Academic Council AC/07.08.2024/RS1
Item No: _____

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

EMPOWERED AUTONOMOUS COLLEGE

SIES College of Arts, Science & Commerce
RISE WITH EDUCATION
NAAC REACCREDITED - 'A' GRADE
BEST COLLEGE AWARD - UNIVERSITY OF MUMBAI

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	Exhibit good domain knowledge and complete the assigned responsibilities effectively and efficiently in par with the expected quality standards.
PO 2	Apply analytical and critical thinking to identify, formulate, analyze, and solve complex problems in order to reach authenticated conclusions.
PO 3	Design and develop solutions for complex problems with specified needs through appropriate consideration for the public safety, cultural, societal, and environmental concerns.
PO 4	Establish the ability to Listen, read, proficiently communicate and articulate complex ideas with respect to the needs and abilities of diverse audiences.
PO 5	Graduates will be able to undertake any responsibility as an individual/member of multidisciplinary teams and have an understanding of team leadership
PO 6	Function as socially responsible individual with ethical values and accountable to ethically validate any actions or decisions before proceeding and actively contribute to the societal concerns

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**
SIUCSMJ211	Major Subject	Operating Systems Concepts with Linux	3	3		3
SIUCSMJP211	Major Practical	Practical of Operating Systems Concepts with Linux	1		1	1
SIUCSMJ212	Major Subject	Java Programming	3	3		3
SIUCSMJP212	Major Practical	Practical of Java Programming	1		1	1
SIUCSMN211	Minor Subject	Software Engineering	3	3		3
SIUCSMNP211	Minor Practical	Practical of Software Engineering	1		1	1
Vocational Courses						
SIUCSVS211	Vocational Skill Course (VSC)	Python Web Development Framework	1	1		1
SIUCSVS211	Vocational Skill Course practical	Practicals of Python Web Development Framework	1		1	1
Generic/ Open Elective Courses (OE)						
SIUCSOE211	Open Elective	Introduction to Python Programming	1	1		1
SIUCSOE211	Open Elective Practical	Practical of Introduction to Python Programming	1		1	1
Ability Enhancement Courses (AEC)						
SIUCSAE211	Ability Enhancement Courses	Hindi/Marathi	2	2		2
OJT,FP,CEP,CC (AEC)						
SIUSFP211	Field Project(FP)	–	2			2
SIUSCC211	Co-Curricular(CC)	–	2			2
Total						**22**

Semester – IV						
Course Code	**Course Type**	**Course Title**	**Credits**	**Lectures/Week**		
				Theory	**Practical**	**Total**
SIUCSMJ221	Major Subject	Mobile applications	3	3		3
SIUCSMJP221	Major Practical	Practical of Mobile applications	1		1	1
SIUCSMJ222	Major Subject	Database Management System	3	3		3
SIUCSMJP222	Major Practical	Practical of Database Management System	1		1	1
SIUCSMN221	Minor Subject	Machine Learning	3	3		3
SIUCSMNP221	Minor Practical	Practical of Machine Learning	1		1	1
Skill Enhancement						
SIUCSSE221	Skill Enhancement Course (SEC)	Cyber Laws and IPR	1	1		1
SIUCSSE221	Skill Enhancement Course (SEC)	Practical of Cyber Laws and IPR	1		1	1
Generic/ Open Elective Courses (OE)						
SIUCSOE221	Open Elective	Beginning MySQL	1	1		1
SIUCSOE221	Open Elective Practical	Practical of Beginning MySQL	1		1	1
Ability Enhancement Courses (AEC)						
SIUCSAE221	Ability Enhancement Courses	Hindi/Marathi	2	2		2
OJT,FP,CEP,CC (AEC)						
	Community Engagement Project(FP)	—	2			2
SIUSCC221	Co-Curricular(CC)	—-	2			2
Total						**22**

SEMESTER -III
MAJOR SUBJECT

Course Code	Course Title	Credits	Lectures /Week
SIUCSMJ211	**Operating Systems Concepts with Linux**	**3**	**3**

About the Course: 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.

Course Objectives:

- To learn basic concepts and structure of operating systems
- To learn about process and synchronisation in operating system level
- To learn CPU scheduling algorithms
- To learn Memory and File system management

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

- Work with any type of operating system.
- Handle threads, processes, process synchronisation.
- Implement CPU scheduling algorithms Understand the background role of memory management Design file system.

Unit	Topics	No of Lectures
I	**Introduction to Operating-Systems:**Definition of Operating System, Operating System's role, Operating-System Operations, Functions of Operating System, Computing Environments. **Operating-System Structures:** Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls, Operating-System Structure. **Processes:** Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication . **Threads:** Overview,Multithreading Models. **CPU Scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms (FCFS, SJF, SRTF, Priority, RR, Multilevel Queue Scheduling Multilevel Feedback Queue Scheduling).	15L
II	**Process Synchronization:** General structure of a typical process, race condition, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization. **Memory Management**: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	15L
	Linux operating system and Basics : History, GNU Info and Utilities,Various Linux Distributions, The Unix/Linux architecture,	

III	Features of Unix/Linux, Starting the shell, Shell prompt, Command structure, File Systems and Directory Structure, man pages, more documentation pages. **Linux Users-** Linux Create User Local su Commands, Linux User Management, User Password, Local Groups, Add User to Group, Linux id Command **Linux Directories-** Linux Home Directory, pwd , cd, Absolute Relative path, Path Completion, ls, mkdir, rmdir, Rename Folder in Linux **Basic Bash shell commands**: General purpose utility Commands, basic commands, Various file types, attributes and File handling Commands,Handling Ordinary Files. More file attributes **Advanced Bash shell commands:**Simple Filters, Filters using regular expressions. **Basic script building:** Using multiple commands, Creating script files,Displaying messages, Using variables, Redirecting Input and Output, Pipes performing math, Exiting the script. **Using structured commands:** Working with if-then, if-then-else and nested if statements, test command, Compound condition testing, while command, until command, case command. **Script and Process control :** 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	15L

Textbook(s):

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, Operating System Concepts, Wiley, 2021
2. “Linux Command line and Shell Scripting Bible”, Richard Blum, Wiley India.

Additional Reference(s):

1. Achyut S. Godbole, AtulKahate, Operating Systems, Tata McGraw Hill, 2017
2.“Unix: Concepts and Applications”, Sumitabha Das, 4th Edition, McGraw Hill.
3. Andrew S Tanenbaum, Herbert Bos, Modern Operating Systems, 4e Fourth Edition, Pearson Education, 2016

Course Code	Course Title	Credits	Lectures /Week
SIUCSMJP211	**Operating Systems Concepts with Linux-Practicals**	**1**	**1**
1	Programs to implement the concept of Multithreading A. Program to display Summation of numbers using thread B. Program to display the prime numbers using thread C. Program to display the Fibonacci series using thread		
2	Write a program to implement the concept of Remote Method Invocation(RMI) A. Program to display square root of a number with RMI B. Program to display factorial of a number with RMI		
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
SIUCSMJ212	**Java Programming**	**3**	**3**

About the Course: The objective of this course is to teach the learner how to use Object Oriented paradigm to develop code and understand the concepts of Java. The learner will understand the process and implementation of creating mvc based applications using Java frameworks fundamentals like Struts.

Course Objectives:

- To provide insight into java based applications using OOP concepts.
- To provide knowledge of web based applications through servlet and jsp.
- To provide understanding and implementation of database connectivity.
- To provide understanding and implementation of basic JSON

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

- The learner will be able to develop applications using Struts 2
- 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	**Introduction:** History, Features of Java, Java Development Kit, Java Application Programming Interface, Java Virtual Machine Java Program Structure, Java Tokens. **OOPS:** Introduction, Class, Object, Static Keywords, Constructors, this keyword, Inheritance,Inner class, Anonymous Inner class, super keyword, Polymorphism (overloading and overriding), Abstraction, Encapsulation, Abstract Classes **Interfaces Packages:** Introduction to predefined packages, User Defined Packages, Access specifiers **Exception Handling:** Introduction, Pre-Defined Exceptions, try-catch finally, throws, throw, User Defined Exceptions **Multithreading:** Thread Creations, Thread Life Cycle, Life Cycle Methods,Synchronisation, wait() notify() notify all() methods	15L
II	**Servlets:** Introduction, Web application Architecture, Http Protocol & Http Methods, Web Server & Web Container, Servlet Interface, GenericServlet, HttpServlet, Servlet Life Cycle, ServletConfig, ServletContext, Filters, Servlet Communication, Session Tracking Mechanisms **JSP:** Introduction, JSP LifeCycle, JSP Implicit Objects & Scopes, JSP Directives, JSP Scripting Elements **JSP Actions**: Standard actions and customised actions **Introduction to Struts 2:** Basic MVC Architecture, Struts 2 framework features, Struts 2 MVC pattern, Request life cycle, Examples, Configuration Files, Actions, Interceptors, Results & Result Types, Value Stack/OGNL **Struts 2 Tags:** TextArea and Reset Tag,Select Tag, Checkbox Tag Checkboxlist Tag, Iterator Tag and If Else Tag **Struts 2 Validation framework:** Basic Validation vs Validation Framework, Field Validators and Non-field Validators	15L
	JDBC: Introduction, JDBC Architecture, JDBC Drivers, JDBC	

III	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 & CLOB **JSON:** Overview, Syntax, DataTypes, Objects, Schema, Comparison with XML, JSON with Java.	15L

Textbook(s):

1. Herbert Schildt, Java The Complete Reference, Eleventh Edition, McGraw-Hill Education, 2020
2. Bryan Basham, Kathy Sierra, Bert Bates, Head First Servlets and JSP, O'reilly (SPD), 2018
3. Cay S. Horstmann, Gary Cornell, Core Java™.2: Volume II–Advanced Features Prentice Hall PTR, 2004
4. Ivan Bayross, Web Enabled Commercial Applications Development Using Java 2, BPB Publications
5. Java XML and JSON: Document Processing for Java SE by Jeff Friesen January 2019, Apress

Additional Reference(s):

1. E. Balagurusamy, Programming with Java- A Primer, Tata McGraw-Hill Education India, 2014
2. Programming in JAVA, 2nd Ed, Sachin Malhotra &SaurabhChoudhary, Oxford Press, 2018
3. Joe Wigglesworth and Paula McMillan, Java Programming: Advanced Topics, Thomson Course Technology (SPD)
4. Eric Jendrock, Jennifer Ball, D Carson and others, The Java EE 5 Tutorial, Pearson Education
5. The Java Tutorials: http://docs.oracle.com/javase/tutorial/ 6. Java Parsing Collection XML JSON: Map List XML JSON Transform by Yang Hu, 2019

Course Code	Course Title	Credits	Lectures /Week
SIUCSMJP212	**Practicals of Java Programming**	**1**	**1**
1	**Basics of Java Programming** A. Write a Program to print the text "Welcome to World of Java". Save it with the name Welcome.java in your folder. B. Write a Program to print the area of triangle. Save it with name Area.java in your folder. C. Write a java Program to check the number is Prime or not.		
2	A. 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. B. 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. C. 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.		
3	A. Write a program in JAVA to demonstrate the method and constructor overloading. B. Write a program in JAVA to create a class Bird also declares the different parameterized constructor to display the name of Birds.		

4	A. 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”. B. Write a java program in which you will declare two interface sum and Add inherits these interface through class A1 and display their content. C. 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”.
5	A. Write a program to define user defined exceptions and raise them as per the requirements . B. Write a java program in which thread sleep for 5 sec and change the name of thread.
6	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. B. Write a Servlet that displays the names and values of the cookie stored on the client. 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
7	A. Write a registration Servlet that accepts the data for a given table and stores it in the database. B. Write a Servlet that displays all the records of a table.
8	A. Design a Struts 2 registration application B. Perform the use of validation framework
9	A. Write a JDBC program that displays the data of a given table B. Write a JDBC program to return the data of a specified record from a given table
10	A. Construct a GUI 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 B. Write a JDBC program to insert / update / delete records into a given table

MINOR SUBJECT

Course Code	Course Title	Credits	Lectures /Week
SIUCSMN211	**Software Engineering**	**2**	**2**

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
- Analyse and translate a specification into a design, and then realise 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	**Introduction:** The Nature of Software, Software Engineering, Professional Software Development, Layered Technology, Process framework, CMM, Process Patterns and Assessment **Prescriptive Models:** Waterfall Model, Incremental, RAD Models **Evolutionary Process Models:** Prototyping, Spiral and Concurrent Development Model **Specialized Models:** Component based, Aspect Oriented development, The Unified Process Phases, Agile Development-Agility, Agile Process, Extreme Programming **Requirement Analysis and System Modeling:** Requirements Engineering, Eliciting Requirements, SRS Validation, Components of SRS, Characteristics of SRS, **Object-oriented design using the UML** - Class diagram, Object diagram, Use case diagram, Sequence diagram, Collaboration diagram, State chart diagram, Activity diagram, Component diagram, Deployment diagram	15L

II	**System Design:** System/Software Design, Architectural Design, LowLevel Design ,Coupling and Cohesion, Functional-Oriented Versus Object-Oriented Approach **Software Measurement and Metrics:** Process Metrics and Project Metrics, Software Measurement, Object Oriented Metrics, Software Project Estimation, LOC based, FP based estimations, Empirical estimation Models **Software Project Management :** **Estimation Project Planning Process** –Software Scope and Feasibility, Resource Estimation, **Empirical Estimation Models** – COCOMO, Estimation for Agile Development, The Make/Buy Decision **Project Scheduling -** Basic Principles, Relationship Between People and Effort, Effort Distribution, Time-Line Charts	15L
III	**Risk Management**-Risk strategies, Software risks, Risk Identification, projection, RMMM Quality Concepts **Software Quality Assurance**-SQA activities, Software reviews, FTR, Software reliability and measures, SQA plan Software Configuration Management, elements of SCM, SCM Process, Capability Maturity Model **Software Testing :**Verification and Validation, Introduction to Testing, Testing Principles, Testing Objectives, Levels of Testing, White-Box Testing/Structural Testing, Functional/Black-Box Testing.	15L

Textbooks:

1. Software Engineering, A Practitioner‘s Approach, Roger S, Pressman, 2019
2. Software Engineering: principles and Practices, Deepak Jain, OXFORD University Press, 2008

Additional References:

1. Software Engineering, Ian Sommerville, Pearson Education, 2017
2. Fundamentals of Software Engineering, Fourth Edition, Rajib Mall, PHI, 2018
3. Software Engineering: Principles and Practices, Hans Van Vliet, John Wiley & Sons, 2010
4. A Concise Introduction to Software Engineering, Pankaj Jalote, Springer

Course Code	Course Title	Credits	Lectures /Week
SIUCSMNP211	**Software Engineering**	**2**	**2**
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		

List of sample projects

1. Student Result Management System
2. Library management system
3. Inventory control system
4. Accounting system
5. Fast food billing system
6. Bank loan system
7. Blood bank system
8. Railway reservation system
9. Automatic teller machine
10. Video library management system
11. Hotel management system
12. Hostel management system
13. Share online trading
14. Hostel management system
15. Resource management system
16. Court case management system

Vocational Skill Course (VSC)

Course Code	Course Title	Credits	Lectures /Week
SIUCSVS211	**Python Web Development Framework**	**1**	**1**

About the Course:
This course will give existing Python developers great handson experience building robust, commercial web applications with the Django framework. This course helps students learn how to write maintainable code.

Course Objectives:

- To learn and understand the Django architecture & MVC Models.
- To build and deploy Django Web Apps.

Learning Outcomes:
After completing this course, students will have a fundamental understanding of how to:

- Understand Django Architecture and its take on MVC (Models, Views & Templates)
- Build and deploy robust Django web apps

Unit	Topics	No of Lectures
I	**Introduction to Django:**Web framework?Introduction to Django , Django Design Philosophies,Advantages of Django , Working of Websites, Model Template View Architecture , Work process of Django ,Installing python Virtual Environment, Django Installation and project setup. **Getting started with Django**:Understanding project structure and configuration files,About the 3 Core Files: models.py, urls.py, views.py **The Basics of Dynamic Web Pages:** First View: Dynamic Content, Mapping URLs to Views ,URLconfs and Loose Coupling, Django Errors, Second View: Dynamic URLs, A Word About Pretty URLs, Wildcard URLpatterns , Django's Pretty Error Pages.static files **The Django Template System:**Template System Basics Using the Template System,Rendering a Template Multiple Contexts, Same Template Context Variable Lookup Playing with Context Objects Basic Template Tags and Filters :Tags, Filters,Template Inheritance **Django Models:** Django ORM, Defining models and database schema,Model Relationships, Django's migration system, Performing migrations,Django CRUD. **Working with Forms:**Creating HTML forms,Handling form submissions in views, Form validation and error handling. **User Authentication**:Implementing user registration and login,Managing user sessions and authentication.	15L

Textbooks:

1. Holovaty, Adrian, and Jacob Kaplan-Moss. The definitive guide to Django: Web development done right. Apress, 2009.
2. Shaw, Ben, et al. Web Development with Django: Learn to build modern web applications with a Python-based framework. Packt Publishing Ltd, 2021.

Additional References:

1. Dauzon, Samuel, Aidas Bendoraitis, and Arun Ravindran. Django: web development with Python. Packt Publishing Ltd, 2016.
2. https://docs.djangoproject.com/

Course Code	Course Title	Credits	Lectures /Week
SIUCSVS211	**Python Web Development Framework-Practicals**	**1**	**1**
1	Create a Django project to demonstrate function based views and url mappings		
2	Create a Django project to demonstrate class based views and url mappings		
3	Create a Django Application and demonstrate URL parameters.		
4	Create a Django Application and create Templates using DTL and render them.		
5	Demonstrate the use of Static files		
6	Demonstrate template inheritance in Django		
7	Create a project and demonstrate models using django shell		
8	Create a project and demonstrate models and Django CRUD		
9	Develop a Django Project that demonstrates handling HTML forms.		
10	Create a Django website for the “Little lemon” restaurant with the below requirements: The Little Lemon website will consist of five pages: ● Home ● About ● Booking ● Menu ● Menu Item		

Open Elective(OE)

Course Code	Course Title	Credits	Lectures /Week
SIUCSOE221	**Introduction to Python Programming**	**1**	**1**

About the Course: The objective of this paper is to introduce various concepts of programming to the students using Python.

Course Objectives:

- To understand the concepts of programming before actually starting to write programs.
- To develop logic for Problem Solving.
- To apply the problem solving skills using syntactically simple language i.e. Python (version: 3.X or higher).

Learning Outcomes:

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

- Implement the basics of Python Programming.

Unit	Topics	No of Lectures
I	**Introduction:** The Python Programming Language, History, features, Installing Python, Running Python program, **Debugging :** Syntax Errors, Runtime Errors, Semantic Errors, Experimental Debugging, Formal and Natural Languages. **Variables and Expressions:** Values and Types, Variables, Variable Names and Keywords, Type conversion, Operators and Operands, Expressions, Interactive Mode and Script Mode, Order of Operations. **Conditional Statements:** if, if-else, nested if –else **Looping:** for, while, nested loops Control statements: Terminating loops, skipping specific conditions. **Compound Data types:** Strings, Lists, Tuples, Dictionaries	15L

Text books:

1. Magnus Lie Hetland, Beginning Python: From Novice to Professional, Apress.
2. Paul Gries, et al., Practical Programming: An Introduction to Computer Science Using Python 3, Pragmatic Bookshelf, 2/E 2014

Additional References:

1. Charles Dierbach, Introduction to Computer Science using Python, Wiley, 2013
2. 2. Paul Gries , Jennifer Campbell, Jason Montojo, Practical Programming: An Introduction to Computer Science Using Python 3, Pragmatic Bookshelf, 2/E 2014
3. Adesh Pandey, Programming Languages – Principles and Paradigms, Narosa, 2008

Course Code	Course Title	Credits	Lecture/ Week
SIUCSOE221	**Practicals on Introduction to Python Programming**	**1**	**1**
1	Installing and setting up the Python IDLE interpreter. Executing simple statements like expression statements (numeric and Boolean types), assert, assignment, delete statements; the print function for output, the input function.		
2	Programs based on conditional constructs(if, if else, if elif else, nested if		
3	Programs based on for statement and the range function, using break and continue statement		
4	Programs based on the while statement		
5	Programs related to string manipulation		
6	Programs related to lists		
7	Programs related to dictionaries		
8	Programs related to functions		

SEMESTER -IV
MAJOR SUBJECT

Course Code	Course Title	Credits	Lectures /Week
SIUCSMJ221	**Mobile Applications**	**3**	**3**

About the Course:
To provide comprehensive insight into developing applications running on smart mobile devices and demonstrate programming skills for managing tasks on mobile. To provide a systematic approach for studying definition, methods and its applications for Mobile-App development.

Course Objectives:
- ❖ Understand the requirements of the Mobile programming environment.
- ❖ Learn about basic methods, tools and techniques for developing Apps.
- ❖ Explore and practice App development on Android Platform.
- ❖ Develop working prototypes of working systems for various uses in daily lives.

Learning Outcomes:
After successful completion of this course, students would be able to
- ❖ Understand cross platform mobile application development using Flutter framework
- ❖ Design and Develop interactive Flutter App by using widgets, layouts, gestures and animation
- ❖ Analyze and Build production ready Flutter App by incorporating backend services and deploying on Android / iOS

Unit	Topics	No of Lectures
I	**Basics of Flutter Programming:**Introduction of Flutter, Understanding Widget Lifecycle Events,Dart Basics, Widget Tree and Element Tree, Basics of Flutter installation, Flutter Hello World App. **Developing Flutter UI:Widgets, Layouts** **USING COMMON WIDGETS**: SafeArea, Appbar, Column, Row, Container, Buttons, Text , Richtext,Form ,Images and Icon. **BUILDING LAYOUTS** : high level view of layouts, Creating the layout, Types of layout widgets **APPLYING GESTURES:** Setting Up GestureDetector, Implementing the Draggable and Dragtarget Widgets,Using the GestureDetector for Moving and Scaling	15L
II	**Developing Flutter UI:Animations & Navigations** **ADDING ANIMATION TO AN APP** :Using Animated Container,Using Animated CrossFade,Using Animated Opacity,Using Animation Controller, Using Staggered Animation **CREATING AN APP'S NAVIGATION:** Using the Navigator,Using the Named Navigator Route,Using the Bottom NavigationBar,Using the TabBar and TabBarView	15L

III	**Working with files :** Including libraries in your Flutter app, Including a file with your app, Reading/Writing to files, Using JSON. **Using Firebase with Flutter:** Adding the Firebase and Firestore Backend,Configuring the Firebase Project,Adding a Cloud Firestore Database and Implementing Security**.** **Testing and Deploying of Flutter Application:** Widget testing, Deploying Flutter Apps on Android / iOS	15L

Textbooks:

1. Beginning Flutter a Hands-on Guide to App Development, Marco L. Napoli, Wiley, 2020.
2. Beginning App Development with Flutter: Create Cross-Platform Mobile Apps, By Rap Payne, 2019.

Additional References:

1. Flutter in Action by Eric Windmill, MANING, 2019
2. Google Flutter Mobile Development Quick Start Guide.Packt,2019

Online References:

1. https://flutter.dev/docs/reference/tutorials
2. https://www.tutorialspoint.com/flutter/index.htm
3. https://www.javatpoint.com/flutter

Course Code	Course Title	Credits	Lectures /Week
SIUCSMJP221	**Practicals of Mobile Applications**	**1**	**1**
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.		

Course Code	Course Title	Credits	Lectures /Week
SIUCSMJ222	**Database Management System**	**3**	**3**

About the Course:
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.

Course Objectives:

- To develop understanding of concepts and techniques for data management and learn about widely used systems for implementation and usage.
- To develop understanding of Transaction management and crash recovery.
- To develop concepts of programming concepts of databases.

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

- Master concepts of stored procedure, functions, cursors and triggers and its use.
- Learn about using PL/SQL for data management.
- Use Collections and records.
- Understand concepts and implementations of transaction management and crash recovery.

Unit	Topics	No of Lectures
I	**Overview of PL/SQL:** Advantages of PL/SQL, Main Features of PL/SQL, Architecture of PL/SQL **Fundamentals of PL/SQL:** Character Sets, Lexical Units, Declarations, References to Identifiers, Scope and Visibility of Identifiers, Assigning Values to Variables, Expressions, Error-Reporting Functions, Data Types. **Control Statements:** Conditional Selection Statements, LOOP Statements, Sequential Control Statements, GOTO, and NULL Statements. **Sequences:** creating sequences, referencing, altering, and dropping a sequence.	15L
II	**Stored Procedures and Functions:** **Procedures:** Types and benefits of stored procedures, creating stored procedures, executing stored procedures, altering stored procedures, viewing stored procedures. **Functions:** Calling function and recursion function. **Collections and Records:** 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.	15L

	Error Handling: Compile-Time Warnings, Overview of Exception Handling, Internally Defined Exceptions, Predefined Exceptions, UserDefined Exceptions, Redeclared Predefined Exceptions, Raising Exceptions Explicitly, Exception Propagation, Unhandled Exceptions. **Cursors:** Overview of Cursor, Types of cursors, Invalid cursor Exception. **Static and Dynamic SQL:** **Static SQL:** Description of Static SQL, Cursors Overview, Processing Query Result Sets, Cursor Variables, CURSOR Expressions, Transaction Processing and Control, Autonomous Transactions. **Dynamic SQL:** Native Dynamic SQL, DBMS_SQL Package, SQL Injection.	
III	**Triggers:** Overview of Triggers, implementing triggers – creating triggers, Insert, delete, and update triggers, nested triggers, viewing, deleting, and modifying triggers, and enforcing data integrity through triggers. **Packages:** Overview of a Package. Need of Packages, Package Specification, Package Body, Package Instantiation and Initialization. **MongoDB(M):** Introduction to MongoDB. Installing MongoDB. Using MongoDB Compass. Using Mongo Shell Interface. Connecting to MongoDB. Creating Schemas and Models. Querying Documents Using find(). Inserting Documents Using create(). Updating Documents Using findOneAndUpdate(). Deleting Documents Using findOneAndDelete() &deleteMany()	15L

Textbook(s):

1.Mastering PL/SQL Through Illustrations: From Learning Fundamentals to Developing Efficient PL/SQL Blocks, Dr. B. Chandra, BPB Publication, 2020
2. Oracle Pl/Sql Training Guide., Training guide, BPB Publications, 2016
3. Raghu Ramakrishnam, Gehrke, Database Management Systems, McGraw‐ Hill,3rd Edition, 2014
4. Abraham Silberschatz, Henry F. Korth,S.Sudarshan , Database System Concepts, 6th Edition 2019

Additional Reference(s):

1. Ivan Bayross, ―SQL, PL/SQL -The Programming language of Oracle‖, B.P.B. Publications 2009
2. Ramez Elmasri Shamkant B.Navathe, Fundamentals of Database Systems, Pearson Education, 2008

Course Code	Course Title	Credits	Lectures /Week
SIUCSMJP222	**Database Management System**	**1**	**1**
1	Writing PL/SQL Blocks with basic programming constructs by including following: a. Sequential Statements b. unconstrained loop		
2	Sequences: a. Creating simple Sequences with clauses like START WITH, INCREMENT BY, MAXVALUE, MINVALUE, CYCLE | NOCYCLE, CACHE | NOCACHE, ORDER | NOORECER.		

	b. Creating and using Sequences for tables.
3	Writing PL/SQL Blocks with basic programming constructs by including following: a. If...then...Else, IF...ELSIF...ELSE... END IF b. Case statement
4	Writing PL/SQL Blocks with basic programming constructs for following Iterative Structure: a. While-loop Statements b. For-loop Statements.
5	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.
6	Writing Procedures in PL/SQL Block a. Create an empty procedure, replace a procedure and call procedure b. Create a stored procedure and call it c. Define procedure to insert data d. A forward declaration of procedure
7	Writing Functions in PL/SQL Block. a. Define and call a function b. Define and use function in select clause, c. Call function in dbms_output.put_line d. Recursive function e. Count Employee from a function and return value back f. Call function and store the return value to a variable
8	Creating and working with Insert/Update/Delete Trigger using Before/After clause.
9	Write an Implicit and explicit cursor to complete the task
10	Create packages and use it in SQL black to complete the task.
11	Write a SQL block to handle exception by writing: a. Predefined Exceptions b. User-Defined Exceptions

MINOR SUBJECT

Course Code	Course Title	Credits	Lectures /Week
SIUCSMN221	**Machine Learning**	**3**	**3**

About the Course:.
This course deals with the basic understanding of programming in machine learning. Topics like supervised vs unsupervised learning, linear & 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.

Course Objectives:

- Describe the various types of Machine Learning algorithms and when to use them .
- Evaluate the results from simple linear, non-linear, and multiple regression on a data set using evaluation metrics.
- Compare and contrast linear classification methods including multiclass prediction, support vector machines, and logistic regression.

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

- Prepare model related to Machine learning concepts
- Apply Probabilistic approach to various problems.

Unit	Topics	No of Lectures
I	**Introduction to Machine Learning :** 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,Issues of Ethics, Bias, and Privacy in Machine Learning **Preparing to model:** Basic data types; exploring numerical data; exploring categorical data; exploring relationship between variables; data issues and remediation; data preprocessing. **Considerations for ML Modelling:** Accuracy, Training–Testing , Training Time ,Linearity , Number of Hyperparameters , Number of Features ,Choosing the Right Estimator.	15L
II	**Modelling and Evaluation:** Selecting a model; training model–holdout, k-fold cross-validation, model representation and interpretability – under-fitting, over-fitting, bias-variance tradeoff; model performance evaluation. **Brief review of probability**: Basic concept of probability, random variables; Discrete distributions – binomial, Poisson, Bernoulli, etc.; Continuous distribution – uniform, normal, Laplace; central theorem; Monte Carlo approximation. **Probabilistic measures:**Akaike Information Criterion (AIC),Bayesian Information Criterion (BIC).	15L

	Bayesian concept learning: Bayes theorem – prior and posterior probability, likelihood; concept learning; Bayesian Belief Network.	
III	**Classification:** classification; k-Nearest neighbour; decision tree; random forest; support vector machine **Regression:** Linear Regression ,Logistic Regression, Ridge and Lasso Regression , Softmax Regression **Clustering -** clustering techniques -Divisive and Agglomerative Clustering	15L
Textbooks: 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 **Additional References:** 1. Pattern Recognition and Machine Learning, by Christopher Bishop (optional)		

Course Code	**Course Title**	**Credits**	**Lectures /Week**
SIUCSMN221	**Practicals of Machine Learning**	**2**	**2**
1	The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is the probability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result.		
2	Write a program to import and export the data		
3	Program to implement Data preprocessing that is Handling missing values isnull() notnull() dropna() fillna() replace() interpolate()		
4	Implementation linear regression using python		
5	Implementation logistics regression using python.		
6	Implementation K-Means_Clustering		
7	Implementation of k-Nearest neighbour Classification		
8	Implementation of Decision tree classification		
9	Implementation of Random Forest		
10	Implementation of SVM Classification		

Skill Enhancement Courses(SEC)

Course Code	Course Title	Credits	Lectures /Week
SIUCSSE221	**Cyber Law and IPR**	**1**	**1**

About the Course:

The course on Cyber Laws and IPR provides a comprehensive understanding of the legal aspects and regulations related to cyberspace and information technology. The course covers a wide range of topics, including basic concepts, internet technology, network security, cyber law, ecommerce, electronic signatures, cyber crimes, privacy, intellectual property rights, and more. Students will explore the legal framework governing cyberspace and develop an understanding of the legal and ethical issues associated with information technology

Course Objectives:

- Understand fundamental concepts of cyber laws and their relevance in the digital age.
- Examine legal frameworks and regulations in cyber laws, including the Information Technology Act 2000 in India.
- Explore key issues in cyber laws such as e-commerce, e-governance, and electronic records and contracts. Gain knowledge of cybercrimes, enforcement mechanisms, and the role of the Cyber Appellate Tribunal.
- Analyze emerging issues in cyber laws, including liability of ISPs, privacy concerns, and jurisdictional aspects.
- Understand intellectual property rights and online regulations, including copyrights, patents, and domain name disputes.

Learning Outcomes:

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

- Demonstrate a comprehensive understanding of cyber laws and their application in the digital age.
- Evaluate legal frameworks and regulations governing cyber laws.
- Identify and assess key issues in cyber laws, such as e-commerce, e-governance, and electronic records and contracts.
- Understand cyber crimes, enforcement mechanisms, and the role of the Cyber Appellate Tribunal.
- Analyse emerging issues in cyber laws, including liability of ISPs, privacy concerns, and jurisdictional complexities.
- Recognize intellectual property rights and online regulations, including copyrights, patents, and domain name disputes.

Unit	Topics	No of Lectures
I	**Introduction to Cyber Laws and Technology:** Basic Concepts, Internet and Advantages and Disadvantages of Internet Technology, Network and Network Security **Legal Framework and Regulations**: Cyber Law & Components of Cyber Law, Cyber Law in India: An Overview of Information Technology Act 15 2000, Cryptography, Encryption Technique & Algorithm and Digital Signature & Electronic Signature	15L

	Key Issues in Cyber Laws: E-Commerce, E-Governance, E-Record & EContract, Regulator, Certifying Authority, Electronic Signature Certificates **Cyber Crimes and Enforcement:** Cyber Appellate Tribunal, Cyber Crimes-Cyber Contraventions, Cyber Offences, Power of Investigation & Search, E-Evidence and Computer Forensic **Emerging Issues and Legal Considerations:** ISP & Intermediary Not to be Liable in Certain Cases, Consequential Amendments in Various Conventional Laws in India, Grey Areas of Information Technology Act, 2000 **Jurisdiction and Privacy:** Cyber Jurisdiction, E-Consumers, Privacy of Online Data and Information. **Intellectual Property Rights and Online Regulations:** Free Speech Online or Online Freedom of Speech and Expression and Liability of Intermediary **Intellectual Property Rights (IPRs), Copyrights & Patents:** International and Indian Scenario, Copyright Issues and Digital Medium, Patent Issues in Digital Medium **Disputes and Resolution:** Domain Name Dispute & Resolution and Trademark Issues in Digital Medium, Spamming and Phishing.	

Textbook(s):

1. Cyber Laws & Information Technology (For LL.B.) Paperback – 1 January 2020
2. Cyber Law in India, Satish Chandra, ABS Books, 2017
3. Cyber Security and Cyber Laws, Nilakshi Jain, Wiley India, October 2020

Additional Reference(s):

1. Cyber Laws, Justice Yatindra Singh, Universal Law Publishing, Universal Publishing, 2016
2. Cyber laws, Dr. Gupta & Agrawal, PREMIER PUBLISHING COMPANY, 2022
3. Cyber Law - An Exhaustive Section Wise Commentary On The Information Technology, Pavan Duggal, Universal Publishing (LexisNexis), 2nd Edition, 2017

Course Code	Course Title	Credits	Lectures /Week
SIUCSSE141	**Practicals of Cyber Law and IPR**	**1**	**1**
A. Case Studies based on Cyber Laws and IPR			

Open Elective(OE)

Course Code	Course Title	Credits	Lectures /Week
SIUCSOE211	**Beginning MySQL**	**1**	**1**

About the Course: The objective of this course is to introduce the concept of the DBMS with respect to the relational model, to specify the functional and data requirements for a typical database application and to understand creation, manipulation and querying of data in databases .

Course Objectives:

- To Gain familiarity with the MySQL development environment.
- To Understand basic concepts of database development.
- To Understand SQL, Database design, Administration, and Security.
- To Design and code a database solution.

Learning Outcomes:

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

- Create Databases using Mysql.
- Perform DML, DDL DCL ,View functions.

Unit	Topics	No of Lectures
I	**Introduction to DBMS:**Database, DBMS –Definition, Overview of DBMS, Advantages of DBMS, Levels of abstraction, Data independence, DBMS Architecture **DDL Statements :** Creating Databases, Using Databases, data types, Creating Tables, Altering Tables, Renaming Tables Dropping Table,Truncating Tables, Backing Up and Restoring databases. **DML Statements:** Viewing the structure of a table insert, update, delete, Select all columns, specific columns, unique records, conditional select, in clause, between clause, limit, aggregate functions (count, min, max, avg, sum), group by clause, having clause. **Function: String Functions**-concat, instr, left, right, mid, length, lcase/lower, ucase/upper, replace, strcmp, trim, ltrim, rtrim **Math Functions** -abs, ceil, floor, mod, pow, sqrt, round, truncate **Date Functions** -add date, datediff, day, month, year, hour, min, sec, now, reverse **Joining Tables :** inner join, outer join (left outer, right outer, full outer)	15L

	Views:creating, altering dropping, renaming and manipulating views **DCL Statements:**creating/dropping users,privileges introduction, granting/revoking privileges, viewing privileges	

Text books:

1. Ramez Elmasri & Shamkant B.Navathe, Fundamentals of Database Systems, Pearson Education, Sixth Edition, 2010
2. Ramakrishnam, Gehrke, Database Management Systems, McGraw‑Hill, 2007
3. Joel Murach,Murach's MySQL, Murach, 2012

Additional References:

1. Robert Sheldon, Geoff Moes, Begning MySQL, Wrox Press, 2005.

Course Code	Course Title	Credits	Lecture/ Week
SIUCSOE211	**Practicals on Beginning MySQL**	**1**	**1**
1	Perform the following: ● Viewing all databases ● Creating a Database ● Viewing all Tables in a Database ● Creating Tables (With and Without Constraints) ● Inserting/Updating/Deleting Records in a Table		
2	Perform the following: ● Altering a Table ● Dropping/Truncating/Renaming Tables		
3	Queries involving ● Date Functions ● String Functions ● Math Functions		
4	Join Queries ● Inner Join ● Outer Join		
5	Views ● Creating Views (with and without check option) ● Dropping views ● Selecting from a view		

Evaluation Scheme

I. Internal Evaluation for Theory Courses

- Major / Minor courses = 25 marks
- VSC/SEC courses = 20 marks

II. External Examination for Theory Courses

- Major / Minor courses = 50 marks

III. Practical Examination

- Major / Minor courses = 25 marks
- VSC/SEC courses = 30 marks
- Minimum 80% practical from each core subjects are required to be completed.
- Certified Journal is compulsory for appearing at the time of Practical Exam.

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