

Academic Council --/--/----  
Item No: \_\_\_\_\_

**SIES College of Arts, Science and Commerce,  
Sion (W)**

**EMPOWERED AUTONOMOUS COLLEGE**



**Syllabus for**  
**Program: Second Year Bachelor of Science**  
**(NEP) Course: Computer Science**  
**Semester: III & IV**

With effect from  
Academic Year 2024 -25

## Preamble

Information and Communication Technology (ICT) has today become an integral part of all industry domains as well as fields of academics and research. The industry requirements and technologies have been steadily and rapidly advancing. Organisations are increasingly opting for open source systems. The students too these days are thinking beyond careers in the industry and aiming for research opportunities.

The B.Sc. Computer Science course structure therefore needed a fresh outlook and complete overhaul. A real genuine attempt has been made while designing the new syllabus for this 3 year graduate course. Not only does it prepare the students for a career in the Software industry, it also motivates them towards further studies and research opportunities.

The core philosophy of overall syllabus is to -

- a. Form strong foundation of Computer science,
- b. Introduce emerging trends to the students in gradual way,
- c. Groom the students for the challenges of ICT industry

In the Second year i.e. for semester III & IV, the basic foundation of important skills required for software development is laid. The syllabus proposes to have 6 core subjects of Computer science and 1 Vocational Skill Course & 1 skill enhancement course of Computer science. In Semester IV the students would also be given industrial exposure via field projects/industrial visit. All core subjects are proposed to have theory as well as practical tracks. While the Computer Science courses will form fundamental skills for solving computational problems, the Mathematics & Statistics course will inculcate research oriented acumen. The syllabus design for further semesters encompasses more advanced and specialized courses of Computer Science.

We sincerely believe that any student taking this course will get a very strong foundation and exposure to basics, advanced and emerging trends of the subject. We hope that the students' community and teachers' fraternity will appreciate the treatment given to the courses in the syllabus.

We wholeheartedly thank all experts who shared their valuable feedback and suggestions in order to improvise the contents, we have sincerely attempted to incorporate each of them. We further thank the Chairperson and members of the Board of Studies for their confidence in us. Special thanks to the Department of Computer Science and colleagues from various colleges, who volunteered or have indirectly helped design certain specialized courses and the syllabus as a whole.

### Program Outcomes

SR.NO	Details
PO 1	Recall and explain acquired scientific knowledge in a comprehensive manner and apply the skills acquired in their chosen discipline. Interpret scientific ideas and relate its interconnectedness to various fields in science.
PO 2	Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organize data and draw inferences.
PO 3	Explore and evaluate digital information and use it for knowledge upgradation. Apply relevant information so gathered for analysis and communication using appropriate digital tools.
PO 4	Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyze results.
PO 5	Take complex challenges; work responsibly and independently, as well as in cohesion with a team for completion of a task. Communicate effectively, convincingly and in an articulate manner.
PO 6	Apply scientific information with sensitivity to values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society.
PO 7	Follow ethical practices at the workplace and be unbiased and critical in interpretation of scientific data. Understand the environmental issues and explore sustainable solutions for it.
PO 8	Keep abreast with current scientific developments in the specific discipline and adapt to technological advancements for better application of scientific knowledge as a lifelong learner.

### Program Specific Outcomes

SR.NO	Details
PSO 1	Apply knowledge of computational mathematics, statistics and programming acquired in the field of Computer Science.
PSO 2	Identify, analyze complex problems in the real world and formulate innovative solutions to those problems.
PSO 3	Compare and apply hardware and software technologies for implementing reliable optimized solutions catering to need and available resources.
PSO 4	Apply software development, managerial, Professional, and soft skills in industry
PSO 5	Understand the global needs and prepare themselves for the changing needs worldwide adapting an ability to engage in life- long learning.
PSO 6	Become a responsible, ethical citizen and explore environmental issues to develop sustainable solutions for it.

**S.Y.B.Sc. Computer Science Syllabus**  
**Credit Based System and Grading System**  
**Academic year 2024-2025**

**Semester – III**

Course Code	Course Type	Course Title	Credits	Lectures/Week		
				Theory	Practical (2 lectures)	Total
SIUCSMJ131	Major Subject	Operating Systems Concepts with Linux	3	3		3
SIUCSMJP131	Major Practical	Practical of Operating Systems Concepts with Linux	1		1	1
SIUCSMJ132	Major Subject	Java Programming	3	3		3
SIUCSMJP132	Major Practical	Practical of Java Programming	1		1	1
SIUCSMN133	Minor Subject	Software Engineering	3	3		3
SIUCSMNP133	Minor Practical	Practical of Software Engineering	1		1	1
<b>Total</b>						<b>12</b>

**Semester – IV**

Course Code	Course Type	Course Title	Credits	Lectures/Week		
				Theory	Practical	Total
SIUCSMJ141	Major Subject	Mobile applications	3	3		3
SIUCSMJP141	Major Practical	Practical of Mobile applications	1		1	1
SIUCSMJ142	Major Subject	Database Management System	3	3		3
SIUCSMJP142	Major Practical	Advanced Database Management System	1		1	1
SIUCSMN143	Minor Subject	Machine Learning	3	3		3
SIUCSMNP143	Minor Practical	Practical of Machine Learning	1		1	1
<b>Total</b>						<b>12</b>

**SEMESTER -III**  
**MAJOR SUBJECT**

Course Code	Course Title	Credits	Lectures /Week
SIUCSMJ131	Operating Systems Concepts with Linux	3	3
<p><b>About the Course:</b> The purpose of this course is to provide an overview of computer operating systems, their functionalities, processes, and computing resource management. In particular, the course will cover processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems.</p>			
<p><b>Course Objectives:</b></p> <ul style="list-style-type: none"> <li>❖ To learn basic concepts and structure of operating systems</li> <li>❖ To learn about process and synchronisation in operating system level</li> <li>❖ To learn CPU scheduling algorithms</li> <li>❖ To learn Memory and File system management</li> </ul>			
<p><b>Learning Outcomes:</b> After successful completion of this course, students would be able to</p> <ul style="list-style-type: none"> <li>❖ Work with any type of operating system.</li> <li>❖ Handle threads, processes, process synchronisation.</li> <li>❖ Implement CPU scheduling algorithms Understand the background role of memory management Design file system.</li> </ul>			
Unit	Topics	No of Lectures	
I	<p><b>Introduction to Operating-Systems:</b> Definition of Operating System, Operating System's role, Operating-System Operations, Functions of Operating System, Computing Environments.</p> <p><b>Operating-System Structures:</b> Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls, Operating-System Structure.</p> <p><b>Processes:</b> Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication .</p> <p><b>Threads:</b> Overview, Multithreading Models.</p> <p><b>CPU Scheduling:</b> Basic Concepts, Scheduling Criteria, Scheduling Algorithms (FCFS, SJF, SRTF, Priority, RR, Multilevel Queue Scheduling Multilevel Feedback Queue Scheduling).</p>	15L	
II	<p><b>Process Synchronization:</b> General structure of a typical process, race condition, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization.</p> <p><b>Memory Management:</b> Main Memory: Background, Logical address space, Physical address space, Contiguous Memory Allocation, Paging, Segmentation , Structure of the Page Table Virtual Memory: Background, Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing</p>	15L	
III	<p><b>Linux operating system and Basics :</b> History, GNU Info and Utilities, Various Linux Distributions, The Unix/Linux architecture, Features of Unix/Linux, Starting the shell, Shell prompt, Command structure, File Systems and Directory Structure, man pages, more documentation pages.</p>		

	<p><b>Linux Users-</b> Linux Create User Local su Commands, Linux User Management, User Password, Local Groups, Add User to Group, Linux id Command</p> <p><b>Linux Directories-</b> Linux Home Directory, pwd , cd, Absolute Relative path, Path Completion, ls, mkdir, rmdir, Rename Folder in Linux</p> <p><b>Basic Bash shell commands:</b> General purpose utility Commands, basic commands, Various file types, attributes and File handling Commands, Handling Ordinary Files. More file attributes</p> <p><b>Advanced Bash shell commands:</b> Simple Filters, Filters using regular expressions.</p> <p><b>Basic script building:</b> Using multiple commands, Creating script files, Displaying messages, Using variables, Redirecting Input and Output, Pipes performing math, Exiting the script.</p> <p><b>Using structured commands:</b> Working with if-then, if-then-else and nested if statements, test command, Compound condition testing, while command, until command, case command.</p> <p><b>Script and Process control :</b> Handling signals, Running scripts in background mode, Running scripts without a console, Job control, Job scheduling commands: ps, nice, renice, at, batch, cron table, Running the script at boot</p>	15L
<p><b>Textbook(s):</b></p> <ol style="list-style-type: none"> <li>1. Abraham Silberschatz, Peter Galvin, Greg Gagne, Operating System Concepts, Wiley, 2021</li> <li>2. “Linux Command line and Shell Scripting Bible”, Richard Blum, Wiley India.</li> </ol> <p><b>Additional Reference(s):</b></p> <ol style="list-style-type: none"> <li>1. Achyut S. Godbole, AtulKahate, Operating Systems, Tata McGraw Hill, 2017</li> <li>2. “Unix: Concepts and Applications”, Sumitabha Das, 4th Edition, McGraw Hill.</li> <li>3. Andrew S Tanenbaum, Herbert Bos, Modern Operating Systems, 4e Fourth Edition, Pearson Education, 2016</li> </ol>		

Course Code	Course Title	Credits	Lectures /Week
SIUCSMJP131	Operating Systems Concepts with Linux - Practicals	1	1
1	Programs to implement the concept of Multithreading <ol style="list-style-type: none"> <li>Program to display Summation of numbers using thread</li> <li>Program to display the prime numbers using thread</li> <li>Program to display the Fibonacci series using thread</li> </ol>		
2	Write a program to implement the concept of Remote Method Invocation(RMI) <ol style="list-style-type: none"> <li>Program to display square root of a number with RMI</li> <li>Program to display factorial of a number with RMI</li> </ol>		
3	Write a program to implement Bounded Buffer to solve Producer -Consumer with semaphore.		
4	File System Commands: touch, help, man, more, less, pwd, cd, mkdir, rmdir, ls, find, ls, etc		
5	File handling Commands: cat, cp, rm, mv, more, file, wc, od, cmp, diff, comm, chmod, chown, chgrp, gzip and gunzip, zip and unzip, tar, ln, umask,, chmod, chgrp, chown, etc		
6	General purpose utility Commands: cal, date, echo, man, printf, passwd, script, who, uname, tty, stty, etc		
7	Simple Filters and I/O redirection: head, tail, cut paste, sort, grep family, tee, uniq, tr, etc.		
8	Editors: vi, sed, awk		
9	Working and Managing with processes- sh, ps, kill, nice, at and batch etc.		
10	Shell scripting I: Defining variables, reading user input, exit and exit status commands, , expr, test, [], if conditional, logical operators Shell scripting II: Conditions (for loop, until loop and while loop) arithmetic operations, examples Shell scripting III: Redirecting Input / Output in scripts, creating your own Redirection		

Course Code	Course Title	Credits	Lectures/Week
SIUCSMJ132	Java Programming	3	3

**About the Course:** This course introduces computer networks, with a special focus on the Internet architecture and protocols. The course includes topics such as network architectures, addressing, naming, forwarding, routing, communication reliability, the client-server model, web, email and other application layer protocols.

**Course Objectives:**

- ❖ To provide insight into java based applications using OOP concepts.
- ❖ To provide understanding of developing GUI based desktop applications in java.
- ❖ To provide knowledge of web based applications through servlet and jsp.
- ❖ To provide understanding and implementation of basic JSON

**Learning Outcomes:** After successful completion of this course, students would be able to

- ❖ Design basic application in java using Graphical User Interface.
- ❖ The learner will be able to develop applications using swings
- ❖ The learner will be able to develop web based applications using servlet and jsp
- ❖ The learner will be able to connect databases with java
- ❖ The learner will be able to perform programs using JSON objects

Unit	Topics	No of Lectures
I	<p><b>Introduction:</b> History, Features of Java, Java Development Kit, Java Application Programming Interface, Java Virtual Machine Java Program Structure, Java Tokens.</p> <p><b>OOPS:</b> Introduction, Class, Object, Static Keywords, Constructors, this keyword, Inheritance, Inner class, Anonymous Inner class, super keyword, Polymorphism (overloading and overriding), Abstraction, Encapsulation, Abstract Classes</p> <p><b>Interfaces Packages:</b> Introduction to predefined packages, User Defined Packages, Access specifiers</p> <p><b>Exception Handling:</b> Introduction, Pre-Defined Exceptions, try-catch finally, throws, throw, User Defined Exceptions</p> <p><b>Multithreading:</b> Thread Creations, Thread Life Cycle, Life Cycle Methods, Synchronisation, wait() notify() notify all() methods</p>	15L
II	<p><b>Servlets:</b> Introduction, Web application Architecture, Http Protocol &amp; Http Methods, Web Server &amp; Web Container, Servlet Interface, GenericServlet, HttpServlet, Servlet Life Cycle, ServletConfig, ServletContext, Filters, Servlet Communication, Session Tracking Mechanisms</p> <p><b>JSP:</b> Introduction, JSP LifeCycle, JSP Implicit Objects &amp; Scopes, JSP Directives, JSP Scripting Elements</p> <p><b>JSP Actions:</b> Standard actions and customised actions</p> <p><b>Introduction to Struts 2:</b> Basic MVC Architecture, Struts 2 framework features, Struts 2 MVC pattern, Request life cycle, Examples, Configuration Files, Actions, Interceptors, Results &amp; Result Types, Value Stack/OGNL</p> <p><b>Struts 2 Tags:</b> TextArea and Reset Tag, Select Tag, Checkbox Tag, Checkboxlist Tag, Iterator Tag and If Else Tag</p> <p><b>Struts 2 Validation framework:</b> Basic Validation vs Validation Framework, Field Validators and Non-field Validators</p>	15L
III	<p><b>JDBC:</b> Introduction, JDBC Architecture, JDBC Drivers, JDBC Connectivity Model, java.sql package, Using Statement, PreparedStatement, CallableStatement, ResultSet, Scrollable and Updatable ResultSet, Navigating and manipulating data, ResultSetMetaData, Managing Transactions in JDBC, JDBC Exception classes, BLOB &amp; CLOB</p>	15L



	<b>JSON: Overview, Syntax, DataTypes, Objects, Schema, Comparison with XML, JSON with Java.</b>	
<b>Textbook(s):</b> <ol style="list-style-type: none"> <li>Herbert Schildt, Java The Complete Reference, Eleventh Edition, McGraw-Hill Education, 2020</li> <li>Bryan Basham, Kathy Sierra, Bert Bates, Head First Servlets and JSP, O'reilly (SPD), 2018</li> <li>Cay S. Horstmann, Gary Cornell, Core Java™.2: Volume II–Advanced Features Prentice Hall PTR, 2004</li> <li>Ivan Bayross, Web Enabled Commercial Applications Development Using Java 2, BPB Publications</li> <li>Java XML and JSON: Document Processing for Java SE by Jeff Friesen January 2019, Apress</li> </ol> <b>Additional Reference(s):</b> <ol style="list-style-type: none"> <li>E. Balagurusamy, Programming with Java- A Primer, Tata McGraw-Hill Education India, 2014</li> <li>Programming in JAVA, 2nd Ed, Sachin Malhotra &amp;SaurabhChoudhary, Oxford Press, 2018</li> <li>Joe Wigglesworth and Paula McMillan, Java Programming: Advanced Topics, Thomson Course Technology (SPD)</li> <li>Eric Jendrock, Jennifer Ball, D Carson and others, The Java EE 5 Tutorial, Pearson Education</li> </ol> The Java Tutorials: <a href="http://docs.oracle.com/javase/tutorial/">http://docs.oracle.com/javase/tutorial/</a> 6. Java Parsing Collection XML JSON: Map List XML JSON Transform by Yang Hu, 2019		

Course Code	Course Title	Credits	Lectures /Week
SIUCSMJP132	Practicals of Java Programming	1	1
1	<b>Basics of Java Programming</b> <ol style="list-style-type: none"> <li>Write a Program to print the text “Welcome to World of Java”. Save it with the name Welcome.java in your folder.</li> <li>Write a Program to print the area of triangle. Save it with name Area.java in your folder.</li> <li>Write a java Program to check the number is Prime or not.</li> </ol>		
2	<ol style="list-style-type: none"> <li>Write a program to create a class Student with data ‘name, city and age’ along with method printData to display the data. Create the two objects s1 ,s2 to declare and access the values.</li> <li>Write a program to create a class Student2 along with two method getData(),printData() to get the value through argument and display the data in printData. Create the two objects s1 ,s2 to declare and access the values from class STtest.</li> <li>Write a program using parameterized constructor with two parameters id and name. While creating the objects obj1 and obj2 passed two arguments so that this constructor gets invoked after creation of obj1 and obj2.</li> </ol>		
3	<ol style="list-style-type: none"> <li>Write a program in JAVA to demonstrate the method and constructor overloading.</li> <li>Write a program in JAVA to create a class Bird also declares the different parameterized constructor to display the name of Birds.</li> </ol>		
4	<ol style="list-style-type: none"> <li>Write a program in java to generate an abstract class A also class B inherits the class A. generate the object for class B and display the text “call me from B”.</li> <li>Write a java program in which you will declare two interface sum and Add inherits these interface through class A1 and display their content.</li> <li>Write a java program in which you will declare an abstract class Vehicle inherits this class from two classes car and truck using the method engine in both display “car has good engine” and “truck has bad engine”.</li> </ol>		
5	<ol style="list-style-type: none"> <li>Write a program to define user defined exceptions and raise them as per the requirements .</li> <li>Write a java program in which thread sleep for 5 sec and change the name of thread.</li> </ol>		

6	Write a program using various swing components design Java application to accept a student's resume. (Design form)
7	<ul style="list-style-type: none"> <li>A. Write a JDBC program that displays the data of a given table</li> <li>B. Write a JDBC program to return the data of a specified record from a given table</li> <li>C. Write a JDBC program to insert / update / delete records into a given table</li> </ul>
8	<ul style="list-style-type: none"> <li>A. Construct a simple calculator using the JAVA Swings with minimum functionality.</li> <li>B. Construct a GUI using JAVA Swings to accept details of a record of a given table and submit it to the database using JDBC technology on the click of a button</li> </ul>
9	<ul style="list-style-type: none"> <li>A. Write a Servlet that accepts a User Name from a HTML form and stores it as a cookie. Write another Servlet that returns the value of this cookie and displays it.</li> <li>B. Write a Servlet that displays the names and values of the cookie stored on the client.</li> <li>C. Write a Servlet that accepts a User Name from a HTML form and stores it as a session variable. Write another Servlet that returns the value of this session variable and displays it</li> </ul>
10	<ul style="list-style-type: none"> <li>A. Write a registration Servlet that accepts the data for a given table and stores it in the database.</li> <li>B. Write a Servlet that displays all the records of a table.</li> </ul>

## MINOR SUBJECT

Course Code	Course Title	Credits	Lectures /Week
SIUCSMN133	Software Engineering	3	3

**About the Course:**

This course covers a collection of methods which embody an "engineering" approach to the development of software. It discusses the nature of software and software projects, software development models, software process maturity, project planning, management, and estimations. It also underlines the topics on software testing and quality assurance.

**Course Objectives:**

- ❖ To learn and understand the Concepts of Software Engineering
- ❖ To learn and understand Software Development Life Cycle
- ❖ To apply the project management and analysis principles to software project development.
- ❖ To apply the design & testing principles to software project development.

**Learning Outcomes:**

After successful completion of this course, students would be able to

- ❖ Plan a software engineering process life cycle, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements
- ❖ Analyze and translate a specification into a design, and then realize that design practically, using an appropriate software engineering methodology.
- ❖ Know how to develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice
- ❖ Able to use modern engineering tools necessary for software project management, time management and software reuse.

Unit	Topics	No of Lectures
I	<p><b>Introduction:</b> The Nature of Software, Software Engineering, Professional Software Development, Layered Technology, Process framework, CMM, Process Patterns and Assessment</p> <p><b>Prescriptive Models:</b> Waterfall Model, Incremental, RAD Models</p> <p><b>Evolutionary Process Models:</b> Prototyping, Spiral and Concurrent Development Model</p> <p><b>Specialized Models:</b> Component based, Aspect Oriented development, The Unified Process Phases, Agile Development-Agility, Agile Process, Extreme Programming</p> <p><b>Requirement Analysis and System Modeling:</b> Requirements Engineering, Eliciting Requirements, SRS Validation, Components of SRS, Characteristics of SRS,</p> <p><b>Object-oriented design using the UML -</b> Class diagram, Object diagram, Use case diagram, Sequence diagram, Collaboration diagram, State chart diagram, Activity diagram, Component diagram, Deployment diagram</p>	15L

II	<p><b>System Design:</b> System/Software Design, Architectural Design, LowLevel Design ,Coupling and Cohesion, Functional-Oriented Versus Object-Oriented Approach</p> <p><b>Software Measurement and Metrics:</b> Process Metrics and Project Metrics, Software Measurement, Object Oriented Metrics, Software Project Estimation, LOC based, FP based estimations, Empirical estimation Models</p> <p><b>Software Project Management :</b></p> <p><b>Estimation Project Planning Process</b> –Software Scope and Feasibility, Resource Estimation,</p> <p><b>Empirical Estimation Models</b> – COCOMO, Estimation for Agile Development, The Make/Buy Decision</p> <p><b>Project Scheduling</b> - Basic Principles, Relationship Between People and Effort, Effort Distribution, Time-Line Charts</p>	15L
III	<p><b>Risk Management</b>-Risk strategies, Software risks, Risk Identification, projection, RMMM Quality Concepts</p> <p><b>Software Quality Assurance</b>-SQA activities, Software reviews, FTR, Software reliability and measures, SQA plan Software Configuration Management, elements of SCM, SCM Process, Capability Maturity Model</p> <p><b>Software Testing</b> :Verification and Validation, Introduction to Testing, Testing Principles, Testing Objectives, Levels of Testing, White-Box Testing/Structural Testing, Functional/Black-Box Testing.</p>	15L
<p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. Software Engineering, A Practitioner’s Approach, Roger S, Pressman, 2019</li> <li>2. Software Engineering: principles and Practices, Deepak Jain, OXFORD University Press, 2008</li> </ol> <p><b>Additional References:</b></p> <ol style="list-style-type: none"> <li>1. Software Engineering, Ian Sommerville, Pearson Education, 2017</li> <li>2. Fundamentals of Software Engineering, Fourth Edition, Rajib Mall, PHI, 2018</li> <li>3. Software Engineering: Principles and Practices, Hans Van Vliet, John Wiley &amp; Sons, 2010</li> <li>4. A Concise Introduction to Software Engineering, Pankaj Jalote, Springer</li> </ol>		

Course Code	Course Title	Credits	Lectures /Week
SIUCSMNP133	Software Engineering	1	1
1	Write down the problem statement for a suggested system of relevance		
2	Perform requirement analysis and develop Software Requirement Specification Sheet (SRS) for suggested system		
3	Draw the function oriented diagram: Data Flow Diagram (DFD) and Structured chart		
4	Draw the user's view analysis for the suggested system: Use case diagram.		
5	Draw the structural view diagram for the system: Class diagram, object diagram.		
6	Draw the behavioural view diagram : State-chart diagram, Activity diagram		
7	Draw the behavioural view diagram for the suggested system: Sequence diagram, Collaboration diagram		
8	Draw the implementation and environmental view diagram: Component diagram, Deployment diagram		
9	Perform Estimation of effort using FP Estimation		
10	Prepare timeline chart/Gantt Chart/PERT Chart		
<b>List of sample projects</b> <ol style="list-style-type: none"> <li>1. Student Result Management System</li> <li>2. Library management system</li> <li>3. Inventory control system</li> <li>4. Accounting system</li> <li>5. Fast food billing system</li> <li>6. Bank loan system</li> <li>7. Blood bank system</li> <li>8. Railway reservation system</li> <li>9. Automatic teller machine</li> <li>10. Video library management system</li> <li>11. Hotel management system</li> <li>12. Hostel management system</li> <li>13. Share online trading</li> <li>14. Hostel management system</li> <li>15. Resource management system</li> <li>16. Court case management system</li> </ol>			

**SEMESTER -IV**  
**MAJOR SUBJECT**

Course Code	Course Title	Credits	Lectures /Week
SIUCSMJ141	Mobile Applications	3	3
<p><b>About the Course:</b> To provide the comprehensive insight into developing applications running on smart mobile devices and demonstrate programming skills for managing task on mobile. To provide systematic approach for studying definition, methods and its applications for Mobile-App development.</p>			
<p><b>Course Objectives:</b></p> <ul style="list-style-type: none"> <li>❖ Understand the requirements of Mobile programming environment.</li> <li>❖ Learn about basic methods, tools and techniques for developing Apps</li> <li>❖ Explore and practice App development on Android Platform</li> <li>❖ Develop working prototypes of working systems for various uses in daily lives.</li> </ul>			
<p><b>Learning Outcomes:</b> After successful completion of this course, students would be able to</p> <ul style="list-style-type: none"> <li>❖ Understand cross platform mobile application development using Flutter framework</li> <li>❖ Design and Develop interactive Flutter App by using widgets, layouts, gestures and animation</li> <li>❖ Analyze and Build production ready Flutter App by incorporating backend services and deploying on Android / iOS</li> </ul>			
Unit	Topics	No of Lectures	
I	<p><b>Basics of Flutter Programming:</b> Introduction of Flutter, Understanding Widget Lifecycle Events, Dart Basics, Widget Tree and Element Tree, Basics of Flutter installation, Flutter Hello World App.</p> <p><b>Developing Flutter UI: Widgets, Layouts</b>  <b>USING COMMON WIDGETS:</b> SafeArea, AppBar, Column, Row, Container, Buttons, Text , RichText, Form , Images and Icon.  <b>BUILDING LAYOUTS :</b> high level view of layouts, Creating the layout, Types of layout widgets  <b>APPLYING GESTURES:</b> Setting Up GestureDetector, Implementing the Draggable and DragTarget Widgets, Using the GestureDetector for Moving and Scaling</p>	15L	
II	<p><b>Developing Flutter UI: Animations &amp; Navigations</b>  <b>ADDING ANIMATION TO AN APP :</b> Using Animated Container, Using Animated CrossFade, Using Animated Opacity, Using Animation Controller, Using Staggered Animation  <b>CREATING AN APP'S NAVIGATION:</b> Using the Navigator, Using the Named Navigator Route, Using the Bottom NavigationBar, Using the TabBar and TabBarView</p>	15L	

III	<p><b>Working with files :</b> Including libraries in your Flutter app, Including a file with your app, Reading/Writing to files, Using JSON.</p> <p><b>Using Firebase with Flutter:</b> Adding the Firebase and Firestore Backend,Configuring the Firebase Project,Adding a Cloud Firestore Database and Implementing Security.</p> <p><b>Testing and Deploying of Flutter Application:</b> Widget testing, Deploying Flutter Apps on Android / iOS</p>	15L
<p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. Beginning Flutter a Hands-on Guide to App Development, Marco L. Napoli, Wiley, 2020.</li> <li>2. Beginning App Development with Flutter: Create Cross-Platform Mobile Apps, By Rap Payne, 2019.</li> </ol> <p><b>Additional References:</b></p> <ol style="list-style-type: none"> <li>1. Flutter in Action by Eric Windmill, MANING, 2019</li> <li>2. Google Flutter Mobile Development Quick Start Guide.Packt,2019</li> </ol> <p><b>Online References:</b></p> <ol style="list-style-type: none"> <li>1. <a href="https://flutter.dev/docs/reference/tutorials">https://flutter.dev/docs/reference/tutorials</a></li> <li>2. <a href="https://www.tutorialspoint.com/flutter/index.htm">https://www.tutorialspoint.com/flutter/index.htm</a></li> <li>3. <a href="https://www.javatpoint.com/flutter">https://www.javatpoint.com/flutter</a></li> </ol>		

Course Code	Course Title	Credits	Lectures /Week
SIUCSMJP141	<b>Practicals of Mobile Applications</b>	<b>1</b>	<b>1</b>
1	To install and configure Flutter Environment.		
2	To design Flutter UI by including common widgets.		
3	To create an interactive Form using form widgets.		
4	To design a layout of Flutter App using layout widgets.		
5	To include icons, images, charts in Flutter app.		
6	To apply navigation, routing and gestures in Flutter App.		
7	To Connect Flutter UI with fireBase database.		
8	To test and deploy production ready Flutter App on Android platform.		

### MAJOR SUBJECT

Course Code	Course Title	Credits	Lectures /Week
SIUCSMJ142	Database Management System	3	3
<p><b>About the Course:</b>            This course deals with the basic understanding of programming in databases. It touches security, recovery, and transaction aspects of the database. The course will increase the confidence among the learner while dealing with databases.</p>			
<p><b>Course Objectives:</b></p> <ul style="list-style-type: none"> <li>❖ To develop understanding of concepts and techniques for data management and learn about widely used systems for implementation and usage.</li> <li>❖ To develop understanding of Transaction management and crash recovery.</li> <li>❖ To develop concepts of programming concepts of databases.</li> </ul>			
<p><b>Learning Outcomes:</b>  <b>After successful completion of this course, students would be able to</b></p> <ul style="list-style-type: none"> <li>❖ Master concepts of stored procedure, functions, cursors and triggers and its use.</li> <li>❖ Learn about using PL/SQL for data management.</li> <li>❖ Use Collections and records.</li> <li>❖ Understand concepts and implementations of transaction management and crash recovery.</li> </ul>			
Unit	Topics	No of Lectures	
I	<p><b>Overview of PL/SQL:</b> Advantages of PL/SQL, Main Features of PL/SQL, Architecture of PL/SQL</p> <p><b>Fundamentals of PL/SQL:</b> Character Sets, Lexical Units, Declarations, References to Identifiers, Scope and Visibility of Identifiers, Assigning Values to Variables, Expressions, Error-Reporting Functions, Data Types.</p> <p><b>Control Statements:</b> Conditional Selection Statements, LOOP Statements, Sequential Control Statements, GOTO, and NULL Statements.</p> <p><b>Sequences:</b> creating sequences, referencing, altering, and dropping a sequence.</p>	15L	
II	<p><b>Stored Procedures and Functions:</b></p> <p><b>Procedures:</b> Types and benefits of stored procedures, creating stored procedures, executing stored procedures, altering stored procedures, viewing stored procedures.</p> <p><b>Functions:</b> Calling function and recursion function.</p> <p><b>Collections and Records:</b> Associative Arrays, Varrays (Variable-Size Arrays), Nested Tables, Collection Constructors, Assigning Values to Collection Variables, Multidimensional Collections, Collection Comparisons, Collection Methods, Collection Types Defined in Package Specifications, Record Variables, Assigning Values to Record Variables.</p> <p><b>Error Handling:</b> Compile-Time Warnings, Overview of Exception Handling, Internally Defined Exceptions, Predefined Exceptions, UserDefined Exceptions, Redeclared Predefined Exceptions, Raising</p>	15L	





	<ul style="list-style-type: none"> <li>a. If...then...Else, IF...ELSIF...ELSE... END IF</li> <li>b. Case statement</li> </ul>
4	<p>Writing PL/SQL Blocks with basic programming constructs for following Iterative Structure:</p> <ul style="list-style-type: none"> <li>a. While-loop Statements</li> <li>b. For-loop Statements.</li> </ul>
5	<p>Writing PL/SQL Blocks with basic programming constructs by including a GoTO to jump out of a loop and NULL as a statement inside IF.</p>
6	<p>Writing Procedures in PL/SQL Block</p> <ul style="list-style-type: none"> <li>a. Create an empty procedure, replace a procedure and call procedure</li> <li>b. Create a stored procedure and call it</li> <li>c. Define procedure to insert data</li> <li>d. A forward declaration of procedure</li> </ul>
7	<p>Writing Functions in PL/SQL Block.</p> <ul style="list-style-type: none"> <li>a. Define and call a function</li> <li>b. Define and use function in select clause,</li> <li>c. Call function in dbms_output.put_line</li> <li>d. Recursive function</li> <li>e. Count Employee from a function and return value back</li> <li>f. Call function and store the return value to a variable</li> </ul>
8	<p>Creating and working with Insert/Update/Delete Trigger using Before/After clause.</p>
9	<p>Write an Implicit and explicit cursor to complete the task</p>
10	<p>Create packages and use it in SQL block to complete the task.</p>
11	<p>Write a SQL block to handle exception by writing:</p> <ul style="list-style-type: none"> <li>a. Predefined Exceptions</li> <li>b. User-Defined Exceptions</li> </ul>

**MINOR SUBJECT**

Course Code	Course Title	Credits	Lectures /Week
SIUCSMN143	Machine Learning	3	3
<p><b>About the Course:</b>            This course deals with the basic understanding of programming in machine learning. Topics like supervised vs unsupervised learning, linear &amp; non-linear regression, simple regression and more will be covered. Also learn about the importance and different types of clustering such as k-means, hierarchical clustering,</p>			
<p><b>Course Objectives:</b></p> <ul style="list-style-type: none"> <li>❖ Describe the various types of Machine Learning algorithms and when to use them</li> <li>❖ Evaluate the results from simple linear, non-linear, and multiple regression on a data set using evaluation metrics</li> <li>❖ Compare and contrast linear classification methods including multiclass prediction, support vector machines, and logistic regression</li> </ul>			
<p><b>Learning Outcomes:</b>            After successful completion of this course, students would be able to</p> <ul style="list-style-type: none"> <li>❖ Design AI/ML models from scoping to deployment</li> <li>❖ Identify gaps in creating and scaling AI/ML models</li> <li>❖ Evaluate and improve AI/ML models for projects</li> </ul>			
Unit	Topics	No of Lectures	
I	<p><b>Introduction to Machine Learning :</b>            Introduction ,What is Human Learning? ,Types of Human Learning ,What is Machine Learning? ,How do machines learn? ,Well-posed learning problem ,Types of Machine Learning :Supervised learning ,Unsupervised learning ,Reinforcement learning ,Comparison – supervised, unsupervised, and reinforcement learning</p> <p><b>Preparing to model:</b> Basic data types; exploring numerical data; exploring categorical data; exploring relationship between variables; data issues and remediation; data preprocessing.</p> <p><b>Modelling and Evaluation:</b> Selecting a model; training model–holdout, k-fold cross-validation, bootstrap sampling; model representation and interpretability – under-fitting, over-fitting, bias-variance tradeoff; model performance evaluation classification, regression, clustering; performance improvement</p>	15L	
II	<p><b>Brief review of probability:</b> Basic concept of probability, random variables; discrete distributions – binomial, Poisson, Bernoulli, etc.; continuous distribution – uniform, normal, Laplace; central theorem; Monte Carlo approximation</p> <p><b>Bayesian concept learning:</b> Bayes theorem – prior and posterior probability, likelihood; concept learning; Bayesian Belief Network</p>	15L	
	<p><b>Supervised learning – Classification:</b> Basics of supervised learning – classification; k-Nearestneighbour; decision tree; random forest;</p>		

III	support vector machine <b>Supervised learning</b> – Regression: Simple linear regression; other regression techniques <b>Unsupervised learning:</b> Basics of unsupervised learning; clustering techniques; association rules	15L
<b>Textbooks:</b> 1. The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman (freely available online) 2. A Hands-On Introduction to Machine Learning by Chirag Shah, 2022, Cambridge University Press & Assessment		
<b>Additional References:</b> 1. Pattern Recognition and Machine Learning, by Christopher Bishop (optional)		

Course Code	Course Title	Credits	Lectures /Week
SIUCSMNP143	Practicals of Machine Learning	1	1
1	Implement Linear Regression (Diabetes Dataset)		
2	Implement Logistic Regression (Iris Dataset)		
3	Implements Multinomial Logistic Regression (Iris Dataset)		
4	Implement SVM classifier (Iris Dataset)		
5	Train and fine-tune a Decision Tree for the Moons Dataset		
6	Train an SVM regressor on the California Housing Dataset		
7	Implement Batch Gradient Descent with early stopping for Softmax Regression		
8	Implement MLP for classification of handwritten digits (MNIST Dataset)		
9	Classification of images of clothing using Tensorflow (Fashion MNIST dataset)		
10	Implement Regression to predict fuel efficiency using Tensorflow (Auto MPG dataset)		