.
- vii. To Introduces Cloud Infrastructure with Terraform and Deployment with Packer
- viii. Understanding DevOps CI/CD Pipeline Version Control with Git, Git, Jenkins & Maven Integration
- ix. To Introduce the process of Continuous Integration and Continuous Delivery
- x. To Introduces the tools Docker and Kubernetes
- xi. Understands the tools for testing applications

##### **Course Outcomes:**

After successful completion of this course, students should be able to:

- Understand the basics of DevOps and its Operations
- Learn Terraform and Deployment with Packer
- Understand the different Tools: Git, Jenkins & Maven
- Learn NuGet, Docker and Kubernetes
- Understand the use of Postmans

##### **Unit I: Introduction to Devops**

What Is Devops, Benefits of working in a DevOps environment, History of Devops, DevOps Main Objectives, DevOps and Software Development Life Cycle: Waterfall Model, Agile Model, DevOps Stages, Continuous Integration & Deployment: Jenkins Containers and Virtual Development: Docker, Vagrant, Configuration Management Tools: Ansible, Puppet, Chef, DevOps Delivery Pipeline, Understanding IAC Practices

##### **Unit II: Provisioning Cloud Infrastructure with Terraform and Deployment with Packer**

Technical Requirements, Installing Terraform, Configuring Terraform for Azure, writing a Terraform scripts to deploy Azure Infrastructure, Deploying the Infrastructure with Terraform, Terraform Command Line and Life Cycle, Overview of Packer, creating packer Template for Azure VMs with Scripts, Executing Packer

##### **Unit III: DevOps CI/CD Pipeline Version Control with Git, Git, Jenkins & Maven Integration**

Version Control Preview, Git Introduction Preview, Git Installation, commonly used commands in Git, working with Remote repository, Branching and merging in Git Preview, Merge Conflicts, Stashing, Rebasing, Reverting and Resetting, Git Workflows

## **UNIT IV Continuous Integration and Continuous Delivery**

CI/CD Principles, Using Package Manager- NuGet and npm, Introduction to Maven, Maven Architecture, Introduction to Continuous Integration, Introduction to Jenkins, Jenkins Architecture, Plugin Management in Jenkins, Jenkins Security Management, Notification in Jenkins, Jenkins Master-slave architecture, Jenkins Delivery Pipeline, Jenkins Declarative pipeline, Using Azure Pipelines

### **Unit V: Containerized Application with Docker and Kubernetes**

Installing Docker, Creating Dockerfile, Building and Running Container on a Local Machine, pushing an Image to Docker Hub, deploying a Container to ACI with a CI/CD Pipeline, Managing Containers Effectively with Kubernetes- Installing Kubernetes, Kubernetes Architecture Overview, Installing Kubernetes Dashboard, First Example of Kubernetes Application Deployments

### **Unit VI: Testing Your Applications**

Creating Postman Collection with Requests, Installing Postman, Creating Collections, Creating Our First Request, Using Environments and Variables to Dynamize requests, Writing postman tests, Executing's Postman request tests locally, Understanding the Newman Concepts, Preparing Postman Collection for Newman, Running the Newman Command Line, Integration of Newman in the CI/CD pipeline process.

### **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. DevOps: A Complete Beginner's Guide to DevOps Best Practices
4. Volume 1 of 1 Series, Jim Lewis, Publisher: Independently Published, 2019, ISBN 1673259146, 9781673259148
5. Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale 1st Edition, Kindle Edition



**M.Sc. Computer Application**

**M.Sc.(CA) S. Y. (Semester IV)**

**SCMPAE-551 DevOps Fundamental**

**Note:** Conduct at least 15 practical based on given syllabus.

**M.Sc. Computer Application**  
**M.Sc.(CA) S. Y. (Semester IV)**  
**SVECP -551-Publication Ethics**

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The syllabus of this paper is available on the university website as a common syllabus for PG SY students

**M.Sc. Computer Application**  
**M.Sc.(CA) S. Y. (Semester IV)**  
**SCMPAR-551 Research Project**

**Note:**

**Students have to complete the research project under the guidance of a research guide.**