Appendix- B
AC –
Item No. –

As per NEP 2020

S. Z. S. P. Mandal's
SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA,
SAWANTWADI
(Autonomous)
Affiliated to University of Mumbai

Title of the Programme: Science

B.Sc. (Computer Science)

A: Certificate in Computer Science: 2023-2024

B: Diploma in Computer Science: 2024-2025

C: Degree in Computer Science: 2025-2026

Syllabus for

Sem-III and Sem-IV

Reference GR dated 16th May 2023 for Credit structure

S. Z. S. P. Mandal's

SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA, SAWANTWADI

(As per NEP 2020)

Sr. No.	Headings	Particulars
1	Title of the Program	Computer Science
2	Eligibility	H.S.C. Science
3	Duration of the Programme	1- Certificate 2- Diploma 3- Advance Diploma 4- Research Degree
4	Scheme of Examination	External : 60 Internal: 40 Separate passing in External and Internal examination
5	Standard of Passing	40.00%
6	Program Academic Level	4.5 Certificate 5.0 Diploma 5.5 Advance Diploma 6.0 Research Degree
7	Pattern	Semester Pattern
8	Status	New
9	To Be Implemented from the academic year	4.6 Certificate 2023-2024 6.0 Diploma 2024-2025 5.5 Advance Diploma 2025-2026 6.0 Research Degree 2026-2027

PREAMBLE:

S. P. K. Mahavidyalaya, Sawantwadi (Autonomous) believes in implementing several measures to bring equity, efficiency and excellence in the higher education system in conformity to the guidelines laid down by the University Grants Commission (UGC). In order to achieve these goals, all efforts are made to ensure high standards of education by implementing several steps to enhance the teaching- learning process, examination and evaluation techniques and ensuring the all-round development of learners.

The four-year course in B.Sc. Computer Science has been designed to have a progressive and innovative curriculum in order to equip our learners to face the future challenges in the field of higher education. To develop this ability, students will be exposed to multiple programming languages, tools, paradigms and technologies as well as the fundamental underlying principles throughout this programme.The programme offers required courses such as programming languages, data structures, computer architecture and organization, algorithms, database systems, operating systems, and software engineering; as well as specialized courses in artificial intelligence, computer-based communication networks, distributed computing, information security, graphics, human-computer interaction, multimedia, scientific computing, web technology, and other current topics in computer science. In semester I & II, the basic foundation of important skills required for software development is laid. The syllabus proposes to have two Major core subjects of Computer science and one Minor core Subject of Application Development.

The syllabus design for further semesters encompasses more advanced and specialized courses of Computer Science. We sincerely believe that any student taking this programme will get a very strong foundation and exposure to basics, advanced and emerging trends of the subject.

OBJECTIVES:

- To develop an understanding and knowledge of the basic theory of Computer Science with a good foundation on theory, systems and applications.
- To foster necessary skills and analytical abilities for developing computer based solutions of real-life problems.
- To provide training in emergent computing technologies which lead to innovative solutions for industry and academia.
- To develop the necessary study skills and knowledge to pursue further postgraduate study in computer science or other related fields.
- To develop the professional skill set required for a career in an information technology oriented business or industry.
- To enable students to work independently and collaboratively, communicate effectively, and become responsible, competent, confident, insightful, and creative users of computing technology

Program Outcome:

After successful completion of this programme learners will be able to

- At the end of three year Bachelor of Computer Science the students will be able:
- To formulate, to model, to design solutions, procedure and to use software tools to solve real world problems.
- To design and develop computer programs/computer -based systems in the areas such as networking, web design, security, cloud computing, IoT, data science and other emerging technologies.
- To familiarise with the modern-day trends in industry and research based settings and
  thereby innovate novel solutions to existing problems.
- To apply concepts, principles, and theories relating to computer science to new situations.
- To use current techniques, skills, and tools necessary for computing practice

Program Specific Outcome:

After successful completion of this programme learners are able to

- To apply standard Software Engineering practices and strategies in real-time software project development
- To pursue higher studies of specialisation and to take up technical employment.
- To work independently or collaboratively as an effective team member on a substantial software project.
- To communicate and present their work effectively and coherently.
- To display ethical code of conduct in usage of Internet and Cyber systems.
- To engage in independent and life-long learning in the background of the rapidly changing IT industry.

Proposed Second Year Credit Structure as per NEP 2020

Department of Computer Science

Proposed Structure for Major /Minor/OE/VSC/SEC/VEC/IKS/CC

Semester	Paper Code	Paper Title	Type	Credits
III (Level 5)	**S109CST**	Principles of Operating System	**Theory**	**2**
	S110CST	Linux Operating System	**Theory**	**2**
	S111CST	Software Engineering	**Theory**	**2**
	S112CSP	Practical - Linux Operating System+Software Engineering	**Practical**	**2**
	S113CST	Core Java	**Theory**	**2**
	S114CST	Php	**Theory**	**2**
	CSOE05T	Information Technology in Banking Insurance-I	**Theory**	**2**
	CSVS03T	Linear Algebra	**Theory**	**2**
	CSAE03T	Green Technologies-I	**Theory**	**2**
	CSFP01P	Mini Project	**Practical**	**2**
	CSCC02P	Practical - Core Java & Php	**Practical**	**2**
IV (Level 5)	**S115CST**	Computer Networks	**Theory**	**2**
	S116CST	Advanced Database Concepts	**Theory**	**2**
	S117CST	Data Structure	**Theory**	**2**
	S118CSP	Practical - Advanced Database Concepts & Data Structure	**Practical**	**2**
	S119CST	Advanced Java	**Theory**	**2**
	S120CST	Node & AngularJS	**Theory**	**2**
	CSOE06T	Information Technology in Banking Insurance-II	**Theory**	**2**
	CSSE03T	IOT Technologies	**Theory**	**2**
	CSAE04T	Green Technologies-II	**Theory**	**2**
	CSCEP01P	Mini Project- IOT Based	**Practical**	**2**
	CSCC03P	Practical - Advanced Java & Node & Angular JS	**Practical**	**2**

Committee for creation of Syllabus

Sr. No.	Name	College Name	Designation	Signature
1	Mrs. Vibha Vilas Gawande	Shri Pancham Khemraj Mahavidyalaya, Sawantwadi	HoD/ Chairman	
2	Mr. Pranam Prakash Kambli	Shri Pancham Khemraj Mahavidyalaya, Sawantwadi	Member	
3	Miss. Gayatri Rajesh Awate	Shri Pancham Khemraj Mahavidyalaya, Sawantwadi	Member	
4	Mr. Deelip Ananda Patil	Bharti Vidyapeeth (Deemed to be University), Institute of Management, Kolhapur.	Member	Attend online
5	Dr.Amol Bhanudas Devale	KIT'S Institute of Management Education and Research, Kolhapur	Member	Attend online
6	Dr. Rajendra Bhaskarrao Patil	Anna Leela College of Commerce & Economics, Shobha Jayram Shetty College of BMS, Kurla, Mumbai	Member	
7	Mr. Rajshekhar Narayanrao Patil	Softmusk Info. Pvt. Ltd., S NO - 86/2 Khanapur Road BGM, Belgaum, Karnataka	Member	
8	Mr. Harshraj Sandesh Sadwelkar	StackFusion Pvt.Ltd, 301,Platinum Tower, Sector 47,Sohna road-122018	Member	Attend online
9	Mrs. Anuja Amit Gharpure	Gogate Jogalekar College, Ratnagiri	Member	

Letter Grades and Grade points

Semester GPA/Program CGPA/Semester Program	Percentage of Marks	Alpha- sign / letter grade result
9.00-10.00	90.00-100	O (Outstanding)
8.00-9.00≥	80.0-90.0	A+ (Excellent)
7.00-8.00	70.0-80.0	A(Very Good)
6.00-7.00	60.0-70.0	B+(Good)
5.50-6.00	55.0-60.0	B(Above Average)
5.00-5.50	50.0-55.0	C(Average)
4.00-5.00	40.0-50.0	P(Pass)
Below 4.00	Below 40.0	F(Fail)
AB (absent)		Absent

Semester - III

Course Code	Course Title	Credits	Lecture/ Week
S109CST	**Principles of Operating System**	**2**	**2**

Desire Objectives:

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

Desire Outcomes:

- After successful completion of this course, students would be able to
- Work with any type of operating system
- Handle threads, processes, process synchronization
- 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 **Operating-System Structures:** User and Operating-System Interface, System Calls, Types of System Calls **Processes:** Process Scheduling, Inter process Communication **Threads:** Multicore Programming, Multithreading Models	**10**
II	**Process Synchronization:** General structure of a typical process, Peterson's Solution, Classic Problems of Synchronization **CPU Scheduling:** Scheduling Criteria, Scheduling Algorithms (FCFS, SJF, SRTF, RR), Thread Scheduling **Deadlocks:** Deadlock Characterization, Methods for Handling Deadlocks	**10**
III	**Main Memory:** Logical address space, Physical address space, MMU, Swapping, Paging **Virtual Memory:** Demand Paging, Page Replacement, Allocation of Frames **Mass-Storage Structure:** Disk Scheduling, Disk Management **File-System Interface:** Access Methods, Directory and Disk Structure	**10**

Textbooks:

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, Operating System Concepts, Wiley, 2021

Additional References:

1. Achyut S. Godbole, Atul Kahate, Operating Systems, Tata McGraw Hill, 2017
2. Naresh Chauhan, Principles of Operating Systems, Oxford Press, 2014
3. Andrew S Tanenbaum, Herbert Bos, Modern Operating Systems, 4e Fourth Edition, Pearson Education, 2016

Course Code	Course Title	Credits	Lecture/ Week
S110CST **S110CST**	**Linux Operating System**	**2**	**2**

Desire Objectives:

- To learn basic concepts of Linux in terms of operating system
- To learn use of various shell commands with regular expressions
- To set Linux Environment variables and learn setting file permissions to maintain Linux
- security implementation
- To learn various editors available in Linux OS
- To learn shell scripting.
- To learn installation of compilers and programming using C and Python languages on Linux
- platform

Desire Outcomes:

- After successful completion of this course, students would be able to
- Work with Linux file system structure, Linux Environment
- Handle shell commands for scripting, with features of regular expressions,redirections
- Implement file security permissions
- Work with vi, sed and awk editors for shell scripting using various control structures
- Install softwares like compilers and develop programs in C and Python programming languages on Linux Platform

Unit	Topics	No of Lectures
I	**Linux operating system and Basics :** 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 **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. **The Linux environment variable:** Setting, Locating and removing environment variables like PATH etc, Default shell environment variables, Using command aliases.	**10**
II	**Understanding Linux file permission:** Linux security, Using Linux groups, Decoding file permissions, Changing security setting, Sharing files. **Linux Security:** Understanding Linux Security, uses of root, sudo command, working with passwords, Understanding ssh. **Networking:** TCP/IP Basics, TCP/IP Model, Resolving IP addresses, Applications, ping, telnet, ftp, DNS **Working withEditors:** awk, sed and Introduction to vi	**10**
III	**Basic script building:** Using multiple commands, Creating script files, Displaying messages, Using variables, Redirecting Input and Output, Pipes performing math, Exiting the script.	**10**

	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	

Textbooks:

1. "Linux Command line and Shell Scripting Bible", Richard Blum, Wiley India.
2. "Unix: Concepts and Applications", Sumitabha Das, 4th Edition, McGraw Hill.
3. "Official Ubuntu Book", Matthew Helmke& Elizabeth K. Joseph with Jose Antonio Rey and Philips Ballew, 8th Ed.

Additional References:

1. "Linux Administration: A Beginner's Guide", Fifth Edition, Wale Soyinka, Tata McGraw-Hill, 2008.
2. "Linux: Complete Reference", Richard Petersen, 6th Edition, Tata McGraw-Hill
3. "Beginning Linux Programming", Neil Mathew, 4th Edition, Wiley Publishing, 2008.

Course Code	Course Title	Credits	Lecture/ Week
S111CST	**Software Engineering**	**2**	**2**

Desire 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.

Desire 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	**Software Engineering Process and Models :**The Nature of Software, Software Engineering, The Software Process, Generic Process Model, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, **Software Engineering Developments and Phases :** Component-Based Development, The Unified Process Phases, Agile Development- Agility, Agile Process, Extreme Programming	**10**

II	**Requirement Analysis and System Modeling:** Requirements Engineering, Eliciting Requirements, SRS Validation, Components of SRS, Characteristics of SRS **UML-Building Blocks:** Things -Structural, Behavioral, Grouping, Annotational, Relationship - Dependency, Association, Generalization, Realization	**10**
III	**Structural Diagram:** Class diagram, Object diagram, Package diagram, Component diagram, Deployment diagram **Behavioural Diagram:** Use case diagram, Activity diagram, State machine diagram **Interaction diagram:** Sequence diagram, Collaboration diagram, Timing diagram	**10**

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
S112CSP	**Practical - Linux Operating System**	**1**	**2**
1	Installation of Ubuntu Linux operating system. a) Booting and Installing from (USB/DVD) b) Using Ubuntu Software centre / Using Synaptic c) Explore useful software packages.		
2	Becoming an Ubuntu power user a) Administering system and User setting b) Learning Unity keyboard c) Using the Terminal d) Working with windows programs		
3	File System Commands: touch, help, man, more, less, pwd, cd, mkdir, rmdir, ls, find, ls, etc		
4	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		
5	General purpose utility Commands:cal, date, echo, man, printf, passwd, script, who, uname, tty, stty, etc Simple Filters and I/O redirection: head, tail, cut paste, sort, grep family, tee, uniq, tr, etc.		
6	Networking Commands: who, whoami, ping, telnet, ftp, ssh, etc		

7	Editors: vi, sed, awk
8	Working and Managing with processes- sh, ps, kill, nice, at and batch etc.
9	Shell scripting I: Defining variables, reading user input, exit and exit status commands, , expr, test, [], if conditional, logical operators
10	Shell scripting II: Conditions (for loop, until loop and while loop) arithmetic operations, examples
11	Shell scripting III: Redirecting Input / Output in scripts, creating your own Redirection
12	Installation of C/C++/Java/Python Compiler and creating an environment for app development. Basic programming using C and Python Languages.

Course Code	Course Title	Credits	Lectures /Week
S112CSP	**Practical - Software Engineering**		
Perform the following exercises for any two projects given in the list of sample projects or any other projects:			
1	Write down the problem statement for a suggested system of relevance		
2	Perform requirement analysis and develop Software Requirement Specification Sheet (SRS) for the 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 behavioral view diagram : State-chart diagram, Activity diagram		
7	Draw the behavioral 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 time line chart/Gantt Chart/PERT Chart		
11	Develop test cases for unit testing and integration testing		
12	Develop test cases for various white box and black box testing		

List of sample projects

a. Student Result Management System
b. Library management system
c. Inventory control system
d. Accounting system
e. Fast food billing system
f. Bank loan system
g. Blood bank system
h. Railway reservation system
i. Automatic teller machine
j. Video library management system
k. Hotel management system
l. Hostel management system
m. Share online trading
n. Hostel management system
o. Resource management system
p. Court case management system

Course Code	Course Title	Credits	Lectures /Week
S113CST	**Core Java**	**2**	**2**

Desire Objectives:
The objective of this course is to teach the learner how to use Object Oriented paradigm to develop code and understand the concepts of Core Java and to cover-up with the prerequisites of Core java.

Desire Outcomes:
1. Object oriented programming concepts using Java.
2. Knowledge of input, its processing and getting suitable output.
3. Understand, design, implement and evaluate classes and applets.
4. Knowledge and implementation of AWT package.

Unit	Topics	No of Lectures
I	**The Java Language:** Features of Java, Java programming format, Java Tokens, Java Statements, Java Data Types, Typecasting, Arrays **OOPS:** Introduction, Class, Object, Static Keywords, Constructors, this Key Word, Inheritance, super Key Word, Polymorphism (overloading and overriding), Abstraction, Encapsulation, Abstract Classes, Interfaces **Packages:** Introduction to predefined packages (java.lang, java.util, java.io, java.sql, java.swing), User Defined Packages, Access specifiers	**10**
II	**Exception Handling:** Introduction, Pre-Defined Exceptions, Try-Catch-Finally, Throws, throw, User Defined Exception examples **Multithreading:** Thread Creations, Thread Life Cycle, Life Cycle Methods, Synchronization, Wait() notify() notify all() methods **Wrapper Classes**: Introduction, Byte, Short, Integer, Long, Float, Double, Character, Boolean classes	**10**
III	**Collection Framework:** Introduction, util Package interfaces, List, Set, Map, List interface & its classes, Set interface & its classes, Map interface & its classes **Inner Classes:** Introduction, Member inner class, Static inner class, Local inner class, Anonymous inner class **AWT:** Introduction, Components, Event-Delegation-Model, Listeners, Layouts, Individual components Label, Button, CheckBox, Radio Button, Choice, List, Menu, Text Field, Text Area	**10**

Textbooks:

1) Herbert Schildt, Java The Complete Reference, Ninth Edition, McGraw-Hill Education, 201

Additional References:

1) E. Balagurusamy, Programming with Java, Tata McGraw-Hill Education India, 2014
2) Programming in JAVA, 2nd Ed, Sachin Malhotra & Saurabh Choudhary, Oxford Press
3) The Java Tutorials: http://docs.oracle.com/javase/tutorial/

Course Code	Course Title	Credits	Lectures /Week
S114CST	**Php**	**2**	**2**

Desire Objectives: The course provides an insight into emerging technologies to design and develop state of the art web applications using server-side scripting, and database connectivity

Desire Outcomes:

1. To learn Server-Side Programming using PHP
2. Mastery of PHP syntax and language features for robust web development.
3. Proficiency in building dynamic, interactive websites and web applications using PHP.
4. Ability to integrate PHP with databases like MySQL for effective data management.
5. Confidence in implementing secure and scalable PHP solutions for various web projects.

Unit	Topics	No of Lectures
I	**Introduction to PHP:** Features and advantages, history, installation, and setup, Creating and running PHP Scripts, Using Variables and Constants, Data Types, Operators in PHP, String Functions, Handling errors **Control Structures and Functions in PHP:** Conditional statements: if, else, elseif, Looping structures: for, while, foreach, Break, Continue and Exit Statements, Functions in PHP: declaration, parameters, return values, Built-in PHP functions and libraries	**10**
II	**Arrays and Forms Handling: Understanding arrays in PHP:** indexed, associative, multidimensional arrays, Processing HTML forms with PHP, Form validation and sanitization techniques, Handling file uploads with PHP **Forms and Database:** Web Forms, Working with FORM tag, Form processing and Validations, Working with Databases-PHP and MySQL, connection, Adding, altering, Inserting, Modifying and Retrieving Data **Advanced Concepts:** Reading and Writing Files, Reading Data from a File, Managing Sessions and Using Session Variables, Destroying a Session, Storing Data in Cookies, Setting Cookies	**10**
III	**MySQL Database Integration :** Introduction to MySQL databases, Connecting PHP with MySQL, CRUD operations in PHP (Create, Read, Update, Delete), Securing database interactions: prepared statements and parameterized queries **OOPS Using PHP:** Basics of OOP: classes, objects, properties, and methods, Encapsulation, inheritance, and polymorphism, Implementing OOP concepts in PHP, Design patterns in PHP: Singleton, Factory, MVC	**10**

Textbooks:

1. "Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5" by Robin Nixon.
2. "PHP Programming for the Absolute Beginner" by Andrew Harris.

Additional References:

1. "PHP 7 Programming Cookbook" by Doug Bierer.
2. "PHP Solutions: Dynamic Web Design Made Easy" by David Powers.

Course Code	Course Title	Credits	Lectures /Week
CSOE05T	**Information Technology in Banking Insurance-I**	**2**	**2**

Desire Objectives:

- students will be able to describe the key functions of IT infrastructure in banking and insurance operations
- students will understand the role of cybersecurity in protecting sensitive financial data and preventing cyber attacks.

Desire Outcomes:

- Understanding of IT Infrastructure in Banking and Insurance: Students will comprehend the architecture and components of IT systems used in banking and insurance institutions.
- Cybersecurity Awareness: Students will understand the importance of cybersecurity in banking and insurance, including common threats, prevention measures, and regulatory compliance.

Unit	Topics	No of Lectures
I	Introduction to Electronic Commerce: A) E-Commerce Framework, E-Commerce and media convergence, anatomy of E-Commerce Applications, E-Commerce Consumer and Organization Applications B) The network Infrastructure for Electronic Commerce - Marketforces influencing the I-way, Components of I-way, Network AccessEquipment C) E-Commerce and World Wide Web- Architectural framework of ECommerce, WWW and its architecture, hypertext publishing, Technology behind the web, Security and the Web	**10**
II	E-banking: A) Meaning, definition, features, advantages and limitations- core banking, the evolution of e-banking in India, Legal framework for e-banking. B) Electronic Payment System Types of Electronic Payment Systems, DigitalToken-based	**10**
III	MS-Office: Packages for Institutional Automation:	**10**

	A) Ms-Word: Usage of smart art tools, bookmark, cross-reference, hyperlink,mail merge utility and converting word as PDF files. B) Ms-Excel: Manipulating data, Working with charts, Working with PIVOT table and what-if analysis; Advanced excel functions-Vlookup (),hlookup(),PV(), FV(),average(),goal seek(),AVERAGE(), MIN(), MAX(), COUNT(),COUNTA(), ROUND(), INT(), nested functions, name ,cells/ranges/constants,relative, absolute & mixed cell references,>,<,=operators, Logical functions using if, and, or =, not, date and timefunctions & annotating formulae. C) Application in Banking and Insurance Sector – Calculation of Interest,Calculation of Instalment, Calculation of Cash Flow, Calculation of Premium,Calculation of risk coverage in Insurance and Reporting	

Textbooks:

1."Electronic Banking: The Ultimate Guide to Business and Technology of Online Banking" by James McKee and Frederick G. Crane.

2. "Banking and Finance on the Internet" by Mary J. Cronin.

3."Cybersecurity for Dummies" by Joseph Steinberg.

Additional References:

1. "Banking and Finance on the Internet" by Mary J. Cronin.
2. "E-Banking Management: Issues, Solutions, and Strategies" by Dr. V. K. Goyal.

Course Code	Course Title	Credits	Lectures /Week
CSVS03T	**Linear Algebra**	**2**	**2**

Desire Objectives:

- To offer the learner the relevant Linear Algebra concepts through Computer Science applications.
- To interpret existence and analyze the solution set of a system of linear equations.
- To formulate, solve, apply, and interpret properties of linear systems.
- To learn about the concept of linear independence of vectors over a field, and the dimension of a nvector space.
- To interpret basic concepts of linear transformations, dimension, matrix representation of a linear transformation, and the change of coordinate matrix.

Desire Outcomes:

- After successful completion of this course, students would be able to
- Appreciate the relevance and applicatio
-
- ns of Linear Algebra in the field of Computer Science.
- Understand the concepts through program implementation.
- Instill a computational thinking while learning linear algebra.
- Express clear understanding of the concept of a solution to a system of equations.
- Find eigenvalues and corresponding eigenvectors for a square matrix.

Unit	Topics	No of Lectures
I	**Field:** Introduction to complex numbers, complex numbers in Python, abstracting over fields, Playing with GF (2). **Vectors:** Vectors are functions, Vector addition, Scalar-vector multiplication, combining vector addition and scalar multiplication, Dictionary-based representations of vectors, Dot-product, Solving a triangular system of linear equations, Support Vector Machine – Introduction, Mechanism. **The Vector Space**: Linear combination, Vector spaces, Linear systems, homogeneous and otherwise	**10**
II	**Matrix:** Matrices as vectors, Matrix-vector and vector-matrix multiplication in terms of linear combinations, Matrix- vector multiplication in terms of dot-products, Null space, Linear functions, Matrix-matrix multiplication, Inner product and outer product, **Basis:** Coordinate systems, Linear dependence, Basis, Unique representation, Change of basis, **Dimension:** Dimension and rank, Direct sum, Dimension and linear functions, The annihilator	**10**
III	**Inner Product:** The inner product for vectors over the reals, Orthogonality. **Orthogonalization:** Projection orthogonal to multiple vectors, projecting orthogonal to mutually orthogonal vectors, Building an orthogonal set of generators, orthogonal complement. **Eigenvalues and Eigenvectors:** Characteristic Polynomials of degree 2 and 3, Eigenvalues and eigenvectors, Properties of eigenvalues and eigenvectors, Cayley–Hamilton Theorem, Rank algorithm.	**10**

Textbooks:

1. Coding the Matrix Linear Algebra through Applications to Computer Science, First Edition, Philip N. Klein, Newtonian Press 2013
2. Schaum's Outline of Linear Algebra, Sixth Edition by Seymour Lipschutz, Marc Lipson, McGraw Hill 2017

Additional References:

1. Linear Algebra and Probability for Computer Science Applications, First Edition, Ernest Davis, A K Peters/CRC Press, 2012.
2. Linear Algebra and Its Applications, Gilbert Strang, Cengage Learning, 4th Edition, 2007
3. Linear Algebra and Its Applications, David C Lay, Pearson Education India; 3rd Edition, 2002
4. Introduction to Information Retrieval, Christopher D. Manning, Prabhakar Raghavan and Hinrich
Schütze, Cambridge University Press, 2008.
5. Computer Networking With Internet Protocols and Technology, William Stallings, Pearson Education India, 2013.

Course Code	Course Title	Credits	Lectures /Week
CSAE03T	Green Technologies-I	**2**	**2**

Desire Objectives:
Know about Green IT Fundamentals: Business, IT, and the Environment
Green IT Strategies and Significance of Green IT Strategies

Desire Outcomes:
After successful completion of this course, students would be able to
Explain drivers and dimensions of change for Green Technology
Appreciate Virtualization; smart meters and optimization in achieving green IT

Unit	Topics	No of Lectures
I	**Green IT Fundamentals:** Information Technology and Environment, Business, Environment, and Green Enterprise Characteristics, Green Vision and Strategic Points, Green Value, Green IT Opportunity, Challenges of a Carbon Economy, Environmental Intelligence, Envisioning the Green Future **Green IT Strategies:** Green strategic alignment, Green IT Drivers-Cost, Regulatory and Legal, Sociocultural and Political, Business ecosystem, New market opportunities, Green IT Business Dimensions, KPIs in GreenStrategies	**10**
II	**Environmentally Responsible Business:** Developing ERBS, Policies, Practices, and Metrics, Mobility and Environment, Green It Metrics and Measurements, Green IT Readiness and CMM, Context Sensitivity and Automation in Green IT Measures **Green Assets:** Introduction, Green Assets, Green IT Hardware, Green Data Centers and ICT Equipment, Server and Data Strategy	**10**
III	**Green Assets and emerging Trends:** Data Servers Optimization and Virtualization, Physical Data Server Organization and Cooling, Cloud Computing and Data Centers, Networking and Communications Infrastructure, End-User Devices, Smart Meters in Real-Time, Managing Devices for Central Green Services, Devices and Organizational Boundaries for Measurements, Mobile Devices, and Sustainability	**10**

Textbooks:
1. Green IT Strategies and Applications Using Environmental Intelligence, Bhuvan Unhelkar, CRC Press, 2016

Additional References:
1. Emerging Green Technologies, Matthew N. O. Sadiku, Taylor and Francis (CRC Press), 2022
2. Sustainability Awareness and Green Information Technologies, Tomayess Issa, Springer, 2021

Course Code	Course Title	Credits	Lectures /Week
CSFP01P	**Mini Project**	**2**	**2**
Refer to the Project Guidelines at the end			

Course Code	Course Title	Credits	Lectures /Week
CSCC02P	**Practical - Core Java**	**1**	**2**
1	Accept two values from user and perform addition of two numbers		
2	Accept integer values for a, b and c which are coefficients of quadratic equation. Find the solution of quadratic equation.		
3	Accept two n x m matrices. Write a Java program to find addition of these matrices.		
4	Accept n strings. Sort names in ascending order.		
5	Create a package: Animals. In package animals create interface Animal with suitable behaviors. Implement the interface Animal in the same package animals.		
6	Demonstrate Java inheritance using extends keyword.		
7	Demonstrate method overloading and method overriding in Java.		
8	Demonstrate creating your own exception in Java.		
9	Using various swing components design Java application to accept a student's resume. (Design form)		
10	Write a Java List example and demonstrate methods of Java List interface.		
11	Design simple calculator GUI application using AWT components		
12	Design Notepad application using AWT components		

Course Code	Course Title	Credits	Lectures /Week
CSCC02P	**Practical - Php**	**1**	**2**
1	Write PHP scripts for Retrieving data from HTML forms		
2	Write PHP scripts for Performing certain mathematical operations for calculating factorial		
3	Write PHP scripts for Performing certain mathematical operations for finding Fibonacci Series		

4	Write PHP scripts for Performing certain mathematical operations for Displaying Prime Numbers in a given range
5	Write PHP scripts for Performing certain mathematical operations for Evaluating Expressions / Calculating reverse of a number
6	Write PHP scripts for Performing certain mathematical operations for Calculating reverse of a number
7	Write PHP scripts for Working with Arrays
8	Write PHP scripts for Working with Files (Reading / Writing)
9	Write PHP scripts for Working with Databases to Storing Records
10	Write PHP scripts for Working with Databases to Retrieve Records
11	Write PHP scripts for Storing and Retrieving Cookies
12	Write PHP scripts for Storing and Retrieving Sessions

Semester - IV

Course Code	Course Title	Credits	Lectures /Week
S115CST	**Computer Networks**	**2**	**2**

Desire Objectives:
To Understand Basic Concepts of Networking.
To Understand Working of Network Layer Architecture.
To Learn Practical Implementation of Basic Routing Algorithms.
To Learn Different Networking Protocols.

Desire Outcomes:
After successful completion of this course, students would be able to Learn basic networking concepts and layered architecture.
Understand the concepts of networking, which are important for them to be known as a networking professionals'.

Unit	Topics	No of Lectures
I	**Introduction:** Networking standards and Administrations, networks, network types – LAN, MAN, WAN. **Network Models:** The OSI model, TCP/IP protocol suite, **Introduction to Physical layer:** Data and signals, transmission impairment **Digital transmissions:** Digital-to-digital conversion, analog-to-digital conversion, transmission modes **Analog transmissions:** digital-to-analog conversion, analog-to-analog Conversion. **Bandwidth Utilization** – Multiplexing **Transmission media:** Guided Media, Unguided Media **Switching:** Circuit Switched Network, Packet Switching.	**10**
II	**Introduction to Data Link Layer:** Link layer addressing **Error detection and correction,** Point-to-point protocol. Media Access Control: Random access, controlled access, **Wired LANs – Ethernet:** Ethernet Protocol, standard Ethernet **Wired Network:** Telephone Network, Cable Network, SONET, ATM **Wireless LANs:** IEEE 802.11 project, Bluetooth **Introduction to Network Layer:** Network layer services, packet switching, IPv4 addressing	**10**
III	**Unicast Routing:** Introduction, routing algorithms, unicast routing Protocols. **Next generation IP:** IPv6 addressing, IPv6 protocol, **Introduction to the Transport Layer:** Transport Layer Protocol, Transmission Control Protocol, **Standard Client-Server Protocols:** WWW, HTTP, FTP, , DNS,	**10**

Textbooks:

1. Data Communications and Networking, Behrouz A. Forouzan, Fifth Edition, TMH, 2018.
2. Computer Network, Andrew S. Tanenbaum, David J. Wetherall, Fifth Edition, Pearson Education, 2018.

Additional References:

1. Computer Network, Bhushan Trivedi, Oxford University Press, 2016
2. Data and Computer Communication, William Stallings, PHI, 2017

Course Code	Course Title	Credits	Lectures /Week
S116CST	**Advanced Database Concepts**	**2**	**2**

Desire 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 database.

Desire Outcomes:
After successful completion of this course, students would be able to Master concepts of stored procedure, functions, cursors and triggers and its use. Understand concepts and implementations of transaction management

Unit	Topics	No of Lectures
I	**Overview of PL/SQL:** Advantages of PL/SQL, Main Features of PL/SQL,Architecture of PL/SQL **Stored 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. **Sequences:** creating sequences, referencing, altering and dropping a sequence **File Organization and Indexing:** Cluster, Primary and secondary indexing, Index data structure: hash and Tree based indexing, Comparison of file organization: cost model, Heap files, sorted files, clustered files. Creating, dropping and maintaining indexes..	**10**
II	**Fundamentals of PL/SQL:** Defining variables and constants, PL/SQL expressions and comparisons: Logical Operators, Boolean Expressions, CASE Expressions Handling, Null Values in Comparisons and Conditional Statements, PL/SQL Datatypes: Number Types, Character Types, Boolean Type, Datetime and Interval Types. **Overview of PL/SQL Control Structures:** Conditional Control: IF and CASE Statements, IF-THEN Statement, IF-THEN-ELSE Statement, IFTHEN-ELSIF Statement, CASE Statement, Iterative Control: LOOP and EXIT Statements, WHILE-LOOP, FOR-LOOP, Sequential Control: GOTO and NULL Statements **Triggers:** Concept of triggers, Implementing triggers – creating triggers, Insert, delete, and update triggers, nested triggers, viewing, deleting and modifying triggers, and enforcing data integrity through triggers.	**10**

	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	
III	**Error Handling:** Compile-Time Warnings, Overview of Exception Handling, Internally Defined Exceptions, Predefined Exceptions, User-Defined Exceptions, Redeclared Predefined Exceptions, Raising Exceptions Explicitly, Exception Propagation, Unhandled Exceptions **Transaction Management:** ACID Properties, Serializability, Two-phase Commit Protocol, Concurrency Control, Lock Management, Lost Update Problem, Inconsistent Read Problem , Read-Write Locks, Deadlocks Handling, Two Phase Locking protocol. **DCL Statements:** Defining a transaction, Making Changes Permanent with COMMIT, Undoing Changes with ROLLBACK, Undoing Partial Changes with SAVEPOINT and ROLLBACK	**10**

Textbooks:

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 References:

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
S117CST	**Data Structure**	**2**	**2**

Desire Objectives:

- To introduce data abstraction and data representation in memory
- To describe, design and use of elementary data structures such as stack, queue, linked list, tree and graph
- How and why different data structures are used for different types of problems.

Desire Outcomes:

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

- Create different types of data structures.
- Understand which data structure to be used based on the type of the problem.
- Apply combined knowledge of algorithms and data structures to write highly effective programs in various domains.

Unit	Topics	No of Lectures
I	**Abstract Data Type:** Different Data Types, different types of data structures & their classifications, Introduction to ADT, Creating user-specific ADT **Stacks:** Stack ADT for Stack, Advantages & Disadvantages, Applications of stack like balanced delimiter, prefix to postfix notation **Queues:** Queue ADT, Advantages & Disadvantages, linked representations. Circular Queue operations, Dequeues, applications of queue like job scheduling queues **Priority Queues & Heaps:** Priority Queue, Priority Queue ADT, Advantages and Disadvantages, Applications, Heaps, types of heaps, Heapifying the element	**10**
II	**Linked Structures:** ADT for linked list, Advantages & Disadvantages, Singly Linked List-Traversing, Searching, Prepending and Removing Nodes, applications of linked list like polynomial equation **Doubly Linked list:** ADT of doubly linked list, Advantages & Disadvantages, Insertion and deletion of nodes at various positions **Trees:** ADT for Tree Structure. Advantages & disadvantages, Binary Tree-Properties, Implementation and Traversals, Binary Search Tree, Balanced BST, Threaded Binary Trees, AVL Trees, Applications of Tree like Huffman Coding	**10**
III	**Graph:** Introduction, Graph ADT, Advantages and Disadvantages, Graph Representation using adjacency matrix and adjacency list, Graph operations ike insertion and deletion of nodes, Graph Traversals using BFS & DFS **Hashing:** Hash Table ADT, Advantages & Disadvantages, Concept of hashing, hash table, hash functions, collision, collision avoidance techniques,Applications of hashing	**10**

Textbooks:

1. Introduction to Algorithm, Thomas H Cormen, PHI
2. Data Structures And Algorithms Made Easy, Narasimha Karumanchi, 2021

Additional References:

1. Fundamentals of Computer Algorithms, Sartaj Sahni and Sanguthevar Rajasekaran Ellis Horowitz, Universities Press, 2018
2. Data Structures and Algorithms in Python, Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Wiley, 2016

Course Code	Course Title	Credits	Lectures /Week
S118CSP	**Practical - Advanced Database Concepts**	**1**	**2**
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, c. Redeclared Predefined Exceptions,		
12	Create nested tables and work with nested tables.		

Course Code	Course Title	Credits	Lectures /Week
S118CSP	**Practical - Data Structure**		
1	Write a program to implement Abstract Data Types (ADT)		
2	Write a program to implement Singly Linked list with insertion, deletion, traversal operations		
3	Write a program to implement Doubly Linked list with insertion, deletion, traversal operations		
4	Write a program to implement Stack with insertion, deletion, traversal operations		
5	Write a program to implement Queue with insertion, deletion, traversal operations		
6	Write a program to implement Priority Queue with insertion, deletion, traversal operations		
7	Write a program to implement Binary Tree with insertion, deletion, traversal operations		
8	Write a program to implement Huffman Coding		
9	Write a program to implement Graph with insertion, deletion, traversal operations		
10	Write a program to implement Travelling Salesman Problem		
11	Write a program to create basic Hash Table for insertion, deletion, traversal operations(assume that there are no collisions)		
12	Write a program to create hash table to handle collisions using overflow chaining		

Course Code	Course Title	Credits	Lectures /Week
S119CST	**Advanced Java**	**2**	**2**
Desire Objectives: Explore advanced topic of Java programming for solving problems.			
Desire Outcomes: 1) Understand the concepts related to Java Technology 2) Explore and understand use of Java Server Programming			
Unit	**Topics**		**No of Lectures**
I	**Swing:** Need for swing components, Difference between AWT and swing, Components hierarchy, Panes, Swing components: Jlabel, JTextField and JPasswordField, JTextAres, JButton, JCheckBox, JRadioButton, JComboBox and JList **JDBC:** Introduction, JDBC Architecture, Types of Drivers, Statement, ResultSet, Read Only ResultSet, Updatable ResultSet, Forward Only		**10**

	ResultSet, Scrollable ResultSet, PreparedStatement, Connection Modes, SavePoint, Batch Updations, CallableStatement, BLOB & CLOB	
II	**Servlets:** Introduction, Web application Architecture, Http Protocol & Http Methods, Web Server & Web Container, Servlet Interface, GenericServlet, HttpServlet, Servlet Life Cycle, ServletConfig, ServletContext, Servlet Communication, Session Tracking Mechanisms **JSP:** Introduction, JSP LifeCycle, JSP Implicit Objects & Scopes, JSP Directives, JSP Scripting Elements, JSP Actions: Standard actions and customized actions,	**10**
III	**Java Beans:** Introduction, JavaBeans Properties, Examples **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 **JSON:** Overview, Syntax, DataTypes, Objects, Schema, Comparison with XML, JSON with Java	**10**

Textbooks:

1) Cay S. Horstmann, Gary Cornell, Core Java™ 2: Volume II–Advanced Features Prentice Hall PTR,9th Edition

2) Herbert Schildt, Java2: The Complete Reference, Tata McGraw-Hill,5th Edition

3) Joe Wigglesworth and Paula McMillan, Java Programming: Advanced Topics, Thomson Course Technology (SPD) ,3rd Edition

Additional References:

1) Advanced Java Programming, Uttam K. Roy, Oxford University Press

2) The Java Tutorials: http://docs.oracle.com/javase/tutorial/)

3) The Java Tutorials of Sun Microsystems Inc

Course Code	Course Title	Credits	Lectures /Week
S120CST	**Node & Angular JS**	**2**	**2**

Desire Objectives:

- Understand the basics of server-side JavaScript programming.
- Learn how to build scalable and efficient web applications using Node.js.
- Explore the Node.js ecosystem, including npm and popular frameworks like Express.js.
- Master asynchronous programming and event-driven development in Node.js.
- Acquire knowledge of RESTful API development and integration with Node.js.
- Develop skills in testing, debugging, and deploying Node.js applications.

Desire Outcomes:

1. Mastery of Node.js: Ability to build scalable and efficient server-side applications.
2. Proficiency in AngularJS: Skills to develop dynamic and interactive front-end web applications.
3. Integration expertise: Capability to seamlessly integrate Node.js backend with AngularJS frontend for full-stack development.
4. Problem-solving skills: Capacity to solve complex real-world challenges by leveraging the power of Node.js and AngularJS together

Unit	Topics	No of Lectures
I	**Node.js (N):** Introduction to Node.js. Installing Node.js. The package.json File. The Node.js Event Loop. The I/O Cycle. The Anatomy of a Node.js Module. Creating Node Modules. Exploring the Node.js HTTP Module. Creating an HTTP Webserver with Node.js. Responding to HTTP Requests. Routing in Node.js. Creating a Sample Node.js Application.	**10**
II	**Server-Side Development with Express (E):** Introduction to the Express Framework. Installing and Testing Express. Creating a Node.js Express App. Restructuring an Express App. Creating Templates. Using Express Middleware Functions. Creating the List Page. Creating the Details Page. Creating the Edit Page. Creating the Add Page. Deleting Data. REST API Basics. Testing REST APIs. Refactoring APIs.	**10**
III	**Understanding Angular.JS (A):** Getting Started with Angular. Creating an Angular Application. Angular Project File Structure. Anatomy of an Angular Component. One-way Data Binding. Two-way Data Binding. Using Nglf Directive. Using NgForOf Directive. Angular Modules. Creating NgModules Using Angular Router. Configuring Templates. Creating Navigations. Working with Template-driven Forms. Working with Reactive Forms. Validating Form Data. Services Dependency Injection (DI). Reading Data from Database. Inserting Data into Database. Updating Data in the Database. Delete Data from Database.	**10**

Textbooks:

1. Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications by Brad Dayley, Brendan Dayley, Caleb Dayley, Pearson, 2018.
2. Beginning Flutter: A Hands On Guide to App Development by Marco L. Napoli, Wrox, 2019

Additional References:

1. Full Stack Javascript Development with Mean - MongoDB, Express, AngularJS, and Node.JS by Adam Bretz, Colin J Ihrig, Shroff/SitePoint, 2015
2. Practical Flutter by Zammetti Frank, Apress, 2019

Course Code	Course Title	Credits	Lectures /Week
CSOE06T	**Information Technology in Banking Insurance-II**	**2**	**2**

Desire Objectives:

- students will be able to describe the key functions of IT infrastructure in banking and insurance operations
- students will understand the role of cybersecurity in protecting sensitive financial data and preventing cyber attacks.

Desire Outcomes:

- Proficient utilization of IT tools for enhanced customer experience and service delivery.
- Improved risk management through the effective implementation of IT systems and protocols.

- Enhanced operational efficiency and automation of processes in banking and insurance operations.
- Adaptation to emerging technologies for competitive advantage and innovation in the financial sector.

Unit	Topics	No of Lectures
I	**E-banking Business Models** Various models- home banking, office banking, online banking, internet banking, mobile banking, SMS banking,- models of electronic payments, other business models	10
II	**Induction of TechnoManagement** Development Life Cycle, Project Management, Building Data Centres, Role of DBMS in Banking, Data Warehousing and Data Mining, RDBMS Tools **Technological Changes in Indian Banking Industry** Trends in Banking and Information Technology, Technology in Banking,Lead Role of Reserve Bank of India, New Horizons for Banking based IT, Automated Clearing House Operations, Electronic Wholesale Banking Credit Transfer, Credit Information Bureau (I) Ltd., Credit Information Company Regulation Bill- 2004, Automation in Indian Banks, Cheque clearing using MICR technology, Innovations, Products and Services,Core-Banking Solutions(CBS), Human Resource Development(HRD)-The Road Ahead, **Technology in Banking Industry** Teleconferencing, Internet Banking, Digital Signature in Banking, MICRFacility for ‘paper-based’ clearing, Cheque Truncation **Dealing with Fraudulent transactions under CTS** Efficient customer service, smart quill computer pen, Institute for Development & Research in Banking & Technology (IDRBT). **E-Checks-Protocols and Standards,** Problems on mechanization, e-Banking-RBI Regulations & Supervision, Technology Diffusion.	10
III	**IT Applications and Banking** Objectives, Electronic Commerce and Banking, Banking Software, Electronic Clearing and Settlement Systems, Plastic Money	10

Textbooks:

1."Electronic Banking: The Ultimate Guide to Business and Technology of Online Banking" by James McKee and Frederick G. Crane.

2. "Banking and Finance on the Internet" by Mary J. Cronin.

3."Cybersecurity for Dummies" by Joseph Steinberg.

Additional References:

1. "Banking and Finance on the Internet" by Mary J. Cronin.
2. "E-Banking Management: Issues, Solutions, and Strategies" by Dr. V. K. Goyal.

Course Code	Course Title	Credits	Lectures /Week
CSSE03T	**IOT Technologies**	**2**	**2**

Desire Objectives:
- Introduce concepts of SoC and IoT
- Introduce various types of IoT platforms
- Interfacing various types of devices using different protocols with IoT
- Understand practical applications of IoT in real life world

Desire Outcomes:
After successful completion of this course, students would be able to
- understand SoC and IoT
- use different types of IoT Platforms and interfaces
- understand and implement an idea of various types of applications built using IoT

Unit	Topics	No of Lectures
I	**Fundamentals of IoT:** Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT **System on Chip:** What is System on chip? SoC Elements: FPGA, GPU, APU, Compute Units. **Different types of IoT/SoC Platforms:** Introduction to Raspberry Pi, Arduino & NodeMCU	**10**
II	**Interfacing with IoT Platforms:** Basic hardware components like LED, Button, Camera, 8X8 LED Grid, Motor etc and interfacing them for input/output with IoT devices using PWM, UART, GPIO, I2C, SPI **IoT and Protocols IoT Security:** HTTP, UPnP, CoAP, MQTT, XMPP, Privacy and Security Issues in IoT.	**10**
III	**IoT & Web:** Web server for IoT, Sending/Receiving data between web server & IoT device, Cloud for IoT, Node RED, M2M vs IoT Communication Protocols, Basics of WSNs, WSN architecture and types, **IoT Applications:** Modern IoT case studies / applications used in the areas of transportation, agriculture, health care etc	**10**

Textbooks:

1. Introduction to IoT Paperback by Sudip Misra , Anandarup Mukherjee , Arijit Roy , Cambridge Press, 2022
2. Jain, Prof. Satish, Singh, Shashi, “Internet of Things and its Applications”, 1st Edition, BPB, 2020.
3. Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, Internet of Things, Wiley, India, 2019
4. IoT and Edge Computing for Architects - Second Edition, by Perry Lea, Publisher: Packt Publishing, 2020

Additional References:

1. Internet of Things by Vinayak Shinde, SYBGEN Learning India Pvt. Ltd, 2020
2. Internet of things, Dr. Kamlesh Lakhwani, Dr. Hemant kumar Gianey, Josef Kofi Wireko, Kamalkant Hiran, BPB Publication, 2020

3. Arduino, Raspberry Pi, NodeMCU Simple projects in easy way by Anbazhagan k and Ambika Parameswari k, 2019.
4. IoT based Projects: Realization with Raspberry Pi, NodeMCU Paperback – February 2020, by Rajesh Singh Anita Gehlot, 2020
5. Mastering the Raspberry Pi, Warren Gay, Apress, 2014

Course Code	Course Title	Credits	Lectures /Week
CSAE04T	**Green Technologies-II**	**2**	**2**

Desire Objectives:
Green Enterprise Architecture and Green Information Systems
Sociocultural Aspects of Green IT and Green Compliance

Desire Outcomes:
After successful completion of this course, students would be able to
Gain knowledge about green assets, green processes, and green enterprise architecture
ISO 14001 and related standards for Audit for Green Compliance

Unit	Topics	No of Lectures
I	**Green Business Process Management:** Introduction, Green Reengineering,Green Process, Green BPM and standards, Green Business Analysis, Green Requirements Modelling, Green IT Governance, Green Business Process and Applications, QoS, Achieving green BPM, Green Mobile Business Process, Digital Library **Green Enterprise Architecture:** Green IT and organizational Systems,Aspects of Green Solutions Architecture, Contents and Integration with Service-Oriented Architecture, Green Supply Chain Management, Green Portals in Green Enterprise Architecture, Environmental Intelligence	**10**
II	**Green Information Systems(GIS):** Design and Development Models: Describing GIS, GIS Requirements **Sociocultural Aspects of Green IT:** Green IT's Social Impact, Learning Organization, Green Social Stakeholders, Role-Based View of Green IT,Green User Practices, Attitude and Subjectivity in Green IT, Green IT Ethics and Code of Conduct, Privacy and Security of Green Information, Green Washing, Communications in Green Transformation Projects, Green HR and Changing Organizational Structures, Green-Collar Workers: Roles and Skill Sets, Green Virtual Communities	**10**
III	**Green Compliance:** Protocols, Standards, and Audits: Protocols and	**10**

	Standards, ISO 14000-2004 Standard, Various initiatives by stakeholders, Green Audits and types, Audit and use of Carbon emission management software **Emerging Carbon Issues:** Technologies and Future: Future Carbon Landscape, Green ICT and Technology Trends, Cloud Computing, Nanotechnology, Quantum computing, Renewable energies, eco-design, Collaborative environmental intelligence	

Textbooks:
1.Green Information and Communication Systems for a Sustainable Future, Rajshree Srivastava, Sandeep Kautish, Rajeev Tiwari. CRC Press, 2020

Additional References:
1. Sustainability Awareness and Green Information Technologies, Tomayess Issa, Springer, 2021
2. Environmental Sustainability Role of Green Technologies, P. Thangavel, and G. Sridevi, Springer, 2016

Course Code	Course Title	Credits	Lectures /Week
CSCEP01P	Mini Project- IOT Based	**2**	**2**
Refer to the Project Guidelines at the end			

Course Code	Course Title	Credits	Lectures /Week
CSCC03P	**Practical - Advanced Java**	**1**	**2**
1	Develop the presentation layer of Library Management software application with suitable menus.		
2	Design suitable database for Library Management System.		
3	Develop business logic layer for Library Management System.		
4	Develop Java application to store image in a database as well as retrieve image from database		
5	Write a Java application to demonstrate simple servlet		
6	Write a Java application to demonstrate servlet life cycle.		
7	Design database for student administration. Develop servlet(s) to perform CRUD operations.		
8	Write a Java application to demonstrate simple jsp page		
9	Create Employees table in EMP database. Perform select, insert, update, and delete operations on Employee table using JSP.		

10	Write a Student class with three properties. The useBean action declares a JavaBean for use in a JSP. Write Java application to access JavaBeans Properties.
11	Design application using Struts2. Application must accept user name and greet user when command button is pressed.
12	Write Java application to encoding and decoding JSON in Java.

Course Code	Course Title	Credits	Lectures /Week
CSCC03P	**Practical - Node & Angular JS**	**1**	**2**
1	To demonstrate the use of Standard callback pattern		
2	To demonstrate the Fs module file paths		
3	Write a simple program for multiplication		
4	Write a program to display your name with welcome note :HELLO		
5	To create a real AngularJS Application for shopping Cart		
6	Write a program to perform validation of a form using AngularJS		
7	Write a program to create and implement modules and controllers in Angular JS		
8	Write a program to implement Error Handling in Angular JS		
9	Create an application for Customer / Students records using AngularJS		
10	Create a simple HTML “Hello World” Project using AngularJS Framework and apply ng-controller, ng-model and expressions		
11	To Develop a Single Page Application Using AngularJS		
12	Write a program to create a simple web application using Express, Node JS and Angular JS		

EXAMINATION PATTERN FOR MAJOR & MINOR SUBJECTS

A) Continuous Internal Assessment (40 Marks):

Sr No.	Particulars	Marks
1	**Assignment / Presentations**	**10**
2	**Mid-Term Class Test**	**20**
3	**Active Participation in routine class**	**10**

B)External Examination for Theory Courses – 60 Marks

- **Duration: 2 Hours**

- **All questions shall be compulsory with internal choice within the questions.**
- **Each Question may be subdivided into sub questions as a, b, c, d, etc. & the allocation of Marks depends on the weightage of the topic.**

Theory question paper pattern:

All questions are compulsory.			
Question	Based on	Options	Marks
Q.1	Unit - I	Any 3 out of 6	15
Q.2	Unit - II	Any 3 out of 6	15
Q.3	Unit - III	Any 3 out of 6	15
Q.4	Unit -I ,II & III	Any 3 out of 6	15

C) Semester End Practical Examination (100 marks):
- **Major subject carries 100 Marks**
- **80 marks + 10 marks (journal) + 10 marks (viva)**
- **Duration: 3 Hours for practical course.**
- **Certified Journal is compulsory for appearing at the time of Practical Exam**
- **The Marking Scheme for each of the Level is given below:**
-

Level 4.5	Part-A	Part-B	Total Marks
Major	Experiment-40+Journal-5 +viva-5 Total:50M	Experiment-40+Journal-5+viva-5 Total:50M	100 M

EXAMINATION PATTERN FOR OE,VSC,SEC,AEC,AEC SUBJECTS

A) Continuous Internal Assessment (20 Marks):

Sr No.	Particulars	Marks
1	**Assignment / Presentations**	**05**
2	**Mid-Term Class Test**	**10**
3	**Active Participation in routine class**	**05**

B)External Examination for Theory Courses – 30 Marks
- **Duration: 1 Hours**
- **All questions shall be compulsory with internal choice within the questions.**
- **Each Question may be subdivided into sub questions as a, b, c, d, etc. & the allocation of Marks depends on the weightage of the topic.**

Theory question paper pattern:

All questions are compulsory.			
Question	Based on	Options	Marks
Q.1	Unit - I	Any 2 out of 4	10
Q.2	Unit - II	Any 2 out of 4	10
Q.3	Unit - III	Any 2 out of 4	10

PRACTICAL EXAMINATION PATTERN FOR VEC & CC SUBJECTS

- **Each Subject carries 50 Marks**
- **30 marks + 10 marks (Journal) + 10 marks (Viva)**
- **Duration: 2 Hours for practical course.**
- **Certified Journal is compulsory for appearing at the time of Practical Exam**
- **The Marking Scheme for each of the Level is given below:**

Level 4.5	Part-A	Part-B	Total Marks
VEC & CC	Experiment-15+Journal-5 +viva-5 Total:25M	Experiment-15+Journal-5+viva-5 Total:25M	50 M

Mini Project Evaluation

The evaluation of the project will include a viva voce, which will assess the project based on the following parameters:

Documentation – 10 Marks: The completeness, accuracy, and professionalism of the project documentation, including the project report and supporting materials, will be Considered.

Quality of the Project – 10 Marks: The overall quality of the project, including its design, implementation, and user experience, will be evaluated.

Working of the Project – 10 Marks: The functionality and performance of the project will be assessed to determine how well it meets the specified requirements and Objectives.

Project Presentation – 10 Marks: The clarity, organization, and effectiveness of the project presentation will be evaluated.

Viva – 10 Marks: The viva voce session will provide an opportunity for the student to demonstrate their knowledge and understanding of the project, as well as to answer questions and engage in a discussion with the evaluators.